BOTSWANA EXAMINATIONS COUNCIL

JUNIOR CERTIFICATE EXAMINATION

SCIENCE

14/2

Paper 2

October/November 2021

Marks: 80

Time: 2 Hours

Candidate Full Names:

Centre Number: J C

Candidate Number:

INSTRUCTIONS

1. Write your full names and examination number in the spaces provided above.
2. Answer **ALL** questions.
3. All answers must be written in the spaces provided.
4. Show **ALL** the necessary working.
5. Calculators may be used in this paper.
6. A copy of the Periodic Table is printed on page 20.

FOR EXAMINER'S USE ONLY

Section	Marks Scored
A	
B	
Total Marks	

*This question paper contains **18** printed pages and **2** blank pages.*

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

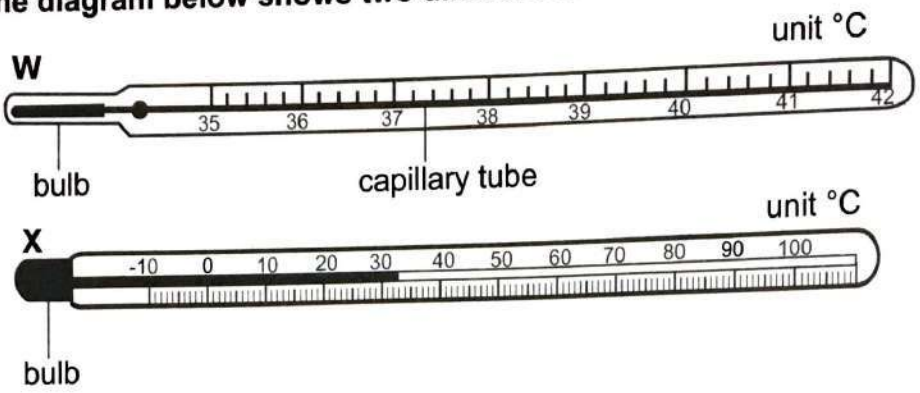
For Examiner's use

SECTION A (60 Marks)

1. **(a)** State the physical quantity measured using a thermometer.

..... (1)

The diagram below shows two different thermometers, W and X.



(b) State **two** differences that can be observed between the scales of the thermometers.

.....

..... (2)

(c) **(i)** State the reading of thermometer **X**.

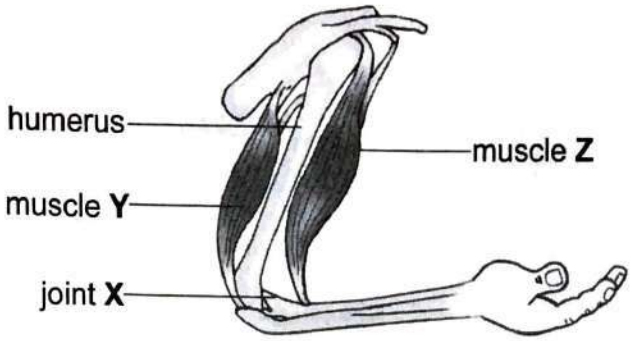
..... °C (1)

(ii) Convert the reading in **(c) (i)** to Kelvins.

..... K (2)

For Examiner's use

The diagram below shows the internal structure of a bent human arm with some parts labelled X, Y and Z. Use it to answer question 2.



2. **(a)** Name joint **X**.

..... (1)

(b) Describe the changes that occur in muscles **Y** and **Z** when the arm is straightened.

.....

.....

..... (2)

For Examiner's use

The diagram shows a menstrual cycle of a woman during the month of April. Use it to answer question 3.

Sun	Mon	Tue	Wed	Thurs	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Key

blood flow

ovulation

3. **(a)** Name the process taking place from the 2nd to the 6th of April.

..... (1)

(b) **(i)** On what date will the thickening of the wall of the uterus begin?

..... (1)

(ii) Give a reason for the thickening of the uterus wall.

.....

..... (1)

(c) On which dates is the woman likely to be pregnant if she engages in unprotected sexual intercourse?

..... (1)

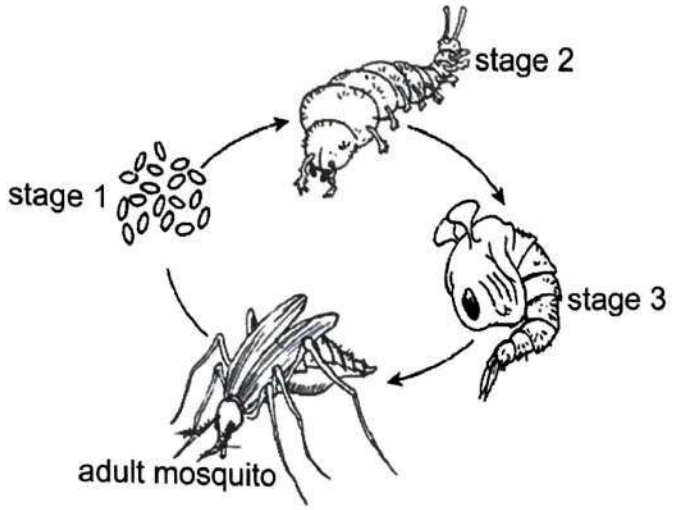
(d) Define safe period.

.....

..... (1)

For Examiner's use

The diagram below shows the life cycle of a mosquito.
Use it to answer question 4.



4. **(a)** Name stage 3.

..... (1)

(b) Name **one** disease that is transmitted by mosquito.

..... (1)

(c) State **two** ways through which the life cycle can be broken at stage 2.

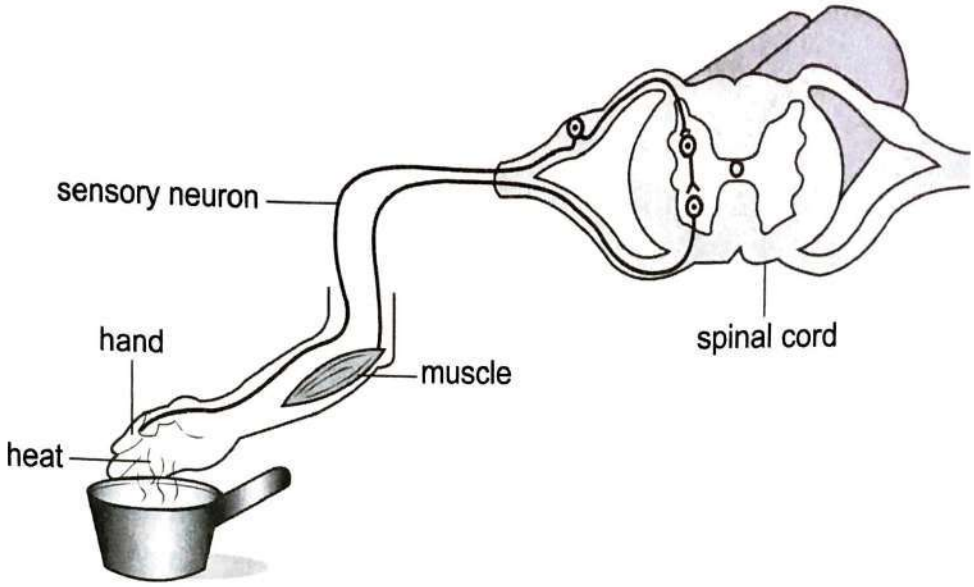
.....

.....

..... (2)

For Examiner's use

The diagram below illustrates a reflex arc in humans.
Use it to answer question 5.



5. **(a)** Draw **two** arrows (→)in the diagram to indicate the direction in which electrical impulses are transmitted. (2)

(b) **(i)** Name a part in the diagram which is an effector organ.

..... (1)

(ii) State the function of the effector organ.

..... (1)

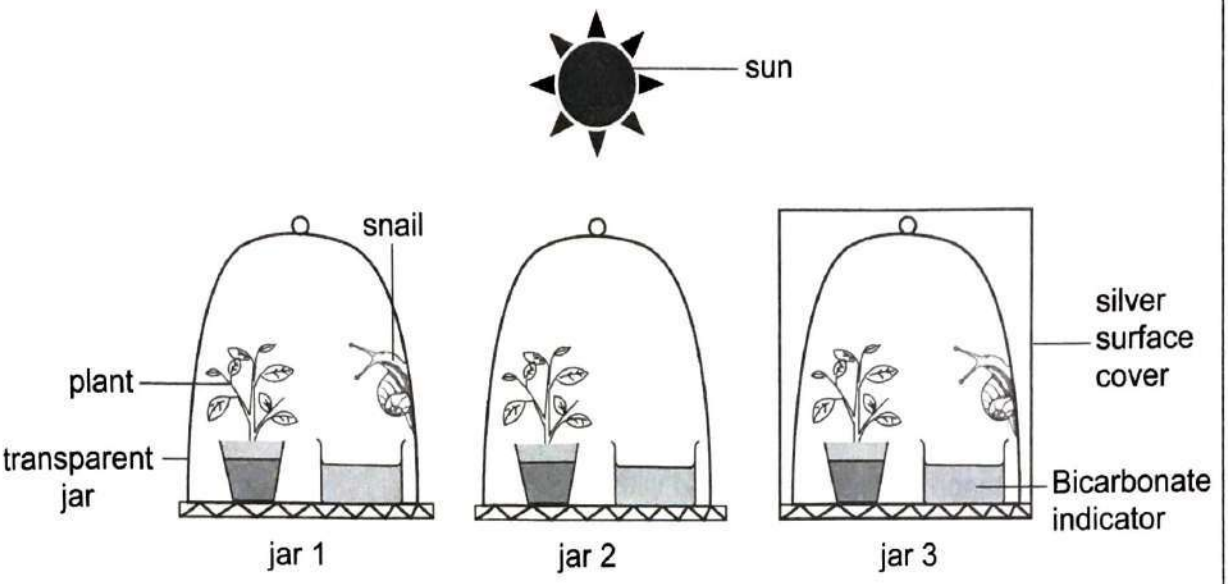
(c) Name **two** systems of the body which are responsible for communication.

.....

..... (2)

For Examiner's use

The diagram below shows a set-up which was used to investigate the relationship between photosynthesis and respiration.
Use it to answer question 6.



Bicarbonate indicator changes from red to yellow as carbon dioxide concentration increases.

6. **(a)** **(i)** In which jar will the Bicarbonate indicator change from red to yellow?

..... (1)

(ii) Explain your answer to **(a)** **(i)** above.

.....

..... (2)

(b) In which jar will the amount of carbon dioxide decrease?

..... (1)

(c) State **one** substance used during the process of respiration.

..... (1)

For Examiner's use

7. The table below shows melting points and boiling points of different substances **X**, **Y** and **Z**.

(a) Complete the table by showing the state of matter of each substance at room temperature (25 °C).

Substance	Melting point (°C)	Boiling point (°C)	State of matter at room temperature
X	-183	-88	
Y	80	218	
Z	-89	118	

(3)

(b) Substance **Y** was found mixed with water.

Name the method of separation which can be used to separate the two.

..... (1)

(c) Substance **Z** is dissolved in water.

Explain how this would affect the boiling point of the water.

.....

.....

..... (2)

(d) Define melting point.

.....

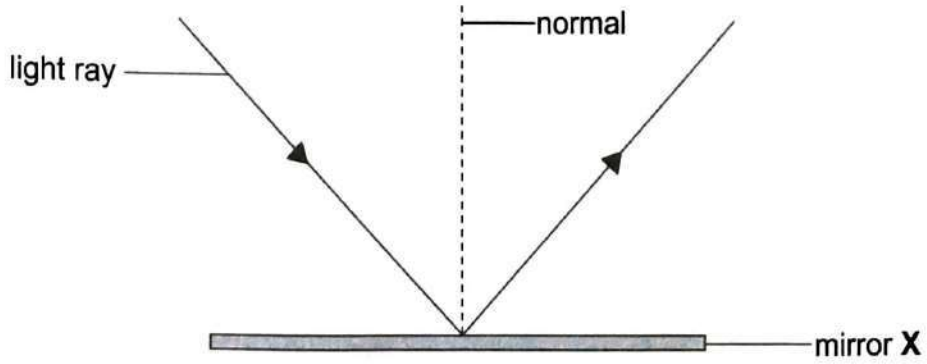
..... (1)

For Examiner's use

8. **(a)** Define reflection.

..... (1)

The diagram below shows a light ray reflected on a plane mirror X.



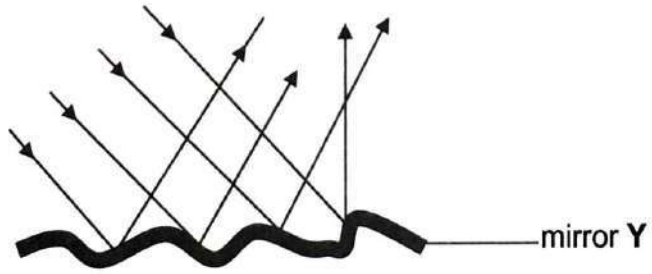
(b) **(i)** On the diagram, mark the angle of incidence with ***i*** and the angle of reflection with ***r***. (2)

(ii) State **one** characteristic of an image that could be formed by mirror **X**.

.....

..... (1)

The diagram below shows another mirror Y, with an uneven reflecting surface.



(c) **(i)** Describe how images formed by mirror **Y** will be different from those formed by mirror **X**.

.....

..... (1)

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

.....

..... (1)

For Examiner's use

9. The table below is on parts of the ear and their functions.

Complete the table by filling in the missing information.

Ear part	Function
Ear flap	
	Transfers electrical impulses from cochlea to the brain
Ear drum	

(3)

For Examiner's use

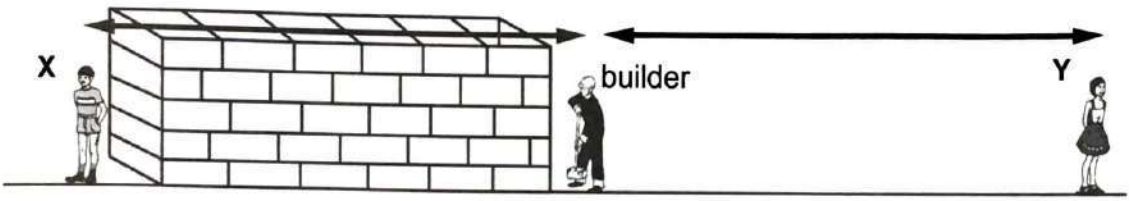
10. (a) The table below shows changes in properties of sound waves.

Complete the table to show how each change affects the sound produced.

Change in wave property	Sound produced
Frequency of the sound wave increases	
The amplitude of the sound wave decreases	

(2)

The diagram below shows a builder hitting a wall with a hammer. Two children, X and Y are standing the same distance from the builder, but on different sides of the wall.



(b) (i) Who of the two children is likely to hear the sound of the hammer **first**?

..... (1)

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

.....

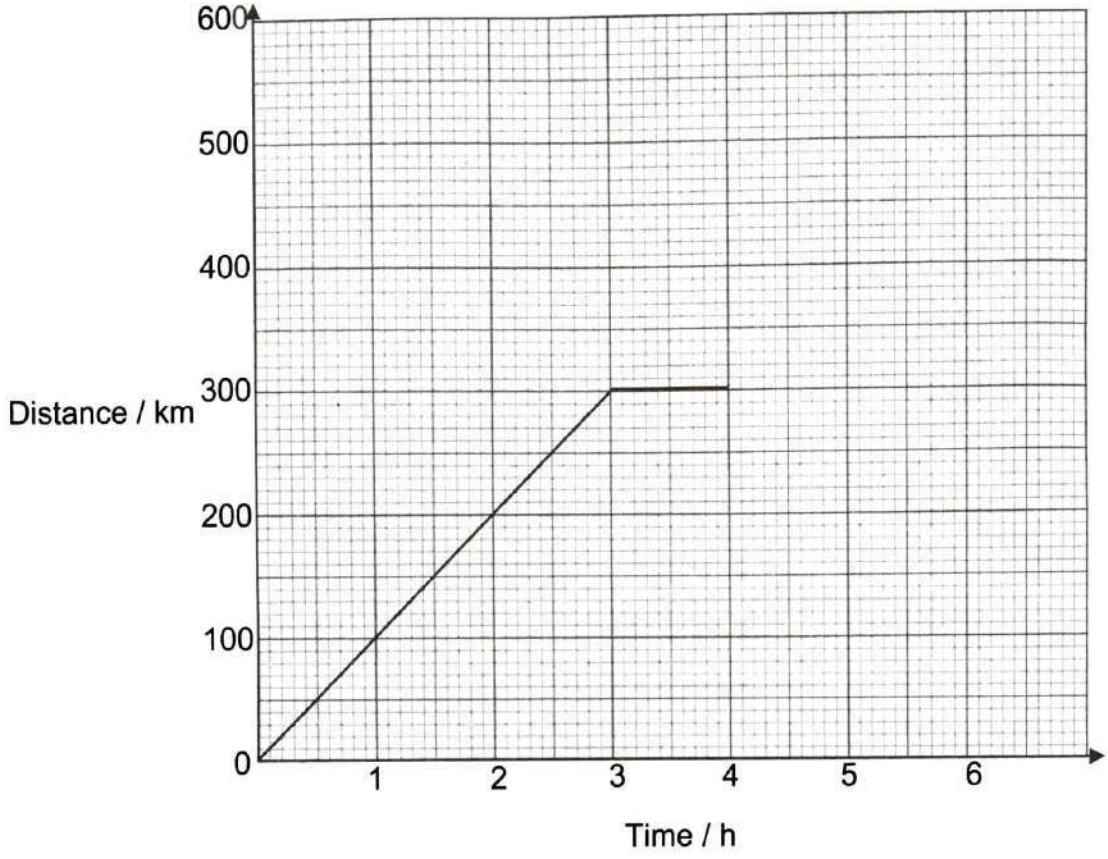
..... (1)

For Examiner's use

11. **(a)** Define speed.

..... (1)

The diagram below shows a distance-time graph for a vehicle.



(b) Describe the motion of the vehicle between the times of 3 and 4 hours.

.....

..... (1)

(c) **(i)** Calculate the speed of the vehicle between 0 and 2 hours.

Speed=.....km/h (2)

(ii) State how the air resistance on the car compares with its driving force.

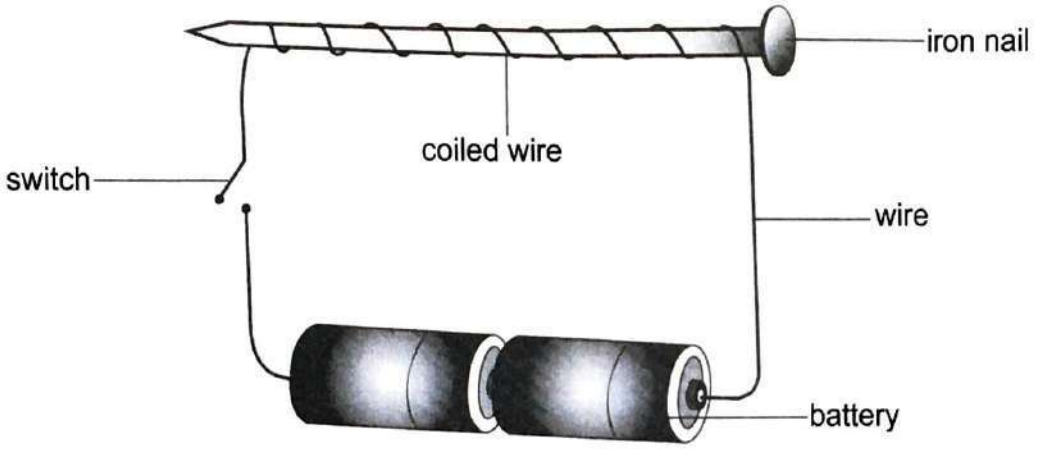
.....

..... (1)

(d) After the 4th hour, the vehicle travelled for two hours at a constant speed returning to where it started.

Complete the graph to show the entire motion of the vehicle. (2)

The diagram below shows a set up used to magnetise a piece of iron nail. Use it to answer question 12.



12. (a) Name the type of current flowing in the coiled wire when the switch is closed.

..... (1)

(b) (i) State the type of magnet produced from the set up.

..... (1)

(ii) Explain why the nail used should be made of iron to obtain the type of magnet in **(b) (i)**.

.....

..... (1)

(c) State **one** use of magnetic materials.

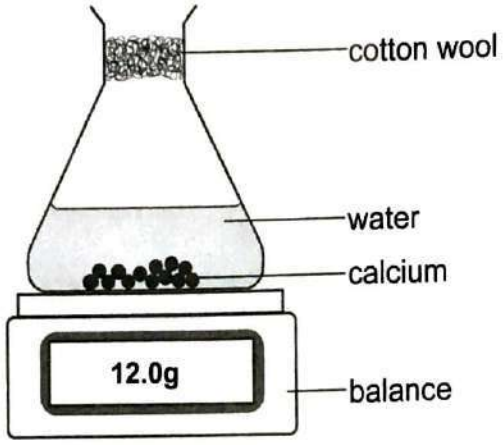
.....

..... (1)

For Examiner's use

SECTION B (20 Marks)

The diagram below shows a set-up that was used to investigate the reaction between water and metals. Calcium granules of mass 5.0g were reacted with excess water. Use it to answer question 13.

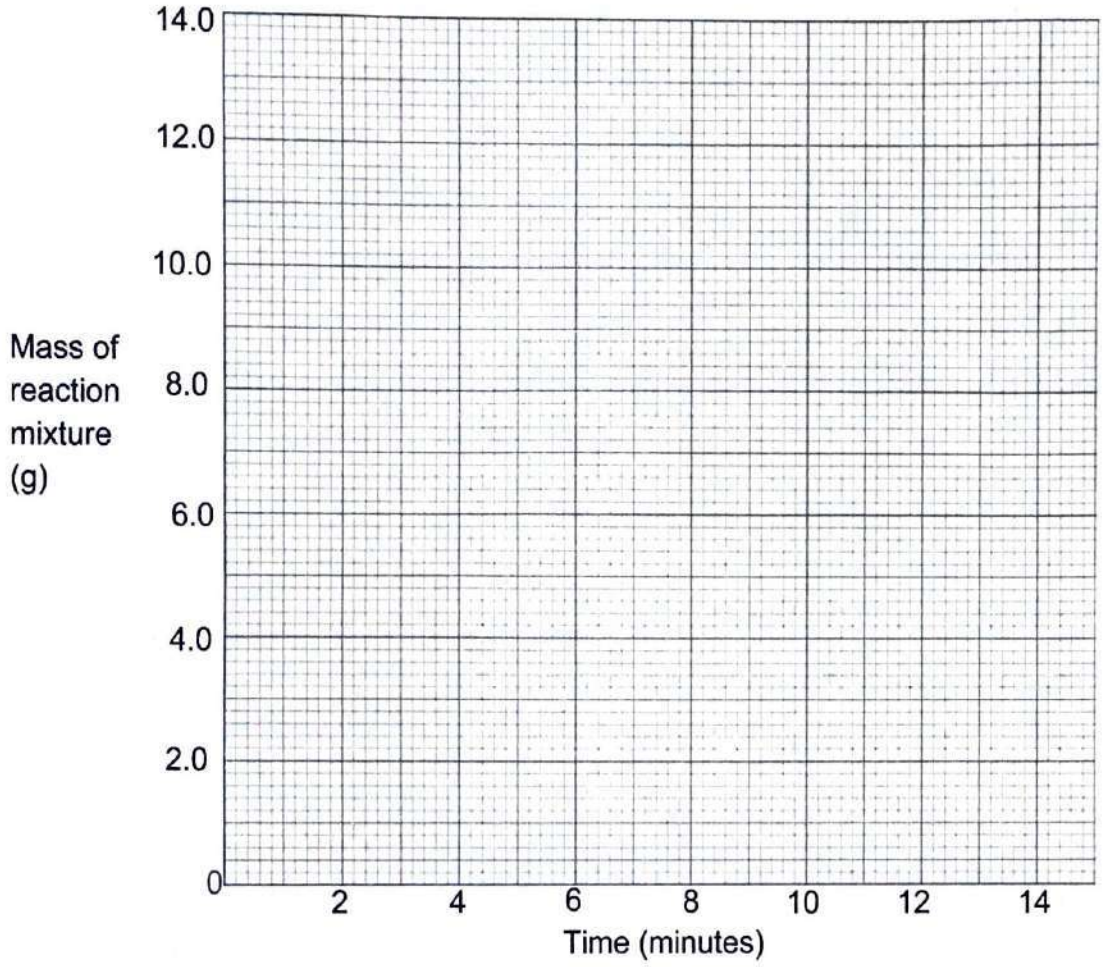


The mass of the reaction mixture was measured at regular time intervals and the results were recorded in the table below.

Time / minutes	0	2	4	6	8	10	12	14
Mass of reaction mixture / g	12.0	7.2	4.0	3.8	2.4	2.2	2.2	2.2

For Examiner's use

13. (a) On the grid below, plot a graph of mass of reaction mixture against time. Label the graph **L**. (4)



(b) Use your graph to determine the mass of reaction mixture after 5 minutes. Show your working.

Mass of reaction mixture.....g (2)

(c) An error was made when measuring one of the mass of the reaction mixture. Use your graph to determine the time when this error was made.

..... (1)

(d) The experiment was repeated with powdered calcium. On the same axis, sketch the graph that could be obtained. Label the graph **M.** (2)

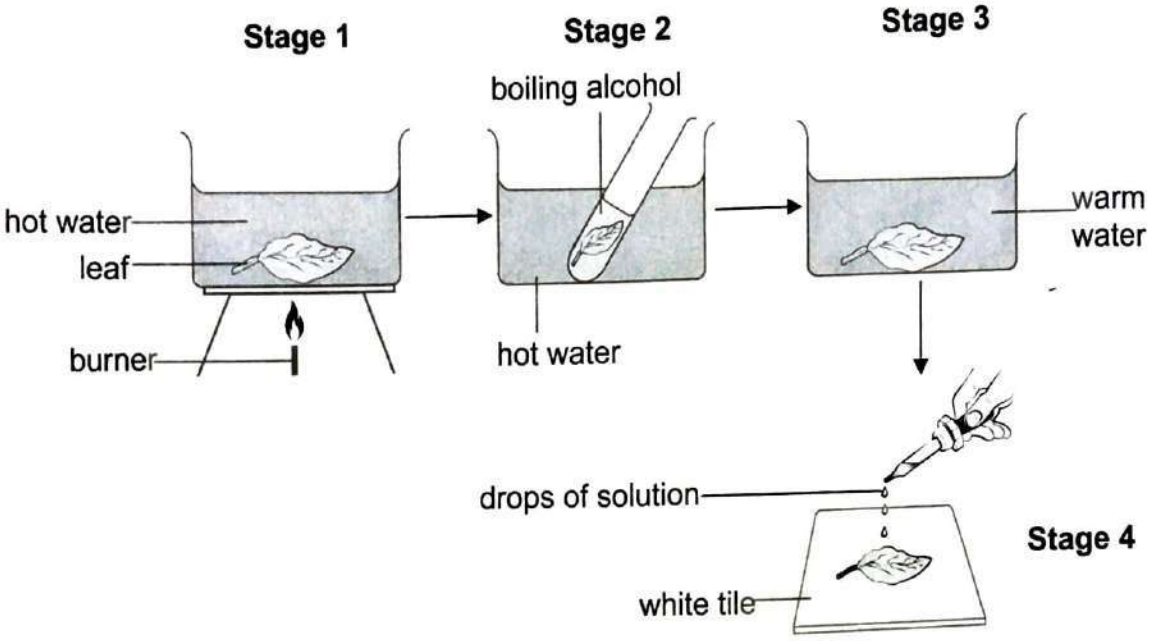
(e) Why was the mass of the reaction mixture decreasing during the reaction?

.....

..... (1)

For Examiner's use

The diagram below shows a set-up used to test for starch in a green leaf. Use it to answer question 14.



14. (a) State the colour of the leaf at;

Stage 1,

.....

Stage 3.

..... (2)

(b) What is the reason for carrying out **Stage 2**?

.....

..... (1)

(c) Name the solution used at **Stage 4**.

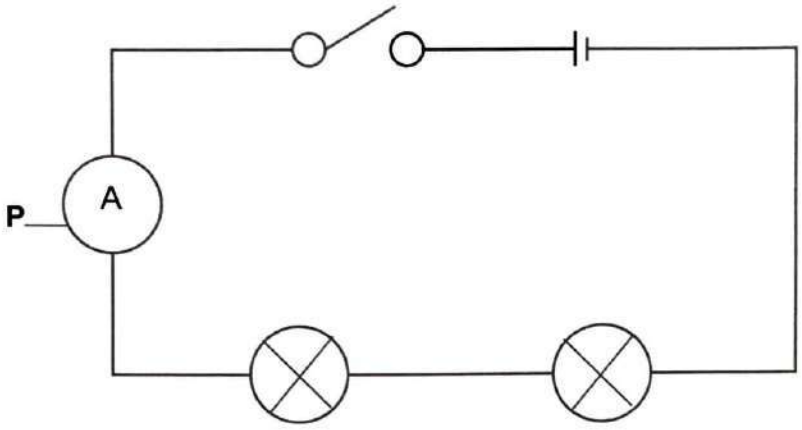
..... (1)

(d) State the observation at **Stage 4** that would confirm the presence of starch.

..... (1)

For Examiner's use

The diagram below shows an electric circuit with two identical bulbs and an electric component labelled P. Use it to answer question 15.



15. (a) Name the component labelled **P**.

..... (1)

(b) The current flowing through the circuit is 0.02 A and the total resistance is 600 Ω. Calculate the potential difference across **one** bulb.

Potential difference=.....V (2)

(c) One bulb is removed from the circuit.

(i) State what will happen to the current flowing through the circuit.

..... (1)

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

.....

..... (1)

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DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

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