



SINGAPORE CHINESE GIRLS' SCHOOL
Preliminary Examination
Secondary Four

CANDIDATE
NAME

--

CLASS

4		
---	--	--

REGISTER
NUMBER

--	--

CENTRE NUMBER

--	--	--	--

INDEX NUMBER

--	--	--	--

Chemistry

6092/01

Paper 1 Theory

Tuesday

1 September 2020

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, class and index number on the Question Paper and Answer Sheet in the spaces provided.

There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A, B, C, D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

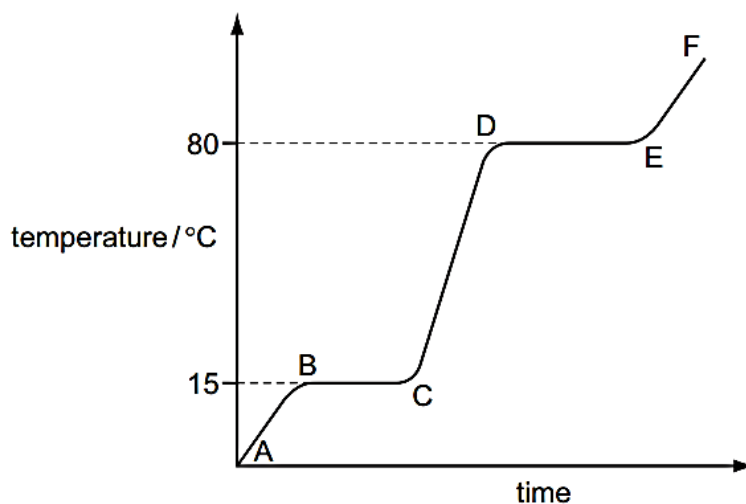
A copy of the Periodic Table is printed on page 17.

The use of an approved scientific calculator is expected, where appropriate.

- 1 Which row represents the particles of a gas colliding most frequently?

	pressure	temperature
A	low	low
B	high	low
C	low	high
D	high	high

- 2 The graph shows the change in temperature with time when substance X is heated.



Which stage does X undergo the smallest change in its volume?

- | | | | |
|----------|--------|----------|--------|
| A | A to B | B | B to C |
| C | D to E | D | E to F |
- 3 Which statement about the Periodic Table is correct?
- A** Most metallic elements are on the left.
 - B** Elements in the same period have the same number of outer electrons.
 - C** Elements on the left are usually gases.
 - D** The reactivity of Group VII elements increases as the atomic radius increases.
- 4 Particles with the same electron arrangement are said to be isoelectronic.

Which of the following compounds contains ions which are isoelectronic?

- A** MgCl_2
- B** KBr
- C** CaCl_2
- D** Na_2S

5 Which statement about an atom is correct?

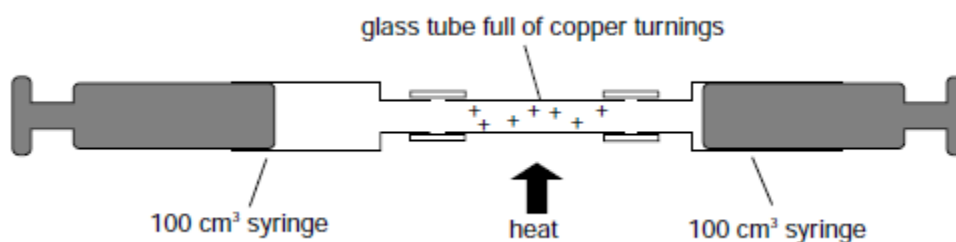
- A** The number of protons and neutrons will always be equal.
- B** The number of electrons and neutrons will always be equal.
- C** The nucleon number can be equal to the proton number.
- D** The nucleon number can be less than the number of electrons.

6 Iodine, I, has a lower relative atomic mass than tellurium, Te, but is placed after it in the Periodic Table.

A blank periodic table grid. The element Tellurium (Te) with atomic number 52 is marked in the bottom right section of the table.

Which statement explains why iodine is placed after tellurium in the Periodic Table?

- A** Iodine has fewer neutrons than tellurium.
- B** Iodine has fewer protons than tellurium.
- C** Iodine has more neutrons than tellurium.
- D** Iodine has more protons than tellurium.
- 7** The percentage of oxygen in the air is found using the apparatus shown in the diagram below. In an investigation, 100 cm³ of air was passed over heated copper turnings until there was no further decrease in volume.

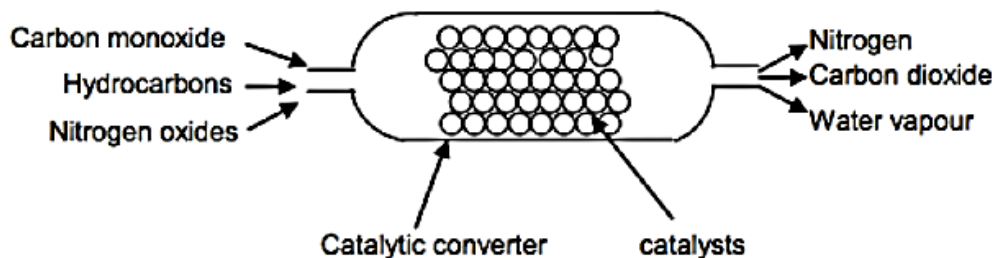


The volume of the gas after the reaction should be about 80 cm³, but was instead measured to be 90 cm³. Which could be (a) possible reason(s) for this result?

- 1 There was insufficient copper to react with all the oxygen in the syringe.
- 2 There was leakage of air out of the syringes.
- 3 The volume of gas was measured while it was still hot.

- A** 1 only
B 1 and 3
C 2 and 3
D 1, 2 and 3

- 8 The diagram below shows the cross section of a catalytic converter in the exhaust system of a car.

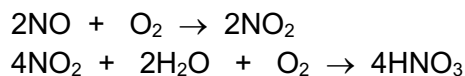


Which process(es) take(s) place in the converter?

- 1 Hydrocarbons oxidise to form carbon dioxide and water vapour.
- 2 Carbon monoxide reacts with nitrogen oxides to form carbon dioxide and nitrogen.
- 3 Nitrogen oxides react with hydrocarbons to form water vapour and nitrogen.

- A** 1 only
B 2 only
C 1 and 2
D 1 and 3

- 9 Two of the reactions used in the manufacture of nitric acid, HNO_3 , are shown.



What is the maximum number of moles of nitric acid which could be formed from one mole of nitrogen monoxide, NO ?

- A** 0.5 **B** 1.0 **C** 2.0 **D** 4.0

- 10 4 g of hydrogen is mixed with 16 g of oxygen and the mixture is ignited to form water.

What are the masses of the substances remaining at the end of the reaction?

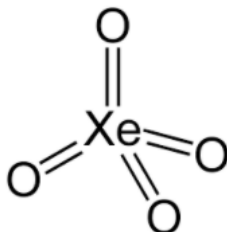
	hydrogen/ g	oxygen/ g	water/ g
A	0	0	20
B	2	0	18
C	0	4	16
D	2	0	9

- 11 All ammonium salts produce ammonia gas on heating with sodium hydroxide.

Which ammonium salt produces the greatest mass of ammonia when heated with sodium hydroxide?

- A** 0.2 mol NH_4Cl **B** 0.3 mol $(\text{NH}_4)_3\text{PO}_4$
C 0.4 mol $(\text{NH}_4)_2\text{SO}_4$ **D** 0.8 mol NH_4NO_3

- 12 The noble gas elements, though being generally unreactive, are known to be able to react with a few elements to form compounds. One such compound is xenon tetraoxide as shown below.



What is the total number of electrons shared in this compound?

- A** 8 **B** 12 **C** 14 **D** 16
- 13 Aerials in portable radios are made of a mixture of the oxides of calcium and iron known as 'ferrite'. It contains 18.5% calcium and 51.9% iron by mass.

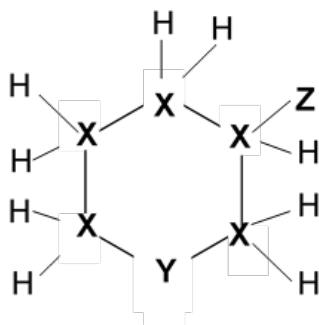
Which is the empirical formula of 'ferrite'?

- A** CaFe_2O
B CaFe_2O_4
C Ca_2FeO_2
D $\text{Ca}_4\text{Fe}_2\text{O}$
- 14 A 14 g sample of nitrogen gas contains the same number of atoms as 23 g of element X which is monoatomic.

What is the relative atomic mass, A_r of X?

- A** 3.5
B 14
C 23
D 46

- 15 The compound below is made up of hydrogen and the elements **X**, **Y** and **Z**.



Which statement is **incorrect**?

- A Element **Z** is most likely from Group I.
- B Element **X** is most likely from Group IV.
- C The compound has a simple molecular structure.
- D The compound has the molecular formula X_5YH_9Z .

- 16 A large piece of calcium is added to a test tube of water.

What is likely to be observed during this reaction?

- 1 The piece of calcium sinks in the water.
- 2 Bubbles of a colourless and odourless gas are given off.
- 3 A white precipitate is observed after a while in a colourless solution.

- A 1 only
- B 2 only
- C 1 and 2 only
- D 1, 2 and 3

- 17 Magnesium oxide is produced by heating magnesium carbonate.



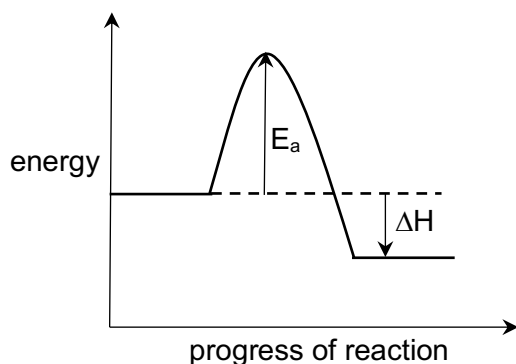
When 84 g of an impure sample of magnesium carbonate is heated, 28 g of magnesium oxide is produced.

What is the mass (in g) of pure magnesium carbonate in the sample?

[M_r : MgCO_3 , 84; MgO , 40]

- A $\frac{28}{40} \times 84$
- B $\frac{28}{84} \times 40$
- C $\frac{40}{28} \times 100$
- D $\frac{84}{28} \times 40$

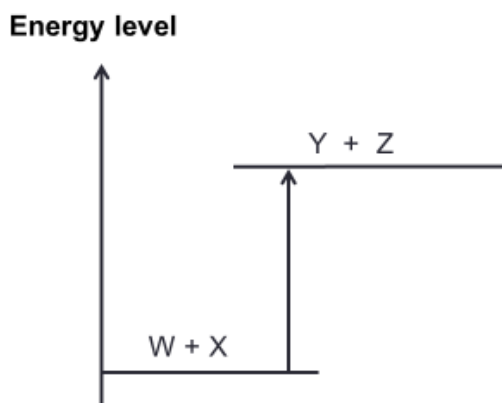
18 The energy profile diagram for a particular reaction is shown below.



Which statement is true about this reaction?

- A E_a is the energy released by breaking bonds in the reactants.
- B ΔH is the energy released by forming bonds in the products.
- C More energy is absorbed in bond-breaking than that released in bond-forming.
- D More energy is released in bond-forming than that absorbed in bond-breaking.

19 The energy level diagram for a reaction is as shown.



The initial temperature measured was $28.0\text{ }^{\circ}\text{C}$. As the reaction progressed, the reaction temperature changed by $5.5\text{ }^{\circ}\text{C}$.

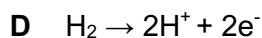
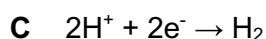
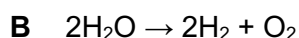
What would be the final temperature recorded?

- | | | | |
|----------|--------------------------------|----------|--------------------------------|
| A | $22.5\text{ }^{\circ}\text{C}$ | B | $28.0\text{ }^{\circ}\text{C}$ |
| C | $33.5\text{ }^{\circ}\text{C}$ | D | $39.0\text{ }^{\circ}\text{C}$ |

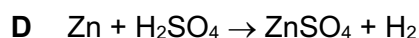
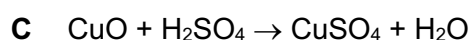
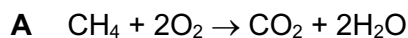
20 How does a catalyst affect the activation energy and enthalpy of a reaction?

	activation energy	enthalpy
A	increases	decreases
B	decreases	decreases
C	decreases	stays the same
D	increases	stays the same

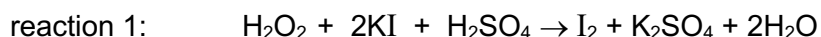
21 Which is the overall equation for the reactions that take place in a hydrogen fuel cell?



22 Which is **not** a redox reaction?



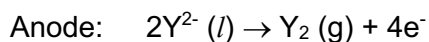
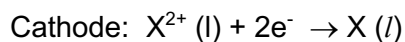
23 Hydrogen peroxide (H_2O_2) acts as an oxidising agent in some reactions, but in others, as a reducing agent.



Which row identifies correctly the role of hydrogen peroxide in each reaction?

	reaction 1	reaction 2	reaction 3
A	oxidising agent	reducing agent	oxidising agent
B	oxidising agent	reducing agent	reducing agent
C	reducing agent	oxidising agent	reducing agent
D	reducing agent	oxidising agent	oxidising agent

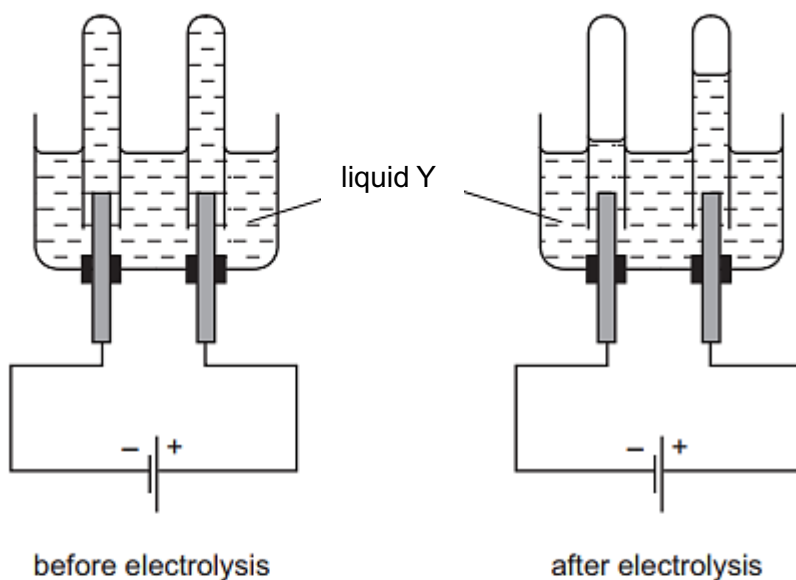
- 24 Element X is extracted by the electrolysis of a molten compound made up of elements X and Y. The electrode reactions are as shown:



Which of the following could be the compound?

- A aluminium oxide
- B calcium chloride
- C magnesium oxide
- D potassium chloride

- 25 The diagrams show an electrolysis set-up using inert electrodes.



Which could be liquid Y?

- 1 aqueous sodium nitrate
- 2 aqueous copper(II) sulfate
- 3 concentrated aqueous sodium chloride
- 4 dilute sulfuric acid

- | | | | |
|----------|--------------|----------|-----------------|
| A | 4 only | B | 1 and 4 only |
| C | 2 and 4 only | D | 1, 3 and 4 only |

- 26** The table below shows details of four experiments (**A**, **B**, **C** and **D**) in which the same mass of the catalyst manganese(IV) oxide was added to 10 cm³ samples of aqueous hydrogen peroxide, H₂O₂.

Different conditions were used to study the effect of each on the rate of reaction, measured by the volume of oxygen produced in 10 s.

In one of the experiments, the catalyst was more finely powdered compared to the others.

Which experiment is this likely to be?

Experiment	concentration of H ₂ O ₂ / mol dm ⁻³	temperature / °C	volume of oxygen produced in 10 s / cm ³
A	0.05	20	10
B	0.05	20	15
C	0.05	30	20
D	0.10	20	20

- 27** A student performs two reactions.

Reaction 1:

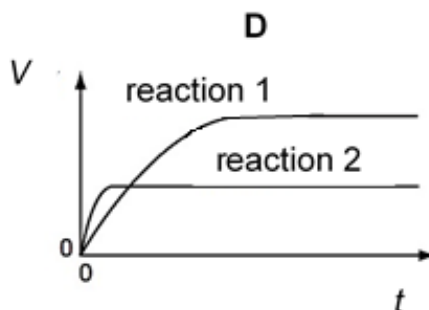
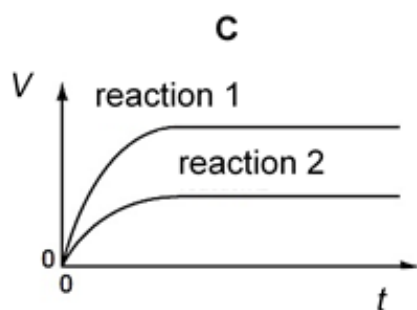
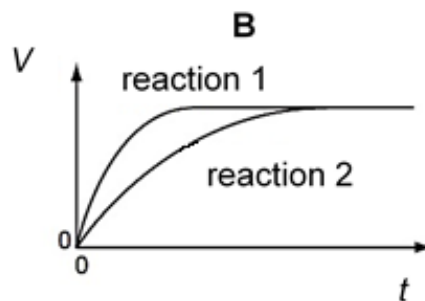
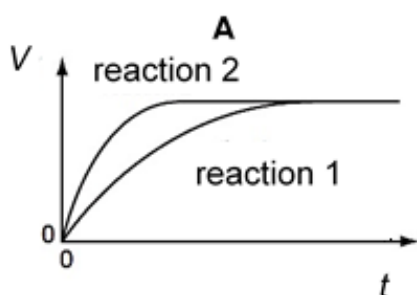
Magnesium ribbon (excess) with 50 cm³ of 1.0 mol/dm³ dilute hydrochloric acid

Reaction 2:

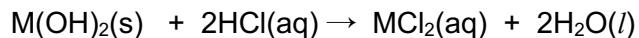
Magnesium ribbon (excess) with 12.5 cm³ of 1.0 mol/dm³ dilute sulfuric acid

In both experiments, the volume of hydrogen produced, *V* is measured against time, *t*, and the results plotted graphically.

Which set of graphs is correct?



- 28 An aqueous solution of a chloride is made by the reaction of hydrochloric acid with the hydroxide of metal M:



Which metal **cannot** be M?

- A** copper
B lead
C magnesium
D iron
- 29 Element X occurs naturally as the uncombined metal; element Y is obtained by chemical reduction of its oxide with carbon; element Z is obtained by electrolysis of its molten chloride.

What is the order of reactivity of X, Y and Z?

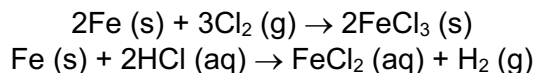
	Least reactive	→	Most reactive
A	X	Y	Z
B	Y	X	Z
C	Z	X	Y
D	X	Z	Y

- 30 Which of the statements are true of the Haber process?

- 1 Ammonia formed is condensed and obtained as a liquid.
- 2 Hydrogen gas is obtained from cracking of crude oil.
- 3 Iron catalyst is used to increase the yield of ammonia.
- 4 Nitrogen gas is oxidised to form ammonia.

- A** 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 3 and 4 only

- 31 The equations for the reactions between iron and chlorine, and iron and hydrochloric acid are shown.



Iron and tin are metals that have similar chemical properties. Iron forms ions with charges of 2+ and 3+ while tin forms ions with charges of 2+ and 4+.

Which reaction/s would occur with tin?

- 1 $\text{Sn (s)} + 2\text{Cl}_2 \text{ (g)} \rightarrow \text{SnCl}_4 \text{ (s)}$
- 2 $\text{Sn (s)} + 2\text{HCl (aq)} \rightarrow \text{SnCl}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$
- 3 $\text{Sn (s)} + \text{Cl}_2 \text{ (g)} \rightarrow \text{SnCl}_2 \text{ (g)}$

- A** 1, 2 and 3
B 1 and 2 only
C 2 and 3 only
D 2 only

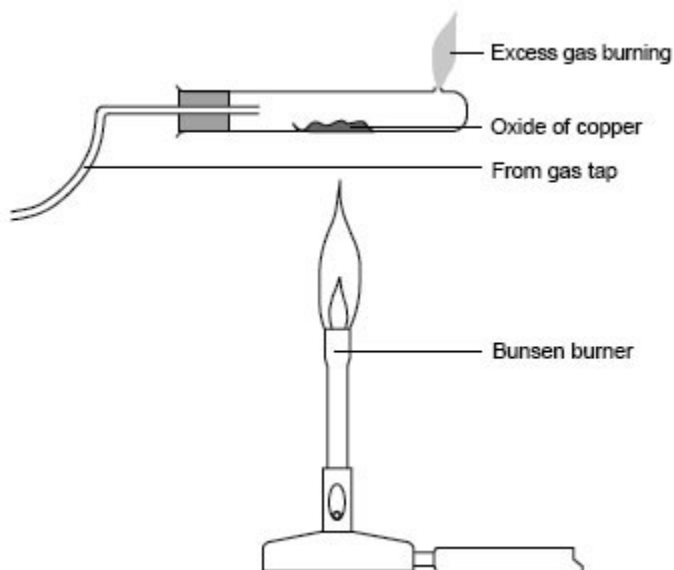
- 32 Iron rusts easily, hence steel structures should be treated to slow down the rusting process.

Which option describes **incorrectly** how each method protects iron from rusting and its main disadvantage?

	Method	how it protects	disadvantage
A	painting steel	provides a barrier between the iron and the atmosphere	paint scrapes off easily, exposing iron to the atmosphere
B	alloying steel with chromium to make stainless steel	chromium reacts with oxygen in the air to form a barrier of chromium oxide which prevents iron from rusting	production of stainless steel is costly
C	storing steel objects in a dry place	absence of water prevents iron from rusting quickly	difficult to keep storage place dry at all times
D	coating steel plates with zinc	zinc is less reactive than iron, and provides a barrier between iron and the atmosphere	when coating of zinc is scratched, iron will corrode in place of zinc, making it rust more quickly

33 The following set-up is used to study the reduction of an oxide of copper.

The oxide of copper is Cu_2O , which is a red solid. What would be observed when the reaction has stopped, and what is the purpose of burning the excess gas?



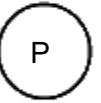
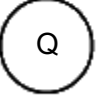
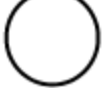
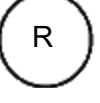
	observation	purpose for burning excess gas
A	red solid turns brown	carbon dioxide is a pollutant
B	red solid remains unchanged	carbon monoxide used to reduce oxide is poisonous
C	red solid turns brown	hydrogen gas used to reduce oxide is highly flammable
D	red solid turns black	nitrogen dioxide gas used to reduce oxide is a pollutant

34 Which substance(s) contain(s) mobile particles that can conduct electricity?

- 1 liquid mercury
- 2 solid bronze
- 3 distilled water
- 4 aqueous ammonia

- A** 1, 2, 3 and 4
B 1, 2, and 4 only
C 1 and 2 only
D 1 and 4 only

- 35 Drops of chlorine, bromine and iodine water are added to petri-dishes containing salt solutions of other halides, shown below.

sodium chloride	sodium bromide	potassium iodide	
			chlorine water
			bromine water
			iodine solution

Which option correctly identifies what will be observed in dishes P, Q and R?

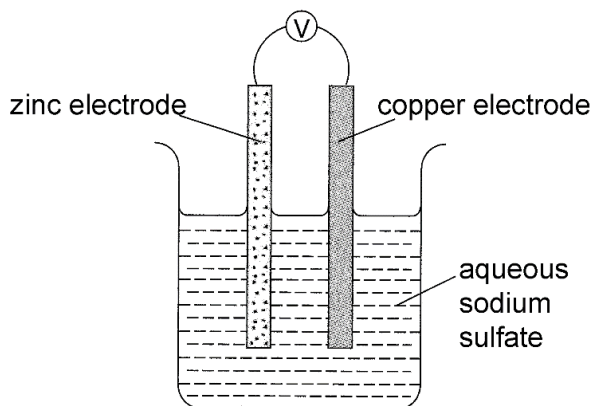
	P	Q	R
A	colourless solution turns brown	colourless solution turns brown	no visible reaction
B	no visible reaction	colourless solution turns brown	brown solution turns colourless
C	colourless solution turns brown	colourless solution turns red brown	colourless solution turns red brown
D	no visible reaction	no visible reaction	colourless solution turns brown

- 36 Tin is a metal between iron and lead in the reactivity series.

Which method is used for the extraction of tin from its ores?

- A** electrolysis of the molten ore
- B** heat alone
- C** heat with aluminium powder
- D** heat with carbon

37 The diagram shows a simple cell.



Which option describes what happens in the cell?

- A Effervescence of hydrogen gas is observed at the zinc electrode.
- B Copper ionizes and becomes smaller.
- C Effervescence of oxygen gas is observed at the copper electrode.
- D Zinc ionizes and becomes smaller.

38 In which reaction is the sulfate ion removed from solution?

- A $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$
- B $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
- C $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$
- D $\text{Na}_2\text{CO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O} + \text{CO}_2$

39 10 g of X_3O_4 , contains 7.5 g of X.

How many moles of X does 7.5 g of the element contain?

- | | |
|---------------------------------------|---------------------------------------|
| A $\frac{2.5}{16} \times \frac{3}{4}$ | B $\frac{7.5}{16} \times \frac{3}{4}$ |
| C $\frac{2.5}{16} \times \frac{4}{3}$ | D $\frac{10}{16} \times \frac{4}{3}$ |

40 Potassium reacts with oxygen to form different types of oxides.

potassium oxide	K_2O
potassium peroxide	K_2O_2
potassium superoxide	KO_2

What are correct oxidation numbers of oxygen in the different anions?

	oxide ion, O^{2-}	peroxide ion, O_2^{2-}	superoxide ion, O_2^-
A	-2	-1	-2
B	-2	-1	-0.5
C	-1	-2	+0.5
D	-2	-2	-1