



EAST SPRING SECONDARY SCHOOL
Towards Excellence and Success

Name: ()

Class:

Preliminary Examination 2020
Secondary 4 Express

CHEMISTRY
Paper 1

6092/01

15 September 2020
Tuesday

1 hour
0800 - 0900

Additional materials:
OTAS

INSTRUCTIONS TO CANDIDATES

1. Write your name and register number in the spaces above and on the OTAS.
2. This paper consists of 40 multiple choice questions **[40 marks]**

Answer **ALL** questions. For each question, there are four possible answers, A, B, C and D. Choose the most suitable answers and record your choice using a 2B pencil on the OTAS.
3. Hand in the OTAS and Question paper separately.
4. The use of calculator is allowed.
5. A copy of the Periodic Table is given on page 16.

- 1 A gas, T, has the following properties:

- 1 has a pungent smell
- 2 turns damp blue litmus paper red
- 3 decolourises purple acidified potassium manganate(VII)

What is T?

- A ammonia
 - B carbon dioxide
 - C chlorine
 - D sulfur dioxide
- 2 Both aqueous sodium carbonate and sodium hydroxide solution turn red litmus paper blue.

Which one of the following substances can be used to differentiate the two solutions?

- A aqueous potassium sulfate
 - B aqueous calcium nitrate
 - C dilute sulfuric acid
 - D carbon dioxide
- 3 50 cm³ of methane, CH₄, diffused through a porous pot in 100 s. 50 cm³ of gas Y took 400 s to diffuse under the same conditions of temperature and pressure.

What could gas Y be?

- A ammonia
- B carbon dioxide
- C hydrogen
- D sulfur dioxide

- 4 The table shows information about ions **Q** and **R**.

	number of proton	number of neutrons	number of electrons
Q	16	18	18
R	17	18	18

What are **Q** and **R**?

- A** positive ions of the same element
B positive ions of different elements
C negative ions of the same element
D negative ions of different elements
- 5 Which statement(s) correctly describe(s) the properties of the mixture of iron and sulfur, and the compound iron(II) sulfide, FeS?
- 1 The ratio of iron to sulfur in mixture is fixed, but varies in the compound iron(II) sulfide.
 - 2 Compound iron(II) sulfide does not have the properties of iron and sulfur but mixture of iron and sulfur has.
 - 3 There is heat and light given out during formation of the mixture of iron and sulfur.
- A** 1 only
B 2 only
C 2 and 3
D 1 and 3
- 6 Which row shows the substances in the increasing order of melting point?

	lowest melting point	—————→	highest melting point
A	sodium	diamond	lead(II) bromide
B	sodium	lead(II) bromide	diamond
C	diamond	lead(II) bromide	sodium
D	lead(II) bromide	diamond	sodium

- 7 The table below shows the electrical conductivity of four substances **E**, **F**, **G** and **H**.

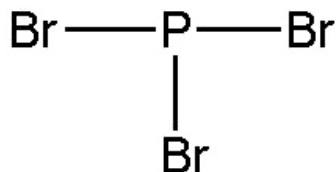
substance	solid state	liquid state	aqueous state
E	X	X	√
F	X	√	√
G	X	X	X
H	√	√	insoluble in water

key:
√ = can conduct electricity

X = cannot conduct electricity

Which of the substance is likely to be hydrogen bromide?

- A substance E
 - B substance F
 - C substance G
 - D substance H
- 8 The diagram shows a molecule of phosphorus tribromide.



How many pairs of electrons in phosphorus atom are not involved in bonding?

- A 2
 - B 4
 - C 5
 - D 6
- 9 The formula of an oxide of element **R** is **R₂O**.
6.2 g of **R₂O** contains 4.6 g of **R**.

How many moles of **R** ions does 6.2 g of **R₂O** contain?

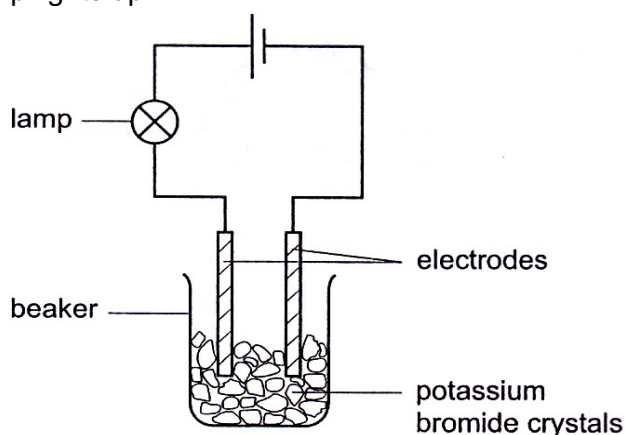
- A $\frac{1.6}{16} \div 2$
- B $\frac{1.6}{16} \times 2$
- C $\frac{6.2}{16 \times 2}$
- D $\frac{6.2}{16} \times 2$

- 10 68 g of impure hydrogen peroxide, H_2O_2 ($M_r = 34$) decomposes in the presence of manganese(IV) oxide, to produce 2.4 dm^3 of oxygen gas at room temperature and pressure as shown in the equation.



What is the purity of the hydrogen peroxide?

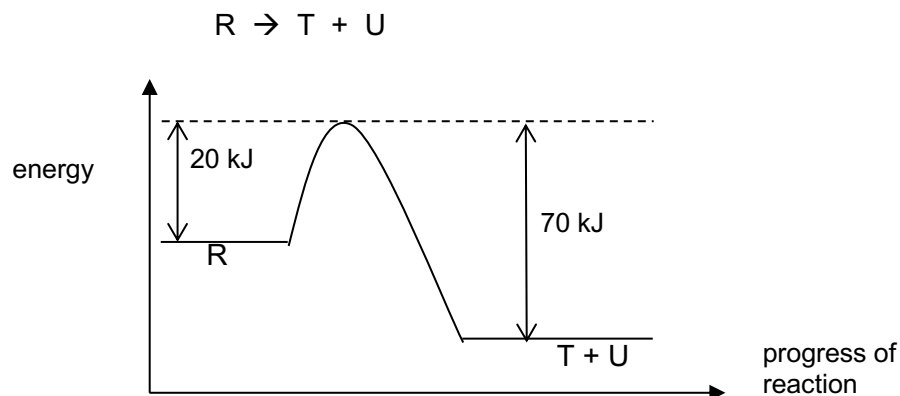
- A 2.5 %
B 5.0 %
C 10.0 %
D 15.0 %
- 11 In the set-up shown, the lamp does not light. Distilled water is then added to the beaker and the lamp lights up.



Which statement explains these results?

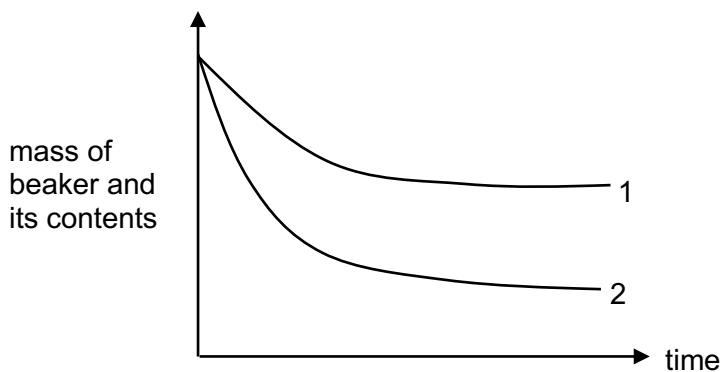
- A Electrons are free to move in the solution when potassium bromide dissolves.
B Metal ions are free to move when potassium bromide melts.
C Metal ions are free to move when potassium reacts with water.
D Oppositely charged ions are free to move in the solution when potassium bromide dissolves.
- 12 Which statement describes what happens in a hydrogen-oxygen fuel cell?
- A Electricity is generated directly.
B Electricity is used to produce water.
C Hydrogen is burned to produce steam.
D Hydrogen reacts to form fuel.

- 13 The diagram below represents the energy profile diagram for the following reaction:



What is the enthalpy change for this reaction?

- A + 50 kJ
 B - 50 kJ
 C - 70 kJ
 D + 90 kJ
- 14 Excess zinc was added to a beaker of dilute nitric acid on an electronic balance. A graph of the mass of the beaker and its contents was plotted against time as shown by **Curve 1** below:

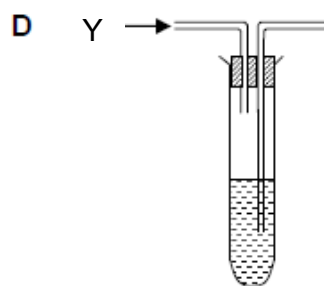
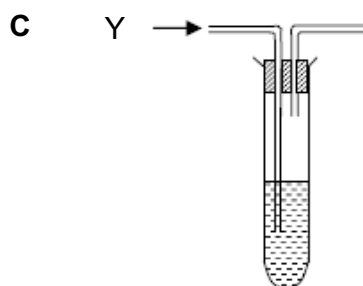
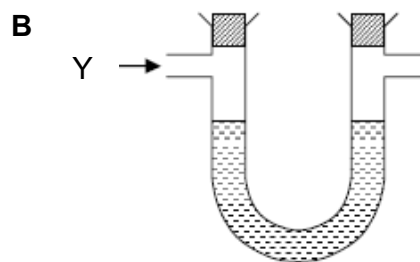
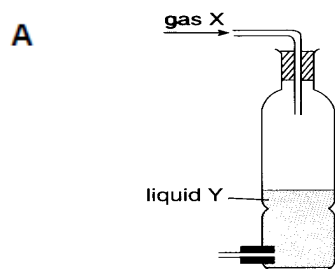


What change(s) in the experiment would give **Curve 2**?

- I The same mass of zinc but in smaller pieces.
 II The same volume of nitric acid but at a higher concentration.
 III The same volume of nitric acid but at a higher temperature.

- A I only
 B II only
 C III only
 D I and III only

- 15 A sample of insoluble gas **Y** contains an impurity that is water soluble. Which of the following is the **most** suitable apparatus to purify gas **Y** using water?



- 16 The half equation for the action of manganate(VII) as an oxidising agent in an acidic medium is:



What is the change in oxidation state of manganese?

- A** 2
B 5
C 7
D 8
- 17 In which reaction is dilute sulfuric acid not behaving as an acid?
- A** $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
B $\text{H}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 + 2\text{HCl}$
C $\text{H}_2\text{SO}_4 + \text{CuO} \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$
D $\text{H}_2\text{SO}_4 + \text{Mg} \rightarrow \text{MgSO}_4 + \text{H}_2$

- 18** The properties of oxides of elements **X**, **Y** and **Z** are given in the following table.

	properties
oxide of X	reacts with both sulfuric acid and aqueous sodium hydroxide
oxide of Y	insoluble in water and aqueous sodium hydroxide but soluble in dilute hydrochloric acid.
oxide of Z	decolourises acidified potassium manganate(VII) solution

What are **X**, **Y** and **Z**?

	X	Y	Z
A	calcium	sulfur	aluminium
B	aluminium	calcium	sulfur
C	sulfur	aluminium	calcium
D	sulfur	calcium	aluminium

- 19** The following statements show the properties of a green solid.

- I It produced water when it is gently heated alone.
- II It gives a green precipitate when dissolved in water and added to aqueous ammonia.
- III It gives a white precipitate when dissolved in water and added to acidified silver nitrate solution.

What could the green solid be?

- A** hydrated iron(II) chloride
- B** hydrated iron(II) sulfate
- C** anhydrous copper(II) chloride
- D** hydrated copper(II) sulfate

- 20 The positions of five elements **P**, **Q**, **R**, **S** and **T** are shown in the part of the Periodic Table.

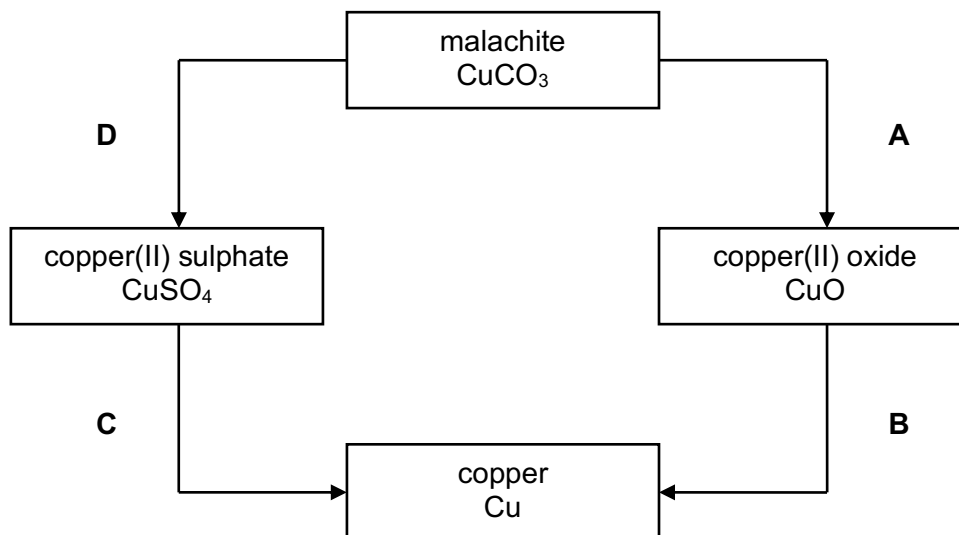
Period	I	II	III	IV	V	VI	VII	0
1st								
2nd				Q				S
3rd					T		R	
4th	P							

Which statement about the elements shown is **not correct**?

- A** Element S exists as a monoatomic gas.
B Element P is the most reactive element in Group I.
C Element T has 5 valence electrons in its outermost shell.
D Elements Q and R form an ionic compound which has the formulae of QR_4 .
- 21 Which element in the table is most likely to be a transition metal?

element	melting point in $^{\circ}\text{C}$	density in g/cm^3	number of chlorides known
A	1083	8.92	2
B	113	2.07	1
C	-7	3.10	2
D	1521	1.12	1

- 22 The diagram shows some reactions of copper compounds.
 Which change is made by adding an acid?



23 Which statement about a weak acid is correct?

- A** It has a pH greater than 7.
- B** It is insoluble in water.
- C** It does not ionise completely in aqueous solution.
- D** It turns Universal Indicator blue.

24 Two elements, **R** and **S**, are in the same Period of the Periodic Table. **R** is a metal.

Which of the following must be true for **S**?

- A** It is a metal.
- B** It forms an acidic oxide.
- C** It is a non-metal.
- D** It has a different proton number.

25 Some facts about three metals are as follows.

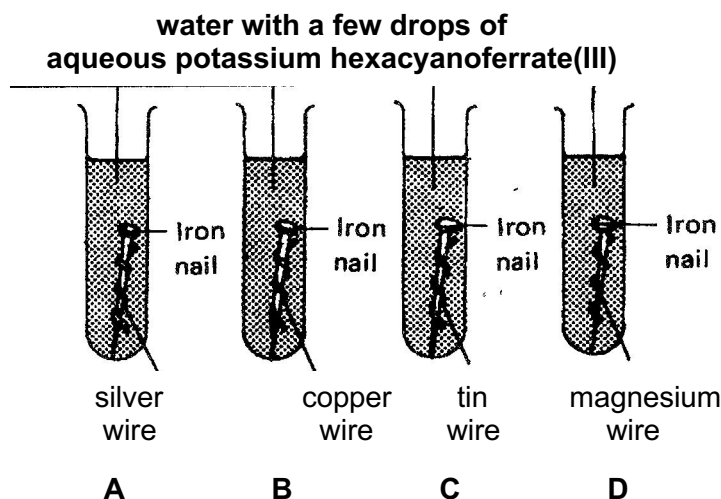
metal	fact
rhodium	found naturally as an alloy with other metals
thallium	extracted by electrolysis of its molten chloride
cobalt	extracted by heating its oxide with coke

What is the likely order of reactivity of the metals?

	least reactive	—————→	most reactive
A	rhodium	thallium	cobalt
B	thallium	cobalt	rhodium
C	rhodium	cobalt	thallium
D	cobalt	rhodium	thallium

- 26 Four test-tubes were set up as shown.

Iron(II) ions will produce a blue colouration in the presence of a few drops of aqueous potassium hexacyanoferrate(III).



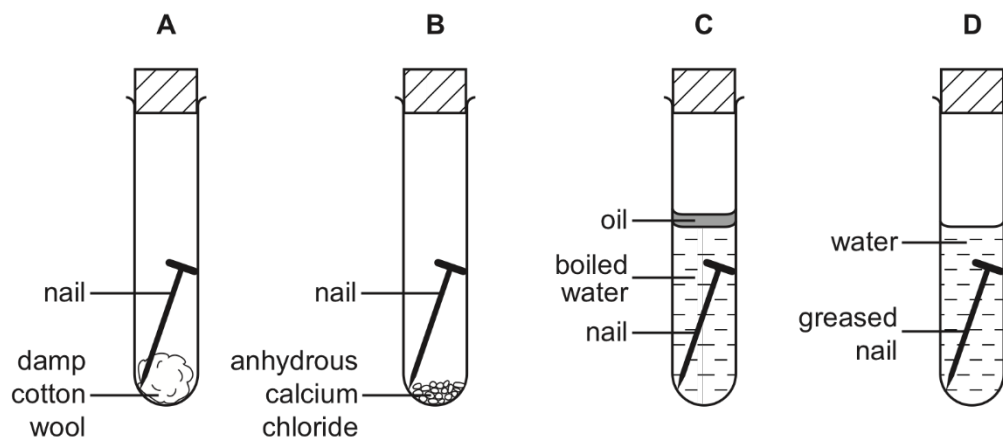
In which test-tube would a blue colour not appear around the iron nail after some time?

- 27 Copper(II) carbonate, zinc carbonate and lead(II) carbonate decompose when heated. The temperature of decomposition depends on the reactivity of the metal in the carbonate.

What is the correct order for their decomposition with respect to temperature?

	lowest temperature → highest temperature		
A	copper(II) carbonate	zinc carbonate	lead(II) carbonate
B	copper(II) carbonate	lead(II) carbonate	zinc carbonate
C	lead(II) carbonate	copper(II) carbonate	zinc carbonate
D	lead(II) carbonate	zinc carbonate	copper(II) carbonate

28 In which test-tube is the iron nail most likely to rust?



29 Magnallium is an alloy of aluminium (85%) and magnesium (15%).

Some properties are listed below.

Which property of magnalium is **not** a reason for its use in the construction of aircraft bodies?

- A It conducts electricity.
- B It is less dense than aluminium.
- C It is stronger than aluminium or magnesium.
- D The surface of the alloy is covered by a protective layer of aluminium oxide.

30 Which pair of pollutants cause damage to buildings?

- A CFCs and carbon monoxide
- B methane and carbon dioxide
- C unburnt hydrocarbon and nitrogen monoxide
- D nitrogen dioxide and sulfur dioxide

31 Why do farmers and gardeners often treat soil with ammonium sulfate?

- A To reduce acidity of soil.
- B To kill insects which are harmful to plants.
- C To increase the sulfur content of the soil.
- D To increase the nitrogen content of the soil.

32 Which statement is true for all noble gases?

- A They have 8 valence electrons.
- B They form neutral oxides.
- C They are monoatomic.
- D They are denser than air

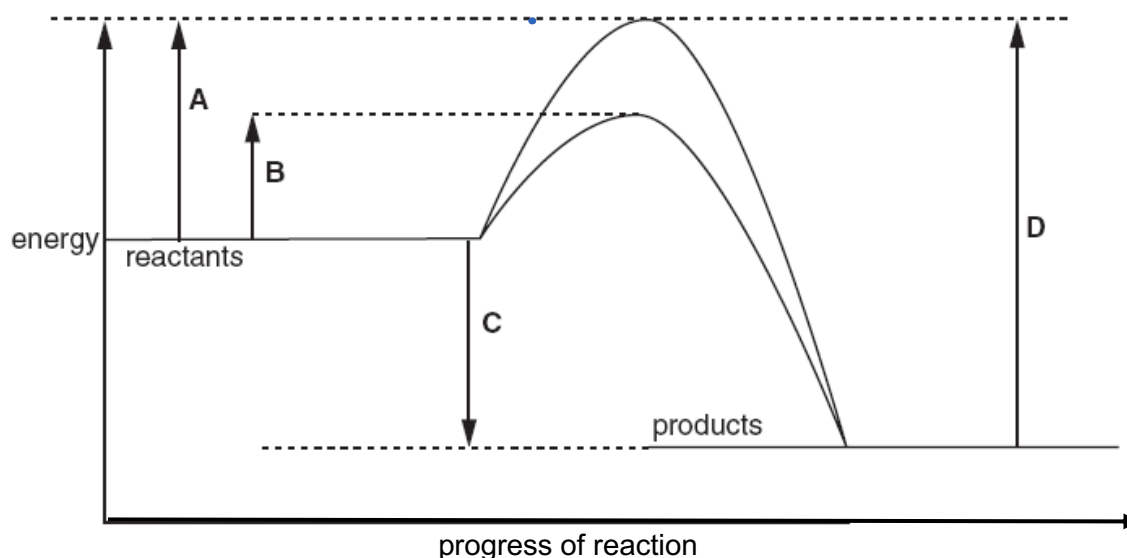
33 Five students each dissolved an indigestion tablet in 100 cm³ of water. They titrated 25.0 cm³ of their solutions with dilute hydrochloric acid, using the same indicator. The results are shown in the table.

student	A	B	C	D	E
volume of diluted hydrochloric acid titrated /cm ³	19.4	19.5	19.4	19.6	21.0

Which statement could explain the result obtained by student E?

- A The pipette was washed out with tablet solution.
- B The burette was washed out with hydrochloric acid.
- C The titration flask was washed out with the tablet solution.
- D The titration flask was washed out with hydrochloric acid.

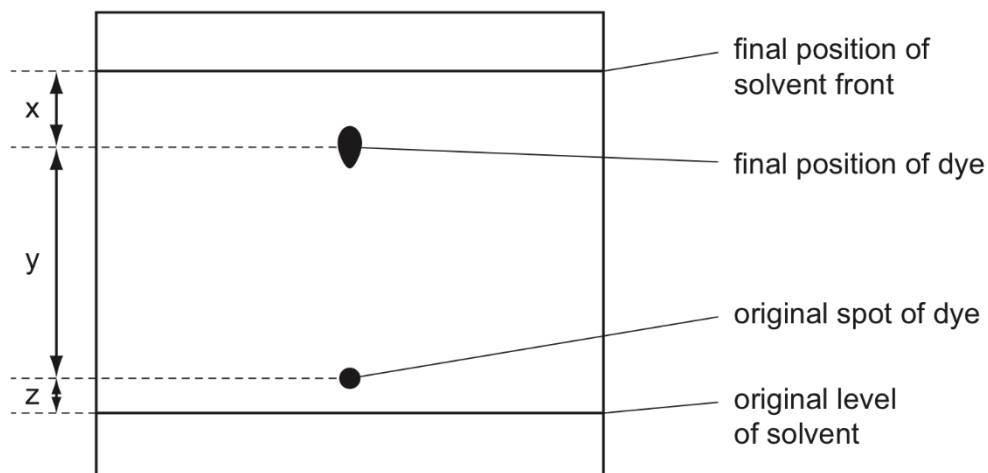
34 The diagram shows the energy profiles of two similar chemical reactions. A catalyst is present in one of the reactions.



Which letter shows the enthalpy change for the uncatalysed reaction?

- 35 The diagram shows the chromatogram obtained by analysis of a single dye.

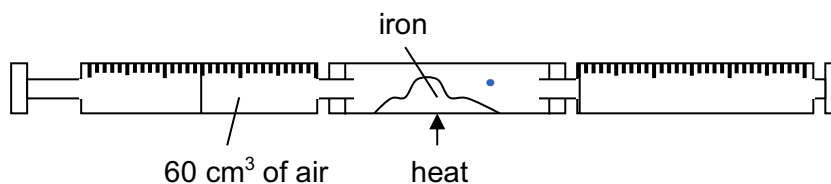
Three measurements are shown.



How is the R_f value of the dye calculated?

- A $\frac{x}{x+y}$
- B $\frac{y}{x+y}$
- C $\frac{x}{x+y+z}$
- D $\frac{y}{x+y+z}$

- 36 60 cm³ of a sample of dry air is trapped in syringe. The air is slowly passed over heated iron in a tube until there is no further decrease in volume.



What is the approximate volume of gas that would be used up in this reaction?

- A 12 cm³
- B 20 cm³
- C 48 cm³
- D 60 cm³

- 37 Aluminium is used to make saucepans because of its apparent lack of reactivity.

Which property of aluminium explains its unreactivity?

- A It has a low density
- B It has a surface layer of oxide.
- C It has a high electrical conductivity.
- D It has shiny surface and reflect heat well.

- 38 Which of the following statements on the trend of Group I elements is **incorrect**?

- A The melting point increases down the group.
- B The atomic radius increases down the group.
- C The reactivity increases down the group.
- D The density increases down the group.

- 39 Why are catalytic converters fitted to the car exhausts?

- A to decrease the amount of carbon dioxide emitted
- B to decrease the amount of nitrogen oxides emitted
- C to improve energy conservation
- D to reduce global warming

- 40 In an electrolysis experiment, the same quantity of electricity deposited 64 g of copper and 24 g of titanium. What was the charge on the titanium?

- A +1
- B +2
- C +3
- D +4

End of Paper 1

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