BOTSWANA EXAMINATIONS COUNCIL

JUNIOR CERTIFICATE EXAMINATION

SCIENCE

14/2

Paper 2

October/November 2020

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 16.

FOR EXAMINER'S USE ONLY

Section	Marks Scored
A	
B	
Total Marks	

*This question paper contains **16** printed pages.*

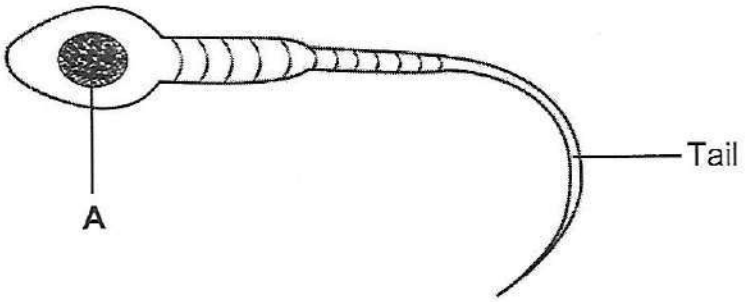
199112

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

For Examiner use

SECTION A (60 Marks)

The diagram below represents a human sperm cell. Use it to answer question 1.



1. **(a)** **(i)** Name the part labelled **A**.

..... (1)

(ii) State the function of part **A**.

..... (1)

(b) State the importance of the structure of a sperm cell to its function.

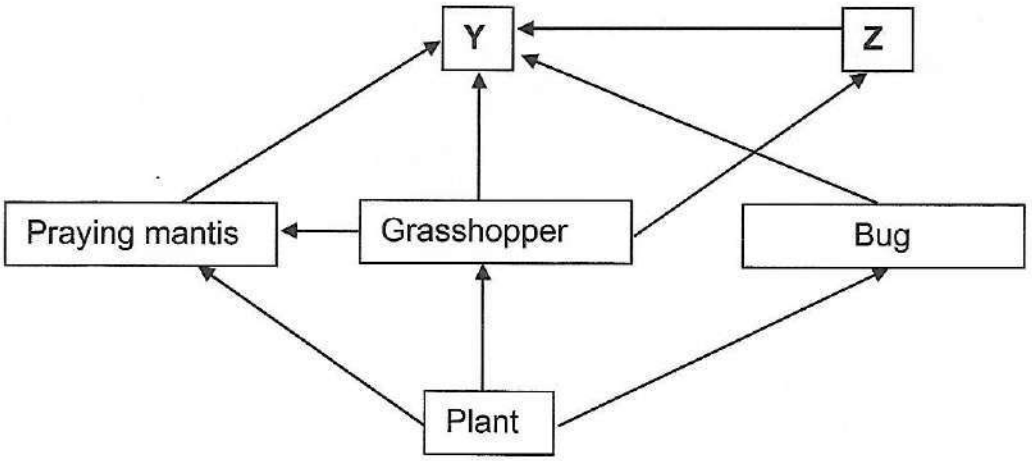
..... (1)

(c) State **one** structural difference between a human egg cell and a human sperm cell.

..... (1)

For Examiner's use

The diagram below represents a relationship of organisms in a habitat. Some organisms are identified only as Y and Z. Use it to answer question 2.



2. **(a)** State the name of the relationship represented by the diagram.

..... (1)

(b) From the diagram, name an organism which is:

(i) an omnivore .....

(ii) a carnivore .....

(iii) a tertiary consumer ..... (3)

(c) State any **two** long term effects of killing all praying mantises in the habitat.

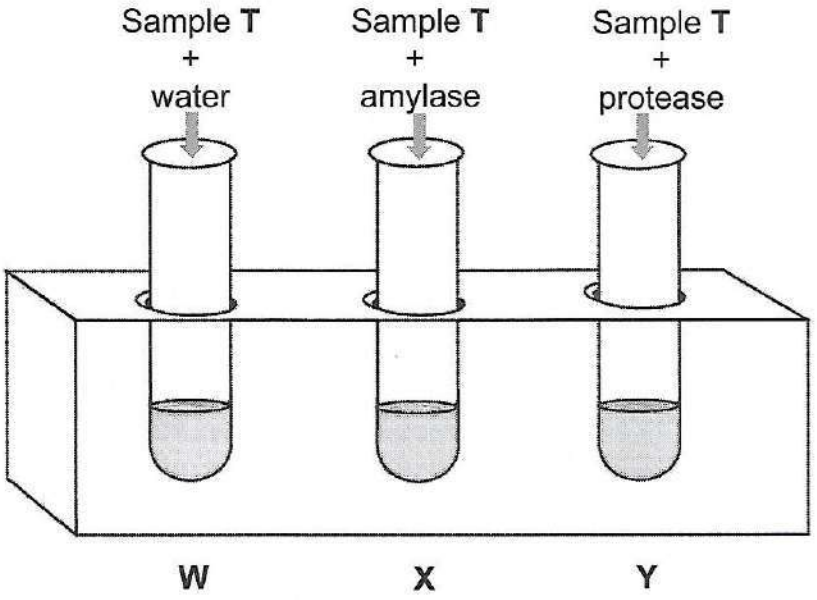
.....

..... (2)

For Examine use

The diagram below shows a set up used by a student to investigate enzyme action. Use the diagram and the information below to answer question 3.

Equal amounts of food sample **T** were placed in each of test tubes **W**, **X** and **Y**. To test tube **W**, 2 ml of water was added. To test tube **X**, 2 ml of amylase solution was added and to test tube **Y**, 2 ml of protease was added.



3. After an hour, the starch test and a protein test were conducted on the contents of test tubes **W**, **X** and **Y**.

(a) **(i)** Complete the table below to show the results of the food tests. Indicate with a tick (✓) for presence or a cross (x) for absence of starch and protein in the test tubes. **W** has been done for you.

	W	**X**	**Y**
Starch	✓		
Protein	✓		

(2)

(ii) State the colour change that was observed for the protein test in test tube **W**.

..... (1)

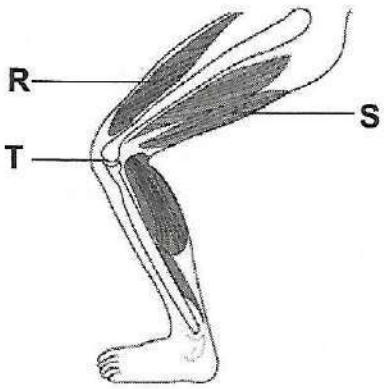
(b) In a different investigation, the temperature of food sample **T** was increased to 70°C and immediately amylase solution was added.

Describe the results of this investigation.

..... (1)

For Examiner's use

The diagram below shows a human leg with some parts identified as R, S and T. Use it to answer question 4.



4. **(a)** Describe how muscles **R** and **S** straighten the leg.

..... (1)

(b) Name the type of joint at **T**.

..... (1)

(c) Name an organ in the human body which is protected by the vertebrae.

..... (1)

Use the information below to answer question 5.

A student carried out an investigation on a 250 g fresh piece of meat. The fresh piece of meat contains 100 g of proteins. The student sun-dried the piece of meat and found its mass to be 150 g upon weighing it.

5. **(a)** Why is the mass of the dried piece of meat different from the mass of the fresh piece of meat?

..... (1)

(b) How does the amount of protein in dried meat compare to the one in fresh meat?

..... (1)

(c) State **one** reason for drying meat.

..... (1)

For Examiner use

Use the information below to answer question 6.

A student collected a water sample from a river. The water sample contained insoluble clay. The water was too salty. The student used a universal indicator to determine the pH of the water which he found to be pH 9.

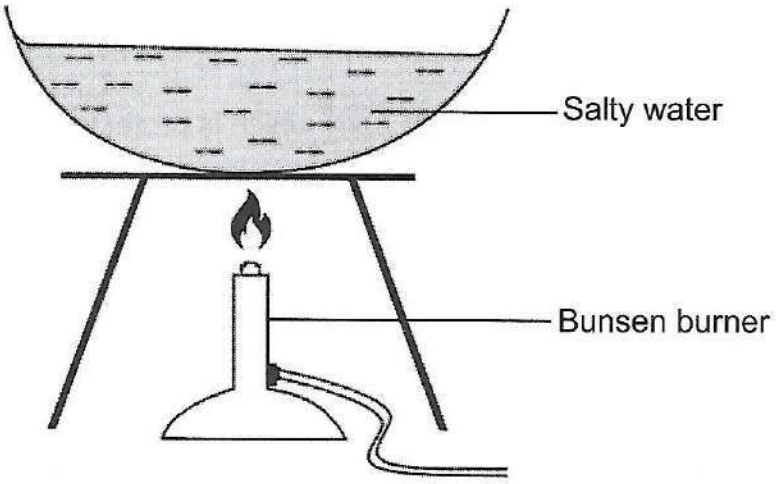
6. **(a)** What was the colour of the universal indicator in the water sample?

..... (1)

(b) Name a method which can be used to separate the clay from the water sample.

..... (1)

After removing the clay, the student then heated the salty water to obtain the salts as shown in the diagram below.



(c) **(i)** State whether the concentration of the salty water **stays the same, increases** or **decreases** as it is being heated.

..... (1)

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

..... (1)

(d) Explain how the boiling point of salty water compares with that of pure water.

.....

..... (2)

For Examiner's use

7. A clean pot made of iron was left unused. A reddish-brown layer was formed on the inside surface of the pot after some time.

(a) Name the reddish-brown layer formed.

..... (1)

(b) State **two** other substances that lead to the formation of the reddish-brown layer in the pot.

.....

..... (2)

(c) **(i)** During manufacturing of pots, iron can be mixed with other metals to prevent the formation of the reddish-brown layer.

State the name given to such a mixture of iron and other metals.

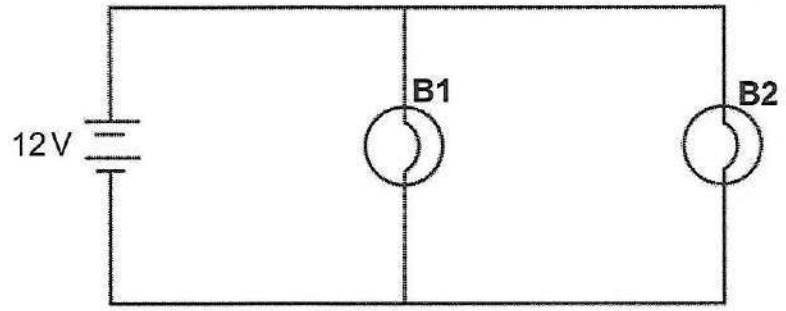
..... (1)

(ii) Give **one** example of such a mixture and provide its use apart from making pots.

Example ..... (1)

Use ..... (1)

The circuit diagram below shows a battery used to power two identical bulbs, B1 and B2. Use it to answer question 8.



8. **(a)** Name the type of circuit shown.

..... (1)

(b) The resistance of each of the bulbs is 6 Ω.

Calculate the current through:

(i) Bulb **B1**,

Current = ...A (2)

(ii) the battery.

Current = ...A (2)

(c) Tick (✓) in one of the boxes below, to show a fuse suitable for protecting both bulbs.

3A fuse ☐

5A fuse ☐

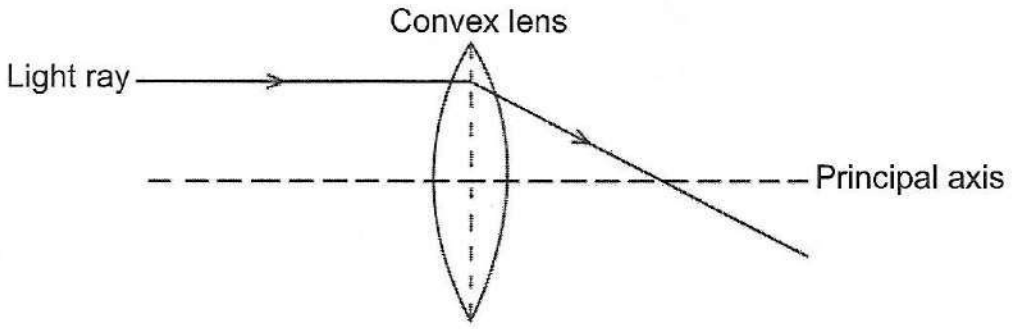
10A fuse ☐ (1)

(d) The bulbs give out light.

State another form of energy given out by the bulbs.

..... (1)

The diagram shows a ray of light passing through a convex lens.
Use it to answer question 9.



9. **(a)** **(i)** Label the focal point of the lens with the letter **F**. (1)

(ii) Measure the focal length of the lens.

Focal length = ... cm (1)

(b) Draw another ray parallel and below the principal axis until it passes through the lens. (2)

(c) Name **two** instruments that use a convex lens.

.....

..... (2)

(d) Describe how a rainbow is formed.

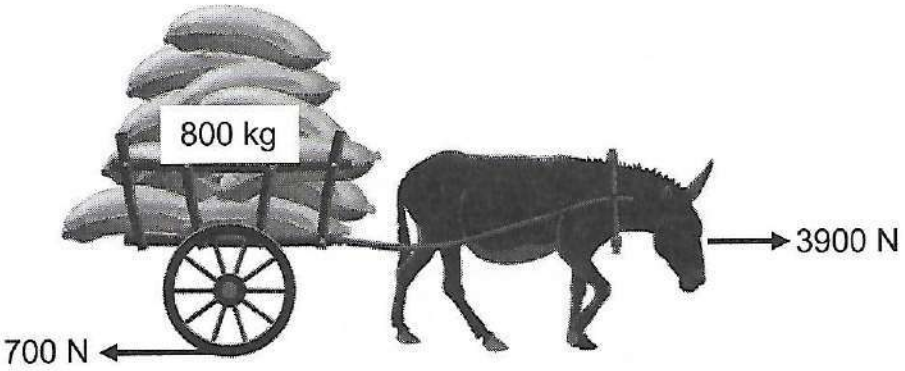
.....

.....

..... (2)

For Examin use

The diagram below shows a donkey applying a force of 3900 N to pull an 800 kg cart along a straight line. The frictional force acting on the cart's motion is 700 N. Use it to answer question 10.



10. **(a)** Friction force is a vector quantity.

Define a vector quantity.

..... (1)

(b) Calculate:

(i) the resultant force acting on the cart.

Resultant force = ... N (2)

(ii) the acceleration of the cart.

Acceleration = ...m/s^2 (2)

(c) Describe how the speed of the cart changes with time.

.....

.....

..... (2)

For Examiner's use

11. Coal is mined and burned to generate electricity.

(a) Give **two** environmental impacts of mining coal.

.....

..... (2)

(b) State the main energy change when coal burns.

.....

..... (2)

(c) Name **two** possible natural disasters that can result from excessive burning of coal for many years.

.....

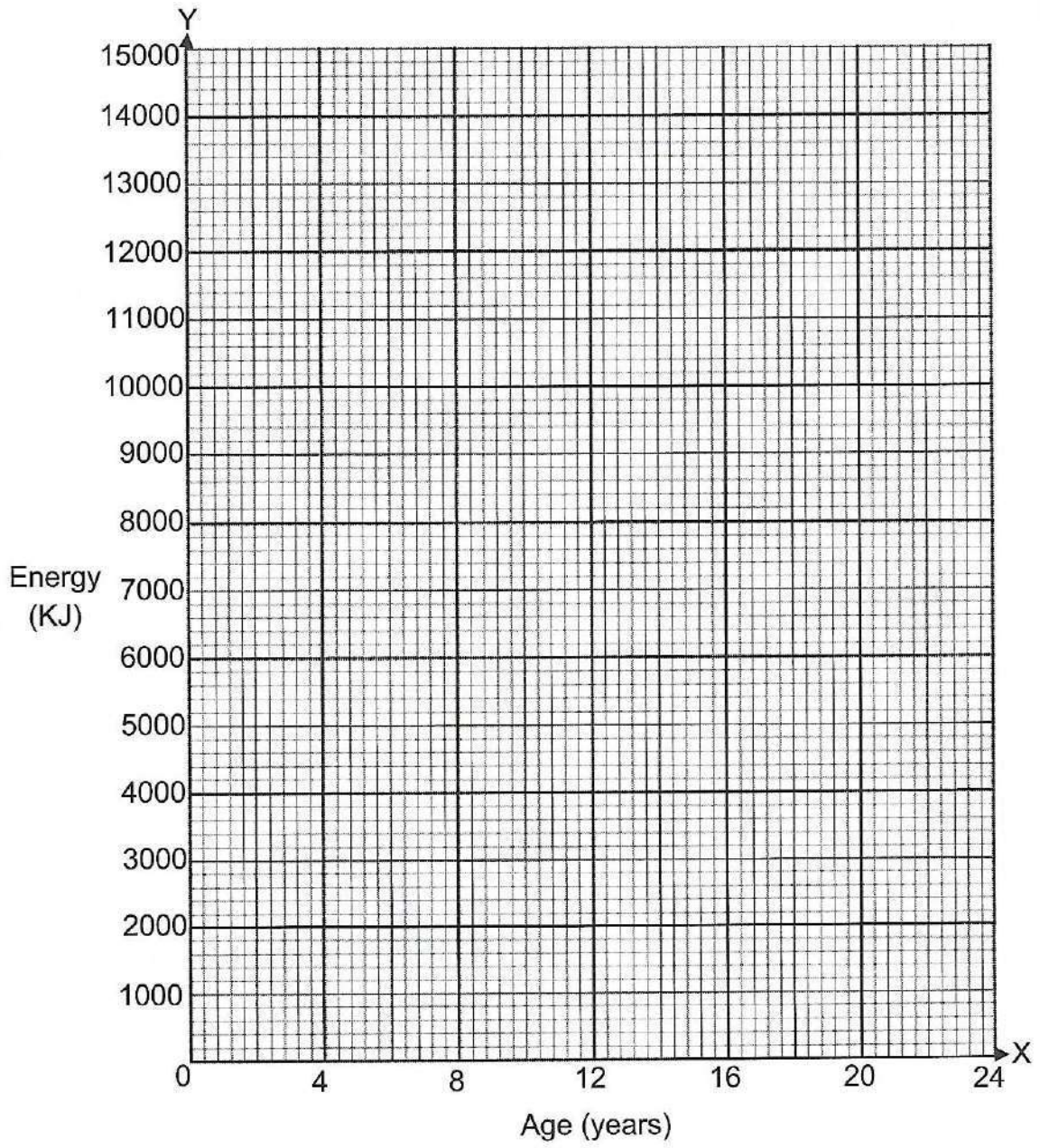
..... (2)

SECTION B (20 Marks)

The table below shows the average daily energy requirements of people of different ages. Use it to answer question 12.

Ages (years)	Energy required (KJ)
1	3 000
2	4 000
6	6 000
12	9 200
16	12 000
18	13 000
20	14 200

12. (a) Using information from the table, plot a graph of energy required against age on the axes given below. (4)



For Examiner use

(b) From the graph, determine the energy requirement of a 10 year old. Show your working.

..... (2)

(c) What conclusion can be made from the graph?

.....

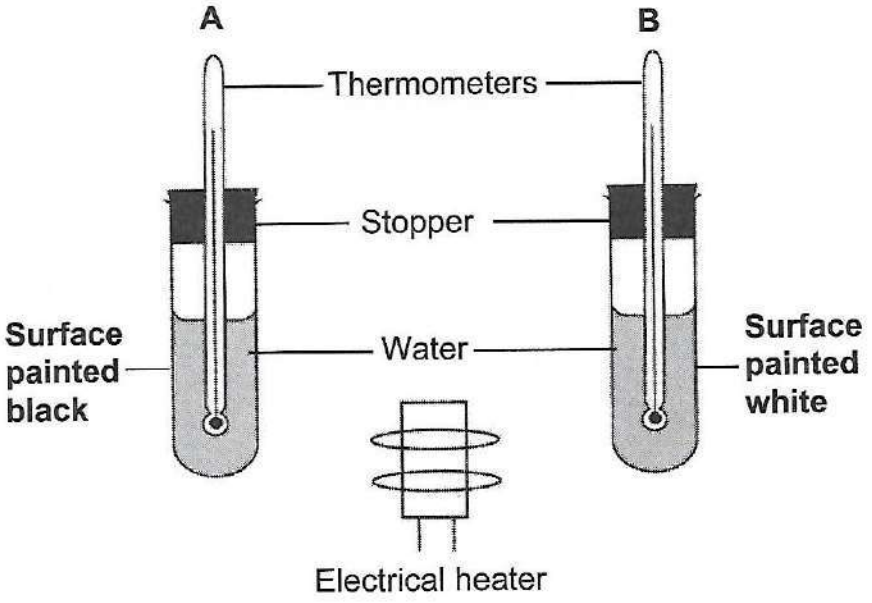
..... (2)

(d) Define a balanced diet.

.....

..... (2)

The diagram below shows a set up used in an experiment to compare heat absorption between black and white surfaces. Use it to answer question 13.



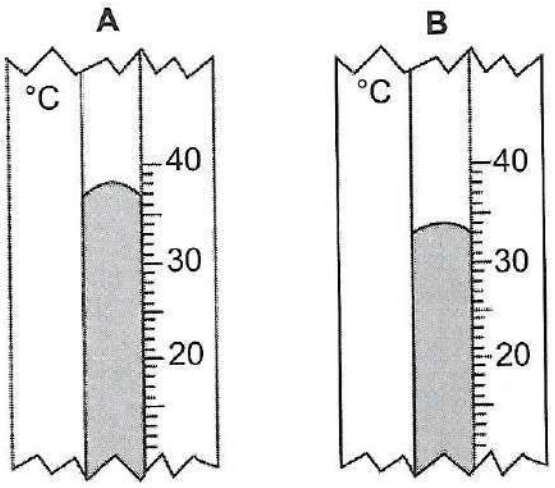
13. The two thermometers show the same reading before the heater is switched on.

(a) Give **two** other variables that need to be **equal** at the start of the experiment.

.....

..... (2)

The diagram below shows part of the scales for the two thermometers after the heater was switched on for some time.



(b) Record the temperature readings shown by thermometers **A** and **B**.

Thermometer **A** = ...

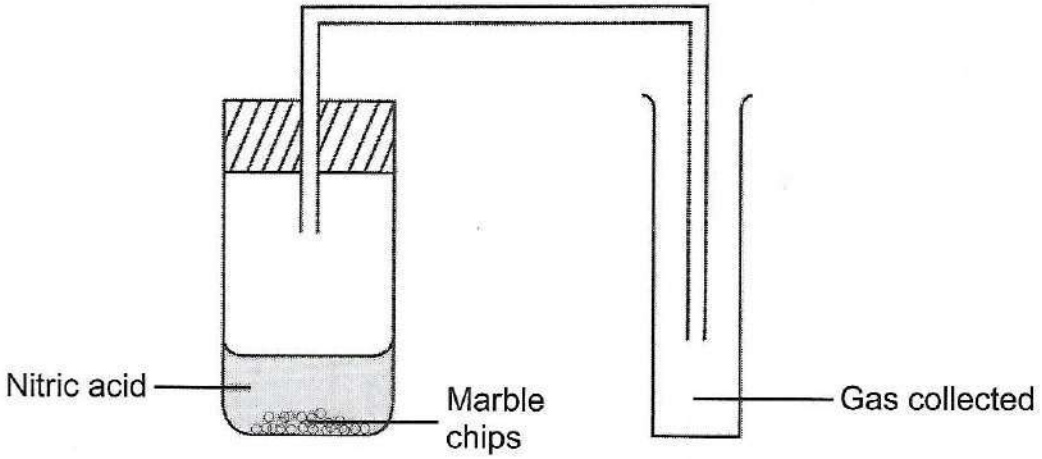
Thermometer **B** = ... (2

For Examiner's use

(c) What conclusion can be drawn from this experiment?

..... (1)

The diagram below shows a set up used by a student to investigate the reaction of nitric acid and marble chips, a carbonate.
Use it to answer question 14.



14. **(a)** **(i)** Name the gas that is produced from the reaction.

..... (1)

(ii) Describe the test for the gas produced from the reaction.

Test

..... (1)

Result

.....

..... (1)

(b) Explain why it is possible to collect the gas produced using the method shown in the diagram.

..... (1)

(c) Name **one** other substance produced during the reaction.

..... (1)

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.).

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