



BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE
NAME

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NUMBER

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SCIENCE : DOUBLE AWARD

0569/03

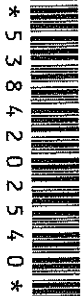
Paper 3

October/November 2015

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.



READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen.

You may use a soft pencil for any diagrams, graphs or rough working.

Do **not** use staples, paper clips, highlighters, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

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

You may use a calculator.

A copy of the Periodic Table is printed on page 20.

For Examiner's Use

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15	
Total	

This document consists of **20** printed pages.



- 1 Fig. 1.1 shows a sketch of a speed-time graph for an object falling through air.

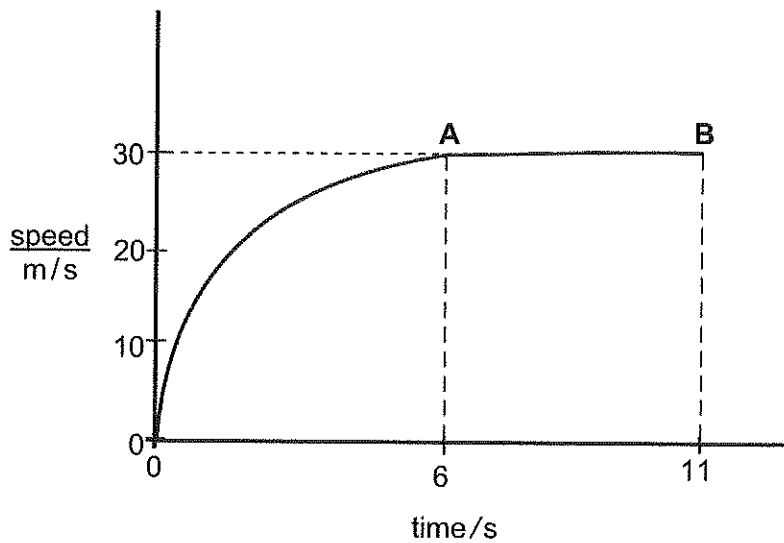


Fig. 1.1

- (a) How long did the object take to reach terminal velocity?

time taken =[1]

- (b) Calculate the distance the object falls between A and B.

distance =[2]

- (c) State whether

- the weight of the object, and
- the air resistance acting on the object,

increases, decreases or remains constant as the object falls from the start to point A.

weight[1]

air resistance[1]

2 Fig. 2.1 shows a hydroelectric power station which supplies a village with electricity.

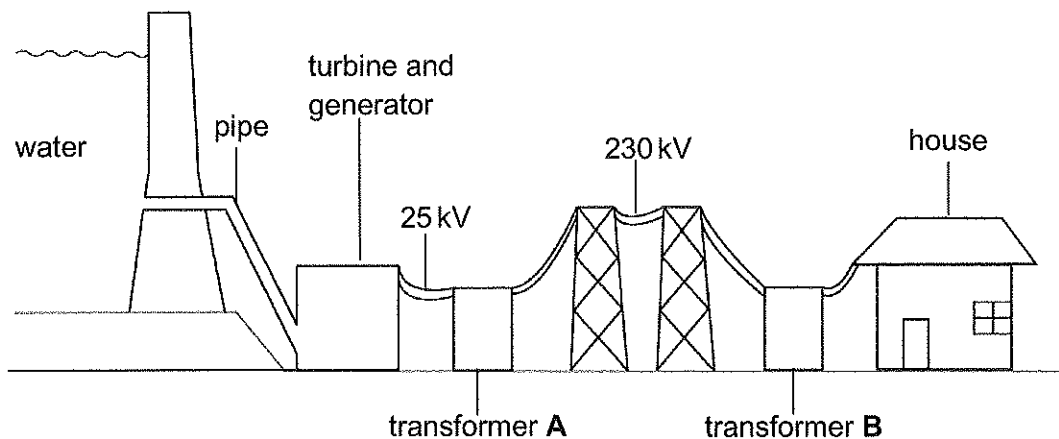


Fig. 2.1

(a) (i) Name the type of transformer labelled transformer B.

.....[1]

(ii) Explain why the electricity is transmitted at 230 kV instead of 25 kV. (1 kV = 1000 V)

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

(b) On leaving the dam, the water falls through a height of 15 m. ($g = 10 \text{ N/kg}$)

Calculate

(i) the decrease in the potential energy of 500 kg of water falling from the dam to the turbine,

decrease in potential energy =[2]

(ii) the maximum possible velocity of the water when it reaches the turbine.

velocity =[2]



(iii) Explain why the actual velocity of the water when it reaches the turbine is less than the velocity calculated in (b)(ii).

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

(c) Suggest **one** environmental impact of a hydroelectric power station.

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

3 Fig. 3.1 shows an electromagnet used to switch on a high voltage circuit.

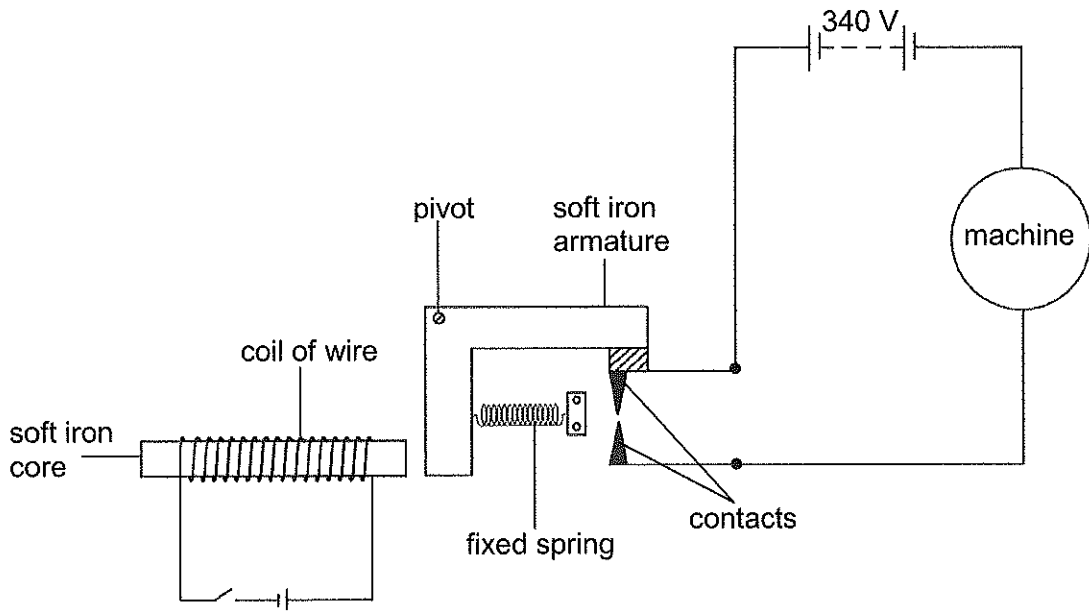


Fig. 3.1

(a) Explain why iron is used to make the core of the electromagnet.

.....
[1]

(b) Describe how the electromagnet switches the high voltage circuit on.

.....

[4]

(c) What is the purpose of the spring?

.....[1]



- 4 Fig. 4.1 shows an electric iron.

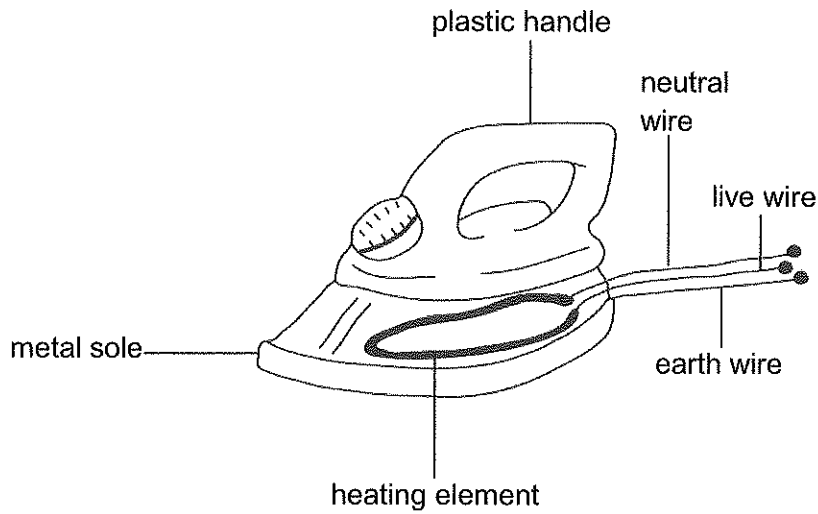


Fig. 4.1

- (a) State the energy change that takes place when the iron is connected to a socket and switched on.

..... → [1]

- (b) Explain why

- (i) the handle of the iron is made of plastic,

..... [1]

- (ii) the earth wire is connected to the metal sole.

.....
 [1]

(c) The iron transfers 3 kWh of energy when it is switched on for 2 hours.

Calculate

(i) the input power of the iron,

power =[2]

(ii) the cost of using the iron for 2 hours. The cost of electricity is P0.65 per kWh.

cost =[1]



5 Fig. 5.1 shows a simplified model of a system used to heat water.

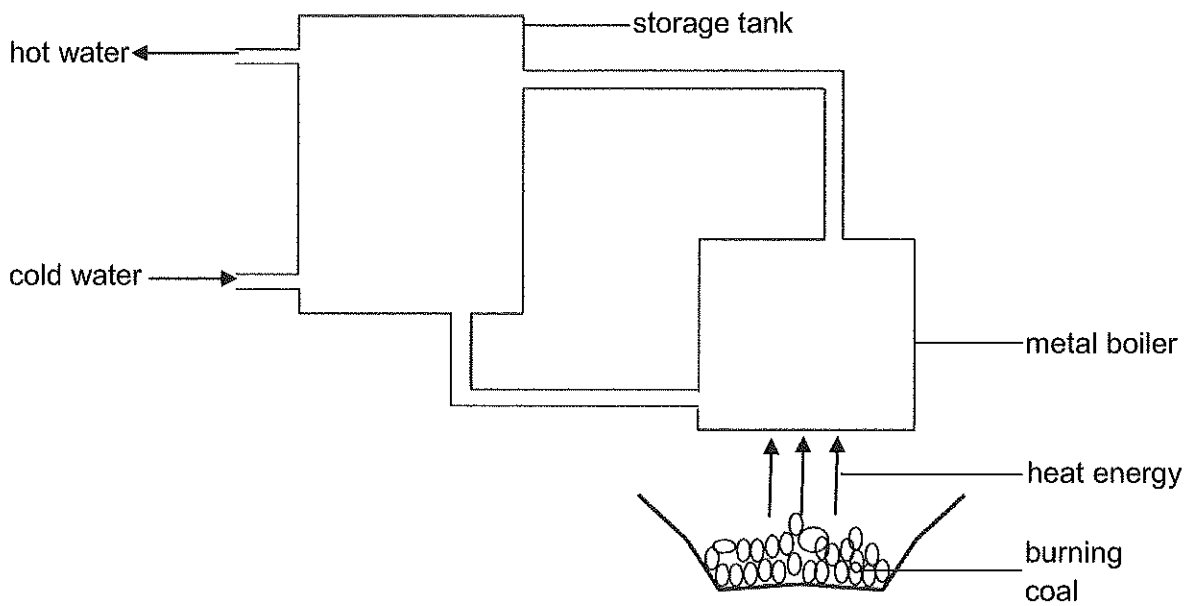


Fig. 5.1

(a) Name the process by which energy passes through the metal to heat the water inside the boiler.

.....[1]

(b) Name and describe the process by which heat energy is transferred from the boiler to the water in the storage tank.

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

(c) Suggest **one** method of reducing energy loss from the storage tank.

.....[1]

6 An experiment was performed to study the penetrating power of radioactive emissions.

Fig. 6.1 shows the set-up that was used.

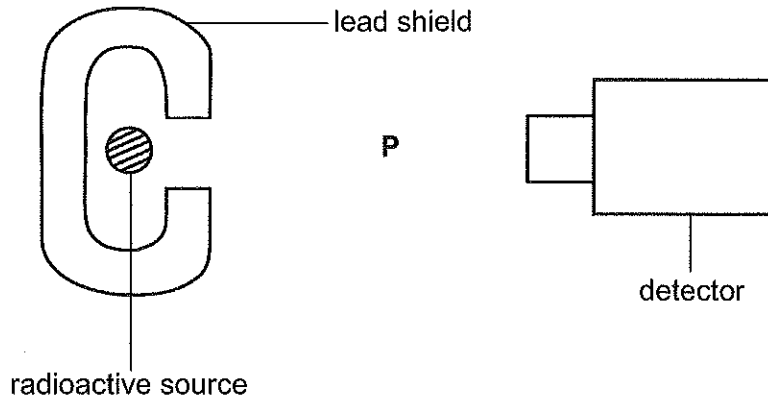


Fig. 6.1

Table 6.1 shows the results with and without a material placed at point P.

Table 6.1

material at P	count rate (counts/second)
none	150
paper	40
aluminium sheet	40

(a) There was a count rate of 10 counts/second when there was no radioactive source in the lead shield.

State what causes this count rate.

.....[1]

(b) (i) Which type of radiation from the source was detected when the count rate was 40 counts/second?

.....[1]

(ii) Which other type of radiation does the source emit?

.....[1]

(c) State one precaution that is taken when using radioactive sources.

.....[1]



7 Choose from the list a substance or substances to fit each given description.

nitrogen dioxide bromine sodium chloride vinegar
carbon monoxide sodium nitrogen hydrogen

(a) Is produced from incomplete combustion of fuels.

.....[1]

(b) Reacts with water to form an alkaline solution.

.....[1]

(c) React together to form ammonia gas.

..... and [2]

(d) Can be used to distinguish between alkanes and alkenes.

.....[1]

(e) Is used as a food preservative.

.....[1]

8 Diamond is a form of a carbon.

(a) Name another form of carbon.

.....[1]

(b) What term is used to describe these forms of carbon?

.....[1]

(c) State **one** use of any **two** forms of carbon.

1 form

use

2 form

use

[2]

- 9 21.2 g of sodium carbonate was dissolved in water and the solution was made up to 500 cm³. The equation for the reaction of sodium carbonate with dilute sulphuric acid is shown.



- (a) Calculate the relative molecular mass of sodium carbonate.

molecular mass =[1]

- (b) Calculate the number of moles in 21.2 g of sodium carbonate.

moles =[2]

- (c) Use your answer to (b) to calculate the concentration of the sodium carbonate solution.

concentration =mol/dm³ [2]

- (d) (i) Use your answer to (c) to determine the number of moles of carbon dioxide produced when excess dilute sulphuric acid is added to the 500 cm³ of sodium carbonate solution.

moles =[1]

- (ii) Use your answer to (d)(i) to calculate the volume of carbon dioxide produced measured at room temperature and pressure. (1 mole of any gas occupies 24 dm³ at r.t.p.)

volume =[2]



- (e) Draw a 'dot and cross' diagram to show the bonding in the water, H_2O , molecule. Show the outer electrons only.

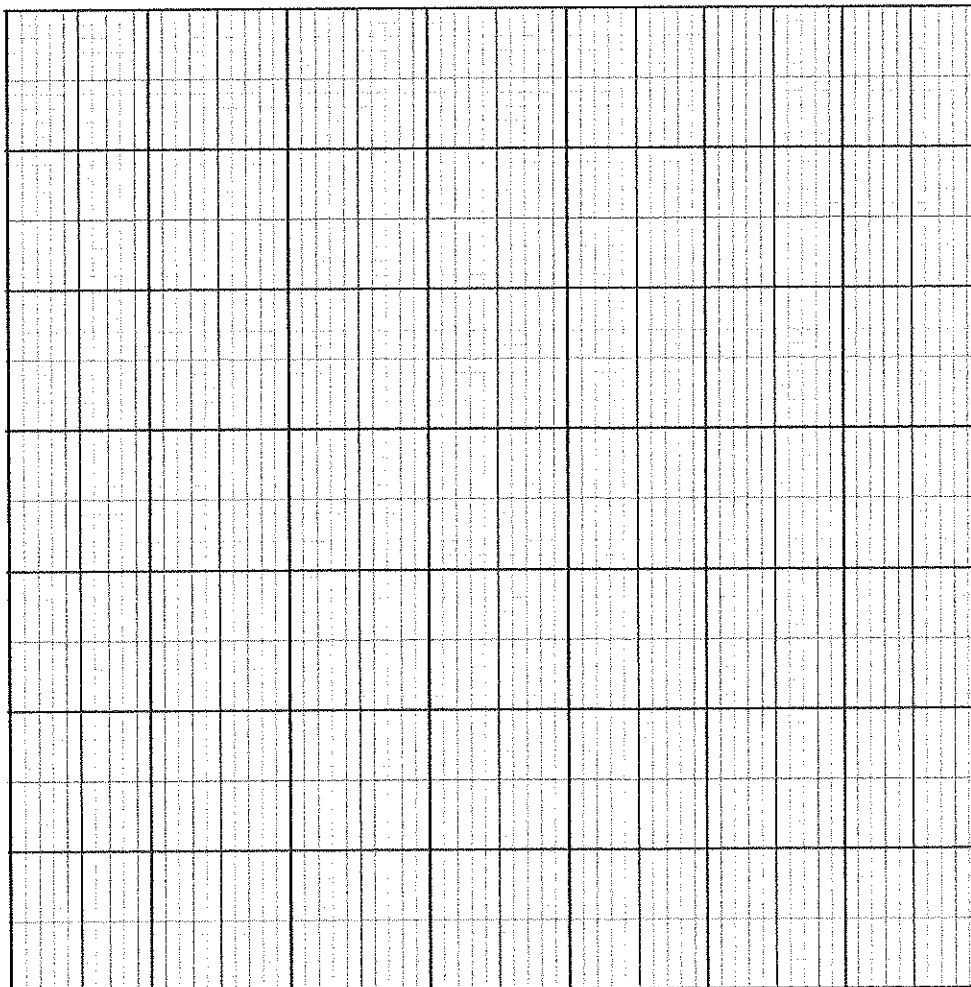
[3]

- (f) The rate of the reaction between a sample of solid sodium carbonate and excess dilute sulphuric acid was investigated at 20°C . The total volume of carbon dioxide produced was measured every minute and the results are shown in Table 9.1.

Table 9.1

time / min	volume / cm^3
1	25
2	45
3	55
4	60
5	60
6	60

On the grid below, plot a graph of volume of carbon dioxide produced against time.



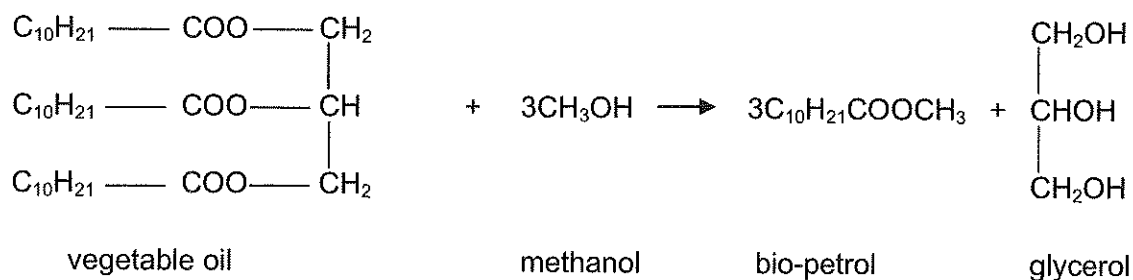
[2]

(g) On the same axes, sketch a graph that will be obtained when half of the original mass of sodium carbonate was used at 20°C. Label this graph Y.

[2]



10 Bio-petrol is an ester compound made from vegetable oil by the following reaction.



(a) Suggest **one** advantage of using bio-petrol as a fuel, compared with using fuels made from crude oil.

.....
 [1]

(b) (i) To which homologous series does glycerol belong?

..... [1]

(ii) Deduce the empirical formula of glycerol.

..... [1]

(c) (i) Draw the structural formula of methanol.

[1]

(ii) Methanol is burned in oxygen in a closed furnace to produce energy.

Write a word equation for the reaction.

.....
 [2]

(d) Ethyl ethanoate is also an ester compound. It is made by the reaction of two organic compounds.

Name the **two** compounds.

3

4

[2]

11 Two identical plots, **F** and **L**, had equal numbers of similar leafy vegetables.

A fertiliser was added to plot **F**. No fertiliser was added to plot **L**.

The plants in both plots were watered with equal amounts of water.

The plants in plot **F** started to wilt, but the plants in plot **L** did not.

(a) (i) Name the process by which the plants lose water.

.....[1]

(ii) Explain why the plants in plot **F** started to wilt but the plants in plot **L** did not.

.....
.....
.....
.....
.....
.....
.....[4]

(b) When the fertiliser was added, a strong smell from the fertiliser reached the farmer.

Name and describe the process by which the fumes from the fertiliser reached the farmer.

name

description.....

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



12 Table 12.1 shows names of some parts present in cells **P**, **Q**, **R** and **S**.

Table 12.1

	P	Q	R	S
nucleus	x	✓	✓	✓
chloroplast	x	x	✓	x
cell wall	x	✓	✓	x
cell membrane	✓	✓	✓	✓

Key

✓ present

x absent

(a) (i) Use the letters **P**, **Q**, **R** or **S** to identify **two** cells which are animal cells.

.....[1]

(ii) Give a reason for the answer in (a)(i).

.....[1]

(b) Suggest the name of cell **P**.

.....[1]

(c) (i) State **one** part of cell **R** which makes it different from the other cells in Table 12.1.

.....[1]

(ii) Explain how the feature in (c)(i) enables cell **R** to perform its function.

.....

[2]

13 Diabetic people often experience low blood sugar, a condition known as hypoglycaemia. They can experience this if they are injected with too much insulin, they have a late meal or they exercise too much.

(a) Name the gland that secretes insulin in the body.

.....[1]

(b) Explain why there can be too little sugar in the blood if the person exercises too much.

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

(c) Suggest why insulin can only be injected into the patient but cannot be taken orally.

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

(d) Explain why too much insulin results in low blood sugar (hypoglycaemia).

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



14 Fig. 14.1 shows part of the female reproductive system.

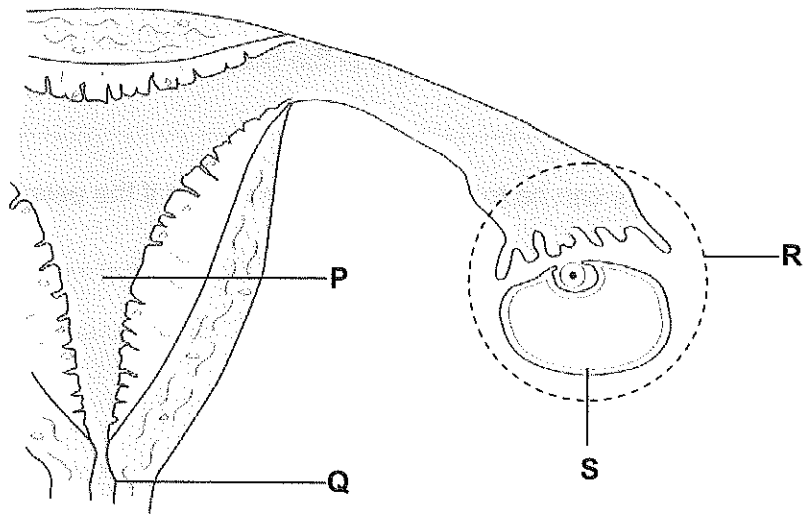


Fig. 14.1 (not to scale)

(a) (i) Name the parts labelled P and Q.

P

Q

[2]

(ii) Name the process occurring at region R.

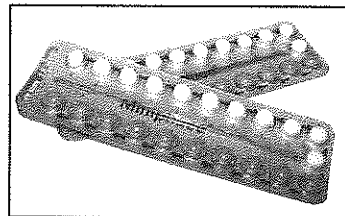
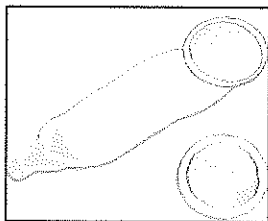
.....[1]

(iii) Which hormone, secreted by structure S, influences the occurrence of the process in (a)(ii)?

.....[1]

(b) Birth control methods can be classified as either; natural, chemical, mechanical or surgical.

Complete the boxes by stating the appropriate class of the methods in Fig. 14.2.



[2]

Fig. 14.2

15 An area with mopane trees has a seasonal presence of mopane worms. During the mopane worm season, people harvest the worms for food. They also harvest the trees for fire wood.

(a) (i) Use the information from the statement to construct a food chain with three trophic levels.

.....[1]

(ii) Suggest the impact of cutting down mopane trees on the food chain.

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

(b) The community living in the area was given the responsibility of managing the area to conserve the mopane worms and trees.

Suggest **two** methods of conservation that they can use.

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

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