

**REGENT SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2020
SECONDARY FOUR (EXPRESS)**

NAME: _____

INDEX NUMBER: _____

CLASS: _____

SETTER : MS CHEW HC

CHEMISTRY

6092/01

Paper 1 Multiple Choice

18 Sep 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 Answer Sheet in the spaces provided unless this has been done for you.

There are forty questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **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 22.

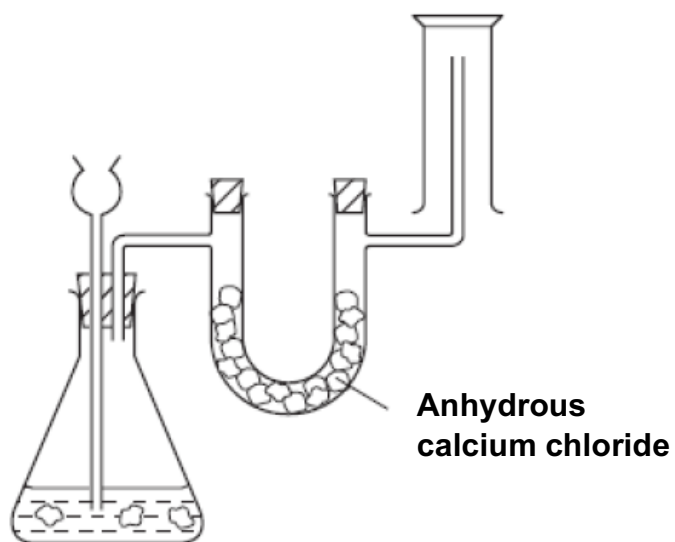
The use of an approved scientific calculator is expected, where appropriate.

	TARGET
40	
PARENT'S SIGNATURE	

Section A [40 marks]

Choose the correct answers and shade the corresponding oval in the OMR provided.

- 1 The diagram shows a simple laboratory apparatus for the preparation and collection of a dry gas.



What is the possible identity of the gas?

- A** Carbon dioxide
- B** Chlorine
- C** Hydrogen
- D** Hydrogen chloride

- 2 A student took 2 g of calcium carbonate and added them to 20 cm³ samples of dilute hydrochloric acid at different temperatures. She measured the time taken for the effervescence to stop.

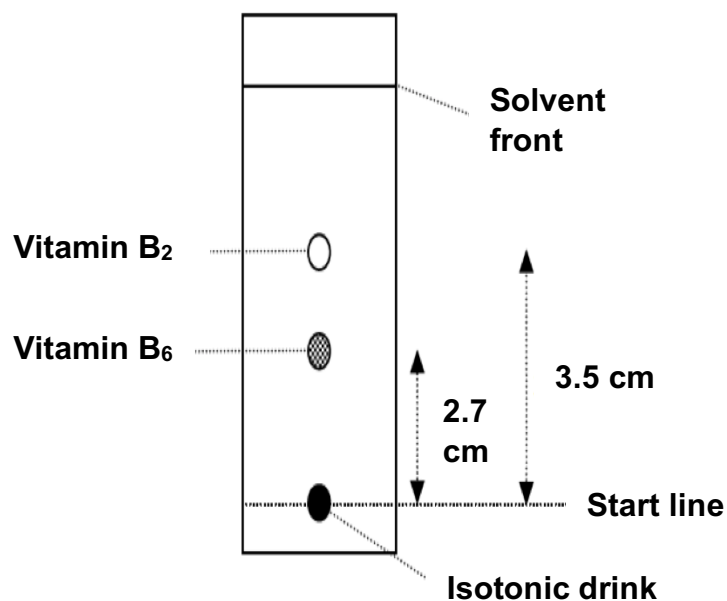
Which apparatus did she use?

	Electronic balance	Stopwatch	Filter funnel	Measuring cylinder	Thermometer
A	✓	✓	✓	✓	✗
B	✓	✓	✗	✓	✓
C	✓	✗	✓	✓	✓
D	✗	✓	✓	✗	✓

- 3 The boiling point of water is 100 °C. The melting point of potassium chloride is 770 °C. What is the most likely boiling point of a sample of water that contains a small quantity of dissolved potassium chloride?

- A 773°C
 B 767°C
 C 103°C
 D 97.0°C

- 4 A sample of isotonic drink containing two water soluble vitamins was analysed using the method of chromatography with water as a solvent. The following chromatogram (*not drawn to scale*) was obtained.

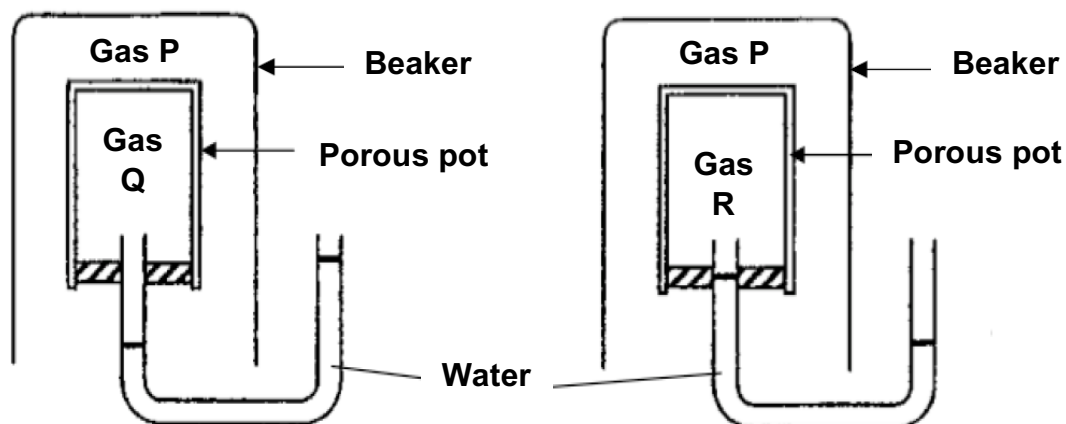


Given that the R_f value of vitamin B₂ is 0.35, which of the following statements can be deduced from the chromatogram?

- 1 Isotonic drink is a mixture.
- 2 The solvent front is at 10 cm from the start line.
- 3 The R_f value of vitamin B₆ is 0.27
- 4 Vitamin B₆ is more soluble in ethanol than vitamin B₂.

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

- 5 The apparatus can be used to show the diffusion of gases. Two beakers containing gas **P** were placed over two porous pots containing gases **Q** and **R** respectively. The results are shown below.



What is the correct order of the relative molecular mass, M_r of gases **P**, **Q** and **R**?

	Lowest M_r Highest M_r		
A	P	Q	R
B	Q	P	R
C	R	P	Q
D	R	Q	P

- 6 The boiling points of some elements are given in the table below.

Element	Boiling point / °C
X	-135
Y	-160
Z	-145

A mixture of elements **X**, **Y** and **Z** was heated from -170 °C to -140 °C. Which of the elements would still remain as a liquid at -140 °C?

- A** **X** only
- B** **Y** only
- C** **X** and **Z** only
- D** **X**, **Y** and **Z**

- 7 Two particles **X** and **Y** have their composition shown in the table given below.

Particle	Number of electrons	Number of neutrons	Number of protons
X	10	8	8
Y	18	18	17

What are particles **X** and **Y**?

- A** metal atoms
- B** non-metal atoms
- C** negative ions
- D** positive ions

- 8 What is the number of the different subatomic particles of the ion ${}_{38}^{90}\text{Sr}^{2+}$?

	Neutrons	Electrons
A	52	36
B	52	38
C	52	40
D	90	52

- 9 The relative atomic mass of an element with atomic number 10 is 20.2.
The element consists of two isotopes, the nuclei of which contain 10 and 12 neutrons respectively.

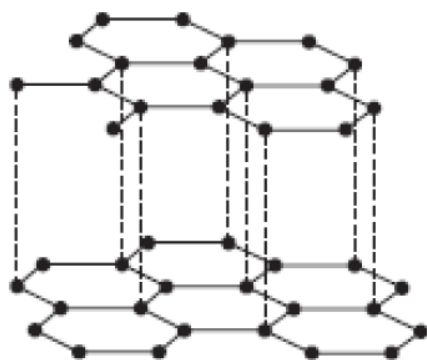
The ratio of the relative abundance of the lighter to heavier isotope is

- A** 1:9
- B** 9:1
- C** 2:8
- D** 8:2

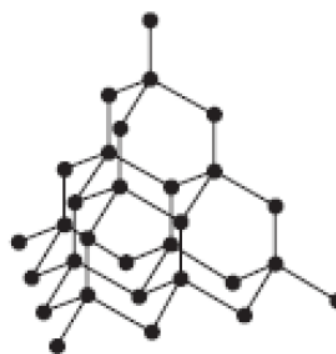
10 How does a magnesium atom form a bond with an oxygen atom?

- A** By giving one pair of electrons to the oxygen atom
- B** By receiving one pair of electrons from the oxygen atom
- C** By sharing one pair of electrons, each atom donating one pair of electrons
- D** Two magnesium atoms each giving one electron to one oxygen atom

11 The diagrams below shows the structures of two forms, **P** and **Q**, of a solid element.



P

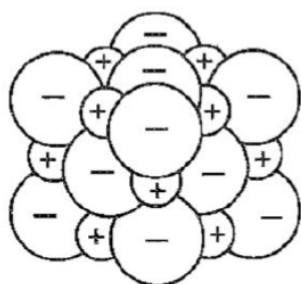
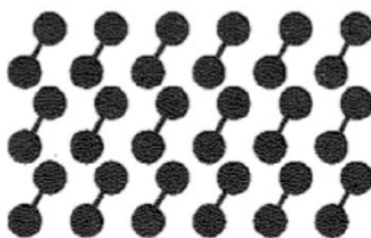
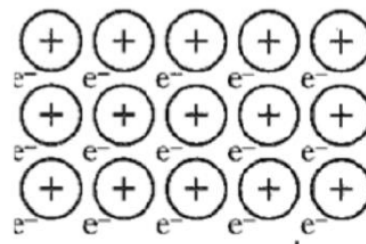


Q

What are the suitable uses of **P** and **Q**, based on their structures?

	Use of P	Use of Q
A	Drilling	Drilling
B	Drilling	Lubricating
C	Lubricating	Drilling
D	Lubricating	Lubricating

- 12 The structures of three substances **P**, **Q** and **R** are shown below.

**P****Q****R**

Which statements are correct?

- 1 **P** and **R** can conduct electricity in the molten state.
- 2 **Q** is an element while **P** and **R** are compounds.
- 3 **P** and **R** have giant structures while **Q** has a simple structure.

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

- 13 110 g of manganese reacts completely with 72 dm³ of fluorine gas to form a fluoride of manganese.

Which of the following correctly represents the reaction?

- A** $\text{Mn} + \text{F}_2 \rightarrow \text{MnF}_2$
B $\text{Mn} + 2\text{F}_2 \rightarrow \text{MnF}_4$
C $2\text{Mn} + 3\text{F}_2 \rightarrow 2\text{MnF}_3$
D $4\text{Mn} + 3\text{F}_2 \rightarrow 2\text{Mn}_2\text{F}_3$

- 14 Potassium hydroxide reacts with sulfuric acid to form potassium sulfate.

Which volume of 0.20 mol/dm^3 potassium hydroxide reacts completely with a solution containing 0.49 g of sulfuric acid?

- A 12.5 cm^3
- B 25.0 cm^3
- C 50.0 cm^3
- D 100.0 cm^3

- 15 Which of the following aqueous solution contains the largest concentration of ions?

- A 100 cm^3 of $0.100 \text{ mol/dm}^3 \text{ CuSO}_4 (\text{aq})$
- B 100 cm^3 of $0.100 \text{ mol/dm}^3 \text{ ZnCl}_2 (\text{aq})$
- C 100 cm^3 of $0.200 \text{ mol/dm}^3 \text{ CH}_3\text{COOH} (\text{aq})$
- D 100 cm^3 of $0.200 \text{ mol/dm}^3 \text{ NH}_4\text{Cl} (\text{aq})$

- 16 Chalk is impure calcium carbonate. A piece of chalk has a mass of 23.0 g . When reacted with excess hydrochloric acid, 4.49 dm^3 of carbon dioxide gas was collected. What is the percentage purity of the piece of chalk?

- A 19.5%
- B 40.7%
- C 55.3%
- D 81.3%

- 17 Aluminium saucepans oxidise on the surface to form a layer of aluminium oxide. Which substance **cannot** be used to remove the layer of aluminium oxide on the saucepan?

- A Nitric acid
- B Sodium hydroxide
- C Sulfuric acid
- D Water

- 18** Lime (calcium hydroxide) is sometimes added to soil to improve crop growth. Which statement correctly explains why lime improves crop growth?
- A** Lime acts as a fertiliser.
 - B** Lime is an effective pesticide and protects the plants from damage.
 - C** Lime is used to reduce the acidity of the soil.
 - D** Lime is used to react with ammonium salts in the soil.
- 19** Which pair of reagents can be used to prepare pure insoluble salt?
- A** Silver oxide and dilute hydrochloric acid
 - B** Iron (III) carbonate and dilute sulfuric acid
 - C** Lithium carbonate and sodium sulfate
 - D** Calcium nitrate and sodium sulfate
- 20** A salt has the following chemical formula $(\text{NH}_4)_2\text{Fe}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$. Excess aqueous sodium hydroxide was added to a hot solution of the salt, shaken and left to stand for some time. Which of the following observations would **not** be made?
- A** A brown precipitate was produced.
 - B** On standing, the precipitate turned red-brown.
 - C** A white precipitate is formed when acidified barium nitrate is added.
 - D** A pungent gas which turned damp red litmus paper blue was produced when the mixture is warmed.
- 21** In an experiment, 8.0 cm^3 of 1.0 mol/dm^3 aqueous copper (II) sulfate and 4.0 cm^3 of 1.0 mol/dm^3 aqueous sodium carbonate are mixed. What does the reaction vessel contain once the reaction is completed?
- A** A colourless solution only
 - B** A green precipitate and a blue solution
 - C** A green precipitate and a colourless solution
 - D** A white precipitate and a colourless solution

- 22** Solution **Y** forms a white precipitate that is insoluble when excess aqueous sodium hydroxide is added to it.

When silver nitrate solution is added to an acidified solution of **Y**, a pale yellow precipitate is formed.

What is solution **Y** likely to be?

- A** Aluminium iodide
- B** Calcium iodide
- C** Lead (II) chloride
- D** Zinc sulfate

- 23** Chromium is a metal that is placed between zinc and iron on the Reactivity Series. A student made four statements about chromium.

- It can be obtained by heating chromium (III) oxide with coke.
- It can displace calcium from aqueous calcium chloride
- It reacts with steam to form chromium (III) hydroxide and hydrogen.
- It is a stronger reducing agent than iron.

How many of the above statements is/are correct?

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

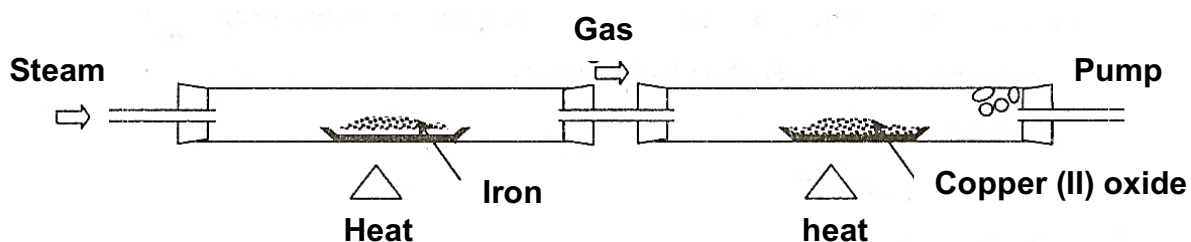
- 24 The table below summarises the reactions of chromium, manganese and nickel with their nitrate salts.

	$\text{Cr}(\text{NO}_3)_3$	$\text{Mn}(\text{NO}_3)_2$	$\text{Ni}(\text{NO}_3)_2$
Cr		x	✓
Mn	✓		✓
Ni	x	x	

What is the order of increasing reactivity of the three metals?

	Least reactive $\longrightarrow$ Most reactive		
A	Chromium	Nickel	Manganese
B	Manganese	Chromium	Nickel
C	Nickel	Chromium	Manganese
D	Manganese	Nickel	Chromium

- 25 In an experiment, steam was passed through two gas syringes as shown in the experimental set-up below.



Which substance would **not** be a product of the reactions?

- A Oxygen
- B Copper
- C Water vapour
- D Iron (III) oxide

- 26 Which of the following is **not** produced in the blast furnace during the extraction of iron?
- A Calcium carbonate
 - B Calcium silicate
 - C Carbon dioxide
 - D Carbon monoxide
- 27 Astatine (At) is in Group VII of the Periodic Table. Which of the following is a property of astatine?
- A It displaces iodine from aqueous magnesium iodide.
 - B It forms a basic oxide.
 - C It is displaced by chlorine from aqueous magnesium astatide.
 - D It is monoatomic.
- 28 The table below shows the properties of some elements **W**, **X**, **Y** and **Z** in Period 3.

	W	X	Y	Z
Appearance at room temperature	Grey solid	Yellow solid	Grey solid	Yellowish-green gas
Reaction with cold water	Violent reaction	No reaction	Vigorous reaction	Slow reaction
Nature of oxide	Reacts with acids	Reacts with bases	Reacts with acids and bases	Reacts with bases

Which of the following shows how the elements are arranged in the Periodic Table in increasing proton number?

- A **W, X, Y, Z**
- B **W, Y, X, Z**
- C **Y, W, X, Z**
- D **Z, X, Y, W**

- 29** The reaction between acidified potassium dichromate (VI) and hydrogen peroxide is represented by the equation below.



Which of the following correctly shows the oxidising agent and reducing agent in this reaction?

	Oxidising agent	Reducing agent
A	H_2O_2	$\text{K}_2\text{Cr}_2\text{O}_7$
B	H_2SO_4	H_2O_2
C	$\text{K}_2\text{Cr}_2\text{O}_7$	H_2O_2
D	$\text{K}_2\text{Cr}_2\text{O}_7$	H_2SO_4

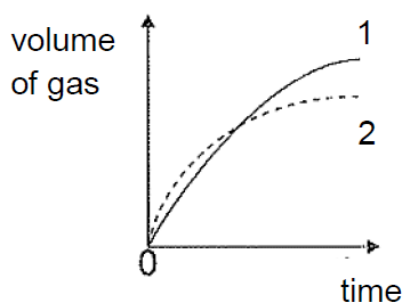
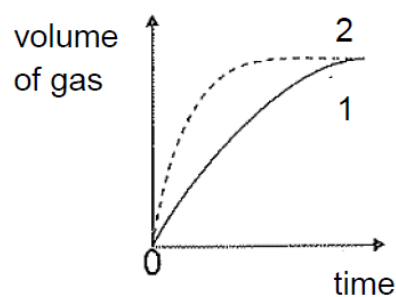
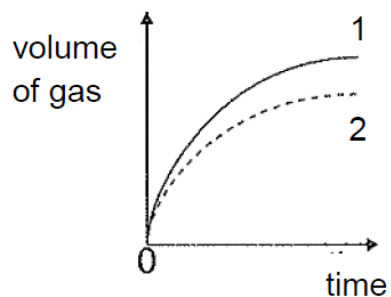
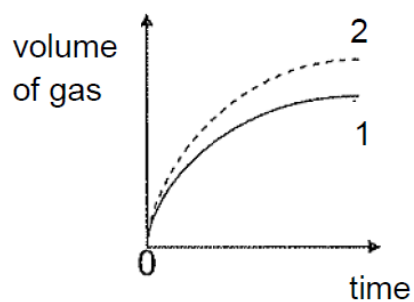
- 30** The transition metal vanadium exists in a range of different oxidation states. Two vanadium ions are VO^{2+} and VO_4^{3-} . What are the oxidation states of vanadium in these two ions, respectively?

- A** +4 and +5
- B** +4 and +8
- C** +6 and +5
- D** +6 and +8

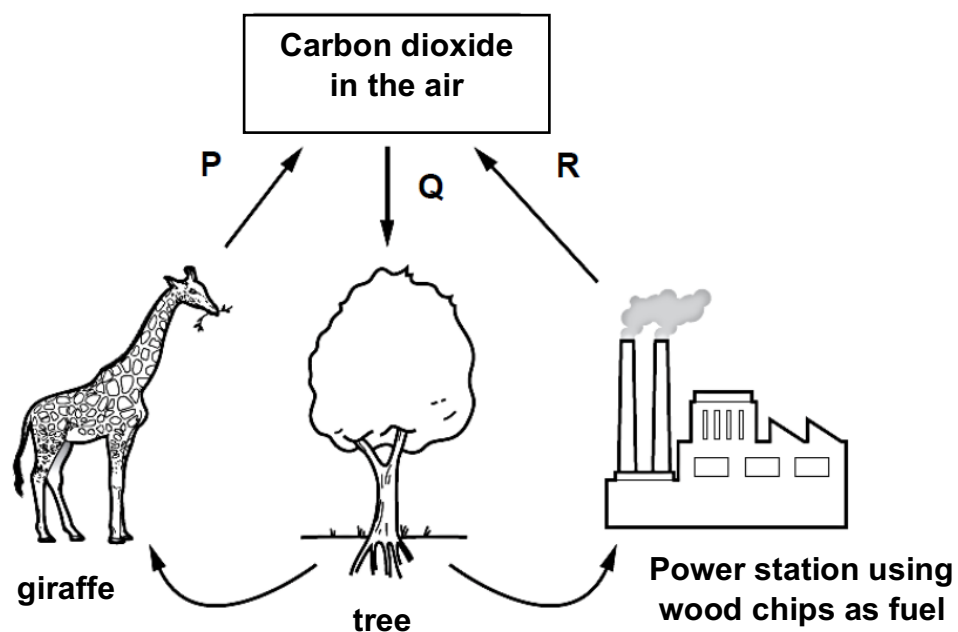
- 31 Two experiments are carried out to measure the volume of carbon dioxide produced when different concentrations of hydrochloric acid are added to excess calcium carbonate.

Experiment	Acid
1	50 cm ³ of 0.200 mol/dm ³ hydrochloric acid
2	20 cm ³ of 0.500 mol/dm ³ hydrochloric acid

A graph of volume of carbon dioxide against time is plotted for both experiments. Which graph best shows the results for these experiments?

A**B****C****D**

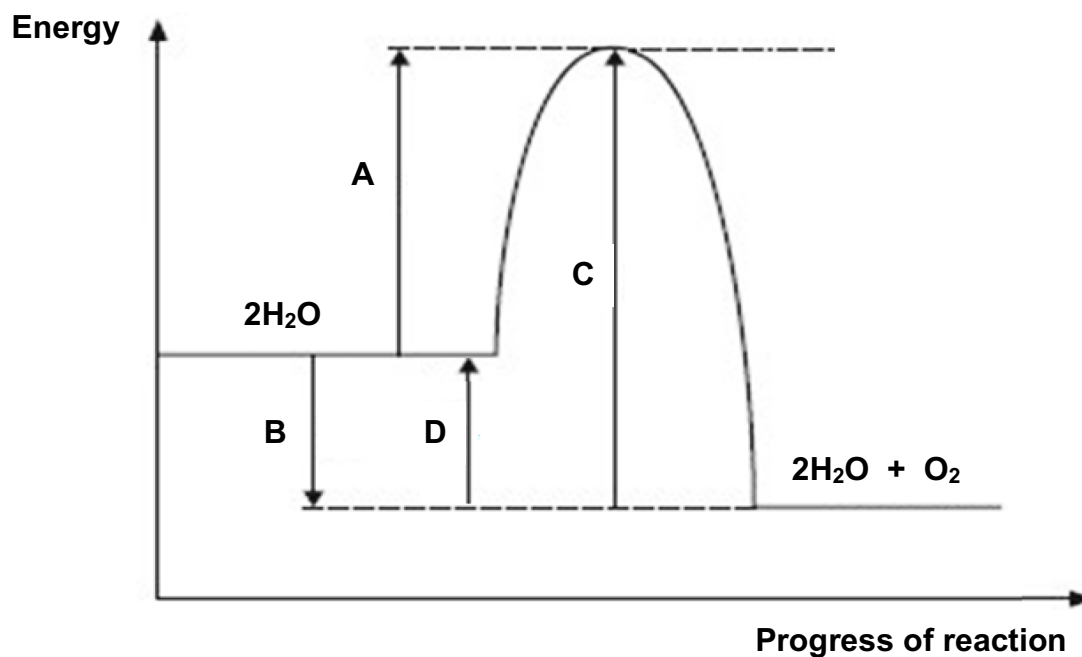
- 32 The diagram below shows part of the carbon cycle.



Which row correctly identifies **P**, **Q** and **R** as exothermic or endothermic reactions?

	P	Q	R
A	Endothermic	Exothermic	Exothermic
B	Exothermic	Exothermic	Exothermic
C	Exothermic	Endothermic	Exothermic
D	Exothermic	Endothermic	Endothermic

- 33** The energy profile diagram for the decomposition of hydrogen peroxide is shown below.



Which one of the energy changes in the energy profile diagram, correctly shows the activation energy?

- 34** Which of the following are true of the Haber Process?

- 1 Nitrogen is oxidised to form ammonia
- 2 The hydrogen is obtained from cracking of petroleum fractions
- 3 Ammonia formed is condensed and obtained as liquid
- 4 A high temperature will increase the yield of ammonia

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

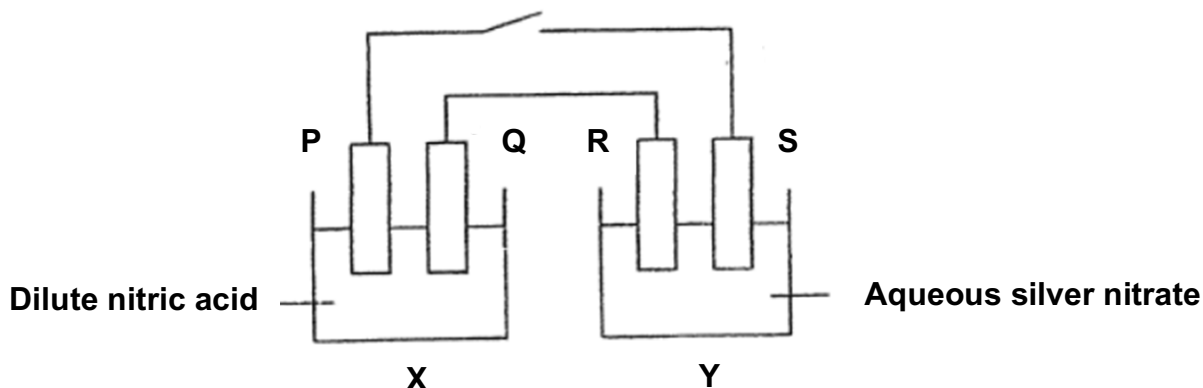
35 Four electrolytes are listed below. Each is electrolysed using inert electrodes.

- 1 Aqueous silver nitrate
- 2 Concentrated aqueous sodium chloride
- 3 Molten aluminium oxide
- 4 Aqueous magnesium chloride

For which electrolytes is a metal formed at the cathode?

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

36 In the set-up **X**, **P** and **Q** are two different metals. In the set-up **Y**, **R** and **S** are carbon electrodes. When the circuit is closed, electric current flows. After some time, silver is formed on the carbon electrode **S**.



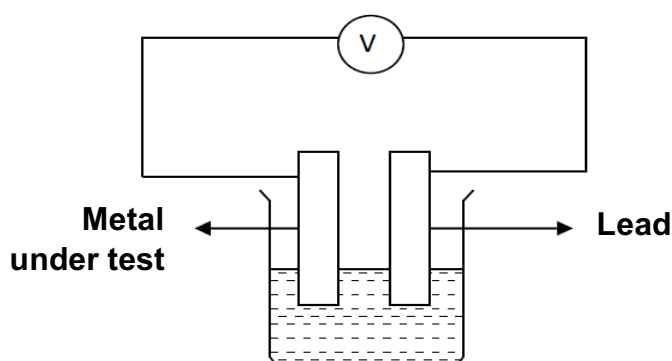
Which statement(s) concerning the set-up is/are correct?

- 1 In set-up **Y**, pH of the electrolyte decreases after some time.
- 2 Electrons flow in a clockwise direction in the circuit.
- 3 Metal **Q** is more reactive than metal **P**.
- 4 Effervescence is observed at **Q**.

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

- 37** The diagram below shows a simple chemical cell. Using the apparatus shown below, a student performs a test on five unknown metal strips (**V**, **W**, **X**, **Y** and **Z**) to determine their order of reactivity with respect to lead.

The voltages produced by different combinations of metal electrodes are shown in the table below.

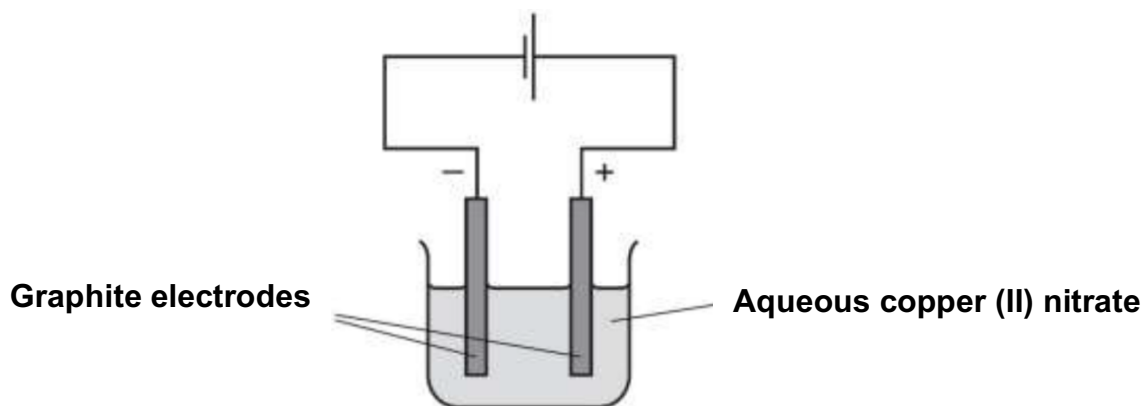


Metals	Direction of electron flow in the external circuit	Voltage / V
V	Lead to V	-0.89
W	W to lead	0.75
X	X to lead	0.65
Y	Lead to Y	-0.55
Z	No electron flow	0.00

What is the order of the reactivity of the metal?

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

- 38** The diagram below shows the electrolysis of aqueous copper (II) nitrate.



Which of the following statements is correct?

- A** A brown gas is produced at the positive electrode.
- B** A pink solid is coated on the negative electrode.
- C** The anode dissolves and becomes smaller.
- D** The electrons move from the negative terminal to positive terminal through the solution

- 39** The air in 4 cities, **A**, **B**, **C** and **D** were analysed, and the concentration of three gases in parts per million (ppm) were tabulated below.

In which city will the air pollution problem of acid rain be most reduced if all cars had to be fitted with catalytic converters?

	Concentration of carbon monoxide / ppm	Concentration of carbon dioxide / ppm	Concentration of nitrogen dioxide / ppm
A	48	23	36
B	44	35	47
C	38	50	22
D	20	44	59

- 40** Which atmospheric pollutants, emitted by internal combustion engines, are reacted together to convert them into less harmful products?
- A** Nitrogen dioxide and sulfur dioxide
 - B** Nitrogen dioxide and carbon monoxide
 - C** Unburned hydrocarbons and carbon monoxide
 - D** Unburned hydrocarbons and carbon dioxide

END OF PAPER

The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	0
		Key proton (atomic) number atomic symbol name relative atomic mass															
3 Li lithium 7	4 Be beryllium 9																
11 Na sodium 23	12 Mg magnesium 24	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
19 K potassium 39	20 Ca calcium 40	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids		72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium -	85 At astatine -
87 Fr francium -	88 Ra radium -	89 – 103 actinoids		104 Rf Rutherfordium -	105 Db dubnium -	106 Sg seaborgium -	107 Bh bohrium -	108 Hs hassium -	109 Mt meitnerium -	110 Ds darmstadtium -	111 Rg roentgenium -	112 Cn copernicium -	114 Fl flerovium -	116 Lv livermorium -			

lanthanoids

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium -	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium -	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium -	94 Pu plutonium -	95 Am americium -	96 Cm curium -	97 Bk berkelium -	98 Cf californium -	99 Es einsteinium -	100 Fm fermium -	101 Md mendelevium -	102 No nobelium -	103 Lr lawrencium -

actinoids

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