Interesting Science fact #13

The fastest speed a falling raindrop can hit you is 28.97 kph.

NATURAL SCIENCES

LESSON PLAN

GRADE 7 TERM 3

A MESSAGE FROM THE NECT

NATIONAL EDUCATION COLLABORATION TRUST (NECT)

Dear Teachers,

This learning programme and training is provided by the National Education Collaboration Trust (NECT) on behalf of the Department of Basic Education (DBE)! We hope that this programme provides you with additional skills, methodologies and content knowledge that you can use to teach your learners more effectively.

What is NECT?

In 2012 our government launched the National Development Plan (NDP) as a way to eliminate poverty and reduce inequality by the year 2030. Improving education is an important goal in the NDP which states that 90% of learners will pass Maths, Science and languages with at least 50% by 2030. This is a very ambitious goal for the DBE to achieve on its own, so the NECT was established in 2015 to assist in improving education and to help the DBE reach the NDP goals.

The NECT has successfully brought together groups of relevant people so that we can work collaboratively to improve education. These groups include the teacher unions, businesses, religious groups, trusts, foundations and NGOs.

What are the Learning programmes?

One of the programmes that the NECT implements on behalf of the DBE is the 'District Development Programme'. This programme works directly with district officials, principals, teachers, parents and learners; you are all part of this programme!

The programme began in 2015 with a small group of schools called the Fresh Start Schools (FSS). Curriculum learning programmes were developed for Maths, Science and Language teachers in FSS who received training and support on their implementation. The FSS teachers remain part of the programme, and we encourage them to mentor and share their experience with other teachers.

The FSS helped the DBE trial the NECT learning programmes so that they could be improved and used by many more teachers. NECT has already begun this embedding process.

Everyone using the learning programmes comes from one of these groups; but you are now brought together in the spirit of collaboration that defines the manner in which the NECT works. Teachers with more experience using the learning programmes will deepen their knowledge and understanding, while some teachers will be experiencing the learning programmes for the first time.

Let's work together constructively in the spirit of collaboration so that we can help South Africa eliminate poverty and improve education!

www.nect.org.za

CONTENTS

PROGRAMME ORIENTATION

Welcome to the NECT Natural Sciences learning programme! This CAPS compliant programme consists of:

- A full set of lesson plans for the term (3 hour lessons per week)
- A resource pack with images to support the lesson plans
- A full colour poster
- An outline of the assessment requirements for the term
- A tracker to help you monitor your progress

Lesson Plan Structure

1. Term 3 lesson plans are structured to run for 9 weeks.
2. Each week, there are three lessons, of the following notional time:

   3 x 1 hour

   This time allocation of 3 hours per week is CAPS aligned.

Lesson Plan Contents

1. The lesson plan starts with a **CONTENTS PAGE** that lists all the topics for the term, together with a breakdown of the lessons for that topic. You will notice that lessons are named by the week and lesson number, for example, Week 8 Lesson 8C.

2. Every topic begins with a 2 - 4 page **TOPIC OVERVIEW**. The topic overview pages are grey, making them easy to identify. The topic overview can be used to introduce the topic to learners. The topic overview includes:

   a. A ***general introduction*** to the topic that states how long the topic runs for, the value of the topic in the final exam and the number of lessons in the topic.

   b. A table showing the ***position of the topic*** in the term.

   c. A ***sequential table*** that shows the prior knowledge required for this topic, the current knowledge and skills that will be covered, and how this topic will be built on in future years. Use this table to give learners an informal quiz to test their prior knowledge. If learners are clearly lacking in the knowledge and skills required, you may need to take a lesson to cover some of the essential content and skills. It is also useful to see what you are preparing learners for next, by closely examining the 'looking forward' column.

   d. A glossary of ***scientific vocabulary***, together with an explanation of each word or phrase. It is a good idea to display these words and their definitions somewhere in the classroom, for the duration of the topic. It is also a good idea to allow learners some time to copy down these words into their personal dictionaries or science exercise books. You must explicitly teach the words and their meanings as and when you encounter these words in the topic. A good way to teach learners new vocabulary is to use 'PATS':

- POINT – if the word is a noun, point at the object or at a picture of the object as you say the word.
- ACT – if the word is a verb, try to act out or gesture to explain the meaning of the word, as you say it.
- TELL – if the word has a more abstract meaning, then tell the learners the meaning of the word. You may need to code switch at this point, but also try to provide a simple English explanation.
- SAY – say the word in a sentence to reinforce the meaning.

e. ***Understanding the uses / value of science***. It is very important to give learners a sense of how science applies to their daily lives, and of the value that science adds to their lives. Hold a brief discussion on this point when introducing the topic, and invite learners to elaborate on the uses and value that this topic will have to their lives.

f. ***Personal reflection***. At the end of every topic, come back to the topic overview, and complete this table. In particular, it is important to note your challenges and ideas for future improvement, so that you can improve your teaching the next year.

3. After the topic overview, you will find the **INDIVIDUAL LESSONS.** Every lesson is structured in exactly the same way. This helps you and the learners to anticipate what is coming next, so that you can focus on the content and skills. Together with the title, each lesson plan includes the following:

a. ***Policy and Outcomes***. This provides you with the CAPS reference, and an overview of the skills that will be covered in the lesson. You can immediately see the science process skills that will be covered, and whether they are lower middle or higher order skills.

b. ***Possible Resources***. Here, you will see the resources that you should ideally have for the lesson. If you need to use the poster or pages from the resource pack, this will be listed here. There is also a space for improvised resources, and you are invited to add your own ideas here.

c. ***Classroom Management***. Every lesson starts in the same way. Before the lesson, you must write a question that relates to the previous lesson on the chalkboard. Train your learners to come in to the classroom, to take out their exercise books, and to immediately try to answer this question. This links your lesson to the previous lesson, and it effectively settles your learners.
Once learners have had a few minutes to answer, read the question and discuss the answer. You may want to offer a small reward to the learner who answers first, or best. Get your learners used to this routine.

Next, make sure that you are ready to begin your lesson, have all your resources ready, have notes written up on the chalkboard, and be fully prepared to start. Remember, learners will get restless and misbehave if you do not keep them busy and focussed.

d. ***Accessing Information***. This section contains the key content that you need to share with learners. Generally, it involves sharing some new information that is written on the chalkboard, explaining this information, and allowing learners some time to copy the information into their exercise books. Train learners to do this quickly and efficiently. Learners must anticipate this part of the lesson, and must have their books, pens, pencils and rulers ready.

Explain to learners that this is an important resource for them, because these are the notes they will revise when preparing for tests and exams.

***Checkpoint 1**.* Straight after 'Accessing Information', you will find two checkpoint questions. These questions help you to check that learners understand the new content thus far.

e. ***Conceptual Development**.* At this point, learners will have to complete an activity to think about and apply their new knowledge, or to learn a new skill. This is the most challenging part of the lesson. Make sure that you fully understand what is required, and give learners clear instructions.

   ***Checkpoint 2**.* Straight after 'Conceptual Development, you will find two checkpoint questions. These questions help you to check that learners understand the new concepts and skills that they have engaged with.

f. ***Reference Points for Further Development**.* This is a useful table that lists the relevant sections in each approved textbook. You may choose to do a textbook activity with learners in addition to the lesson plan activity, or even in place of the lesson plan activity. You may also want to give learners an additional activity to do for homework.

g. ***Additional Activities / Reading**.* This is the final section of the lesson plan. This section provides you with web links related to the topic. Try to get into the habit of visiting these links as part of your lesson preparation. As a teacher, it is always a good idea to be more informed than your learners.

4. At the end of the week, make sure that you turn to the **TRACKER,** and make note of your progress. This helps you to monitor your pacing and curriculum coverage. If you fall behind, make a plan to catch up.

5. **POSTER AND RESOURCE PACK.** You will have seen that the *Possible Resource* section in the lesson plan will let you know which resources you will need to use in a lesson.

Please note that you will only be given these resources once. It is important for you to manage and store these resources properly. Do this by:

- Writing your name on all resources
- Sticking resource pages onto cardboard or paper
- Laminating all resources, or covering them in contact paper
- Filing the resource papers in plastic sleeves once you have completed a topic

Have a dedicated wall or notice board in your classroom for Natural Sciences.

- Use this space to display the resources for the topic
- Display the vocabulary words and meaning here, as well as the resources
- Try to make this an attractive and interesting space
- Display learners' work on this wall – this gives learners a sense of ownership and pride

6. **ASSESSMENT.** At the end of the lesson plans, you will find a sample assessment task, an examination and memorandum. Feel free to use this task with your learners in the first year of this programme. Thereafter, use it as a model to structure your own assessment tasks, in the same way.

Lesson Plan Routine

Train your learners to know and anticipate the routine of Natural Sciences lessons. You will soon see that a good knowledge of this routine will improve time-on-task and general classroom discipline and that you will manage to work at a quicker pace.

Remember, every Natural Sciences lesson follows this routine:

1. **Classroom Management**: settle learners by having two questions written on the chalkboard. Learners take out their exercise books and pens, and immediately answer the questions. Discuss the answers to the questions, and reward the successful learner.
2. **Accessing Information:** have key information written on the chalkboard. Explain this to learners. Allow learners to copy this information into their books.
3. **Checkpoint 1:** ask learners at least two questions to check their understanding.
4. **Conceptual Development:** complete an activity to apply new knowledge or skills.
5. **Checkpoint 2:** ask learners at least two questions to check their understanding.
6. **Reference Points for Further Development:** links to textbook activities – you may choose to use these activities as additional classwork activities, or as homework activities.
7. **Tracker:** fill in your tracker at the end of the lessons to track your progress.

PROGRAMME ORIENTATION

A vehicle to implement CAPS

Teaching Natural Sciences can be exciting and rewarding. These lesson plans have been designed to guide you to implement the CAPS policy in a way that makes the teaching and learning experience rewarding for both the teacher and the learners.

To support the policy's fundamentals of teaching Natural Sciences, these lesson plans use the CAPS content as a basis and:

- provide a variety of teaching techniques and approaches
- promote enjoyment and curiosity
- highlight the relationship between Natural Science and other subjects
- where appropriate, draw on and emphasise cultural contexts and indigenous knowledge systems
- show the relationship between science, learners, their societies and their environments
- aim to prepare learners for economic activity and self-expression

Content and Time Allocation

These lessons plans have been developed to comply with CAPS in respect of both content and time allocation. In developing these lesson plans, consideration of the realities of teachers was taken and to this end, some simple adjustments were made, without deviating from policy, to make the teaching of these lesson plans more achievable. The kinds of adjustments made include using some of the practical tasks in the lesson plans for assessment purposes; and building in time for revision and exams during terms 2 and 4.

CAPS assigns one knowledge strand to form the basis of content in each term. These strands are as follows:

- Term 1: ***Life and Living***
- Term 2: ***Matter and Materials***
- Term 3: ***Energy and Change***
- Term 4: ***Planet Earth and Beyond***

PROGRAMME ORIENTATION

The distribution of these strands across the year is summarised in the table below:

Grade 7			
Term 1	**Term 2**	**Term 3**	**Term 4**
NS Strand	**NS Strand**	**NS Strand**	**NS Strand**
Life and Living	**Matter and Materials**	**Energy and Change**	**Planet Earth and Beyond**
The biosphere Biodiversity Sexual Reproduction Variation	Properties of materials Separating mixtures Acids, bases and neutrals Introduction to the periodic table of the elements	Sources of energy Potential and Kinetic energy Heat transfer Insulation and energy saving Energy transfer to surroundings The national electricity supply system	Relationship of the Sun and the Earth Relationship of the Moon and the Earth Historical development of astronomy
These lesson plans have been designed against the stipulated CAPS requirements with topics being allocated for the time prescribed by CAPS. (Remember that some slight changes have been incorporated to accommodate time for revision, tests and examinations).			

PROGRAMME ORIENTATION

The time allocation by topic is summarised in the table below.

Remember that one week equates to 3 hours or three lessons of 1 hour each.

	GRADE 7		GRADE 8		GRADE 9	
TERM	**Topic**	**Time in weeks**	**Topic**	**Time in weeks**	**Topic**	**Time in weeks**
Term 1: Life and Living	• The biosphere • Biodiversity • Sexual Reproduction • Variation	1 3½ 3½ 1	• Photosynthesis and respiration • Interactions and interdependence within the environment • Micro-organism	2 5 2	• Cells as the basic units of life • Systems in the human body • Human Reproduction • Circulatory and respiratory systems • Digestive system	2 2 2 1½ 1½
		(9 wks)		(9 wks)		(9 wks)
Term 2: Matter and Materials	• Properties of materials • Separating mixtures • Acids, bases and neutrals • Introduction to the periodic table of the elements	2 2 2 2	• Atoms • Particle model of matter • Chemical reactions	2 5 1	• Compounds • Chemical reactions • Reactions of metals with oxygen • Reactions of non-metals with oxygen • Acids, bases and pH value • Reactions of acids with bases (I) • Reactions of acids with bases (II) • Reactions of acids with bases (III) • Reactions of acids with metals	1 1 1½ 1 1 ½ 1 ½ 1
		(8 wks)		(8 wks)		(8 wks)

Term 3: Energy and Change	• Sources of energy • Potential and Kinetic energy • Heat transfer • Insulation and energy saving • Energy transfer to surroundings • The national electricity supply system	1 2 2 2 1 1	• Static electricity • Energy transfer in electrical systems • Series and parallel circuits • Visible light	1 3 2 3	• Forces • Electric cells as energy systems • Resistance • Series and parallel circuits • Safety with electricity • Energy and the national electricity grid • Cost of electrical power	2 ½ 1 2 ½ 1 2
		(9 wks)		(9wks)		(9 wks)
Term 4: Planet Earth and Beyond	• Relationship of the Sun and the Earth • Relationship of the Moon and the Earth • Historical development of astronomy	4 2 2	• The Solar System • Beyond the Solar System • Looking into space	3 3 2	• The Earth as a system • The Lithosphere • Mining of mineral resources • Atmosphere • Birth, life and death of stars	1 2 2 2 1
		(8 wks)		(8 wks)		(8 wks)
TOTALS	34 weeks		34 weeks		34 weeks	

REFLECTING ON THE LESSONS THAT YOU TEACH

It is important to reflect on your teaching. Through reflection, we become aware of what is working and what is not, what we need to change and what we do not. Reflecting on your use of these lesson plans will also help you use them more effectively and efficiently.

These lesson plans have been designed to help you deliver the content and skills associated with CAPS. For this reason, it is very important that you stick to the format and flow of the lessons. CAPS requires a lot of content and skills to be covered – this makes preparation and following the lesson structure very important.

Use the tool below to help you reflect on the lessons that you teach. You do not need to use this for every lesson that you each – but it is a good idea to use it a few times when you start to use these lessons. This way, you can make sure that you are on track and that you and your learners are getting the most out of the lessons.

LESSON REFLECTION TOOL			
Preparation			
1.	What preparation was done?		
2.	Was preparation sufficient?		
3.	What could have been done better?		
4.	Were all of the necessary resources available?		
Classroom Management			
		Yes	**No**
5.	Was there a question written on the board?		
6.	Was there an answer written on the board?		
7.	Was the answer discussed with the learners in a meaningful way?		
8.	Overall reflection on this part of the lesson: What was done well? What could have been done better?		

PROGRAMME ORIENTATION

Accessing Information			
		Yes	**No**
9.	Was the text and/ or diagrams written on the chalkboard before the lesson started?		
10.	Was the work on the board neat and easy for the learners to read?		
11.	Was the explanation on the content easy to follow?		
12.	Was the information on the board used effectively to help with the explanations?		
13.	Was any new vocabulary taught effectively? (in context and using strategies like PATS)		
14.	Were the learners actively engaged? (asked questions, asked for their opinions and to give ideas or suggestions)		
15.	Were the checklist questions used effectively?		
16.	Overall reflection on this part of the lesson: What was done well? What could have been done better?		

Conceptual Development			
		Yes	**No**
17.	Was the information taught in the 'Accessing Information' part of the lesson used to foreground the activity?		
18.	Were clear instructions given for the conceptual development activity?		
19.	Were the outcomes/answers to the activities explained to the learners?		
20.	Could the learners ask questions and were explanations given?		
21.	Was a model answer supplied to the learners? (written or drawn on the board)		
21.	Were the checklist questions used effectively?		
22.	At the end of the lesson, were the learners asked if they had questions or if they needed any explanations?		
23.	Overall reflection on this part of the lesson: What was done well? What could have been done better?		

TOPIC OVERVIEW:
Sources of energy
Term 3, Weeks 1A – 1C

A. TOPIC OVERVIEW

TERM 3, WEEKS 1A – 1C

- This topic runs for 1week.
- It is presented over 3 x 1 hour lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 6	GRADE 7	GRADE 9
LOOKING BACK	CURRENT	LOOKING FORWARD
• Fossil fuels • Fossil fuels are non-renewable resources • In South Africa, coal is mostly used as a fuel in power stations • Renewable ways of generating electricity	• Energy is needed to make everything work • A source of energy has storedenergy • Non-renewable sources of energy can only be used once • Renewable sources of energy can be re-used	• Electricity generation • Nuclear power in South Africa • The National Electricity Grid

C. SCIENTIFIC AND TECHNOLOGICAL VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	energy	Ability of a body to do work
2.	matter	Substance which has mass and occupies space
3.	organism	A living body that has the ability to function without help
4.	energy sources	Substances or organisms that store energy
5.	fossil fuels	Energy that is formed in the Earth from plant and animal remains
6.	hydropower	Electricity that is created by falling water turning large turbines
7.	biofuel	Plant or animal waste used to produce energy
8.	non-renewable	Natural resources that cannot be replaced or reused once they have been used up
9.	uranium	Radioactive element that is used to make nuclear energy
10.	generators	Mechanical devices that generate electricity from moving parts
11.	turbines	Mechanical devices that use the force of wind or water to move (rotate) and generate electricity
12.	extracted	Taken out of

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

It is important to understand where electrical energy comes from. It is vital that we know about different sources of energy and identify renewable and non-renewable sources of energy. Non-renewable sources of energy, such as fossil fuels, will eventually run out. We are using fossil fuels faster than they can form. For us to continue living our daily lives, we need to find other sources of energy. Renewable sources of energy will never run out and are a more sustainable and cleaner source of energy.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

1 A

Term 3, Week 1, Lesson A
Lesson Title: Sources of energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Renewable and non-renewable sources of energy
CAPS Page Number	26

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that energy is needed to make everything work, move or live
- Identify different types of energy sources
- Identify ways in which different types of energy sources are used.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions	✓	12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 1: Energy sources in South Africa (2012).	
Resource 2: Identifying energy sources.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What are fossil fuels?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Fossil fuels are fuels or substances that are formed in the Earth from dead plant and animal remains.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

SOURCES OF ENERGY

1. All living things need **energy**.
2. The Sun is the main source of energy for all living things.
3. The energy from the Sun allows plants to grow and produce food.
4. Living things need the energy stored in food to breathe and carry out daily activities.
5. People also use machines that need energy in order to work.
6. Energy can be stored in **substances** and **organisms** called **energy sources**.
7. Examples of substances that store energy are: oil, coal, natural gas, nuclear fuels, wind, water (hydropower), sunlight, biofuel (wood).
8. The energy from energy sources can be used to make something happen.
9. For example, natural gas is used for cooking and for lighting.

2. Make sure that Resource 1 of the 'Energy sources in South Africa' is on display in the classroom.
3. Explain the following to the learners:
    a. Energy sources are substances or organisms that store energy. This energy can be used to make something happen.Ask learners to think about the different energy sources they use every day.
    b. Oil, coal and natural gas are fossil fuels.
    c. **Fossil fuels** are formed in the Earth from plant and animal remains.
    d. Nuclear fuels are formed when the nucleus of an atom is broken apart and releases huge amounts of energy.
    e. Biofuel is a fuel that is produced from animal or plant waste, like maize, sugar cane and sorghum.
4. Use the pie chart of the 'Energy sources in South Africa' (Resource 1) as you discuss the sources of energy in South Africa.
    a. South Africa's main source of energy is from the burning of coal. This process is used to generate electricity.
    b. Crude oil is used to produce petrol and diesel which are mainly used to fuel cars, buses and other vehicles.
    c. Biofuels can be used in vehicles or cooling and heating systems.
    d. Wood is a biofuel and is burned for cooking, heating and lighting.
    e. A gas stove uses natural gas for cooking.
5. Ask the learners if they have any questions.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is the definition of an energy source?
b. What is the main source of energy in South Africa?

Answers to the checkpoint questions are as follows:

a. Substance or organism that stores energy
b. Coal

E CONCEPTUAL DEVELOPMENT

1. Divide the class into manageable groups. Give each group a copy of Resource 2 'Identifying energy sources' from the resource pack.
2. Write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Table to show symbol and type of energy source that it represents

Symbol	**Source of energy**
A	
B	
C	
D	
E	
F	
G	
H	

TASK 1

1. Draw the table in your workbook.
2. Use the pictures to identify the types of energy sources.
3. Fill in the missing spaces in Column 2 by writing in the types of energy sources.

TASK 2

1. Discuss which energy sources you use at home. Fill these in on the table.

3. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has two columns.
   b. The first column has the following heading: Symbol.
   c. The second column has the following heading: Source of energy.
   d. Work in a group. Use the copy of the resource given to you by your teacher. Look at the symbols of different sources of energy. Use the symbols to identify the types of energy sources and complete Column 2 of your table only.
4. Give learners some time to complete Task 1 in their workbooks.
5. Ask learners to share their answers to Task 1 with the class.
6. The completed table is shown below. Fill in the missing sources of energy on the table on the chalkboard.
7. *Model answer: Task 1*

TASK 1 *Table to show symbol and type of energy source that it represents*	
Symbol	***Source of energy***
A	*sun/sunlight*
B	*biofuel*
C	*wind*
D	*nuclear fuel*
E	*hydro power/water*
F	*coal*
G	*natural gas*
H	*oil*

8. When the learners have completed Task 1, hold a short class discussion to revise the different types of energy sources.
9. Next, get the learners to do Task 2 by discussing in groups which energy sources they use at home.
10. Ask learners to share their answers to Task 2 with the class. Fill these in on the table.
11. Discuss the answers with the learners.
12. *Model answer: Task 2 (Answers may vary.)*

TASK 2 *Table to show possible uses of each type of energy source at home*	
Source of energy	***Uses at home***
sun/sunlight	*generation of electricity*
biofuel	*burning wood for heating, cooking*
wind	*generation of electricity*
nuclear fuel	*generation of electricity*
hydro power/water	*generation of electricity*
coal	*heating, cooking, generation of electricity*
natural gas	*heating, cooking, generation of electricity*
oil	*petrol, diesel*

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is this statement true or false? Coal, natural gas and wind are examples of fossil fuels.
b. Which energy source allows a petrol car to work?

Answers to the checkpoint questions are as follows:

a. False
b. Oil

13. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Sources of energy	114-127
Viva	Sources of energy	191
Platinum	Sources of energy	97-102
Solutions for All	Sources of energy	111-115
Day-by-Day	Sources of energy	100-103
Oxford	Sources of energy	125
Spot On	Sources of energy	98-102
Top Class	Sources of energy	149-165
Sasol Inzalo Bk B	Sources of energy	2-17

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=zaXBVYr9Ij0 (2min 42sec) [Fossil fuels 101]
2. https://www.youtube.com/watch?v=q8HmRLCgDAI(3min 12sec) [Hydropower 101]
3. https://www.youtube.com/watch?v=44ovdxOvP_A (2min 56sec) [Nuclear 101]
4. https://www.youtube.com/watch?v=Z5c50-_hcD0 (1min 46sec) [Wind 101]

1 B

Term 3, Week 1, Lesson B
Lesson Title: Renewable and non-renewable sources of energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Renewable and non-renewable sources of energy
CAPS Page Number	26

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define non-renewable sources of energy
- List and identify non-renewable energy sources
- Define renewable sources of energy
- List and identify renewable energy sources.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring	✓	9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 1: Energy sources in South Africa (2012).	
Resource 2: Identifying energy sources.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

> What are the three types of fossil fuels?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

> *Coal, oil and natural gas*

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

> <u>RENEWABLE AND NON-RENEWABLE SOURCES OF ENERGY</u>
>
> 1. Sources of energy that cannot be re-used or replaced once they have been used up are called non-renewable sources of energy.
> 2. Fossil fuels (coal, oil and natural gas) are examples of non-renewable sources of energy.
> 3. Nuclear energy is produced using **uranium** which is not a fossil fuel, but is a non-renewable source of energy.
> 4. Sources of energy that can be re-used or replaced and never run out are called renewable sources of energy.
> 5. **Hydropower**, wind, sunlight and **biofuel** are examples of renewable sources of energy.

2. Make sure that Resource 1 of the ‘Energy sources in South Africa’is on display in the classroom.
3. Point to the sector on the pie chart labelled ‘coal’.
4. Explain the following to the learners:
   a. South Africa mainly uses coal as an energy source.
   b. Coal is a fossil fuel and is a non-renewable source of energy.
5. Point to the sectors on the pie chart labelled crude oil and natural gas.

6. Explain the following to the learners:
    a. Oil and natural gas are also fossil fuels and are non-renewable sources of energy.
    b. Nuclear fuels are also non-renewable sources of energy.
7. Point to the sectors on the pie chart labelled hydropower, solar and wind, and biofuel.
8. Explain the following to the learners:
    a. Hydropower, solar and wind, and biofuel are all renewable sources of energy.
    b. South Africa uses very few renewable sources of energy.
    c. Hydropower uses falling water to generate electricity by turning large turbines. These turbines are connected to generators that generate electricity.
    d. Wind can be used to turn large turbines to generate electricity.
    e. The sunlight from the Sun can be used to generate electricity. The energy from the sunlight is absorbed by solar panels that generate electricity.
    f. Biofuel is produced from plant and animal waste, for example wood.
9. Ask the learners if they have any questions.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is the difference between a renewable and a non-renewable source of energy?
b. Is the energy from the Sun a renewable or non-renewable source of energy?

Answers to the checkpoint questions are as follows:

a. Non-renewable sources of energy can be used upand run out. Renewable sources of energy can be re-used or replaced and do not run out.
b. Renewable source of energy

E CONCEPTUAL DEVELOPMENT

1. Divide the class into manageable groups. Give each group a copy of Resource 2:'Identifying energy sources' from the resource pack.
2. Writethe following onto the chalkboard(always try to do this before the lesson starts):

ACTIVITY

Here is a text box that lists types of energy sources.

wind	natural gas	biofuel	coal
sunlight	hydropower	oil	nuclear energy

Here is a table that shows renewable and non-renewable energy sources.

Renewable sources of energy	**Non-renewable sources of energy**

TASK 1

1. Use the text box listing the types of energy sources. Now link each type of energy source to the correct picture (A - H).

TASK 2

1. Draw the table in your workbook.
2. Use the text box listing the types of energy sources.
3. Fill in the missing spaces in the table by classifying the energy sources as renewable or non-renewable energy sources.

3. Explain Task 1 to the learners as follows:
   a. Work in a group. Use the copy of the resource given to you by your teacher.In your groups discuss the sources of energy that each picture represents.
4. Give learners some time to do Task 1.
5. Next, get the learners to do Task 2.
6. Explain Task 2 to the learners as follows:
   a. The table drawn on the chalkboard has two columns.
   b. The first column has the following heading: Renewable sources of energy.
   c. The second column has the following heading: Non-renewable sources of energy.
   d. Draw the table into your workbooks.
   e. Work on your own and use the energy sources in the text box to fill in the missing spaces in the table by classifying the energy sources as renewable or non-renewable energy sources.
7. Give learners some time to do Task 2.
8. Ask learners to share their answers to Task 2 with the class.

9. The completed table is shown below. Fill the missing sources of energy in the table on the chalkboard.
10. Discuss the answers with the learners.
11. *Model answer: Task 2*

TASK 2

Table to show renewable and non-renewable energy sources.

Renewable sources of energy	***Non-renewable sources of energy***
wind	coal
sunlight	oil
hydropower	natural gas
biofuel	nuclear energy

12. When the learners have completed Task 2, hold a short class discussion to revise:
    a. Wind, sunlight, hydropower and biofuel are renewable source of energy.
    b. Coal, oil, natural gas and nuclear energy are non-renewable source of energy.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is this statement true or false? Coal, natural gas and wind are examples of renewable sources of energy.
b. Which non-renewable energy source does South Africa generate most of its electricity from?

Answers to the checkpoint questions are as follows:

a. False
b. Coal

13. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Sources of energy	114-127
Viva	Sources of energy	192-201
Platinum	Sources of energy	97-102
Solutions for All	Sources of energy	111-115
Day-by-Day	Sources of energy	100-103
Oxford	Sources of energy	126-129
Spot On	Sources of energy	98-102
Top Class	Sources of energy	149-165
Sasol Inzalo Bk B	Sources of energy	2-17

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=wMOpMka6PJI (18min 40sec) [Different sources of energy and using energy responsibly]

1 C

Term 3, Week 1, Lesson C
Lesson Title: Renewable and non-renewable sources of energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Renewable and non-renewable sources of energy
CAPS Page Number	26

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain why some energy sources are renewable
- Explain why some energy sources are non-renewable.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
-	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Are fossil fuels renewable or non-renewable sources of energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Fossil fuels are non-renewable sources of energy.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

RENEWABLE AND NON-RENEWABLE SOURCES OF ENERGY

1. Non-renewable sources of energy will eventually run out.
2. Fossil fuels (coal, oil and natural gas) are **extracted** from under the ground and will eventually run out.
3. Nuclear energy (uranium) is also extracted from under the ground and will eventually run out.
4. Therefore, fossil fuels and nuclear energy are non-renewable sources of energy.
5. Renewable sources of energy can be re-used or replaced.
6. Hydropower, wind and sunlight cannot run out. They can be re-used.
7. Biofuel will not run out, if it is replaced. We can plant new trees to replace the wood that has been used.
8. Therefore, hydropower, wind, sunlight and biofuel are renewable sources of energy.

2. Explain the following to the learners:
   a. Coal, oil and natural gas are fossil fuels that are extracted from underground. Nuclear fuels are also dug out from underground and are also non-renewable sources of energy.
   b. Fossil fuels and nuclear fuels are all extracted from under the ground. This means that they will eventually run out.
   c. Non-renewable sources of energy are sources of energy that cannot be replaced once they have been used up. Therefore coal, oil, natural gas and nuclear fuels are non-renewable sources of energy.
   d. We need to find alternative energy sources that will not run out.

3. Explain the following to the learners:
    a. Hydropower uses water to generate electricity. The water does not get used up.
    b. Wind can be used to turn large turbines to generate electricity. The wind does not get used up.
    c. The sunlight from the Sun can be used to generate electricity. The Sun will continue to emit light for many years.
    d. Biofuel is produced from plant and animal waste. The wood from trees can be replaced by planting new trees.
    e. Hydropower, sunlight, wind and biofuel can be re-used or replaced.
    f. Renewable sources of energy are sources of energy that can be re-used or replaced. Therefore hydropower, sunlight, wind and biofuel are renewable sources of energy.
    g. We do not use up renewable sources of energy.
4. Ask the learners if they have any questions.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:
    a. How do we know that a source of energy is renewable?
    b. How do we know that natural gas is a non-renewable source of energy?

Answers to the checkpoint questions are as follows:
    a. The source of energy can be reused or replaced.
    b. Natural gas is extracted from underground and will eventually run out. Non-renewable sources of energy will eventually run out.

E CONCEPTUAL DEVELOPMENT

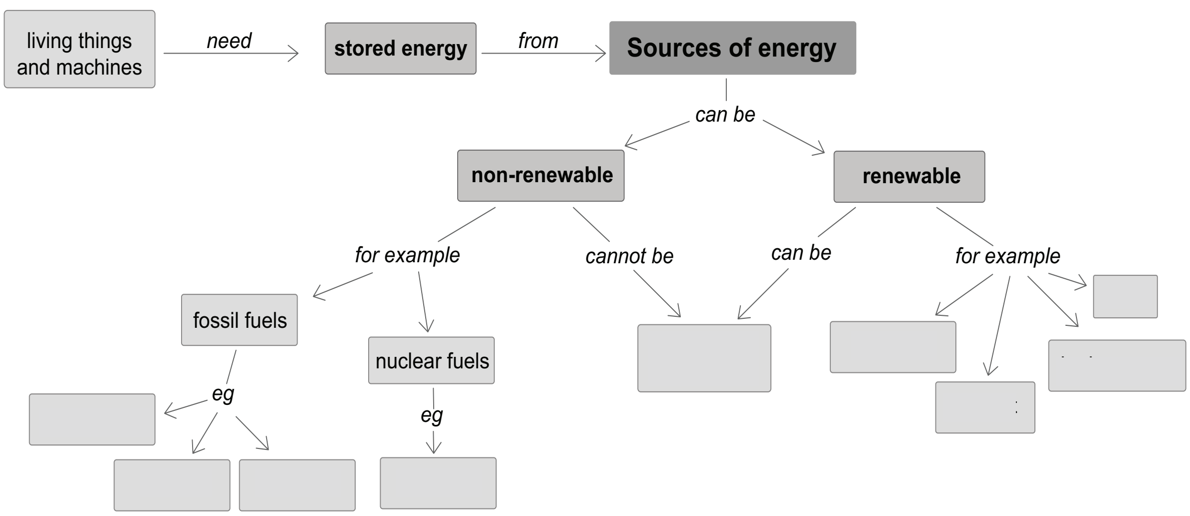
1. Write the following on the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Text box to list types of energy sources.

wind	natural gas	biofuel	coal
sunlight	hydropower	oil	Uranium
reused or replaced			

Concept map of different types of sources of energy



TASK 1

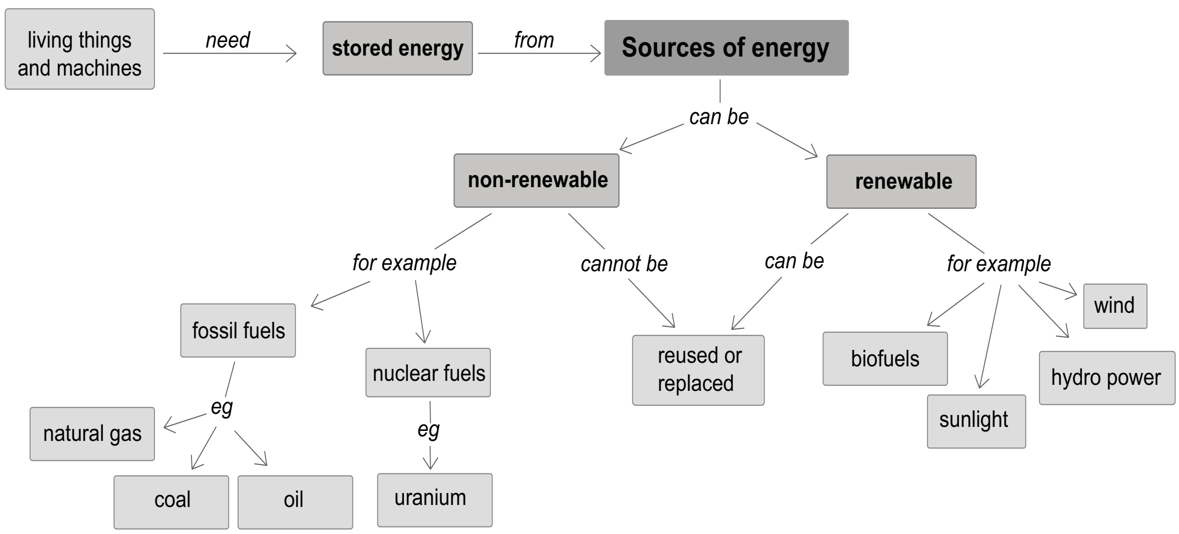
1. Draw the concept map in your workbook.
2. Use the text box to fill in the missing words in the concept map.

TASK 2

1. Explain why coal is a non-renewable source of energy.
2. Explain why biofuel is a renewable source of energy.

2. Explain Task 1 to the learners as follows:
   a. The concept map drawn on the board has words missing.
   b. Copy the concept map into your workbooks.
   c. Use the words from the text box to fill in the missing words in the concept map.
   d. Each word can only be used once.
3. Give learners some time to complete Task 1 in their workbooks.
4. Ask learners to share their answers to Task 1 with the class.
5. The completed concept map is shown below. Complete theconcept map on the chalkboard.
6. *Model answer: Task 1*

Concept map of different types of sources of energy



7. When the learners have completed Task 1, hold a short class discussion to revise:
   a. A renewable source of energy is a source of energy that can be re-used or replaced and never runs out.
   b. A non-renewable source of energy is a source of energy that cannot be replaced once it has been used up.
8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Copy the questions into your workbooks.
   b. Answer the questions in your workbooks.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

1. A non-renewable source of energy is used up and cannot be replaced. Coal is dug up from underground and once it has been used up there is no more coal for us to use.

2. A renewable source of energy can be reused and replaced. Wood is an example of a biofuel. We can grow more trees to replace the wood that has been used.

14. When the learners have completed Task 2, ask the learners if they have any questions and provide answers and explanations.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is this statement true or false? Biofuel is an example of a non-renewable energy source because we cannot re-use wood.
b. How can we make sure that we do not run out of energy sources in the future?

Answers to the checkpoint questions are as follows:

a. False
b. We should use renewable energy sources.

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Sources of energy	114-127
Viva	Sources of energy	192-201
Platinum	Sources of energy	97-102
Solutions for All	Sources of energy	111-115
Day-by-Day	Sources of energy	100-103
Oxford	Sources of energy	126-129
Spot On	Sources of energy	98-102
Top Class	Sources of energy	149-165
Sasol Inzalo Bk B	Sources of energy	2-14

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.eia.gov/energyexplained/?page=nonrenewable_home [Non-renewable energy explained]

TOPIC OVERVIEW:
Potential and kinetic energy
Term 3, Weeks 2A – 3C

A. TOPIC OVERVIEW

TERM 3, WEEKS 2A – 3C

- This topic runs for 2 weeks.
- It is presented over 6 x 1 hour lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 6	GRADE 7	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Stored energy in fuels • Energy and electricity • Electric circuits	• Potential energy is energy that is stored in a system • Kinetic energy is energy that a body has when it is moving • Potential and kinetic energy in systems • Law of conservation of energy	• Electric cells as energy systems

C. SCIENTIFIC AND TECHNOLOGICAL VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	energy	Ability to do work
2.	work	Work is done when a force causes an object to move
3.	transfer	Change from one form to another
4.	energy system	A group of parts that work together to change energy from one form to another
5.	potential energy	Energy that is stored. There are three types of potential energy, namely; elastic, gravitational or chemical potential energy
6.	kinetic energy	Energy that a body has when it is moving
7.	mechanical system	Energy system that uses parts that move and use force to do work
8.	thermal system	Energy system that uses heat energy to increase the amount of kinetic energy in a substance
9.	thermal energy	Energy that is produced by heat
10.	particle	Basic unit of matter, for example: molecule or atom
11.	electrical system	Energy system that uses the movement of electrons through an electrical circuit to transfer energy
12.	biological system	Energy system that uses biological energy
13.	biological energy	Energy obtained through the consumption of plants
14.	buzzer	Electric device that vibrates and makes a buzzing or ringing sound
15.	flow diagram	Diagram that shows the transfer of energy when different parts of a system interact
16.	input	Where energy comes from
17.	process	How energy is transferred when different parts of the system interact
18.	output	The changes that can be seen, heard or felt as a result of energy being transferred

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

It is important for us to know about the energy we use every day. The main source of energy on Earth comes from the Sun. Without the energy of the Sun, we would not be able to survive. We cannot create energy or destroy energy, but we can transfer the energy from one form to another as we eat, move and use many different types of machines that need energy to provide a particular output, for example, the generation of electricity or pumping of water from a well. Every organism or object on Earth that does work or has the potential to work,uses energy. The energy is transferred from one form to another within different types of energy systems or between different types of energy systems. Often, we cannot see energy transfers. We may only see the output of the energy systems. Flow diagrams can help us represent the different energy transfers that occur in the systems.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

2 A

Term 3, Week 2, Lesson A
Lesson Title: Potential energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Potential energy
CAPS Page Number	26

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define the term energy as the ability to do work
- Explain potential energy as energy that is stored in a system
- Describe the different forms of potential energy
- Read the energy content in different foods from the food packaging.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

TOPIC: Potential and kinetic energy

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Elastic band (rubber band)	Spring (from a clicking pen)
Book	Any other object that can rest on a table
Cells (battery)	
Any food with packaging, for example, a chip packet	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is energy measured in?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Energy is measured in joules (J).

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

ENERGY SYSTEM

1. Any object that has **energy**, has the ability to do **work**.
2. Energy cannot be created or destroyed but it can be **transferred** from one energy system to another.(according to the law of conservation of energy)
3. An **energy system** is a group of parts that work together to change energy from one form to another, for example, a wind turbine.

POTENTIAL ENERGY

1. **Potential energy** is energy that is stored in an object or system.
2. There are three types of potential energy:
   a. Elastic potential energy
      A stretched elastic band has elastic potential energy because it moves (does work) when it is released.
   b. Gravitational potential energy
      A weight balanced on the edge of a table has gravitational potential energy because of its position above the Earth.

c. Chemical potential energy

The food we eat has chemical potential energy. We obtain energy to live from the food we eat. Cells (battery) or fuel also have chemical potential energy.

2. Explain to the learners that:
   a. Any object that has energy has the potential to do work.
   b. Energy is measured in Joules (J) and is transformed from one form to another.
   c. Potential energy is energy that is stored in an object or system.
3. Show learners a stretched elastic band.
4. Explain to the learners that:
   a. If we release a stretched elastic band, it will fly across the room because it has elastic potential energy when it is stretched.
5. Place a weight (or book or any other object) on the edge of a table.
6. Explain to the learners that:
   a. The weight (of the book) balancing on the edge of the table will fall to the ground if it falls off the table. The weight has gravitational potential energy before it falls because of its position above the ground.
7. Show learners a cell (or battery).
8. Explain to the learners that:
   a. The cell will light up a light bulb if it is connected to an electric circuit. The cell has energy stored inside it. This energy is called chemical potential energy.
9. Show learners a food packaging.
10. Explain to the learners that:
    a. All the food we eat has chemical potential energy. We can use the energy to breathe, walk, run and do daily activities. Every food packaging should have information telling us how much energy in joules or kilojoules is in that food.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What type of potential energy does food contain?
b. What type of potential energy does a man standing on a chair have?

Answers to the checkpoint questions are as follows:

a. Chemical potential energy
b. Gravitational potential energy

E CONCEPTUAL DEVELOPMENT

1. Draw and write the following onto the chalkboard(always try to do this before the lesson starts):

ACTIVITY

Food type	Energy (kJ per 100g)
Chips	1995
Wheat flour	1467
Chocolate	1737
Chicken	800
Potato	1440

TASK 1

1. Which food type has the most energy?
2. Arrange the food types in order from the food type with the highest energy to the lowest energy.

TASK 2

1. What type of energy is found in food?
2. Why do you think food packaging tells us how much energy is in each food type?

2. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has two columns.
   b. The first column has the following heading: Food type.
   c. The second column has the following heading: Energy (kJ per 100g).
   d. The energy in the table of each food type was read from the food packaging. All food packaging should tell you how much energy is in that food type.
   e. Work on your own and complete Task 1.
3. Give learners some time to do Task 1.
4. Ask learners to share their answers to Task 1 with the class.
5. Discuss the answers with the learners.
6. *Model answer: Task 1*

   1. *Chips*
   2. *Chips; chocolate; wheat; flour; potatoes; chicken.*

7. Next, get the learners to do Task 2.
8. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer the questions in Task 2.
9. Give learners some time to do Task 2.
10. Ask learners to share their answers to Task 2 with the class.
11. Discuss the answers with the learners.
12. *Model answer: Task 2*

> 1. *Chemical potential energy.*
> 2. *It is important for us to know how much energy we are obtaining from the food we need. The more activity you do in the day, the more energy you need to keep doing those activities.*

13. When the learners have completed Task 2, hold a short class discussion to revise:
    a. Potential energy is energy that is stored in an object or system.
    b. There are three types of potential energy.
    c. Elastic potential energy is stored energy in a stretched elastic band.
    d. Gravitational potential energy is the energy an object has because of its position above the Earth.
    e. Chemical potential energy is found in the food we eat, cells (battery) and fuel (petrol or diesel).

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What is the difference between gravitational potential energy and chemical potential energy?
b. Which of the following is an example of elastic potential energy; a banana, compressed spring, a bag on a chair?

Answers to the checkpoint questions are as follows:

a. Gravitational potential energy is the energy an object has due to its position above the Earth. Chemical potential energy is the energy that is stored inside substances like food.
b. Compressed spring

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Potential and kinetic energy	128-129
Viva	Potential and kinetic energy	202-207
Platinum	Potential and kinetic energy	103-105
Solutions for All	Potential and kinetic energy	116-118
Day-by-Day	Potential and kinetic energy	104-105
Oxford	Potential and kinetic energy	131-135
Spot On	Potential energy and kinetic energy	103-104
Top Class	Potential energy and kinetic energy	166-171
Sasol Inzalo Bk B	Potential and kinetic energy	18-28

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-potential-energy.pdf [Potential energy]
2. https://www.youtube.com/watch?v=PjU0HXF5UIk (1min 49sec) [Types of potential energy]

2 B

Term 3, Week 2, Lesson B
Lesson Title: Kinetic energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Kinetic energy
CAPS Page Number	26

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain kinetic energy as the energy that a body has when it is moving
- Identify examples of kinetic energy.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	
3. Comparing	✓	8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations	✓	15. Scientific Process	

TOPIC: Potential and kinetic energy

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Elastic band (rubber band)	Spring (from a clicking pen)
Book	Any other object that can rest on a table
Two cups, one filled with water	
Five balloons, 25m string cut into five metre lengths, five straws	
Sticky tape (duct tape) – enough for five groups	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is potential energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Energy that is stored in a system.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

<u>KINETIC ENERGY</u>

1. **Kinetic energy** is the energy that a body has when it is moving.
2. Here are some examples of objects that have kinetic energy:
   a. When a stretched elastic band is released, it shoots across the room. It has kinetic energy.
   b. When a weight falls off the table, it has kinetic energy because it is falling.
   c. When cells (for example, in a battery) are connected to a closed circuit, current flows through the circuit and has kinetic energy.
   d. When cars drive around, they have kinetic energy because they are moving.
   e. When water is falling over a waterfall, it has kinetic energy.

2. Explain to the learners that:
   a. Any object that is moving has kinetic energy.
   b. Energy is measured in Joules (J).

3. Show learners a stretched elastic band. Release the elastic band so that it flies across the room, away from the learners.
4. Explain to the learners that:
    a. If we release a stretched elastic band, it will fly across the room. It has kinetic energy because it is moving.
5. Place a weight (or book or any other object that cannot break) on the edge of a table. Push the weight off the table.
6. Explain to the learners that:
    a. The weight falls to the ground when it is pushed off the table. As it falls, it gains kinetic energy.
7. Switch off the lights in the classroom. Then switch them back on.
8. Explain to the learners that:
    a. When the lights are switched off, there is no current flowing. When the lights are switched on, current flows. The electrical current has kinetic energy when it flows.
9. Pour water from one cup to another. Make sure the learners can see the water flowing.
10. Explain to the learners that:
    a. The water is falling as it is transferred from one cup to another. The water has kinetic energy as it falls.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. How do we know that an object has kinetic energy?
b. What energy does air blowing in the wind have?

Answers to the checkpoint questions are as follows:

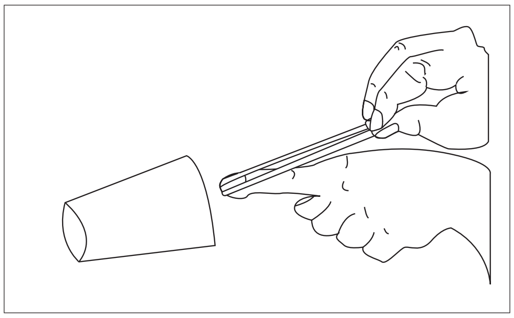
a. It is moving.
b. Kinetic energy

E CONCEPTUAL DEVELOPMENT

1. This will be a group activity.
2. Ideally the learners should work in pairs or small groups.
3. To do this activity, each group will need:
   - An elastic band
   - A ruler
   - A paper or polysyrene cup cut in half lengthways.
4. Ensure you have these materials prepared for each group before the lesson starts.
5. Tell the learners that they are going to be doing an investigation where they will be exploring potential and kinetic energy.
6. Write the following onto the chalkboard (always try to do this before the lesson starts):

PRACTICAL TASK

1. We are going to be exploring the potential energy of an elastic band and the kinetic energy output.
2. To do the experiment:
   - Place the cup on the desk, cut down the side with knife or scissors.
   - The opening should be facing the edge of the desk.
   - The opening should be 5cm from the edge of the desk. Measure this distance.
   - Use one finger to hold the elastic on the edge of the desk and the other finger to pull the elastic back to the correct distance.
   - Carefully aim the elastic at the same spot inside of the cup and let go.
   - Measure how far the cup travelled.
   - Repeat this another two times.
3. We are going to stretch the rubber band to three different lengths – a short stretch, a medium stretch and a long stretch. Each different stretch is called a 'condition' of your experiment.
4. You will need to do three tests for each 'condition'.
5. For each test make sure the cup is in the same position and the elastic is stretched to the same length. USE A RULER.



7. Read through the practical task with the learners.
8. You may need to demonstrate the activity once.
9. Ask the learners if they have any questions.
10. The following will need to be written onto the chalkboard:

Task 1: (9 marks)

1.1 What do you predict is the relationship between elastic potential energy and kinetic energy?

____

____

1.2 Copy and complete this table as you do the experiments.

CONDITION 1: Short stretch ________cm *Potential energy* (the stretched elastic)	**CONDITION 2**: Medium stretch ______cm Potential energy (the stretched elastic)	**CONDITION 3**: Long stretch ________cm Potential energy (the stretched elastic)
First test Cup moved ____cm	First test Cup moved ____cm	First test Cup moved ____cm
Second test Cup moved ____cm	Second test Cup moved ____cm	Second test Cup moved ____cm
Third test Cup moved ____cm	Third test Cup moved ____cm	Third test Cup moved ____cm
Now add the three measurements together and divide by three to get an average. _______cm	Now add the three measurements together and divide by three to get an average. _______cm	Now add the three measurements together and divide by three to get an average. _______cm
Kinetic energy (reperesented by the cup movement) = ________cm	*Kinetic energy* (reperesented by the cup movement) = ________cm	*Kinetic energy* (reperesented by the cup movement) = ________cm

11. Tell the learners to copy the question and table into their workbooks.
12. Read through task 1 with the learners.
13. Ask them if they have any questions.
14. Tell the learners they have 15 minutes to complete this task.
15. Supervise the learners whilst they complete the task and answer any questions they may have.
16. After 15 minutes call the learners back to attention.
17. Tell the learners that they are now going to complete task 2.
18. The following will need to be written on the chalkboard:

Task 2: (11 marks)

2.1 Draw a bar graph representing the data you have collected.

- On the Y-axis record the number of centimetres travelled.
- On the X-axis record the "conditions" tested using bars (a bar graph)
- Label the bars on the X-axis
- Label both axes
- Label the graph

2.2. Looking at the data you have collected, what can you conclude about potential energy and kinetic energy?

19. Read through the task with the learners.
20. Ask them if they have any questions.
21. Tell the learners they have 10 minutes to complete this task.
22. Supervise the learners whilst they complete the task and answer any questions they may have.
23. After 10 minutes call the learners back to attention.
24. Tell the learners to return all equipment and to tidy their work areas.
25. Collect books for assessment.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Potential and kinetic energy	130-135
Viva	Potential and kinetic energy	203-204
Platinum	Potential and kinetic energy	106
Solutions for All	Potential and kinetic energy	118
Day-by-Day	Potential and kinetic energy	106
Oxford	Potential and kinetic energy	136
Spot On	Potential energy and kinetic energy	104-105
Top Class	Potential energy and kinetic energy	171-174
Sasol Inzalo Bk B	Potential and kinetic energy	28-31

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=ASZv3tIK56k (1min 57sec) [Kinetic and potential energy]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-kinetic-energy.pdf [Potential and kinetic energy]

2 C

Term 3, Week 2, Lesson C
Lesson Title: Potential and kinetic energy in mechanical and thermal systems
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Potential and kinetic energy in systems
CAPS Page Number	26

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define energy systems as a group of parts that work together to change energy from one form to another
- Describe a mechanical system using examples
- Identify the energy transfers in a mechanical system
- Describe a thermal system using examples
- Identify the energy transfers in a thermal system.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

TOPIC: Potential and kinetic energy

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Pair of scissors and piece of paper	
30cm plastic ruler and crumpled up paper	
Resource 7: Identifying systems.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is kinetic energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Kinetic energy is the energy that a body has when it is moving.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

<u>POTENTIAL AND KINETIC ENERGY SYSTEMS</u>

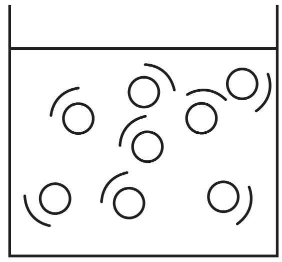
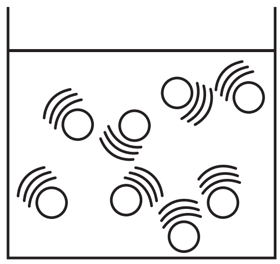
1. An energy system is a group of parts that work together to change energy from one form to another, for example, a wind turbine.

<u>MECHANICAL SYSTEMS</u>

1. **Mechanical systems** have parts that move and use force to do work. For example, a pair of scissors cutting paper, bending a ruler to flick a piece of paper, hitting a ball with a cricket bat.
2. In all the examples, potential energy is changed to kinetic energy.

<u>THERMAL SYSTEMS</u>

1. **Thermal systems** use **thermal energy** to increase the amount of kinetic energy in a substance.
2. Thermal energy is energy that is produced by heat. Warmer objects transfer heat to cooler objects. When objects are heated, their **particles** move faster and have more kinetic energy.
3. When the particles move very fast, we say that the object is hot.
4. Thermal energy increases the amount of kinetic energy an object has. For example, a candle heating cold water in a can or a cup of tea loses heat to the surroundings.

Cool water	Hot water
	

2. Explain to the learners that:
    a. An energy system is a group of parts that work together to change energy from one form to another.Wind turbines have blades. The wind turns the blades to change energy from one form to another.
    b. A wind turbine is an example of a mechanical system.
    c. Mechanical systems have moving parts that convert potential energy to kinetic energy.
3. Use the pair of scissors and cut a piece of paper.
4. Explain to learners that:
    a. When the scissors are open, they have potential energy to cut the paper. As the blades slide past each other, they are moving and have kinetic energy. The result from this mechanical energy is cut paper.
5. Crumple a piece of paper and place it on a table. Bend a 30cm plastic ruler so that it flicks the paper across the table when it is released.
6. Explain to learners that:
    a. When we bend the ruler, it has elastic potential energy. The energy is stored.
    b. When we release the ruler, it flicks the piece of paper across the table. As the paper moves, it has kinetic energy.
7. Refer to the diagrams drawn on the chalkboard.
8. Explain the following to the learners:
    a. Heat produces thermal energy.
    b. Heat is always transferred from objects that are hotter to objects that are cooler.
    c. An example is heating water in a pot on a flame.
    d. As the water is heated, the particles in the water start moving faster. They will have more kinetic energy as the water gains heat.
    e. When the water is taken off the flame, it will start to cool down.
    f. The water will lose kinetic energy because the particles move more slowly, and the water cools down.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a mechanical system?
b. What is a thermal system?

Answers to the checkpoint questions are as follows:

a. A system with parts that move in order to change potential energy to kinetic energy
b. A system that uses thermal energy (heat) to increase the amount of kinetic energy in a substance

E CONCEPTUAL DEVELOPMENT

1. Be sure that Resource 7 is on display in the classroom so that learners can refer to it.
2. Divide the class into five groups.
3. Write the following onto the chalkboard (always try to do this before the lesson starts):

TASK 1

Look at the picture of a ball being thrown in the air.

1. What type of system is this showing?
2. Explain the energy conversions that are occurring in this system as the ball moves from one position to another.

TASK 2

Look at the picture of a person on a swing.

1. What type of system is this showing?
2. Explain the energy conversions that are occurring in this system as the person swings from one position to another.

4. Explain Task 1 to the learners as follows:
   a. Work in your groups.
   b. Eachdiagram showsan energy system.
   c. Identify the energy system being shown in the first picture.
   d. Explain the energy conversions that occur as the ball moves from the person's hands, to the air and back down in the person's hands.
5. Give learners some time to complete Task 1 in their workbooks.
6. Ask learners to share their answers to Task 1 with the class.
7. *Model answer: Task 1*

1. Mechanical system

2. When you throw a ball up in the air, it slows down as it moves upwards, stops for a short time and then speeds up as it falls back down into your hands.Kinetic energy was transferred from your hand to the ball. As the ball moves up, kinetic energy istransferred to potential energy because it moves further away from the Earth. As the ball falls back down to the earth, the potential energy is transferred back to kinetic energy.

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Work in your groups.
   b. Eachdiagram shows an energy system.
   c. Identify the energy system being shown in the second picture.
   d. Explain the energy conversions that occur as the ball moves from the person's hands, to the air and back down to the person's hands.
10. Give learners some time to complete Task 2 in their workbooks.
11. Ask learners to share their answers to Task 2 with the class.
12. *Model answer: Task 2*

> 1. *Mechanical system*
> 2. *When you swing and reach the highest point, you have potential energy because you are far from the Earth. As you move back down to the Earth, the potential energy is converted to kinetic energy.*

13. Discuss the answers with the learners. Add further explanations as necessary.

> **Checkpoint 2**
>
> Ask the learners the following questions to check their understanding at this point:
>
> a. Is this statement true or false? A candle heating cold water in a can is an example of a mechanical system.
> b. Which system is used when a heated brick is placed in the sun?
>
> Answers to the checkpoint questions are as follows:
>
> a. False
> b. Thermal system

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Potential and kinetic energy	136-139
Viva	Potential and kinetic energy	208-213
Platinum	Potential and kinetic energy	107-109
Solutions for All	Potential and kinetic energy	119-124
Day-by-Day	Potential and kinetic energy	106-107
Oxford	Potential and kinetic energy	138-140
Spot On	Potential energy and kinetic energy	106-108
Top Class	Potential energy and kinetic energy	174-178
Sasol Inzalo Bk B	Potential and kinetic energy	32-41

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-in-systems-1.pdf [Potential and kinetic energy in systems-1]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-Thermal-systems.pdf [Thermal systems]

3 A

Term 3, Week 3, Lesson A
Lesson Title: Potential and kinetic energy in electrical and biological systems
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Potential and kinetic energy in systems
CAPS Page Number	26

Lesson Objectives

By the end of the lesson, learners will be able to:

- Describe an electrical system using examples
- Identify the energy conversions in an electrical system
- Describe a biological system using examples
- Identify the energy transfers in a biological system.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

TOPIC: Potential and kinetic energy

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Cells/battery	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is an energy system?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

A group of parts that work together to change energy from one form to another.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

<u>ELECTRICAL SYSTEMS</u>

1. An electric circuit is an **electrical system**.
2. An electrical circuit is made up of components (connecting wire, cells, lightbulb) that make up the system.
3. A battery has chemical potential energy. Once it is connected to a closed circuit, current flows as charges move. The chemical potential energy is converted into kinetic energy.

<u>BIOLOGICAL SYSTEMS</u>

1. **Biological systems** are energy systems that use biological energy. Living organisms get **biological energy** from the Sun (plants) or the food they eat (animals).
2. The food we eat is stored as chemical potential energy.
3. We need energy to move and live.
4. The chemical potential energy is changed to kinetic energy when we move around and do work. For example, a horse gets energy from the plants it eats. The horse uses the energy to move or pull a cart.

2. Show learners a battery or cell.
3. Explain to learners that:
   a. An electric circuit is an electrical system.
   b. A cell has chemical potential energy. Remember that this energy is stored in the cell.

   c. When the cell is connected to a circuit, current flows. The current has kinetic energy.
   d. Potential energy is transferred tokinetic energy when current flows in a circuit.
4. Explain to learners that:
   a. The food we eat gives us energy to move and live.
   b. The energy is stored in our bodies as chemical potential energy.
   c. We convert the chemical potential energy to kinetic energy when we move or do work.
   d. We are an example of a biological system.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

   a. A person eating food is an example of what type of system?
   b. A torch light is an example of what type of system?

Answers to the checkpoint questions are as follows:

   a. Biological system
   b. Electrical system

E CONCEPTUAL DEVELOPMENT

1. Write the following on the chalkboard (always try to do this before the lesson starts):

TASK 1

Answer the questions.

1. Describe an electrical system.
2. Energy being passed along a food chain is an example of what type of system?

TASK 2

Listen to the reading below and answer the following questions.

1. Who do you think will win the race, Thabo or Karabo?
2. Why do you think that person (Thabo or Karabo) will win the race?

2. Explain Task 1 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer both questions.
3. Give learners some time to complete Task 1 in their workbooks.
4. Ask learners to share their answers to Task 1 with the class.
5. *Model answer: Task 1*

   1. *An electrical system is a system that is made up of electrical components that convert chemical potential energy into kinetic energy.*
   2. *Biological system*

3. Read the following extract to the learners:
4. "Thabo and Karabo are getting ready to run an 800 metre race after school. Thabo was too nervous to eat breakfast and forgot to eat lunch at school. Karabo had a good breakfast and ate her lunch at school during break. Thabo was feeling very tired at the start of the race. Karabo was feeling energetic and strong.''
5. Next, get the learners to do Task 2.
   a. Explain Task 2 to the learners as follows:
   b. Work on your own.
6. The two questions in Task 2 above are based on the reading. Answer both questions.
7. Give learners some time to complete Task 2 in their workbooks. (Read the extract again if learners need to listen to the reading again).
8. Ask learners to share their answers to Task 2 with the class.
9. *Model answer: Task 2*

> 1. *Karabo*
> 2. *Karabo ate breakfast and lunch and has more chemical potential energy. She will be able to convert more chemical potential energy into kinetic energy to help her win the race.*

10. Discuss the answers with the learners. Add further explanations as necessary.

> **Checkpoint 2**
>
> Ask the learners the following questions to check their understanding at this point:
>
> a. Is this statement true or false? When we eat plants or animals we are able to use the stored potential energy to make our bodies function.
> b. Which system allows us to use stored energy when we run?
>
> Answers to the checkpoint questions are as follows:
>
> a. True
> b. Biological system

11. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Potential and kinetic energy	136-139
Viva	Potential and kinetic energy	214-218
Platinum	Potential and kinetic energy	110-111
Solutions for All	Potential and kinetic energy	120-125
Day-by-Day	Potential and kinetic energy	106-107
Oxford	Potential and kinetic energy	140-141
Spot On	Potential energy and kinetic energy	108-109
Top Class	Potential energy and kinetic energy	174-179
Sasol Inzalo Bk B	Potential and kinetic energy	6-8

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-electrical-systems.pdf [Electrical systems]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-in-biological-systems-1.pdf [Biological systems]

3 B

Term 3, Week 3, Lesson B
Lesson Title: Law of conservation of energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Law of conservation of energy
CAPS Page Number	27

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define the law of conservation of energy by stating that energy cannot be created or destroyed, but it can be transferred from one form to another
- Explain how energy can be transferred from one form to another.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

TOPIC: Potential and kinetic energy

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Elastic bands, string, erasers – enough for each pair of learners	Any small object that can be tied to a string

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Which energy system involves the movement of electrons through a conducting wire?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Electrical system.

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

THE LAW OF CONSERVATION OF ENERGY

1. The law of conservation of energy states that energy cannot be created or destroyed, but can be transferred from one form to another.
2. Conservation of energy means that the amount of energy at the end of a process will be the same as the amount of energy needed at the beginning.

2. Stretch an elastic band.
3. Explain to learners that:
   a. Energy cannot be created or destroyed.
   b. Energy can only be transferred from one form to another.
   c. We have looked at four systems; mechanical, thermal, electrical and biological.
   d. In each system that we have looked at, energy has been transformed from one type of energy to another type of energy.
   e. Look at the systems that we used in making the elastic band fly across the room (kinetic energy). We then had to give it potential energy by stretching it. We needed to move our hands in order to stretch the elastic band (kinetic energy). We needed to have stored energy in our bodies (chemical or biological potential energy) to move our hands. We need the energy from food in order to have chemical potential energy. This is a never-ending process. All the types of energy are transferred from one form to another. Energy can also be transferred from one system to another.
   f. Energy in the universe is being recycled all the time.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What does the law of conservation of energy state?
b. Where do we get the energy to live from?

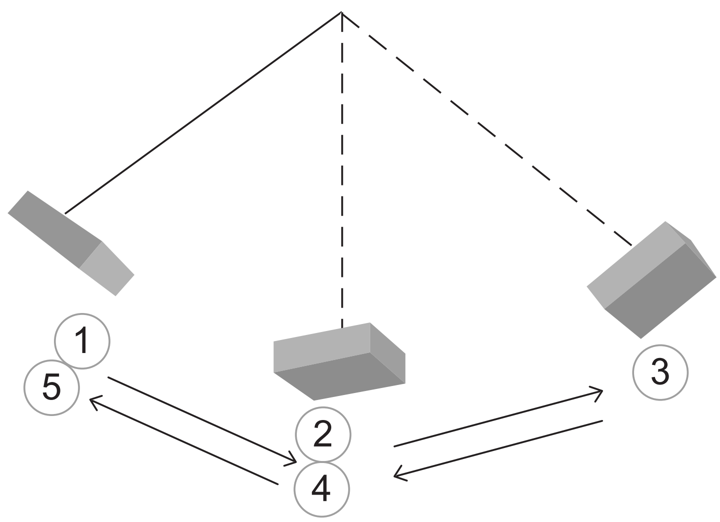
Answers to the checkpoint questions are as follows:

a. Energy cannot be created or destroyed, but can be converted from one form to another.
b. From the chemical potential energy in the food that we eat.

E CONCEPTUAL DEVELOPMENT

1. Write the following on the chalkboard (always try to do this before the lesson starts):

ACTIVITY: MAKING A PENDULUM



TASK 1

1. Make your own pendulum.
2. List the energy transformations that occur as the eraser swings from point 1 to 5?

TASK 2

1. Where did the energy at position 1 come from? List all the energy types that were used.

2. Explain Task 1 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Make your own pendulum using string and an eraser (or any other small object if the learners do not have an eraser).
   c. Tie the string around the eraser.
   d. Hold the eraser up on one side, and let it swing to the other side.
   e. Watch the eraser as it swings.
   f. Answer the questions.

3. Give learners some time to complete Task 1 in their workbooks.
4. Ask learners to share their answers to Task 1 with the class.
5. *Model answer: Task 1*

FROM POINT:

1 to 2 - gravitational potential energy to kinetic energy

2 to 3 - kinetic energy to gravitational potential energy

3 to 4 - gravitational potential energy to kinetic energy

4 to 5 - kinetic energy to gravitational potential energy

6. Next, get the learners to do Task 2.
7. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer the question.
8. Give learners some time to complete Task 2 in their workbooks.
9. Ask learners to share their answers to Task 2 with the class.
10. *Model answer: Task 2*

At position 1, there is gravitational potential energy. We moved our hands to pull the eraser back and gave it stored energy. We used kinetic energy to pull the eraser back. To move our hands, we used chemical potential energy stored inside our bodies. We received the chemical potential energy in our bodies from the animal meat and plants that we eat. Animals obtain the chemical potential energy they need from plants. Plants get their energy from the Sun. The Sun gets its energy in other ways.

11. Discuss the answers with the learners.
12. Explain to learners that:
    a. Energy cannot be created or destroyed at any point. It can only be transferred from one form to another.
13. Add further explanations as necessary.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is this statement true or false? My body createskinetic energy when I run.
b. Is this statement true or false? When I throw a ball up in the air, I am not creating energy. I am transferring the kinetic energy from my hands to the ball.

Answers to the checkpoint questions are as follows:

a. False
b. True

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Potential and kinetic energy	140
Viva	Potential and kinetic energy	218-219
Platinum	Potential and kinetic energy	107
Solutions for All	Potential and kinetic energy	125-129
Day-by-Day	Potential and kinetic energy	108-109
Oxford	Potential and kinetic energy	142
Spot On	Potential energy and kinetic energy	110-111
Top Class	Potential energy and kinetic energy	179-185
Sasol Inzalo Bk B	Potential and kinetic energy	31-32

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=C1w_-hL6mag (3min 19sec) [Potential and kinetic energy video for kids]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-Law-of-conservation-energy.pdf [Law of conservation of energy]

3 C

Term 3, Week 3, Lesson C
Lesson Title: Energy transfers
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Law of conservation of energy
CAPS Page Number	27

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain, with examples, that energy can be transferred in a system when different parts of a system interact with one another and cause changes
- Explain that energy can be transferred from one system to another
- Describe the effects of energy transfers in different parts of a system
- Draw flow diagrams to show how energy changes as it is transferred.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues	✓	11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Cell	Paper clip or safety pin
Connecting wire, switch, buzzer	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What does the law of conservation of energy state?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

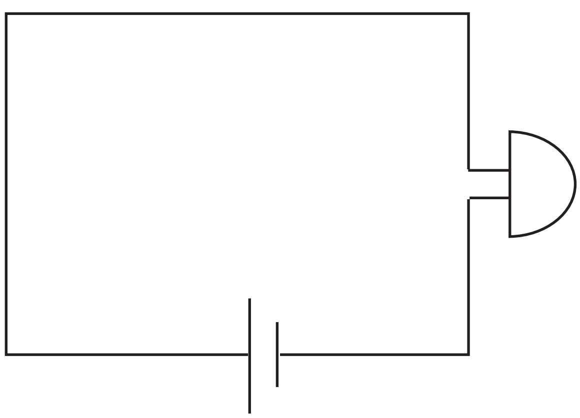
Energy cannot be created or destroyed, but can be transferred from one form to another.

D ACCESSING INFORMATION

1. Construct the circuit as shown in the diagram below if the resources are available.
2. Write and draw the following information on the chalkboard (always try to do this before the lesson starts):

ENERGY TRANSFERS

1. Energy can be transferred in a system when different parts of the system interact with one another and cause changes.
2. Energy can also be transferred from one system to another such as from an electrical system to a mechanical system in a buzzer.
3. Energy is transferred from the electrical system to the mechanical system.



a. The parts that make up the above electrical system are a switch, cell and connecting wires.
   The part that makes up the mechanical system is the buzzer.

4. We can represent the energy transfers in a flow diagram where the arrows show how energy is changed as it is transferred to different parts of the system.

INPUT
chemical potential energy in cell

→

OUTPUT
kinetic energy as the buzzer vibrates

→

PROCESS
chemical potential energy in the cell is transferred to kinetic energy as electrons move

5. We know the energy transfers are happening because we can see the buzzer vibrating and we can hear it ringing.

3. Explain to learners that:
   a. Energy can be transferred in a system when the different parts of the system interact. For example, when you swing on a swing, energy is converted from gravitational potential energy to kinetic energy, then back to gravitational potential energy, and so the process continues.
   b. Energy can also be transferred from one system to another.
4. Demonstrate to the learners how a buzzer vibrates and makes sound when it is connected, if the required resources are available. Otherwise, refer to the diagram on the chalkboard.
5. Explain to the learners that:
   a. The electrical system is made up of the cell, connecting wires and switch. These parts interact in the electrical system to transfer energy.
   b. The mechanical system is can be a buzzer.
   c. The mechanical system needs energy from the electrical system in order to work.
   d. The cell provides the electric circuit with chemical potential energy which causes the electrons in the connecting wires to move.
   e. The chemical potential energy from the cell is converted to kinetic energy as the electrons move.
   f. The electrons then provide the buzzer with kinetic energy to vibrate and produce sound.
6. Point and refer to the flow diagram on the chalkboard.
7. Explain to learners that:
   a. We represent these energy changes using flow diagrams.
   b. Flow diagrams show us the energy transfers that happen in and between systems.
   c. Flow diagrams have an input. This is where the energy in the system comes from.
   d. Flow diagrams have processes showing how the energy is transferred within the system or between systems.
   e. Flow diagrams also have an output. This is the energy that leaves the system.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What does a flow diagram show us?
b. What is the input energy in a system?

Answers to the checkpoint questions are as follows:

a. The energy transfers that happen in and between systems
b. The energy that enters a system

E CONCEPTUAL DEVELOPMENT

1. Write the following on the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Scenario 1: A boy kicks a soccer ball and the soccer ball moves
Scenario 2: An electric circuit connects to a fan motor and the blades of the fan rotate

TASK 1

1. Identify the systems involved in scenario 1.
2. What is the input energy in scenario 2?

TASK 2

1. Show the energy transformations that occur in scenarios 1 and 2, using flow diagrams.
2. How do we know that energy has been transferred in scenario 2?

2. Explain Task 1 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Read scenario1 and 2 carefully.
   c. Answer the questions.
3. Give learners some time to complete Task 1 in their workbooks.
4. Ask learners to share their answers to Task 1 with the class.
5. *Model answer: Task 1*

1. Mechanical system
2. Chemical potential energy

6. Next, get the learners to do Task 2.
7. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Read scenarios 1 and 2 carefully.
   c. Answer the questions.
8. Give learners some time to complete Task 2 in their workbooks.
9. Ask learners to share their answers to Task 2 with the class.
10. *Model answer: Task 2*

1. a.

INPUT	PROCESS	OUTPUT
chemical potential energy in boy	*Transfer of chemical potential energy to kinetic energy as the boy's leg moves. Kinetic energy from the boy's leg is transferred to the ball as it moves.*	*ball moves (kinetic energy)*

b.

INPUT	PROCESS	OUTPUT
chemical potential energy in cell	*kinetic energy in moving electrons as current flows*	*rotation of fan blades (kinetic energy)*

2. The output is the rotation of the fan blades. If no energy transfers occurred, the blades will not rotate.

11. Discuss the answers with the learners.
12. Add further explanations, if necessary.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. A horse eats carrots and then pulls a cart. Which two energy systems are involved in this scenario?
b. What is the input energy in the system?

Answers to the checkpoint questions are as follows:

a. Biological system and mechanical system
b. Chemical potential energy

13. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Potential and kinetic energy	140
Viva	Potential and kinetic energy	218-219
Platinum	Potential and kinetic energy	107
Solutions for All	Potential and kinetic energy	125-129
Day-by-Day	Potential and kinetic energy	108-109
Oxford	Potential and kinetic energy	142
Spot On	Potential energy and kinetic energy	110-111
Top Class	Potential energy and kinetic energy	179-185
Sasol Inzalo Bk B	Potential and kinetic energy	31-32

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=eTtzE19CZVM (3min 25sec) [Energy flow diagrams]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Potential-kinetic-energy-kinetic-energy.pdf [Potential and kinetic energy]

TOPIC OVERVIEW:
Heat transfer
Term 3, Weeks 4A – 5C

A. TOPIC OVERVIEW

TERM 3, WEEKS 4A – 5C

- This topic runs for 2 weeks.
- It is presented over 6 x 1 hour lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 6	GRADE 7	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Electrical conductors and insulators	• Heating as a transfer of energy • Conduction • Conductors and insulators of heat energy • Convection • Convection currents • Radiation • Reflectors and absorbers of radiant heat	• Radiation of light

C. SCIENTIFIC VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	heating	Process in which energy is transferred from a hotter body to a cooler body
2.	hotter	Having a higher temperature
3.	cooler	Having a lower temperature
4.	temperature	A measure of how hot or cold something is
5.	conduction	Transfer of energy between solid objects that are in direct physical contact with each other
6.	conductor(s)	Materials that transfer energy easily
7.	insulator(s)	Materials that are poor conductors of heat
8.	variables	Factors that are changed in an experiment in order to see the effect of the variable dependency on the results of the experiment in comparison to the one kept constant or controlled.
9.	convection	Transfer of heat from one place to another by the movement of particles in liquids or gases
10.	expand	Increase in size and volume
11.	convection current	The upward movement of heated particles and downward movement of cooled particles in a liquid or gas during heat transfer
12.	radiant heat	Heat energy that is transferred through radiation
13.	radiation	The transfer of heat energy by electromagnetic waves
14.	electromagnetic waves	Special waves that can transfer heat energy
15.	vacuum	Empty space that has no particles
16.	heat absorption	A process where an object gains heat energy and becomes hotter through radiation
17.	heat reflection	A process where radiation is bounced off the surface of an object as a result of the light or shiny properties of the surface

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

It is important to understand heat as a transfer of energy because our main source of heat energy comes from the Sun, and because we use heat energy everyday in our lives. Heat transfer occurs when heat energy is transferred from a hotter object to a cooler object. There are different methods of heat transfer namely: conduction, convection and radiation. Everything in the universe is made up of matter that consists of particles. Matter can be in the form of a solid, liquid or gas. Different heat transfer methods occur in solids, liquids and gases. In order to understand how some things in life work, it is important for us to understand how the different methods of heat transfer transfer heat from one object to another. Some surfaces absorb heat energy better than others and become hotter. This is important so that we know which is the best material to use for cooking, or keeping something cool.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

4 A

Term 3, Week 4, Lesson A
Lesson Title: Heat as a transfer of energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Heating as a transfer of energy
CAPS Page Number	27

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define heating as a process in which energy is transferred from a hotter body to a cooler body
- Explain that the energy transfer continues until both bodies are the same temperature
- List the three different methods of heat transfer as conduction, convection and radiation.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions	✓	12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

TOPIC: Heat transfer

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Poster: Heat transfer	
Resource 4: Example of heat transfer: 1.	
Resource 5: Example of heat transfer: 2.	
Resource 6: Example of heat transfer: 3.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is thermal energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Energy that is produced by heat

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

<u>HEATING AS A TRANSFER OF ENERGY</u>

1. **Heating** is a process in which energy is transferred from a **hotter** body to a **cooler** body.
2. Heat can also be transferred from a hotter part of an object to a cooler part of that same object.
3. The energy transfer continues until both bodies are at the same **temperature**.
4. **Heat** is always transferred from a hotter body to a cooler body.
5. Heat can be transferred in three ways:
6. conduction (in solids)
7. convection (in liquids and gases)
8. radiation (through empty space or an object that allows it).

2. Make sure that the poster of Heat Transfer is on display in the classroom.
3. Explain to the learners that:
   a. They have learnt about thermal energy, which is the energy that is produced by heat.
   b. The transfer of energy is the movement of energy from one body to another.
   c. Heating is a process in which energy is transferred from a hotter body to a cooler body.

   d. Heat can also be transferred from a hotter part of an object to a cooler part of that same object.
   e. The energy transfer continues until both bodies are at the same temperature.
   f. For example, when you touch hot water from the tap, you can feel the heat on your hands. The hot water is transferring heat energy to your hands. When you touch cold water, you can feel the cold on your warmer hands. Heat energy is transferred from your hands to the cold water.
4. Refer to the poster of Heat Transfer is on display in the classroom.
5. Explain to the learners that:
   a. Heat can be transferred in three ways.
   b. Conduction occurs in and between sold objects.
   c. Convection occurs in liquids and gases.
   d. Radiation occurs through empty space or through some objects.
6. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

   a. What is heating?
   b. In which direction is heat transferred? From a cooler object to a hotter object, or from a hotter object to a cooler object?

Answers to the checkpoint questions are as follows:

   a. A process in which energy is transferred from a hotter body to a cooler body.
   b. Hotter object to a cooler object

E CONCEPTUAL DEVELOPMENT

1. Use Resources 4, 5 and 6. Make sure they are on display on the chalkboard in the classroom.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Description of picture	**Hotter object**	**Cooler object**	**Heat transfer explanation**
Ironing clothing			
Boiling water in a kettle over the flame of a gas stove			
Burning wood			

TASK 1

1. Copy the table into your workbooks.
2. Identify the hotter object in each picture and fill in the second column.
3. Identify the cooler object in each picture and fill in the third column.

TASK 2

1. Explain which object the heat is being transferred to, and fill in the fourth column.

3. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has four columns.
   b. The first column has the following heading: Description of picture.
   c. The second column has the following heading: Hotter object.
   d. The third column has the following heading: Cooler object.
   e. The fourth column has the following heading: Heat transfer explanation.
   f. Look at the pictures on display on the chalkboard.
   g. Work in groups and complete Task 1.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

Description of picture	**Hotter object**	**Cooler object**	**Heat transfer explanation**
Ironing clothing	*iron*	*clothing*	
Boiling water in a kettle over the flame of a gas stove	*kettle*	*water*	
Cooking chicken on a fire	*fire*	*chicken*	

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Work on your own.
   b. Complete Task 2.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

Description of picture	Hotter object	Cooler object	Heat transfer explanation
Ironing clothing	*iron*	*clothing*	*Heat energy is transferred from the iron to the clothing.*
Boiling water in a kettle over the flame of a gas stove	*kettle*	*water*	*Heat energy is transferred from the kettle to the water.* *Heat is also transferred from the flame to the kettle.*
Cooking chicken on a fire	*fire*	*chicken*	*Heat energy is transferred from the fire to the chicken.*

14. When the learners have completed Task 2, hold a short class discussion to revise:
   a. The transfer of energy is the movement of energy from one body to another.
   b. Heating is a process in which energy is transferred from a hotter body to a cooler body.
   c. Heat can also be transferred from a hotter part of an object to a cooler part of that same object.
   d. The energy transfer continues until both bodies are at the same temperature.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

1. What happens to ice when it is taken out of the freezer on a hot summer day?
2. Why does ice melt when it is taken out of the freezer?

Answers to the checkpoint questions are as follows:

1. The ice melts.
2. The ice melts because the heat energy from its surroundings (the object it is resting on and the surrounding air) is transferred to the ice.

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Heat transfer	141
Viva	Heat transfer	224-225
Platinum	Heat transfer	113
Solutions for All	Heat transfer	130
Day-by-Day	Heat transfer	110
Oxford	Heat transfer	148-149
Spot On	Heat transfer	112-114
Top Class	Heat transfer	186-188
Sasol Inzalo Bk B	Heat transfer	56-57

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=xGKg3TSO4v8 (6min 47sec) [Science for kids. Heat energy video]

4 B

Term 3, Week 4, Lesson B
Lesson Title: Conduction
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Conduction of heat
CAPS Page Number	27

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define conduction as the transfer of heat between solid objects that are in direct physical contact with each other
- Explain that conduction only occurs in solids
- Explain that heat can be transferred from a heat source to an object, from one object to another, and from one part of an object to another.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing	✓	7. Raising Questions		12. Recording Information	
3. Comparing	✓	8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

TOPIC: Heat transfer

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Poster: Heat transfer	
Resource 8: Example of heat transfer: 1.	
Resource 9: Example of heat transfer: 2.	
Resource 10: Example of heat transfer: 3.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What are the three ways in which heat can be transferred?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Conduction, convection and radiation

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

CONDUCTION

1. **Conduction** is the transfer of heat energy between solid objects that are touching (in direct physical contact with each other).
2. An example is a cooking pot on a hot stove.
3. Heat can be transferred from one object to another, or from one part of an object to another part of the same object.
4. An example is the handle of a hot cooking pot.
5. Conduction from one part of an object to another part of the same object can only occur in solids.
6. However, conduction of heat energy can occur between a solid and a liquid or a gas.

2. Make sure that the poster of Heat Transfer is on display in the classroom.
3. Point to the cooking pot on the poster, under the heading: Conduction.

4. Explain to the learners that:
   a. Conduction is the transfer of heat energy between solid objects that are touching.
   b. Heat can be transferred from one object to another object.
   c. For example, when a cooking pot is placed on a hot stove, the heat energy from the hot stove is transferred to the cooking pot. The cooking pot then transfers the heat energy to the water that you are heating in the pot.
5. Point to the cooking pot handle on the poster, under the heading: Conduction.
6. Explain to the learners that:
   a. Heat can also be transferred from one part of an object to another part of the same object, if that object is a solid.
   b. For example, a metal handle of a cooking pot will be hotter at the point where it is connected to the hot pot. The other end of the handle is cooler. Heat energy is transferred along the handle to the cooler part of the handle. The heat energy transfer will continue until the handle is the same temperature.
7. Point to the cooking pot on the poster, under the heading: Conduction.
8. Explain to the learners that:
   a. Conduction of heat can also occur between a solid object and a liquid, or a solid object and a gas.
   b. The heat energy from the hot cooking pot is transferred to the cooler water in the pot because the cooler water is touching the hotter cooking pot.
   c. Here is another example. Think about a hot cup of tea. The tea in the cup is hot. When we touch the outside surface of the cup, we can feel that it is hot. Heat energy has been transferred from the hot tea to the cooler cup by conduction, because the hot tea is in direct contact with the cooler cup.
9. Tell the learners to copy the information on the chalkboard into their workbooks

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:
   a. What is conduction?
   b. Can conduction occur between two objects that are not touching?

Answers to the checkpoint questions are as follows:
   a. The transfer of heat energy between solid objects that are touching.
   b. No

E CONCEPTUAL DEVELOPMENT

1. Use Resources 8, 9 and 10. Make sure they are on display on the chalkboard in the classroom.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Description of picture	Conduction? (Yes/No)	Conduction of heat explanation
Ironing clothing		
Boiling water in a kettle over the flame of a gas stove		
Cooking chicken on a fire		

TASK 1

1. Copy the table into your workbooks.
2. Look at the pictures on display on the chalkboard.
3. Identify which pictures that show heat transfer by conduction and fill in the second column.

TASK 2

1. Explain how heat conduction occurs or why it does not occur in terms of each picture in the third column.

3. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has three columns.
   b. The first column has the following heading: Description of picture.
   c. The second column has the following heading: Conduction? (Yes/No).
   d. The third column has the following heading: Conduction of heat explanation.
   e. Look at the pictures on display on the chalkboard.
   f. Work in groups and complete Task 1 by writing Yes or No in the second column of the table.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

Description of picture	Conduction? (Yes/No	Conduction of heat explanation
Ironing clothing	*yes*	
Boiling water in a kettle over the flame of a gas stove	*yes*	
Cooking chicken on a fire	*no*	

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer the question in Task 2.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

Description of picture	Conduction? (Yes/No	Conduction of heat explanation
Ironing clothing	*yes*	*The iron is hot. The clothing is cool. The hot iron is touching the cool clothing. Heat is transferred from the hot iron to the cool clothing by conduction. As a result, the clothing will become hotter.*
Boiling water in a kettle over the flame of a gas stove	*yes*	*The water is in the kettle. The water is touching the kettle. The kettle becomes hot from the flame. The kettle transfers heat to the water by conduction. The water will become hotter and start to boil.* *The transfer of heat from the flame to the kettle does not constitute heat conduction because the flame is not touching the kettle.*
Cooking chicken on a fire	*no*	*This is not heat transfer by conduction because the chicken is not touching the fire.*

14. When the learners have completed Task 2, hold a short class discussion to revise:
   a. Potential energy is energy that is stored in an object or system.
   b. There are three types of potential energy.
   c. Elastic potential energy is stored energy in a stretched elastic band.
   d. Gravitational potential energy is the energy an object has because of its position above the Earth.
   e. Chemical potential energy is found in the food we eat, cells (battery) and fuel (petrol or diesel).

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is this statement true or false? Heat that is transferred from a cooler part of an object to a hotter part of an object is an example of heat conduction.
b. Is this statement true or false? The heat that you can feel from the Sun on your skin is an example of heat conduction.

Answers to the checkpoint questions are as follows:

a. False. Heat that is transferred from a hotter part of an object to a cooler part of an object is an example of heat conduction. Heat transfer is always from a hotter object to a cooler object.
b. False. For heat conduction to occur, two objects must be touching. You cannot touch the Sun.

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Study & Master	Heat transfer	142-145
Viva	Heat transfer	226-228
Platinum	Heat transfer	114-115
Solutions for All	Heat transfer	130-132
Day-by-Day	Heat transfer	110-113
Oxford	Heat transfer	150-155
Spot On	Heat transfer	115-118
Top Class	Heat transfer	188-190
Sasol Inzalo Bk B	Heat transfer	57-65

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=w_IbPRNZ6ho (2min 24sec) [Conduction of heat]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-conduction.pdf [Heat transfer: Conduction]

4 C

Term 3, Week 4, Lesson C
Lesson Title: Conduction
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Good and bad conductors of heat
CAPS Page Number	27

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define conductors as materials that conduct heat easily
- List examples of objects made of materials that are conductors
- Define insulators as materials that prevent heat conduction
- List examples of objects made of materials that are insulators.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS

1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicting	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Poster: Heat transfer	
Kettle filled with one litre of water	
Four tea cups of the same height	Four small jars
Steel, brass, aluminium and iron rods each about 15cm long	
Drawing pins	
Vaseline	Wax (from a burning candle)
Stopwatch	Wrist watch
Four Aluminium foil squares (15 cm x 15 cm)	Cellophane plastic

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is conduction?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

The transfer of heat between solid objects that are in contact with one another

D ACCESSING INFORMATION

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

<u>CONDUCTORS</u>

1. Materials that transfer heat easily are called **conductors**.
2. Metals are good conductors of heat.
3. Some metals conduct heat better than others.
4. Good conductors are used for making items, such as cooking pots.

<u>INSULATORS</u>

1. Poor conductors of heat slow down conduction of heat.
2. Poor conductors of heat are called **insulators** of heat.
3. Plastic, wood and styrofoam are insulators.

VARIABLES IN EXPERIMENTS

1. **Variables** are factors that can change in an experiment.
2. Examples of variables are time, the amount of material used, the type of material used, and temperature.
3. When experiments are done, only one variable is changed each time the experiment is repeated. The same variable must be changed each time in order for us to compare the results of our experiments.
4. We can compare the results from our experiments in graphs such as **bar graphs**.

3. Point to the cooking pot on the poster, under the heading: Conduction.
4. Explain to the learners that:
   a. Sometimes we need to transfer heat from one object to another. An example is from a stove top to a cooking pot.
   b. Conductors are materials that allow heat energy to be transferred.
   c. A cooking pot should be made out of a conductor, so that the heat energy from the stove can be transferred to the cooking pot.
   d. Metals are good conductors of heat, but some metals conduct heat better than others.
5. Explain to the learners that:
   a. Sometimes we do not want heat energy to be transferred.
   b. For example, on a cold day we wear thick jackets. The jackets prevent heat from being transferred from our warm bodies to the cooler air. This helps to keep us warm. Our clothes are poor conductors of heat.
   c. Poor conductors of heat slow down the conduction of heat.
   d. Poor conductors of heat are called insulators of heat.
   e. Plastic, wood and Styrofoam are all examples of heat insulators.
6. Point to the cooking pot handle on the poster, under the heading: Conduction.
7. Explain to the learners that:
   a. A cooking pot handle should be made out of an insulating material. Since the handle is touching the hot pot, the heat will be transferred along the handle by conduction until the handle is the same temperature everywhere. This means that the handle will be very hot when we touch it, if it is made of a conducting material like a metal. If the pot handle is made of an insulating material like wood or plastic, then the heat transfer is slowed down and the handle will not become hot. It will not burn us when we touch it.
8. Explain to the learners that:
   a. We are going to be doing some experiments to test how fast heat is transferred through some metal conductors. It is important for us to understand what a variable is in an experiment.
   b. Variables are factors that can change in an experiment.
   c. Examples of variables are time, temperature and the type of material.
   d. We change the same variable in a series of experiments in order to see how the variable affects the results of the experiment.
   e. We can use graphs such as bar graphs to show the results of the experiments.
9. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a conductor of heat energy?
b. What is the name given to materials that prevent or slow down the conduction of heat?

Answers to the checkpoint questions are as follows:

a. Materials that allow the transfer of heat
b. Insulators

E CONCEPTUAL DEVELOPMENT

1. Advance preparation: ensure that you have all the resources required for the demonstration.
2. If you have enough resources, you can get the learners to do the investigation in groups.
3. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Type of material	Time taken for pin to drop
Aluminium	
Steel	
Brass	
Iron	

TASK 1

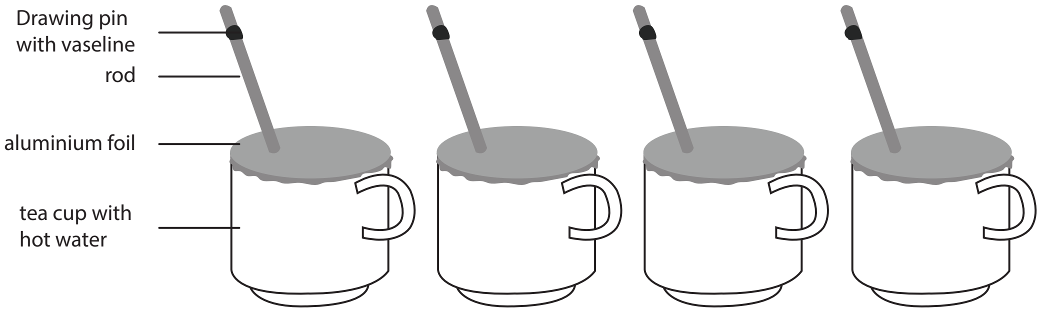
1. Copy the table into your workbooks.
2. Observe the demonstration that is done by your teacher.
3. Fill in the required information in the second column of the table.

TASK 2

1. Show the information in the table in the form of a bar graph in your workbooks.
2. Which material is the best heat conductor and how do we know this?
3. What was the variable that was changed for each tea cup demonstration?
4. What other variables could have affected the findings of the demonstration?

4. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has two columns.
   b. The first column has the following heading: Type of material.
   c. The second column has the following heading: Time taken for pin to drop (s).
   d. Watch the demonstration carefully.
   e. Make sure you fill in the second column of the table correctly.

5. Demonstrate the investigation of heat transfer in conductors:
   a. Learners observe while you set up the investigation, as follows:



Step	Instruction	Notes for teacher
1	Select two learners to be time keepers. The learners can use a stop watch or a wrist watch.	The learners must be ready to start timing once you instruct them (in step 10).
2	Place four tea cups on a table in front of the learners. Make sure that you have the aluminium foil squares cut and ready for use.	Try and use tea cups that are similar in size. Make sure all the tea cups are filled to the same height.
3	Label each tea cup so that the learners know which rod will be placed in which cup. Use the following labels with the correct rods: ● Aluminium rod ● Steel rod ● Brass rod ● Iron rod.	Make sure you match each label with the correct metal rod.
4	Make a marking in each rod at a distance of 15 cm from one side.	The markings must not be too far from the end that will be put in each tea cup.
5	Place enough Vaseline at each mark on each rod so that a drawing pin can stick to the rod without falling off. Stick a drawing pin on each rod.	Try and put the same amount of Vaseline on each rod to make the results more reliable.
6	Boil one litre of water in the kettle.	
7	Quickly and carefully fill each tea cup with boiling water.	Do this as quickly as possible to prevent the water from cooling down too much.
8	Cover each tea cup with a sheet of aluminum foil, so that the steam does not escape.	Covering the tea cups with aluminium foil prevents the steam from rising and melting the Vaseline. We want the heat from the boiling water to be transferred to the Vaseline through conduction.

9	Push one rod through each aluminium foil sheet and push the rod down to touch the bottom of the tea cup.	
10	Once all the rods have been pushed into the tea cups, instruct the time keepers to start timing.	The learners can start the timer as soon as the last rod has been pushed in.
11	Record how long it takes for each drawing pin to fall or slide off each rod.	All the learners should record the time it takes for the drawing pin of each rod to fall.

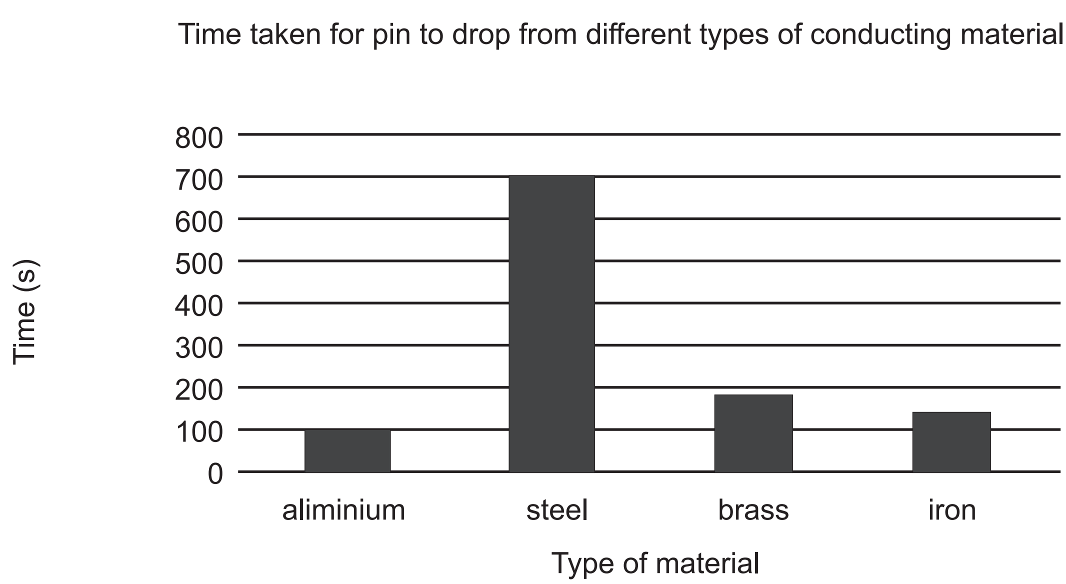
6. Explain Task 1 to the learners as follows:
   a. Complete Task 1.
7. Give learners some time to do Task 1.
8. Ask learners to share their answers to Task 1 with the class.
9. Discuss the answers with the learners.
10. *Model answer: Task 1*

Times recorded in the table will vary. Record the times of your experiment.

11. Next, get the learners to do Task 2.
12. Explain Task 2 to the learners as follows:
    a. Work with the person sitting next to you.
    b. Answer the questions in Task 2.
13. Give learners some time to do Task 2.
14. Ask learners to share their answers to Task 2 with the class.
15. Discuss the answers with the learners.
16. *Model answer: Task 2*

The time taken for each pin to drop must be the same as what was recorded during the demonstration.

The following bar graph is a sample of what the bar graph should look like but with the times from the demonstration:



1. Check that the bar graph has:
    - a suitable heading
    - time in seconds on the y-axis
    - type of material on the x-axis
    - a suitable scale on the y-axis
    - equal spaces between the bars and bars of the same thickness
    - correct time for each material type as recorded during the demonstration.
    - Also check that a ruler was used to draw the bar graph.
2. The best heat conducting material should be aluminium because the drawing pin on the aluminium rod should have fallen off first. (This answer may differ depending on the results of the demonstration.)
3. Material type
4. The following variables could have affected the results:
    a. different rod thicknesses
    b. different distances from the surface of the water to the drawing pin
    c. different water temperatures
    d. unequal amounts of Vaseline
    e. ripped aluminium foil that allows steam to escape and melt the Vaseline.

17. Answer any questions that learners may have and provide further explanations.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

1. Should a cooking pot be made up of metal or wood?
2. Why do some metal spoons have plastic material on the handle?

Answers to the checkpoint questions are as follows:

1. Metal
2. To prevent or slow down the conduction of heat along the spoon, so that it does not burn your hand.

18. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Heat transfer	142-145
Solutions for all	Heat transfer	226-228
Spot On	Heat transfer	114-115
Top Class	Heat transfer	130-132
Via Afrika	Heat transfer	110-113
Platinum	Heat transfer	150-155
Oxford Successful	Heat transfer	115-118
Pelican Natural Sciences	Heat transfer	188-190
Sasol Inzalo Bk B	Heat transfer	57-65

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=9joLYfayee8 (2min 50sec) [Physics-Energy-Heat Transfer-Conduction]
2. https://www.youtube.com/watch?v=Ry8yXhCxclA (3min 15sec) [What materials conduct heat: best Science experiment]

5 A

Term 3, Week 5, Lesson A
Lesson Title: Convection
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Convection currents
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define convection as the transfer of heat from one place to another by the movement of liquid or gas particles
- Explain that particles move upwards when they are heated
- Explain that particles move downwards when they are cooled
- Define a convection current as the movement of particles in a liquid or gas, during heat transfer
- Explain why heaters are best placed near the floor and air conditioners best placed near the ceiling.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions	✓	12. Recording Information	✓
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Poster: Heat transfer	
Beaker	
Bunsen burner	Candle
Tripod stand	
Potassium permanganate crystals	Food colouring
Straw	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is an insulator?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

A poor conductor of heat

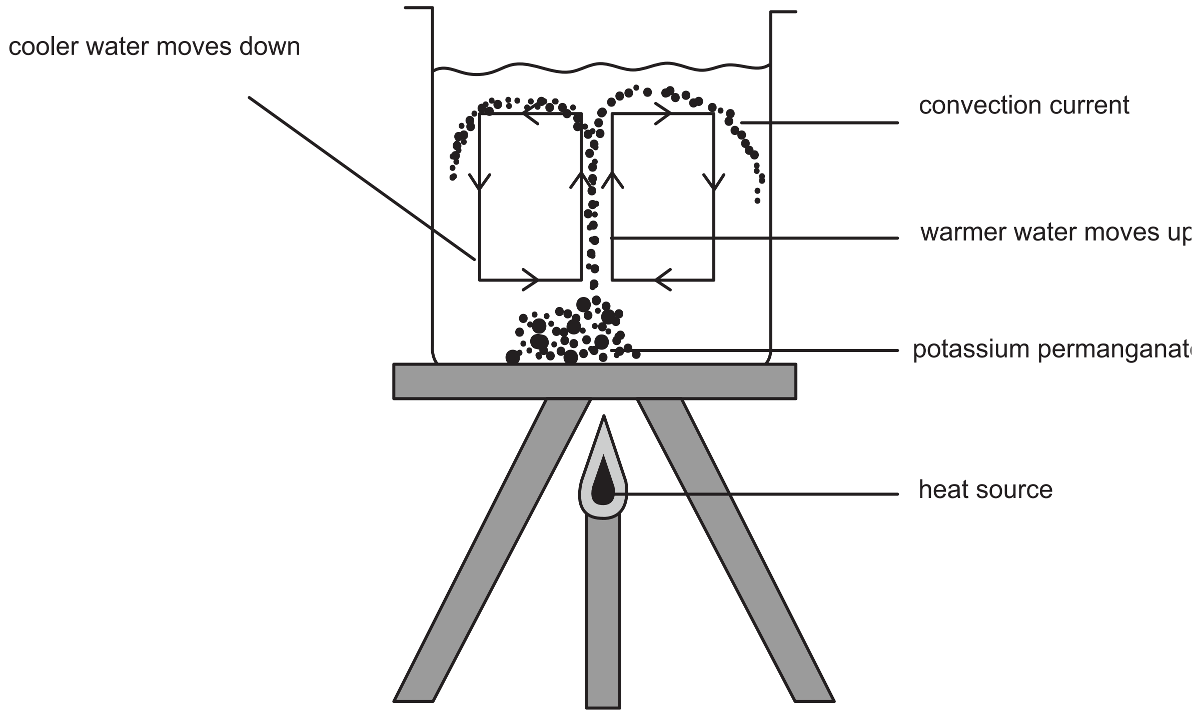
D ACCESSING INFORMATION

1. Write the following information and copy the diagram on the chalkboard (always try to do this before the lesson starts):

CONVECTION

1. **Convection** is the transfer of heat from one place to another by the movement of liquid or gas particles.
2. Convection only occurs in liquids or gases which have particles that move around easily.
3. The particles of liquids and gases move more quickly when they are heated.
4. When the particles move more quickly, they take up more space and the liquid or gas **expands**.
5. The particles move upwards when they are heated.
6. The particles move downwards when they are cooled.
7. A **convection current** is the upward movement of heated particles and the downward movement of cooled particles in a liquid or gas which occur during heat transfer.
8. The heat is moved around in the liquid or gas by convection currents.

9. An example is heating water in a cooking pot. The hotter particles at the bottom of the pot will rise to the top of the pot. The cooler particles at the top of the pot will sink to the bottom of the pot. This continues in a cycle.



2. Make sure that the poster of Heat Transfer is on display in the classroom.
3. Advance preparation: ensure that you have all the resources for the demonstration.
4. Demonstrate the convection currents in water:
   a. Learners observe while you set up the demonstration, as follows:

Step	Instruction	Notes for teacher
1	Set up the tripod, beaker and heat source as shown in the diagram. (Do not switch on the Bunsen burner yet.)	Make sure the set-up is well balanced so that it does not fall over. If you do not have a Bunsen burner, use a candle.
2	Fill the beaker with tap water.	The beaker can be filled to approximately two-thirds of the beaker.
3	Place the straw in the water until it touches the bottom of the beaker.	Wait for the water to be still after the straw has touched the bottom. Do not move the straw around. Keep it still.
4	Carefully slide a few crystals of potassium permanganate or a few drops of food colouring down the straw. The crystals or food colouring should fall to the bottom of the beaker.	Make sure you do not spill as you slide the crystals or food colouring down the straw.
5	Remove the straw very slowly.	Make sure the straw is removed very slowly so that the crystals or food colouring are not disturbed.

6	Switch on the Bunsen burner and heat up the water.	Take care when using the Bunsen burner.
7	Carefully observe what happens.	The crystals or food colouring should move along convection currents. The colouring of the crystals or food colouring should clearly outline the convection currents.

5. Point to the cooking pot on the poster under the heading: Convection.
6. Explain to the learners that:
   a. Convection is the transfer of heat from one place to another by the movement of liquid or gas particles.
   b. Convection can only occur in liquids and gases. It cannot occur in solids because the particles have a fixed structure and cannot move around easily like the particles in liquids and gases.
   c. As particles are heated, they gain kinetic energy and move around faster and become hotter.
7. Point to the convection currents on the poster, under the heading: Convection.
8. Explain to the learners that:
   a. As the particles become hotter, they move upwards.
   b. The particles at the top then become cooler and sink down to the bottom of the beaker.
   c. The particles at the bottom of the beaker are then heated up again.
   d. This continuous up-and-down movement of particles is called a convection current.
   e. Convection currents will continue until the liquid or gas is the same temperature.
9. Tell the learners to copy the information on the chalkboard into their workbooks

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a convection current?
b. Can convection occur in a spoon?

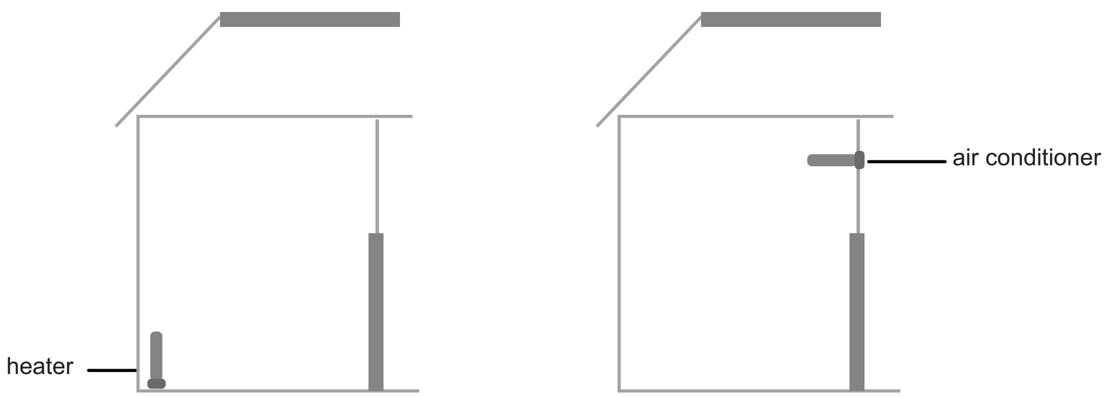
Answers to the checkpoint questions are as follows:

a. The upward movement of heated particles and the downward movement of cooled particles in a liquid or gas, during heat transfer
b. No. Convection currents only occur in liquids and gases.

E CONCEPTUAL DEVELOPMENT

1. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY



TASK 1

1. Heaters are used to heat up the air in a room. Heaters are usually placed on the floor. Why are heaters placed on the floor of a room?
2. Air conditioners are used to cool the air in a room. They are usually placed close to the ceiling of a room. Why are air conditioners placed near the ceiling of a room?

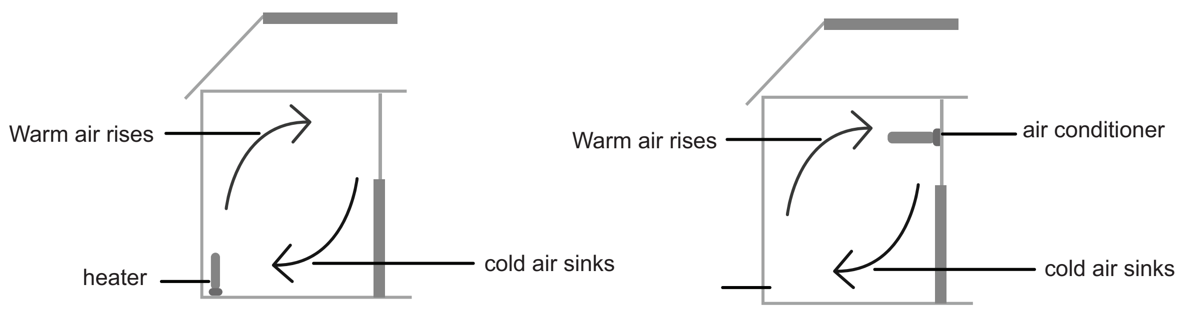
TASK 2

1. Copy the diagrams into your workbooks.
2. Draw a labeled diagram to explain why heaters are placed on the floor of a room and why air conditioners are placed near the ceiling. Show the convection currents.

2. Explain Task 1 to the learners as follows:
   a. Work in groups and complete Task 1.
3. Give learners some time to do Task 1.
4. Ask learners to share their answers to Task 1 with the class.
5. Discuss the answers with the learners.
6. *Model answer: Task 1*

1. *Heaters are placed on the floor because they heat up the air in a room and cause the air to rise. The hot air rises to the ceiling of the room and the cool air sinks to the floor of the room. The heater then heats up the cool air. Convection currents spread the heat throughout the room, keeping the room warm.*
2. *Air conditioners are placed near the ceiling, because they cool down the air in a room and cause the cool air to sink. The cool air sinks to the floor and the hot air rises to the ceiling of the room. The air conditioner then cools down the hot air. Convection currents spread the cooler air throughout the room, keeping the room cool.*

7. Next, get the learners to do Task 2.
8. Explain Task 2 to the learners as follows:
    a. Work on your own.
    b. Answer the questions in Task 2.
9. Give learners some time to do Task 2.
10. Ask learners to share their answers to Task 2 with the class.
11. Discuss the answers with the learners.
12. *Model answer: Task 2*



13. When the learners have completed Task 2, hold a short class discussion to revise:
    a. Convection is the transfer of heat from one place to another by the movement of liquid or gas particles.
    b. The particles move upwards when they are heated.
    c. The particles move downwards when they are cooled.
    d. A convection current is the upward movement of heated particles and the downward movement of cooled particles in a liquid or gas, during heat transfer.
    e. The heat is moved around in the liquid or gas by convection currents.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:
    a. Is the statement true or false? Convection is the transfer of heat from one place to another by the movement of particles in liquids, gases and solids.
    b. What term do we give to the movement of particles in liquids and gases during heat transfer?

Answers to the checkpoint questions are as follows:
    a. False. Convection is the transfer of heat from one place to another by the movement of particles in liquids and gases only. Convection cannot occur in solids.
    b. Convection currents

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Heat transfer	146-149
Solutions for all	Heat transfer	228-232
Spot On	Heat transfer	116-117
Top Class	Heat transfer	132-134
Via Afrika	Heat transfer	113-115
Platinum	Heat transfer	156-158
Oxford Successful	Heat transfer	119-120
Pelican Natural Sciences	Heat transfer	190-193
Sasol Inzalo Bk B	Heat transfer	65-71

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=VxGIiOTuAIs (2min 07sec) [Physics-Energy-Heat Transfer-Convection]
2. https://www.youtube.com/watch?v=O3Z-lioH2k0 (2min 08sec) [Convection-Smoke Flow]
3. https://www.youtube.com/watch?v=WEDUtS0IMws (4min 30sec) [Convection Demos]

5 B

Term 3, Week 5, Lesson A
Lesson Title: Radiation
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Radiation
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define radiant heat as heat energy that is transferred through radiation
- Define radiation as the transfer of heat energy by electromagnetic waves. It does not require physical contact or movement of particles.
- Explain that heat from the Sun travels by radiation through a vacuum of empty space to the Earth
- Explain that all hot objects take in and give off heat energy.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions	✓	12. Recording Information	✓
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Poster: Heat transfer	
Candle	
Matches	Lighter
Resource 4: Example of heat transfer: 1.	
Resource 5: Example of heat transfer: 2.	
Resource 6: Example of heat transfer: 3.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is a convection current?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

A convection current is the upward movement of heated particles and the downward movement of cooled particles in a liquid or gas, during heat transfer

D ACCESSING INFORMATION

1. Write the following information and copy the diagram on the chalkboard (always try to do this before the lesson starts):

RADIATION

1. **Radiant heat** is heat energy that is transferred through **radiation**.
2. Radiation is the transfer of heat energy by **electromagnetic waves**, which are special waves that can transfer heat energy.
3. Radiation is different from conduction and convection because radiation does not need objects to be touching or particles to move.
4. Radiation can transfer heat energy through a **vacuum**.
5. Heat from the Sun travels by radiation through the vacuum of empty space to the Earth.
6. Electromagnetic waves transfer heat energy to an object when the waves travel to the object.
7. All hot objects take in and give off heat. This is called radiant heat.

2. Advance preparation: ensure that you have all the resources for the demonstration. Tell the learners to copy the information on the chalkboard into their workbooks.
3. Demonstrate heat energy transfer through radiation using a candle.
   a. Learners observe while you set up the demonstration, as follows:

Step	Instruction	Notes for teacher
1	Place a lit candle in the front of the classroom.	Make sure the candle is on a surface that does not have any objects around it that can catch fire.
2	Allow the learners, one by one, to carefully bring their hands sufficiently near the flame to feel the heat energy from the flame.	Make sure you assist each learner as they come up one by one to feel the flame. Make sure learners line up in an orderly fashion, and sit down once they have finished.

4. Make sure that the poster of Heat Transfer is on display in the classroom.
5. Point to the hands on the fire on the poster under the heading: Radiation.
6. Explain to the learners that:
   a. Radiant heat is heat energy that is transferred through radiation.
   b. Radiation is the transfer of heat energy by electromagnetic waves, which are special waves that can transfer heat energy.
   c. Radiation is different from conduction and convection because radiation does not need objects to be touching or particles to move.
   d. Heat transfer through conduction needs a solid object made of tightly packed particles.
   e. Heat transfer through convection needs a liquid or gas made up of particles that can move around more freely.
   f. Radiation does not need any particles; therefore, it does not need matter to transfer heat. It can occur in empty space.
   g. A vacuum is a term used to describe empty space.
   h. Radiation can transfer heat energy through a vacuum. Heat from the Sun travels by radiation through the vacuum of empty space to the Earth.
7. Point to the hands on the fire on the poster, under the heading: Radiation.
8. Explain to the learners that:
   a. Electromagnetic waves transfer heat energy to an object when the waves travel to the object.
   b. All hot objects take in and give off heat. This is called radiant heat.
   c. The hands on the poster will absorb the radiant heat given off by the fire.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is radiation?
b. How is radiation different to conduction and convection?

Answers to the checkpoint questions are as follows:

a. Radiation is the transfer of heat energy by electromagnetic waves.
b. Radiation does not need objects to be touching or particles to move in order to transfer heat energy.

E CONCEPTUAL DEVELOPMENT

1. Use Resources 4, 5 and 6. Make sure they are on display on the chalkboard in the classroom.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Description of picture	Radiation? (Yes/No)	Radiation of heat explanation
Ironing clothing		
Boiling water in a kettle over the flame of a gas stove		
Cooking chicken on a fire		

TASK 1

1. Copy the table into your workbooks.
2. Look at the pictures on display on the chalkboard.
3. Identify the pictures that show heat transfer by radiation and fill in the second column.
4. Explain how heat conduction occurs, or why it does not occur, for each picture in the third column.

TASK 2

1. Why is the water in the kettle that is being heated not an example of heat transfer by radiation?

3. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has three columns.
   b. The first column has the following heading: Description of picture.
   c. The second column has the following heading: Radiation? (Yes/No).
   d. The third column has the following heading: Radiation of heat: explanation.

   e. Look at the pictures on display.
   f. Work in groups and complete Task 1 by writing Yes or No in the second column of the table.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

ACTIVITY

Description of picture	Radiation? (Yes/No)	Radiation of heat explanation
Ironing clothing	*No*	*The iron is in direct contact with the clothing. This is not heat transfer through radiation.*
Boiling water in a kettle over the flame of a gas stove	*Yes*	*The flame from the gas stove radiates heat energy to the kettle. The kettle absorbs the radiant heat and becomes hot.*
Cooking chicken on a fire	*Yes*	*The flames from the fire, burning the coals, radiate heat energy. The chicken absorbs the radiant heat, making the chicken hot and causing it to cook.*

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer the questions in Task 2.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

The water being heated in the kettle is a liquid. Liquids are heated by convection which is the movement of particles during heat transfer. Radiation does not need any particles to transfer heat. Radiation transfers heat through empty space.

14. When the learners have completed Task 2, hold a short class discussion to revise:
   a. Radiant heat is heat energy that is transferred through radiation.
   b. Radiation is the transfer of heat energy by electromagnetic waves, which are special waves that can transfer heat energy.
   c. Radiation can transfer heat energy through a vacuum.
   d. Heat from the Sun travels by radiation through the vacuum of empty space to the Earth.
   e. All hot objects take in and give off heat. This is called radiant heat.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What method of heat energy transfer does the Sun use to transfer heat energy to the Earth?
b. Is the following statement true or false? All hot objects radiate electromagnetic waves.

Answers to the checkpoint questions are as follows?

a. Radiation
b. True

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Heat transfer	149-151
Solutions for all	Heat transfer	232-238
Spot On	Heat transfer	118-120
Top Class	Heat transfer	135-138
Via Afrika	Heat transfer	115-119
Platinum	Heat transfer	158-162
Oxford Successful	Heat transfer	128-123
Pelican Natural Sciences	Heat transfer	193-201
Sasol Inzalo Bk B	Heat transfer	71-81

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=tZIiZyoYT80 (1min 36sec) [Heat Transfer-Radiation]
2. https://www.youtube.com/watch?v=gY9BpJmhIrE (3min 54sec) [GCSE-Heat transfer-radiation]
3. https://www.youtube.com/watch?v=Atnjo7dD_bA&t=110s (3min 24sec) [Heat Transfer: Conduction, Convection and Radiation]

5 C

Term 3, Week 5, Lesson C
Lesson Title: Radiation
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Absorption and reflection of heat
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- Define heat absorption as a process where an object gains heat energy and becomes hotter through radiation
- Define heat reflection as a process where radiation is bounced off the surface of an object
- Explain that dark surfaces absorb heat energy faster than light or shiny surfaces
- Shiny surfaces are better reflectors of heat energy than dark or dull surfaces.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing	✓	8. Predicting		13. Interpreting Information	✓
4. Measuring	✓	9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Poster: Heat transfer	
Black envelope	Black cardboard paper
White envelope	White cardboard paper
Aluminium foil rectangle sheet	
Thermometer	
Stopwatch	Wristwatch

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is radiation?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

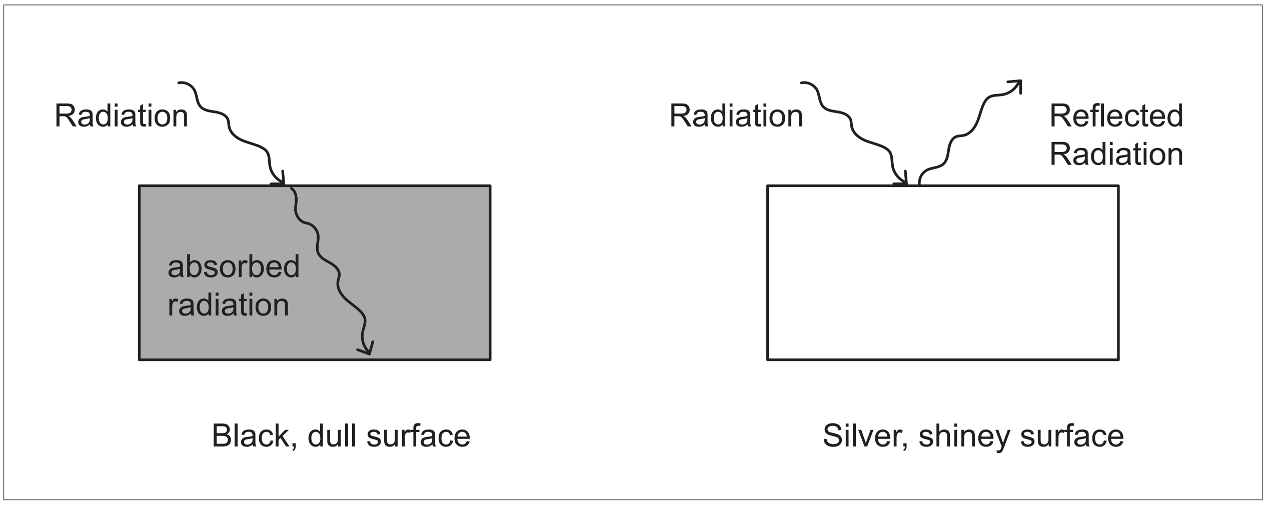
Radiation is the transfer of heat through empty space that does not require physical contact or the movement of particles.

D ACCESSING INFORMATION

1. Write the following information and copy the diagram on the chalkboard (always try to do this before the lesson starts):

ABSORPTION AND REFLECTION OF RADIANT HEAT

1. When an object becomes hot through radiation, we say the object has absorbed heat energy.
2. When heat energy is absorbed, the radiation waves enter the object and heat it up.
3. Some surfaces absorb heat energy, and some surfaces reflect heat energy.
4. When heat energy is reflected, the radiation waves bounce off the surface of the object.
5. Dark surfaces (black) absorb heat energy faster than light surfaces (white).
6. Dark surfaces heat up faster than light surfaces.
7. Shiny surfaces (silver) are better reflectors of heat energy than dull surfaces.
8. Shiny surfaces take longer to heat up then dull surfaces.
9. Radiation heats up dark surfaces faster than it heats up shiny surfaces.



2. Make sure that the poster of Heat Transfer is on display in the classroom.
3. Point to the hands near the fire on the poster, under the heading: Radiation.
4. Explain to the learners that:
   a. When an object becomes hot through radiation, we say the object has absorbed heat energy.
   b. The hands on the poster are absorbing the heat energy that is being radiated by the fire. As a result, the hands will warm up. Therefore, we use fires in winter to help keep us warm. We can feel the radiant heat of the fire over a distance.
   c. Not all surfaces absorb heat energy and become hotter.
   d. Some surfaces absorb radiant heat faster than other surfaces.
5. Show learners a black envelope and a white envelope.
6. Explain to the learners that:
   a. Dark surfaces absorb heat energy faster than light surfaces.
   b. Dark surfaces will heat up faster than light surfaces. That is why we wear dark coloured clothes in winter, and light colour clothes in summer.
9. Show learners a shiny envelope (aluminium foil).
10. Explain to the learners that:
    a. Shiny surfaces are better reflectors of heat energy than dull surfaces. Dull surfaces are surfaces that are not shiny.
11. Point to the diagram of the silver, shiny surface on the chalkboard.
12. Tell the learners to copy the information on the chalkboard into their workbooks. Then explain to the learners that:
    a. Shiny surfaces will take longer to heat up than dull surfaces or dark surfaces because the radiation waves bounce off the shiny surface. Silver cars have a shiny surface so that they can reflect heat radiation and be cool on hot days.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. Which car would be cooler to sit in on a hot summer day? A black car or a white car?
b. Why will that car colour be cooler?

Answers to the checkpoint questions are as follows:

a. White car.
b. The black car has a darker surface and will absorb heat radiation faster than the white car.

E CONCEPTUAL DEVELOPMENT

1. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

	Temperature (°C)		
Time in envelope (seconds)	**White**	**Black**	**Aluminium foil**
0			
30			
60			
90			
120			
150			
180			

TASK 1

1. Observe the demonstration carefully.
2. Use the results from the demonstration to fill in the table.

TASK 2

1. Draw a line graph to show the results.
2. Which envelope had the highest temperature?
3. Which envelope had the lowest temperature?

2. Make sure that the poster of Heat Transfer is on display in the classroom.
3. Advance preparation: ensure that you have all the resources for the demonstration.
4. Demonstrate and measure the amount of radiant heat absorbed by different surfaces:
5. Learners observe while you set up the demonstration, as follows:

ACTIVITY

Step	Instruction	Notes to teacher
1	Allow the thermometer so the temperature reading is as low as possible.	Make sure you do this carefully so that you do not drop the thermometer.
2	Put the thermometer in the white envelope.	
3	Use the stop watch as a timer and hold the white envelope in the Sun.	Make sure you are not touching the thermometer while you hold the envelope in the Sun.
4	Record the temperature reading in degrees Celsius, on the thermometer, every 30 seconds for three minutes.	Take the reading as accurately as possible.
5	Allow the thermometer so the temperature reading is as low as possible.	
6	Put the thermometer in the black envelope.	
7	Record the temperature reading in degrees Celsius, on the thermometer, every 30 seconds for three minutes.	Make sure you are not touching the thermometer while you hold the envelope in the Sun.
8	After two minutes, take out the thermometer and read the temperature in degrees Celsius.	Take the reading as accurately as possible.
9	Put the thermometer in the aluminium foil envelope.	
10	Record the temperature reading in degrees Celsius, on the thermometer every 30 seconds for three minutes.	Make sure you are not touching the thermometer while you hold the envelope in the Sun.
11	After two minutes, take out the thermometer and read the temperature in degrees Celsius.	Take the reading as accurately as possible.
12	Put the empty envelopes in the Sun at the same time	Place all three envelopes on the floor in the sun. Try to put them on grass or sand and not bricks or concrete.
13	Feel the surface of each envelope.	All the learners to feel the surface of each envelope.

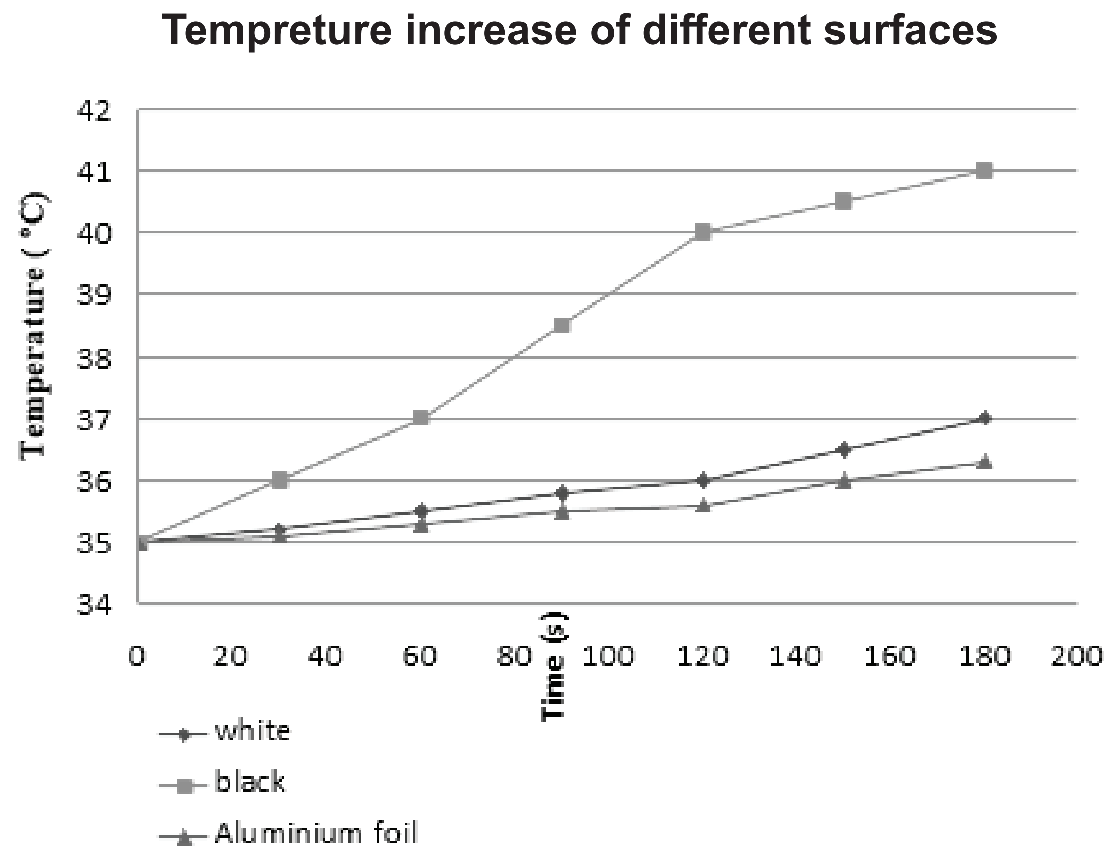
2. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has two columns.
   b. The first column has the following heading: Envelope colour.
   c. The second column has the following heading: Temperature (°C).
   d. Work on your own.
   e. Use the results from the demonstration to complete Task 1.
3. Give learners some time to do Task 1.
4. Ask learners to share their answers to Task 1 with the class.
5. Discuss the answers with the learners.
6. *Model answer: Task 1*

The temperature readings will vary according to your results. The table should look something like this:

	Temperature (°C)		
Time in envelope (seconds)	**White**	**Black**	**Aluminium foil**
0	*35*	*35*	*35*
30	*35.2*	*36*	*35.1*
60	*35.5*	*37*	*35.3*
90	*35.8*	*38.5*	*35.5*
120	*36*	*40*	*35.6*
150	*36.5*	*40.5*	*36*
180	*37*	*41*	*36.3*

7. Next, get the learners to do Task 2.
8. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer the questions in Task 2.
9. Give learners some time to do Task 2.
10. Ask learners to share their answers to Task 2 with the class.
11. Discuss the answers with the learners.
12. *Model answer: Task 2*

1. The temperature readings will vary according to your results. The graph should look something like this:



a. Check that the bar graph has:
   - a suitable heading
   - time in seconds on the x-axis
   - temperature in (°C) on the y-axis
   - a suitable scale on the x-axis
   - a suitable scale on the y-axis
   - lines are labeled correctly
   - the correct time for each envelope colour as recorded during the demonstration.
   - a ruler which was used to draw the line graph.

2. Black envelope
3. Aluminium envelope

13. Answer any questions that learners may have and provide further explanations.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Why did the black envelope in the demonstration have the highest temperature?
b. Why did the aluminium envelope in the demonstration have the lowest temperature?

Answers to the checkpoint questions are as follows:

a. The black envelope has a darker surface and absorbs heat radiation faster than the light surface or the shiny surface.
b. The aluminium foil has a shiny surface and reflects heat radiation.

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Heat transfer	149-151
Solutions for all	Heat transfer	232-238
Spot On	Heat transfer	118-120
Top Class	Heat transfer	135-138
Via Afrika	Heat transfer	115-119
Platinum	Heat transfer	158-162
Oxford Successful	Heat transfer	128-123
Pelican Natural Sciences	Heat transfer	193-201
Sasol Inzalo Bk B	Heat transfer	71-81

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-radiation.pdf [Heat transfer: Radiation]

TOPIC OVERVIEW:
Insulation and energy saving
Term 3, Weeks 6A – 7C

A. TOPIC OVERVIEW

TERM 3, WEEKS 6A – 7C

- This topic runs for 2 weeks.
- It is presented over 6 1 hour lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 6	GRADE 7	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Cost of electricity • Renewable ways to generate electricity	• Insulating materials • Using insulating materials • Heat loss • Heat gain • Conservation of energy in homes • Indigenous, traditional homes and technology in South Africa, and heat insulation	• Cost of electrical power

C. SCIENTIFIC VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	electric geysers	Storage tanks that use electrical heating elements to heat water in our homes so that we have hot water
2.	elements	A part of a heating appliance that outputs heat energy
3.	insulating	Slowing down the transfer of heat from a hotter area to a cooler area
4.	solar water heater	A system that heats water using the Sun's radiant heat energy which consists of collector pipes and a storage tank
5.	collector pipes	Part of the solar water heating system that transfers heat energy by conduction from the radiation of the Sun to the water in the pipes
6.	storage tank	Part of the solar water heating system that stores the cold water at the bottom of the tank that needs to be heated and the hot water at the top of the tank that is ready for use
7.	minimise	Reduce as much as possible
8.	styrofoam	A light-weight plastic material that is made of polystyrene and has small bubbles of air making it a very good heat insulator
9.	cool boxes	Specially insulated containers made of plastic, designed to store objects and keep them hot or cool
10.	hot box	Specially insulated container that can prevent heat loss and can maintain the temperature of food that is placed inside it, allowing it to cook at a high temperature for longer
11.	ceiling	An upper surface of a room that creates a barrier between the roof and the room. It creates an air space between itself and the roof and acts as an insulator
12.	thatched roofs	Roofs that are made of grass material
13.	indigenous	Occuring naturally in a particular / nature area
14.	traditional	Handing down of cultures and beliefs from one generation to the next
15.	energy efficient	Using energy wisely (without wasting it)
16.	rondavel	A round hut that is usually made up of mud and a thatched roof
17.	Southern Hemisphere	Part of the Earth that lies South of the Equator (the lower part of the Earth)
18.	technology(ies)	Knowledge that deals with science, industry and inventions aimed at solving problems or meeting the demands of society
19.	double glazed windows	Windows that are made of two glass panels with an air gap between them. The air gap acts as an insulation layer slowing down the transfer of heat

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

It is important to know about insulating materials and how they are used in our daily lives. Heat energy can be lost or gained through conduction, convection and radiation. Electric geysers need to be insulated efficiently in order to lose heat energy as slowly as possible, so that energy is saved. Solar water heaters can make use of renewable energy sources, such as radiant heat from the Sun, in order to heat water for our use. Insulating materials can slow down heat transfer, keeping things cool in hot conditions or keeping things warm in cool conditions. Cool boxes, refrigerators, and flasks are all examples of devices we use every day to keep objects cool. Flasks, hot water bottles, and clothing are all objects that we use every day to keep objects and our bodies warm. These items act as insulators, slowing down the transfer of heat from a location of higher temperature to a lower temperature. In order to conserve energy in our homes, we can use special insulating materials such as thatched roofs, ceilings, hollow cement bricks, and carpets to help us keep our houses warm in winter and cool in summer.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

6 A

Term 3, Week 6, Lesson A
Lesson Title: Using insulating material
Time for lesson: 1 hour

A

POLICY AND OUTCOMES

Sub-Topic	Loss of heat
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- State that heat can be lost through conduction, convection and radiation
- Explain that heat can be lost from our bodies and objects such as electric geysers.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions	✓	12. Recording Information	
3. Comparing		8. Predicting	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 7: Electric geyser.	
Resource 8: Insulating objects.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is an insulator?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

An insulator is material that is a poor conductor of heat energy.

D ACCESSING INFORMATION

1. Make sure that Resource 7: 'Electric geyser' is on display in the classroom.
2. Write the following information on the chalkboard (always try to do this before the lesson starts):

<u>HEAT LOSSES</u>

1. Heating is the transfer of heat energy from an area with a higher temperature to an area with a lower temperature.
2. Heat can be lost by conduction, convection and radiation from our bodies and objects, for example, electric geysers.
3. **Electric geysers** have **elements** that heat the water. When the water is hot, the element switches off. To save energy, we want the water in the electric geyser to stay hot for as long as possible. We need to prevent the heat from being transferred. The part of the geyser that stores the water should be made of an insulating material or wrapped in an **insulating** material that prevents heat loss.

3. Explain to the learners that:
   a. They have learnt that heating is the transfer of heat from one object to another. The transfer of heat is always from the hotter object to the cooler object. Heat transfer will continue until both objects are the same temperature.
   b. Heat can be lost from our bodies by conduction, convection and radiation.
   c. We can use our bodies as an example. In winter, our bodies are hotter than the air around us. This means that our bodies will radiate heat and lose heat energy to the air around us. We will lose heat until our bodies are the same temperature as the air. This situation is sometimes too cold for our bodies.

   d. We need to stop the heat from radiating out of our bodies to the surrounding air, so that we can stay warm and not freeze in winter. To stop heat energy from radiating from our bodies, we wear thick clothing. The thick clothing acts as an insulator of heat. This stops heat from escaping, keeping us warm.
   e. Heat can also be lost by conduction, convection and radiation in objects, for example, electric geysers.
4. Show learners Resource 7: Electric geyser. Use the diagram in Resource 7 while explaining to the learners.
5. Explain to the learners that:
   a. An electric geyser has an element inside it that becomes hot, similar to a stove plate. The heat from the element is transferred to the water in the geyser by conduction. Convection then heats the water.
   b. When the water in the geyser becomes hot, the element switches off. To save energy, we want the water in the electric geyser to stay hot for as long as possible. Otherwise we need to use more electricity to heat the water again. We need to prevent the heat from being transferred.
   c. The part of the geyser that stores the water should be made of an insulating material or wrapped in an insulating material that prevents heat loss. Special geyser blankets can be used as insulating material.
   d. A flask is a container that is used to store drinks. Flasks can either be used to keep our hot drinks hot on a cold day, or to keep our cold drinks cold on a hot day. A flask is made of special insulating material. A flask is also made up of two cups, where one cup sits inside another cup. There is a space between the two cups. There is nothing in this space, not even air. It is a vacuum (empty space).
   e. Remember that in a vacuum there are no particles. This means that the hot or cold drink cannot transfer heat to the flask container by conduction or convection. This vacuum is a form of insulation.
6. Tell the learners to copy the information into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

   a. Why do we wear more clothes in winter than in summer?
   b. Why do you think astronauts wear special space suits with insulating material?

Answers to the checkpoint questions are as follows:

   a. To prevent heat loss to the cooler surrounding air. Clothing acts as an insulator.
   b. It is very cold in space. Astronauts need special insulated suits so that they do not lose their body heat and freeze in space.

E CONCEPTUAL DEVELOPMENT

1. Use Resources 7 and 8. Make sure they are on display on the chalkboard in the classroom.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

> ACTIVITY
>
> TASK 1
>
> Look at the picture of the electric geyser on the Resource Page.
>
> 1. Explain why it would be a good idea to wrap the geyser in insulating material?
>
> TASK 2
>
> Look at the pictures of a hot water bottle, flask and gloves on the Resource Page.
>
> 1. How do you think each object is designed to prevent heat loss?

3. Explain Task 1 to the learners as follows:
   a. Look at the picture on display on the chalkboard.
   b. There is a picture of an electric geyser on the chalkboard.
   c. Remember that electric geysers are used to heat water and store the hot water in our homes so that we have hot water when we turn on the tap.
   d. The hot water is inside the geyser container and is in direct contact with the container.
   e. Work in pairs and complete Task 1.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

> 1. *The water is in direct contact with the container. This means that the hot water can transfer heat energy to the container by conduction. When the container is hot, it will radiate heat to the surrounding air. This means it will lose heat. The water will also lose heat. We should wrap the container in insulating material to prevent heat loss and keep the water hotter for longer. This will save energy.*

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. A hot water bottle is a rubber container that stores hot water. People use hot water bottles in winter to keep warm.
   b. A flask is a container that is used to store hot drinks like coffee and tea. A flask is designed in a special way. A flask has a smaller cup that sits inside a larger cup. The walls of the two cups do not touch. There is a vacuum between the walls of the two cups. The vacuum acts as an insulator.
   c. Work on your own.
   d. Answer the questions in Task 2.

10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

Hot water bottle	*A hot water bottle is made of rubber which is an insulating material. The bottle can also be wrapped in a jersey to reduce heat loss.*
Flask	*A flask is made of special insulating material that reduces heat loss. A flask also has a vacuum between the two cups that it is made up of. The vacuum acts as an insulating material. This allows your coffee or tea to stay hot for longer.*
Gloves	*Gloves are worn on our hands to keep our hands warm in cold weather. The gloves act as insulators, preventing our hands from losing heat to the cold air.*

14. When the learners have completed Task 2, hold a short class discussion to revise:
    a. Heating is the transfer of heat energy from an area of a higher temperature to an area with a lower temperature.
    b. Heat can be lost by conduction, convection and radiation from our bodies and objects

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Do you think ovens should be made of an insulating material?
b. Why do you think ovens should be made of an insulating material?

Answers to the checkpoint questions are as follows:

a. Yes
b. Ovens heat up in order to cook our food. We want the oven to lose as little heat as possible so that it can cook our food at the correct temperature and be energy efficient. If an oven was not made of insulating material, then a lot of heat would be lost to the surrounding air. It would take a very long time for our food to cook.

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Insulation and energy saving	152-154
Solutions for all	Insulation and energy saving	239-255
Spot On	Insulation and energy saving	121-128
Top Class	Insulation and energy saving	139-146
Via Afrika	Insulation and energy saving	120-125
Platinum	Insulation, energy saving and energy transfer to the surroundings	163-173
Oxford Successful	Insulation and energy saving	124-129
Pelican Natural Sciences	Insulation and energy saving	202-217
Sasol Inzalo Bk B	Insulation and energy saving	82-105

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-insulation-1.pdf [Heat transfer: insulation 1]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-insulation-2.pdf [Heat transfer: insulation 2]

6 B

Term 3, Week 6, Lesson B
Lesson Title: Using insulating material
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Gaining heat
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that heat can be gained through radiation, conduction and convection
- Explain how a solar water heating system works.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 9: Solar water heater photo.	
Resource 10: Solar water heater diagram.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

How can we prevent an object from losing heat?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

We can prevent an object losing heat by wrapping the object in insulating material or making the object out of insulating material.

D ACCESSING INFORMATION

1. Make sure that Resources 9 and 10 are on display in the classroom.
2. Write the following information on the chalkboard (always try to do this before the lesson starts):

GAINING HEAT

1. Heat can be gained by conduction, convection and radiation, for example in **solar water heaters**.
2. A solar water heater is a system that heats water using the Sun's radiant heat energy.
3. A solar water heater is made up of **collector pipes** and a **storage tank**.
4. Cold water flows from the bottom of the tank to the collector pipes.
5. Heat energy is transferred by radiation from the Sun to the collector pipes.
6. The collector pipes absorb the radiant heat energy from the Sun and so become hotter.
7. The collector pipes transfer the heat energy by conduction to the water flowing in the collector pipes.
8. The water that moves through the pipes transfers the heat energy by convection.
9. Water that is heated in the collector pipes flows to the top of the tank.
10. The hot water at the top of the tank will not sink to the bottom because it is hot, and cold water at the bottom of the tank will not rise to the top because it is cold.

11. The water leaving the top of the tank is too hot for us to use.
12. The cold water leaving the tank at the bottom will be heated by the collector pipes.
13. The storage tank has a layer of insulation around it to keep the water hotter for longer.

3. Explain to the learners that:
   a. Heat can be obtained by conduction, convection and radiation, for example, in solar water heaters.
4. Show learners Resource 9: 'Solar water heater'.
5. Explain to the learners that:
   a. A solar water heater uses the radiant heat from the Sun to heat up water. It is made up of collector pipes and a storage tank.
6. Show learners Resource 10: 'Solar water heater diagram'.
7. Explain to the learners that:
   a. Cold water flows from the bottom of the tank to the collector pipes.
   b. Heat energy is transferred by radiation from the Sun to the collector pipes. The collector pipes absorb the radiant heat energy from the Sun and become hotter.
   c. The collector pipes transfer the heat energy to the water by conduction.
   d. The water that moves through the pipes transfers the heat energy by convection.
   e. Water that is heated in the collector pipes flows to the top of the tank.
   f. The hot water at the top of the tank will not sink to the bottom because it is hot and cold water at the bottom of the tank will not rise to the top because it is cold. This ensures that the water leaving the top of the tank is hot for us to use and the cold water leaving the tank at the bottom will be heated by the collector pipes.
   g. The storage tank has a layer of insulation around it to keep the water hotter for a longer time.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a solar water heating system?
b. Why should the storage tanks of solar water heating systems be covered with an insulating material?

Answers to the checkpoint questions are as follows:

a. A system that heats water using the Sun's radiant heat energy
b. To prevent heat loss and keep the water hotter for longer

E CONCEPTUAL DEVELOPMENT

1. Use Resource 10. Make sure it is on display on the chalkboard.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

TASK 1

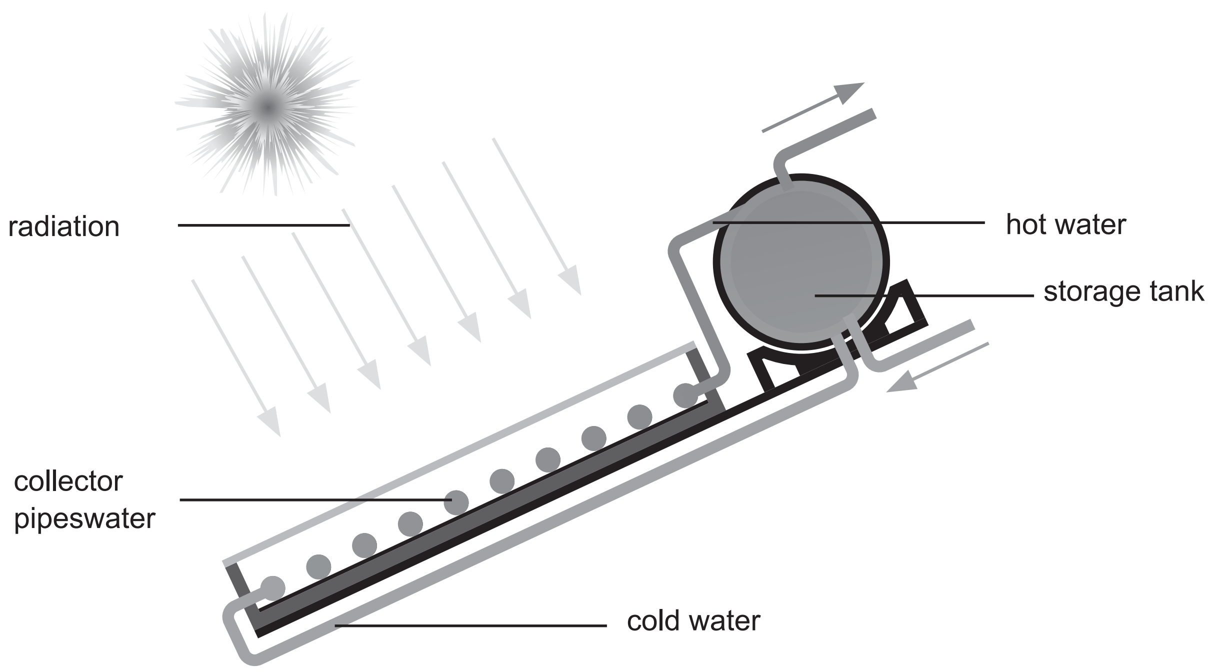
1. Copy the diagram on the chalkboard into your workbooks.
2. Indicate the direction of the flow of water through the solar heating system using arrows. Also show the radiation from the Sun.
3. Add the following labels to your diagram: collector pipes, storage tank, cold water, hot water, radiation.

TASK 2

1. Using the diagram and the notes on the chalkboard, explain how a water heating system works. Make sure you explain how the water is heated by the methods of heat transfer: conduction, convection and radiation.

3. Explain Task 1 to the learners as follows:
   a. Look at the diagram of a solar water heating system on display in the classroom.
   b. Copy down the diagram neatly into your workbooks.
   c. Work in pairs and complete Task 1.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

The diagram in the learners' workbooks should look something like this:



8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
    a. Work on your own.
    b. Follow the instructions in Task 2.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

Cold water flows from the bottom of the tank to the collector pipes. Heat energy is transferred by radiation from the Sun to the collector pipes. The collector pipes absorb the radiant heat energy from the Sun and become hotter. The collector pipes transfer the heat energy to the flowing water by conduction. The water that moves through the pipes transfers the heat energy by convection. Water that is heated in the collector pipes flows to the top of the tank. The hot water at the top of the tank will not sink to the bottom because it is hot, and cold water at the bottom of the tank will not rise to the top because it is cold. This ensures that the water leaving the top of the tank is hot, and the cold water leaving the tank at the bottom will be heated by the collector pipes.

14. When the learners have completed Task 2, hold a short class discussion to revise:
    a. Heat can be gained by conduction, convection and radiation, for example, in solar water heaters.
    b. A solar water heater is a system that heats water using the Sun's radiant heat energy.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:
a. How is heat gained by radiation in a solar water heating system?
b. How is heat gained by conduction in a solar water heating system?

Answers to the checkpoint questions are as follows:
a. Heat energy from the Sun is transferred to the collector pipes by radiation.
b. Heat energy is transferred from the hot collector pipes to the water in the pipes by conduction.

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Insulation and energy saving	152-154
Solutions for all	Insulation and energy saving	239-255
Spot On	Insulation and energy saving	121-128
Top Class	Insulation and energy saving	139-146
Via Afrika	Insulation and energy saving	120-125
Platinum	Insulation, energy saving and energy transfer to the surroundings	163-173
Oxford Successful	Insulation and energy saving	124-129
Pelican Natural Sciences	Insulation and energy saving	202-217
Sasol Inzalo Bk B	Insulation and energy saving	82-105

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-insulation-1.pdf [Heat transfer: insulation 1]
2. https://www.youtube.com/watch?v=NsCZD1MZPPo (1min 25 sec) [My Energy: How Solar Water Heaters Work]

6 C

Term 3, Week 6, Lesson C
Lesson Title: Insulating materials
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Different insulating materials
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that heat can be gained through radiation, conduction and convection
- Explain how a solar water heating system works.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	✓
3. Comparing		8. Predicting	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Styrofoam cup	
Glass cup	
Plastic cup	
Kettle	Ice and cold water

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is a solar water heater?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

A water heater is a system that uses the radiant heat from the Sun to heat up water in a storage tank.

D ACCESSING INFORMATION

1. Make sure that Resources 9 and 10 are on display in the classroom.
2. Write the following information on the chalkboard (always try to do this before the lesson starts):

DIFFERENT INSULATING MATERIALS

1. In winter, we want to keep things warm.
2. People use different insulating materials to help **minimise** heat loss in winter.
3. In summer, we want to keep things cool.
4. We can also use different insulating materials to help minimise heat gain in summer.
5. **Styrofoam**, newspaper, plastic and glass are examples of insulating materials that we often use.

3. Explain to the learners that:
    a. In winter the air is cold, so we want to try keep our bodies and some objects as warm as possible.
    b. We can use different insulating materials to help minimise heat loss in winter.
    c. For example, we wear clothes to slow down the transfer of heat from our bodies to the surrounding air, and we use flasks to keep our hot drinks hot.
    d. In summer the air is warm, and so we want to try keep our bodies and some objects as cool as possible.
    e. We can use different insulating materials to help minimise heat gain in summer.
    f. For example, we keep food in fridges which are made of insulation material that prevents the heat from outside the fridge from entering the fridge. We also use cool boxes, when we cannot use fridges, to keep food or drinks cool when we want to leave the house.
    g. Styrofoam, newspaper, plastic and glass are examples of insulating materials that we often use.
4. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. How does insulation like clothing keep our bodies warm in winter?
b. How does insulation keep objects like cooler boxes cool in summer?

Answers to the checkpoint questions are as follows:

a. Clothing prevents heat loss from our bodies.
b. Cooler boxes have special insulating material that prevents heat from entering the cooler box.

E CONCEPTUAL DEVELOPMENT

1. Advance preparation: ensure that you have all the resources for the demonstration. You can also do the same investigation using very cold water with ice blocks.
2. If you have enough resources, you can ask the learners to do the investigation in groups.
3. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

<table>
<tr><td colspan="3"><u>ACTIVITY</u></td></tr>
<tr><td colspan="3">Cup type</td></tr>
<tr><td colspan="3">Glass</td></tr>
<tr><td colspan="3">Plastic</td></tr>
<tr><td colspan="3">Styrofoam</td></tr>
<tr><td>Hottest</td><td>Less hot</td><td>Least hot</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td colspan="3"><u>TASK 1</u>
1. Copy the tables into your workbooks.
2. Observe the demonstration that is done by your teacher.
3. Rank the cups from hottest to least hot in the second table.

<u>TASK 2</u>
1. Which cup is the best insulating material? Explain.
2. Which cup is the worst insulating material? Explain.
3. Which cup will keep the water hot for the longest time? Why?</td></tr>
</table>

4. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has three columns.
   b. The first column has the following heading: hottest.
   c. The second column has the following heading: less hot.
   d. The third column has the following heading: least hot.
   e. Watch the demonstration carefully.
5. Demonstrate the investigation of heat transfer in insulators:
   a. Learners observe as you pour the boiling water into the three cups.

Step	Instruction	Notes to teacher
1	Place the glass, plastic and styrofoam cups on a table in front of the learners.	Place them somewhere in the room where learners will be able to walk past and feel the cups.
2	Boil one litre of water in the kettle.	
3	Fill each cup with boiling water.	Carefully fill the cups without spilling hot water.
4	Get the learners to come and feel the outside of each cup with their fingers.	Make sure you help and supervise all the learners as they touch the cups so that they do not burn themselves.

6. Explain Task 1 to the learners as follows:
    a. Complete Task 1.
7. Give learners some time to do Task 1.
8. Ask learners to share their answers to Task 1 with the class.
9. Discuss the answers with the learners.
10. *Model answer: Task 1*

Hottest	***Less hot***	***Least hot***
Glass cup	*Plastic cup*	*Styrofoam cup*

11. Next, get the learners to do Task 2.
12. Explain Task 2 to the learners as follows:
    a. Work with the person sitting next to you.
    b. Answer the questions in Task 2.
13. Give learners some time to do Task 2.
14. Ask learners to share their answers to Task 2 with the class.
15. Discuss the answers with the learners.
16. *Model answer: Task 2*

> 1. *The styrofoam cup is the best insulating material because it was the least hot. Insulating materials prevent heat from being transferred. Because the cup is the least hot, it means that the material does not allow the heat to be transferred as easily as the other cups.*
> 2. *The glass cup is the worst insulating material because it is the hottest.*
> 3. *The styrofoam cup will keep the water hot for the longest. Styrofoam is the best insulator of the three cups and will allow the least amount of heat to be transferred.*

17. Answer any questions that learners may have and provide further explanations.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. A company sells coffee in glass cups. The customers complained that the coffee gets cold too quickly. What can the shop do to make the customers happy?
b. Why do we use oven gloves when we take hot food out of the oven?

Answers to the checkpoint questions are as follows:

a. Use different cups made from plastic or styrofoam because they are better insulators than glass cups and will keep the coffee warmer for longer.
b. Oven gloves act as insulators and slow down or prevent the transfer of heat to our hands so that we do not get burnt.

18. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Insulation and energy saving	152-154
Solutions for all	Insulation and energy saving	239-255
Spot On	Insulation and energy saving	121-128
Top Class	Insulation and energy saving	139-146
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Oxford Successful	Insulation and energy saving	124-129
Pelican Natural Sciences	Insulation and energy saving	202-217
Sasol Inzalo Bk B	Insulation and energy saving	82-105

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=E2_BI-qg5Bw (1min 26sec) [Insulation explained with some help from coffee cups!]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-conduction.pdf [Heat transfer: conduction]

7 A

Term 3, Week 7, Lesson A
Lesson Title: Insulating materials
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Uses of insulating materials
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that insulating materials slow down the transfer of heat energy through conduction, convection and radiation
- Explain that insulating materials can prevent an object from losing heat and prevent an object from gaining heat
- Give examples of objects or structures where we use insulating materials.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions	✓	12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations	✓	15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Cooking pot	Glass jar
Cardboard box with a lid that is large enough to store the cooking pot	Plastic bowl large enough to store the cooking pot
Newspaper	
Blankets	Towels or cloths
Kettle with water	
Rice (one cup)	
Spoon	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Why do we use insulating materials in summer?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

We use insulating materials in summer to prevent heat gain and keep things cool.

D ACCESSING INFORMATION

1. Make sure that Resources 9 and 10 are on display in the classroom.
2. Write the following information on the chalkboard (always try to do this before the lesson starts):

USES OF INSULATING MATERIALS

1. Insulating materials slow down the transfer of heat energy through conduction, convection and radiation.
2. Insulating materials can prevent an object from losing heat and prevent an object from gaining heat.
3. We use insulating materials to make objects like '**cool boxes**' to keep things cool.
4. We use insulating materials in ceilings to prevent heat from escaping. This will also keep the room warm.
5. We also use insulating material for clothing like jerseys, coats, woolly hats and blankets.

6. A **hot box** is a device that saves energy by preventing heat loss.
7. Hot objects like food can be placed inside a hot box. The hot box prevents heat loss and keeps the food at a cooking temperature for a much longer time. A hot box can also keep objects cool.

3. Explain to the learners that:
   a. Insulating materials slow down the transfer of heat energy through conduction, convection and radiation.
   b. Insulating materials can prevent an object from losing heat, for example, flasks, blankets, gloves.
   c. We also use insulating material for clothing like jerseys, coats, woolly hats and blankets.
   d. We use insulating materials in ceilings to prevent heat from escaping. This will also keep the room warm.
   e. Insulating materials can prevent an object from gaining heat, for example, cool boxes, fridges, and flasks.
   f. A hot box is a device that saves energy by preventing heat loss.
4. Explain to the learners that:
   a. A hot box is an energy saving device. It is usually filled with small polystyrene balls which are very good insulators.
   b. We are going to build a hot box, but we will be using newspaper and blankets instead as our insulating material.
   c. Cooking foods such as rice or beans takes a long time and uses a lot of energy. When we use a hot box, the food first needs to start boiling, then it can be put in the hot box. The hot box will keep the water hot enough to cook the food. After a few hours, the food will be cooked and can be removed from the hot box.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a hot box?
b. Why is a hot box considered as an energy saver?

Answers to the checkpoint questions are as follows:

a. A hot box is a device that is used to help cook food, like rice, by preventing heat loss.
b. A hot box is an energy saver because it prevents heat loss, and the food can continue cooking even when it is removed from the stove or fire.

E CONCEPTUAL DEVELOPMENT

1. Advance preparation: ensure that you have all the resources for the demonstration. You can also do the same investigation using very cold water with ice blocks.
2. If you have enough resources, you can ask the learners to do the investigation in groups.
3. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

TASK 1

1. Observe your teacher as he or she shows you how to make a hot box.
2. At the end of the lesson, your teacher will show you that the water in the cooking pot is still very hot and the rice is still cooking.
3. Draw a labeled diagram of a hot box.

TASK 2

1. Explain how a hot box can be used to cook rice.

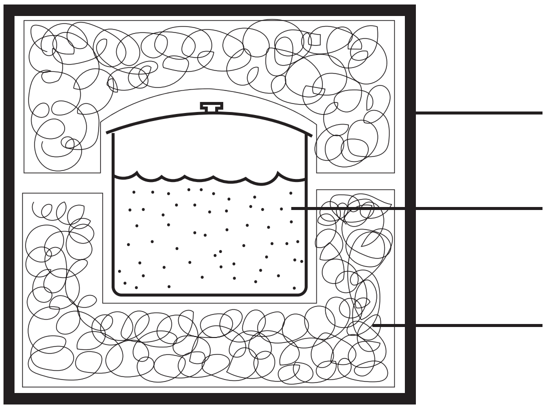
4. Explain Task 1 to the learners as follows:
   a. Watch the demonstration carefully.
   b. Demonstrate the investigation of heat transfer in insulators.
   c. Learners must observe as you make a hot box.

Step	**Instruction**	**Notes to teacher**
1	Crumple some newspaper into balls.	You should ask the learners to help you do this.
2	Place some of the crumpled newspaper at the bottom of the box.	The newspaper will be the insulating material that stops heat from being lost.
3	Boil water in a kettle.	
4	Pour one cup of rice into a cooking pot.	
5	Pour three cups of boiling water into the cooking pot.	Do this carefully so that you do not burn yourself with boiling water.
6	Place the lid on it.	Do this carefully so that hot water does not spill out and burn you.
7	Put the cooking pot in the box, on the crumpled newspaper.	Make sure there is enough newspaper underneath the cooking pot.
8	Place the rest of the newspaper in the box, around the cooking pot. Add as much newspaper as you can.	The more newspaper you add, the better the insulation will be, and the less heat will be lost.
9	Close the box and leave it until the end of the lesson.	Do not open the hot box until the end of the lesson.

10	Learners should complete Tasks 1 and 2.	
11	Just before the end of the lesson, remove the lid from the pot and show the learners that the water is hot and the rice is still cooking.	

5. Work in groups and complete Task 1.
6. Give learners some time to do Task 1.
7. Ask learners to share their answers to Task 1 with the class.
8. Discuss the answers with the learners.
9. *Model answer: Task 1*

3.



10. Next, get the learners to do Task 2.
11. Explain Task 2 to the learners as follows:
    a. Work on your own.
    b. Answer the question in Task 2.
12. Give learners some time to do Task 2.
13. Ask learners to share their answers to Task 2 with the class.
14. Discuss the answers with the learners.
15. *Model answer: Task 2*

1. *A cooking pot with boiling water and rice is placed in a hot box. The hotbox is made of cardboard and newspaper. Newspaper is crumpled up into balls and placed around the cooking pot. The newspaper is an insulator that prevents or slows down heat loss from the cooking pot.*

16. When the learners have completed Task 2, hold a short class discussion to revise:
    a. Insulating materials can prevent an object from losing heat and prevent an object from gaining heat.
    b. We use insulating materials in ceilings to prevent heat from escaping. This will keep the room warm.
    c. A hot box is a device that saves energy by preventing heat loss.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is the statement true or false? In summer, insulation is used in cool boxes to keep objects in the cool box hot.
b. Through which heat transfer methods does insulation slow down the transfer of heat?

Answers to the checkpoint questions are as follows:

a. False. In summer, insulation is used in cool boxes to keep objects cool.
b. Conduction, convection and radiation

17. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
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Sasol Inzalo Bk B	Insulation and energy saving	82-105

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=oRmpH7ViwYw (3min 27sec) [South Africa's Wonderbag Revolutionizes Cooking]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-insulation-2.pdf [Heat transfer: Insulation 2]

7 B

Term 3, Week 7, Lesson B
Lesson Title: Using insulating materials
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Conservation of heat energy in homes
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that conservation of heat energy in homes can be improved by reducing heat loss in winter and heat gain in summer
- Identify some insulating materials used in houses.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing	✓	8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 11: Foam boards for ceiling insulation	
Resource 12: Thatched roof for insulation	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Why is it important to use insulating material to make a hot box?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Insulating material slows down the transfer of heat and allows the cooking pot to stay hot for a longer time.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

<u>CONSERVATION OF HEAT ENERGY IN HOMES AND BUILDINGS</u>

1. In winter, we want our rooms to be warm.
2. In summer, we want our rooms to be cool.
3. We can use insulating material in our homes to help us prevent heat loss or heat gain, depending on the season.
4. Insulating material like Styrofoam (foam boards) can be used in **ceilings** to prevent heat loss or heat gain.
5. Carpets prevent heat loss during winter.
6. **Thatched roofs** can help keep houses cooler in summer and warmer in winter.
7. Painting the walls of a house white can help reflect heat radiation, keeping the house cooler than if it was painted a darker colour.

2. Explain to the learners that:
   a. In South Africa, we have cold winters and hot summers.
   b. Our houses need to be made of special insulating materials so that they are cool in summer and warm in winter.
   c. In winter, insulating materials in houses slow down heat transfer from the inside of the house to the outside cooler air.

   d. In summer, insulating materials in houses slow down heat transfer from the hot outside air to the inside of the house

3. Show learners Resource 11: 'Foam boards for ceiling insulation'.
4. Explain to the learners that:
   a. Foam boards are similar to Styrofoam and can be placed in the ceilings of houses. In summer, the foam boards slow down heat transfer from hot roofs to the rooms in the house, keeping them cool. The foam boards also slow down heat transfer from the warmer rooms to the cold roof in winter, keeping the rooms warm.
   b. Carpets are also good insulating materials. In winter, they slow down the transfer of heat from warmer rooms to the cooler floor.
5. Show learners Resource 12: 'Thatched roof for insulation'.
6. Explain to the learners that:
   a. Thatched roofs are made of grass material. In summer, thatched roofs slow down heat transfer from the hotter outside air to rooms. In winter, they also slow down heat transfer from the warmer rooms to the outside cooler air.
   b. Other roofs, such as tin roofs and corrugated iron roofs, become very hot in summer and cause the rooms in the house to become very hot. They are also very cold in winter with the result that rooms are also very cold.
7. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. Why is it better to use thatched roofs instead of tin roofs for houses?
b. Why should we keep windows closed in winter?

Answers to the checkpoint questions are as follows:

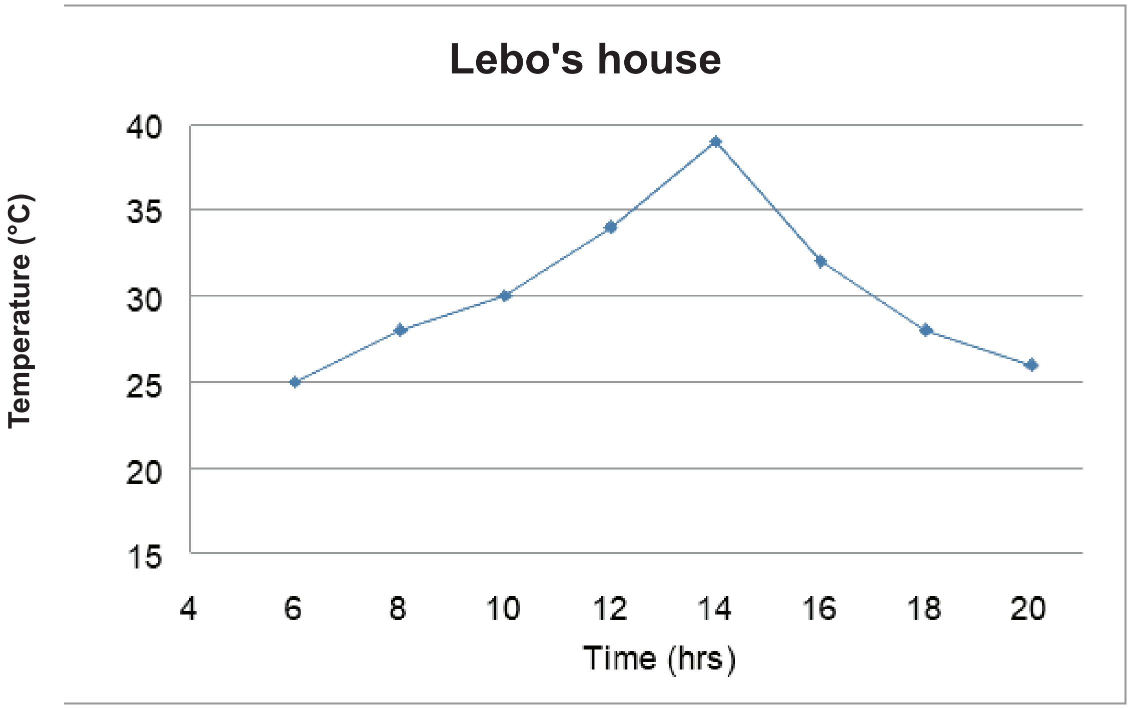
a. Tin roofs become very hot in summer with the result that rooms in the house become very hot. They are also very cold in winter and so cause the rooms to be very cold. In summer, thatched roofs slow down the heat transfer from the hotter outside air to rooms keeping them cooler. In winter, they also slow down the heat transfer from the warmer rooms to the outside cooler air, keeping the rooms warmer.
b. Open windows allow heat from the room to be transferred to the outside cooler air, making the room colder.

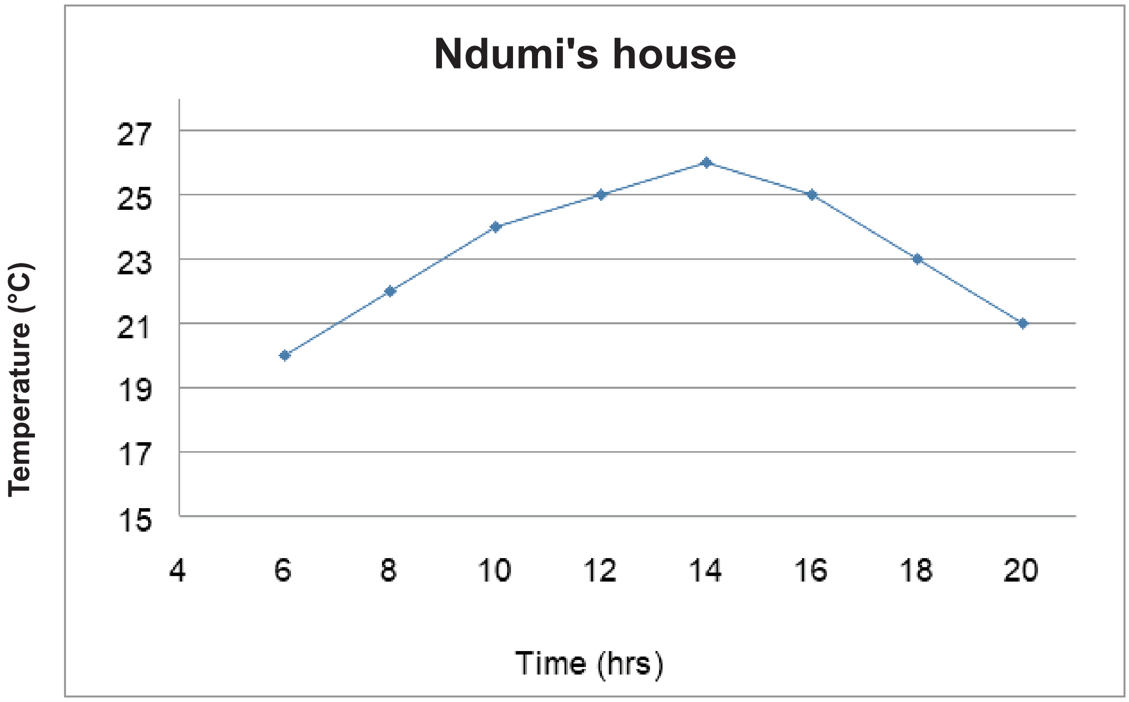
E CONCEPTUAL DEVELOPMENT

1. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Lebo and Ndumi live in different houses but are next door neighbors. Lebo can feel that his house gets much hotter in summer than Ndumi's house. To prove this, Lebo decided to use a thermometer and measure the temperature of the rooms in each house on the same day. He recorded the temperature every two hours and presented his results in two line graphs.





TASK 1

1. Copy the graphs into your workbooks.
2. Use the graphs to answer the following questions.
   a. What was the hottest temperature in Ndumi's house?
   b. What was the hottest temperature in Lebo's house?

TASK 2

1. What time was the hottest temperature in Ndumi's house?
2. What time was the hottest temperature in Lebo's house?
3. How much hotter was Lebo's house than Ndumi's house?
4. List two insulating materials that Ndumi's house could be made of to keep his house cooler.

2. Explain Task 1 to the learners as follows:
   a. The graphs drawn on the chalkboard each have a heading.
   b. The first graph has the following heading: Lebo's house.
   c. The second graph has the following heading: Ndumi's house.
   d. Each graph shows the temperature readings (on the y-axis) and the time (on the x-axis) at which each reading was taken.
   e. Analyse both line graphs carefully.
   f. Work in groups and complete Task 1.
3. Give learners some time to do Task 1.
4. Ask learners to share their answers to Task 1 with the class.
5. Discuss the answers with the learners.
6. *Model answer: Task 1*

a. 26°C
b. 39°C

7. Next, get the learners to do Task 2.
8. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer the questions in Task 2.
9. Give learners some time to do Task 2.
10. Ask learners to share their answers to Task 2 with the class.
11. Discuss the answers with the learners.
12. *Model answer: Task 2*

1. 14:00
2. 14:00
3. 39°C - 26°C = 13°C
4. Thatched roof or foam board in the ceiling or has a lighter colour paint on the outside of his house

13. When the learners have completed Task 2, hold a short class discussion to revise:
    a. In winter, we want our rooms to be warm.
    b. In summer, we want our rooms to be cool.
    c. We can use insulating material in our homes to help us prevent heat loss or heat gain, depending on the season.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Is the following statement true or false? A tin roof will keep your house cooler in summer because it is a good heat insulator.
b. Is the following statement true or false? Carpets help to keep your room warmer in winter.

Answers to the checkpoint questions are as follows?

a. False. A tin roof will not keep your house cooler in summer because it is a good heat conductor and a poor heat insulator.
b. True

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Insulation and energy saving	152-154
Solutions for all	Insulation and energy saving	239-255
Spot On	Insulation and energy saving	121-128
Top Class	Insulation and energy saving	139-146
Via Afrika	Insulation and energy saving	120-125
Platinum	Insulation, energy saving and energy transfer to the surroundings	163-173
Oxford Successful	Insulation and energy saving	124-129
Pelican Natural Sciences	Insulation and energy saving	202-217
Sasol Inzalo Bk B	Insulation and energy saving	82-105

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=N0-YD32ujYY (2min 26sec) [How radiant barriers work]
2. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-change-heat-transfer-insulation-2.pdf [Heat transfer: Insulation 2]

7 C

Term 3, Week 7, Lesson C
Lesson Title: Using insulating materials
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Insulating materials in South Africa
CAPS Page Number	28

Lesson Objectives

By the end of the lesson, learners will be able to:

- List examples of indigenous and traditional insulating materials used in the construction of homes in a South African climate
- Explain how the insulating materials work
- Explain how South Africa uses technologies to design homes to suit the climate.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues	✓	11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing	✓	8. Predicting		13. Interpreting Information	
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 11: Foam boards for ceiling insulation	
Resource 12: Thatched roof for roof insulation	
Resource 13: Xhosa beehive hut	
Resource 14: Hollow cement bricks	
Resource 15: Double glazed windows	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

Why do we use insulation in our homes?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

We use insulation in our homes to keep them warm in winter and cool in summer.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

INSULATION IN SOUTH AFRICA

1. South Africa has **indigenous** and **traditional** homes that are designed to be **energy efficient** in our climate by using materials that help conserve energy.
2. A traditional Xhosa **rondavel** has a thatched roof, thick walls, small windows and a space between the walls and the thatched roof. Hot air rises and escapes through the space, keeping it cool in summer.
3. A traditional Zulu beehive hut has good insulation because the walls and roof are made of grass.
4. Sand is a good insulator and is used as mud to cover the walls of many houses in South Africa.
5. South Africa is in the **Southern Hemisphere**. Houses should be built facing north to get the most sunlight. This will enable houses to be warmer in winter.
6. South Africa also has technologies that can improve the energy efficiency of our homes.
7. Ceilings are placed between the roof of a house and the floor. Ceilings trap air between the ceiling and the roof, forming an insulation layer.

8. Earth bricks, concrete and hollow cement blocks are examples of materials that store heat during the day and release it at night. Buildings should be made from these materials to be energy efficient.
9. **Double glazed windows** can also be used as insulation. The air gap between the two panels of glass acts as an insulator.

2. Explain to the learners that:
   a. South Africa has indigenous and traditional homes that are designed to be energy efficient in our climate by using materials that help conserve energy.
3. Show learners Resource 12: 'Thatched roof for roof insulation'.
4. Explain to the learners that:
   a. A traditional Xhosa rondavel has a thatched roof, thick walls, small windows and a space between the walls and the thatched roof. We have learnt that hot particles rise and cold particles sink. Hot air in the house rises and escapes through the space, keeping it cool in summer.
5. Show learners Resource 13: 'Xhosa beehive hut'.
6. Explain to the learners that:
   a. A traditional Zulu beehive hut has good insulation because the walls and roof are made of grass.
   b. Sand is a good insulator and is used as mud to cover the walls of many houses in South Africa.
   c. South Africa is in the Southern Hemisphere. Houses should be built facing north to get the most sunlight. This will make houses warmer in winter. The roof overhang of houses should also be on the north side. The sun is higher in the sky during summer and lower during winter. The roof overhang will create shade during summer because the sun is high in the sky. The roof overhang will not create too much shade in winter because the sun is lower in the sky.
   d. South Africa also has technologies that can improve the energy efficiency of our homes.
7. Show learners Resource 11: 'Foam boards for ceiling insulation'.
8. Explain to the learners that:
   a. Ceilings are placed between the roof of a house and the floor. Ceilings trap air between the ceiling and the roof, forming an insulation layer.
9. Show learners Resource 14: 'Hollow cement bricks'.
10. Explain to the learners that:
    a. Earth bricks, concrete and hollow cement blocks are examples of materials that store heat during the day and release it at night. Buildings should be made from these materials to be energy efficient. Hollow bricks allow walls to have air pockets. The air pockets act as insulators.
11. Show learners Resource 15: 'Double glazed windows'.
12. Explain to the learners that:
    a. Double glazed windows can also be used as insulation. Double glazed windows are made of two glass panels with an air gap between them. The air gap between the two panels of glass acts as an insulator.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. Why are Xhosa huts suited to the South African climate?
b. Why are Zulu beehive huts suited to the South African climate?

Answers to the checkpoint questions are as follows:

a. They have thatched roofs that keep the house cool in summer and warm in winter. They have thick walls, small windows and a gap between the roof and the wall, allowing heat to escape. The houses then stay cool in summer.
b. The walls and roof of the Zulu beehive hut are made of grass which is a good insulator, keeping the house warm in winter and cool in summer.

E CONCEPTUAL DEVELOPMENT

1. Divide the class into five groups.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Column A	Column B
1. Light coloured walls	A. An insulated device that keeps cold drinks cool during a hot day.
2. Electric geyser	B. A layer placed above a room to create an air gap that acts as an insulator
3. Thatched roof	C. Walls that reflect radiant heat and help to keep the house cool in summer
4. Hot box	D. Cause movement of air (convection) from hotter air inside a room to the cooler air outside
5. Ceiling	E. Grass roofs that help keep a house cool in summer and warm in winter
6. Double glazed windows	F. A system that heats water using the Sun's radiant heat energy
7. Carpet	G. A device that saves energy by preventing heat loss when hot food is put inside it to be cooked
8. Open windows	H. Floor covering that slows down the transfer of heat from inside a house, to the cooler floor
9. Hollow cement bricks	I. A system in our houses that uses electricity to heat water and store it
10. Cool box	J. Windows made of two glass panels with an air gap between them that acts as an insulation layer
11. Solar water heater	K. Building material that allows walls to have air pockets that act as insulators

TASK 1

1. Copy the table into your workbooks.

TASK 2

a. Match the words in column A with the correct description of the word in column B. Answer like this: 1.C

3. Explain Task 2 to the learners as follows:
   a. The table drawn on the chalkboard has two columns.
   b. The first column has the following heading: Column A.
   c. The second column has the following heading: Column B.
   d. Match the words in column A with their correct descriptions in column B.
4. Give learners some time to do Task 2.
5. Ask learners to share their answers to Task 2 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 2*

1. C
2. I
3. E
4. G
5. B
6. J
7. H
8. D
9. K
10. A
11. F

8. Answer any questions that learners may have and provide further explanations.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:
   a. How does a ceiling provide insulation for a house?
   b. How do hollow cement bricks provide insulation for a house?

Answers to the checkpoint questions are as follows:
   a. A ceiling creates an air gap between the roof and the ceiling which acts as an insulating layer, keeping the house cool in summer and warm in winter.
   b. Hollow cement bricks have holes in them that create air spaces in the walls of a house. The air spaces act as an insulation layer, keeping the house cool in summer and warm in winter.

9. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Insulation and energy saving	152-154
Solutions for all	Insulation and energy saving	239-255
Spot On	Insulation and energy saving	121-128
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Via Afrika	Insulation and energy saving	120-125
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Oxford Successful	Insulation and energy saving	124-129
Pelican Natural Sciences	Insulation and energy saving	202-217
Sasol Inzalo Bk B	Insulation and energy saving	82-105

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=3hHTClPuG4Q (50sec) [What is double glazing]
2. https://www.youtube.com/watch?v=4ceicm8siTs (55sec) [Benefits of insulation]
3. https://www.youtube.com/watch?v=58Oox90jRCQ (5min 32sec) [Understanding heat transfer]

TOPIC OVERVIEW:
Energy transfer to surroundings
Term 3, Weeks 8A – 8C

A. TOPIC OVERVIEW

Term 3, Weeks 8a – 8c

- This topic runs for 1 week.
- It is presented over 3 x 1 hour lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 5	GRADE 7	GRADE 8
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Stored energy in fuels • Use of fuels as sources of useful energy • Burning fuels produces useful output energy such as heat and light	• Useful energy output • Wasted energy • Heat and sound energy as wasted energy	• Output devices in series and parallel circuits

C. SCIENTIFIC AND TECHNOLOGICAL VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	useful energy output	Energy released by a system that helps us perform a specific function
2.	wasted energy	Energy that escapes to the surrounding environment in the form of heat or sound

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

It is important for us to understand how energy is transferred in energy systems and how much of the energy is actually useful. Energy efficiency is becoming more important in our daily lives as we try to reduce the amount of energy we use in order to save the limited resources (fossil fuels) available on earth. A system is 100% efficient if all the input energy is transferred into useful output energy that can be used every day to perform functions. However, no system is 100% efficient. Much of the input energy is lost as wasted energy in the form of heat energy and sound energy. Therefore, it is a good idea to change old incandescent light bulbs to more modern fluorescent or LED light bulbs because they are more energy efficient and waste less heat energy.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

8 A

Term 3, Week 8, Lesson A
Lesson Title: Useful and wasted energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Useful energy
CAPS Page Number	29

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that input energy is changed in energy systems to useful output energy
- Identify energy outputs from different machines, appliances and tools.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions	✓	12. Recording Information	✓
3. Comparing		8. Predicting	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 4: Example of heat transfer: 1	
Resource 16: Electric drill	
Resource 17: Electric kettle	
Resource 18: Electric food mixer	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is input energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Input energy is energy that enters an energy system.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

USEFUL ENERGY OUTPUTS

1. Systems such as appliances, tools, vehicles and machines provide **useful energy outputs.**
2. Systems change input energy to provide useful output energy. For example, the input energy in cars comes from fuel. The input energy is changed to produce movement, moving us from one place to another.
3. Another example is a kettle. The input energy is electrical energy. The input energy is changed to heat energy that allows us to heat and boil water. This heat energy is useful output energy.

2. Explain to the learners that:
   a. We have learnt that energy systems change energy from one form to another.
   b. Energy systems always have an input energy and an output energy.
   c. Input energy is the energy that is put into a system.
   d. The input energy is changed to output energy. Output energy is the energy we get at the end of an energy system.
   e. Cars need fuel in order to drive us from one place to another. We cannot use fuel to travel far distances. We use a system in the car to change the input energy (fuel) into useful output energy (movement). The useful output energy is called kinetic energy. It is useful because it allows us to travel far distances.
   f. A kettle needs electrical energy to heat up water. We cannot use the input electrical energy directly. It must be changed to heat energy in order to heat water. The useful output energy that a kettle provides us with is heat energy.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

   a. What is the input energy of an electric stove?
   b. What is the output energy of an electric stove?

Answers to the checkpoint questions are as follows:

   a. Input energy = electrical energy
   b. Output energy = heat energy

E CONCEPTUAL DEVELOPMENT

1. Use Resources 8, 20, 21 and 22. Make sure they are on display on the chalkboard in the classroom.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Tool or appliance	Input energy	Output energy
Electric iron		
Electric drill		
Electric kettle		
Electric food mixer		

TASK 1

1. Copy the table into your workbooks.
2. Look at the picture of the tools and appliances on the chalkboard.
3. Use the pictures to help you complete the table by filling in columns 2 and 3.

TASK 2

1. List the input and output energy of the system needed to make a car work.
2. What is the output energy of an energy system of a television?

3. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has three columns.
   b. The first column has the following heading: Tool or appliance.
   c. The second column has the following heading: Input energy.
   d. The third column has the following heading: Output energy.
   e. Look at the picture on display.
   f. Use the pictures to fill in the table.
   g. Work in pairs and complete Task 1.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

Tool or appliance	Input energy	Output energy
Electric iron	Electrical energy	Heat energy
Electric drill	Electrical energy	Kinetic energy
Electric kettle	Electrical energy	Heat energy
Electric food mixer	Electrical energy	Kinetic energy

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Work on your own.
   b. Answer the questions in Task 2.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

1. Input energy = chemical potential energy (fuel)
Output energy = kinetic energy (movement)
2. Output energy = light, sound and heat energy

14. When the learners have completed Task 2, hold a short class discussion to revise:
   a. Systems such as appliances, tools, vehicles and machines provide useful energy outputs.
   b. Systems change input energy to provide useful output energy.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What is the output energy of fire when wood is burned?
b. What is the input and output energy of a person that is running?

Answers to the checkpoint questions are as follows:

a. Heat and light energy.
b. Input energy = chemical potential energy (from food)
   Output energy = kinetic energy (running)

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Insulation and energy saving	155-156
Solutions for all	Insulation and energy saving	257-259
Spot On	Insulation and energy saving	130-132
Top Class	Insulation and energy saving	147-150
Via Afrika	Insulation and energy saving	126-129
Platinum	Insulation, energy saving and energy transfer to the surroundings	176-180
Oxford Successful	Insulation and energy saving	130-131
Pelican Natural Sciences	Insulation and energy saving	218-229
Sasol Inzalo Bk B	Insulation and energy saving	106-121

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-transfer-surroundings-useful-wasted-energy.pdf [Useful and wasted energy]
2. https://www.youtube.com/watch?v=1-g73ty9v04 (3min 39sec) [Energy, let's save it!]

8 B

Term 3, Week 8, Lesson B
Lesson Title: Useful and wasted energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Wasted energy
CAPS Page Number	29

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that some energy transferred in a system can escape to the surrounding environment
- State that the energy that escapes to the surrounding environment is called wasted energy
- Explain that the output energy of a system is always less than the input energy of a system because some energy is wasted
- Explain energy efficiency in terms of wasted energy in different machines such as cars and power stations
- Identifying types of wasted energy in systems from different machines and appliances.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues	✓	11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring	✓	9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

TOPIC: Energy transfer to surroundings

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
N/A	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is output energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

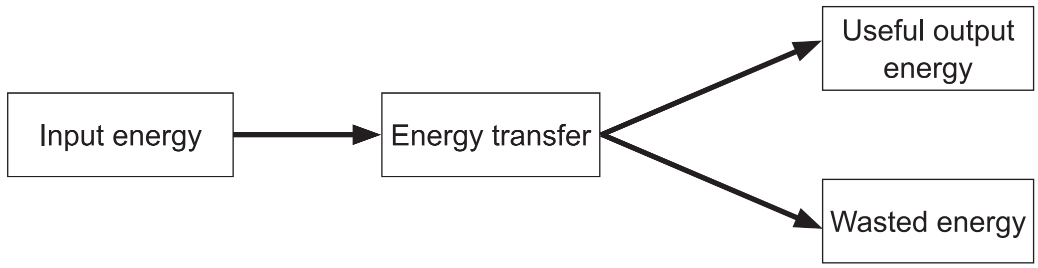
Output energy is useful energy released from a system after it has been transferred.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

WASTED ENERGY

1. The law of conservation of energy states that energy cannot be created or destroyed, but it can be transferred from one form to another.
2. The output energy in a system is always less than the input energy in a system because some energy is wasted.
3. **Wasted energy** is energy that escapes to the surrounding environment when it is being transformed in an energy system.
4. Energy efficiency tells us how much of the input energy is transferred into useful output energy. This is given as a percentage out of 100%.
5. An energy efficiency of 80% means that 80% of the input energy is transferred into useful output energy. The remaining 20% is lost as wasted energy.
6. For example, the energy efficiency of a standard car is 35%. This means that 65% of the energy is wasted.
7. A power station has an energy efficiency of 50%. This means that 50% of the energy is wasted.



2. Explain to the learners that:
   a. The output energy in a system is always less than the input energy in a system because some energy is wasted.
   b. Wasted energy is energy that escapes to the surrounding environment when it is being transformed in an energy system.
   c. Energy efficiency tells us how much of the input energy is transferred into useful output energy. This is given as a percentage out of 100%. The more energy efficient a system is, the more input energy is transferred into output energy and less energy is wasted.
   d. An energy efficiency of 80% means that 80% of the input energy is transferred into useful output energy and the remaining 20% is lost as wasted energy.
   e. For example, the energy efficiency of a standard car is 35%. This means that 65% of the energy is wasted as other forms of energy. Only 35% of the input energy is transferred into useful output energy.
   f. A power station has an energy efficiency of 50%. This means that 50% of the energy is wasted and 50% of the input energy is converted into useful output energy.
3. Refer to the flow diagram on the chalkboard.
4. Explain to the learners that:
   a. An energy system transfers input energy into different forms of energy, and finally transforms the energy into useful output energy, as well as wasted energy. Therefore, the useful output energy in a system is always less than the input energy in the system.
5. Tell the learners to copy this information into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is energy efficiency?
b. Why is output energy always less than the input energy?

Answers to the checkpoint questions are as follows:

a. A measure of how much of the input energy is transferred into useful output energy
b. Some energy is wasted.

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Appliance or machine	Energy efficiency
Kettle	90%
Generator	45%
Car	35%
Power station	50%
Electric drill	60%

TASK 1

1. What is energy efficiency?
2. Why is output energy always less than the input energy?

TASK 2

1. Which appliance or machine is the most energy efficient?
2. Which appliance or machine is the least energy efficient?
3. What percentage of energy is wasted in an electric drill?
4. What type of energy is the useful output energy of an electric drill?
5. What type of energy do you think is the wasted energy of an electric drill? Think about what you can hear and feel.

2. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has two columns.
   b. The first column has the following heading: Appliance or machine.
   c. The second column has the following heading: Energy efficiency.
   d. Copy down the table into your workbooks.
   e. Work in pairs and complete Task 1.
3. Give learners some time to do Task 1.
4. Ask learners to share their answers to Task 1 with the class.
5. Discuss the answers with the learners.
6. *Model answer: Task 1*

1. A measure of how much of the input energy is transferred into useful output energy. It is shown as a percentage.
2. Not all input energy is transferred to useful output energy. Some input energy is transferred to wasted energy.

7. Next, get the learners to do Task 2.
8. Explain Task 2 to the learners as follows:
    a. For question 5, think about what you can hear when someone is using an electric drill. Also think about what the end of the electric drill feels like after it has been used to drill a hole.
    b. Work in pairs and complete Task 2.
9. Give learners some time to do Task 2.
10. Ask learners to share their answers to Task 2 with the class.
11. Discuss the answers with the learners.
12. *Model answer: Task 2*

1. Kettle
2. Car
3. 100% - 60% = 40%
4. Kinetic energy
5. Heat and sound energy.
You can hear the electric drill when it is working and the end of the electric drill becomes hot after it drills a hole.

13. When the learners have completed Task 2, hold a short class discussion to revise:
    a. The output energy in a system is always less than the input energy in a system because some energy is wasted.
    b. Wasted energy is energy that escapes to the surrounding environment when it is being transformed in an energy system.
    c. Energy efficiency tells us how much of the input energy is transferred into useful output energy. This is given as a percentage out of 100%.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:
a. Light bulb A is 6 times more efficient than light bulb B. Which light bulb would you use in your home?
b. A hair dryer has an energy efficiency of 85%. What percentage of energy is wasted?

Answers to the checkpoint questions are as follows:
a. Light bulb A
b. 100% - 85% = 15%

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Energy transfer to surroundings	155-156
Solutions for all	Energy transfer to surroundings	257-259
Spot On	Energy transfer to surroundings	130-132
Top Class	Energy transfer to surroundings	147-150
Via Afrika	Energy transfer to surroundings	126-129
Platinum	Insulation, energy saving and energy transfer to the surroundings	176-180
Oxford Successful	Energy transfer to surroundings	130-131
Pelican Natural Sciences	Energy transfer to surroundings	218-229
Sasol Inzalo Bk B	Energy transfer to surroundings	106-121

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-transfer-surroundings-useful-wasted-energy.pdf [Useful and wasted energy]
2. https://www.youtube.com/watch?v=ytkt2YxGou4 (3min 21sec) [What countries are the most energy efficient?]

8 C

Term 3, Week 8, Lesson C
Lesson Title: Useful and wasted energy
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Forms of wasted energy
CAPS Page Number	29

Lesson Objectives

By the end of the lesson, learners will be able to:

- State that wasted energy can escape in the form of heat and/or sound
- Identify devices such as electric drills, food processors and hair dryers that release wasted energy in the form of sound
- Identify objects such as candles, lamps and engines that release wasted energy in the form of heat
- Identify input energy, useful output energy and wasted energy when systems operate.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	✓
2. Observing	✓	7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Candle	
Matches	Lighter
Resource 4: Example of heat transfer: 1	
Resource 16: Electric drill	
Resource 17: Electric kettle	
Resource 18: Electric food mixer	
Resource 19: Car engine	
Resource 20: Paraffin lamp	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is wasted energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

Wasted energy is energy that escapes to the surrounding environment when it is being transformed in an energy system.

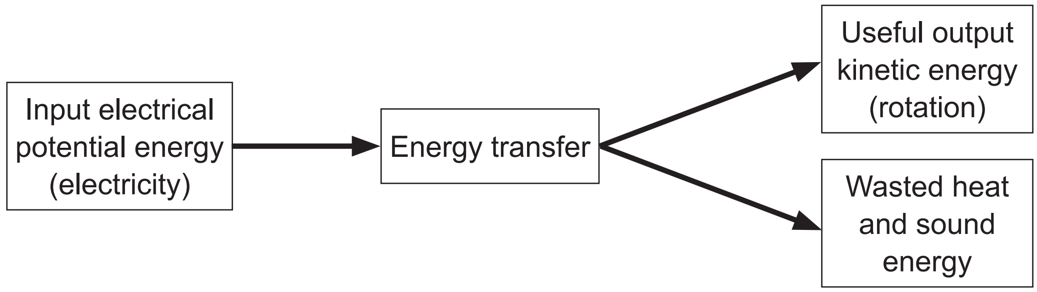
D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

FORMS OF WASTED ENERGY

1. Wasted energy can escape in the form of heat and/or sound.
2. Devices such as electric drills, food processors and hair dryers release wasted energy in the form of sound.
3. Candles, lamps and engines release wasted energy in the form of heat.
4. For example, the purpose of an electric drill is to transfer electrical potential energy into useful kinetic energy as the end of the drill rotates and drills a hole.
5. When we switch on an electric drill, we hear sound.

6. When we touch the end of the electric drill after it has drilled a hole, we feel heat.
7. The sound and heat energy are wasted energy because they do not help us drill a hole.
8. The useful output energy is only the kinetic energy that helps us drill a hole.
9. This can be shown in a flow diagram:



2. Explain to the learners that:
   a. Wasted energy cannot be created. It is energy that has been transferred to other forms of energy such as heat and sound by the input energy.
   b. Devices such as electric drills, food processors and hair dryers release wasted energy in the form of sound.
   c. Objects such as candles, lamps and engines release wasted energy in the form of heat.
   d. Wasted energy does not help us perform the required activity.
   e. For example, an electric drill is designed to drill holes. Therefore, an electric drill needs output kinetic energy for the end of the drill to rotate and drill a hole. However, the drill also produces a lot of noise which is sound energy. This noise is not useful and so the sound energy is wasted. When a drill is drilling a hole, there is a lot of friction. Friction means that the wall is trying to stop the drill from rotating. This friction causes heat and makes the end of the drill hot after drilling. The heat energy does not help us to drill a hole. Therefore, the heat energy is wasted energy.
3. Refer to the flow chart on the chalkboard.
4. Explain to the learners that:
   a. Not all the input electrical potential energy is transferred to useful kinetic energy. Some energy is lost as heat and sound energy. That is why useful output energy is always less than input energy.
5. Tell the learners to copy this information into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What energy is wasted when a hole is drilled
b. Why is the energy in the first question considered wasted?

Answers to the checkpoint questions are as follows:

a. Heat and sound energy
b. This noise (sound energy) does not help us drill the hole, and so it is wasted.
   Heat energy does not help us to drill a hole, so it is wasted energy. Only kinetic energy helps us drill a hole and is the only useful output energy.

E CONCEPTUAL DEVELOPMENT

1. Advance preparation: ensure that you have all the resources for the demonstration.
2. Use Resources 4, 16, 17, 18, 19 and 20. Make sure they are on display in the classroom.
3. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

System	Input energy	Released energy	Useful output energy	Wasted energy
Electric drill	Electrical potential energy	Kinetic energy Sound energy Heat energy		
Electric iron	Electrical potential energy	Heat energy		
Electric kettle	Electrical potential energy	Heat energy Sound energy		
Electric food mixer	Electrical potential energy	Kinetic energy Heat energy Sound energy		
Candle	Chemical potential energy	Heat energy Light energy		
Car engine	Chemical potential energy	Kinetic energy Heat energy Sound energy		
Paraffin lamp	Chemical potential energy	Heat energy Light energy		

TASK 1

1. Observe the demonstration done by your teacher of a lit candle.
2. What is the input energy?
3. What is the output energy?
4. If you wanted to use candles to light up your room, what is the wasted energy?

TASK 2

1. Use the pictures on the chalkboard to fill in the last two columns on the table.

4. Light the candle then demonstrate the investigation of input, output and wasted energy of a candle:
   a. Explain to the learners that they should watch the demonstration carefully.
5. Explain Task 1 to the learners as follows:
   a. Complete Task 1.
6. Give learners some time to do Task 1.
7. Ask learners to share their answers to Task 1 with the class.
8. Discuss the answers with the learners.
9. *Model answer: Task 1*

> 2. *Chemical potential energy (material that can burn)*
> 3. *Heat and light energy*
> 4. *Heat energy*

10. Next, get the learners to do Task 2.
11. Explain Task 2 to the learners as follows:
    a. The table drawn on the chalkboard has five columns.
    b. The first column has the following heading: System.
    c. The second column has the following heading: Input energy.
    d. The third column has the following heading: Released energy.
    e. The fourth column has the following heading: Useful output energy.
    f. The fifth column has the following heading: Wasted energy.
    g. Work with the person sitting next to you.
    h. Use the pictures on the chalkboard and the table to fill in the last two columns in the table.
12. Give learners some time to do Task 2.
13. Ask learners to share their answers to Task 2 with the class.
14. Discuss the answers with the learners.
15. *Model answer: Task 2*

System	Input energy	Released energy	Useful output energy	Wasted energy
Electric drill	*Electrical potential energy*	*Kinetic energy* *Sound energy* *Heat energy*	*Kinetic energy*	*Sound energy* *Heat energy*
Electric iron	*Electrical potential energy*	*Heat energy*	*Heat energy*	
Electric kettle	*Electrical potential energy*	*Heat energy* *Sound energy*	*Heat energy*	*Sound energy*
Electric food mixer	*Electrical potential energy*	*Kinetic energy* *Heat energy* *Sound energy*	*Kinetic energy*	*Heat energy* *Sound energy*
Candle	*Chemical potential energy*	*Heat energy* *Light energy*	*Light energy*	*Heat energy*
Car engine	*Chemical potential energy*	*Kinetic energy* *Heat energy* *Sound energy*	*Kinetic energy*	*Heat energy* *Sound energy*
Paraffin lamp	*Chemical potential energy*	*Heat energy* *Light energy*	*Light energy*	*Heat energy*

14. When the learners have completed Task 2, hold a short class discussion to revise:
    a. Wasted energy can escape in the form of heat and/or sound.
    b. Devices such as electric drills, food processors and hair dryers release wasted energy in the form of sound.
    c. Objects such as candles, lamps and engines release wasted energy in the form of heat.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. The input energy of a coal driven train releases kinetic energy, sound energy and heat energy. Which energy is useful output energy?
b. Which energy is wasted energy?

Answers to the checkpoint questions are as follows:

a. Kinetic energy
b. Heat and sound energy

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	Energy transfer to surroundings	155-156
Solutions for all	Energy transfer to surroundings	257-259
Spot On	Energy transfer to surroundings	130-132
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Via Afrika	Energy transfer to surroundings	126-129
Platinum	Insulation, energy saving and energy transfer to the surroundings	176-180
Oxford Successful	Energy transfer to surroundings	130-131
Pelican Natural Sciences	Energy transfer to surroundings	218-229
Sasol Inzalo Bk B	Energy transfer to surroundings	106-121

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://e-classroom.co.za/wp-content/uploads/2014/09/EngGr7T3-NS-Energy-transfer-surroundings-useful-wasted-energy.pdf [Useful and wasted energy]
2. https://www.youtube.com/watch?v=CVzT-Ya118A (3min 23sec) [Useful and wasted energy]

TOPIC OVERVIEW:
The national electricity supply system
Term 3, Weeks 9A – 9C

A. TOPIC OVERVIEW

TERM 3, WEEKS 9A – 9C

- This topic runs for 1 week.
- It is presented over 3 x 1 hour lessons.
- This topic's position in the term is as follows:

LESSON	WEEK 1			WEEK 2			WEEK 3			WEEK 4			WEEK 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

LESSON	WEEK 6			WEEK 7			WEEK 8			WEEK 9			WEEK 10		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C

B. SEQUENTIAL TABLE

GRADE 6	GRADE 7	GRADE 9
LOOKING BACK	**CURRENT**	**LOOKING FORWARD**
• Fossil fuels and electricity • Cost of electricity • Renewable ways to generate electricity	• Energy transfers in the national grid • Sequence of electricity supply and generation • Dynamos • Dynamo uses • Conserving electricity in the home	• Electricity generation • Nuclear power in South Africa • National Electricity Grid

C. SCIENTIFIC AND TECHNOLOGICAL VOCABULARY

Ensure that you teach the following vocabulary at the appropriate place in the topic:

	TERM	EXPLANATION
1.	useful energy output	Energy released by a system that helps us perform a specific function
2.	wasted energy	Energy that escapes to the surrounding environment in the form of heat or sound

D. UNDERSTANDING THE USES / VALUE OF SCIENCE

It is important for us to understand how energy is transferred in energy systems and how much of the energy is actually useful. Energy efficiency is becoming more important in our daily lives as we try to reduce the amount of energy we use in order to save the limited resources (fossil fuels) available on earth. A system is 100% efficient if all the input energy is transferred into useful output energy that can be used every day to perform functions. However, no system is 100% efficient. Much of the input energy is lost as wasted energy in the form of heat energy and sound energy. Therefore, it is a good idea to change old incandescent light bulbs to more modern fluorescent or LED light bulbs because they are more energy efficient and waste less heat energy.

E. PERSONAL REFLECTION

Reflect on your teaching at the end of each topic:

Date completed:	
Lesson successes:	
Lesson challenges:	
Notes for future improvement:	

9 A

Term 3, Week 9, Lesson A
Lesson Title: Energy transfers in the national grid
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	The National Electricity Grid system
CAPS Page Number	29

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that the National Electricity Grid is a circuit system
- Interpret and explain the sequence of electricity supply from power stations to consumers
- Explain the energy transfers that occur in the sequence of electricity supply from power stations to consumers.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues		11. Doing Investigations	
2. Observing		7. Raising Questions	✓	12. Recording Information	
3. Comparing		8. Predicting	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

TOPIC: National electricity supply system

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 21: The national grid. Page 25.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What are the two forms of wasted energy?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

The two forms of wasted energy are heat and sound.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

THE NATIONAL ELECTRICITY GRID SYSTEM

1. Eskom is the largest supplier of electricity in South Africa.
2. A **National Electricity Grid** is a system that delivers electricity to our homes from electricity suppliers like Eskom.
3. The National Electricity Grid is a circuit that is made up of a **power station** which produces electricity, and power lines (cables) that carry electricity to our homes.
4. The electricity is supplied in the following process:
5. Energy from different energy sources like coal, oil, gas, nuclear fuels, falling water and wind is transferred to kinetic energy that turns turbines.
6. Turbines transfer the kinetic energy to a generator.
7. A generator changes the energy from kinetic energy (mechanical movement) into electricity.
8. The generator is also linked to a **transformer** which sets the electricity to the correct **voltage**. The electricity is then transferred to the cables of the National Electricity Grid.
9. The cables transfer energy from one **electrical pylon** to another and then to the electrical appliances and lights in our homes.

2. Explain to the learners that:
   a. We all know that the electricity in our homes is generated at power stations.
   b. How does the electricity get to our homes?
      Electricity travels along cables from the power station, to our homes. These cables are part of the National Electricity Grid.
   c. The National Electricity Grid system is like an electric circuit. It is made up of a power station where the electricity is produced, and power lines which transport the electricity.
   d. The power station is made up of components that transfer input energy into useful output energy (electricity).
   e. Input chemical potential energy such as coal, oil, gas and nuclear fuels or kinetic energy such as falling water or wind can be used as input energy in power stations.
   f. The input energy is transferred into kinetic energy as it forces turbines to rotate.
   g. For example, falling water or wind forces turbines to rotate; also fossil fuels like coal are burned to produce steam that operates turbines.
   h. The turbines then transfer the kinetic energy to a generator. Remember that a generator is a device that transfers mechanical movement (kinetic energy) into electrical energy.
   i. The generator also transfers the electricity in the cables of the National Electricity Grid. A transformer sets the voltage of the electricity at 230 volts in South Africa. Most of our appliances run on 230 volts. A higher voltage can damage our appliances. The cables carry electricity along cables supported by pylons to our homes. The cables transfer energy to our electrical appliances and lights. Pylons are the large metal structures that have many cables.
   j. Tell the learners to copy the information on the chalkboard into their workbooks.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is the National Electricity Grid?
b. How is electricity transported to our homes?

Answers to the checkpoint questions are as follows:

a. A system that delivers electricity to our homes
b. By cables that carry electricity from the power station to our homes

E CONCEPTUAL DEVELOPMENT

1. Use Resource 21: The national grid. Make sure it is on display in the classroom.
2. Draw and write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

Number on diagram	Explanation	Energy transfer
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

TASK 1

1. Look at the diagram of the national grid (coal power station) on the chalkboard.
2. Copy the table into your workbooks.
3. Fill in the table by explaining what happens at each number and explain the energy transfers that happen at each number.

TASK 2

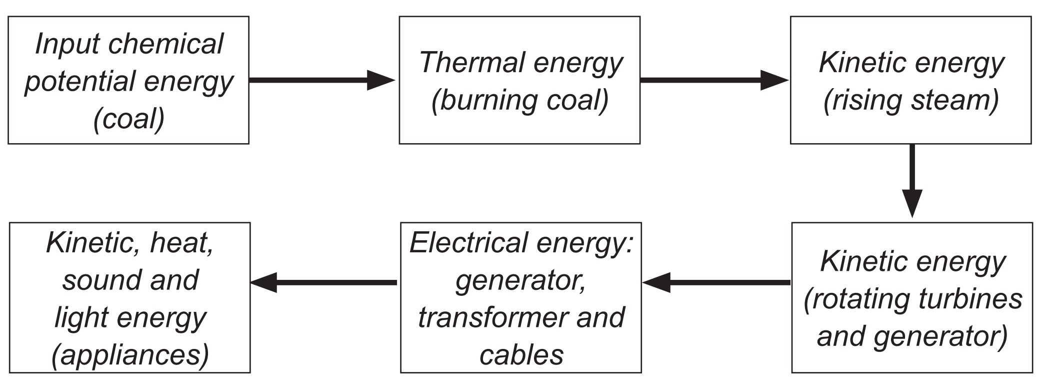
1. Draw a flow diagram to show the energy transfers that occur at each number.

3. Explain Task 1 to the learners as follows:
   a. The table drawn on the chalkboard has three columns.
   b. The first column has the following heading: Number on diagram.
   c. The second column has the following heading: Explanation.
   d. The third column has the following heading: Energy transfer.
   e. Look at the diagram on display.
   f. The diagram shows how electricity is supplied to a house from a coal power station.
   g. The diagram has numbers on it from 1 to 8.
   h. At each number, explain what is happening and what type of energy transfer is happening.
   i. Work in groups and complete Task 1.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

ACTIVITY

Number on diagram	Explanation	Energy transfer
1.	*Coal is burned to provide heat energy.*	*Chemical potential energy to thermal (heat) energy*
2.	*The heat energy is used to boil water and make steam.*	*Thermal energy to kinetic energy*
3.	*The steam rises and forces turbines to turn.*	*Kinetic energy to kinetic energy (mechanical movement)*
4.	*The rotating turbine turns a generator which makes electricity.*	*Kinetic energy to electrical energy*
5.	*A transformer changes the voltage of the electricity to 230 volts.*	*Stays as electrical energy*
6.	*The electricity is transferred into cables that run along pylons over long distances.*	*Stays as electrical energy*
7.	*The cables are connected to our homes.*	*Stays as electrical energy*
8.	*The electricity is used to power our electrical appliances and lights.*	*Electrical energy is transferred to kinetic, heat, sound or light energy in our appliances.*

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Work on your own.
   b. Complete the flow diagram in Task 2.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*



14. When the learners have completed Task 2, hold a short class discussion to revise:
    a. The electricity is supplied in the following process:
    b. Energy from different energy sources like coal, oil, gas, nuclear fuels, falling water and wind is transferred to kinetic energy that turns turbines.
    c. Turbines transfer the kinetic energy to a generator.
    d. A generator changes the energy from kinetic energy (mechanical movement) into electricity.
    e. The generator is also linked to a transformer which sets the electricity to the correct voltage. The electricity is then transferred to the cables of the National Electricity Grid.
    f. The cables transfer energy from one electrical pylon to another to the electrical appliances and lights in our homes.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. What is the purpose of a generator in the national grid?
b. Why do you think cables are used to transfer electricity to our homes?

Answers to the checkpoint questions are as follows:

a. Transfer kinetic energy to electrical energy
b. Cables are good conductors of electricity and allow electricity to flow easily.

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	National electricity supply system	157
Solutions for all	The national electricity supply system	267-270
Spot On	The national electricity supply system	134-136
Top Class	The national electricity supply system	151-152
Via Afrika	The national electricity supply system	130-132
Platinum	The national electricity supply system	181-184
Oxford Successful	The national electricity supply system	132-133
Pelican Natural Sciences	The national electricity supply system	230-236
Sasol Inzalo Bk B	The national electricity supply system	122-128

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=SeXG8K5_UvU (2min 12sec) [How a coal power station works]
2. https://www.youtube.com/watch?v=w4waoi0rUe0 (4min 3sec) [Energy transfer (power station and car)]

9 B

Term 3, Week 9, Lesson B
Lesson Title: Energy transfers in the national grid
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Dynamos
CAPS Page Number	29

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that a dynamo is a small electrical generator which transfers mechanical movement (kinetic energy) to electrical energy
- List some uses of dynamos.

Specific Aims	1. DOING SCIENCE	
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	✓

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues	✓	11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing		8. Predicting		13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	✓
5. Sorting & Classifying	✓	10. Planning Investigations		15. Scientific Process	

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 22: Dynamo in a wind-up torch.	
Resource 23: Dynamo in a bicycle light.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What does a generator do?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

A generator changes kinetic energy into electrical energy.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

<u>DYNAMOS</u>

1. A **dynamo** is a small generator.
2. Dynamos also change kinetic energy (mechanical movement) into electrical energy.
3. Dynamos use the movement of another object to move parts in the dynamo and so generate electricity.
4. The faster the parts in the dynamo turn, the more electricity is generated.
5. Dynamos are used in bicycle lights, mine helmets, **wind-up torches** and radios.
6. Bicycle lights use the rotation of the wheel to generate electricity and operate a bicycle light. The faster the wheel rotates, the brighter the bicycle light will shine.
7. Wind-up torches have a handle that can be rotated. The movement of the handle gives the dynamo kinetic energy that is transferred to electrical energy.
8. The bicycle light and wind-up torch do not need a power supply or batteries to light up.

2. Explain to the learners that:
   a. A dynamo is a small generator.
   b. Dynamos also change kinetic energy (mechanical movement) into electrical energy.
   c. Dynamos use the movement of another object to move parts in the dynamo and so generate electricity. The small parts are coiled wires that move in a magnetic field. A magnetic field is the force that we feel when we put two magnets together. As the wire moves through the magnetic field, electricity is generated. You will learn more about this in higher grades.
   d. The faster the parts in the dynamo turn, the more electricity is generated.
   e. Dynamos are used in bicycle lights, mine helmets, wind-up torches and radios.
3. Show learners Resource 23: 'Dynamo in a bicycle light'.
   a. Bicycle lights are used for safety so that cyclists can see where they are going. Other people can also see the cyclists.
   b. Bicycle lights use the rotation of the wheel to generate electricity and operate a bicycle light. The faster the wheel rotates, the brighter the bicycle light will shine.
4. Show learners Resource 22: 'Dynamo in a wind-up torch'.
   a. A wind-up torch is a special torch that can light up while you rotate a lever.
   b. Wind-up torches have a handle that can be rotated. The movement of the handle gives the dynamo kinetic energy that is transferred to electrical energy.
   c. The bicycle light and wind-up torch do not need a power supply or batteries to light up.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

a. What is a dynamo?
b. How does a dynamo work?

Answers to the checkpoint questions are as follows:

a. A small generator
b. It transforms kinetic energy to electrical energy.

E CONCEPTUAL DEVELOPMENT

1. Use Resources 22 and 23. Make sure they are on display chalkboard in the classroom.
2. Write the following onto the chalkboard (always try to do this before the lesson starts):

> <u>ACTIVITY</u>
>
> <u>TASK 1</u>
>
> 1. Look at the pictures of a bicycle light and a wind-up torch on display.
> 2. Explain what a dynamo is and what it is used for.
>
> <u>TASK 2</u>
>
> 1. For each picture, explain how the lights work.

3. Explain Task 1 to the learners as follows:
   a. Look at the pictures of a bicycle light and a wind-up torch.
   b. Work in pairs and complete Task 1.
4. Give learners some time to do Task 1.
5. Ask learners to share their answers to Task 1 with the class.
6. Discuss the answers with the learners.
7. *Model answer: Task 1*

> *2. A dynamo is a small generator that is used to generate electricity by transferring kinetic energy into electrical energy.*

8. Next, get the learners to do Task 2.
9. Explain Task 2 to the learners as follows:
   a. Work on your own.
   b. Answer the question in Task 2.
10. Give learners some time to do Task 2.
11. Ask learners to share their answers to Task 2 with the class.
12. Discuss the answers with the learners.
13. *Model answer: Task 2*

> *1. Bicycle lights use the rotation of the wheel to generate electricity and operate a bicycle light. The faster the wheel rotates, the brighter the bicycle light will shine.*
> *Wind-up torches have a handle that can be rotated. The movement of the handle gives the dynamo kinetic energy that is transferred to electrical energy.*

14. When the learners have completed Task 2, hold a short class discussion to revise:
    a. A dynamo is a small generator.
    b. Dynamos also change kinetic energy (mechanical movement) into electrical energy.
    c. Dynamos use the movement of another object to move parts in the dynamo and generate electricity.
    d. The faster the parts in the dynamo turn, the more electricity is generated.
    e. Dynamos are used in bicycle lights, mine helmets, wind-up torches and radios.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. How can you make the light of a wind-up torch brighter?
b. What energy transfers take places when a bicycle light lights up?

Answers to the checkpoint questions are as follows:

a. Turning the lever faster generates more electricity.
b. Kinetic energy to electrical energy to light and heat energy.

15. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	National electricity supply system	157
Solutions for all	The national electricity supply system	270-271
Spot On	The national electricity supply system	137
Top Class	The national electricity supply system	153-154
Via Afrika	The national electricity supply system	133
Platinum	The national electricity supply system	185
Oxford Successful	The national electricity supply system	134
Pelican Natural Sciences	The national electricity supply system	237-239
Sasol Inzalo Bk B	The national electricity supply system	129

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. http://www.edisontechcenter.org/generators.html [Generator and dynamos]

9 C

Term 3, Week 9, Lesson C
Lesson Title: Conserving electricity in the home
Time for lesson: 1 hour

A POLICY AND OUTCOMES

Sub-Topic	Conserving electricity at home
CAPS Page Number	30

Lesson Objectives

By the end of the lesson, learners will be able to:

- Explain that South Africa has a limited supply of electrical energy
- Identify methods to use energy wisely and save energy at home.

Specific Aims	1. DOING SCIENCE	✓
	2. KNOWING THE SUBJECT CONTENT & MAKING CONNECTIONS	✓
	3. UNDERSTANDING THE USES OF SCIENCES & INDIGENOUS KNOWLEDGE	

SCIENCE PROCESS SKILLS					
1. Accessing & recalling Information	✓	6. Identifying problems & issues	✓	11. Doing Investigations	
2. Observing		7. Raising Questions		12. Recording Information	
3. Comparing	✓	8. Predicting	✓	13. Interpreting Information	✓
4. Measuring		9. Hypothesizing		14. Communicating	
5. Sorting & Classifying		10. Planning Investigations		15. Scientific Process	

TOPIC: National electricity supply system

B POSSIBLE RESOURCES

For this lesson, you will need:

IDEAL RESOURCES	IMPROVISED RESOURCES
Resource 24: Incandescent and fluorescent light bulbs.	

C CLASSROOM MANAGEMENT

1. Make sure that you are ready and prepared.
2. Write the following question onto the chalkboard before the lesson starts:

What is a dynamo?

3. Learners should enter the classroom, then discuss the question with the teacher and then answer it in their workbooks.
4. Discuss their answers with the learners.
5. Write the model answer onto the chalkboard.

A dynamo is a small generator that transfers kinetic energy to electrical energy.

D ACCESSING INFORMATION

1. Write the following information on the chalkboard (always try to do this before the lesson starts):

CONSERVING ELECTRICITY AT HOME

1. South Africa has a **limited** supply of electricity.
2. Therefore, it is important for us to use electricity wisely and not waste it.
3. There are many ways to use energy wisely in our homes:
   a. Switch off lights and appliances, like TVs, when we are not using them.
   b. Use energy saver light bulbs that use less electricity to light a room (modern **LED** or **fluorescent light bulbs**).
   c. Wear warm clothes in winter to keep warm, instead of using heaters.
   d. Stop cold **draughts** by closing windows and doors in winter.
   e. Use energy efficient appliances. Replace old technology with modern technology.
   f. Use a pot that is the same size as the stove plate so that heat energy is not wasted.
   g. Use a hotbox for cooking.

2. Explain to the learners that:
   a. South Africa has a limited supply of electricity. We mainly use coal in power stations. Coal is a fossil fuel which means it is a non-renewable energy source that cannot be re-used or replaced.
   b. Therefore, it is important to use electricity wisely and not waste it.
   c. There are many ways to use energy wisely in our homes:
   d. Switch off lights and appliances, like TVs, when not in use. The output energy of a TV is light, sound and heat. The heat energy is wasted energy. You should switch off your TV when you are not watching.
3. Show learners Resource 24: 'Incandescent and fluorescent light bulbs'.
4. Explain to the learners that they should:
   a. Use energy saver light bulbs that use less electricity. Incandescent light bulbs produce much more heat energy than modern LED or fluorescent light bulbs. Therefore, we can save energy by using LED or fluorescent light bulbs.
   b. Wear warm clothes in winter to keep warm instead of using heaters.
   c. Stop cold draughts by closing windows and doors in winter.
   d. Use energy efficient appliances by replacing old technology with modern technology.
   e. Use a pot that is the same size as the stove plate so that heat energy is not wasted.
   f. Use a hotbox for cooking.

Checkpoint 1

Ask the learners the following questions to check their understanding at this point:

   a. What is our main source of electricity generation in South Africa?
   b. Why is it important to use electricity wisely and not waste it?

Answers to the checkpoint questions are as follows:

   a. Coal power stations
   b. South Africa has a limited supply of electricity.

E CONCEPTUAL DEVELOPMENT

1. Write the following onto the chalkboard (always try to do this before the lesson starts):

ACTIVITY

TASK 1

1. Jabu is very stressed because his monthly electricity costs are very high. Help Jabu by informing him of five ways that he can reduce energy usage in his home and lower his electricity costs.

TASK 2

1. Do you think it is a good idea to change incandescent light bulbs to more energy efficient LED or fluorescent light bulbs?
2. Why or why not?
3. Identify ways in which you waste energy in your homes.
4. What can you do to prevent the energy from being wasted?

2. Explain Task 1 to the learners as follows:
   a. Work on your own and complete Task 1.
3. Give learners some time to do Task 1.
4. Ask learners to share their answers to Task 1 with the class.
5. Discuss the answers with the learners.
6. *Model answer: Task 1*

1. Any five of the following are acceptable:
   a. Switch off lights and appliances, like TVs, when not in use.
   b. Use energy saver light bulbs that use less electricity.
   c. Wear warm clothes in winter to keep warm instead of using heaters.
   d. Stop cold draughts by closing windows and doors in winter.
   e. Using energy efficient appliances by replacing old technology with modern technology.
   f. Use a pot that is the same size as the stove plate so that heat energy is not wasted.
   g. Use a hotbox for cooking.

7. Next, get the learners to do Task 2.
8. Explain Task 2 to the learners as follows:
   a. Work with the person sitting next to you.
   b. Answer the questions in Task 2.
9. Give learners some time to do Task 2.
10. Ask learners to share their answers to Task 2 with the class.
11. Discuss the answers with the learners.

12. *Model answer: Task 2*

Answers may vary.

1. *Yes*
2. *More modern LED or fluorescent light bulbs do not waste as much heat energy as incandescent light bulbs and they are more efficient.*
3. *Answers for 3 and 4 will be different depending on the living situations of the learners.*

13. Answer any questions that learners may have and provide further explanations.

Checkpoint 2

Ask the learners the following questions to check their understanding at this point:

a. Do you think it is a good idea to keep the fridge door open for long periods of time? Give a reason.
b. Do you think it is better to cook food with the pot lid on or off? Give a reason.

Answers to the checkpoint questions are as follows:

a. No. When the fridge door is open for long periods of time, the heat energy from the room is transferred to the air in the fridge, making it warm. The fridge will have to work harder and use more energy to make the air in the fridge cool again.
b. On. It is easier for heat energy to escape when the lid is not on the pot. It will take longer for the food to cook and will use more electricity.

14. Ask the learners if they have any questions and provide answers and explanations.

F REFERENCE POINTS FOR FURTHER DEVELOPMENT

If you need additional information or activities on this topic, you can find these in your textbook on the following pages:

NAME OF TEXTBOOK	TOPIC	PAGE NUMBER
Step-by-Step	National electricity supply system	158
Solutions for all	The national electricity supply system	272-282
Spot On	The national electricity supply system	138-139
Top Class	The national electricity supply system	154-157
Via Afrika	The national electricity supply system	134-135
Platinum	The national electricity supply system	186-192
Oxford Successful	The national electricity supply system	135-136
Pelican Natural Sciences	The national electricity supply system	239-240
Sasol Inzalo Bk B	The national electricity supply system	130-143

G ADDITIONAL ACTIVITIES/ READING

In addition, further reading, listening or viewing activities related to this sub-topic are available through the following web links:

1. https://www.youtube.com/watch?v=ycdke8MTSCI (3min 3sec) [How to save energy for School Teaching]

NATURAL SCIENCES

ASSESSMENT

GRADE 7 TERM 3

GRADE 7 ASSESSMENT

- This section presents the CAPS assessment requirements for this grade for this term.
- See your prescribed textbooks for examples of the required assessments.

CAPS Assessment

Assessment is a continuous planned process that involves identifying, gathering, interpreting and diagnosing information about the performance of learners.

Assessment involves generating and collecting evidence of learner achievement and progress, and using this information to understand and provide assistance to the learner during the process of teaching and learning.

Assessment should be both *formal* and *informal*:

a. ***Informal Assessment*** involves regular checking of learners' class work and practical tasks; asking questions; discussions; informal classroom interactions; and giving constructive feedback. Informal assessment marks do not need to be recorded, but the teacher can make notes for future reference.

b. ***Formal Assessment*** provides teachers with a systematic way of evaluating how well learners are progressing. Formal Assessment consists of selected assessment tasks. These tasks are stipulated by CAPS and the marks need to be recorded. These tasks are done throughout the year, and include practical / investigations, project, tests and examinations.

i. ***Tests and Examinations***

The weighting of the marks should reflect the time allocated to each section in the curriculum content. Tests and exams should consist of a range of questions that cover different cognitive levels: recall; understanding; application; evaluation; analysis; and synthesis. CAPS aligned tests and examinations, with accompanying memoranda, are provided with these lesson plans.

ii. ***Practical / investigation tasks***

Practical / investigation tasks give learners the opportunity to demonstrate knowledge, skills and understanding. They form part of the activities included in these lesson plans. Each term, one practical / investigation task has been selected for assessment. A rubric is provided to conduct the assessment.

iii. ***Poject***

Projects give learners the opportunity to demonstrate knowledge, skills, understanding and application. The project can be given in any term but must be recorded for term 4 assessment.

A minimum mark allocation is prescribed in CAPS for, practical / investigation, projects, tests and examinations for each grade. These are summarised, by grade, in the table below:

GRADE 7 ASSESSMENT – RUBRIC

Grade 7					
Programme of Formal Assessment					
Formal Assessments	**TERM 1**	**TERM 2**	**TERM 3**	**TERM 4**	**TOTAL % FOR THE YEAR**
School-based assessments	Test 1 [30 marks] Practical task/ investigation 1 [20 marks]	Test 2 [30 marks] Practical task/ investigation 2 [20 marks]	Test 3 [30 marks] Practical task/ investigation 3 [20 marks]	Practical task/ investigation 4 [20 marks] Project [20 marks]	40%
Exams **[60 minutes]**		Exam 1 on work from terms 1 and 2 [60 marks]		Exam 2 on work from terms 3 and 4 [60 marks]	60%
Number of formal assessments	2	3	2	3	Total: 100%

Refer to CAPS on the processes for converting marks to percentages and to the 7-point scale.

In this section of the booklet, you will find your science assessments for this term.

There are two assessments included:

1. A Practical Activity

The activity completed is drawn from one of the lessons in the lesson plans. The rubric or memorandum attached in this pack will assist you with assessing the task completed by the learners.

2. A Test

The test included will need to be copied onto the chalkboard for learners to complete. There is also a test memorandum included to assist you with marking the learners completed test scripts.

3. A Project

The project will be completed in Term 3, but the marks will be used in Term 4. The project focuses on Term 3 work. There are instructions for learners and a memorandum is included to assist you with marking the completed projects.

All of the assessments are aligned to CAPS requirements and the marks allocated for each assessment are as stipulated in CAPS.

GRADE 7 ASSESSMENT – PROJECT TERM 3

Natural Sciences
Grade 7
Project

Information and instructions for the teacher

NOTE TO THE TEACHER:

If possible, photocopy this test for each learner. If this is not possible, write the test on the chalkboard.

INSTRUCTIONS TO THE LEARNERS

1. If possible, photocopy the project information for each learner. If this is not possible, write the information on the chalkboard and have the learners copy it down.
2. This project will focus on Energy and Electricity.
3. Time needs to be taken to explain the project at the beginning of term 3.
4. A due date needs to be set for submission at the end of Term 3 or early in Term 4.
5. The project mark is to be used in Term 4.
6. This project is out of 20 marks.
7. The rubric for assessing the project is provided.
8. Ongoing support, encouragement and reminders should be provided for the learners.
9. The due date should be visibly displayed in the classroom.

GRADE 7 ASSESSMENT – PROJECT TERM 3

Grade 7
Natural Sciences
Project
Topic: Energy And Electricity

20 Marks

Name or learner:	______________________________
Due date:	______________________________

INSTRUCTIONS TO THE LEARNERS

1. This project will be done in groups of four.
2. This project is made up of two parts.
3. Each person must participate in all aspects of the project.
4. Pay attention to the mark allocations.
5. The marks for this project count towards term 4 assessment.
6. Read through the entire project to ensure you understand the tasks.
7. Plan your time carefully.
8. NO LATE projects will be accepted.
9. Work neatly and pay attention to your presentation.

<u>PART 1: Data collection and presentation on a graph & conclusion [12 marks]</u>

1. Each person in your group must interview 4 people using the interview sheet below.
   (This means you will have 16 sets of data altogether).
2. Record the interviews you do in your workbooks or on paper.
   (This means you will have 4 interviews in your workbook/ on your paper).
3. Keep the interview sheet from each interview as proof of the work done if you have not written them in your workbook.
4. DO NOT go to a stranger's home alone. Try to interview friends, family, teachers and neighbours.

GRADE 7 ASSESSMENT – PROJECT TERM 3

Interview for Data Capture

Name of person being interviewed: _________________

Date of interview: ____________________

Place of residence: ___________________

Type of housing: formal/informal

QUESTIONS:

1. Do you have electricity running to your home?
2. If no, what do you use for light and cooking?
3. If yes:
    a. Do you use pre-paid electricity?

       OR

    b. Do you pay for metered electricity?

       OR

    c. Do you use an unmetered connection for your electricity?

       OR

    d. Do you use another source for electricity e.g.: solar panels?
4. If you use electricity from the National Grid (Eskom), would you prefer to use a solar panel? Why/ why not?
5. Do you worry about air pollution from our coal fired power stations?
6. Do you have any general comments about electricity in South Africa?

Thank you for your time.

GRADE 7 ASSESSMENT – PROJECT TERM 3

Working together and comparing all the data you have collected:

1. Draw a bar graph showing:
    - The y-axis with the number of interviewees.
    - The x-axis with the categories of your findings.
2. The data on the x-axis should show:
    - The number of people with no form of electricity at their homes.
    - The number of people using pre-paid electricity.
    - The number of people using metered electricity.
    - The number of people using illegal connections.
    - The number of people using solar/other forms of electricity.
3. Ensure you have labelled your graph with:
    - A label on y-axis.
    - A label for each of the bars on the x-axis.
    - An overall title for your graph.
4. Now, look carefully at the data you have collected, including the areas and the type of housing. Analyse and compare the data and write a paragraph of 4-5 lines about what you can conclude from this data.

GRADE 7 ASSESSMENT – PROJECT TERM 3 MEMO

PROJECT ASSESSMENT RUBRIC
GRADE 7
Names of Learner/s: ____________________

Date: ____________________

	Excellence achieved	Achieved	Mostly achieved	Partially achieved	Was not submitted	Total
Score	4	3	2	1	0	
Data collection	All interviews were conducted Data is thorough and organised Data is neat and available	All interviews were conducted There is enough data to complete graphs Data is organised	Most interviews were conducted Data is incomplete	Few interviews were completed There is insufficient data	Work not submitted	
Graph	X and y axis are correct Both axis are labelled All data required is correctly recorded Graph is neat and easy to read Graph has a title	X and y axis are correct Both axis are labelled Most data required is correctly recorded Graph is neat and easy to read Graph has a title	X and y axis are correct Both axis are labelled Not all data required is correctly recorded Graph has a title	X and y axis may be incorrect Both axis may not be labelled Not all data required is correctly recorded	Work was not submitted	
Observations	Observations are clear and logical and well-constructed.	Observations show understanding of data	Observations show an understanding of most data	Limited observations and limited understanding	Work was not submitted	
Conclusions	Conclusion takes all variables into consideration and states a clear conclusion	Conclusion takes most variables into control and makes a conclusion	Conclusion considers main points but forgets some important points. A conclusion is made.	Conclusion does not consider all points.	Work was not submitted	
Presentation	Work is presented neatly and in a variety of colours – a lot of effort	Work is presented neatly with limited colours – some additional effort	Work is satisfactory – no additional effort	Work has untidy elements – limited effort	Work was not submitted	
						20 marks

Natural Sciences
Grade 7
Practical Task
Term 3

20 Marks

Time allocation: 40 minutes (15 minutes preparation, 25 minutes task time)

NOTE TO THE TEACHER:

1. This practical activity will be completed as part of Section E of lesson 2B.
2. This practical will take place during the lesson after the teaching component in Section D, "Accessing Information".
3. The first 15 minutes will be used to teach section D and prepare learners for the practical task.
4. The next 25 minutes will be used to complete the practical activity as outlined in Section E.
5. The instructions and content of the practical task should be written on the chalkboard for the learners.
6. The memo for assessing the practical task is provided.
7. This will be a pair-work or small-group work lesson.
8. The following equipment will need to be collected before the lesson:
    - An elastic band
    - A paper or polystyrene cup cut in half (You may need to improvise with a matchbox, or a half-can)
    - A ruler
9. Ensure that all the materials have been collected before the practical lesson. This may take a few days. Allow enough time for this.
10. The learners should complete the drawings/ graphs with a sharp pencil and the written answers should be completed in pen.

Grade 7
Natural Sciences
Term 3
Practical

Memorandum

<table>
<tr><th>CAPS Topic</th><th>Task</th><th>Expected answer(s)</th><th>Marks</th></tr>
<tr><td></td><td>1</td><td></td><td></td></tr>
<tr><td>Potential and kinetic energy</td><td>1.1</td><td>(Answers may vary)

The greater the potential energy (input) the greater the kinetic energy (output). ✓</td><td>1</td></tr>
<tr><td>Potential and kinetic energy</td><td></td><td>
<table>
<tr><td>CONDITION 1:

Short stretch ________ cm

Potential energy (the stretched elastic)</td><td>CONDITION 2:

Medium stretch ______cm

Potential energy (the stretched elastic)</td><td>CONDITION 3:

Long stretch ________ cm

Potential energy (the stretched elastic)</td></tr>
<tr><td>First test

Cup moved ____cm</td><td>First test

Cup moved ____cm</td><td>First test

Cup moved ____cm</td></tr>
<tr><td>Second test

Cup moved ____cm</td><td>Second test

Cup moved ____cm</td><td>Second test

Cup moved ____cm</td></tr>
<tr><td>Third test

Cup moved ____cm</td><td>Third test

Cup moved ____cm</td><td>Third test

Cup moved ____cm</td></tr>
<tr><td>Now add the three maesurements together and divide by three to get an average.
_______cm</td><td>Now add the three maesurements together and divide by three to get an average.
_______cm</td><td>Now add the three maesurements together and divide by three to get an average.
_______cm</td></tr>
<tr><td>Kinetic energy (reperesented by the cup movement) =
________cm</td><td>Kinetic energy (reperesented by the cup movement) =
________cm</td><td>Kinetic energy (reperesented by the cup movement) =
________cm</td></tr>
</table>
(Answers will vary).
• Marks allocated as follows:
• A measurement suitable for each condition ✓
• Three tests for each condition ✓ ✓ ✓
• Average calculation for each condition ✓ ✓ ✓
• Kinetic energy measurement recorded ✓</td><td>

1
3
3
1</td></tr>
</table>

	2.		
Potential and kinetic energy	2.1	Marks allocated as follows: • Y-axis measured out in centimetres ✓ • Y-axis has suitable label ✓ • X-axis shows 3 bars of data ✓ ✓ ✓ • On X-axis, data bars are labelled ✓ • Both axes are labelled ✓ • Graph has a label ✓ • Graph is neat and accurate ✓	 1 1 3 1 1 1 1
Potential and kinetic energy	2.2	*(Answers may vary)* ✓ ✓ • The further back we pulled the elastic the greater the potential energy. The cups moved further. • The greater the potential energy the greater output of kinetic energy.	2
			TOTAL 20

Grade 7
Natural Sciences
Term 3
Test

30 Marks
60 Minutes

NOTE TO THE TEACHER:

1. If possible, photocopy this test for each learner. If this is not possible, write the test on the chalkboard.

INSTRUCTIONS TO THE LEARNERS

1. Answer all questions in blue or black ink.
2. Read each question carefully before answering it.
3. Pay attention to the mark allocations.
4. Plan your time carefully.
5. Write your answers in the spaces provided.
6. Write neatly.

PRACTICE QUESTION

Read the question and circle the letter that shows the correct answer.

1.1. An example of a renewable energy source is ?

a. oil

b. sunlight

c. coal

d. gas

You have answered correctly if you have circled (B)

QUESTION 1: MULTIPLE CHOICE [4]

Read each question and circle the letter that shows the correct answer.

1.1. Which one of these is NOT a fossil fuel?

a. coal

b. natural gas

c. uranium

d. oil

1.2. Which of these statements is false?

a. Potential energy is energy that is stored in an object or system.

b. The food we eat has chemical potential energy.

c. A compressed spring is an example of elastic potential energy.

d. Potential energy cannot be transferred.

1.3. Which of these statements is true?

a. Heating is a process where energy is transferred from a cooler body to a hotter body.

b. Conduction is a form of heat transfer through liquids.

c. Heating is a process where energy is transferred from a hotter body to a cooler body.

d. An example of conduction is cooking a chicken on a fire.

1.4. Which one of these is NOT a useful insulator when building an energy efficient house?

a. Large glass windows

b. Thatch roofing

c. Foam ceiling boards

d. Hollow cement blocks

QUESTION 2: MATCH THE COLUMNS [4]

COLUMN A	
example	Needed by all living things to survive
2.1.	Part of a heating appliance that outputs energy
2.2.	An empty space that has no particles
2.3.	An extremely small part of matter
2.4.	Plant or animal waste used to produce energy

COLUMN B	
A.	Particle
B.	Element
C.	Biofuel
D.	Vacuum
E.	E. Air

Question 3 [5]

Write the word or words that is/are being described in the sentences below.

Only write the answer.

2.1. The upward movement of heated particles and the downward movement of cooled particles in a liquid or gas during heat transfer.

____

2.2. Special waves that can transfer heat energy

____

2.3. Materials that are poor conductors of heat.

____

2.4. Energy saving light bulbs that can be used to light a room.

____

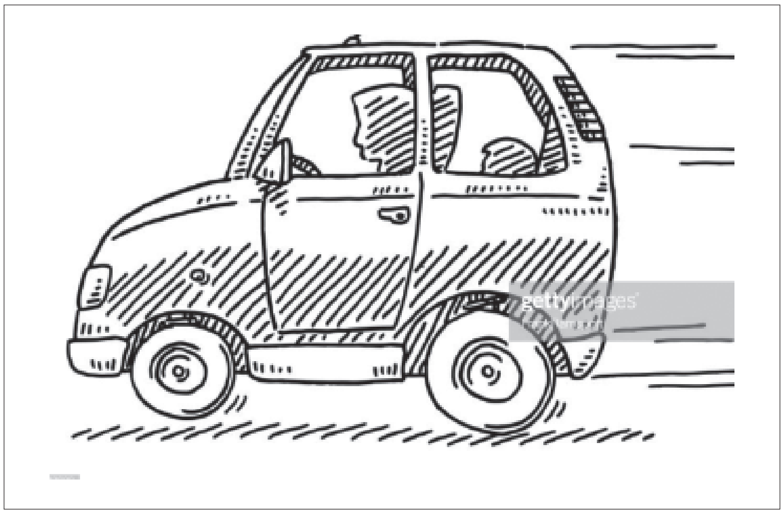
2.5. The transfer of heat energy by electromagnetic wave.

____

QUESTION 4 [4]

(Note to educator: This drawing can be replicated, (or Resource 19 can be used.)

Look at the drawing of the car below. The car has a petrol engine and is driving a family to a wedding.



4.1. What do we call the input energy of the car?

____

4.2. The released energy is heat energy, sound energy and what other kind of energy?

____

4.3. What is the useful output energy in this situation?

____

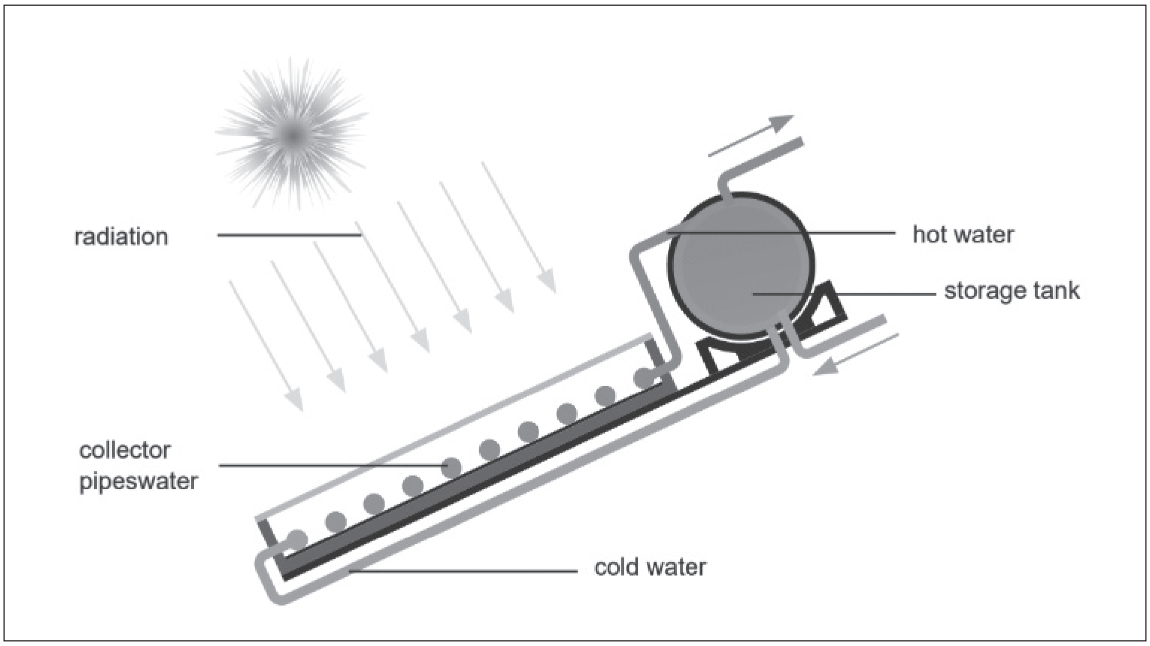
4.4. Name one wasted output energy in this situation.

____

QUESTION 5 [7]

Note to educator: The diagram below can be replicated, or Resource 10 can be used.)

Look at the diagram of diagram of a solar water heating system below:



Using what you have learnt, and the above diagram to help you, explain how a solar water heating system works using conduction, convection and radiation.

____

____

____

____

____

____

____

QUESTION 6 [3]

Say if the following sentences are TRUE or FALSE:

6.1. The National Electricity Grid is a circuit that is made up of a power station and power lines.

____

6.2. Power stations are used to store energy.

____

6.3. The voltage of electricity in South Africa is set at 230 volts by a transformer.

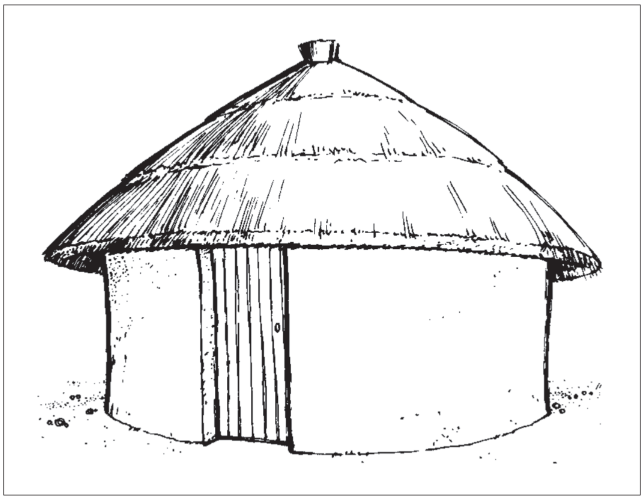
____

QUESTION 7 [3]

Read the quote below:

"It has been argued that traditional Xhosa rondavels and Zulu beehive huts can teach us much about energy efficiency. It is also argued that there are more modern ways of being energy efficient."

Look at this picture of an example of a traditional hut:



7.1. In your opinion, explain how traditional Xhosa and Zulu buildings teach us anything about energy efficiency. Give reasons for your answer.

Total: [30 marks]

Grade 7
Natural sciences
Term 3

Test
Memorandum

CAPS Topic	**Questions**	**Expected answer(s)**	**Marks**
	1		
Sources of energy	1.1	C ✓	1
Potential and kinetic energy	1.2	D ✓	1
Heat transfer	1.3	C ✓	1
Insulation and energy saving	1.4	A ✓	1
	2.		
Heat transfer	2.1	B ✓	1
Heat transfer	2.2	D ✓	1
Potential and kinetic energy	2.3	A ✓	1
Sources of energy	2.4	C ✓	1
	3.		
Heat transfer	3.1	convection current ✓	1
Heat transfer	3.2	electromagnetic waves ✓	1
Heat transfer	3.3	insulators ✓	1
National electricity supply system	3.4	LED or fluorescent lighting ✓	1
Heat transfer	3.5	radiation ✓	1
	4.		
Energy transfer to surroundings	4.1	chemical potential energy ✓	1
Energy transfer to surroundings	4.2	kinetic energy ✓	1
Energy transfer to surroundings	4.3	kinetic energy ✓	1
Energy transfer to surroundings	4.4	• heat energy • sound energy • (Any one) ✓	1

	5.		
Insulation and energy saving	5	• Cold water flows from the bottom of the tank to the collector pipes where heat energy is transferred by radiation from the sun. ✓ • Radiant energy is absorbed in these pipes and the water gets hotter. ✓ • The collector pipes transfer the heat energy by conduction. ✓ • The water that moves through the pipes ✓ transfers the heat energy by convection. ✓ • Hot water flows to the top of the tank. ✓ • Cold water sinks to the bottom of the tank. ✓ • This ensures that the water leaving the top of the tank is hot and that the cold water leaving the bottom of the tank will be heated by the collector pipes. ✓	7
	6		
The national electricity supply system	6.1	True ✓	1
The national electricity supply system	6.2	False ✓	1
The national electricity supply system	6.3	True ✓	1
	7		
Insulation and energy saving	7.1	Answers will vary, but may include: ✓ ✓ ✓ • Southern Africa can be very hot in summer and therefore people may want to keep their homes cool. • The grass thatch keeps the heat out and the cool air inside. • The thick stone walls keep the inside of the house cool • The mud and dung floors do not get too cold. • The small door helps keeps the air temperature constant. • The small windows can be opened for ventilation.	3
			TOTAL 30