BOTSWANA EXAMINATIONS COUNCIL

JUNIOR CERTIFICATE EXAMINATION

SCIENCE

14/2

Paper 2

October/November 2022

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	

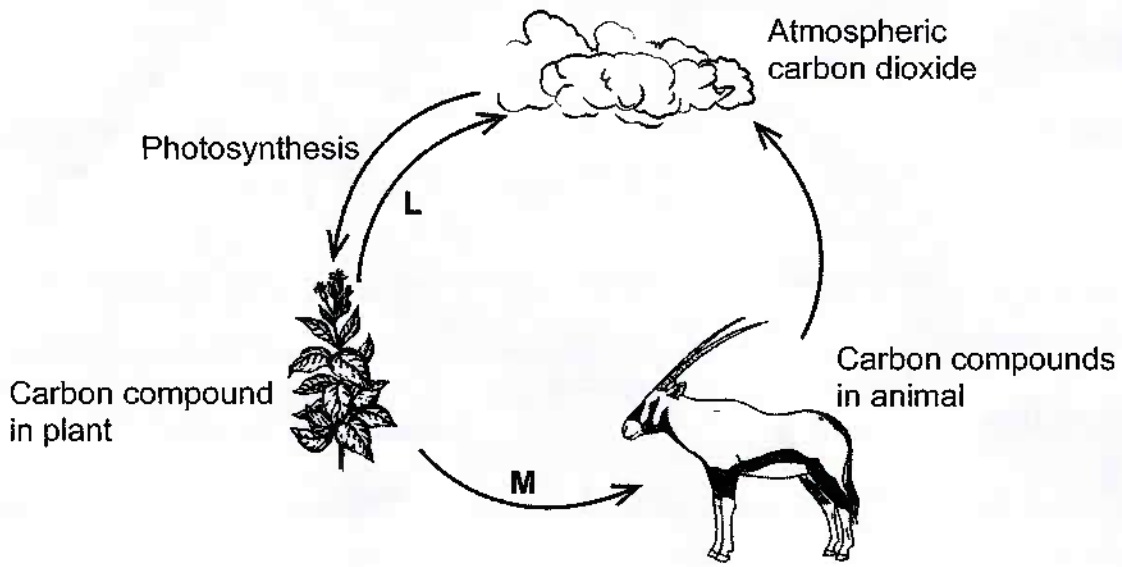
*This question paper contains **19** printed pages and **1** blank page.*

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

For Examiner's use

SECTION A (60 Marks)

The diagram below shows part of the carbon cycle with some processes labelled L and M. Use it to answer question 1.



1. **(a)** Name the processes, **L** and **M**.

L .....

M ..... (2)

(b) Name any carbon compound in plants.

..... (1)

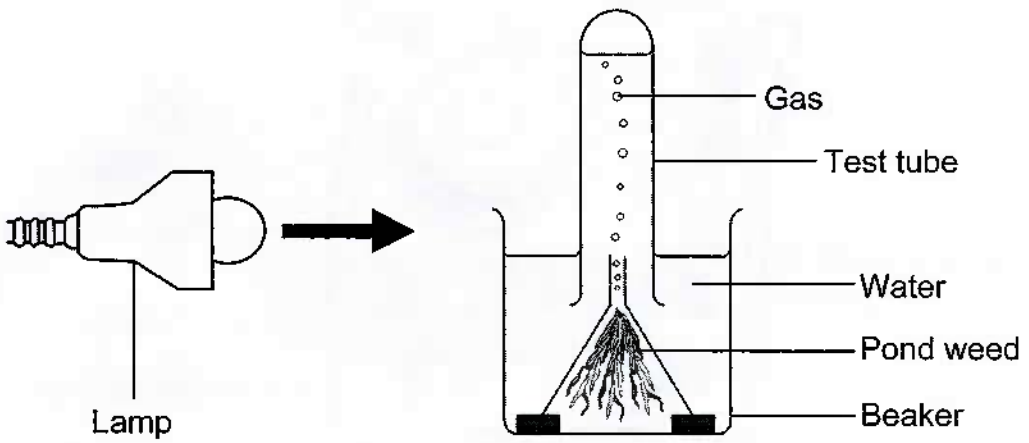
(c) Suggest **two** human activities that increase the amount of carbon dioxide in the atmosphere.

.....

..... (2)

For Examiner's use

The diagram shows a pond weed placed in a beaker near a lit lamp. A test tube was used to collect the gas from the pond weed. Use it to answer question 2.



2 **(a)** Name the gas collected.

..... (1)

(b) State **two** substances needed to produce the gas.

.....

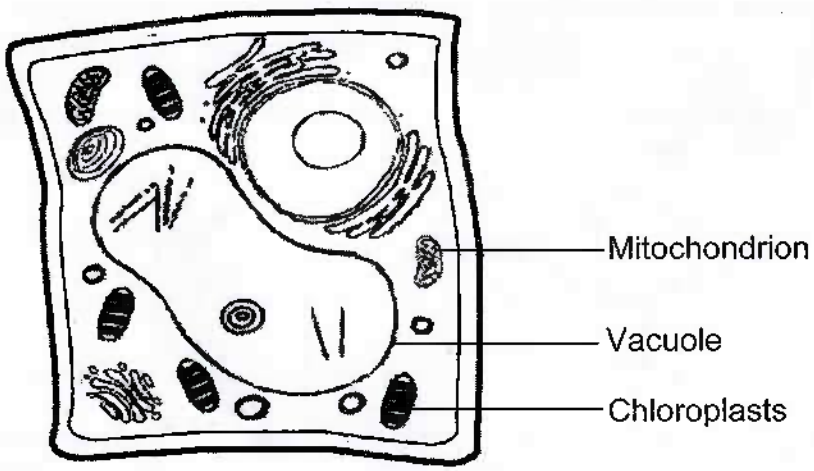
..... (2)

(c) How can the rate of production of gas bubbles by the pond weed be increased?

..... (1)

For Examiner's use

The diagram below shows a cell. Use it to answer question 3.



3. **(a)** **(i)** Name an organ where the cell is found.

..... (1)

(ii) Give a reason for your answer in **(a) (i)**.

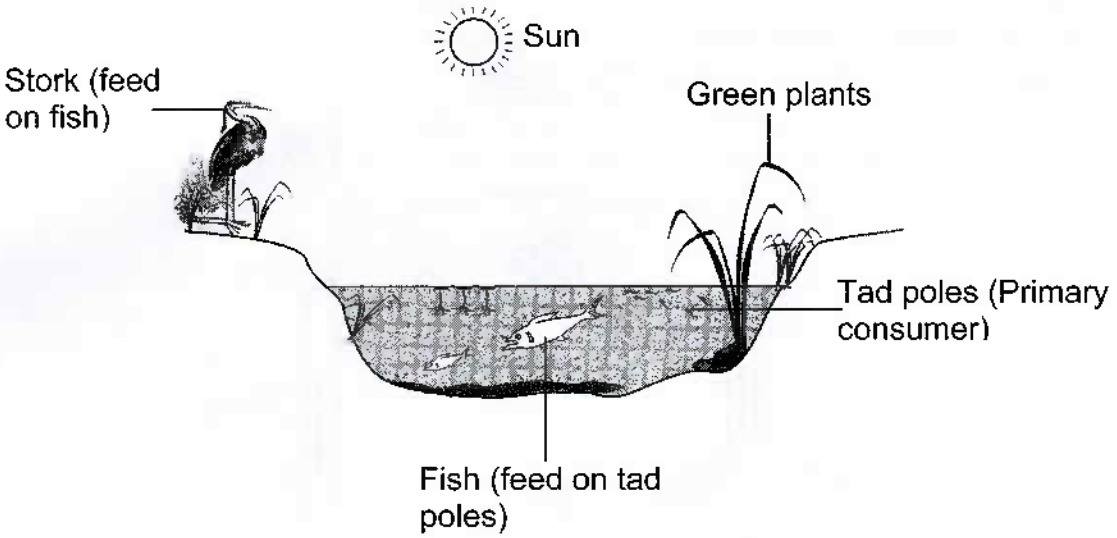
..... (1)

(b) State the function of the mitochondria.

..... (1)

For Examiner's use

The diagram below shows an ecosystem. Use it to answer question 4.



4. **(a)** Use the information on the diagram to construct a food chain of the ecosystem.

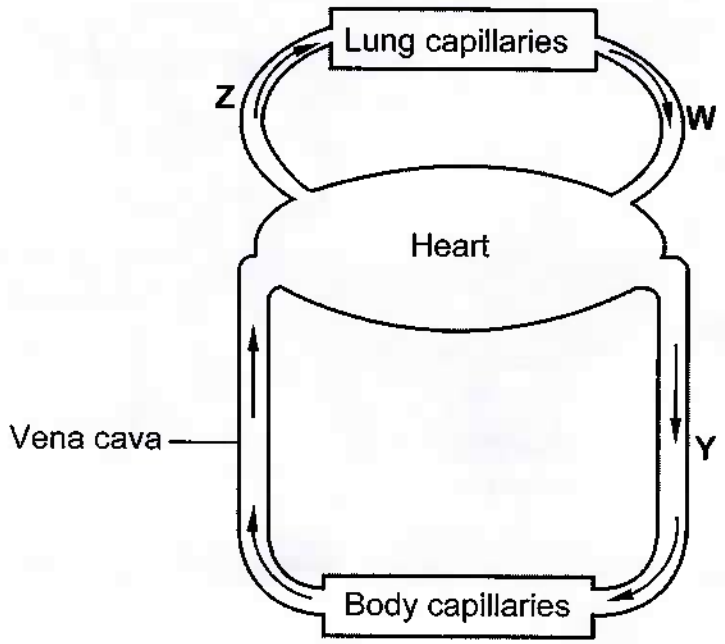
(2)

(b) State the number of trophic levels in the ecosystem.

..... (1)

For Examiner's use

The diagram below represents a circulatory system with blood vessels W, Y and Z. Use it to answer question 5.



5. **(a)** Name blood vessel **W**.

..... (1)

(b) How is blood in blood vessel **Z** different from that of blood vessel **W**?

..... (1)

(c) State **one** difference between the structure of the vena cava and that of blood vessel **Y**.

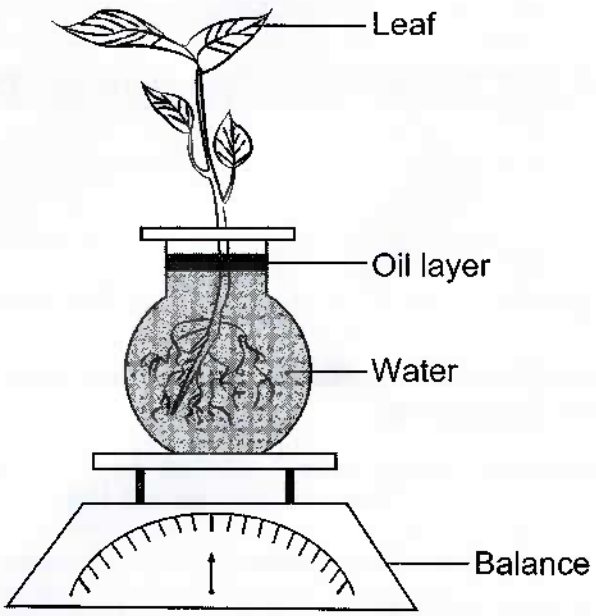
.....

..... (1)

For Examiner's use

Use the information below to answer question 6.

A student carried out the following investigation: She placed a leafy plant into a flask with water and covered the water surface with a layer of oil. She then placed the flask on top of a balance to weigh it.



6. **(a)** State the aim of the investigation.

..... (1)

(b) What will happen to the reading on the balance when the plant is exposed to higher temperature?

..... (1)

(c) What is the purpose of the oil layer in the investigation?

..... (1)

For Examiner's use

7. **(a)** Define excretion.

.....

..... (1)

(b) State **one** substance excreted by the human skin.

..... (1)

(c) Name **two** other organs in the human excretory system.

.....

..... (2)

The table below gives information about substances R, S and T.
Use it to answer question 8.

Substance	Information about the substance
R	A red liquid, when distilled a colourless liquid is obtained
S	A white solid which reacts to produce a salt, water and carbon dioxide
T	A brown solid which cannot be broken down into anything simpler

8. **(a)** Classify each of the substances as either an element, a compound or a mixture.

Element .....

Compound .....

Mixture .....

(3)

(b) Define the term molecule.

.....

..... (1)

For Examiner's use

9. **(a)** The table below shows some incomplete information about the atoms of elements **G** and **H**.

(i) Complete the table by giving the missing information. (2)

Element	Atomic number	Number of neutrons	Mass number
G	7		14
H	9	10	

(ii) Draw the atomic structure of element **G** from the table. (3)

(b) A student found a substance with the following information labelled on its container.

Melting point = 1278 °C

Boiling point = 2970 °C

Element found in group II, period 2 of the Periodic Table

(i) Write the symbol for the element showing the atomic number and mass number in the box below.

(2)

(ii) Is the element a metal or non-metal?

..... (1)

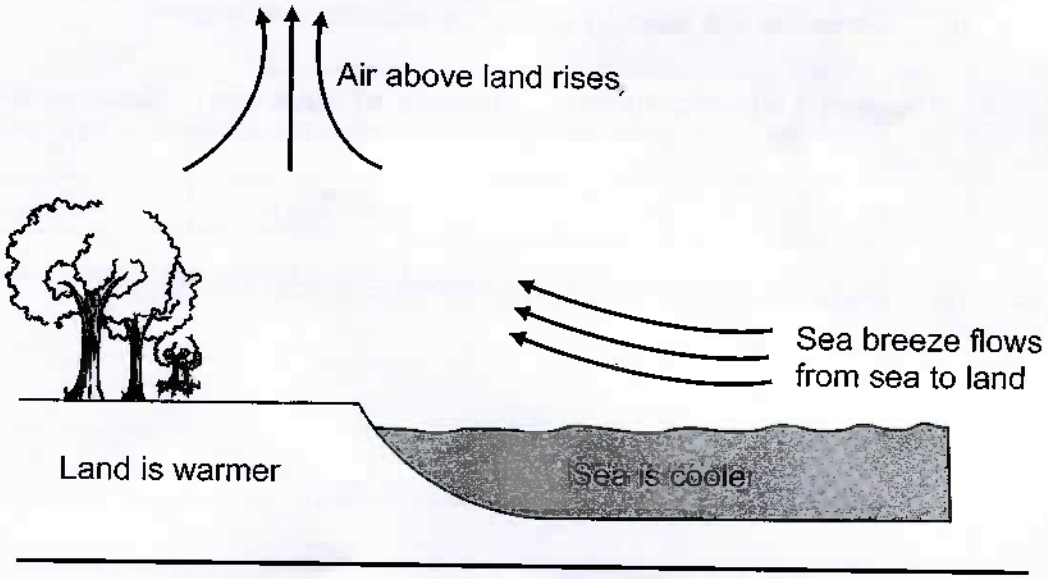
(iii) Explain your answer to **(b) (ii)**.

.....

..... (1)

For Examiner's use

10. **(a)** The diagram below shows the flow of air masses between land and sea during the day.



(i) Explain why the air above the land rises.

.....

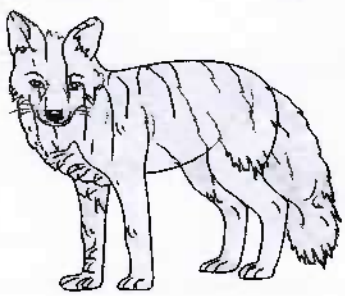
.....

..... (2)

(ii) State the method of heat transfer which enables the sea breeze to flow from sea to land.

..... (1)

(b) The diagram below shows two species of foxes living in different regions.



Fox living in hot regions

Fox living in cold regions

(i) Explain how the bigger ears help foxes from hot regions to maintain good body temperature.

.....

..... (2)

For Examiner's use

(ii) Describe how the fur helps foxes from cold regions to keep warm.

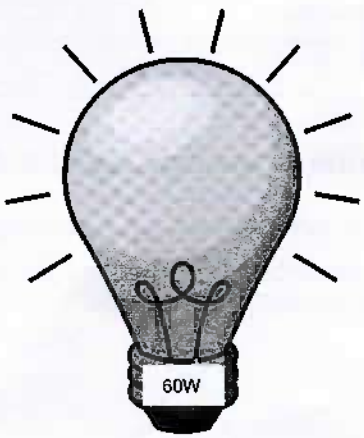
.....

..... (1)

(c) Suggest a suitable colour for houses in very hot countries.

..... (1)

The diagram below shows a filament bulb. Use it to answer question 11.



11. (a) (i) Name the physical quantity which the 60W value labelled on the bulb represents.

..... (1)

(ii) These days, people are encouraged to replace filament bulbs with fluorescent bulbs rated between 10W and 30W.

State why it is advisable to use fluorescent bulbs instead of filament bulbs.

.....

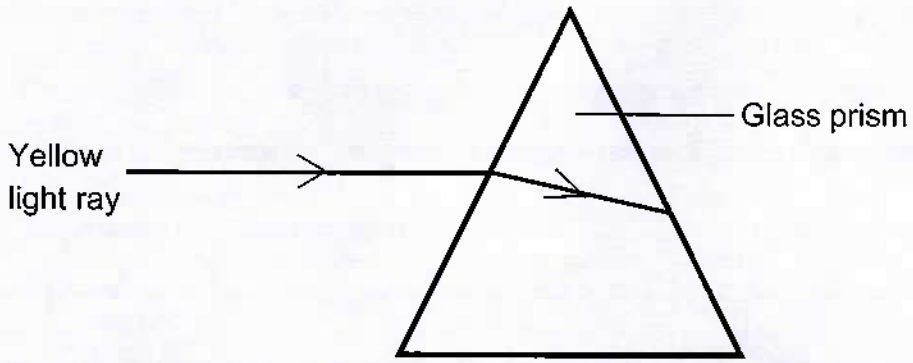
..... (1)

(b) Fill in the boxes below to show energy changes that take place in a lit filament bulb. (2)

[ ] energy → [ ] energy

For Examiner's use

12. The diagram below shows a ray of yellow light as it approaches and enters a glass prism.

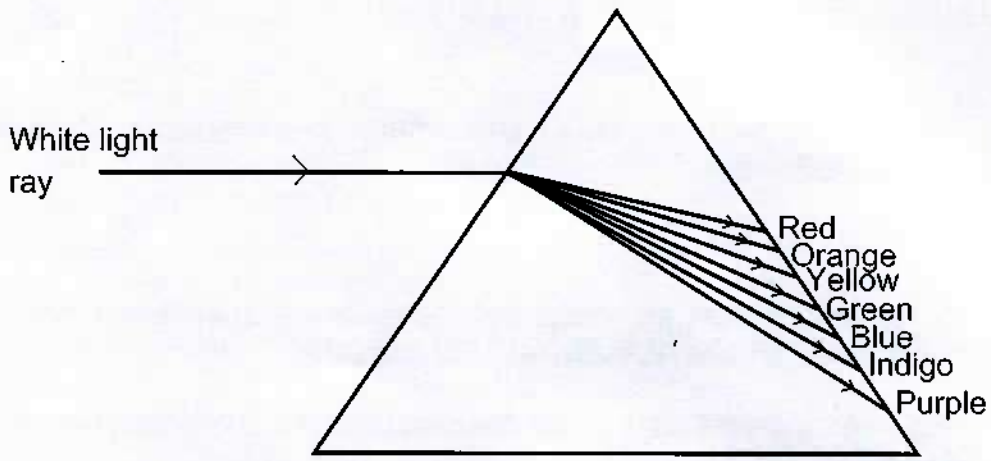


(a) **(i)** Name the process that leads to the yellow light ray changing direction as it enters the glass prism.

..... (1)

(ii) On the diagram, draw the yellow light ray as it leaves the glass prism. (1)

(b) The yellow light ray is then replaced by a white light ray. This leads to the white light ray separating as shown below.



(i) Name the phenomenon where the white light ray is separated into several colours by a triangular prism.

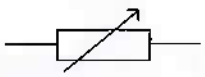
..... (1)

(ii) Which natural occurrence is a result of white light ray separating as shown on the diagram.

..... (1)

For Examiner's use

13. The table below shows circuit symbols for some circuit components. Two of the circuit components have been named.

Circuit symbol	Circuit component
	Variable resistor
	
	
	Connecting wires

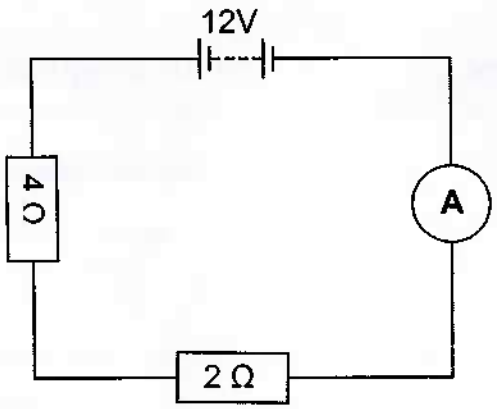
(a) **(i)** Complete the table by naming the remaining circuit components. (2)

(ii) Use the circuit symbols from the table to draw a parallel circuit on the space below.

(1)

For Examiner's use

(b) The diagram below shows a circuit.



(i) Calculate the total resistance in the circuit.

Total Resistance = ... Ω (2)

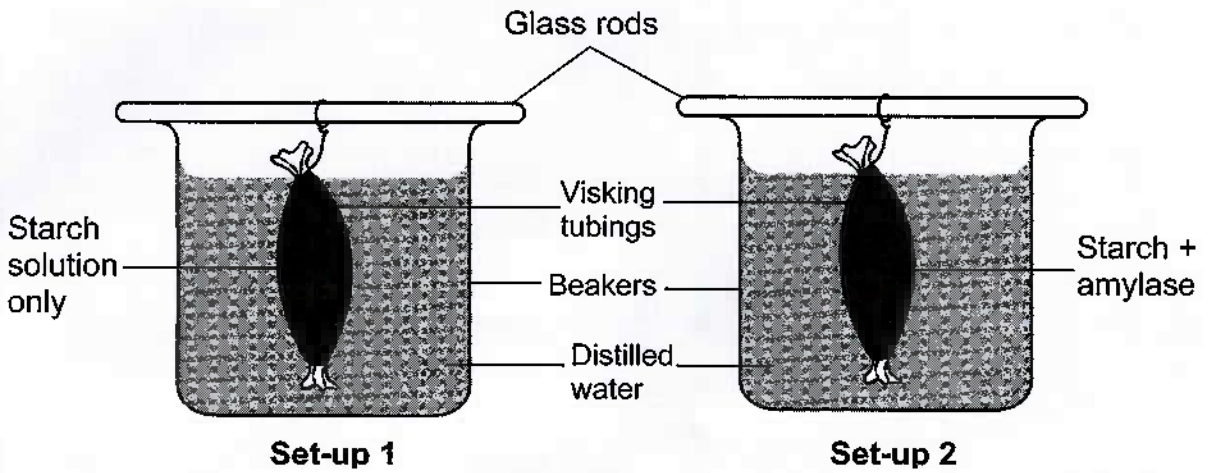
(ii) Calculate the current that will be read on the ammeter, *A*.

Current = ... *A* (2)

For Examiner's use

SECTION B (20 Marks)

A student performs an experiment to demonstrate digestion using the movement of particles in and out of a visking tube. The apparatus was arranged as shown in **Set-up 1** and **Set-up 2**.



14. After some minutes the student observed some differences in the appearance between **Set-up 1** and **Set-up 2**.

(a) **(i)** State **one** difference that the student will observe.

..... (1)

(ii) Explain the observation in **(a) (i)**.

..... (1)

(b) **(i)** Name a substance that would be found in distilled water at **Set-up 2** after an hour.

..... (1)

(ii) State the name of the solution used to test for the presence of the substance in **(b) (i)**.

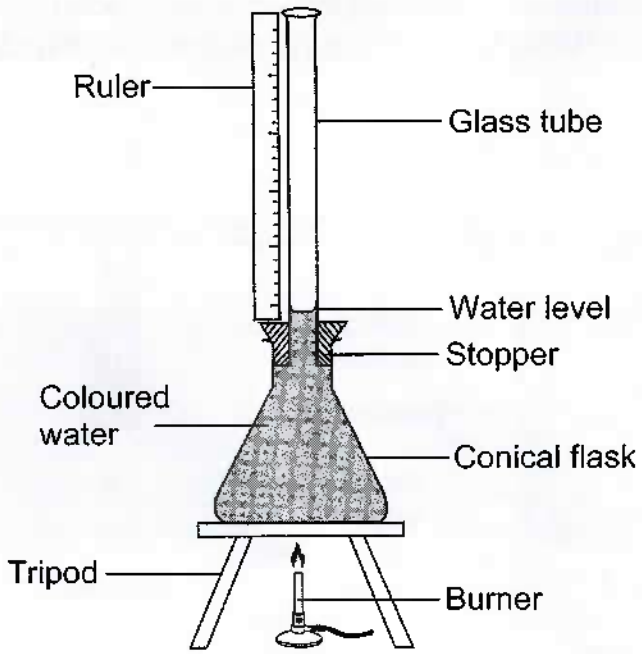
..... (1)

(c) Name an organ in the human body whose function is being demonstrated by the visking tubing.

..... (1)

For Examiner's use

15. A student uses the set-up below to determine the rate at which the level of water rises when water is heated.



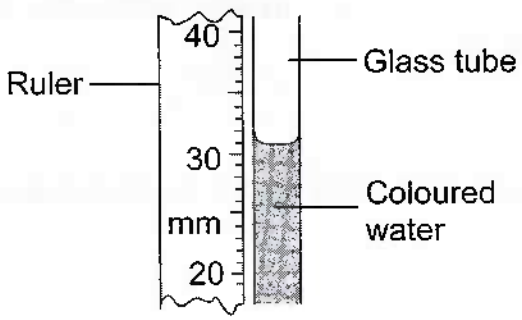
(a) The rise in water level in the glass tube was measured every 20 seconds and recorded in a table below.

Time / seconds	0	20	40	60	80	100	120	140	160
Rise in water level / mm	0	8	17	23		41	47	56	63

(i) Name an instrument that is likely to have been used to measure the time taken.

..... (1)

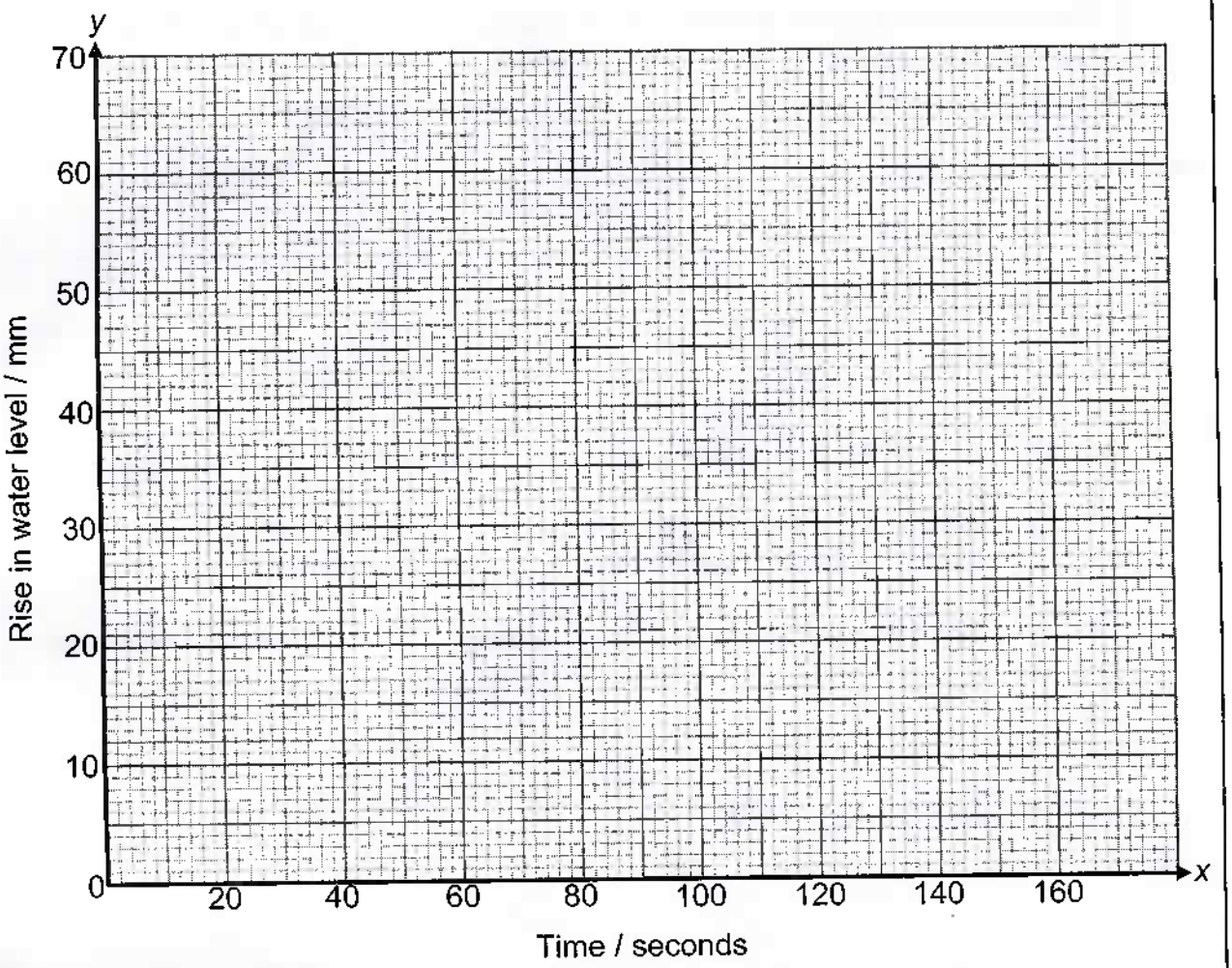
(ii) The diagram below shows the level of water after 80 seconds of heating the water.



Read and record in the table above the level of water after 80 seconds. (1)

For Examiner's use

(b) (i) Plot a graph of rise in water level against time on the grid below. (4)



(ii) Determine the rate at which the water level rises, which is the gradient of the graph. Show your working.

Rate of rise of water level = ... (3)

(c) State **one** source of error in this experiment when measuring the rise in water level.

..... (1)

For Examiner's use

Use the information below to answer question 16.

Some students wanted to keep fish in a tank. They researched and discovered that fish needs water at pH between 7 and 8.

16. (a) Define pH.

.....

..... (1)

(b) The water in the tank was found to be slightly acidic.

(i) Which of the following substances can be added to the water to make it suitable for the fish. Place a Tick (✓) in the correct box. (1)

Sodium Hydroxide pellets	**Vinegar**	**Calcium carbonate**
☐	☐	☐

(ii) Explain your choice.

.....

..... (2)

(iii) Suggest what the student could do in order to confirm whether the pH of water is suitable for fish or not.

.....

..... (1)

DATA SHEET
The Periodic Table of the Elements

Group I	Group II										Group III	Group IV	Group V	Group VI	Group VII	Group 0
																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 = 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.).