

Name : _____()

Class: _____



FAIRFIELD METHODIST SCHOOL (SECONDARY)

PRELIMINARY EXAMINATION 2020

SECONDARY 4 EXPRESS

CHEMISTRY

6092/01

Paper 1 Multiple Choice

Date: 14 September 2020

Duration: 1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces 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 16.

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

Parent's/Guardian's Signature:

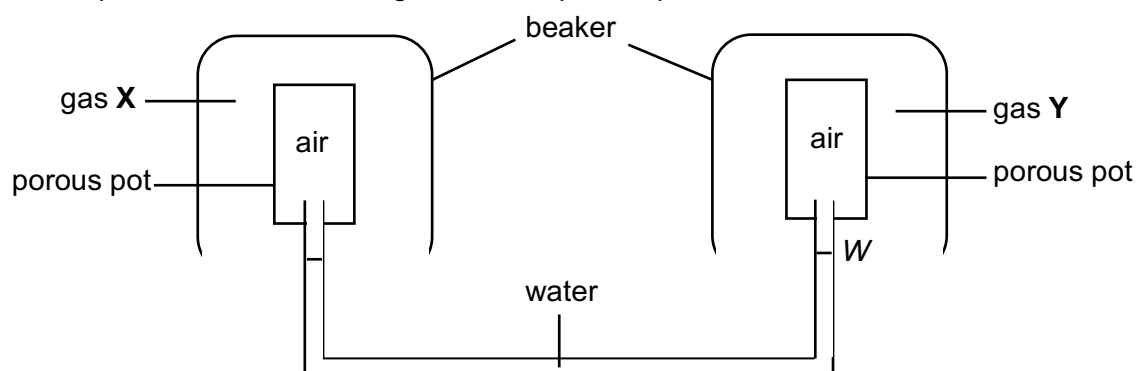
- 1 The melting and boiling point of five substances are provided.

substance	melting point / °C	boiling point / °C
tannium	50	90
chagon	70	600
cidium	65	67
karenium	-30	-12
chinium	-15	101

At what temperature would there be exactly two substances at liquid state?

- A** -20°C
B -14°C
C 16°C
D 80°C

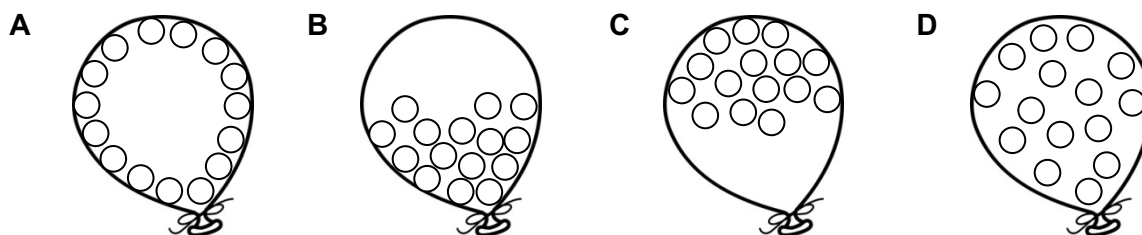
- 2 The setup below uses different gases in the porous pot.



Which pair of gases would result in a rise in water level at W?

- | | gas X | gas Y |
|----------|-----------------|-----------------|
| A | Ne | SO ₂ |
| B | CO ₂ | He |
| C | SO ₃ | CO ₂ |
| D | NO ₂ | N ₂ |

- 3 Which diagram shows the arrangement of particles inside a balloon containing krypton?



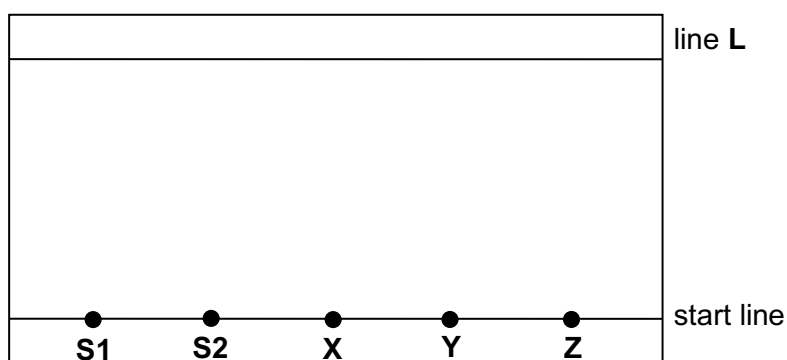
- 4 A mixture of manganese(IV) oxide and sulfur may be separated by the following procedure.

step 1 The mixture is added into carbon disulfide and stirred.
 step 2 The resulting mixture is filtered to remove manganese(IV) oxide as the residue.
 step 3 The filtrate is distilled to recover the sulfur and the solvent is condensed by using a condenser.

What conclusion can be deduced from the procedure described?

- A** Carbon disulfide has a boiling point just below that of water.
B Carbon disulfide is an organic solvent.
C Sulfur has a higher boiling point than carbon disulfide.
D Particles of sulfur is smaller than manganese(IV) oxide.
- 5 Components present in two samples of soda, **S1** and **S2**, and three food dyes, **X**, **Y** and **Z** are separated and analysed using chromatography.

The chromatography paper is placed in the solvent and the samples are allowed to travel up the paper until all spots crosses line **L**. The time taken for the spots present in each dye to cross line **L** is recorded.



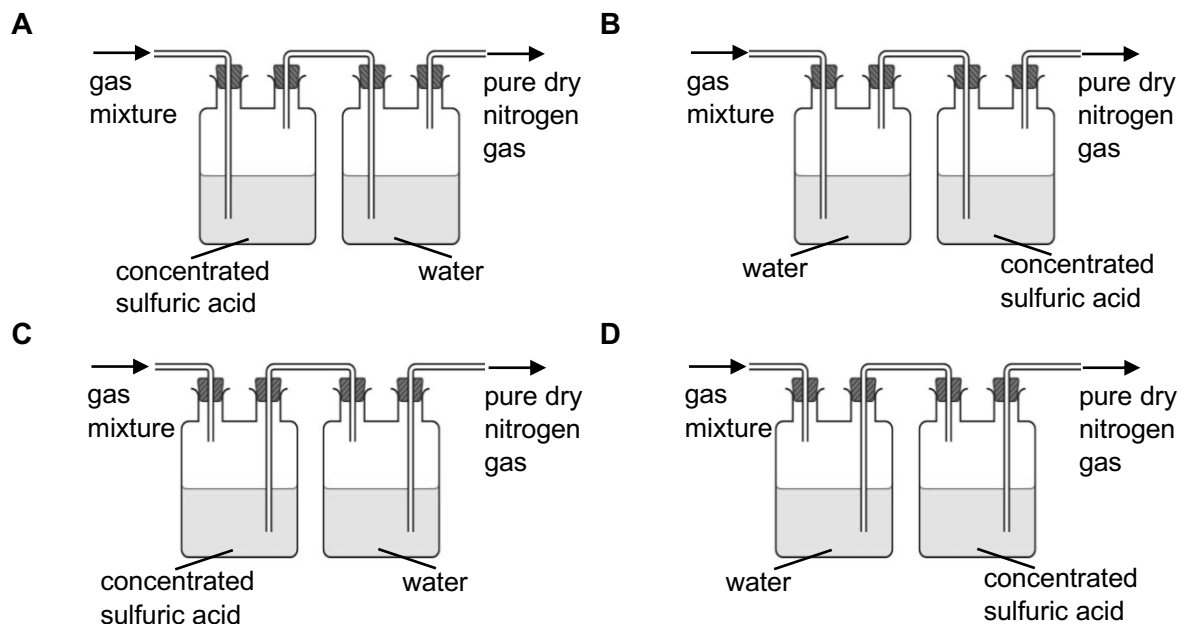
sample	time taken /s		
	first spot	second spot	third spot
X	15	-	-
Y	27	52	-
Z	65	-	-
S1	27	44	65
S2	52	65	-

Which statement is true?

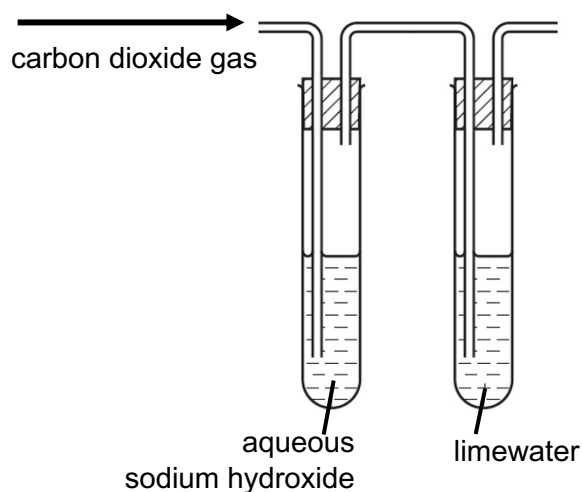
- A** Dye **Z** is more soluble than dye **X**.
B Samples **S1** and **S2** contain dye **Y**.
C Samples **S1** and **S2** contain dye **Z**.
D The second spot in dye **Y** has a larger R_f value than the first spot in dye **Y**.

- 6 A mixture of damp nitrogen gas contains a small amount of soluble hydrogen chloride gas.

Which diagram shows the method most suitable to obtain pure dry nitrogen gas?



- 7 A student carried out a test to test for carbon dioxide gas using the setup as shown.



Which statement is true about the test?

- A** A white precipitate will form in both aqueous sodium hydroxide and limewater.
B A white precipitate will formed in the limewater.
C A white precipitate will formed in limewater and dissolved when excess gas is passed through.
D No visible observation observed for limewater.

- 8 Fullerene is a perfect sphere with the chemical formula C_{60} .

Which statement about fullerene is true?

- A It is a compound made up of 60 atoms.
- B It is a compound made up of 60 elements.
- C It is a mixture made up of 60 elements.
- D It is an element made up of 60 atoms.

- 9 The table below provides some information on four particles, E^+ , F^{2-} , G^{3+} and H .

particle	relative atomic mass	no. of neutrons
E^+	21	10
F^{2-}	30	14
G^{3+}	41	20
H	38	18

Which pair of particles have the same number of electrons?

- A E^+ and F^{2-}
- B F^{2-} and G^{3+}
- C G^{3+} and H
- D H and E^+

- 10 Carbon-12 and carbon-13 are two isotopes of carbon.

Which statement about the isotopes is incorrect?

- A Atoms of both isotopes contains six electrons.
- B Atoms of both isotopes contains six neutrons.
- C Atoms of both isotopes contains six protons.
- D Atoms of both isotopes has an electronic configuration of 2.4.

- 11 Silicon carbide is made of one atom of silicon and one atom of carbon bonded with a similar structure to diamond, while boron nitride is made of one atom of boron and one atom of nitrogen bonded with a similar structure to graphite. However, boron nitride does not contain any delocalised electrons. Bronze is an alloy of copper and tin.

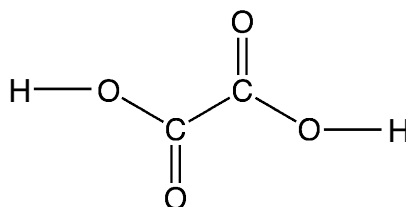
Which statements about the three substances of silicon carbide, boron nitride and bronze are correct?

- I All three substances are covalent bonded.
 - II All three substances have high melting point.
 - III Boron nitride and silicon carbide does not conduct electricity when solid.
 - IV Silicon carbide can be used as a lubricant, while boron nitride can be use as a drill tip for cutting.
- A II and III only
B III and IV only
C II, III and IV only
D All of the above statements are correct.

- 12 Which statement explains why calcium oxide has a very high melting point?

- A Calcium atoms and oxygen atoms are joined by strong double bonds.
B The crystal lattice of calcium oxide resembles that of diamond.
C The reaction between calcium and oxygen involves two electrons.
D The calcium ions are strongly attracted to the oxide ions.

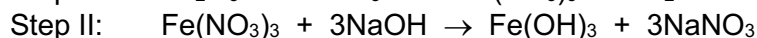
- 13 The diagram shows a molecule of oxalic acid.



What is the total number of electrons **not** involved in bonding?

- A 12
B 16
C 18
D 28
- 14 An impure sample of calcium carbonate is determined to have 85% purity. The remaining composition of the impure sample does not react with dilute hydrochloric acid.
- 5.0 dm³ of dilute hydrochloric acid was used to react with 200 g of the impure calcium carbonate. What is the concentration of the dilute hydrochloric acid?
- A 0.34 mol/dm³
B 0.40 mol/dm³
C 0.68 mol/dm³
D 0.80 mol/dm³

- 15 Iron(III) oxide, Fe_2O_3 , is converted into iron(III) hydroxide, $\text{Fe}(\text{OH})_3$ through the following processes.



Calculate the mass of iron(III) oxide required to produce 53.5 g of iron(III) hydroxide.

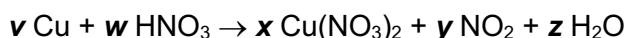
- A 80.0 g
B 71.6 g
C 40.0 g
D 35.8 g
- 16 20 cm^3 of 1 mol/dm^3 aqueous copper(II) nitrate solution was mixed with 40 cm^3 of 1 mol/dm^3 aqueous sodium carbonate solution.

What is the final observation of the resulting mixture that is formed?

- A A blue solution is formed.
B A green precipitate in a blue solution is formed.
C A green precipitate in a colourless solution is formed.
D A white precipitate in a blue solution is formed.
- 17 40 cm^3 of a gaseous oxide of nitrogen were decomposed completely into 40 cm^3 of nitrogen gas and 20 cm^3 of oxygen gas at the same temperature and pressure.

What is the formula of the oxide?

- A NO
B N_2O
C N_2O_3
D NO_2
- 18 The reaction between copper and dilute nitric acid is shown below.



For the chemical equation to be balanced, what is the value of v , w , x , y and z ?

	v	w	x	y	z
A	2	4	2	1	2
B	2	6	2	2	3
C	1	4	1	2	2
D	1	4	1	2	4

- 19 Solid **P** produces a gas when heated strongly. The gas forms a white precipitate **Q** when passed through limewater. The residue after heating solid **P** reacts with dilute acid and aqueous alkali in separate reactions.

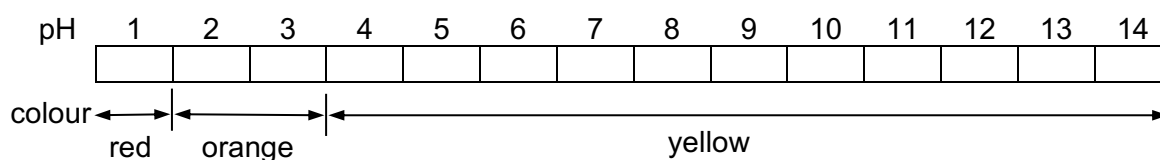
What is **P** and **Q**?

	P	Q
A	aluminium oxide	calcium carbonate
B	calcium oxide	calcium hydroxide
C	lead(II) carbonate	calcium hydroxide
D	zinc carbonate	calcium carbonate

- 20 Which statement best explains why sulfuric acid is a strong acid?

- A** Every mole of sulfuric acid gives two moles of hydrogen ions.
- B** Sulfuric acid has a pH of less than 7.
- C** Sulfuric acid ionises completely in water to form hydrogen ions.
- D** Sulfuric acid is very soluble in water.

- 21 The colour of an indicator **X** in solutions of different pH is shown below.



Which pair of substances would indicator **X** be suitable to distinguish?

- A** aqueous solutions of ammonia and sodium chloride
- B** aqueous solutions of ammonia and sodium hydroxide
- C** unpolluted rainwater and hydrochloric acid
- D** unpolluted rainwater and sodium hydroxide

22 The table shows information about three indicators.

indicator	colour at pH 1	pH at which colour changes	colour at pH 12
thymol blue	red	3	yellow
congo red	blue	5	red
phenolphthalein	colourless	10	red

An aqueous solution **X** shows the following colours with the indicators:

indicator	colour of mixture when indicator added to X
thymol blue	yellow
congo red	red
phenolphthalein	red

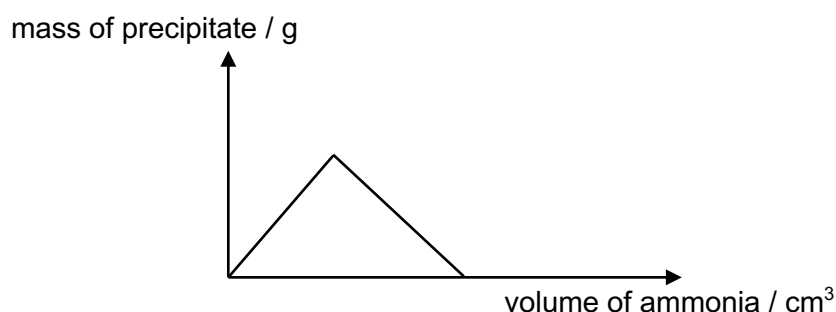
Which of the statements below about the aqueous solution **X** is true?

- A** It could be an acid.
- B** It could be pure water.
- C** Its pH is at least 10.
- D** **X** could be obtained by evaporation of its aqueous solution to dryness.

23 Which equation describes the most suitable reaction for preparing lead(II) sulfate salt?

- A** $\text{Pb} + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2$
- B** $\text{PbCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$
- C** $\text{Pb}(\text{NO}_3)_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{HNO}_3$
- D** $\text{Pb}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + 2\text{H}_2\text{O}$

24 An unknown solution **G** was added to a test tube and aqueous ammonia was gradually added from a burette into solution **G**. The mass of the precipitate in the test tube was measured for various volumes of alkali added and a graph was plotted as shown below.



What is the identity of the unknown solution **G**?

- A** aluminium chloride
- B** lead(II) nitrate
- C** zinc carbonate
- D** zinc sulfate

- 25** Five students performed titration where they each add the same concentration of hydrochloric acid from a burette to a flask containing 25.0 cm^3 of aqueous sodium hydroxide of the same concentration.

The table shows the volume of hydrochloric acid used for neutralisation.

student	1	2	3	4	5
volume / cm^3	25.20	25.30	25.30	26.10	25.20

What could be a reason for the result obtained by student 4?

- A** The burette was rinsed with hydrochloric acid.
- B** The flask was rinsed with aqueous sodium hydroxide.
- C** The flask was rinsed with deionised water.
- D** The pipette was rinsed with aqueous sodium hydroxide.

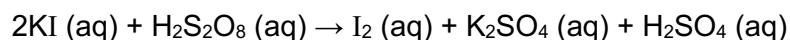
- 26** The table shows equations of four reactions of iron compounds.

- I $4\text{FeO} + \text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3$
- II $\text{FeO} + \text{H}_2 \rightarrow \text{Fe} + \text{H}_2\text{O}$
- III $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
- IV $\text{Fe}_2\text{O}_3 + 3\text{H}_2\text{SO}_4 \rightarrow \text{Fe}_2(\text{SO}_4)_3 + 3\text{H}_2\text{O}$

Which reaction(s) is/are redox reaction(s)?

- A** I only
- B** II and III only
- C** I, II and III only
- D** All the reactions are redox reactions.

- 27** The reaction between KI and $\text{H}_2\text{S}_2\text{O}_8$ can be represented by the equation below.



What is the role of $\text{H}_2\text{S}_2\text{O}_8$ in this reaction?

- A** an acid
- B** an oxidising agent
- C** a base
- D** a reducing agent

28 The table refers to four metals and some of their compounds.

metal	action of dilute sulfuric acid on metal	effect of carbon monoxide on heated metal oxide	action of metal on a solution of the sulfate of R
P	no reaction	reduced	no reaction
Q	gas evolved	no reaction	metal R formed
R	gas evolved	no reaction	no reaction
S	gas evolved	reduced	no reaction

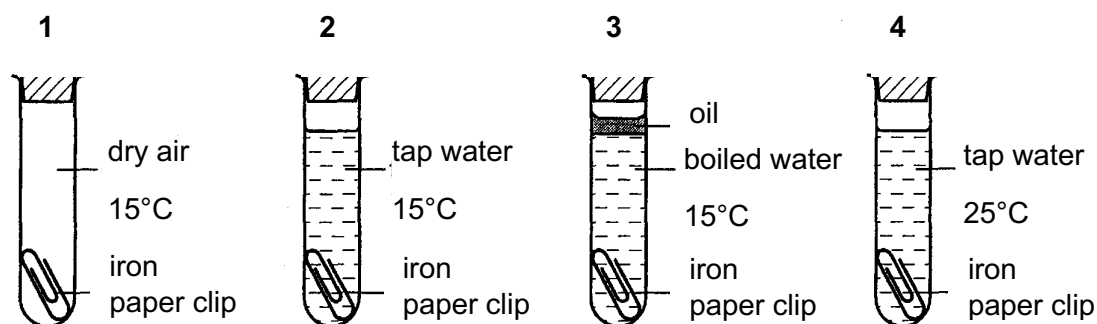
What is the reactivity of the metals in order of increasing reactivity?

- A** S, P, Q, R
B P, S, R, Q
C Q, R, S, P
D R, Q, S, P

29 Which statement correctly describes a reaction taking place in a blast furnace?

- A** Carbon is reduced by the hot air to form carbon monoxide.
B Coke is oxidised by the hot air to form carbon monoxide
C Haematite is reduced by carbon monoxide to form iron(III) oxide.
D Limestone is decomposed to form calcium silicate.

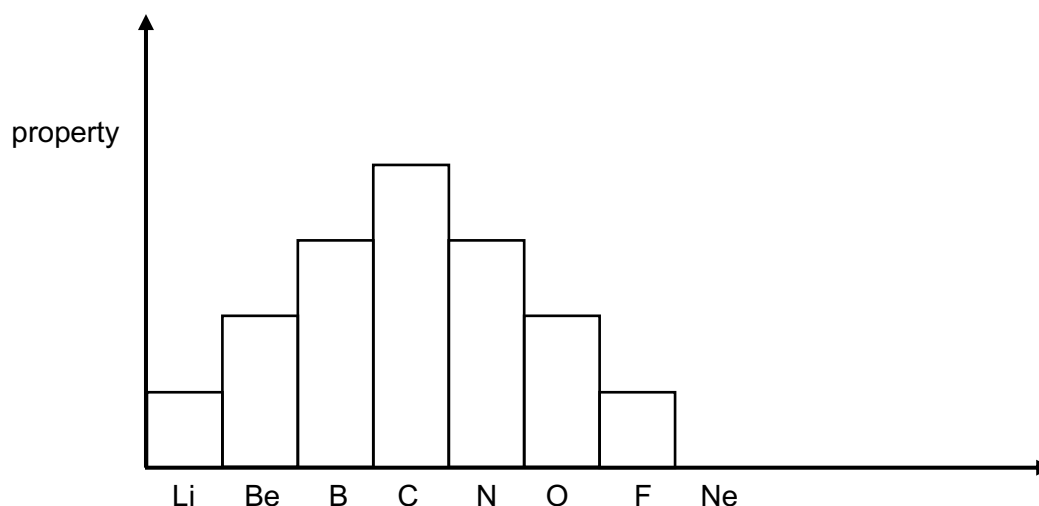
30 Four experiments on rusting are shown.



Which two experiments can be used to show that air is necessary for iron to rust?

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

- 31 The bar chart shows how a property of elements in Period 2 changes from lithium to neon.



Which property is shown in the chart?

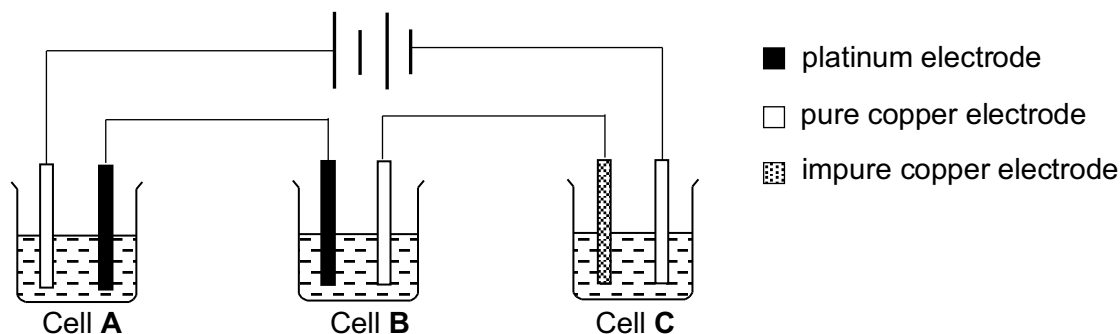
- A The number of valency electrons
 - B The number of electrons used in bonding
 - C The group number of the element
 - D The melting point of the element
- 32 The table shows the melting point of elements from Group I obtained from the *Los Alamos National Laboratory, U.S. Department of Energy*.

element	melting point / °C
Li	180.5
Na	97.8
K	65.5

Which statement can be inferred from the melting points of the elements?

- A The energy needed to overcome metallic bond increases down Group I from lithium to potassium
- B The radius of the atom decreases down Group I from lithium to potassium
- C The radius of the atom increases down Group I from lithium to potassium
- D The reactivity of group I elements decreases down Group I from lithium to potassium.

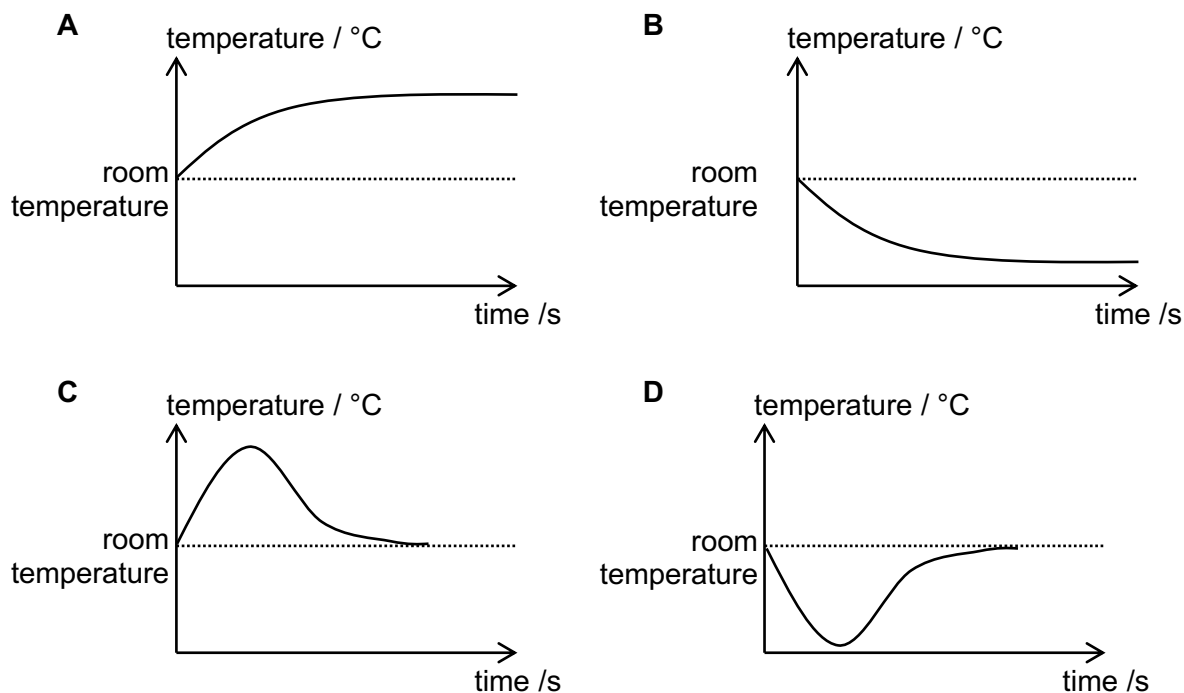
- 33** The diagram shows an electrolysis set up. The electrolyte present in cell **A**, **B** and **C** is dilute copper(II) sulfate solution



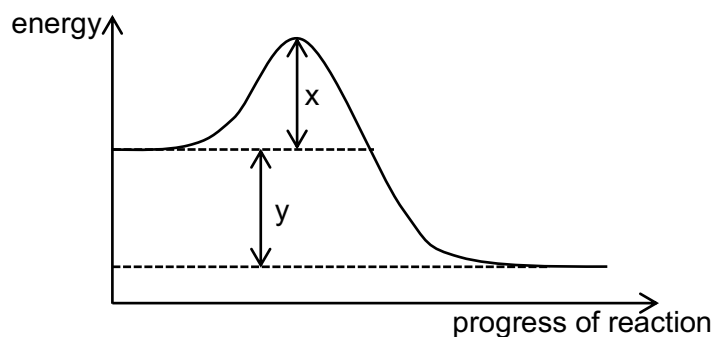
Which statement is true?

- A** Effervescence is observed in cells **A** and **B** only.
B Reddish-brown solid is deposited in cells **A**, **B** and **C**.
C The blue solution decolourises in cells **A** and **B** only.
D The solution remains blue in cells **A**, **B** and **C**.
- 34** The dissolving of ammonium chloride in water is an endothermic process.

Which graph shows the change in temperature of the mixture from the time ammonium chloride is added in water until no further change in temperature is observed?

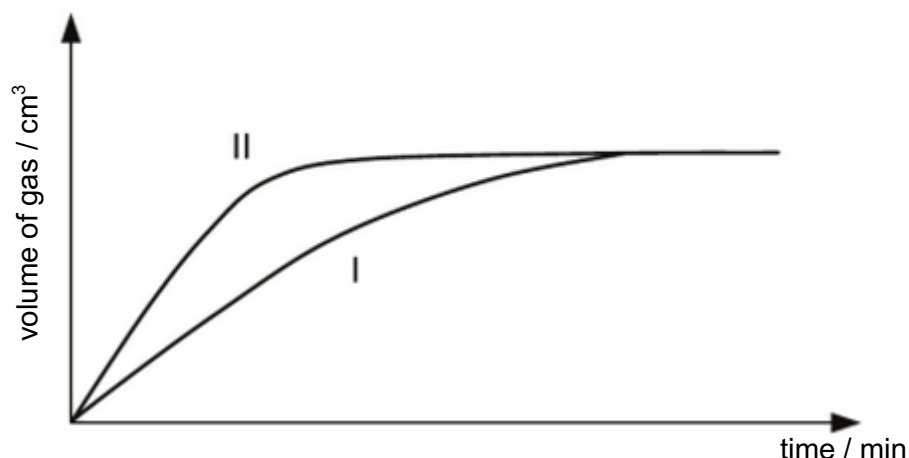


- 35 The energy profile diagram for a chemical reaction is shown.

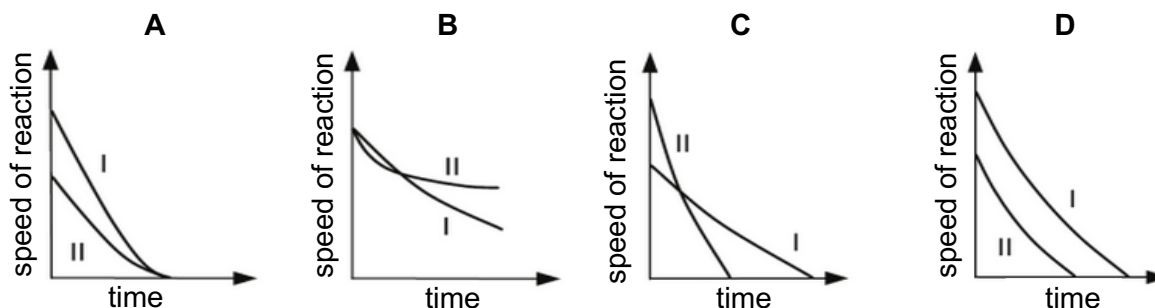


Which statement about the reaction is correct?

- A The activation energy of the backward reaction is $x+y$.
 - B The activation energy of the forward reaction is y .
 - C The enthalpy change of the backward reaction is $x+y$.
 - D The enthalpy change of the forward reaction is x .
- 36 In two separate experiments, equal masses of a substance are decomposed. The gas evolved is collected. The graph shows the total volume of gas collected against time for each experiment.



Which graph best shows how the speed of reaction varies with time in each experiment?



37 In which reaction is the pressure least likely to affect the speed of reaction?

- A** $\text{C (s)} + \text{CO}_2 \text{ (g)} \rightarrow 2\text{CO (g)}$
- B** $2\text{NO (g)} + \text{O}_2 \text{ (g)} \rightarrow 2\text{NO}_2 \text{ (g)}$
- C** $\text{CH}_4 \text{ (g)} + 2\text{O}_2 \text{ (g)} \rightarrow \text{CO}_2 \text{ (g)} + 2\text{H}_2\text{O (g)}$
- D** $\text{NaOH (aq)} + \text{HCl (aq)} \rightarrow \text{NaCl (aq)} + \text{H}_2\text{O (l)}$

38 Which option shows the optimal condition for the manufacture of ammonia in the Haber process?

	temperature / °C	pressure / atm	ratio of N ₂ : H ₂
A	250	450	1:3
B	250	450	3:1
C	450	250	1:3
D	450	250	3:1

39 Which air pollutant is not responsible for the formation of photochemical smog?

- A** carbon monoxide
- B** oxides of nitrogen
- C** ozone
- D** unburnt hydrocarbons

40 Which method of environmental mitigation does not help to reduce the emission of greenhouse gases?

- A** reduce consumption of livestock
- B** use of catalytic converter in motor vehicle
- C** use of hydrogen fuel cell to power vehicle
- D** use of solar energy

End of Paper

Name : _____ ()

Class: _____

The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	0
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	21 Sc scandium	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	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 -	118 Ts tennessine -	119 Og oganeson -	120 Nh nihonium -	122 Fl flerovium -

57 La lanthanum 139 58 Ce cerium 140																	
89 Ac actinium — 90 Th thorium 232																	

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).