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YISHUN TOWN SECONDARY SCHOOL

G3

PRELIMINARY EXAMINATION 2025

SECONDARY 4 & 5

G3 SCIENCE (CHEMISTRY)

(5086/1)

DATE : 14 Aug 2025

DAY : Thursday

DURATION : 1 hr

MARKS : 20 marks

ADDITIONAL MATERIALS

Multiple Choice Answer Sheet (OMS)

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.

There are twenty questions. 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 very carefully the instructions on the answer sheet.

INFORMATION FOR CANDIDATES

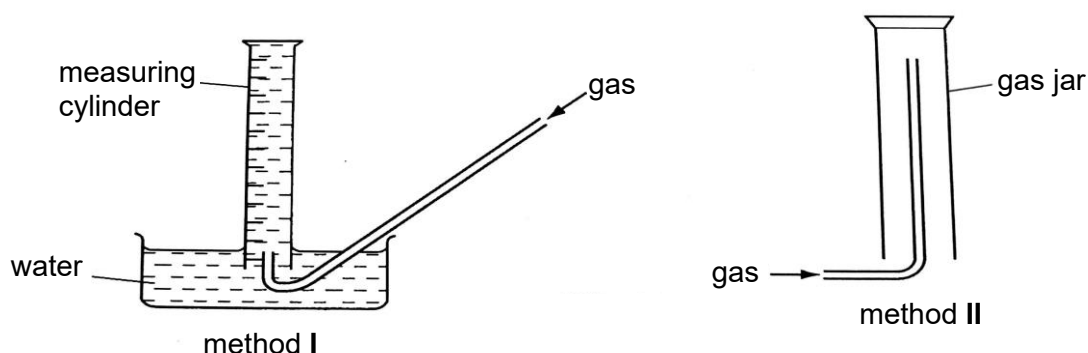
Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

You may use an approved calculator.

A copy of the Periodic Table and Colours of Metal Hydroxides are printed on the last two pages.

Multiple Choice Questions (20 marks)

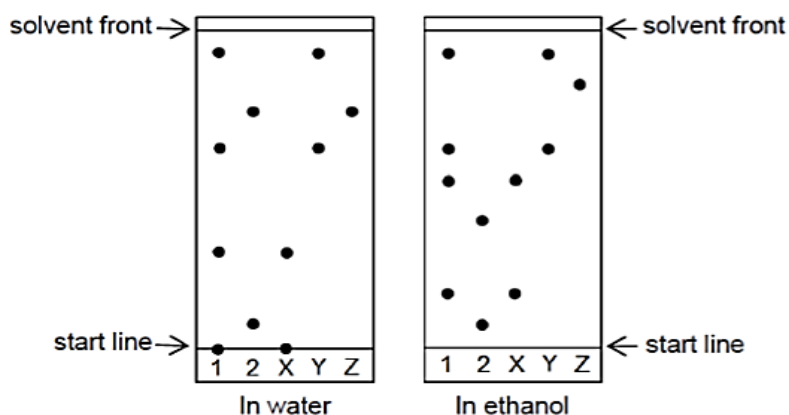
- 1 Two methods of gas collection are shown below.



Which row correctly describes the properties of a gas which allow it to be collected by **both** methods?

	solubility in water	density
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

- 2 Food dyes, 1 and 2 are known to contain one or more of the three substances X, Y and Z. Two chromatograms are developed; one used water as the solvent, and the other used ethanol. The results are shown in the diagram below.

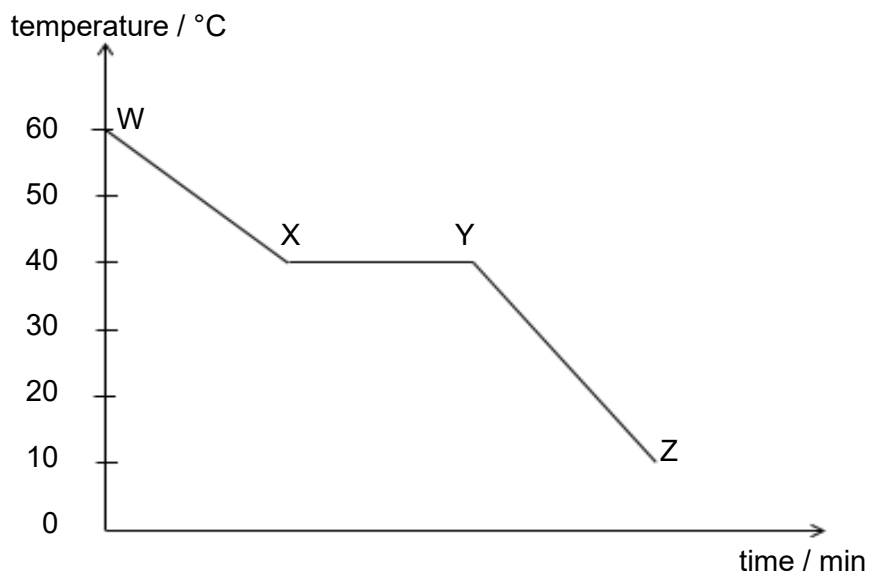


Which statements are correct?

- I Substance Y is likely to be pure.
- II The component in Z is less soluble in water than in ethanol.
- III There is a component in sample 1 that is insoluble in water but soluble in ethanol.

- | | |
|---|---|
| <p>A I and II only</p> <p>C II and III only</p> | <p>B I and III only</p> <p>D All of the above</p> |
|---|---|

- 3 The graph below shows how temperature changes over time when liquid S was cooled.



Which statement **incorrectly** describes the cooling curve of liquid S?

- A Heat energy is gained by the particles at region XY to overcome the forces of attraction.
- B There is a mixture of solid and liquid at region XY.
- C The particles are vibrating about fixed positions at region YZ.
- D The particles are arranged closely in a disorderly manner at region WX.

- 4 Element **G** has an electronic structure of 2,8,1.

Which statements about element **G** are correct?

- I **G** reacts with cold water.
- II **G** forms an ion of -1 charge.
- III **G** is in Period 3 of the Periodic Table.

- A I and II only
- B I and III only
- C II and III only
- D All of the above

- 5 There are a few isotopes for uranium atom. One such atom is uranium-235. What is a possible atomic structure of another isotope of uranium-235?

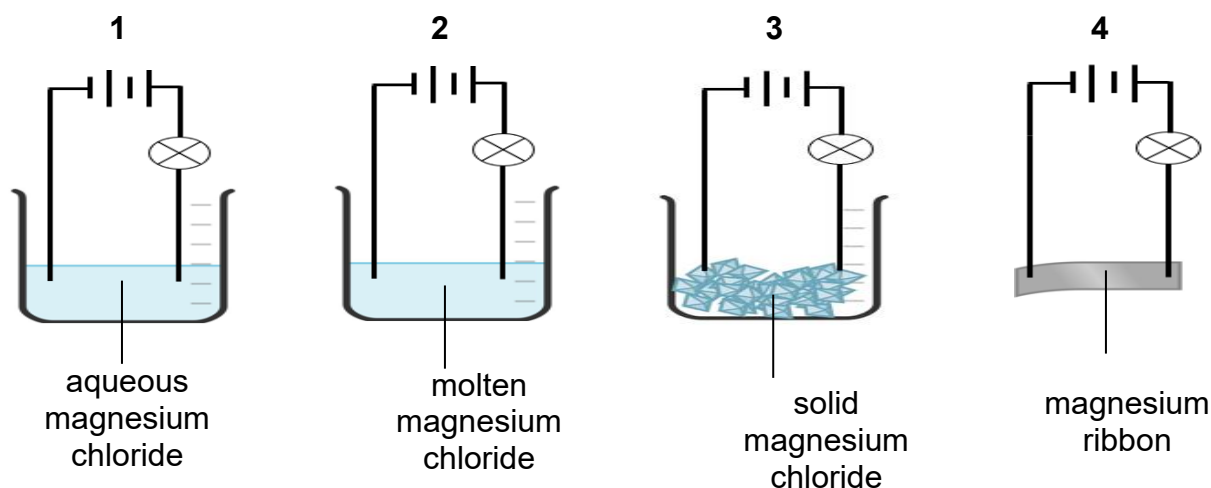
	number of protons	number of neutrons	number of electrons
A	90	143	92
B	92	143	90
C	90	146	90
D	92	146	92

6 Four set-ups are shown below.

Key

⊗ - bulb

||| - batteries



In which set-ups will the bulb light up?

A 1 and 2 only

C 1, 2 and 4 only

B 2 and 4 only

D All of the above

7 The statements below contain descriptions of four different substances **Q**, **R**, **S** and **T**.

substance	description
Q	A reddish liquid that boils at 59 °C and cannot be broken down into simpler substances.
R	White solid that melts over a range of temperatures.
S	A white solid that partially dissolves when placed in a beaker of excess water. It can be separated into a colourless solution and white residue by filtration.
T	A purple substance that has a constant composition and decomposes into two elements when heated.

What is the correct classification of the four substances?

	element	compound	mixture
A	Q	T	R and S
B	Q	R and T	S
C	S	R and T	Q
D	Q and R	S	T

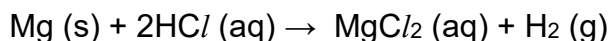
8 Which observation is correct?

	reaction between	observation
A	aqueous copper(II) sulfate and barium nitrate	blue precipitate and colourless solution obtained
B	aqueous sodium chloride and silver nitrate	white precipitate and green solution obtained
C	calcium carbonate and hydrochloric acid	effervescence observed colourless gas extinguished a lighted splint with a 'pop' sound
D	sodium hydroxide and ammonium carbonate	colourless gas turned moist red litmus paper blue on warming

9 Which substance has the least number of moles?

- A** 6 g of hydrogen molecules
- B** 48 g of magnesium atoms
- C** 100 cm³ of 0.25 mol/dm³ aqueous sodium chloride
- D** 24 000 cm³ of ammonia gas at room temperature and pressure

10 Magnesium reacts with hydrochloric acid.



What is the volume of hydrogen gas produced at room temperature and pressure if 6.0 g of magnesium reacts with 100 cm³ of 0.10 mol/dm³ hydrochloric acid?

- A** 0.06 dm³
- B** 0.12 dm³
- C** 3.00 dm³
- D** 6.00 dm³

11 The table below shows the reaction of four metals, W, X, Y and Z, with water and steam.

metal	reaction with water	reaction with steam
W	catches fire	explodes
X	no change	no change
Y	no change	slow effervescence
Z	slow effervescence	rapid effervescence

What is the order of reactivity of the metals from most reactive to least reactive?

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

- 12 A student carried out two experiments by mixing marble and dilute hydrochloric acid together.

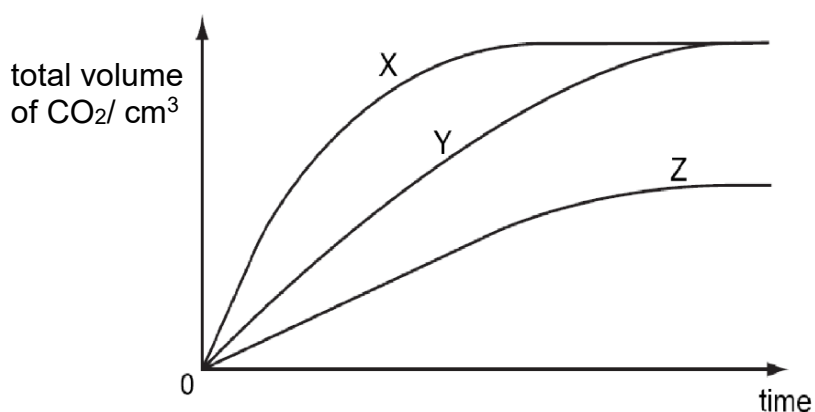
Experiment 1

Excess finely powdered marble and 20 cm³ of 0.10 mol/dm³ dilute hydrochloric acid

Experiment 2

Excess marble chips and 20 cm³ of 0.10 mol/dm³ dilute hydrochloric acid

The total volume of carbon dioxide given off is determined at regular time intervals and plotted in the following graph.



Which curves are obtained in the two experiments?

	experiment 1	experiment 2
A	X	Z
B	X	Y
C	Y	Z
D	Y	X

- 13 In which reaction is hydrochloric acid **not** behaving as an acid?

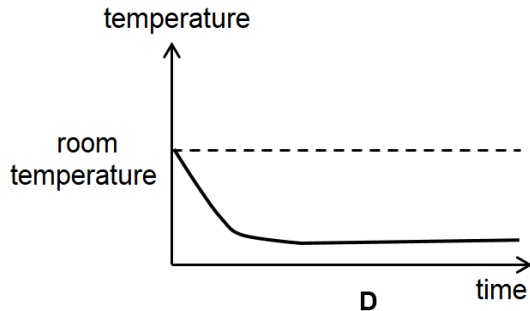
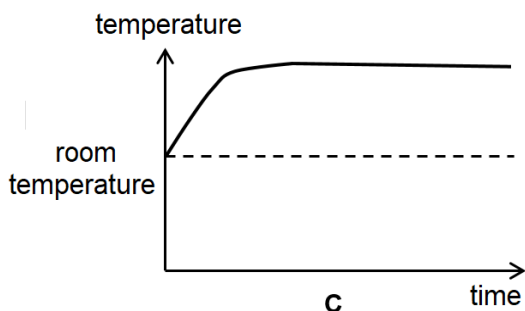
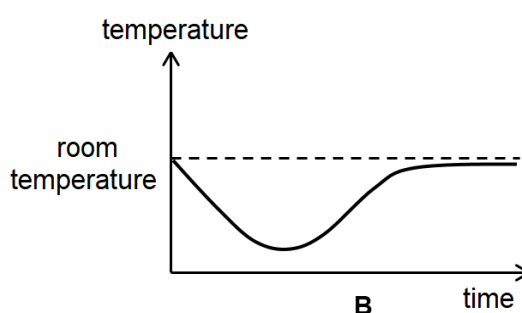
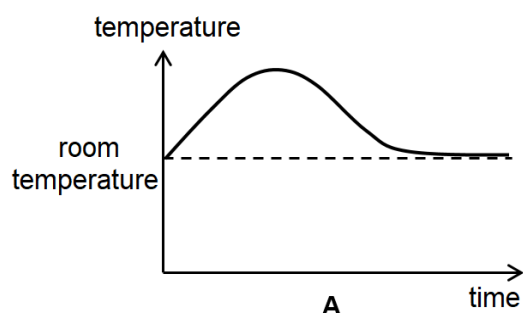
- A** $\text{HCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{HNO}_3$
B $2\text{HCl} + \text{CaCO}_3 \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
C $2\text{HCl} + \text{Fe} \rightarrow \text{FeCl}_2 + \text{H}_2$
D $6\text{HCl} + \text{Fe}_2\text{O}_3 \rightarrow 2\text{FeCl}_3 + 3\text{H}_2\text{O}$

- 14 What are the oxidation states of chlorine in Cl_2O and ClO_4^- ?

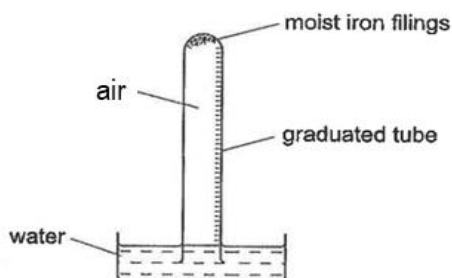
	Cl_2O	ClO_4^-
A	-2	-1
B	+1	+3
C	+1	+7
D	+2	+8

- 15 Solid barium hydroxide is added into a beaker containing crystalline ammonium chloride and the mixture is stirred. When the two solids react, a thin layer of ice forms on the external surface of the beaker.

Which graph shows how the temperature of the mixture changes as the reaction progresses and the remaining mixture is left to stand for some time?



- 16 The apparatus shown below was set up by a student to investigate the effect of air on rusting.



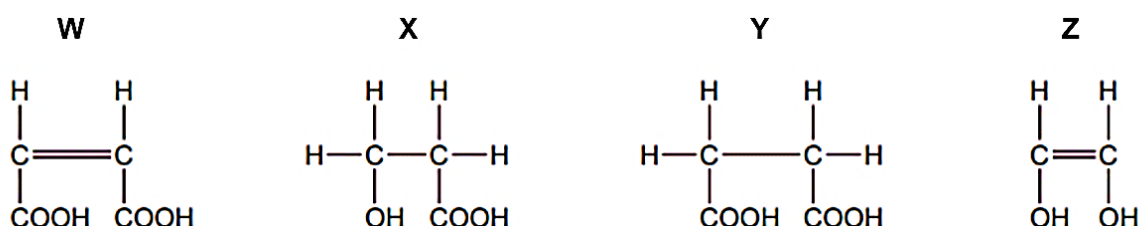
The student discovered that after a few days, the height of the water in the test tube rose by 4 cm. What was the original volume of air found in the test tube?

- A 4 cm³ B 10 cm³
C 20 cm³ D 40 cm³

- 17 Which pollutant, from the combustion of petrol in an internal combustion engine, can cause limestone buildings to corrode?
- A carbon
 B carbon monoxide
 C nitrogen dioxide
 D unburnt hydrocarbon

- 18 Which statement about alkenes is **incorrect**?
- A They are unsaturated hydrocarbons.
 B They decolourise bromine water.
 C They are always formed during cracking of hydrocarbons.
 D Their viscosity decreases as the relative molecular mass increases.

- 19 What are the reactions of compounds **W**, **X**, **Y** and **Z**?



	undergoes addition polymerisation	undergoes oxidation
A	X and Y	W, X, Y and Z
B	X and Y	X and Y
C	W and Z	X and Z
D	W and Z	Z only

- 20 Bioethanol is a biofuel produced by fermenting sugarcane. Carbon dioxide is produced during the production of bioethanol, as well as when it is burnt as a fuel. However, this may not result in an overall increase in the amount of carbon dioxide in the atmosphere.

Which statement explains this advantage of bioethanol as a fuel?

- A A similar amount of carbon dioxide is removed from the atmosphere due to photosynthesis in the sugarcane plants.
 B A similar amount of carbon dioxide is used up by the sugarcane plants during respiration.
 C Bioethanol is a non-renewable resource.
 D The combustion of bioethanol produces less carbon dioxide per carbon atom.

Colours of Some Common Metal Hydroxides

aluminium hydroxide	white
calcium hydroxide	white
copper (II) hydroxide	light blue
iron (II) hydroxide	green
iron (III) hydroxide	red-brown
zinc hydroxide	white

The Periodic Table of Elements

Group

Periodic Table of Elements																			
1		2		Group								13	14	15	16	17	18		
Key proton (atomic) number atomic symbol name relative atomic mass							1 H hydrogen 1										2 He helium 4		
3 Li lithium 7	4 Be beryllium 9													5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24	3	4	5	6	7	8	9	10	11	12	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40		
19 K potassium 39	20 Ca calcium 40	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		
37 Rb rubidium 85	38 Sr strontium 88	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 –	86 Rn radon –		
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 dm³ at room temperature and pressure (r.t.p).