康 柏 中 学

COMPASSVALE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
SCIENCE (CHEMISTRY, BIOLOGY) 5078/01

Paper 1 Multiple Choice

Secondary Four Express / Five Normal (Academic)

Name: _____ Duration: 1 h

Index No: _____ Date: 31 Aug 2022

Class: _____ Marks: _____ / 40

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 Data Sheet is printed on page 19.
A copy of the Periodic Table is printed on page 20.
The use of an approved scientific calculator is expected, where appropriate.

This paper consists of **20** printed pages including this page. Setters: Mdm C Lim,

1 Which apparatus is most suitable for collecting 25.0 cm^3 of fluorine at room temperature?

A burette

B gas syringe

C measuring cylinder

D pipette

2 The melting and boiling points of two substances X and Y are shown.
Substances X and Y are miscible liquids.

substance	melting point / °C	boiling point / °C
X	5.5	80
Y	–95	110

Which method is most suitable to separate substances X and Y?

A crystallisation

B filtration

C fractional distillation

D simple distillation

3 Which statements about the Kinetic Particle Theory are correct?

1 In gaseous state, particles are far apart and moving in random directions.

2 Particles in solid state have lower kinetic energy than particles in liquid state.

3 During boiling, particles gain energy and break free from their fixed positions.

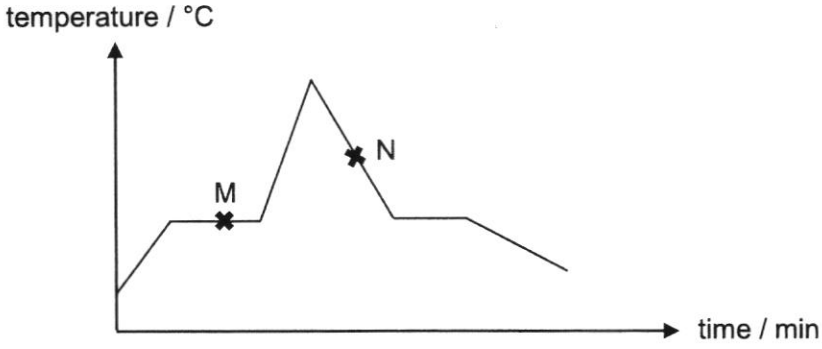
A 1 and 2

B 1 and 3

C 2 and 3

D 1, 2 and 3

4 A solid substance is heated to melt and cooled as shown in the diagram.



What are the physical states of the substance at M and N?

	M	N
A	liquid	liquid + solid
B	liquid + solid	liquid
C	liquid + solid	solid
D	solid	liquid + solid

5 A solution of lead(II) nitrate is tested with different reagents.

Which row gives the correct observation?

	test	observation
A	aqueous ammonia added	white precipitate formed, soluble in excess
B	aqueous sodium hydroxide added	white precipitate formed, soluble in excess
C	aqueous sodium hydroxide added	effervescence observed
D	dilute nitric acid added	effervescence observed

6 An element X forms an ion X^{2-}.

Which group of the Periodic Table is this element found in?

A Group I

B Group II

C Group VI

D Group VII

7 The chemical formula of the compound formed by P and Q is PQ_2.

Both P and Q are non-metals.

What is the correct electronic configuration of P and Q?

	P	Q
A	2.2	2.7
B	2.4	2.6
C	2.8.1	2.6
D	2.8.6	2.1

8 Potassium chlorate has the formula $KClO_3$.

What is the chemical formula of copper(II) chlorate?

A $CuClO_3$

B Cu_2ClO_3

C $Cu_3(ClO_3)_2$

D $Cu(ClO_3)_2$

9 A solution of nitric acid is made by dissolving 31.5 g of HNO_3 in 200 cm^3 of water.

What is the concentration, in mol/dm^3, of this solution?

A 0.0025 mol/dm^3

B 0.1575 mol/dm^3

C 2.5 mol/dm^3

D 157.5 mol/dm^3

10 A student adds an aqueous solution of sodium hydroxide to a solution of dilute hydrochloric acid. The reaction is exothermic.

Which row shows the direction of heat flow and the change in temperature for this reaction?

	temperature change	direction of heat flow
A	fall	from surroundings
B	fall	to surroundings
C	rise	from surroundings
D	rise	to surroundings

11 Copper(II) oxide is added to excess dilute nitric acid.

The equation for the reaction is shown.

$$CuO(s) + 2HNO_3(aq) \rightarrow Cu(NO_3)_2(aq) + H_2O(l)$$

Which change in the conditions will increase the speed of reaction?

A decrease the concentration of nitric acid

B decrease the volume of nitric acid

C increase the particle size of copper(II) oxide

D increase the temperature

12 Part of some chemical reactions are shown.

Which reaction represents reduction?

A $2Cl^- \rightarrow Cl_2 + 2e^-$

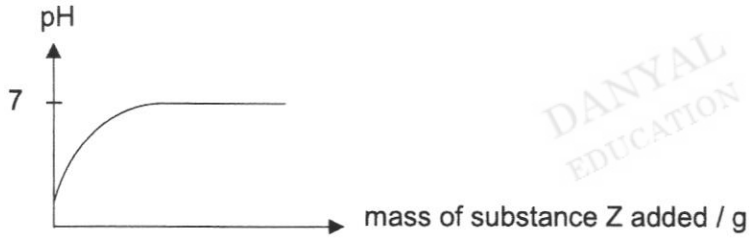
B $H^+ + OH^- \rightarrow H_2O$

C $Na^+ + Cl^- \rightarrow NaCl$

D $Fe^{3+} + e^- \rightarrow Fe^{2+}$

13 Substance Z is an insoluble solid. Excess substance Z is added into a beaker of dilute hydrochloric acid.

The pH of the reaction mixture is measured and shown.



What is substance Z?

A calcium hydroxide

B magnesium carbonate

C potassium oxide

D silver chloride

14 Some information about oxides of T and U are given.

	reacts with acid to form salt and water	reacts with base to form salt and water
oxide of T	✓	×
oxide of U	×	×

What type of oxides are oxides of T and U?

	T	U
A	acidic	amphoteric
B	amphoteric	acidic
C	basic	neutral
D	neutral	basic

15 Which salt requires pipette and burette in its preparation?

A ammonium chloride

B barium sulfate

C lead(II) chloride

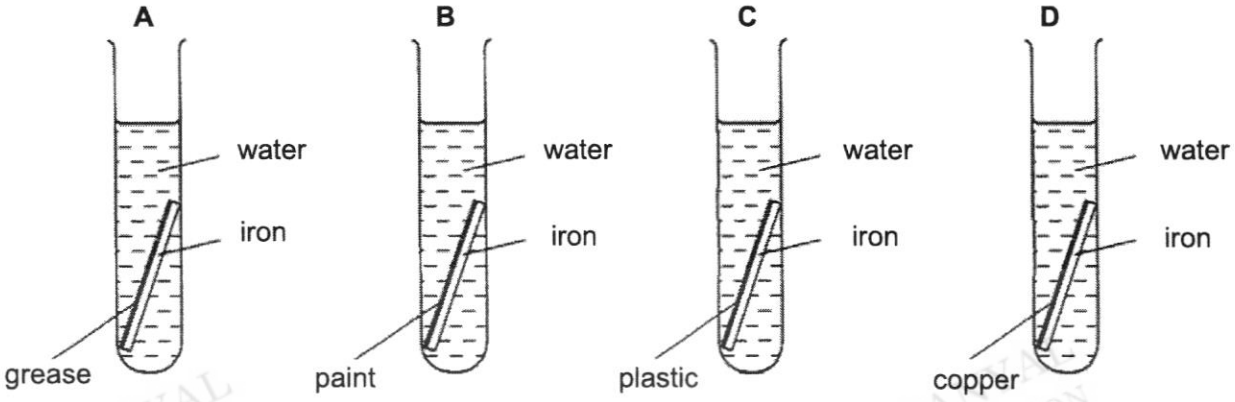
D zinc nitrate

16 Which row about bromine is correct?

	state at room temperature	colour	displacement reactions
A	liquid	red-brown	displaces chlorine from chlorides
B	liquid	red-brown	displaces iodine from iodides
C	solid	brown	displaces chlorine from chlorides
D	solid	brown	displaces iodine from iodides

17 Identical pieces of iron are placed in four different test-tubes.

In which test-tube will the iron rust?



18 Two statements were made about acid rain.

Statement 1: The burning of fossil fuels containing sulfur is a cause of 'acid rain'.

Statement 2: Acid rain is formed from sulfur dioxide which is produced when sulfur compounds burn.

Which of the following is true?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is incorrect.

D Statement 2 is correct but statement 1 is incorrect.

19 Which petroleum fraction is used as a material for road surfaces?

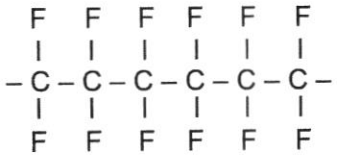
A bitumen

B diesel

C lubricating oil

D naphtha

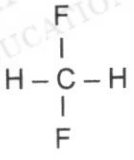
20 The diagram shows part of the structure of an addition polymer.



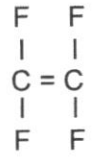
Which monomer is used to make this polymer?

A

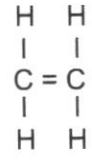
B



C



D



康 柏 中 学
COMPASSVALE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
SCIENCE (CHEMISTRY) 5076/03, 5078/03
Paper 3 Theory
Secondary Four Express / Five Normal (Academic)

Name: _____ Duration: 1 h 15 min

Index No: _____ Date: 26 Aug 2022

Class: _____ Marks: _____/ 65

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

The use of an approved scientific calculator is expected, where appropriate.
You may lose marks if you do not show your working or if you do not use appropriate units.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer any **two** questions.
Write your answers in the spaces provided on the question paper.

A copy of the Data Sheet is printed on page 14.
A copy of the Periodic Table is printed on page 15.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This paper consists of **15** printed pages including this page. Setter: Mdm C Lim

Section A

Answer **all** the questions in the spaces provided.

1 Write on the line above the arrow a suitable description of the change. The first has been completed for you as an example.

example	ethene	***polymerisation*** ⟶	poly(ethene) production
(a)	bromine atom	..... ⟶	bromide ion
(b)	carbon	..... ⟶	carbon dioxide
(c)	dissolving ammonium chloride in water	..... ⟶	drop in temperature
(d)	sea water	..... ⟶	pure water
(e)	sodium chloride crystals	..... ⟶	molten sodium chloride

[5]

2 Use the Periodic Table to help you answer the following questions.

(a) State the order by which the elements are arranged in the Periodic Table.

..... [1]

(b) Which group contains only

(i) relatively soft, low density metals, ... [1]

(ii) monatomic non-metals? ..... [1]

(c) Name an element which is

(i) found in Group VI, period 3, ... [1]

(ii) in the same period as beryllium but has a more metallic character.

..... [1]

3 Paper chromatography was used to find out the type of food colourings used in Brand **X** Jelly. Five commonly used food colourings, **A**, **B**, **C**, **D** and **E** were spotted on the chromatogram.

Fig 3.1 shows the chromatogram.

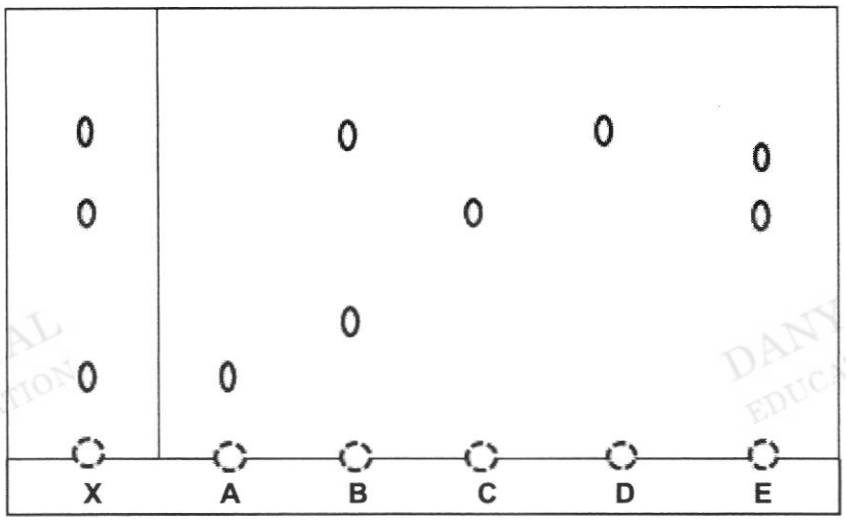


Fig. 3.1

(a) State which food colourings Brand **X** Jelly contain.

..... [1]

(b) From the chromatogram, state and explain one difference in physical property between food colourings **C** and **D**.

.....

..... [2]

(c) What would you say about the boiling point of food colouring **B**? Use Fig 3.1 to explain your reason.

.....

..... [2]

4 A photochromic glass is a type of glass that darkens on exposure to UV light.

In photochromic lenses, silver chloride and copper(I) chloride crystals are added during the manufacturing of the glass.

In the presence of UV light, silver particles produced darken the glass.

$$AgCl(s) + CuCl(s) \rightarrow Ag(s) + CuCl_2(s)$$

(a) Determine the oxidation states of copper and silver in this reaction.

element	oxidation state in reactants	oxidation state in products
copper		
silver		

[2]

(b) Using your answer in **(a)**, identify and explain which element is oxidised in the reaction.

.....

..... [1]

5 When sodium hydrogen carbonate, $NaHCO_3$, is heated, it decomposes to form sodium carbonate, Na_2CO_3, water vapour and carbon dioxide as shown in the equation:

$$2NaHCO_3(s) \rightarrow Na_2CO_3(s) + H_2O(g) + CO_2(g)$$

16.8 g of sodium hydrogen carbonate is heated and decomposed.

(a) Calculate the relative formula mass of sodium hydrogen carbonate, $NaHCO_3$.

relative formula mass = ... [1]

(b) Calculate the mass of sodium carbonate, Na_2CO_3 produced.

mass of sodium carbonate = ... g [2]

(c) Calculate the total volume of gas produced.

volume of gas = ... dm^3 [2]

6 Fig. 6.1 describes some of the reactions of an aqueous salt solution, **A**.

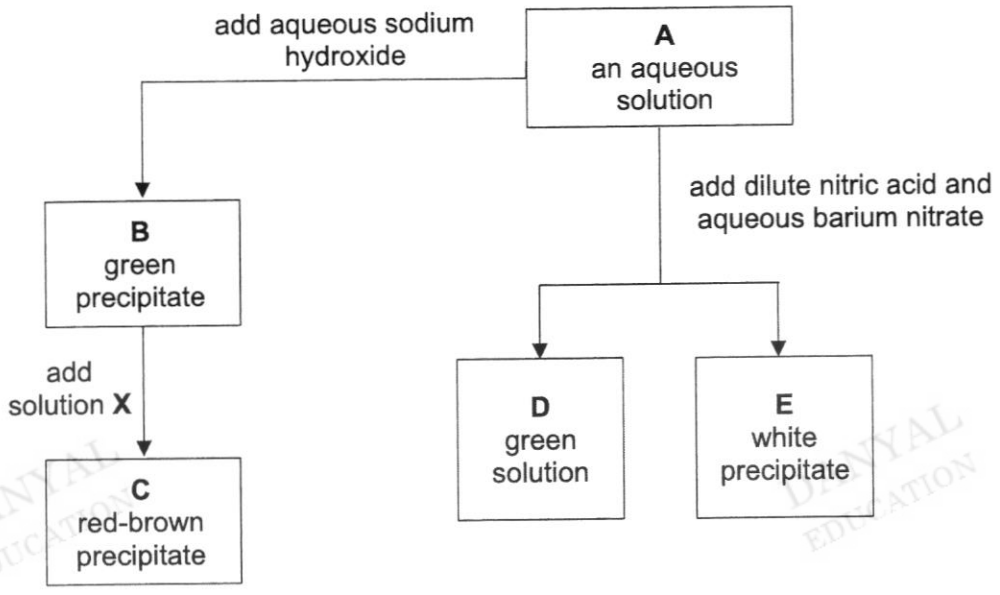


Fig. 6.1

(a) Identify **A**, **B**, **C**, **D** and **E**.

A .....

B .....

C .....

D .....

E ..... [5]

(b) Write a balanced chemical equation for any of the reactions included in Fig. 6.1.

..... [2]

(c) Suggest the identity of solution **X** and state the role it plays in the reaction.

.....

..... [2]

7 A student investigated the reactivity of three metals – magnesium, nickel and zinc.

(a) In the first experiment, the student investigated the temperature change when he added different metals to dilute hydrochloric acid.

Table 7.1 shows the results.

Table 7.1

metal added	initial temperature / °C	final temperature / °C
magnesium	25.0	42.5
nickel	25.0	27.0
zinc	25.0	32.5

(i) State **two** variables that needs to be kept constant to ensure a fair experiment.

.....

..... [2]

(ii) Using the information in Table 7.1, place the metals in order of their reactivity.

most reactive .....

.....

least reactive ..... [1]

(b) In the second experiment, the student then added the same three metals – magnesium, nickel and zinc, to different metal sulfate solutions.

Predict if there would be a reaction occurring and complete Table 7.2.

You should:

- use a tick (✓) to show where a reaction will occur
- use a cross (✗) to show where no reaction will occur

Table 7.2

	magnesium sulfate	nickel sulfate	zinc sulfate
magnesium			
nickel			
zinc			

[2]

8 Table 8.1 shows the proton and nucleon numbers of some particles.

Table 8.1

particle	proton number	nucleon number
V	8	17
W	8	18
X	9	18
Y	12	25
Z	17	35

(a) Particles **Y** and **Z** react together to form a compound.

(i) Draw a 'dot-and-cross' diagram to show the arrangement of electrons in this compound. Only the outer shells of electrons need to be shown.

[2]

(ii) Describe **two** physical properties of this compound.

.....

.....

..... [2]

(b) **(i)** Which two particles have the same chemical properties but different masses?

..... [1]

(ii) Explain why this is so, using information from Table 8.1.

.....

.....

..... [3]

Section B

Answer any **two** questions in this section.

Write your answers in the spaces provided.

9 A student investigates how the speed of a reaction changes over time.

(a) Excess zinc granules are added to dilute sulfuric acid in a flask and placed on an electronic balance. The mass of the flask and its contents are measured regularly until the reaction is completed.

(i) Sketch the graph that the student will obtain from the data collected. Label both axes.

[2]

(ii) Explain how the graph shows that the speed of reaction changes over time.

.....

.....

.....

..... [2]

(b) The student then investigated how the concentration of acid and the particle size of zinc affect the speed of reaction.

The student varied the concentration and particle size as shown in Table 9.1.

Table 9.1

experiment	concentration of H_2SO_4 / mol/dm^3	particle size of Zn
1	0.5	granules
2	1.0	powder
3		

(i) Fill in the conditions for Experiment 3 in Table 9.1 for the student to be able to determine how concentration and particle size affect the speed of reaction. [1]

(ii) State how the concentration of acid and the particle size of zinc affect the speed of reaction.

Use your knowledge of reacting particles to explain your answer.

.....

.....

.....

.....

.....

.....

..... [5]

10 Most metals exist in the form of ores. An ore is a compound of the metal mixed with large amounts of earth and rock.

(a) The position of a metal in the reactivity series affects the ease of extraction of the metal from its ore.

Both magnesium and iron are found in the reactivity series.

(i) State the methods of extraction for magnesium and iron.

magnesium .....

iron ..... [2]

(ii) Explain the difference in the ease of extraction of magnesium and iron from their ores.

.....

.....

..... [2]

(b) Name one metal that occurs freely in nature as an uncombined metal.

..... [1]

(c) Many metal ores contain carbonates of a metal. The amount of carbonate can be determined by reacting the ore with an acid.

You are provided with two metal ores, **P** and **Q**.

Describe a laboratory investigation that can be used to decide which metal ore, **P** or **Q** contains more carbonate. Include all the measurements you would make.

You may draw a diagram to help you.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) Instead of extracting metals from their ores, we are encouraged to recycle metals.

State an advantage of recycling metals.

.....

..... [1]

11 Alkanes and alkenes are two homologous series of hydrocarbons. One property of a homologous series is that the members have the same general formula.

(a) State the general formulas of alkane and alkene homologous series.

alkane .....

alkene ..... [2]

(b) State **two** other properties of a homologous series.

.....

.....

..... [2]

(c) The cracking of nonane, C_9H_{20}, produces methane and ethene.

(i) Write a balanced chemical equation for this reaction.

..... [2]

(ii) Describe a test to distinguish between methane and ethene.

.....

.....

..... [2]

(iii) Describe what is a cracking process and explain why cracking is important in the chemical industry.

.....

.....

..... [2]

Compassvale Secondary School
Preliminary Examination 2022
Sec 4 Exp/5NA Science (Chemistry) 5076/5078
Marking Scheme

Setter: Mdm C Lim

Paper 1

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	C	A	B	B	C	B	D	C	D
Q11	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**
D	D	B	C	A	B	D	A	A	C

Paper 3

Section A

1 (a) reduction [1]

(b) combustion/oxidation [1]

(c) endothermic [1]

(d) simple distillation [1]

(e) melting [1]

2 (a) increasing proton number [1]

(b) (i) Group I [1]
(ii) Group 0 [1]

(c) (i) sulfur [1]
(ii) lithium [1]

3 (a) A, C, D

(b) Food colouring C is less soluble than D [1]
as its spot travels a smaller/shorter distance from the starting line / spot is nearer to starting line [1]

(c) Food colouring B will boil over a range of temperatures. [1]
as it is a mixture of 2 components/substances [1]

4 **(a)**

element	oxidation state in reactants	oxidation state in products
copper	+1	+2
silver	+1	0

any 2 [1]

(b) Copper is oxidised as its oxidation state increases from +1 in $CuCl$ to +2 in $CuCl_2$. [1]

5 **(a)** relative formula mass = 23 + 1 + 12 + 3(16) = 84 [1]

(b) Number of moles of $NaHCO_3$ = 16.8 / 84 [1]
= 0.2

By mole ratio,

$NaHCO_3 : Na_2CO_3$
2 : 1
0.2 : 0.1

mass of Na_2CO_3= 0.1 x [2(23) + 12 + 3(16)] = 10.6g [1]

(c) By mole ratio,

$NaHCO_3 : H_2O : CO_2$
2 : 1 : 1 [1]
0.2 : 0.1 : 0.1

volume of gas = (0.1 + 0.1) x 24 = 4.8dm^3 [1]

6 **(a)** A: iron(II) sulfate / $FeSO_4$ [1]
B: iron(II) hydroxide / $Fe(OH)_2$ [1]
C: iron(III) hydroxide / $Fe(OH)_3$ [1]
D: iron(II) nitrate / $Fe(NO_3)_2$ [1]
E: barium sulfate / $BaSO_4$ [1]

(b) $FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$ [2]

OR

$FeSO_4 + Ba(NO_3)_2 \rightarrow Fe(NO_3)_2 + BaSO_4$

1m for correct formulas; 1m for balanced chemical equation

(c) acidified potassium manganate(VII) / $KMnO_4$ or acidified potassium dichromate(VI) [1]
oxidising agent [1]

7 (a) (i) same size/mass of metal [1]
same concentration/volume of acid [1]

(ii) most reactive **magnesium** [1]

zinc

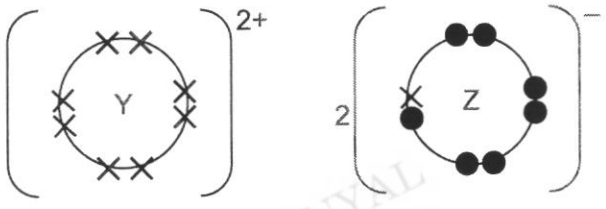
least reactive **nickel**

(b)

	magnesium sulfate	nickel sulfate	zinc sulfate
magnesium		✓	✓
nickel	×		×
zinc	×	✓	

any 3 – 1m [2]

8 (a) (i) [2]



1m for correct charge and ratio; 1m for correct electronic structure
minus 1m for drawing inner shell electrons

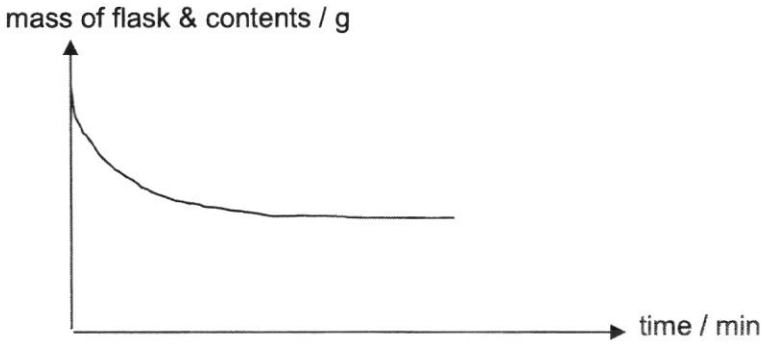
(ii) soluble in water, not soluble in organic solvent [2]
high melting and boiling point
good conductor of electricity in molten and aqueous state
any 2

(b) (i) V and W [1]

(ii) They are isotopes of the same element. [1]
They have the same number of valence electrons, 6, hence same chemical properties [1]
They have different number of neutrons, V has 9 and W has 10 hence different masses. [1]

Section B

9 **(a)** **(i)** [2]



label – 1m
shape of graph – 1m

(ii) Gradient is steepest at the start; speed of reaction is the fastest [1]
Gradient decreases with time until gradient is zero; speed of reaction decreases with time until reaction stops. [1]

(b) **(i)** 0.5 and powder [1]
or
1.0 and granules

(ii) Speed of reaction increases with higher frequency of effective collisions between reacting particles of H_2SO_4 and Zn. [1]

When the concentration of acid increases, speed of reaction increase. [1]
As there are more H^+ ions per unit volume. [1]

When particle size of Zn decrease, speed of reaction increase. [1]
Smaller particle size provides a larger total surface area for collision. [1]

10 **(a)** **(i)** magnesium: electrolysis [1]
iron: reduction using carbon [1]

(ii) Magnesium is more reactive than iron [1]
hence more energy is needed to break the bond in the compound to extract magnesium than iron. [1]

(b) gold/platinum [1]

(c) Experimental set-up with gas syringe *(draw or describe)* [1]

Add the same mass of P and Q in the same volume and concentration of hydrochloric acid, separately in each conical flask. [1]

Measure the volume of carbon dioxide gas collected until the reaction has stopped / volume of gas collected remains constant / over a period of time e.g. 5min [1]

The ore that produces more volume of carbon dioxide gas contains more carbonate. [1]

(d) It conserves finite resources [1]
It requires less energy to recycle than to extract from its ore.

any 1

11 **(a)** alkane: C_nH_{2n+2} [1]
alkene: C_nH_{2n} [1]

(b) They have similar chemical properties [1]
They show a gradation in physical properties [1]
members in the homologous series differ by $-CH_2-$

(c) **(i)** $C_9H_{20} \rightarrow CH_4 + 4C_2H_4$ [2]

correct formula of methane and ethene – 1m
balanced chemical equation – 1m

(ii) Test: Bubble methane and ethene separately into aqueous bromine. [1]
Observation: Red-brown aqueous bromine turns colourless when ethene is added, remains red-brown when methane is added. [1]

(iii) Cracking is a chemical reaction which breaks up large and long-chain alkane molecules into smaller and more useful hydrocarbons molecules, and/or hydrogen. [1]
it converts long-chain alkanes into smaller and more useful hydrocarbon molecules, which are in greater demand. [1]