



BEATTY SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
SECONDARY FOUR EXPRESS

CANDIDATE
NAME

CLASS

REGISTER
NUMBER

CHEMISTRY

Paper 1

Multiple Choice

Setter:

Mdm Stella Soh

6092/01

28 August 2024

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 register number on the Multiple Choice Answer Sheet provided.

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.

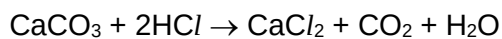
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

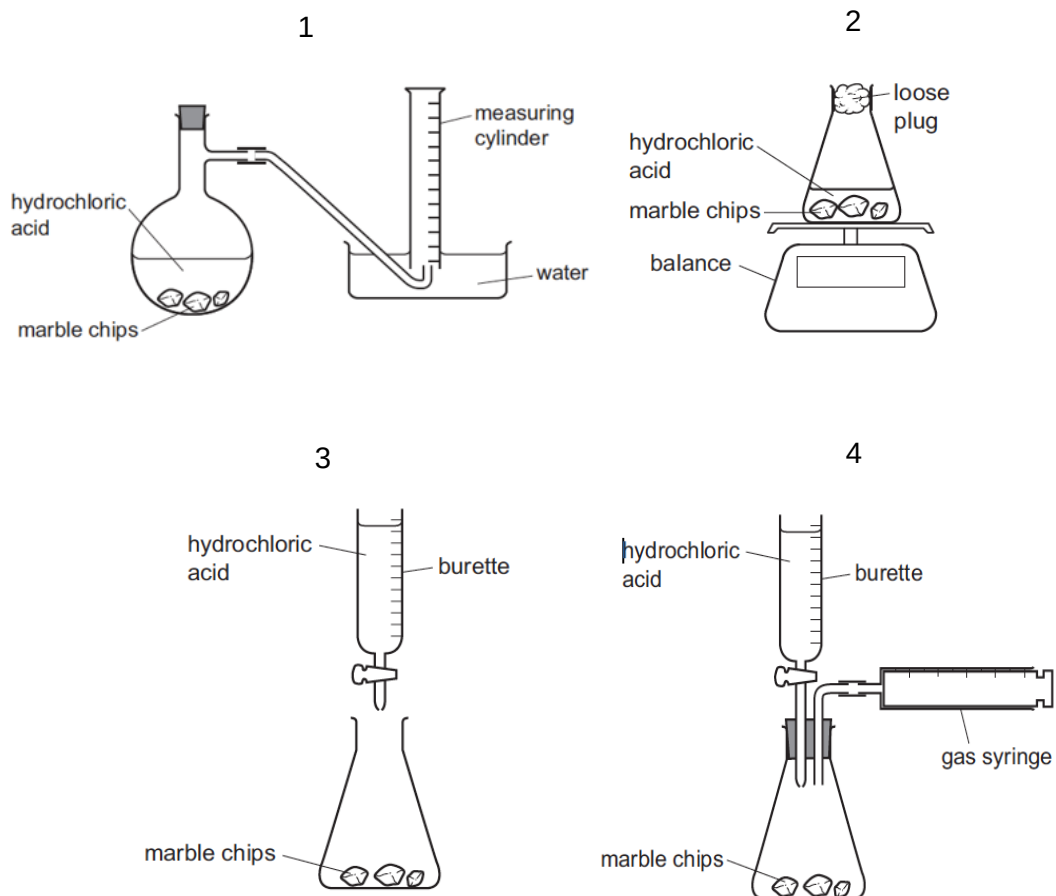
A copy of the Periodic Table is printed on page 18.

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

- 1 A student follows the rate of the reaction between marble chips, CaCO_3 , and dilute hydrochloric acid.



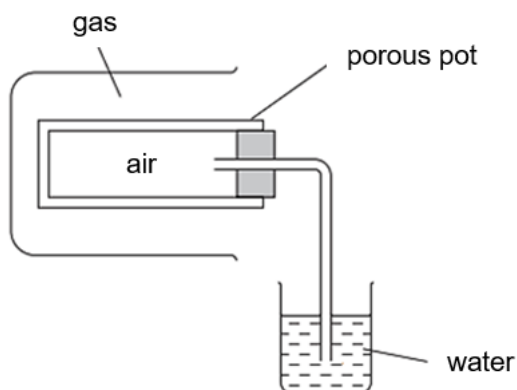
Which set-ups show the apparatus that are required for this experiment?



- A** 1 and 2 only
C 2 and 4 only

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

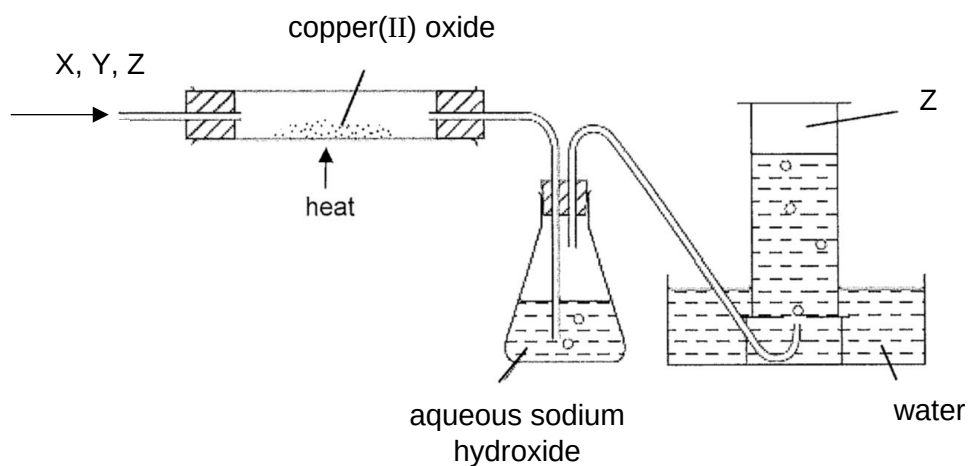
- 2 The apparatus shown in the diagram was used to compare the rate of diffusion between a gas and air.



A beaker containing the gas was placed over the porous pot.

Which gas would cause bubbles to be observed in the beaker of water?

- A carbon monoxide
 B hydrogen chloride
 C methane
 D sulfur dioxide
- 3 An unknown gas, Z can be separated from a mixture of gases, X, Y and Z using the set-up as shown below.

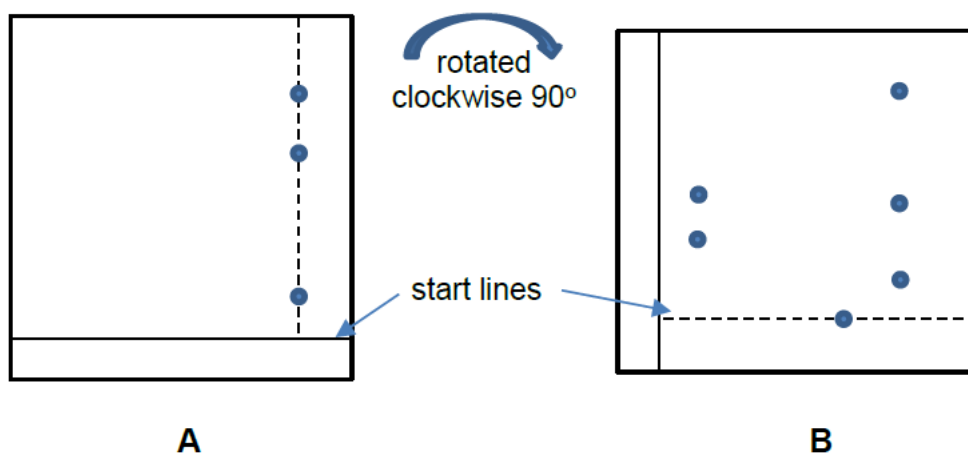


In which mixture will Z be effectively separated from?

	X	Y	Z
A	carbon dioxide	nitrogen	oxygen
B	hydrogen	carbon dioxide	nitrogen
C	nitrogen	oxygen	hydrogen
D	oxygen	hydrogen	carbon monoxide

- 4 A chromatography experiment was done on a brand of food colouring to determine the number of coloured dyes present.

Chromatogram A shows the separation of the coloured dyes using water as a solvent. It is then rotated clockwise 90° and placed in ethanol as a solvent as shown in the chromatogram B.



How many different types of coloured dyes are present in the food colouring?

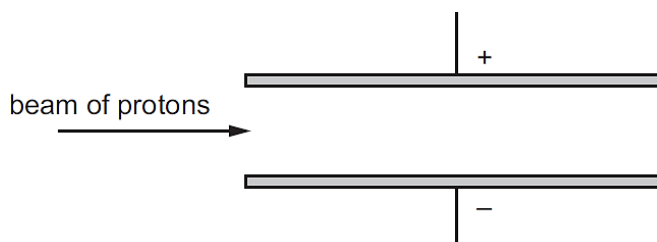
- A** 3 **B** 6 **C** 9 **D** 12
- 5 The melting and boiling points of the substances are tabulated in the table.

	melting point / $^\circ\text{C}$	boiling point / $^\circ\text{C}$
P	50	80
Q	70	500
R	65	67
S	-15	-12
T	0	99

At which temperature would two liquids exist?

- A** -20°C
B -15°C
C 15°C
D 85°C

- 6 A beam of protons was passed through an electrostatic field between two charged plates. The electrostatic field deflected the beam of protons towards the negatively charged plates. The lower the relative mass of the particle, the larger the deflection.



The experiment was repeated using a beam of electrons in place of the beam of protons.

Which row correctly shows the extent of deflection and the direction of the beam of electrons?

	amount of deflection of beam of electrons	direction of deflection of beam of electrons
A	deflected less than beam of protons	opposite direction to beam of protons
B	deflected less than beam of protons	same direction as beam of protons
C	deflected more than beam of protons	opposite direction to beam of protons
D	deflected more than beam of protons	same direction as beam of protons

- 7 Which compound has both ionic and covalent bonds?

- A** hydrogen chloride
- B** magnesium nitrate
- C** potassium fluoride
- D** zinc chloride

- 8 Which statements correctly describe the sub-atomic particles present in a selenium atom, $^{79}_{34}\text{Se}$?

1. It has the same number of electrons as a $^{32}_{16}\text{S}^{2-}$ ion.
2. It has the same number of neutrons as a $^{80}_{35}\text{Br}$ atom.
3. It has twice the number of protons as a $^{35.5}_{17}\text{Cl}^{-}$ ion.

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

- 9 Which statement about diamond and graphite is correct?

- A** Both diamond and graphite are conductors of electricity and can be used as an electrode.
- B** Both diamond and graphite are macromolecules and allotropes of carbon.
- C** Diamond is hard with high melting point but graphite is soft with low melting point.
- D** Diamond is made up of covalent bonds whereas graphite is made up of ionic bonds.

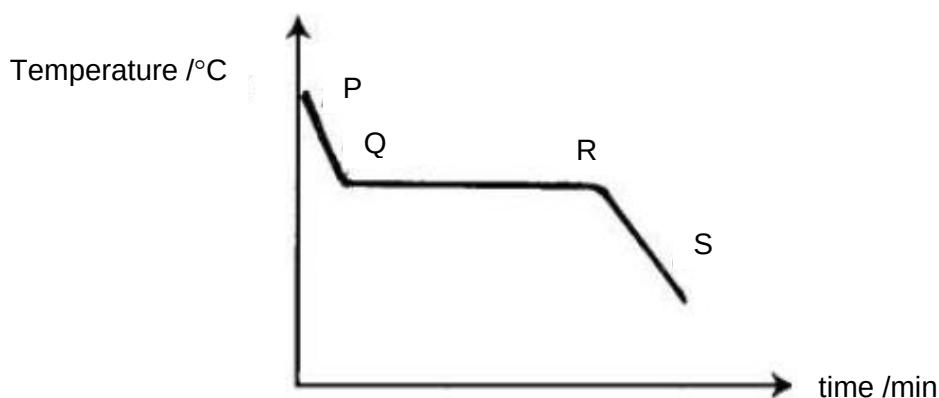
- 10 The table below shows the properties of some substances.

Which underlined substance has been classified as an element, compound or mixture **incorrectly**?

	property	classification
A	A <u>white solid</u> is formed when a silvery metal is burnt in air.	element
B	<u>Black powder</u> burns in air to form a colourless gas.	element
C	<u>Green powder</u> on heating leaves a black residue and a colourless gas is evolved.	compound
D	<u>White solid</u> melts over 56 °C to 58°C	mixture

- 11 A sample of solid X is heated until it is completely melted.

The graph shows how its temperature varies with time as molten X is cooled.



Which statements are true about the particles in X as it cools?

1. They are closer to each other at stage RS than at stage PQ.
2. The forces of attraction are stronger at stage P than at stage S.
3. The arrangement is more orderly at stage RS than at stage PQ.
4. Their total energy content at stage QR is lower than stage RS.

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

- 12** A tablet of aspirin, $\text{C}_9\text{H}_8\text{O}_4$, is crushed and dissolved in water. The acid present in a tablet of aspirin can be neutralized by 12.25 cm^3 of 0.147 mol/dm^3 sodium hydroxide.



Given that one grain of aspirin is 0.0648 g , how many grains of aspirin are there in the tablet?

[M_r : $\text{C}_9\text{H}_8\text{O}_4$, 180]

- A** 0.0018 **B** 0.324 **C** 5 **D** 15
- 13** Zinc reacts with dilute hydrochloric acid.

Which solution would give the fastest initial rate of reaction?

- A** 10 g of HCl in 50 cm^3 of water
B 25 g of HCl in 100 cm^3 of water
C 30 g of HCl in 500 cm^3 of water
D 45 g of HCl in 1000 cm^3 of water
- 14** Methanethiol gas, CH_3SH , burns as shown in the equation below.

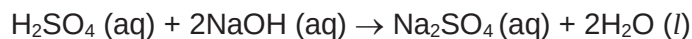


A sample of 20 cm^3 of methanethiol gas was burned with 30 cm^3 of oxygen gas.

What would be the final volume of the resultant mixture of gases when cooled to room temperature and pressure?

- A** 20 cm^3
B 30 cm^3
C 40 cm^3
D 50 cm^3
- 15** Which statements best describe what happens in the Haber process ?
1. The hydrogen needed is obtained from the fractional distillation of liquefied air.
 2. The process is reversible.
 3. The ratio of the molar volume of hydrogen to nitrogen is 3:1.
 4. The unchanged reactants are reused.
- A** 1 and 3 only
B 1, 2, 3 and 4
C 2 and 3 only
D 2, 3 and 4 only

- 16 Yanny titrated 25.00 cm³ of 0.100 mol/dm³ of sulfuric acid with 0.250 mol/dm³ of sodium hydroxide using a methyl orange indicator.



She recorded the volume of sodium hydroxide used to be 24.00 cm³.

Which statement(s) is/are correct?

1. The colour of the solution at the end of the titration is yellow.
2. The colour of the solution at the end of the titration is orange.
3. She has exceeded the end-point of the titration.
4. She has just reached the end-point of the titration

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

- 17 A student is given five reagents as shown below to make salts.

dilute hydrochloric acid
 dilute nitric acid
 dilute sulfuric acid
 solid lead (II) oxide
 solid copper (II) oxide

How many soluble salts can be prepared?

- A** 3
B 4
C 5
D 6

- 18 Four bottles, **A**, **B**, **C** and **D**, containing colourless solutions have no labels. A series of tests are conducted on each of the solutions.

Which bottle contains ammonium chloride solution?

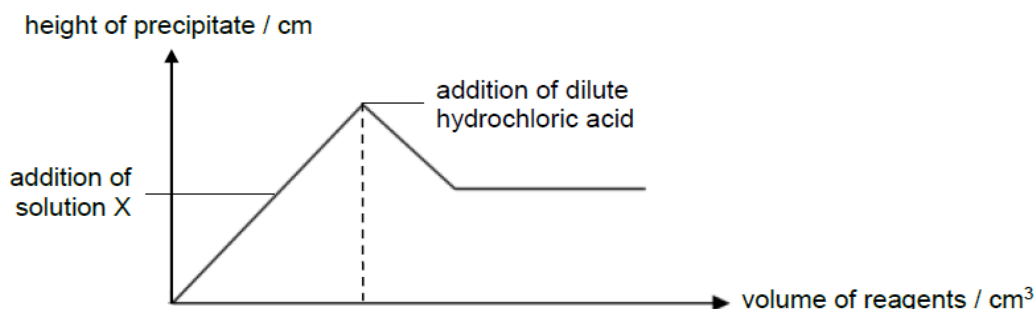
Bottle	test 1: add dilute hydrochloric acid	test 2: add warm aqueous sodium hydroxide	test 3: add dilute nitric acid and aqueous silver nitrate
A	bubbling	gas produced turns damp red litmus blue	no visible change
B	no visible change	gas produced turns damp red litmus blue	no visible change
C	no visible change	gas produced turns damp red litmus blue	white precipitate forms
D	no visible change	no reaction	white precipitate forms

19 Which method produces the highest yield of calcium sulfate from calcium carbonate?

- A Addition of aqueous dilute hydrochloric acid
- B Addition of aqueous sodium sulfate
- C Addition of dilute hydrochloric acid, followed by solid barium sulfate
- D Addition of dilute hydrochloric acid, followed by sodium sulfate solution

20 The graph below shows how the height of the precipitate formed increases when solution X is gradually added to solution Y.

The height of the precipitate then decreases when excess dilute hydrochloric acid is added to the mixture.



What is the identity of solution X and the anions present in solution Y?

	solution X	solution Y
A	aqueous barium nitrate	carbonate, chloride
B	aqueous barium nitrate	iodide, sulfate
C	aqueous silver nitrate	carbonate, chloride
D	aqueous silver nitrate	iodide, sulfate

21 There are four stages of reactions for the conversion of solid candlewax, $C_{30}H_{62}$, to carbon dioxide and water. The reactions can be represented by the chemical equations below.

- 1 $C_{30}H_{62} (s) \rightarrow C_{30}H_{62} (l)$
- 2 $C_{30}H_{62} (l) \rightarrow C_{30}H_{62} (g)$
- 3 $C_{30}H_{62} (g) + 45.5 O_2 \rightarrow 30 CO_2 (g) + 31 H_2O (g)$
- 4 $30 CO_2 (g) + 31 H_2O (g) \rightarrow 30 CO_2 (g) + 31 H_2O (l)$

Which stages are exothermic?

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

- 22 The table below show the chemical formulae of the different compounds formed by carbon and other elements.

compound	chemical formula
potassium cyanide	KCN
iron(II) carbide	Fe ₂ C
carbon dioxide	CO ₂
calcium carbonate	CaCO ₃

In which substance, does carbon has the same oxidation state?

- A carbon dioxide and calcium carbonate
 B carbon dioxide and potassium cyanide
 C iron(II) carbide and calcium carbonate
 D iron(II) carbide and potassium cyanide
- 23 Separate samples of an unknown solution W are added to aqueous potassium iodide and acidified potassium manganate(VII).

It is observed that aqueous potassium iodide turns from colourless to brown and acidified potassium manganate(VII) remains purple.

What conclusion about W is correct?

- A W is both an oxidising agent and a reducing agent.
 B W is neither an oxidising agent nor a reducing agent.
 C W is only a reducing agent.
 D W is only a oxidising agent.
- 24 Each of the following halogens, X₂, Y₂ and Z₂, was added to the respective halide solutions and the observations are shown in the table below.

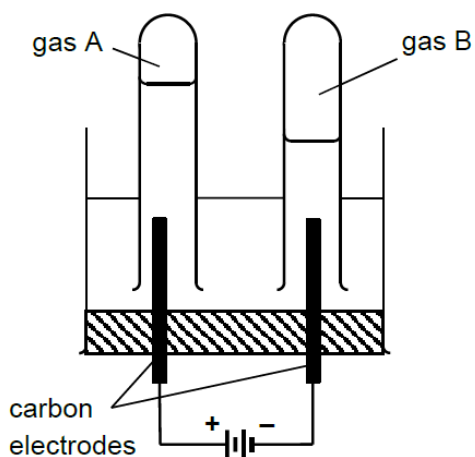
halogen added	NaX	NaY	NaZ
X ₂	--	Y ₂ displaced	no visible reaction
Y ₂	no visible reaction	--	no visible reaction
Z ₂	X ₂ displaced	Y ₂ displaced	--

Which row lists the elements X, Y and Z in decreasing order of reactivity?

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

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

- 28 The diagram shows an electrolytic cell used to electrolyse a solution.



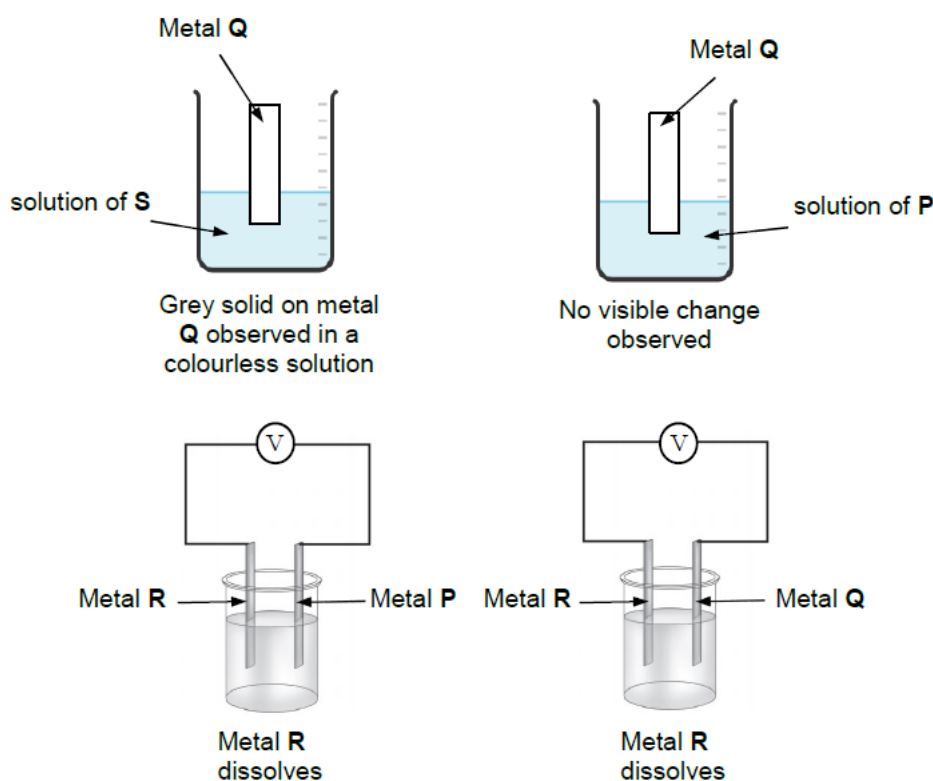
What is a possible identity of this solution?

- A concentrated magnesium chloride
 - B concentrated silver nitrate
 - C concentrated sodium iodide
 - D dilute potassium fluoride
- 29 During an experiment, a student found out the following properties of element X.
1. Oxide of element X can react with both acid and base to form salt and water.
 2. X can only be extracted from its ore by electrolysis of molten compound of X.

What could element X be?

- A aluminium
- B calcium
- C lead
- D zinc

- 30 Stephy conducted four experiments to find out the reactivity of four metals P, Q, R and S. The results and set-ups of her four experiments can be shown below.

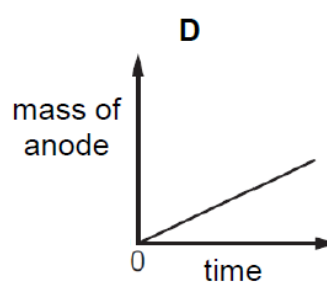
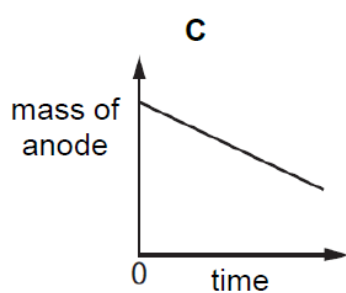
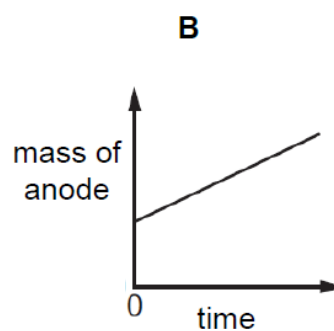
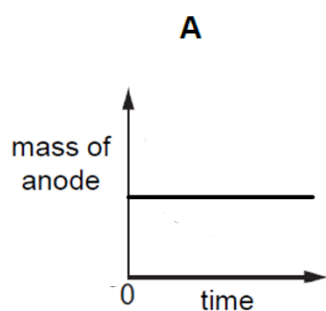


Based on the results of the experiments, arrange the metals in decreasing order of reactivity.

	most reactive  least reactive			
A	P	Q	R	S
B	R	P	Q	S
C	S	Q	P	R
D	S	R	Q	P

- 31 Aqueous copper(II) sulfate is electrolysed using copper electrodes. The current is constant and the anode is weighed at regular time intervals.

Which graph is obtained when the mass of the anode is plotted against time?

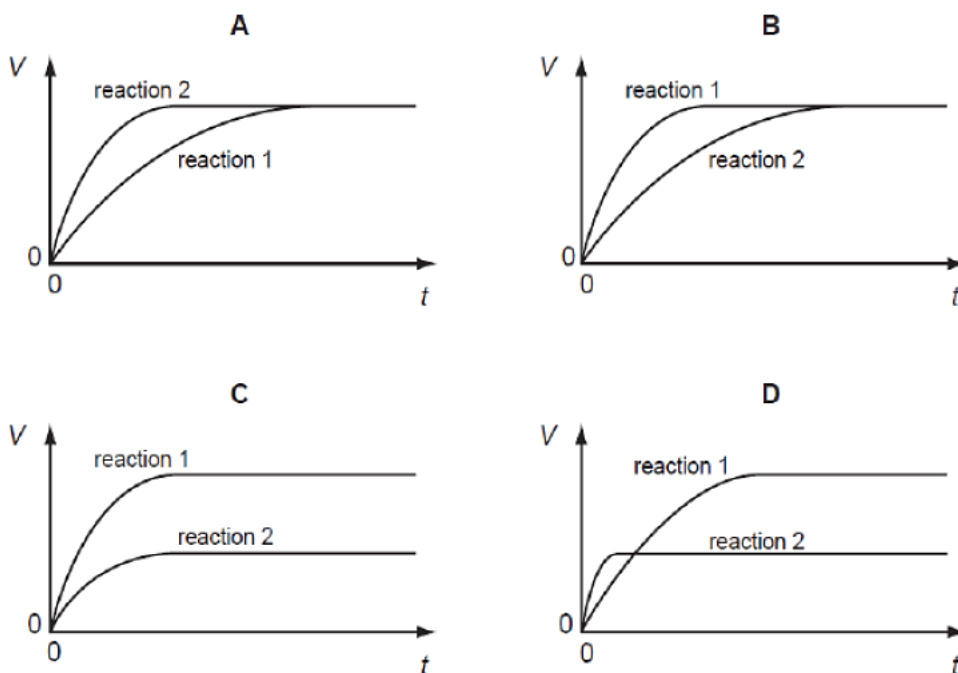


- 32 Amy conducted two experiments.

Experiment 1	10 g of granules of calcium carbonate with 1 dm ³ of 2.0 mol/dm ³ dilute hydrochloric acid
Experiment 2	5 g of powdered calcium carbonate with 1 dm ³ of 3.0 mol/dm ³ dilute hydrochloric acid

In both experiments, the volume of carbon dioxide produced, V is measured against time, t and the results are plotted graphically.

Which set of graphs is correct?



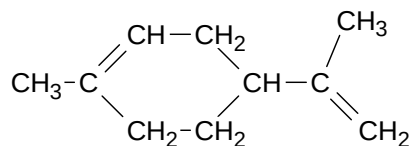
- 33 When 50 cm³ of 1 mol/dm³ HCl is mixed with 50 cm³ of 1 mol/dm³ NaOH, the temperature of the resulting solution increases by 6°C. What will be the temperature change when 100 cm³ of each of these solutions are mixed?

- A 3 °C
- B 6 °C
- C 12 °C
- D 24 °C

- 34 Which formula below best represents a straight-chain hydrocarbon that contains only single covalent bonds?

- A C₆H₆
- B C₆H₁₂
- C C₆H₁₄
- D C₆H₅OH

- 35** Limonene is found in oils of orange, grapefruit and lemon. The structure of limonene is as shown.

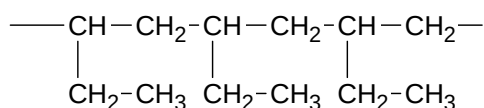


Which statements are true about limonene?

1. It reacts with chlorine in the presence of light.
 2. It is flammable.
 3. It can react with hydrogen gas to form saturated hydrocarbon.
- A** 1 and 2 only
B 1 and 3 only
C 1, 2 and 3
D 2 and 3 only
- 36** A molecule of hydrocarbon, $C_{16}H_{34}$, undergoes cracking to produce one molecule of butane and the rest ethene molecules.

How many ethene molecules are produced?

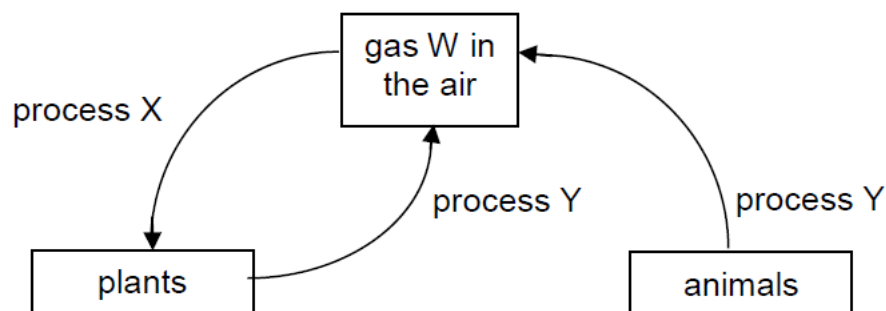
- A** 4
B 6
C 8
D 10
- 37** The structure of a polymer is shown below.



What is the molecular formula of the monomer?

- | | |
|-------------------|----------------------|
| A C_2H_4 | B C_3H_8 |
| C C_4H_8 | D C_4H_{10} |

38 The diagram shows part of the carbon cycle.



What is the correct identity of gas W and processes X and Y?

	gas W	process X	process Y
A	carbon dioxide	photosynthesis	respiration
B	carbon dioxide	respiration	photosynthesis
C	carbon monoxide	photosynthesis	respiration
D	carbon monoxide	respiration	photosynthesis

39 Which pair of pollutants can cause the most damage to limestone buildings?

- A** carbon monoxide and oxygen
- B** chloroflurocarbons and ozone
- C** methane and sulfur dioxide
- D** nitrogen oxides and sulfur dioxide

40 A car burning lead-free fuel has a catalytic converter filled to its exhaust. On analysis, its exhaust gases are shown to contain small quantities of nitrogen oxides.

What modification(s) would result to a lower exhaust concentration of nitrogen oxides?

1. An increase in the surface area of the catalyst in the converter.
2. An increase in the percentage of oxygen going into the car.
3. A higher temperature of combustion in the engine.

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

The Periodic Table of Elements

Group																									
1	2	1 H hydrogen 1										13	14	15	16	17	18								
		Key																							
3	4	proton (atomic) number atomic symbol name relative atomic mass														9	10	11	12	5	6	7	8	17	18
Li lithium 7	Be beryllium 9																							F fluorine 19	Ne neon 20
Na sodium 23	Mg magnesium 24																							Cl chlorine 35.5	Ar argon 40
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36								
K potassium 39	Ca calcium 40	Sc scandium 45	Ti titanium 48	V vanadium 51	Cr chromium 52	Mn manganese 55	Fe iron 56	Co cobalt 59	Ni nickel 59	Cu copper 64	Zn zinc 65	Ga gallium 70	Ge germanium 73	As arsenic 75	Se selenium 79	Br bromine 80	Kr krypton 84								
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54								
Rb rubidium 85	Sr strontium 88	Y yttrium 89	Zr zirconium 91	Nb niobium 93	Mo molybdenum 96	Tc technetium –	Ru ruthenium 101	Rh rhodium 103	Pd palladium 106	Ag silver 108	Cd cadmium 112	In indium 115	Sn tin 119	Sb antimony 122	Te tellurium 128	I iodine 127	Xe xenon 131								
55	56	57–71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86								
Cs caesium 133	Ba barium 137	lanthanoids	Hf hafnium 178	Ta tantalum 181	W tungsten 184	Re rhenium 186	Os osmium 190	Ir iridium 192	Pt platinum 195	Au gold 197	Hg mercury 201	Tl thallium 204	Pb lead 207	Bi bismuth 209	Po polonium –	At astatine –	Rn radon –								
87	88	89–103	104	105	106	107	108	109	110	111	112		114		116		–								
Fr francium	Ra radium	actinoids	Rf rutherfordium	Db dubnium	Sg seaborgium	Bh bohrium	Hs hassium	Mt meitnerium	Ds darmstadtium	Rg roentgenium	Cn copernicium		Fl flerovium		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 –