GRADE 9
2005

COMMON TASK FOR ASSESSMENT (CTA)

NATURAL SCIENCE

TEACHER'S BOOK

SECTION A

Suggested Time : 5 hours

Marks : 120

The Common Task for Assessment consists of two components:

- Section A - a preparatory, class component;
- Section B - an individual learner, controlled-conditions, component.

SECTION A

- Section A is made up of three tasks with activities. The time and mark allocation for each activity is indicated.
- Section A should take 5 hours of class time and extra hours of homework.
- Section A is allocated 120 marks.
- Section A should be done in the learner's Natural Sciences workbook or in an ordinary exercise book specifically for Section A of the CTA. Learners can do certain parts on separate sheets of paper (especially where the activity needs to be marked by the teacher).
- Teachers are encouraged to use their discretion when dealing with learners who need extra support.
- Learners should complete all the activities in Section A in order to be properly prepared for Section B. Hints and suggestions are included to support the assessment of each activity.

SECTION B

- Section B should take a maximum of 2 hours and must be completed under controlled conditions.
- Section B is allocated 80 marks.
- A Teacher's Book is provided to assist with the assessment of Section B.

This manual contains only Section A. The table on pages 2 - 5 details the Specific Outcomes, Assessment Criteria and Performance Indicators dealt with in Section A. You need to carefully consult the Learner's Book for each activity and to take special note of the kinds of evidence learners are expected to produce for each activity as described in the Learner's Book. This is an integrated teaching, learning and assessment process. Teachers should help learners generate evidence of their knowledge and concepts, skills, attitudes and values as required by the relevant Specific Outcomes.

SECTION A – TEACHER SUMMARY

TASK 1						
PAGE NO	**ACTIVITY (time) (maximum marks)**	**SPECIFIC OUTCOME**	**ASSESSMENT CRITERIA**	**PERFORMANCE INDICATORS**	**ASSESSED AGAINST**	**WHO ASSESSES?**
6	**1. Translating information – What do we know about the planets in our Solar system?** 20 minutes (class) + 20 minutes (homework) 15 marks	**SO1** - Use process skills to investigate phenomena related to the Natural Sciences	• Evidence is analysed, evaluated and interpreted	• Present data in ways which facilitate analysis and interpretation	• Type of graph. • Choosing scale of y-axis • Plotting graph • Labelling graph • Appearance of graph	TEACHER
8	**2. Consolidating ideas – What makes planet Earth suitable for life?** 30 minutes (class) + 20 minutes (homework) 10 marks	**SO2** - Demonstrate an understanding of concepts and principles, and constructed knowledge in the Natural Sciences	• Acquired scientific knowledge, concepts and principles are used to inform actions (Earth & Beyond)	• Identify and select relevant scientific concepts in Earth & Beyond • Demonstrate an understanding of these concepts	• Extent of ideas • Relevance of ideas • Structure of a thinking map • Use of space • Appearance of thinking map	SELF
TASK 2						
PAGE NO	**ACTIVITY (time) (maximum marks)**	**SPECIFIC OUTCOME**	**ASSESSMENT CRITERIA**	**PERFORMANCE INDICATORS**	**ASSESSED AGAINST**	**WHO ASSESSES?**
11	**3. Acquiring knowledge – How can we represent the chemistry of life on planet Earth?** 50 minutes (class) 20 marks	**SO2** - Demonstrate an understanding of concepts and principles, and constructed knowledge in the Natural Sciences	• Acquired scientific knowledge, concepts and principles are used to inform actions (Matter & Materials)	• Identify and select relevant scientific concepts in Matter & Materials • Demonstrate an understanding of these concepts	• Writing chemical formulae • Drawing microscopic view diagrams • Balancing chemical equations • Writing balanced chemical equations	SELF

PAGE NO	ACTIVITY (time) (maximum marks)	SPECIFIC OUTCOME	ASSESSMENT CRITERIA	PERFORMANCE INDICATORS	ASSESSED AGAINST	WHO ASSESSES?
14	**4. Debating an issue – What responsibilities do humans have to life on Earth?** 20 minutes (class) + 10 minutes (homework) 10 marks	**SO5** - Use scientific knowledge and skills to support responsible decision-making	• Non-scientific issues are acknowledged • Alternatives are considered • Reasons for decisions are communicated	• Distinguish between matters of a mainly scientific nature and issues of another nature • Prioritise information by identifying critical and essential viewpoints, attitudes and values • Consider alternatives • Develop communications about their decisions and justify these decisions in a consistent way	• Making an ethical choice • Justifying an ethical choice	TEACHER
		SO8 - Demonstrate knowledge and understanding of ethical issues, bias and inequities related to the Natural Sciences	• A variety of viewpoints are acknowledged • Scientific inputs are used • Arguments are presented and evaluated	• Argue, reason and analyse ethical issues related to the use and development of science • Communicate the analysis of their arguments showing a clear grasp of relationships between ethical and scientific considerations		
15	**5 . Designing experiments – How can we test a condition necessary for life?** 40 minutes (class) + 30 minutes (homework) 15 marks	**SO1** - Use process skills to investigate phenomena related to the Natural Sciences	• Phenomena are identified and questions are posed • Hypotheses are formulated • Investigative plans of action are formulated	• Select a phenomenon • Formulate investigative question • Identify the priorities of the action steps, the control of variables, and the specific methods of data collection	• Forming a hypothesis • Designing a fair test • Identifying variables • Controlling variables • Choosing measurement method	TEACHER
		SO2 - Demonstrate an understanding of concepts and principles, and constructed knowledge in the Natural Sciences	• Acquired scientific knowledge, concepts and principles are used to inform actions (Life & Living)	• Identify and select relevant scientific concepts in Life and Living • Demonstrate an understanding of these concepts		

TASK 3						
PAGE NO	**ACTIVITY (time) (maximum marks)**	**SPECIFIC OUTCOME**	**ASSESSMENT CRITERIA**	**PERFORMANCE INDICATORS**	**ASSESSED AGAINST**	**WHO ASSESSES?**
18	**6. Brainstorming ideas and calculating my footprint – What threatens life on Earth and what threats do you personally pose?** 40 minutes (class) + 10 minutes (homework) 15 marks	**SO1** - Use process skills to investigate phenomena related to the Natural Sciences **SO2** - Demonstrate an understanding of concepts and principles, and constructed knowledge in the Natural Sciences	• Evidence is collected and recorded • Evidence is analysed, evaluated and interpreted • Acquired scientific knowledge, concepts and principles are used to inform actions (Energy & Change)	• Collect data • Critically evaluate Interpretations • Identify and select relevant scientific concepts in Energy & Change • Demonstrate an understanding of these concepts	• Calculation of personal carbon footprint • Comparing data	PEER
22	**7. Predicting impact – What can our country do to safeguard planet Earth?** 20 minutes (class) + 30 minutes (homework) 20 marks	**SO4** - Demonstrate an understanding of how scientific knowledge and skills contribute to the management, development and utilisation of natural and other resources **SO5** - Use scientific know-ledge and skills to support responsible decision-making **SO9** - Demonstrate an understanding of the interaction between the Natural Sciences and socio-economic development	• Management, development and utilisation practices are investigated • Alternative strategies and responsible decision-making are explored • Alternatives are considered • The way in which scientific and technological developments have changed the lives of people is analysed • Roles and consequences of science in society are communicated	• Identify human and social dimensions to the management, develop-ment and utilisation of resources • Assess impacts of technologies on environments • Discuss how decisions need to take all interests into account in order to have a degree of responsibility • Generate alternative decisions to accommodate different input • Provide reports that show a clear grasp of the use and effects of science and technology on society	• Identifying positive social impacts • Identifying negative social impacts • Identifying positive environmental impacts • Identifying negative environmental impacts	TEACHER

PAGE NO	ACTIVITY (time) (maximum marks)	SPECIFIC OUTCOME	ASSESSMENT CRITERIA	PERFORMANCE INDICATORS	ASSESSED AGAINST	WHO ASSESSES
24	**8. Taking personal responsibility – What can YOU do to safeguard planet Earth?** 80 minutes (class) 15 marks	**SO2** - Demonstrate an understanding of concepts and principles, and constructed knowledge in the Natural Sciences	• Acquired scientific knowledge, concepts and principles are used to inform actions (Energy & Change)	• Identify and select relevant scientific concepts in Energy & Change • Demonstrate an understanding of these concepts	• Extent of ideas • Value of ideas • Organisation of ideas • Innovation of design • Visual impact of poster	PEER
		SO3 - Apply scientific knowledge and skills to problems in innovative ways	• Relevant scientific knowledge is selected • Innovative options are generated • Possible plan of action is communicated	• Select scientific principles and formulate them in terms of the problem and issues • Propose and prioritise options or solutions • Communicate a coherent, structured and detailed plan that addresses the problem		
		SO4 - Demonstrate an understanding of how scientific knowledge and skills contribute to the management, development and utilisation of natural and other resources	• The importance of sound management practices for resources is acknowledged Alternative strategies and responsible decision-making are explored • Findings and conclusions are communicated	• Explain the significance of sound management in relation to resource cycles • Investigate ways of sustaining life now and in the future • Communicate findings within the school environment		

TASK 1

ACTIVITY 1: What do we know about the planets in our Solar system?

Time: **20 minutes class work** **Marks: 15**
20 minutes homework

Overview

During this activity each learner will draw a bar graph to represent one set of information about the different planets in our Solar system. This is a group activity but each group member will draw one different graph for assessment.

Activity

- Learners must work in groups of six. Each learner must choose one set of planetary data to plot a graph for their group. The options are: Distance from Sun; Year Length; Mass; Diameter; Density and Gravity.

- Discuss the features of plotting a graph:

  1. Identify the independent variable – that which you decide on.
  2. Identify the dependent variable – that which is measured for the independent variable.
  3. Decide on the graph type: in this case a bar graph – for data not continuous and/or not numerical.
  4. Choose a scale for the x-axis to represent the independent variable.
  5. Choose a scale for the y-axis to represent the dependent variable.
  6. Plot the graph.
  7. Label the graph and axes.

- They must now discuss in their groups before starting:

  what sort of bar graph to use
  what scale to use
  what heading to have
  what labels to include.

- Provide each learner with an A4 piece of graph paper. Learners must make sure that their names are clearly presented on the graph that they hand in. Each group must hand in all six graphs.

Optional Activity

Instead of plotting graphs by hand, allow learners to use Microsoft Excel to plot data.

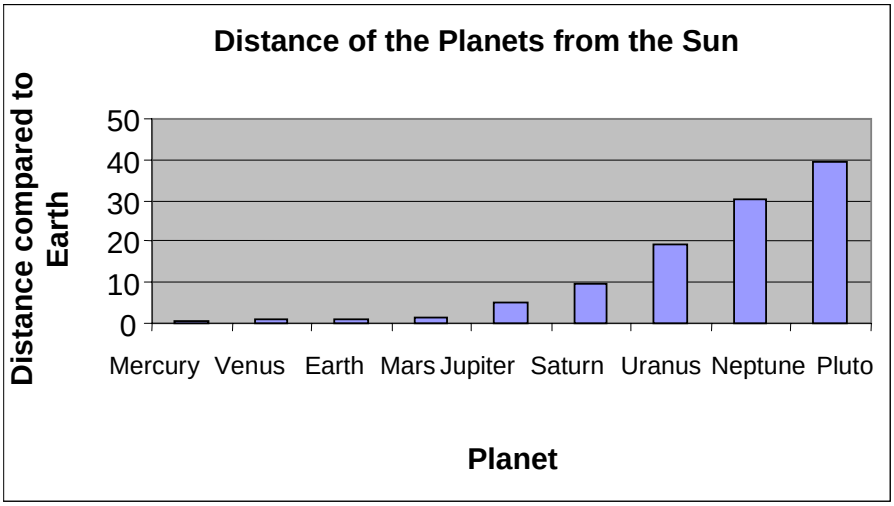
Time Management

- Allocate 10 minutes (class time) to outline the activity and revise the process of plotting a graph.
- Allocate 10 minutes (class time) for learners to allocate graphs to be plotted in their group and to discuss the questions concerning the graphs.
- Allocate 20 minutes (homework time) to plot the individual graphs. Graphs are handed in per group in the next lesson.

Assessment

- The teacher allocates marks according to the following rubric for each graph:

	0 marks	1 mark	2 marks	3 marks
Type of graph	No bar graph drawn	Bar graph drawn but with major errors	Bar graph drawn with minor inaccuracies	Correct and proper bar graph drawn
Choosing scale of y-axis	Scale not present	Scale present but incorrect	Scale correct but lacking accuracy	Scale correct and clearly accurate
Plotting graph	Graph not plotted	Graph plotted but with obvious major errors	Graph plotted correctly but lacking accuracy	Graph correctly plotted with clear accuracy
Labelling graph	Labels not present	One of three labels present	Two of three labels present	x-axis, y-axis and heading labels present
Appearance of graph	Graph not done or recognisable as such	Graph poor but recognisable	Graph adequate but lacking neatness and/or clarity	Graph excellent, neat and clear



- Add up marks to get a total out of 15 for each graph and record this mark for each individual learner.

ACTIVITY 2: What makes planet Earth suitable for life?

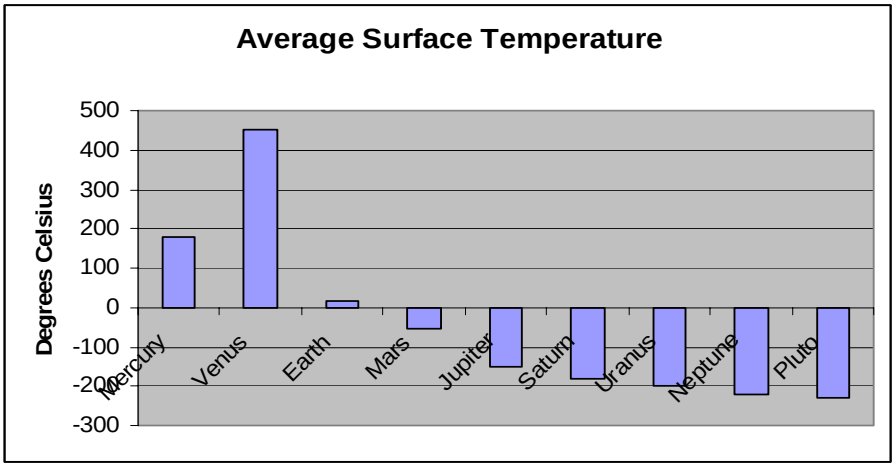
Time: **30 minutes class work** **Marks: 10**
20 minutes homework

Overview

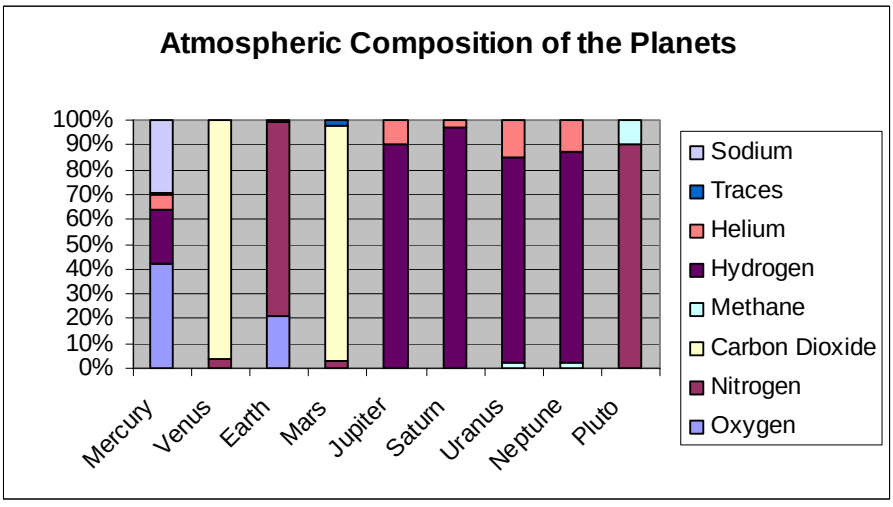
During this activity the learners need to brainstorm in a group in order to identify what makes planet Earth suitable for life and each learner must produce a thinking map of ideas.

Activity

Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
180	450	15	-55	-150	-180	-200	-220	-230



	Oxygen	Nitrogen	Carbon Dioxide	Methane	Hydrogen	Helium	Traces	Sodium
Mercury	42	0	0	0	22	6	1	29
Venus	0	4	96	0	0	0	0	0
Earth	21	78	0	0	0	0	1	0
Mars		3	95	0	0	0	2	0
Jupiter	0	0	0	0	90	10	0	0
Saturn	0	0	0	0	96	3	0	0
Uranus	0	0	0	2	83	15	0	0
Neptune	0	0	0	2	85	13	0	0
Pluto	0	90	0	10	0	0	0	0



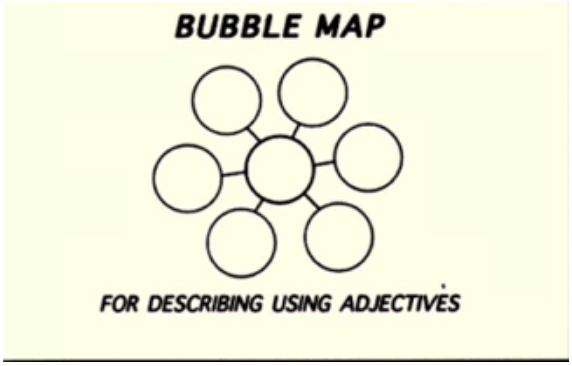
- Remind the learners of what they know about Earth from activity 1, i.e. its distance from the Sun, etc. Initiate a discussion about: 'What makes planet Earth suitable for life?' Use the Average Surface Temperature and Atmospheric Composition information (make an overhead transparency if you wish) to compare Earth's environment to the other planets.
  Discuss the following points with the class.

  Earth's Sun is the right kind (size) of star – big enough to radiate lots of energy, not too small to burn out.
  Earth is the right distance from the Sun to maintain a suitable temperature – far enough to avoid burning up, close enough not to be completely frozen.
  Earth is the right kind of planet – Earth's molten interior creates the magnetic field which shields us from cosmic radiation; it also created outgassing which provided the atmosphere and it provides plate tectonics which makes the Earth's surface uneven preventing it from all being underwater.
  Earth's Moon acts as a twin planet stabilising the Earth so that it spins at the right speed and angle
  Earth has the right chemistry – it is made of the right chemical elements in the right proportions. It has water; it has oxygen; it has carbon.

  Working in their groups, the learners brainstorm the answer to the question: **What makes planet Earth suitable for life?** They must include as many relevant ideas as they can, as a written group answer. Each learner must make his/her own copy of the group list.

  You need to explain to the class that they can use a thinking map to show what they have learnt. Thinking Maps were developed as a language for learning by Dr. David Hyerle, author of Visual Tools and Field Guide to Using Visual Tools. Visual tools (Thinking Maps) help learners to transform information into knowledge. There are eight Thinking Maps, based on fundamental cognitive skills: circle, bubble, double bubble, flow, multi-flow, tree, race, and bridge. These maps represent the thinking processes like defining in context, describing, comparing and contrasting, sequencing, causes and effects, classifying, analyzing parts to whole, and seeing analogies. Refer to http://www.thinkingmaps.com/htthinkmapx.php3

  The appropriate Thinking Map to use in this task is the Bubble Map – used for 'describing' activities. Explain that a Bubble Map has a central 'bubble' in which the main idea (in this case, question) is written and the descriptions with adjectives are included in connected 'bubbles' around it.



Each learner must use his/her copy of the group's list to produce his/her own Thinking Map that answers the question: 'What makes planet Earth suitable for life?'

Time Management

Allocate 15 minutes for class discussion of 'What makes planet Earth suitable for life'.
Allocate 10 minutes for groups to compile a group list of ideas and an individual copy for creating their thinking map.
Allocate 5 minutes for explaining the Thinking Map. Learners must complete an individual Thinking map from the group used for homework.

Assessment

- Guide the learners to mark their own Thinking Map according to the following rubric:

	0 marks	1 mark	2 marks
Extent of ideas	No ideas presented.	Less than 5 ideas presented.	More than 5 ideas presented
Relevance of ideas	No ideas presented.	Some irrelevant ideas included.	No irrelevant ideas included.
Structure of thinking map	No thinking map presented.	Structure is unclear – no 'bubbles' evident.	Structure is clear – 'bubbles' are clearly evident.
Use of space	No thinking map presented.	Space has not been effectively used.	All available space has been effectively and creatively used.
Appearance of thinking map	No thinking map presented.	Thinking map lacks neatness and/or visual appeal.	Thinking map is neat and visually appealing.

- Record a mark out of 10 for each learner.

TASK 2

ACTIVITY 3: How can we represent the chemistry of life on planet Earth?		
Time:	**50 minutes class work**	**Marks: 20**

Overview

During this activity the learners will look at the special chemistry of life on Earth. You will revise chemical formulae, microscopic view chemical diagrams, chemical reaction equations and balancing chemical equations using oxygen, water and carbon compounds as examples.

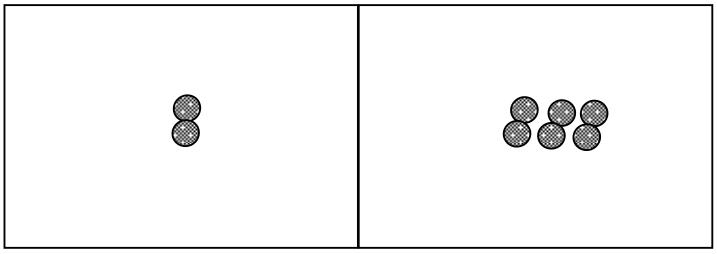
Activity

- Read through "Three Substances Important to Sustain Life" in the Learner's Book and discuss with the learners.

- Explain how we have two ways of looking at matter in chemistry: macroscopically and microscopically. When we look at matter macroscopically, we look at what we see with our own eyes: its shape, colour, state, etc. When we look at it microscopically, we imagine that we can see the particles that make it up.

- Draw the following on the overhead projector or board and explain carefully the differences between each diagram.

Example 1 This is how one oxygen molecule can be represented:	Example 2: This is how three oxygen molecules can be represented:



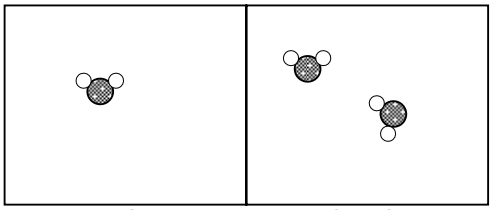
- Explain how the phase of the substance is represented microscopically. Explain how from these microscopic diagrams, we can write a chemical formula for what is represented:

Example 1:	Example 2:
O_2	$3O_2$

Revise how both the diagrammatic representation and the chemical formula allow us to deduce the number of atoms of each type making up the molecule in these examples.

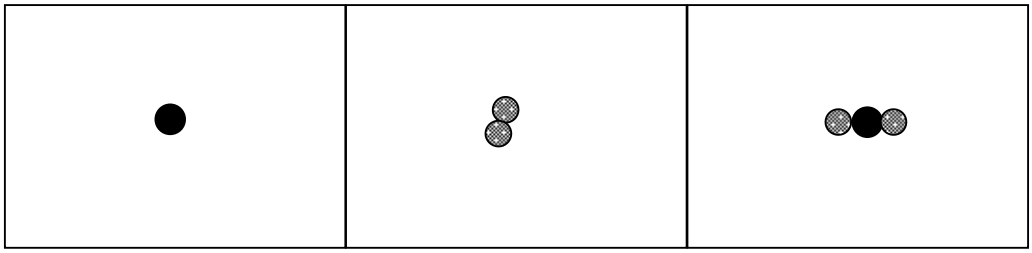
- Ask the learners to complete examples 4 and 5 in the Learner Manual on their own.
- Go through examples 4 and 5 on the overhead projector or board and discuss.

Exemplar Response

	Example 3 One water molecule	Example 4: Two water molecules
		
Formula:	H_2O	$2H_2O$

- Explain how the phase is represented in this case.
- Discuss that substances undergo chemical changes. These chemical changes or reactions are responsible for life processes. We can use chemical formulae to represent these chemical reactions.
- Go through "Representing chemical reactions using equations" in the Learner's Book revising microscopic view diagrams and balancing chemical equations using diagrams.

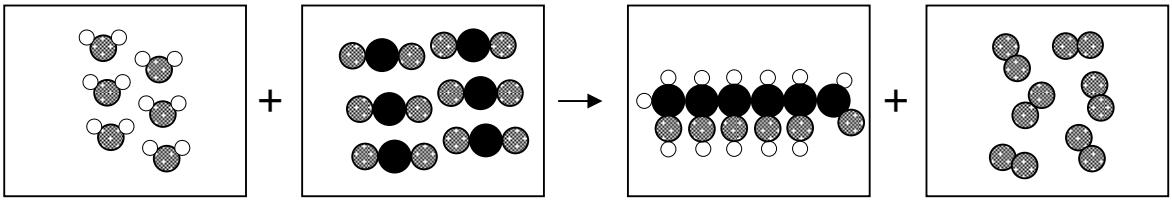
Microscopic diagrams to represent carbon burning to form carbon dioxide



- Discuss the process of photosynthesis. Energy from the Sun is harnessed by the chlorophyll pigment in green leaves of plants and is used to convert carbon dioxide from the air and water from the soil into carbohydrates like glucose.
  Derive the reaction equation:

$$H_2O + CO_2 \xrightarrow{\text{sunlight}} C_6H_{12}O_6 + O_2$$

Discuss which are the reactants (carbon dioxide and water) and which are the products (glucose and oxygen). Draw microscopic view diagrams as shown below and discuss conservation of mass (that the number of each kind of atom present in the reactant molecules is the same as the number of each kind of atom present in the product molecules). Balance the number of atoms by adding molecules to the diagram.



Discuss respiration as the reverse reaction when we use up carbohydrates in our bodies. We use the oxygen that we breathe in from the atmosphere to break down our food like glucose to form carbon dioxide and water. This carbon dioxide we breathe out into the atmosphere. Other chemical reactions also produce carbon dioxide. For example, when we burn fuels like petrol, gas, oil and wood, we produce carbon dioxide which builds up in the atmosphere.

- Learners must complete 3.1 and 3.2 for assessment.

Time Management

Allocate 20 minutes to explain the chemistry.
Allocate 20 minutes to complete the exercise individually in class.
Allocate 10 minutes to self assessment in class.

Assessment

Ask each learner to score their own homework.

Exemplar Response

3.1 a) O_2 ✓

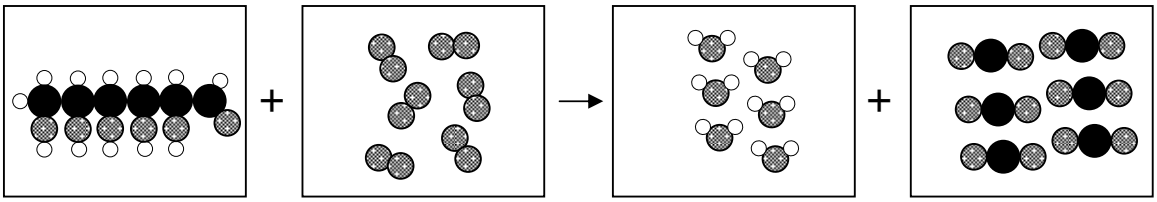
b) CO_2 ✓ (order not important i.e. O_2C is considered correct)

c) C_2H_4 ✓ (order not important i.e. H_4C_2 is considered correct)

d) CH_4O ✓ (order not important i.e. COH_4 or H_4CO or H_4OC or OCH_4 or OH_4C are considered correct)

e) $3CH_4$ ✓✓ (order not important i.e. $3H_4C$ is considered correct)

3.2 a)



✓particle structure ✓particle number ✓particle structure ✓particle number ✓particle structure ✓particle number

b) $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2$

✓formula ✓formula ✓formula ✓formula
✓✓ balancing

Go through the Exemplar Response and tell learners how to allocate marks.
Collect the marks, out of 20, for each learner.

ACTIVITY 4: What responsibilities do humans have for life on Earth?

Time: 20 minutes class work **Marks: 10**
10 minutes homework

Overview

During this activity, the learners will prepare for Activity 5 which involves testing a condition for life on a living organism. The learners will discuss and debate the responsibilities that we as humans have to other life forms on Earth.

Activity

- In activity 5 the learner will need to design an experiment to test a condition for life. They will need to use a living organism in their test and in the process of experimenting, their living organism may die. They must think about how they feel about experimenting on living organisms as experimenting on living organisms, particularly animals, is common in scientific research.
- Read through the scenario from the website onlineethics.org with the learners.
- Ask the learners to discuss in their group their feelings about this. What should John do?
- Learners must copy and complete the checklists in 4.1 on their own by ticking the appropriate block and answer 4.2 by writing a paragraph expressing their personal views.

Time Management

Allocate 10 minutes to introduce the activity and read through the scenario.
Allocate 10 minutes to complete the checklists and discuss their feelings in their group.
Allocate 10 minutes homework time to write the paragraph for 4.2.

Assessment

Mark each learner's response in 4.2 according to:

Making an ethical choice:
Allocate 1 mark for making a choice in 4.2 a)

Justifying an ethical choice:
Allocate as follows for 4.2 b)

0 marks	1 – 3 marks	4 – 6 marks	7 – 9 marks
No justification is made at all.	Little detail is presented in paragraph. View is confused. Justification is attempted but lacks clarity and sense.	Basic detail is presented in paragraph. A simple view is described. Simple justification is made but lacking conviction OR	Paragraph contains details of view and justification. A clear and well-conceived view is described.

		emotional response but lacking ability to successfully back up choice.	A carefully thought out justification is made with clarity, conviction and passion.

Collect a mark out of 10 for each learner.

ACTIVITY 5: How can we test a condition necessary for life?

Time: 40 minutes class work **Marks: 15**
30 minutes homework

Overview

During this activity, the learners will choose a testable condition for life (like air, water, light or food). They will look at what is needed to design a fair test and then design such a test for their chosen condition for life.

Activity

To prepare, put the Exercise on page 18 which follows, up on the overhead projector and discuss with the class.

Memo for Exercise – Fair Tests

1. No.
They do not start from the same point.

2. No.
Duncan is not holding his dart at the same height above the wood as the other two boys. Ian's dart is much bigger than the darts of the other two boys. In order to be a fair test, all variables but the one being tested must be controlled or kept the same. The same darts must be used, they must be held at the same height and dropped in the same way. Only the type of wood should be varied (the thickness, size and shape of the wood samples must be the same too.)

3. a) Amount of powder
Amount of water
Vessel containing the water
Temperature of water
Stirring procedure

b) The type of powder

c) The time taken for the powder to dissolve

Learners need to meet in their groups. Instruct each group to choose one condition to test as a condition for life. They must discuss in their group how they would design an experiment, a fair test, to test this condition.

Learners must present an individual report guided by the checklist provided in their Learner's Book. They must each copy and complete a checklist for their report and hand this in with their report.

Time Management

Allocate 20 minutes to discuss fair tests and do the exercise on page 18 as a class activity.
Allocate 20 minutes to discuss their experiment in their group and start their report.
Allocate 30 minutes homework time to complete the report and checklist.

Assessment

Mark each learner's report according to the following rubric:

	0 mark	1 mark	2 marks	3 marks
Forming a hypothesis	Not done	Hypothesis is unclear and/or senseless	Hypothesis is clear but obvious, lacking detail	Hypothesis is clear, detailed and with insight
Designing a fair test	Not done	Designed test is not fair – major error evident	Designed test is fair but minor errors evident	Designed tes is fair – no errors evident.
Identifying variables	Not done	Only one variable correctly identified	[Not applicable]	Both independent and dependant variables are correctly identified
Controlling variables	Not done	One control variable identified	Two control variables identified	Three contro variables identified
Choosing measurement method	Not done	Measurement method is inappropriate or incorrect	Measurement method is appropriate but too simply described	Measuremen method is appropriate and described in detail

Exemplar Response

An example:

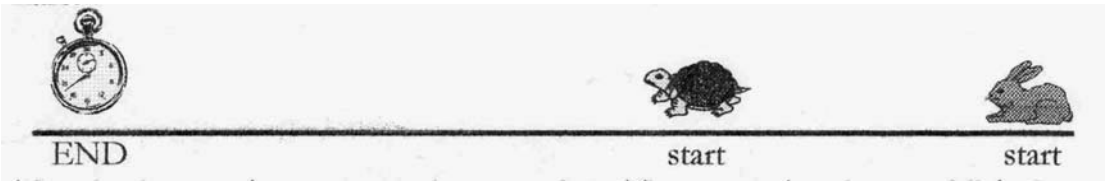
	Testing necessity of WATER for life
Condition for life:	water
Living organism:	pot plant
Investigative question:	Can a pot plant live without water?
Hypothesis:	A pot plant requires water in order to live. Without water the pot plant will die.
Method:	Take 6 identical pot plants and water two of them once a day with 200ml; two of them once a week with 200ml and two of them not at all.
What to measure:	the mass of the pot plant
How to measure:	using a balance scale
Independent variable:	the amount of water provided per month

Dependent variable:	the mass of the pot plant
Controlled variables:	Starting mass of plant, pot and soil Type, size and condition of plant Type, size and condition of pot Type, amount and condition of soil

Collect the marks, total out of 15, for each learner.

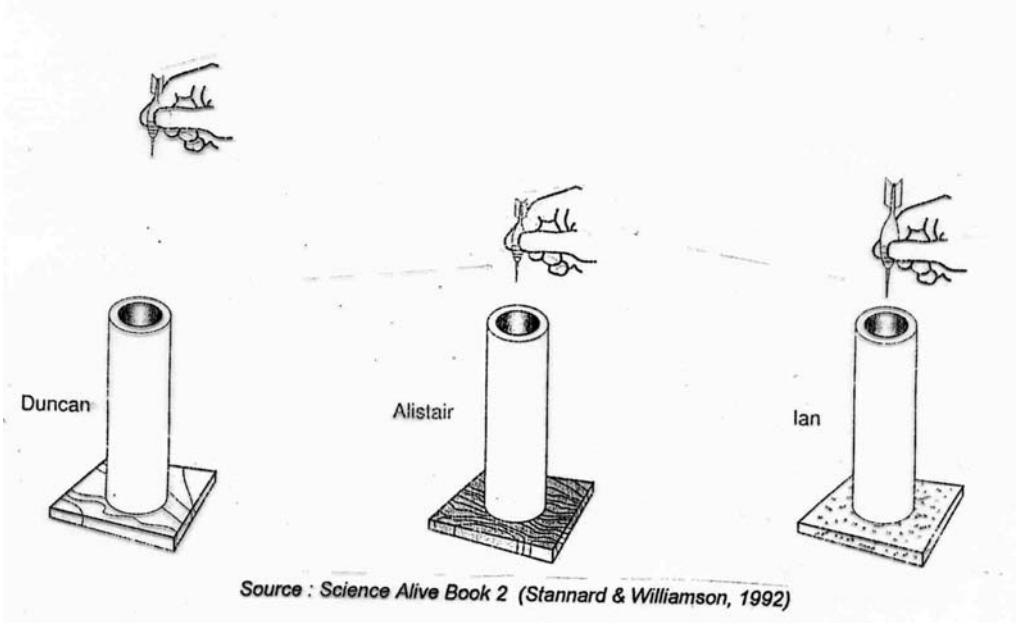
EXERCISE – Fair Tests

1. A race was organised to see once and for all, who is faster: the tortoise or the hare?



They both started to move at the same time. They were timed to establish the winner. Is this a fair test? If not, why not?

2. Duncan, Alistair and Ian are comparing the hardness of three different types of wood, as shown below.



Is this a fair test? If not, explain how the test could be improved.

3. You have three different powders. You want to find out which one dissolves most rapidly in water.

a) What things would you need to keep the same in your test?
b) What will you purposely change?
c) What will you measure?

TASK 3

ACTIVITY 6: What threatens life on Earth and what threats do you personally pose?		
Time:	**40 minutes class work** **10 minutes homework**	**Marks: 15**

Overview

Before this activity the learners will need to find out some details of their home energy consumption. During this activity, you will discuss what threatens life on Earth. The learners will look at the way in which their activities threaten planet Earth's ability to sustain life by working out their carbon footprint.

Activity

- You will introduce a class discussion of the threats to Earth's ability to sustain life. Collect these ideas on the board or overhead projector.

  Some ideas:

  - Asteroid strike – could change Earth's position relative to the Sun (Refer to the films: *Armageddon* starring Bruce Willis and *Deep Impact* starring Robert Duvall)
  - Changes in the Earth's molten core – could change the magnetic field, atmosphere and surface (Refer to the film: *The Core* starring Aaron Eckhart)
  - Climate change – global warming caused by a build up of carbon dioxide in the atmosphere or cooling down caused by a massive nuclear explosion
  - Extreme pollution – could change the chemical composition of the Earth's surface, water and atmosphere and damage the ozone layer

- Ask the learners which of these threats their activities actually contribute to.

- Explain that the impact that we have on the planet is called our 'ecological footprint'. A big impact causing lots of damage is referred to as a 'heavy footprint', while a small impact causing little damage is referred to as a 'light footprint'. Ask: What sort of footprint do we (South African scholars) have?

- An ecological footprint can be divided into various categories such as 'energy' and 'carbon'. Explain that the learners are going to measure their own carbon footprint – the impact that they are having on the atmosphere by adding CO_2 to it, through their activities. The amount of CO_2 in the atmosphere is a direct cause of global warming.

- The learners need to find out the following information from home:

  How many members are in their household?

  How many cars are in their household?

  How many litres of fuel are used in each car per month?

What type of fuel does each car use (diesel or petrol)?

How many kilowatts of electricity are used in their home per month?

How much of other household fuels are used per month, e.g. paraffin, candle wax, propane, liquid gas, kerosene or coal?

- Explain how the learners can use the following steps in their Learner's Book to calculate their carbon footprint:

Exemplar Response

For example:

A.

Motor vehicle 1:

number of litres of fuel used per month = 50L

number of litres of fuel x Emission Factor of the fuel

= number of kilograms of CO_2 emitted per month

No. of litres fuel	Emission Factor	No. of kilograms CO_2
50 L	~~x 2,68 (diesel)~~	117,5
	x 2,35 (petrol)	

B.

Motor vehicle 2:

number of litres of fuel used per month = 40L

number of litres of fuel x Emission Factor of the fuel

= number of kilograms of CO_2 emitted per month

No. of litres fuel	Emission Factor	No. of kilograms CO_2
40 L	x 2,68 (diesel)	107,2
	~~x 2,35 (petrol)~~	

C.

Household Electricity Consumption:

number of kilowatt hours consumed per month x Emission Factor for South Africa = number of kilograms of CO_2 emitted per month

No. of kwh	Emission Factor	No. of kilograms CO_2
980	x 0,44	431,2

D.

Other Household Fuel Consumptions:

Fuel	Monthly Consumption	Emission Factor	No. of kilograms CO_2
Paraffin	Litres	x 2.7	
Candle Wax	kilograms	x 3,1	
Propane	Litres	x 1,52	
Liquid gas	Litres	x 1,535	
Kerosene	Litres	x 2,58	
Coal	kilograms	x 2,465	

To work out the carbon footprint, add the number of kilograms of carbon dioxide produced by the household each month, i.e. motor vehicle 1 + motor vehicle 2 + household electricity + other household fuels.

117,5 + 107,2 + 431,2 = 655,9 kg

Divide the total by the number of people (consumers) in the household or family.

655,9 ÷ 3 = 218,6 kg!

This answer is the number of kilograms of carbon dioxide that you are responsible for pumping into the atmosphere each month.

NOTE: The carbon dioxide footprint for individuals is based on two areas of energy use that make up the majority of most individuals' carbon dioxide emissions. Actually the website, Greater Good SA recommends that each household should add 750kg of CO_2 per month to their carbon footprint to account for the manufactured goods that we buy and use. The following calculations are based on data available at the website of the **GHG Protocol Initiative**. The emissions factors come from **Energy Information Administration**, Fuel and Energy Source Codes and Emissions Coefficients.

- Instruct the learners to get together in their groups to compare their carbon footprints and then individually answer the questions.

- Instruct the learners to mark their responses in their groups.

Time Management

Learners must collect the necessary information from home as preparation for this activity.
Allocate 10 minutes to discussing threats to planet Earth.
Allocate 10 minutes to calculating their carbon footprint.
Allocate 10 minutes to comparing results in their groups and answering questions.

Allocate 10 minutes to marking their answers in the group.

Assessment

Learners must swap Carbon footprint calculations with another in their group to mark.

Guide them through the following mark allocation:
Final calculated carbon footprint in kg of carbon dioxide: 2 marks
Correct calculation of transport carbon footprint: 2 marks OR
Correct calculation of paraffin use 2 marks
Correct calculation of electrical carbon footprint: 2 marks OR
Correct calculation of candle wax use 2 marks
Correct addition: 2 marks
Correct division: 2 marks
(Total 10 marks)
Learner must mark their own answers with the consensus of the group for 6.1. out of 5 marks.
Collect the marks, out of 15 for each learner.

ACTIVITY 7: What can our country do to safeguard planet Earth?

Time: 20 minutes class work **Marks: 20**
30 minutes homework

Overview

During this activity the learners will consider some ideas that could be implemented by our government and the impact these could have on the people and environment of South Africa.

Activity

- Describe the activity to the learners: imagine that our South African Department of Energy Affairs proposes the following plans to save our planet by reducing our national carbon footprint:

  Plan 1: Install a solar panel system to generate 10% of our electricity
  Plan 2: Increase the price of electricity to curb consumption
  Plan 3: Place a levy on the price of motor vehicles with high fuel consumption
  Plan 4: Put a daily limit on the numbers of cars travelling into major cities

- Instruct the learners to discuss in their groups whether implementing each plan would be more positive or more negative for people; and whether implementing each plan would be more positive or more negative for the environment. In order to do this, they must identify the possible positive and negative impacts on people and on the environment that each plan could have. They must then copy the table and complete it by writing in the positive and negative impacts and then ticking whether they think the plan would be more positive or negative for the people and the environment. This must be done on their own for homework.

Time Management

Allocate 5 minutes to introducing the activity.
Allocate 15 minutes to group discussion.
Allocate 30 minutes homework to completing the table.

Assessment

Collect and mark according to Exemplar Response.

Exemplar Response

Plan	Positive Impact on People	Negative Impact on People	Positive Impact on Environment	Negative Impact on Environment
Plan 1	Less air pollution Sense of responsibility to the health of the planet Few operating costs after installation (1 mark)	System may be less reliable Costly to install (1 mark)	Renewable energy source No CO_2 emission No air pollution (1 mark)	May be unsightly (1 mark)
More positive? More negative?				
Plan 2	May become more responsible in controlling energy use (e.g. turning off lights when not required) (1 mark)	Return to damaging, dangerous or less reliable forms of energy: wood, paraffin; kerosene (1 mark)	Reduced energy consumption resulting in reduced harmful impact (1 mark)	Possible deforestation due to use of wood as an alternative (1 mark)
More positive? More negative?				
Plan 3	Will drive more cost efficient 'nippy' vehicles (e.g. 'smartcar') (1 mark)	Unable to afford big 4X4 vehicles (1 mark)	Less CO_2 emission Less air pollution Less road damage (1 mark)	None (1 mark)
More positive? More negative?				
Plan 4	Less traffic congestion and fewer road accidents Travelling will become more sociable as sharing is encouraged (1 mark)	Freedom of choice of movement will be restricted at certain peak times (1 mark)	Less CO_2 emission Less air pollution (1 mark)	None (1 mark)
More positive? More negative?				

Allocate a ½ mark per choice made i.e. 1 mark per plan for a commitment to the overall impact on people and the overall impact on the environment.

Collect a mark out of 20 for each learner.

ACTIVITY 8: What can YOU do to safeguard planet Earth?

Time: 80 minutes class work Marks: 15

Overview

During this activity the learners will identify what they and their peers can do to safeguard the planet by reducing their own personal carbon footprints. They will design and create a poster to share these ideas with their peers.

Activity

- Organise the learners in their groups to make a list of all the things that they and their peers can do in their own environment to reduce their personal carbon footprints. Instruct them to organise their list into related categories. They must plan and create a poster to educate the other groups as to the difference that they can make. Everyone in the group must contribute to the poster.

  Some ideas:
  Transport:

  - walk or cycle whenever possible
  - use car pools (lift clubs)
  - use mass transit (like buses)
  - choose a small efficient vehicle
  - properly operate and maintain your car
  - drive smarter
  - encourage people to work from home

  Around the house:

  - properly operate and maintain your electrical appliances
  - conserve hot water
  - buy energy efficient appliances
  - install energy efficient lamps
  - use solar panels for heating water
  - use exterior paint colours and shade to improve your temperature control
  - choose a small house
  - reduce consumption
  - reduce waste
  - recycle waste

  Socially:

  - encourage others to reduce emissions
  - urge your parents to consider the impact of their investments
  - encourage others to keep their families small
  - take political action

Time Management

Allocate 5 minutes to introducing the activity.
Allocate 15 minutes to discuss and work in groups.
Allocate 40 minutes for poster to be completed– all members must contribute.
Allocate 20 minutes to assess posters and finalise individual marks.

Assessment

- Guide the class to assess each group's poster by class consensus, allocating marks according to the rubric:

	0 marks	1 mark	2 marks	3 marks
Number of ideas	No ideas presented	1 – 2 ideas presented	3 – 4 ideas presented	5 – 6 ideas presented
Value of ideas	No ideas presented	Ideas are inappropriate and/or irrelevant	Ideas are appropriate and relevant but a key idea is missing	Ideas are appropriate and relevant and all key ideas are included
Organisation of ideas	No ideas presented	Organisation is unclear and confusing	Organisation is clear but too simple	Organisation is clear, detailed and interesting
Innovation of design	No poster created	Little innovation of design is evident	Some innovation of design is evident	Design is innovative and inspiring
Visual impact	No poster created	Poster is dull and lacks visual impact	Poster is visually pleasing but not eye-catching	Poster is visually exciting and eye-catching

- Add up marks to get a total out of 15 for each group's poster.
- Present this mark to the group of learners. They must multiply this mark by the number of learners in the group and then re-allocate those marks to individuals to reflect the contribution to the group.
- After they have negotiated their individual marks within the group, record each mark for each learner.