O

JURONG SECONDARY SCHOOL
2020 GRADUATION EXAMINATION
SECONDARY 4 EXPRESS

CANDIDATE NAME	

CLASS		INDEX NUMBER	

CHEMISTRY **6092/01**

PAPER 1 2 September 2020

1 hour

Additional Materials: Multiple Choice Answer Sheet.

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, 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.

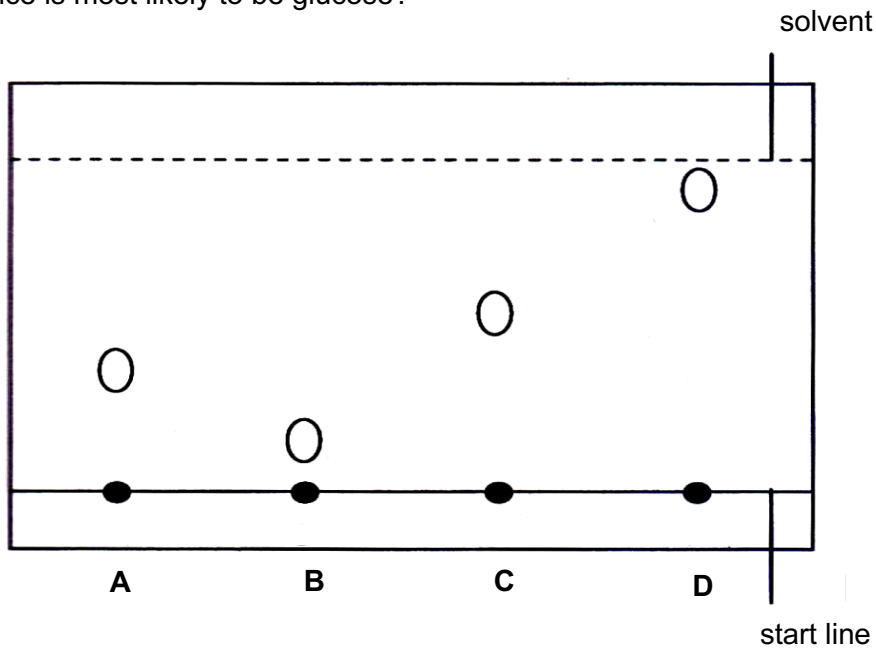
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

A copy of the Periodic Table is to be found on page 20.
The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use	
TOTAL [40 marks]	

1 Four different colourless substances are tested using paper chromatography as shown below. One of them, glucose, has an R_f value of 0.5.

Which substance is most likely to be glucose?



2 Blue mixture B contains two cations.

When aqueous ammonia is added to the aqueous mixture, a blue precipitate is formed which dissolves in excess aqueous ammonia to form a deep blue solution. No other precipitate is formed.

What are the two cations present in mixture B?

A Cu^{2+} and Al^{3+}

B Cu^{2+} and Ca^{2+}

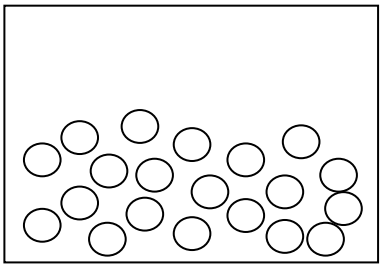
C Cu^{2+} and Fe^{2+}

D Cu^{2+} and Zn^{2+}

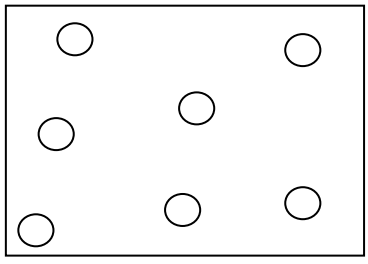
3 In which of the following cases will there be **no** observable change when gas Q reacts with aqueous solution R?

	gas Q	solution R
A	ammonia	hydrochloric acid
B	carbon dioxide	calcium hydroxide
C	chlorine	potassium iodide
D	sulfur dioxide	potassium manganate(VII)

4 The diagrams show the arrangement of particles in a substance at two different temperatures.



-168 °C



30 °C

Which of the following is most likely the melting and boiling points of the substance?

	melting point / °C	boiling point / °C
A	-150	25
B	-170	25
C	-165	40
D	-170	40

5 Two gases, P and Q, are separately released in the laboratory on a cold day. The experiment is repeated on a hot day. The time taken for the gases to reach the opposite end of the laboratory is recorded for each experiment.

The relative molecular mass of gas P is 34 and the relative molecular mass of gas Q is 64.

Which gas on which day would reach the end of the laboratory in the shortest time?

	gas	day
A	P	cold
B	P	hot
C	Q	cold
D	Q	hot

6 An ion of element X is represented by $^{16}_{8}X^{2-}$.

What is the number of sub-atomic particles of an **isotope** of element X?

	number of protons	number of electrons	number of neutrons
A	8	8	10
B	8	10	8
C	16	8	8
D	16	10	7

7 Which statements correctly describe the properties of mixtures of iron and sulfur, and the compound iron(II) sulfide, FeS.

	mixtures of iron and sulfur	compound iron(II) sulfide
1	iron and sulfur mix without chemically reacting	iron and sulfur combine in a chemical reaction to form iron(II) sulfide
2	the ratio of iron to sulfur in mixtures can vary	the ratio of iron to sulfur in iron(II) sulfide is always the same
3	the mixtures do not have the properties of iron or sulfur	iron(II) sulfide has the properties of iron or sulfur

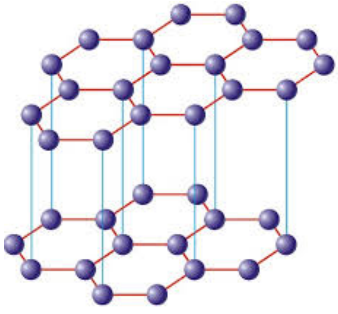
A 1 only

B 1 and 2

C 2 and 3

D 3 only

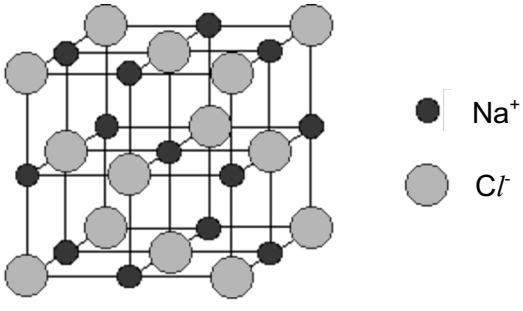
8 The diagram shows the structure of graphite.



Which row best describes its property and use?

	property	use
A	slippery	pencil lead
B	slippery	cutting tool
C	very hard	pencil lead
D	very hard	cutting tool

9 The diagram below shows the arrangement of the ions in a crystal lattice structure of sodium chloride, NaC*l*.



Which group of substances consists of constituent particles arranged in a similar manner as sodium chloride?

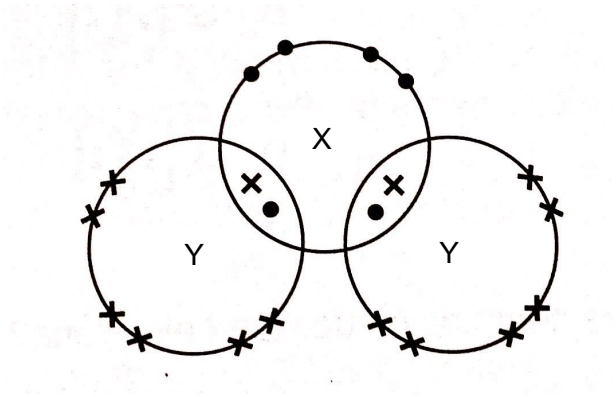
A magnesium oxide, calcium oxide, carbon monoxide

B rubidium iodide, hydrogen chloride, potassium bromide

C lithium chloride, silver chloride, magnesium chloride

D potassium bromide, magnesium oxide, lithium chloride

10 The diagram shows the bonding between two different elements.



What could be element X and Y?

	element X	element Y
A	chlorine	oxygen
B	oxygen	sulfur
C	oxygen	chlorine
D	sulfur	oxygen

11 Which of the following does 1 mole of the metal have the most electrons in the 'sea of electrons'?

A aluminium

B beryllium

C calcium

D potassium

12 30 cm^3 of 0.1 mol/dm^3 sodium hydroxide is added to 10 cm^3 of 0.1 mol/dm^3 sulfuric acid in a beaker.

When the reaction is complete, what is the concentration of sodium hydroxide in the beaker?

A 0.025 mol/dm^3

B 0.033 mol/dm^3

C 0.050 mol/dm^3

D 0.100mol/dm^3

13 Car air bags contain sodium azide, NaN_3, which decomposes into its elements when heated to 300 °C.

What is the volume of gas (at r.t.p.) produced by the decomposition of 6.5 g of sodium azide?

A 2.4 dm^3

B 3.6 dm^3

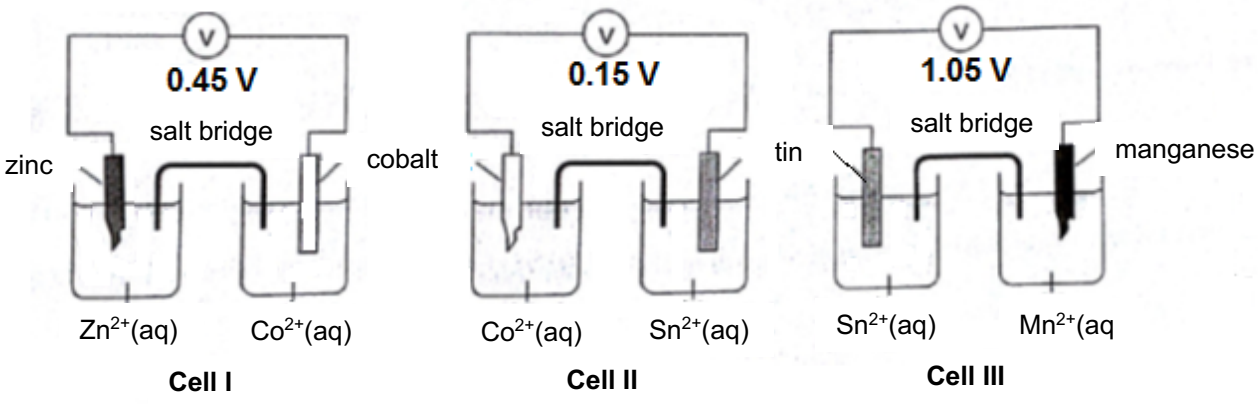
C 4.8 dm^3

D 7.2 dm^3

14 Which particles are responsible for the conduction of electricity through metals and electrolytes?

	metals	electrolytes
A	electrons	electrons
B	electrons	positive and negative ions
C	positive ions only	electrons
D	negative ions only	positive and negative ions

15 Three cells are set up as shown in the diagram below.



What is the order of reactivity of the four metals?

increasing reactivity →

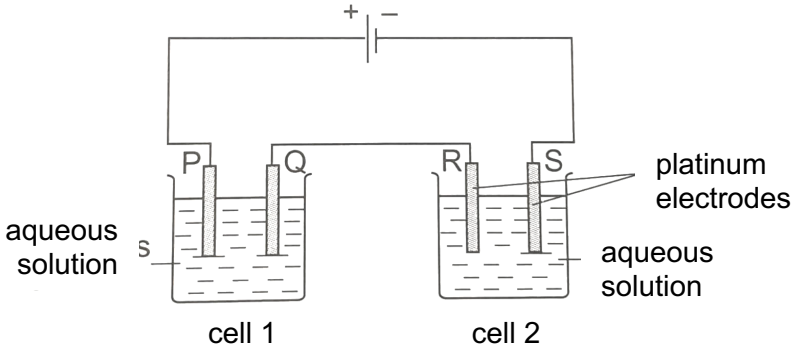
A	manganese	zinc	cobalt	tin
B	tin	cobalt	zinc	manganese
C	manganese	zinc	tin	cobalt
D	tin	cobalt	manganese	zinc

16 Molten copper(II) chloride is electrolysed using carbon electrodes.

What would you expect to see during electrolysis?

	At the cathode	At the anode
A	Pink solid forms.	Anode dissolves.
B	Yellowish-green gas forms.	Anode dissolves.
C	Yellowish-green gas forms.	Pink solid forms.
D	Pink solid forms.	Yellowish-green gas forms.

17 In the diagram, each cell contains an aqueous solution of a single salt and all four electrodes are platinum. Electrodes Q and S increase in mass during the electrolysis but no gas is given off at Q or S.



The increase in mass of Q is greater than the increase in mass of S.

Which statement must be correct?

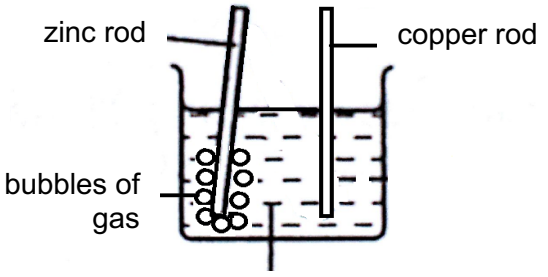
A The cation of the solution in cell 1 is different from the cation in cell 2.

B The current flowing in cell 1 is greater than the current flowing in cell 2.

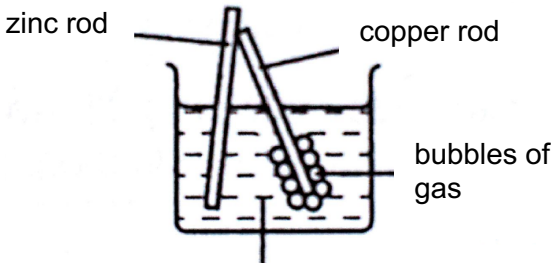
C The cation in cell 1 is the same as in cell 2 but the solution in cell 1 is more concentrated than in cell 2.

D The loss of mass of electrode P is less than the loss of mass in electrode R.

18 Rods of zinc and copper are dipped into dilute sulfuric acid as shown in the two set-ups below.



set-up 1

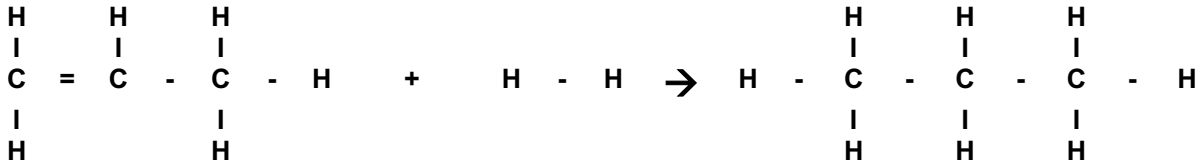


set-up 2

Which of the following correctly explains the observations in set-up 1 and 2?

	set-up 1	set-up 2
A	zinc metal reacts with acid to give hydrogen gas	reduction of H^+ ions to form hydrogen gas at copper rod
B	reduction of H^+ ions to form hydrogen gas at zinc rod	oxidation of OH^- ions to form oxygen gas at copper rod
C	oxidation of OH^- ions to form oxygen gas at zinc rod	reduction of H^+ ions to form hydrogen gas at copper rod
D	zinc metal reacts with acid to give hydrogen gas	copper metal reacts in place of zinc to give hydrogen gas

19 Propene gas reacts with hydrogen to form propane gas as shown in the equation below.



type of bond	bond energy / (kJ/mol)
C – C	347
C = C	613
C – H	416
H – H	437

Which of the following correctly describes the above reaction?

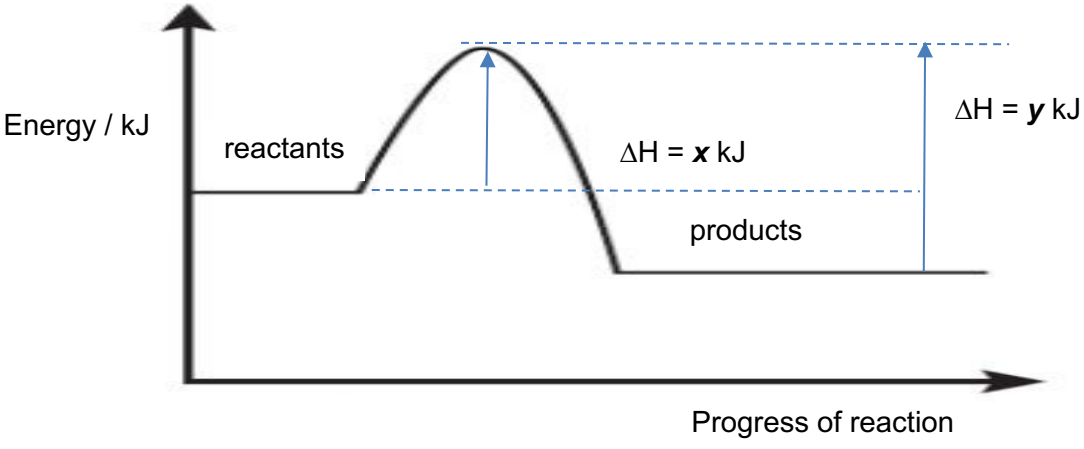
A The breaking of H – H bonds releases energy.

B The products possess more energy than the reactants.

C The number of bonds broken is more than the number of bonds formed.

D The total energy change in bond formation is greater than that in bond breaking.

20 The diagram shows the energy profile diagram of a reaction.



Which of the following is true about the reaction?

A The reaction is endothermic.

B The activation energy is ***y*** kJ.

C The heat of reaction is –(***y*** – ***x***) kJ.

D The products have more energy than the reactants.

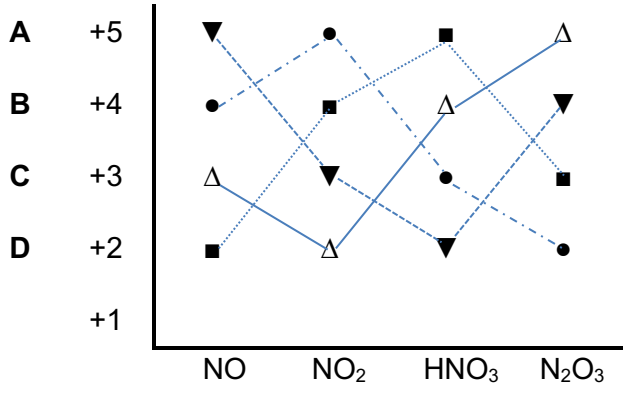
21 How does the activation energy for a reaction between two gases change when it is carried out either in the presence of a catalyst or when the temperature is increased?

	change in activation energy	
	increase in temperature	presence of catalyst
A	decreases	decreases
B	stays the same	decreases
C	decreases	increases
D	stays the same	increases

22 Nitrogen monoxide, NO, undergoes the following changes.

$NO \rightarrow NO_2 \rightarrow HNO_3 \rightarrow N_2O_3$,

Which line represents the changes in the oxidation state of nitrogen?



23 Ripening fruits release ethene, C_2H_4, which in turns causes other fruits to ripen. This can be prevented by keeping fruits with potassium manganate(VII), $KMnO_4$, as potassium manganate(VII) reacts with ethene.

$C_2H_4\ (g) + 4KMnO_4\ (aq) \rightarrow 4MnO_2(aq) + 4KOH(aq) + 2CO_2\ (g)$

Which substance is oxidised?

A carbon

B hydrogen

C manganese

D oxygen

24 An aqueous solution has a pH value of 14.

What information does this fact give about the ions present in the solution?

	concentration of H^+ ions	concentration of OH^- ions
A	high	none
B	high	low
C	low	high
D	none	high

25 A white solid is often seen around the stoppers of glass bottles containing sodium hydroxide solution.

Which substance could have reacted with sodium hydroxide to form the solid?

A carbon dioxide in the air

B impurities in the glass

C oxygen in the air

D water in the solution

26 The oxides of two elements, M and N, are reacted with hydrochloric acid and sodium hydroxide.

test	observations	
	oxide of M	oxide of N
hydrochloric acid added	dissolves rapidly	dissolves rapidly
sodium hydroxide added	no visible reaction	dissolves slowly

What are possible identities of elements M and N?

	M	N
A	aluminium	magnesium
B	aluminium	zinc
C	magnesium	aluminium
D	zinc	magnesium

27 Which reactants can be safely used to prepare a pure sample of potassium nitrate in the laboratory?

A K and HNO_3

B KC*l* and $AgNO_3$

C KOH and HNO_3

D KOH and $NaNO_3$

28 The atom of element X has the electronic configuration 2. 8. 7.

Which statements about element X are correct?

1. It is a non-metal found in Period 3.
2. It is a non-metal found in Group III.
3. It will gain one electron to form an ion with -1 charge.
4. It will form covalent compounds with Group VI elements.

A statements 1 and 2 only

B statements 1, 3 and 4 only

C statements 2 and 4 only

D statements 2, 3 and 4 only

29 Which statement best describes the change in property of the elements from left to right of the Periodic Table?

A The metallic property decreases.

B The non-metallic property decreases.

C The number of electron shells increases.

D The size of the atom increases.

30 The table shows the electronic configuration of five different atoms of elements.

atom	P	Q	R	S	T
electronic configuration	2.2	2.6	2.8.7	2.8.8	2

Which of the atoms are found in the same group?

A atoms P and Q

B atoms P and T

C atoms R and S

D atoms S and T

31 A new element, “Judium”, with a chemical formula, Jd, was recently discovered. Its atom has one valence electron and it is placed between caesium and francium in the Periodic Table.

Which statements best describes “Judium”?

1. It reacts explosively with water.
2. It has a higher density than caesium.
3. It has a lower melting point than francium.
4. It forms a covalent compound with bromine.

A statements 1 and 2 only

B statements 1, 2 and 3 only

C statements 2 and 4 only

D statements 2, 3 and 4 only

32 Which of the following properties of mercury is **not** typical of metals?

A Mercury has a density of 13.5 g/cm^3.

B Mercury has a melting point of -39 ^{o}C.

C Mercury is a good conductor of heat.

D Pure, solid mercury is malleable.

33 Element **M** reacts in the following ways:

M + H_2SO_4 → **M**SO_4 + H_2

2**M**O + C → 2**M** + CO_2

MO + H_2 → no reaction

What could element **M** be?

A magnesium

B lead

C silver

D zinc

34 The table gives information about four metals.

metal	percentage in the Earth's crust	cost per tonne / $
aluminium	8	15 000
copper	0.001	5 000
iron	5	300
tin	less than 0.001	15 000

The general pattern suggests that the higher the percentage in the Earth's crust, the lower the cost.

Which of the following best explains why aluminium does not fit this pattern?

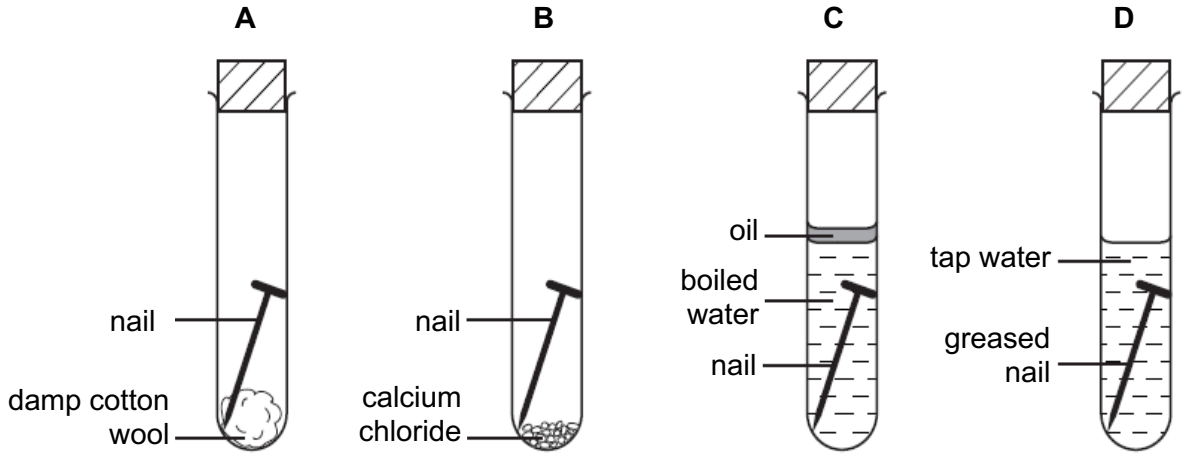
A Collection and transportation of used aluminium for recycling costs more money than the other metals.

B Demand for aluminium is greater than for other metals.

C Reduction of aluminium oxide using electricity is more expensive than the extraction of the other metals.

D The oxide layer protecting aluminium has to be removed.

35 In which test-tube is the iron nail most likely to rust?



36 What happens if an iron object that has been electroplated with zinc has its zinc surface scratched?

A The iron underneath does not rust.

B The iron underneath starts to rust at a faster rate.

C The zinc forms an alloy with iron to make the structure stronger.

D The zinc reacts with the iron underneath to form a new compound.

37 The global atmospheric concentration of carbon dioxide has increased in the last 200 years.

What could be causing this increase?

1 deforestation
2 emissions from motor vehicles
3 power stations using fossil fuels

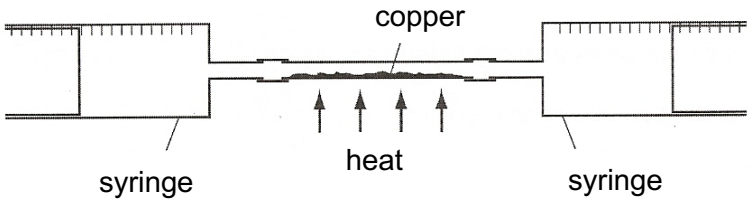
A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

38 100 cm^3 of air is passed forward and backward between two syringes until the reaction is completed.



What is the final volume of gas after cooling to the original temperature?

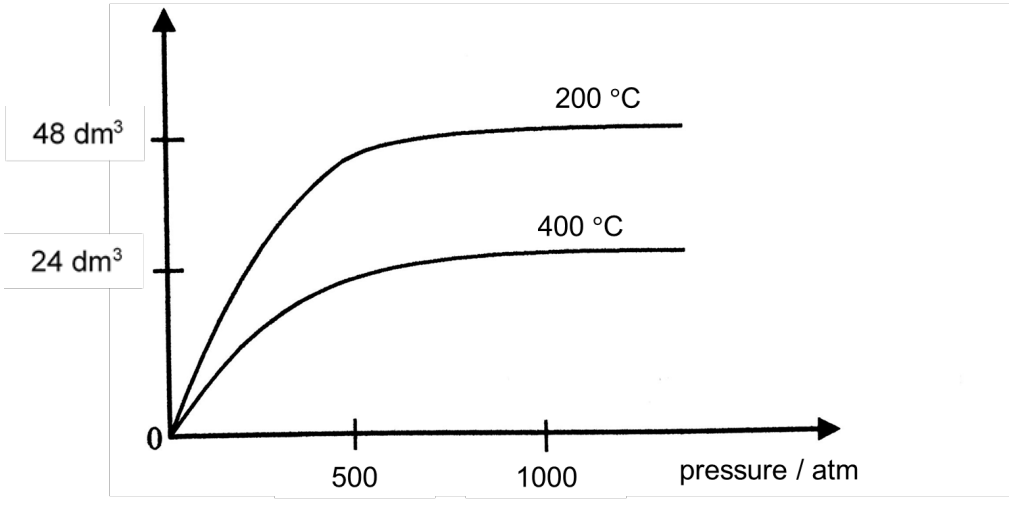
A 0 cm^3

B 21 cm^3

C 24 cm^3

D 79 cm^3

39 The graph below shows the volume of ammonia produced at different temperatures and pressures when nitrogen and hydrogen gas are reacted together.



Which statement(s) may be deduced from this information?

1 At 500 atm, the volume of ammonia produced is greater at 200 °C than at 400 °C.

2 An increase of pressure from 0 to 500 atm will increase the volume of ammonia produced at both 200 °C and 400 °C.

3 At 500 atm and 300 °C, the volume of ammonia produced is likely to be greater than 24 dm^3.

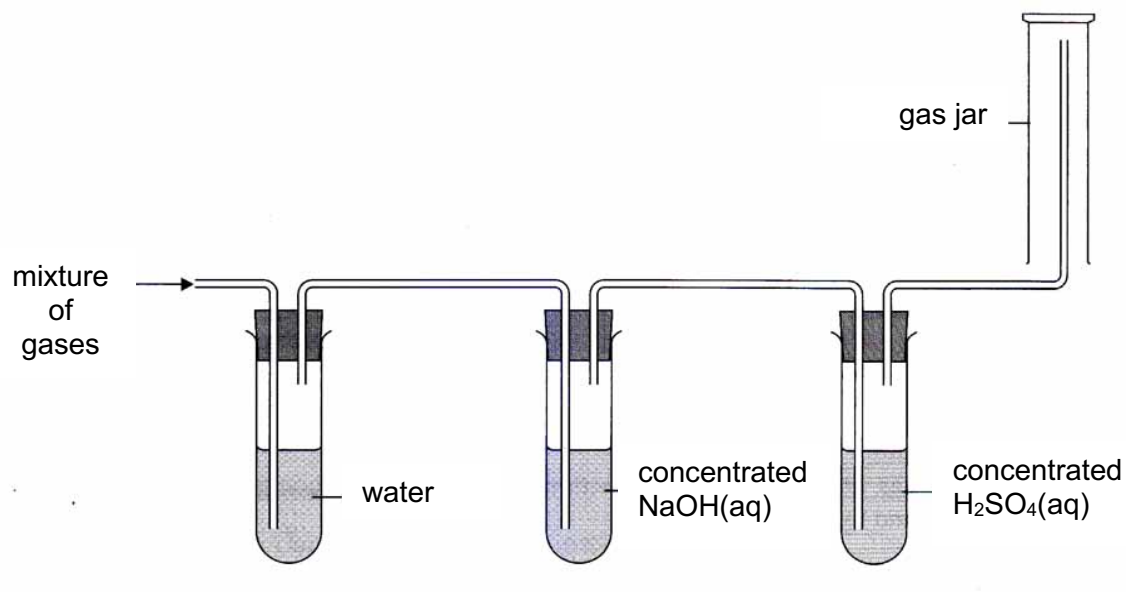
A Only 1 is correct.

B Only 1 and 2 are correct.

C Only 2 and 3 are correct.

D 1, 2 and 3 are all correct.

40 A mixture of four gases, hydrogen, carbon dioxide, hydrogen chloride and sulfur dioxide, is passed through the experimental set-up shown below.



Which gas is collected in the gas jar?

A carbon dioxide

B hydrogen

C hydrogen chloride

D sulfur dioxide

END OF PAPER

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key proton (atomic) number atomic symbol name relative atomic mass									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											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
actinoids	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 –

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