

Candidate Name \_\_\_\_\_

Centre Number	Candidate Number

**MINISTRY OF EDUCATION, BOTSWANA**  
in collaboration with  
**UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE**  
**Botswana General Certificate of Secondary Education**  
**SCIENCE : DOUBLE AWARD**  
**PAPER 3**

**0569/3**

**OCTOBER/NOVEMBER SESSION 2002**

2 hours

Candidates answer on the question paper  
Additional materials:  
Electronic calculator  
300 mm ruler

**TIME** 2 hours

**INSTRUCTIONS TO CANDIDATES**

Write your name, Centre number and candidate number in the spaces at the top of this page

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
1	
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16	
TOTAL	

This question paper consists of 15 printed pages and 1 blank page.

- 1 Fig. 1.1 shows a man of mass 60 kg climbing up a tree to a height of 6 m to escape a lion.

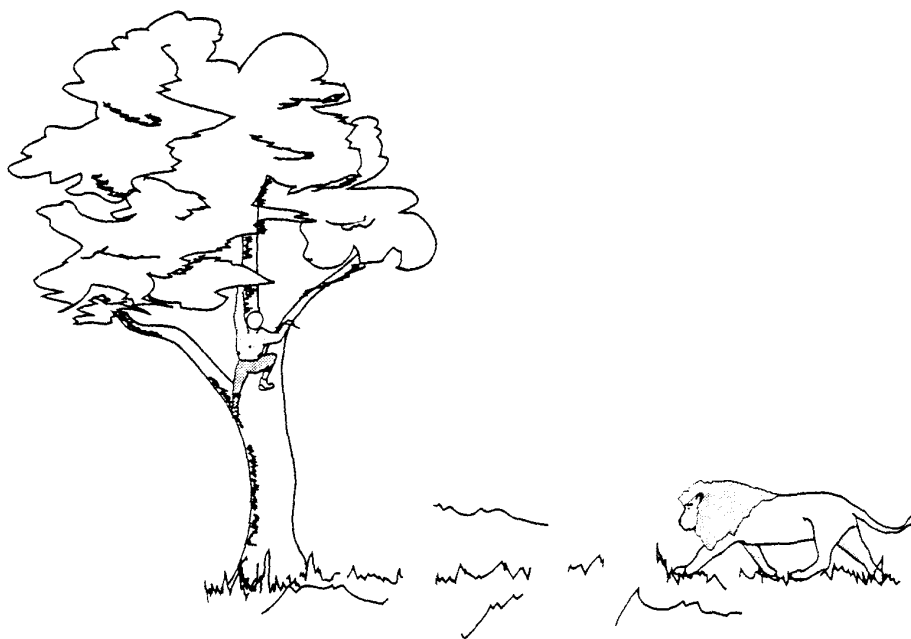


Fig. 1.1

- (a) What form of energy does he gain as he goes up the tree?

.....[1]

- (b) Calculate the work done by the man in climbing the tree (take  $g = 10 \text{ N/kg}$ ).

work done = ..... [2]

- (c) If he reaches the top of the tree in 10 s, what power does he develop?

power = ..... [2]

- 2 Tshepo and Kagiso stand in front of a high vertical cliff 640 m away to measure the speed of sound in air. When Tshepo hits a drum Kagiso starts a stopwatch. She stops the watch when she hears the echo. The time measured by Kagiso is 4 s.

(a) Calculate the speed of sound in air.

speed of sound = ..... [2]

(b) How will the pitch of the original sound compare with that of the echo?

.....  
..... [1]

(c) Explain why the original sound is louder than the echo.

.....  
..... [1]

- 3 Fig. 3.1 shows two rays of light reflected from a pebble at the bottom of a pool.

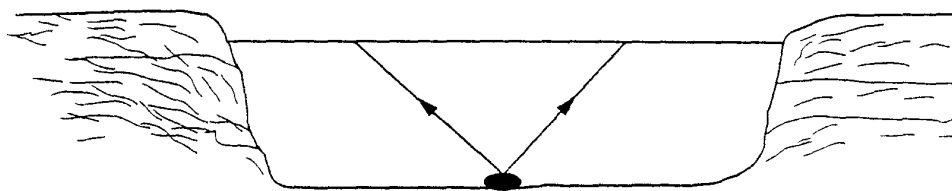


Fig. 3.1

- (a) On the diagram;
- (i) continue the paths of the two rays when they emerge from the water surface. [2]
  - (ii) use the refracted rays to show the position of the image of the pebble; label the image I. [2]
- (b) The real depth of the pool is 1.5 m and the image appears to be 1.1 m beneath the water surface.

Calculate the refractive index of the water.

refractive index = ..... [2]

- 4 Fig. 4.1 shows the direction in which a compass needle points when it is placed on a wooden table.



Fig. 4.1

Two plotting compasses are then placed near a metal bar, AB and the compass needles point as shown in Fig. 4.2.

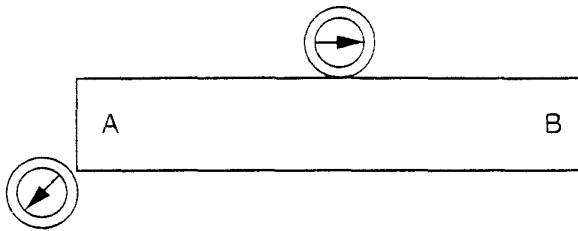
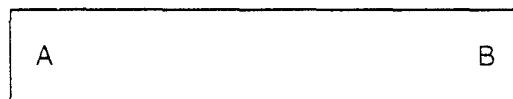


Fig. 4.2

- (a) How do the plotting compasses show that bar AB is a magnet?

.....  
 .....[1]

- (b) Draw the magnetic field around metal bar AB.



[2]

- (c) Describe an electrical method of demagnetising a magnet.

.....  
 .....[2]

- 5 Two neutral metal spheres, A and B are mounted on insulating stands as shown in Fig. 5.1.

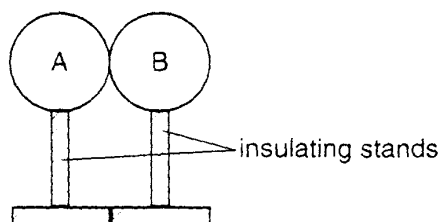


Fig. 5.1

Describe and illustrate how a negatively charged rod may be used to charge the spheres by induction so that A is negatively charged and B is positively charged.

.....

.....

.....

.....[4]

- 6 (a) Fig. 6.1 shows an electric heater.

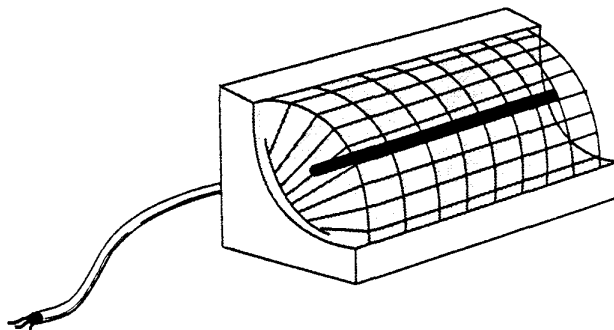


Fig. 6.1

- (a) Name the three wires in the cord of the heater and state the colour of each wire.

Name	Colour
1. ....	.....
2. ....	.....
3. ....	.....[3]

- (b) Which **two** wires are connected to the heating element of the heater?

.....[1]

- (c) What is the function of the third wire?

.....  
.....[2]

- (d) The heater is rated at 250 V, 1000 W.

- (i) Calculate the normal operating current of the heater.

current = ..... [2]

- (ii) From the list of fuses below, choose by a tick the lowest fuse rating suitable to be used to protect the heater.

1 A, 2 A, 10 A, 15 A. [1]

- 7 (a) Use dot and cross diagrams to draw the electronic structures of

(i) methane

[2]

(ii) calcium chloride

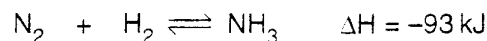
[3]

- (b) Give two properties of ionic compounds.

1. ....

2. .... [2]

- 8 The equation shows the reaction between hydrogen and nitrogen to produce ammonia.



- (a) Balance the chemical equation. [1]

- (b) The reaction is exothermic. Explain what this means in terms of bond breaking and bond formation.

.....

.....

..... [3]

- (c) (i) What volume of nitrogen is needed to react completely with  $24 \text{ dm}^3$  of hydrogen at room temperature and pressure? (1 mole of a gas occupies  $24 \text{ dm}^3$  at r.t.p.)

volume = ..... [2]

- (ii) Calculate the volume of ammonia produced, assuming 10% conversion.

volume = ..... [3]

- (d) Give **one** use of ammonia.

..... [1]



- 9 Coal is a mixture of carbon, hydrocarbons and sulphur compounds. When coal is burned sulphur dioxide is produced.

(a) Name two other gaseous products formed when coal is burned.

1. ....

2. ....[2]

(b) In a coal-fired factory, sulphur dioxide can be removed before the waste gases are released into the atmosphere.

(i) Suggest a reason for removing sulphur dioxide.

.....

.....

Sulphur dioxide is removed by passing the waste gases through a mixture of water and powdered calcium carbonate.

Explain the action in this process of:

(ii) water .....

(iii) calcium carbonate .....[3]

- 10 Hydrochloric acid is a strong acid and ethanoic acid is a weak acid.

(a) What is meant by a strong acid?

.....

.....[1]

(b) What is the pH of dilute hydrochloric acid and of ethanoic acid likely to be?

(i) dilute hydrochloric acid; .....

(ii) ethanoic acid; .....[2]

11 Fig. 11.1 shows an apparatus used to obtain different fractions from crude oil.

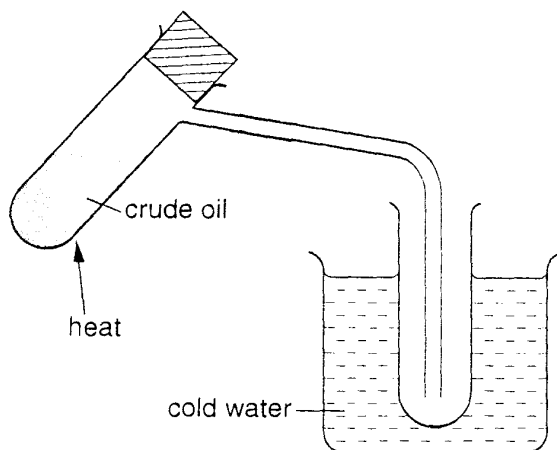


Fig. 11.1

(a) Complete the diagram by drawing a thermometer used to measure the boiling point of the fractions. [1]

(b) (i) Name the process carried out in this experiment.

.....

(ii) Name two elements that are found in compounds in the fractions of crude oil.

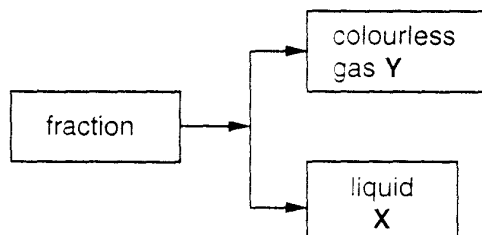
1. ....

2. ....

(iii) Name the fraction with the highest boiling point.

.....[3]

(c) The flow diagram shows the production of gas Y from one of the fractions of crude oil. Liquid X does not react with bromine water but the colourless gas Y reacts with bromine water to give a colourless solution.



(i) Name the process shown in the flow diagram.

.....

(ii) What colour is bromine water?

.....

(iii) Name the homologous series of organic compounds to which liquid **X** belongs.

.....

(iv) State **one** difference between the structures of molecules of gas **Y** and the molecules in liquid **X**.

.....[4]

12 Mpho likes serobe (tripe) and he eats it quite often. Dineo advises him to exercise every day.

(a) (i) State **one** problem Mpho is likely to face if he eats too much serobe.

.....

.....

(ii) Explain how the problem in (i) above occurs.

.....

.....

.....

.....[4]

(b) Explain how Dineo's advice is sensible.

.....

.....[2]

(c) Dineo also suggests that Mpho should eat his serobe/tripe with plenty of fresh vegetables.

Give one reason why this is good advice.

.....[1]

- 13 Fig. 13.1 shows a set up used by two students investigating the loss of water from a plant. They used a freshly cut shoot.

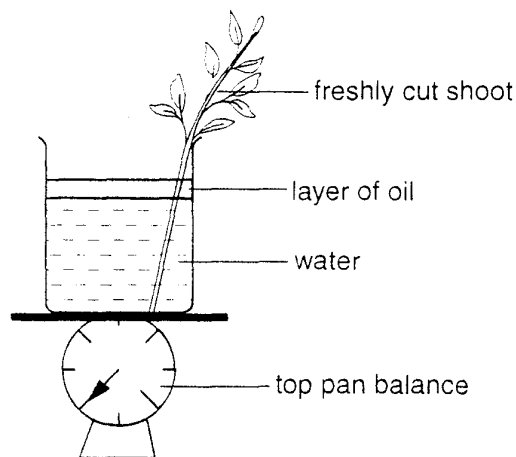


Fig. 13.1

They weighed the plant, with beaker, water and oil layer, at the end of each complete day for six days. At the start the total mass was 90 g.

day	mass of beaker + water + oil + shoot/ g
1	87.5
2	84.5
3	81.5
4	77.0
5	71.0
6	60.5

- (a) Name the process under investigation.

.....[1]

- (b) State the purpose of using oil in the experiment.

.....  
.....[1]

- (c) (i) State the day with the highest amount of water loss.

.....[1]

- (ii) Suggest the likely weather conditions of the day.

.....  
.....[2]

- (d) Explain the importance of nitrogen and magnesium to plants.

nitrogen: .....

magnesium: .....[2]

14 Fig. 14.1 shows a section through human skin.

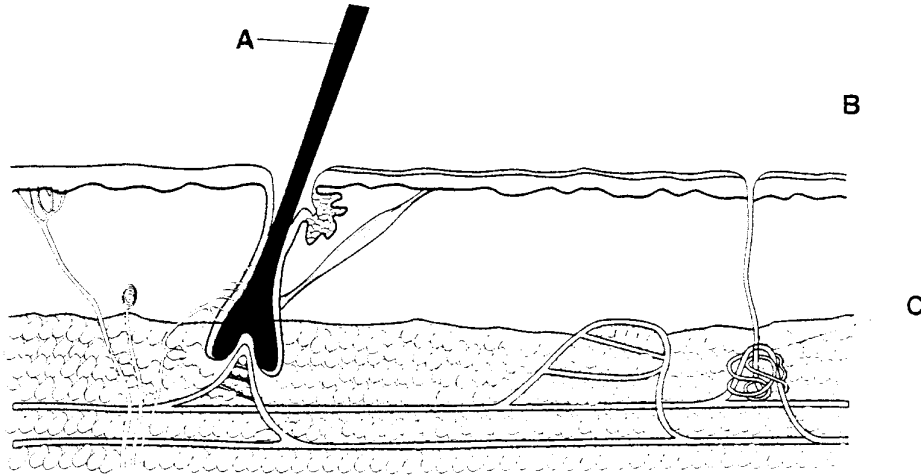


Fig. 14.1

(a) Identify structures A and B.

A. ....

B. ....[2]

(b) What causes shivering?

.....  
 .....[2]

(c) (i) When the body is overheated the arterioles in the skin dilate. Explain how this helps the body maintain a constant temperature.

.....  
 .....  
 .....  
 .....[3]

(ii) Suggest how structure C is involved in maintaining a constant body temperature during hot weather.

.....  
 .....  
 .....[2]

15 Fig. 15.1 shows parts of a flower.

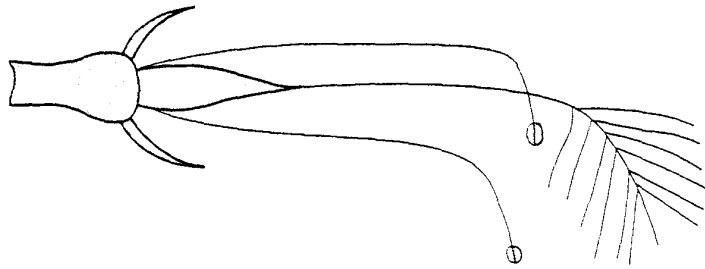


Fig. 15.1

(a) State how this flower is pollinated.

.....[1]

(b) Describe the path taken by the pollen grain nucleus from the stigma to the region where fertilisation takes place.

.....  
 .....  
 .....[3]

16 Conservation involves preserving habitats and protecting individual species of plants and animals to get maximum advantage without degrading it.

(a) What is meant by *habitat*?

.....  
 .....[1]

(b) Explain why conservation of habitats is important for

(i) medicine, .....

.....

(ii) employment. ....

.....[2]

(c) Suggest the importance of recycling paper.

.....  
 .....[1]

(d) Describe how overstocking can contribute to destruction of a local environment.

.....  
 .....  
 .....[3]