

## EXAMINATION PAPER 13 + Academic Scholarship 2024

# Science (Paper 1)

Time allowed: 1 hour

Name: \_\_\_\_\_

#### Instructions

- Write your name clearly in the space above.
- Answer on this paper.
- Calculators <u>are</u> allowed.
- Answer ALL the questions in all sections.
- You are expected to write clearly and accurately throughout each of your answers. You should leave some time towards the end of the examination to check your work carefully.
- The maximum number of marks for this paper is **57**.

### SECTION ONE: PHYSICS [20 marks]

1. A student determines the density of a solid metal cube.

Which piece of equipment should the student use?

- A) A balance and force meter
- B) A balance and ruler
- C) A micrometer and a measuring cylinder
- D) A ruler and a measuring cylinder

Answer \_\_\_\_\_

[1 mark]

2. The diagram shows a burning candle.



Which energy store is associated with the burning candle?

- A) Chemical
- B) Elastic
- C) Electrostatic
- D) Nuclear

Answer \_\_\_\_\_

3. Bar magnets and various non-magnetic and demagnetised metal bars are placed in the different arrangements shown.

In which arrangement do the bars repel?



[1 mark]

4. A house is to thermally insulated to reduce the thermal energy loss and reduce fuel costs.



Which type of thermal insulation pays back the cost of insulation in the shortest time?

- A) Cavity wall insulation
- B) Double glazing
- C) Draught proofing
- D) Loft insulation

Answer \_\_\_\_\_

5. A uniform horizontal beam, pivoted at its right-hand end, is in equilibrium. A force of 60N acts vertically upwards on the beam as shown.



- B) 40N
- C) 90N
- D) 100N

Answer \_\_\_\_\_

[1 mark]

6. Light is incident on a mirror at an angle of 45° as shown. The mirror can be rotated about an axis into the page through point X.



The mirror is rotated until the light is reflected back along its original path.

Through which angle is the mirror rotated?

- A) 22.5° clockwise
- B) 22.5° anticlockwise
- C) 45° clockwise
- D) 45° anticlockwise

Answer \_\_\_\_\_

7. Figure 1. shows a set of masses made from the same material.



Figure 1.

(a) Identify the quantity that is the same for all the masses

Tick **one** box.



[1 mark]

(b) The largest mass is 2.5kg.

State the number of grams in 2.5kg.

2.5kg = \_\_\_\_\_ g

[1 mark]

(c) The three largest masses are 2.5kg, 1.0kg and 0.5kg.

Calculate the combined **weight** of these three masses. Include the unit.

weight = \_\_\_\_\_

[4 marks]

8. A student pushes a drawing pin into a wooden board, as shown in Figure 2.



The area of the pin in contact with the finger is  $5.0 \times 10^{-2} \text{m}^2$ . The student pushes downwards with a force of 26N.

The mass of the drawing pin is very small.

(a) Calculate the pressure exerted by the finger on the drawing pin.

Pressure =\_\_\_\_\_ Pa

[2 marks]

(b) Compare the force exerted by the finger on the drawing pin with the force exerted by the drawing pin on the wooden board.

\_\_\_\_\_ [1 mark]

(c) Explain why the drawing pin goes into the wooden board but not into the finger.



9. A bag filled with water is punctured with several holes. This is shown in Figure. 3.



Figure 3.

(a) Explain why the water emerges from each hole in a direction at right angles to the surface of the bag.

\_\_\_\_\_ [2 marks]

(b) The holes at A and B are the same size.

Explain why the water emerges faster from the hole at A than from the hole at B.



## SECTION TWO: CHEMISTRY [20 marks]

#### A periodic table is provided

			·	1				
	0	Helium 22 Helium	20 20 10 10 10 10 10 10 10 10 10 10	84 Krypton 36	131 Xenon 54	222 Radon 86		
	7		19 Fluorine 35.5 Chlorine	80 Bromine 35	127 Iodine 53	210 At Astatine 85		
	9		16 Oxygen 8 Sultur Sultur	79 Selenium 34	128 Te Tellurium 52	210 Polonium 84		
	2ı		Nitrogen 7 7 Phosphorus	75 AS Arsenic 33	122 Sb Antimony 51	209 Bis muth 83		
	4		Silicon Silicon Silicon	73 Germanium 32	55 TS -19	Pb Lead 82		
	ო		11 Boron 5 27 Autominium	70 Gallium 31	115 Indium 49	204 Thallium 81		
				65 Zn Zinc 30	112 Cd 48	201 Mercury 80		
TABLE				63.5 Copper 29	108 Ag Silver 47	197 Au Gold 79		
liodic				28 Nickel 28 28	106 Pd Palladium 46	195 Platinum 78		
HE PEP				59 Cobalt 27	103 Rhodium 45	192 Iridium 77		
É				56 Fe	101 Ruthenium 44	Osmirm 76 76	Se ac	
	Group	Hydrogen +		55 Mn Manganese 25	99 TC 43	186 Rhenium 75	Key Relative ato mass Symbol Name Atomic numi	
				52 Cr Chromium 24	96 Mo Molybdenum 42	184 V 74 74		
				51 Vanadium 23	93 Niobium 41	181 Tantalum 73		
				48 Titanium 22	91 Zr Zirconium 40	179 Hathium 72		
				45 Scandium 21	89 ۲ttrium 39	139 Lanthanum 57 AC AC 89		
	N		9 Be Paryllium 24 Mg Mg Mg Mg	Calcium 20 Calcium 20 Calcium	88 Strontium 38	137 Barium 56 226 Radium 88		
	-		Lithium 13 Sodium Sodium	39 Potassium 19	86 Rb Bubidium 37	133 CS Caesium 55 223 Fr Francium 87		
		Period 1	0 0	4	2 2	- 9		

1. The three states of matter are solid, liquid and gas.

What is the name of the change of state when a liquid changes into a solid?

- A) Condensation
- B) Evaporation
- C) Freezing
- D) Melting

Answer \_\_\_\_\_

[1 mark]

2. The diagrams represent some elements, compounds and mixtures.



Which row best describes the diagrams?

	1	2	3	4
Α	element	mixture of compounds	compound	mixture of elements
в	compound	mixture of compounds	element	mixture of elements
С	element	mixture of elements	compound	mixture of compounds
D	compound	mixture of elements	element	mixture of compounds

Answer \_\_\_\_\_

[1 mark]

- 3. Which of the following is true for most metals?
  - A) They are dull
  - B) They have low melting points
  - C) They are found on the right hand side of the periodic table
  - D) They are malleable

Answer \_\_\_\_\_

4. When solid sodium chloride is mixed with water, sodium chloride solution forms.

What name is given to the process of mixing a solid with water to form a solution?

- A) Crystallizing
- B) Diluting
- C) Dissolving
- D) Melting

Answer \_\_\_\_\_

[1 mark]

5. Which row of the table shows the correct formula of sodium chloride and of water?

	Sodium chloride	Water
А	NaCl <sub>2</sub>	H <sub>2</sub> O
В	NaCl <sub>2</sub>	HO <sub>2</sub>
С	NaCl	H <sup>2</sup> O
D	NaCl	H <sub>2</sub> O

Answer \_\_\_\_\_

[1 mark]

6. The reactivity of copper, magnesium and zinc was investigated.

Each metal was placed separately in dilute hydrochloric acid.

The amount of effervescence was observed.

a. The same mass of metal was used in each experiment.

Which piece of apparatus should be used to find the mass of metal used?

- A) A balance
- B) A pipette
- C) A stopwatch
- D) A thermometer

Answer \_\_\_\_\_

b. State two variables, apart from the mass of the metals, that should be controlled in this investigation.

1	
2	
۲ <u>ــــــــــــــــــــــــــــــــــــ</u>	
	[2 marks]
Magnesium produces the most vigorous effervescence.	

c.

Copper does not produce any effervescence.

Give the reason why copper does not produce any effervescence

[1 mark]

d. The magnesium reacts with dilute hydrochloric acid to form magnesium chloride solution and hydrogen gas.

The equation for the reaction is:

 $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(\_\_\_) + H_2(\_\_\_)$ 

Fill in the missing state symbols in the spaces provided.

7. The apparatus for a simple distillation is shown below:



a. Use words from the box to complete the sentences.

You may use each word once, more than once, or not at all.

condensation	distillate	evaporation
gas	residue	solid

Simple distillation is used to separate a liquid from a \_\_\_\_\_

In the apparatus labelled A, vapour is cooled to form liquid.

This process is called \_\_\_\_\_\_.

The liquid collected in the beaker is known as the \_\_\_\_\_\_.

[2 marks]

b. Pure water collects in the beaker.

Explain how the apparatus will show that the liquid collected is pure water.

[2 marks]

A beaker of barium chloride solution and a beaker of dilute sulfuric acid were placed on a balance, as shown.



The total mass reading on the balance was 25.7 g.

The dilute sulfuric acid was poured into the barium chloride solution and the beaker replaced on the balance, as shown.



The mixture formed contained a white precipitate.

c. State the total mass reading on the balance after the reaction

[1 mark]

d. Complete the equation below with the name of the white precipitate formed by the reaction of barium chloride solution with dilute sulfuric acid.

Barium chloride + sulfuric acid  $\rightarrow$  hydrochloric acid + \_\_\_\_\_.

8. A substance is heated at a constant rate and its temperature is taken every minute.

During the heating, the substance undergoes one change of state.

The results are shown on the graph below:



Explain the shape of the graph in terms of the changes in the movement and arrangement of the particles as the substance is heated.

\_ [4 marks]



### SECTION THREE: BIOLOGY [17 marks]

1. Match up the words in the first column with the descriptions in the second column.

Stomach	Pumps blood around an animal's body.
Heart	Remove impurities from the blood.
Lungs	Controls many of the life processes in animals.
Kidneys	Allow oxygen to enter the body.
Brain	Stores and churns food.
Liver	Deals with food taken into the body through the intestines .

[4 marks]

2. Match up the words in the first column with the descriptions in the second column.

Leaf	Make the plant's sex cells.
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Roots Holds leaves up close to the light.

Stem Absorb minerals from the soil.

Flowers Traps sunlight.

[2 marks]

- 3. All organisms require water and oxygen. Animals also need nutrients as part of a balanced diet.
  - (a) List the five nutrients an animal must take in to survive.

\_\_\_\_\_ [3 marks]

(b) Explain why all organisms require oxygen.	
	[2 marks]
(c) Which nutrient provides energy in a balanced diet?	
	[1 mark]
(d) Which nutrient do doctors suggest should be limited in a balanced diet	?
	[1 mark]
(e) Suggest how a balanced diet may differ between a teenage athlete and older person.	a sedentary,

4. Think about how plants and animals differ in the way they feed themselves. Explain how this difference means that plants don't need to move much but animals do.

\_\_\_\_\_ [2 marks]