BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

SCIENCE: DOUBLE AWARD **0569/03**

Paper 3 **October/November 2018**

2 hours

Candidates answer on the Question Paper.

No Additional Materials are required.

809

READ THESE INSTRUCTIONS FIRST

Write your candidate name, Centre number and candidate number 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 lose marks if you do not show your working or if you do not use appropriate units.
You may use a calculator.

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

A020

For Examiner's Use	
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Total	

This document consists of **19** printed pages and **1** blank page.

[Turn over

1 Fig. 1.1 shows a speed-time graph of an object.
The object was projected vertically upwards from the ground and held briefly at its maximum height. It was then released to fall to the ground.

Ignore air resistance. (g = 10 m/s^2)

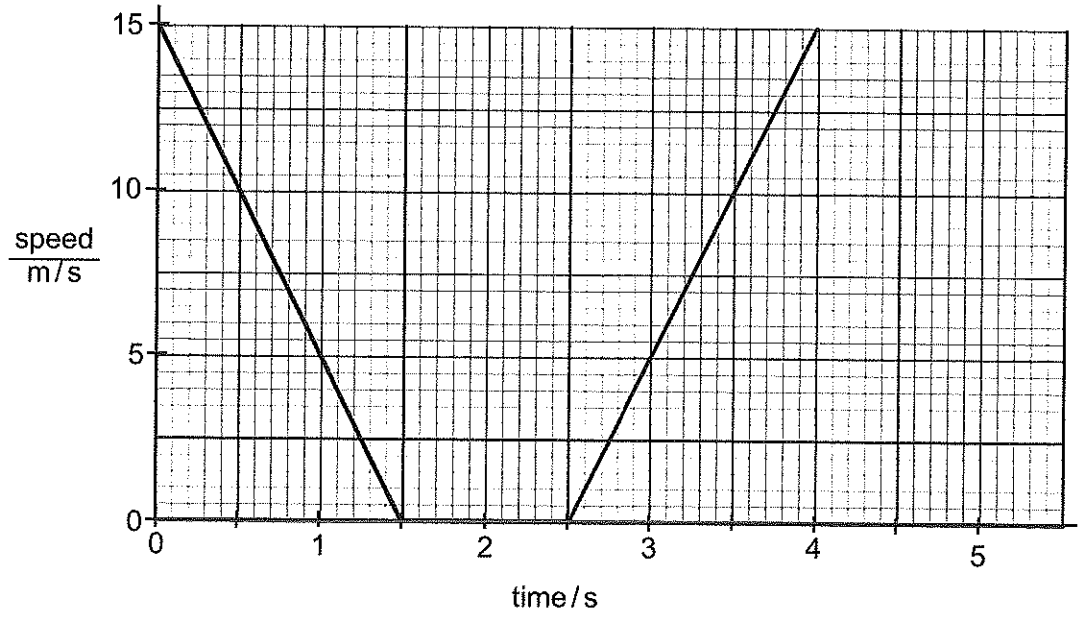

Fig. 1.1

(a) Use the graph to determine the time

(i) taken by the object to reach its maximum height,

time = ... s [1]

(ii) the object was held at the maximum height.

time = ... s [1]

(b) Calculate the maximum height reached by the object.

maximum height =..... [2]

(c) The mass of the object is 0.5 kg.

(i) Calculate the kinetic energy of the object as it leaves the ground.

kinetic energy = ... [2]

(ii) State whether the maximum gravitational potential energy of the object is **equal to**, **greater than** or **less than** the maximum kinetic energy of the object.
Explain your answer.

statement .....

explanation .....

....
[1]

2 **(a)** Fig. 2.1 shows a liquid-in-glass thermometer.

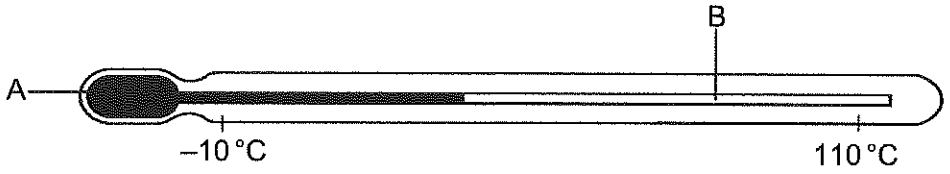

Fig. 2.1

Name the parts labelled A and B.

A .....

B .....

[2]

(b) Fig. 2.2 shows a thermometer that uses a bimetallic strip to measure the temperature of a domestic oven. The bimetallic strip is fixed at point P.
A movable pointer is attached to the other end of the strip.

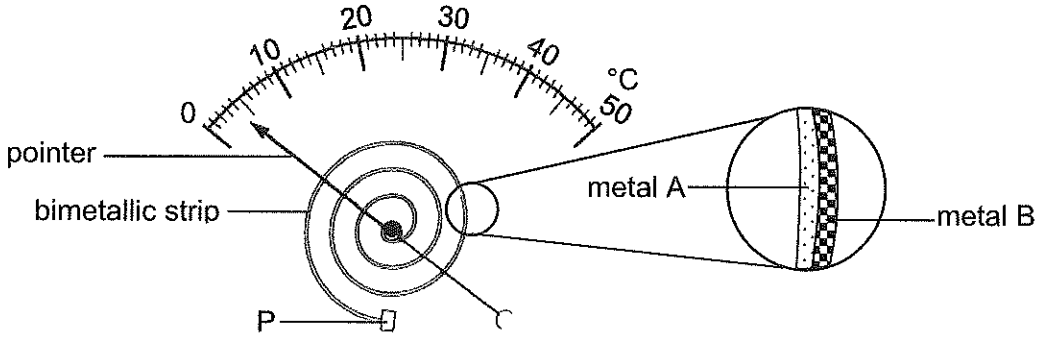

Fig. 2.2

(i) Which physical property varies with temperature in the thermometer in Fig. 2.2?

..... [1]

(ii) Describe how the thermometer works when the oven is switched on.

.....

.....

.....

.....

.....[3]

3 **(a)** Define the term *amplitude*.

.....

..... [1]

(b) Fig. 3.1 shows a displacement-time graph for a sound wave.

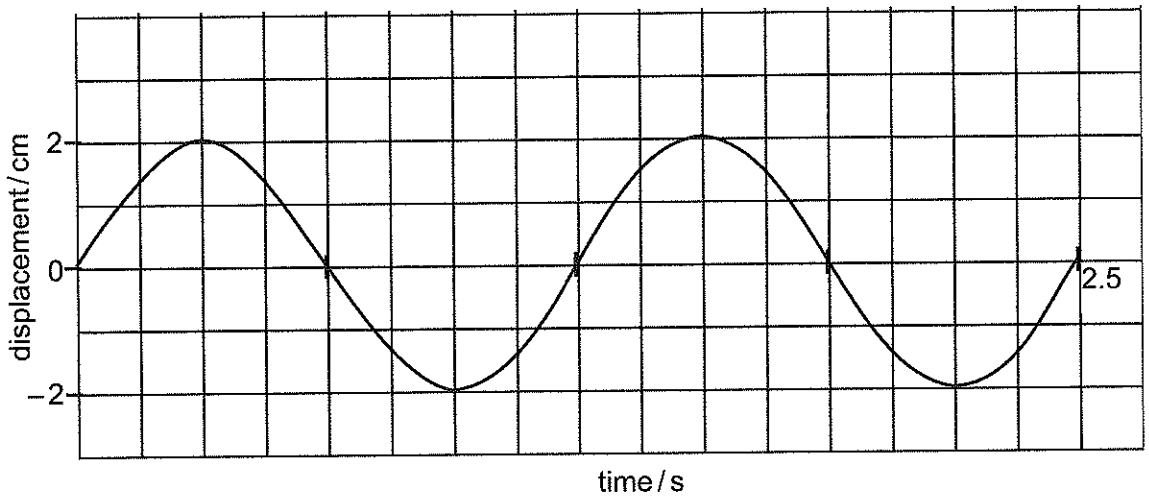

Fig. 3.1

Use Fig. 3.1 to determine the period of the wave.

period = ... s [1]

(c) The frequency of the wave is increased and the loudness remains the same.

On Fig. 3.1, draw one complete wavelength to show the new sound wave. [2]

(d) A whistle produces a sound wave of frequency 256 Hz.
The speed of sound in air is 340 m / s.

Calculate the wavelength of the sound wave.

wavelength = ... [2]

4 Fig. 4.1 shows a method of making a permanent magnet.
A plotting compass is placed beside the magnet.

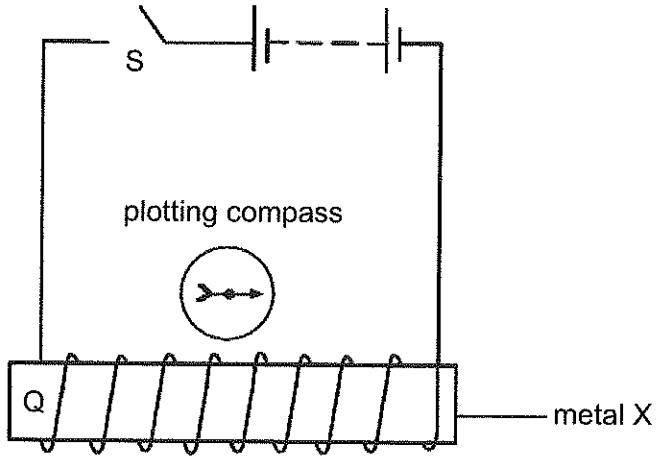

Fig. 4.1

(a) State **two** properties of permanent magnets.

1 .....

2 .....

[2]

(b) **(i)** State the name of the method used in Fig. 4.1.

..... [1]

(ii) Suggest the name of metal X.

..... [1]

(iii) Name another method which can be used to make a magnet.

..... [1]

(c) Switch S is closed and the compass needle points as shown in Fig. 4.1.

State the name of the pole formed at end Q.

..... [1]

For Examiner's Use

5 Fig. 5.1 shows an electric circuit.

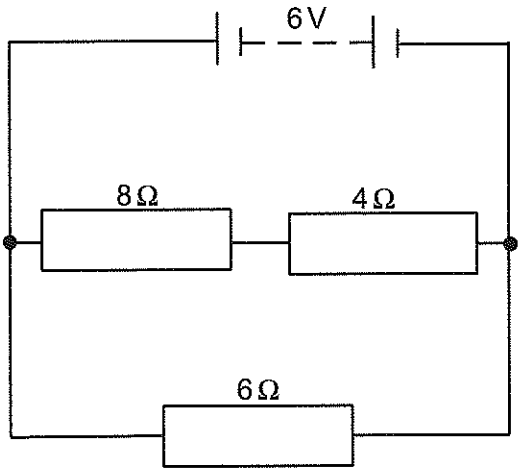

Fig. 5.1

Calculate

(a) the total resistance of the circuit,

total resistance = ... Ω [2]

(b) the current in the 6 Ω resistor,

current = ... [2]

(c) the potential difference across the 8 Ω resistor.

potential difference = ... V [2]

6 A hospital keeps some radioactive sources for medical purposes.

(a) State **one** safety precaution when handling the sources.

..... [1]

(b) State **one** danger of being exposed to radioactive emissions.

..... [1]

(c) Suggest **one** way of safely disposing the sources from the hospital.

..... [1]

7 Choose **one** substance from the list to fit each given description.
You may use each substance once, more than once or not at all.

sodium carbonate **sodium hydroxide** **copper(II) sulphate**

copper(II) carbonate **chlorine** **ammonia**

(a) It is a solid that dissolves in water to form an alkaline solution.

..... [1]

(b) It is a solid that is soluble in water and reacts with aqueous barium nitrate to form a white precipitate.

..... [1]

(c) It is a gas that bleaches damp litmus paper.

..... [1]

(d) It decomposes on heating to form carbon dioxide.

..... [1]

(e) It is used to sterilise water.

..... [1]

8 Fluorine, chlorine, bromine and iodine are elements in group VII of the Periodic Table.

(a) Give a reason why these elements are placed in group VII of the Periodic Table.

..... [1]

(b) (i) Describe the trend of the reactivity of the elements in group VII.

.....

..... [1]

(ii) Explain your answer in **(b)(i)**.

.....

.....

..... [2]

(c) Hydrochloric acid reacts with magnesium ribbon to form magnesium chloride and hydrogen gas.

(i) Write a balanced chemical equation for the reaction. Include state symbols.

..... [3]

(ii) State **two** changes that can be made to increase the rate of the reaction in **(c)(i)**.

1 .....

2 .....
[2]

(iii) Hydrochloric acid is reacted with aluminium metal. Bubbles are produced slowly at the start of the reaction and then rapidly as the reaction progresses.

Give an explanation for this observation.

.....

.....

..... [3]

9 Excess magnesium carbonate is added to 25.0 cm^3 of 2.00 mol / dm^3 nitric acid.

The equation for the reaction is:

$$MgCO_3(s) + 2HNO_3(aq) \longrightarrow Mg(NO_3)_2(aq) + CO_2(g) + H_2O(l)$$

(a) Name the process used to remove the excess magnesium carbonate from the mixture.

..... [1]

(b) Calculate the number of moles in 25.0 cm^3 of 2.00 mol / dm^3 nitric acid.

moles = ... [2]

(c) Use the equation and the answer in **(b)** to calculate the number of moles of magnesium nitrate formed.

moles = ... [2]

(d) The solution of magnesium nitrate from the reaction is evaporated and 6.9 g of hydrated magnesium nitrate, $Mg(NO_3)_2.6H_2O$, is obtained.

The equation for the formation of hydrated magnesium nitrate is:

$$Mg(NO_3)_2 + 6H_2O \longrightarrow Mg(NO_3)_2.6H_2O$$

(i) Use the equation and the answer from **(c)** to calculate the number of moles of hydrated magnesium nitrate.

moles = ... [1]

(ii) Calculate the mass of 1 mole of hydrated magnesium nitrate, $Mg(NO_3)_2.6H_2O$.

mass = ... [1]

(iii) Use your answers to **(d)(i)** and **(d)(ii)** to calculate the mass of the hydrated magnesium nitrate formed.

mass = ... [1]

(iv) Calculate the percentage yield of the hydrated magnesium nitrate.

percentage yield = ... [1]

10 Ethene, C_2H_4, is an unsaturated compound.

(a) State the meaning of *unsaturated compound*.

..... [1]

(b) Ethene reacts with bromine water and decolourises it.

Draw the structure of the compound formed from the reaction.

[2]

(c) The equation for the addition of steam to ethene is:

$$C_2H_4 + H_2O \longrightarrow C_2H_5OH$$

Give any **two** conditions for the reaction.

1 .....

2 .....

[2]

(d) Draw a 'dot and cross' diagram to show the structure of a molecule of carbon dioxide.

[2]

For Examiner's Use

11 Fig. 11.1 shows a cross-section of the human heart.

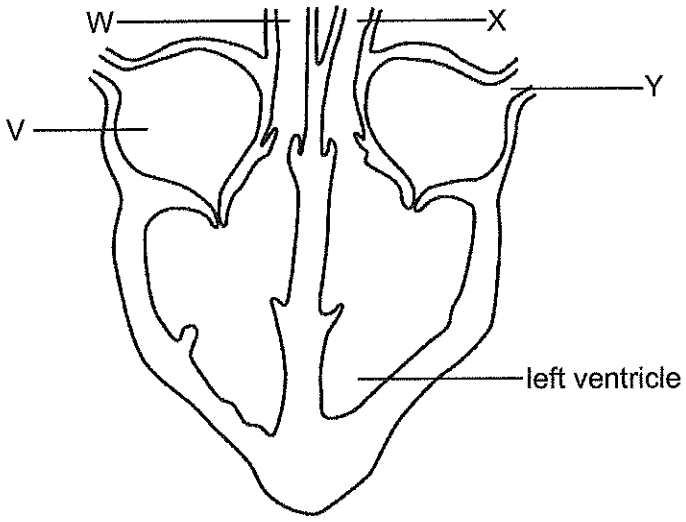

Fig. 11.1

(a) State the name of the structures labelled V and X.

V .....

X .....
[2]

(b) Explain how the structure of the left ventricle enables it to pump blood to distant parts of the body.

.....

..... [2]

(c) State **two** structural differences, apart from the presence of valves, between the parts labelled W and Y.

1 .....

.....

2 .....

.....
[2]

(d) On Fig. 11.1, use arrows to show the movement of deoxygenated blood in and out of the heart. [1]

12 Beer contains a drug that is commonly abused.

(a) Define the term *drug*.

.....

..... [2]

(b) Name the drug contained in beer.

..... [1]

(c) Fig. 12.1 shows the hands of two persons, L and M, performing an experiment to demonstrate the reaction time of M before drinking beer.
L releases the metre rule and M catches it at point A.

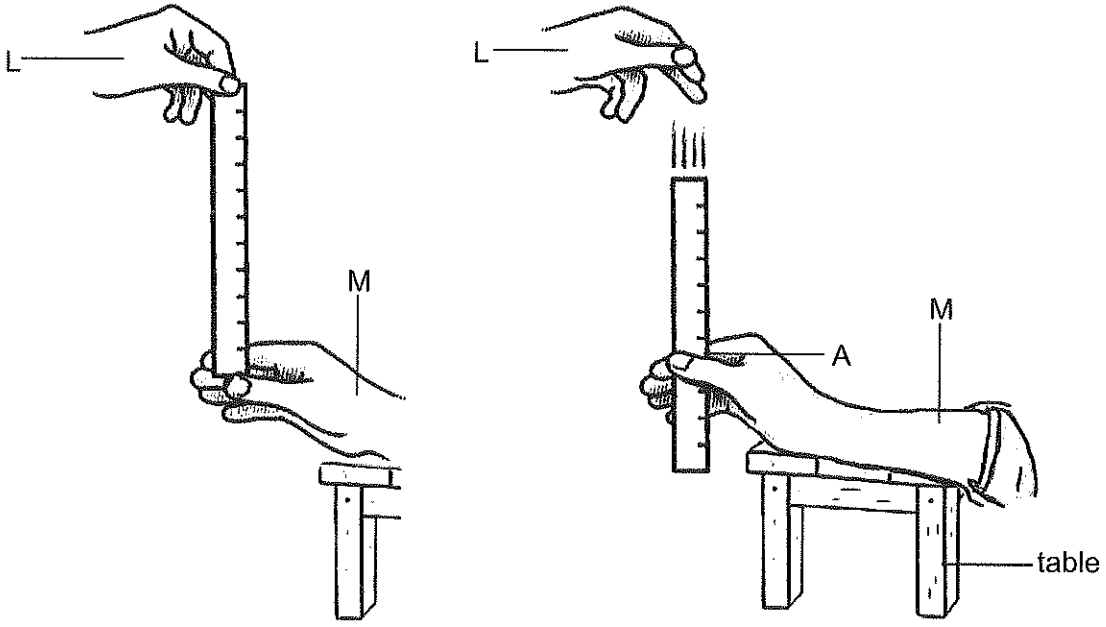

Fig. 12.1

State and explain what is observed if the experiment is repeated 30 minutes after M drank a lot of beer.

observation ..... [1]

explanation .....

..... [2]

For Examiner's Use

13 Fig. 13.1 shows the human digestive system.

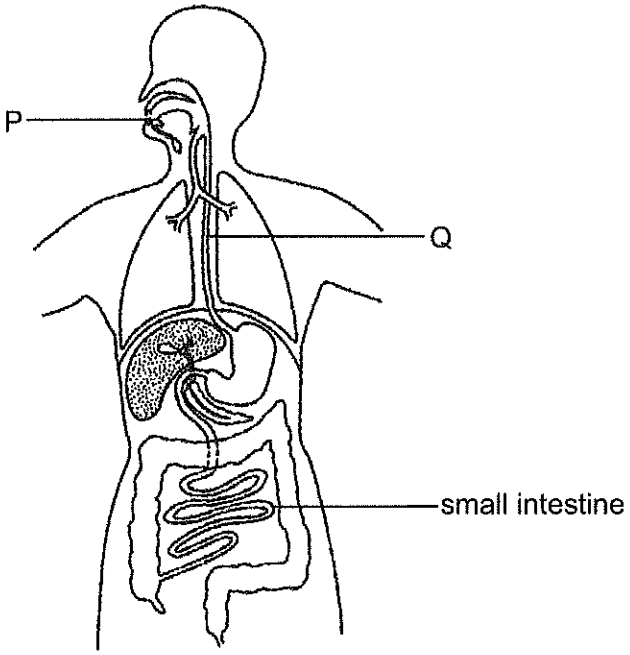

Fig. 13.1

A boy eats solid food that contains carbohydrates, proteins and fats.

(a) State the name of the process through which food is taken into P.

..... [1]

(b) State the name of the process which makes food move through Q.

..... [1]

(c) Fig. 13.2 shows bar charts representing proportions of nutrients in a food sample obtained at the end of digestion in each region of the alimentary canal.
Letters W, X and Y represent regions of the alimentary canal.

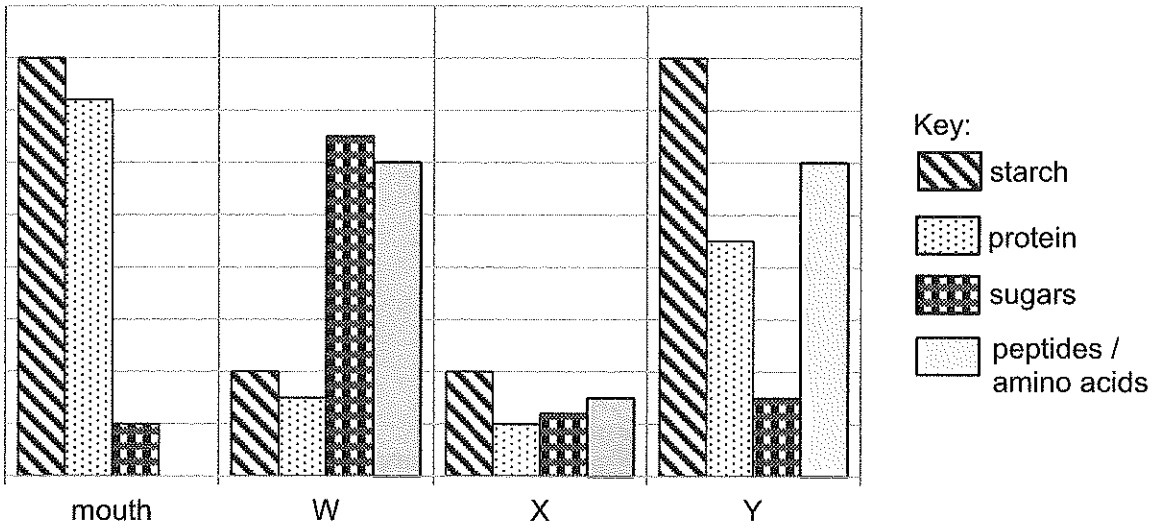

Fig. 13.2

(i) Which section of the bar chart is for the sample obtained from the duodenum?

..... [1]

(ii) Explain your answer in **(c)(i)**.

.....

.....

.....

.....

..... [4]

For Examiner's Use

14 Fig. 14.1 shows a nerve cell found in an organism.

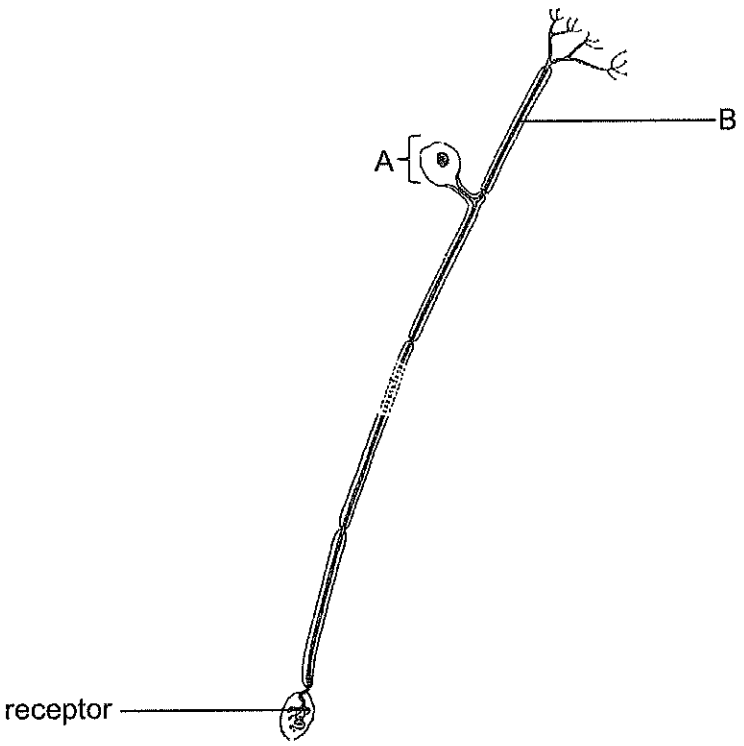

Fig. 14.1

(a) Define the term *organism*.

..... [1]

(b) State the name of the nerve cell in Fig.14.1.

..... [1]

(c) Identify the parts labelled A and B.

A .....

B .....

[2]

(d) The normal concentration of glucose in human blood is 100 mg / dm^3.

Suggest how a decrease in the concentration of glucose may affect the activity of the cell in Fig .14.1.

.....

.....

.....

..... [3]

15 Fig. 15.1 is a graph showing water loss by a plant on two different days.

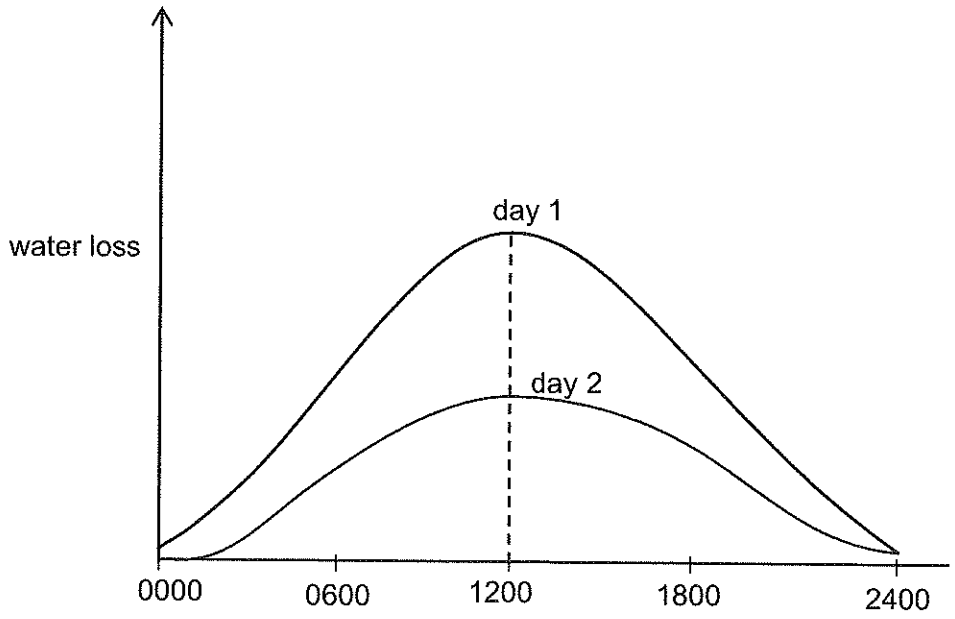

Fig. 15.1

(a) State the name of the part of the leaf through which plants lose water.

..... [1]

(b) Describe and explain the shape of the graph for day 1.

.....

.....

.....

..... [3]

(c) Suggest **one** environmental condition which could have resulted in the graph obtained in day 2. Explain how the condition affected the rate of water loss.

environmental condition .....

explanation.....

.....

[2]

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DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a	a = relative atomic mass
X	X = atomic symbol
b	b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).