

Candidate Name _____

Class Register Number

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**PEIRCE SECONDARY SCHOOL**

Department of Science

GCE 'O' Level Preliminary Examination I for Secondary Four Express**CHEMISTRY****6092****Wednesday****9 May 2018****0900 – 1000****Time: 1 hour****INSTRUCTIONS TO CANDIDATES**

Write in soft pencil.

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

Write your name, Index number on the Answer Sheet in the spaces provided.

There are forty questions in 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.

INFORMATION FOR CANDIDATES

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

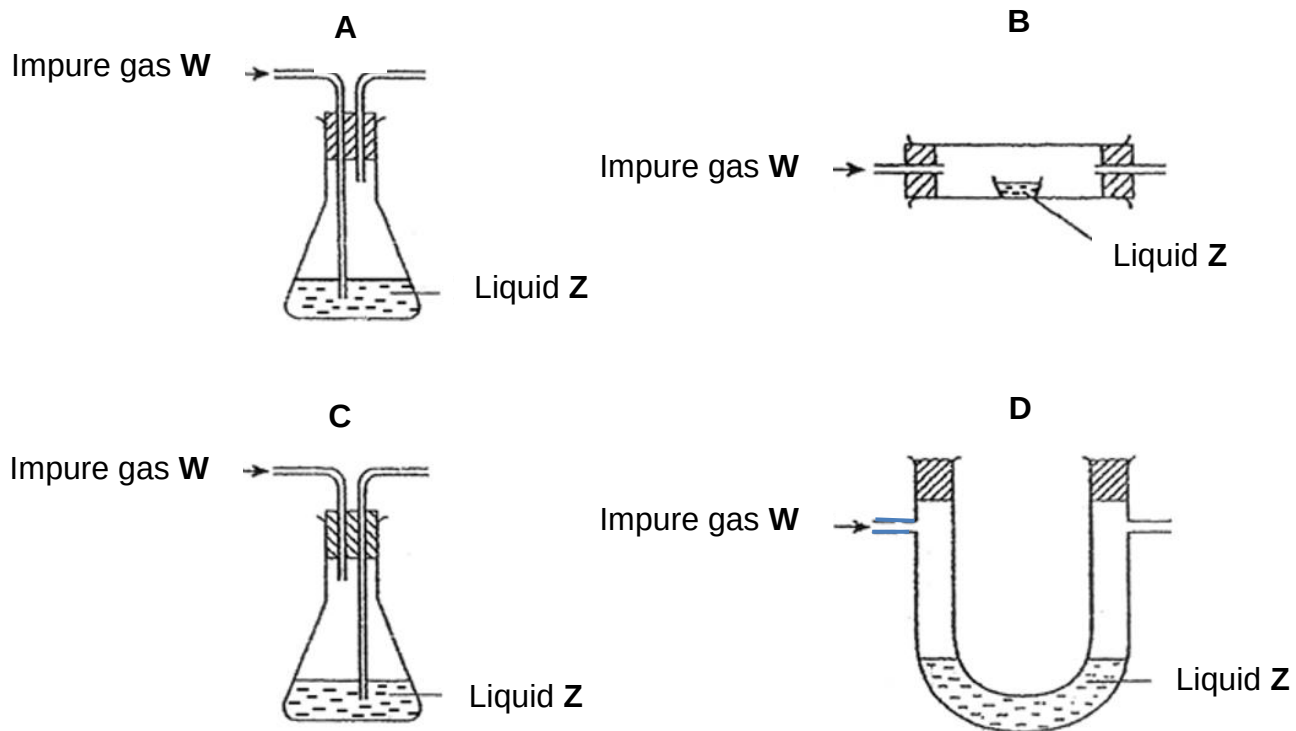
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page **19**.This paper consists of **15** printed pages.

Setter: Mr Ashwin Selvarajan

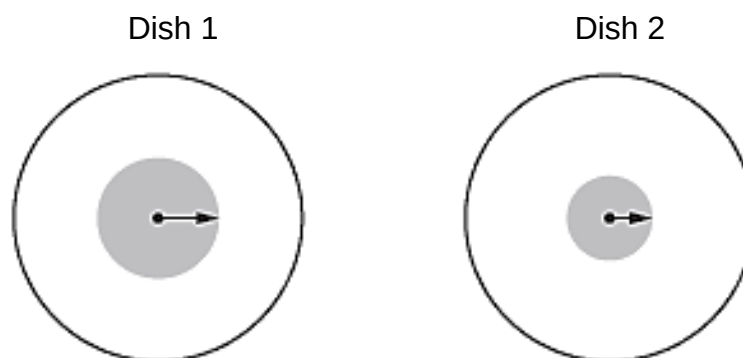
- 1 Gas **W** is contaminated with another gas. The impure gas can be removed using liquid **Z**.

Which apparatus is most suitable for the collection of pure gas **W**?



- 2 Small crystals of red cobalt(II) nitrate and blue copper(II) sulfate were placed at the centers of separate petri dishes filled with agar jelly. They were left to stand under the same physical conditions.

After some time, the colour of each substance has spread out as shown.

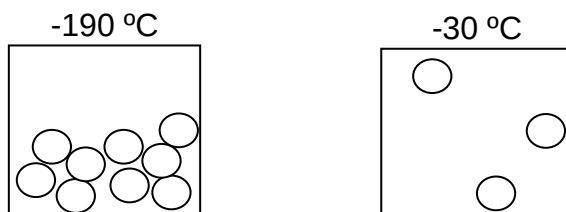


The lengths of the arrows indicate the relative distances travelled by particles of each substance. Which statement is correct?

- A** Diffusion is faster in dish 1 because the mass of the particles is greater.
B Diffusion is faster in dish 2 because the mass of the particles is smaller.
C Diffusion is slower in dish 1 because the mass of the particles is smaller.
D Diffusion is slower in dish 2 because the mass of the particles is greater.
- 3 A scientist wishes to separate a mixture of iodine, magnesium chloride and lead(II) chloride. Which of the following is the most appropriate sequence of techniques for the scientist to use?

	Step 1	Step 2	Step 3
A	sublimation	dissolution and filtration	crystallisation
B	sublimation	fractional distillation	dissolution and filtration
C	dissolution and filtration	crystallisation	sublimation
D	dissolution and filtration	fractional distillation	crystallisation

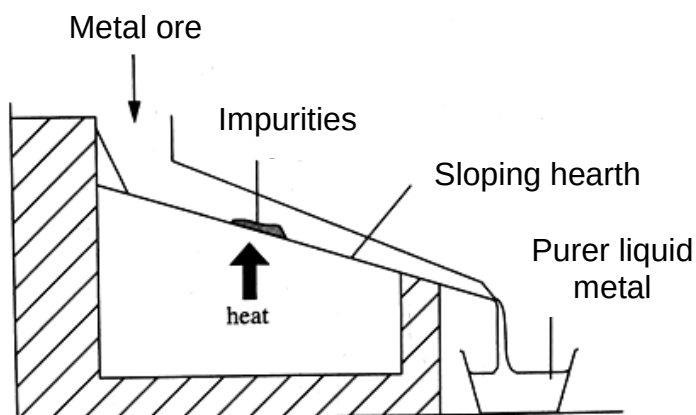
- 4 The following diagrams show the arrangement of particles of a substance at two different temperatures.



Which substance could the diagrams represent?

Substance	Melting point / °C	Boiling point / °C
A	-210	-50
B	-210	-10
C	-100	-50
D	-100	-10

- 5 Liquation is an old method of separating a metal from its ore and is shown in the following diagram.



Tin ore, containing iron and lead and other impurities, can be refined to a purer form using this method. The impure tin ore is added from the top of the furnace, which has a sloping hearth. The pure liquid tin is collected at the bottom of the furnace, while the impurities are left behind.

What can you deduce about the properties of tin from the method?

- A** It is an inert metal.
- B** It is less reactive than iron and lead.
- C** It is more reactive than iron and lead.
- D** It has a melting point and boiling point lower than those of iron and lead.

- 6 Indium (In) with a relative atomic mass of 114.9 consists of two naturally occurring isotopes. One of these isotopes is In-115, with 95.7% abundance.

Given that there are 49 protons in an atom of indium, calculate the nucleon number of the second naturally occurring isotope in indium.

- A 49
- B 64
- C 113
- D 114

- 7 Four particles **W**, **X**, **Y** and **Z** have the composition shown in the table below.

particle	number of electrons	atomic number	mass number
W	10	10	20
X	11	11	23
Y	10	11	23
Z	19	19	39

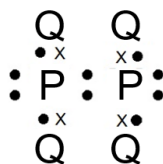
There are three statements below with regards to particles **W**, **X**, **Y** and **Z**.

- 1 Particle **X** gives away one electron to form particle **Y**.
- 2 Particle **W** and particle **Y** are isotopes.
- 3 Substance made of particle **Z** has a lower melting point than substance **X**

Which of the following statements are correct?

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

- 8 The diagram below shows the arrangement of outermost electrons for element **P** when it reacts with element **Q** to form a compound.



To which groups of the Periodic Table do element **P** and element **Q** belong?

	element P	element Q
A	Group V	Group VI
B	Group V	Group VII
C	Group VI	Group I
D	Group VI	Group VII

- 9 The table provides some information of three particles.

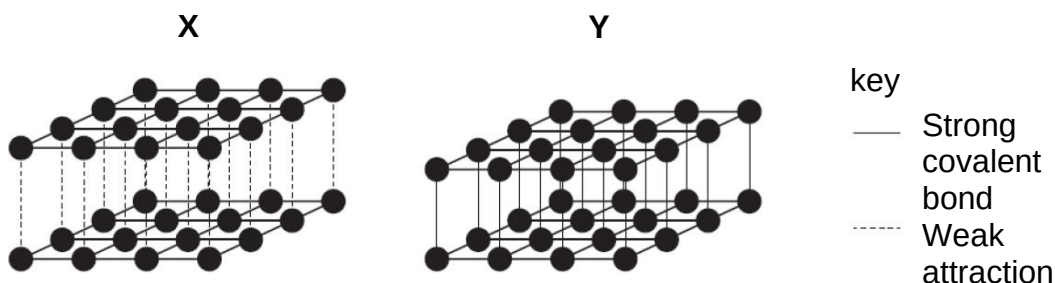
charge of particle	number of electrons	number of neutrons	nucleon number
0	18	X	40
1+	18	20	Y
Z	10	8	16

What are the values of **X**, **Y** and **Z**?

	X	Y	Z
A	18	37	2-
B	18	39	2+
C	22	39	2-
D	22	37	2+

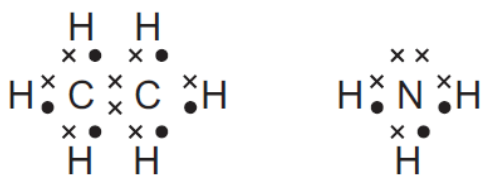
- 10** Substances with giant covalent structures can be used as lubricants or as cutting tools for hard materials.

The diagram shows how the atoms are arranged in two giant covalent structures, **X** and **Y**.



Which statement is correct?

- A** Only X is used as a cutting tool and only Y is used as a lubricant.
B Only X is used as a lubricant and only Y is used a cutting tool.
C X and Y are both used as a cutting tool.
D X and Y are both used as lubricants.
- 11** Ethane, C_2H_6 , and ammonia, NH_3 , are covalent compounds. The “dot-and-cross” diagrams of these compounds are shown.



Which statements are correct?

- 1 A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
- 2 An unreacted nitrogen atom has five outer electrons.
- 3 In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each carbon atom.

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

- 12** The active component of tobacco, nicotine, found in cigarette smoke is thought to increase the chances of a person developing lung cancer.

The percentage composition of nicotine is 74.0% carbon, 8.7% hydrogen and 17.3% nitrogen. The relative molecular mass of nicotine is 162.

What is the molecular formula of nicotine?

- A** $\text{C}_3\text{H}_2\text{N}$
 - B** $\text{C}_5\text{H}_7\text{N}$
 - C** $\text{C}_9\text{H}_6\text{N}_3$
 - D** $\text{C}_{10}\text{H}_{14}\text{N}_2$
- 13** 68 g of hydrogen peroxide is dissolved in water to form an aqueous solution. The solution is heated and decomposes in the presence of manganese(IV) oxide to give 2.4 dm^3 of oxygen gas as follows.



What is the percentage purity of the hydrogen peroxide? (All gases are measured at room temperature and pressure.)

- A** 2.5%
 - B** 5.0%
 - C** 10.0%
 - D** 100.0%
- 14** Dinitrogen tetroxide, N_2O_4 , is a poisonous gas. It can be disposed off safely by reaction with sodium hydroxide. In the experiment, the concentration of aqueous sodium hydroxide used is 1.5 mol/dm^3 .



Which of the following is the least volume of aqueous sodium hydroxide required to dispose off 300 cm^3 of N_2O_4 at room temperature and pressure?

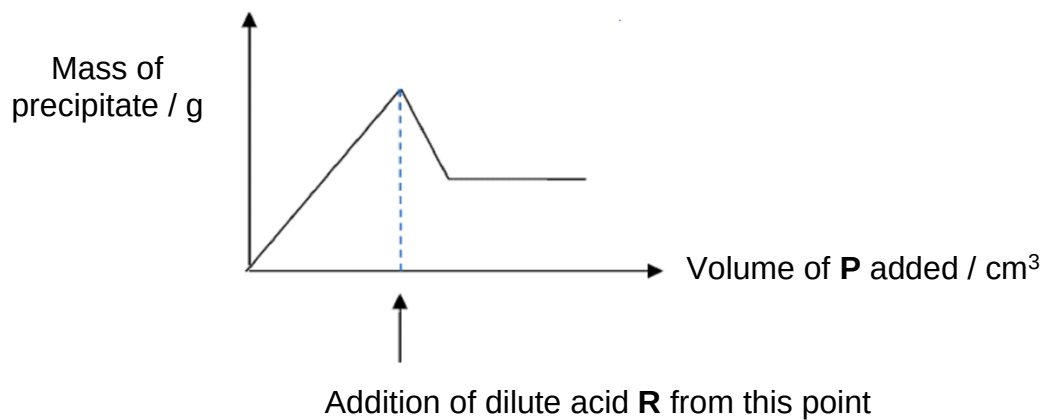
- A** 10 cm^3
- B** 20 cm^3
- C** 120 cm^3
- D** 240 cm^3

- 15** Which pairs of statements correctly describe the differences between the conduction of electricity during electrolysis and the conduction of electricity by metals?

	conduction during electrolysis	conduction by metals
1	The current is due to the movement of both positive and negative ions.	The current is due to the movement of electrons.
2	Charged particles move towards both electrodes.	Charged particles move in one direction only.
3	It results in a chemical change.	It does not result in a chemical change.

- A** 1, 2 and 3 are correct
B 1 and 2 are correct
C 2 and 3 are correct
D 1 is correct
- 16** Which is the best way to prepare maximum yield of barium sulfate, starting from barium carbonate?
- A** Add dilute sulfuric acid to barium carbonate and then filter.
B Add excess aqueous sodium sulfate to barium carbonate and then filter.
C Add barium carbonate to nitric acid followed by dilute sulfuric acid and filter.
D Heat barium carbonate and then react the barium oxide with dilute sulfuric acid, then filter.

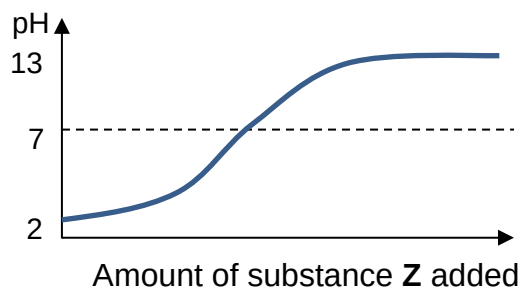
- 17 In a qualitative analysis, reagent **P** is added gradually to solution **Q**, followed by the addition of a dilute acid **R**.



The graph shows how the mass of the precipitate changes as the reagents are added. Which of the following entries is correct?

	P	anions in Q	R
A	aqueous silver nitrate	Cl^- and CO_3^{2-}	dilute nitric acid
B	aqueous silver nitrate	Cl^-	dilute nitric acid
C	aqueous barium chloride	Cl^- and CO_3^{2-}	dilute hydrochloric acid
D	aqueous barium chloride	CO_3^{2-}	dilute hydrochloric acid

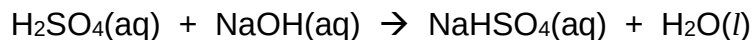
- 18** An excess of substance **Z** was added slowly, with stirring, to aqueous solution **P**. The changes in the pH of the mixture are shown in the graph below.



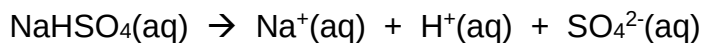
What could substances **P** and **Z** be?

	substance Z	substance P
A	aluminium oxide	sulfuric acid
B	magnesium oxide	ethanoic acid
C	potassium oxide	sulfuric acid
D	zinc oxide	ethanoic acid

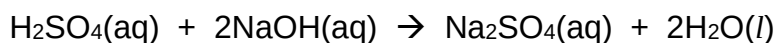
- 19** When dilute sulfuric acid and aqueous sodium hydroxide react, sodium hydrogen sulfate, NaHSO_4 , is first formed.



Aqueous sodium hydrogen sulfate dissociates into ions.



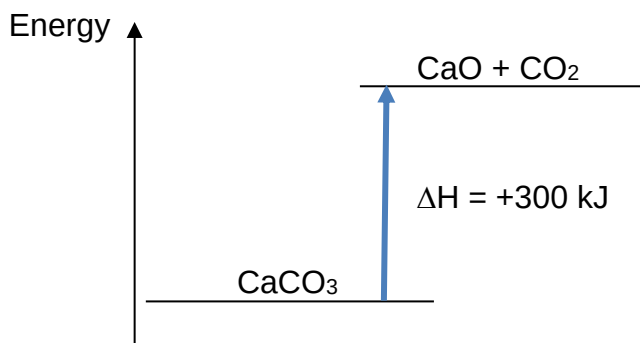
If more sodium hydroxide is added, sodium sulfate, Na_2SO_4 , can be formed.



Which results for these two salts, when tested with Universal Indicator and barium nitrate solution are correct?

		pH	addition of barium nitrate solution
A	NaHSO_4	>7	no reaction
	Na_2SO_4	7	no reaction
B	NaHSO_4	>7	white precipitate
	Na_2SO_4	7	white precipitate
C	NaHSO_4	<7	no reaction
	Na_2SO_4	7	no reaction
D	NaHSO_4	<7	white precipitate
	Na_2SO_4	7	white precipitate

- 20 The energy level diagram for the decomposition of calcium carbonate is shown below.

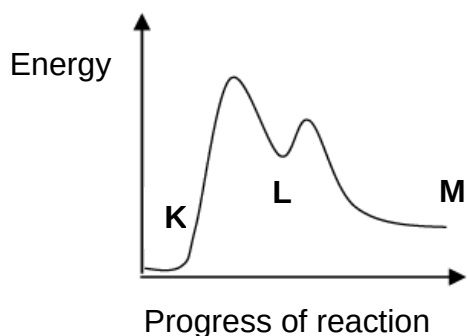


Which of the following can be deduced from the above energy level diagram when 1 mole of calcium carbonate is decomposed?

- A The formation of bonds in the products uses 300 kJ of energy.
 - B 300 kJ of energy is lost to the surrounding due to bond breaking.
 - C The activation energy of the reaction must be more than 300 kJ.
 - D The amount of energy released for bond formation is more than the amount absorbed for bonds breaking.
- 21 In the conversion of compound **K** to compound **M**, it was found that the use of a catalyst caused the reaction to proceed through the formation of an intermediate compound **L**.

The following graph shows the energy profile diagram for the reactions.

Step 1: Compound **K** → Compound **L**
 Step 2: Compound **L** → Compound **M**



Which of the following can be deduced from the diagram?

- A Both Steps 1 and 2 are endothermic.
- B The overall reaction to convert **K** to **M** is exothermic.
- C Step 1 has a lower activation energy as compared to Step 2.
- D Step 1 requires more energy for bond breaking than Step 2.

- 22** Iron rusts easily, hence steel structures should be treated to slow down the rusting process.

Which row incorrectly describes how each method protects iron from rusting and its main disadvantage?

	method	how it protects	disadvantage
A	painting steel	provides a barrier between the iron and the atmosphere	paint scrapes off easily, exposing iron to the atmosphere
B	alloying steel with chromium to make stainless steel	chromium reacts with oxygen in the air to form a barrier of chromium oxide which prevents iron from rusting	production of stainless steel is costly
C	storing steel objects in a dry place	absence of water prevents iron from rusting quickly	difficult to keep storage place dry at all times
D	coating steel plates with zinc	zinc is more reactive than iron, and provides a barrier between iron and the atmosphere	when coating of zinc is scratched, iron will corrode in place of zinc, making it rust more quickly

- 23** The list shows the position of metal **X** in the reactivity series of metals.

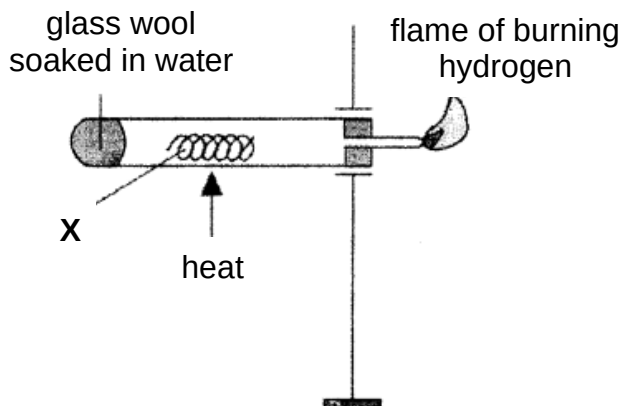
Na Al Fe **X** Cu Ag

Which method(s) could be used to extract metal **X**?

- 1 electrolysis of the solid metal oxide
- 2 heating the metal oxide with copper
- 3 heating the metal oxide with carbon

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

- 24 A substance **X** is heated in the setup shown in the diagram. A flame is produced.



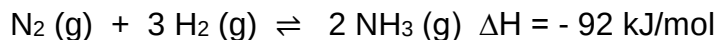
What is substance **X** most likely to be?

- A **X** is a metal above hydrogen in the reactivity series.
B **X** is a metal below hydrogen in the reactivity series.
C **X** is an oxide of a metal that is above hydrogen in the reactivity series.
D **X** is an oxide of a metal that is below hydrogen in the reactivity series.
- 25 About 40 % of all steel and iron is produced by recycling.
Which statements are correct reasons for recycling iron?

I	Iron, when obtained by a recycling process, produces less carbon dioxide than the blast furnace process.
II	Recycling iron allows land to be used for other purposes e.g. housing
III	Scrap steel, if not recycled, would cause environmental problems due to its disposal by landfill.

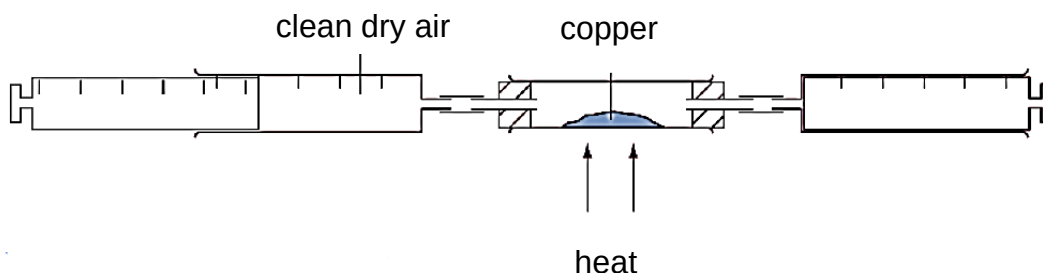
- A I and II
B I and III
C II and III
D I, II and III

- 26 Ammonia is manufactured by the Haber Process. The equation for the Haber process is given below.



Which statement about the Haber Process is true?

- A Hydrogen used is obtained from the hydrogenation of alkenes.
 - B Nitrogen used is obtained from the fractional distillation of crude oil.
 - C The reaction is exothermic as energy is absorbed to break the strong $\text{N}\equiv\text{N}$ bonds.
 - D The yield of the reaction is always lower than 100% as the reaction is reversible.
- 27 A sample of clean, dry air is passed over hot copper until there is no further change to the volume of air.

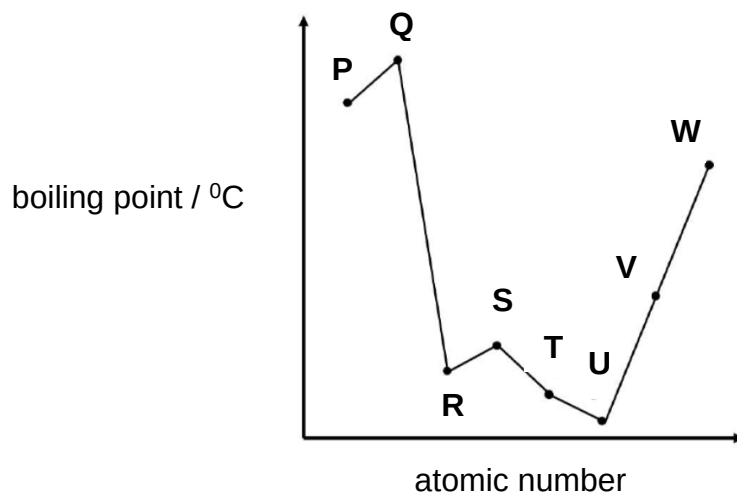


The volume of air decreased by 14.5 cm^3 .

What was the starting volume of the sample of air?

- A 18.4 cm^3
- B 53.9 cm^3
- C 69.0 cm^3
- D 85.5 cm^3

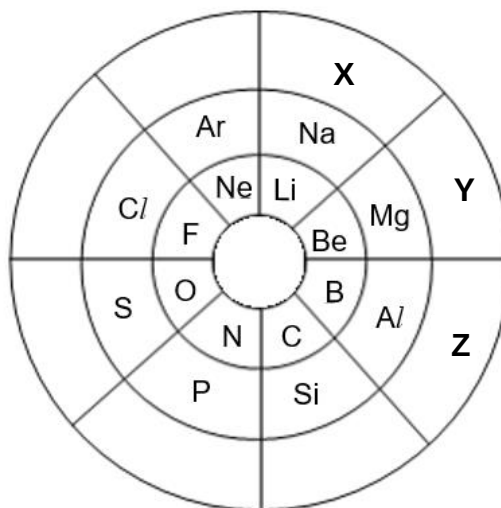
- 28 The graph below shows the variation in boiling points for eight consecutive elements in Periods 3 and 4 of the Periodic Table with atomic numbers less than or equal to 20.



What can be deduced from the above?

- A Element P is a Group I element.
- B Element S has a metallic lattice structure.
- C Element U exists as diatomic molecules.
- D Element V is a strong reducing agent.

- 29** Dimitri Mendeleev, a chemist, organised the elements using a system called the Periodic Table. A student suggested another way of arranging the elements as shown below.



Which of the following statements is correct?

- A** An atom of **X** contains three valence electrons.
- B** Elements **X** and **Y** belong to the same group.
- C** Element **X** contains more electrons than element **Z**.
- D** Elements **X**, **Y** and **Z** belong to the same period.

- 30** The carbonates of four metals **P**, **Q**, **R** and **S** are heated to the same temperature. The results of the experiments are shown in the table below.

carbonates of	products of thermal decomposition
P	metal oxide and carbon dioxide
Q	no visible change
R	metal and carbon dioxide
S	metal oxide and carbon dioxide

When metal **S** reacts with steam, a bright white glow is observed. However, metal **P** is not affected by steam. What is the correct order of reactivity of the four metals?

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

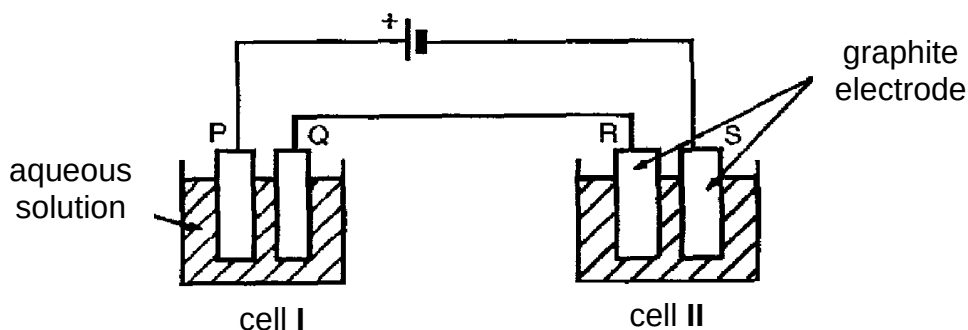
- 31** In an electrolysis experiment, the same amount of charge deposited 38.4 g of copper and 10.4 g of chromium. The charge on the copper ion was 2+.

What is the charge of Chromium?

[Ar: Cr, 52; Cu, 64]

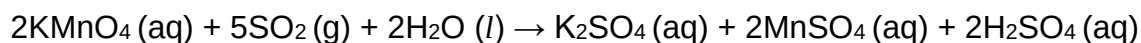
- A** 2+
- B** 3+
- C** 4+
- D** 6+

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



If an increase in mass of **Q** is greater than the increase of mass of **S** in the same time, which of the following statements is necessarily true?

- A** The cation discharged in Cell I is different from the cation discharged in Cell II.
 - B** The anion of the solute in Cell I is different from the anion of the solute in Cell II.
 - C** The solution in Cell I is more concentrated than the solution in Cell II.
 - D** The loss of mass of electrode P is less than the loss of mass of electrode R.
- 33** Study the reaction below:



Which is the correct pair of oxidising and reducing agents and the corresponding observation in this reaction?

	oxidising agent	reducing agent	observations
A	SO_2	KMnO_4	colourless solution turns purple
B	KMnO_4	SO_2	purple solution decolourises
C	KMnO_4	H_2O	purple solution decolourises
D	H_2SO_4	MnSO_4	colourless solution turns purple

34 When crude oil is fractionally distilled, which compounds leave from the bottom of the fractionating column?

- A** The compounds that are least flammable.
- B** The compound that are the least viscous.
- C** The compounds with the lowest relative molecular mass.
- D** The compounds with the lowest boiling points.

35 Ethanol can be manufactured from ethene or from glucose. The table gives statements about the processes involved.

	process using ethene	process using glucose
1	reaction is faster at 300 °C than at 200 °C	reaction is faster at 100 °C than at 30 °C
2	produces pure ethanol	produces a dilute aqueous solution of ethanol
3	uses a catalyst	uses a catalyst
4	uses steam	produces carbon dioxide

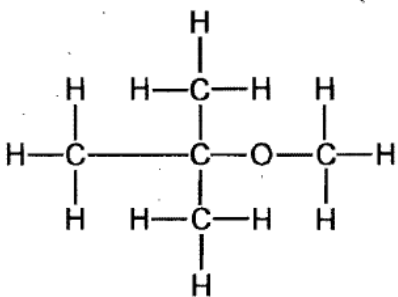
In which rows are both statements correct?

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

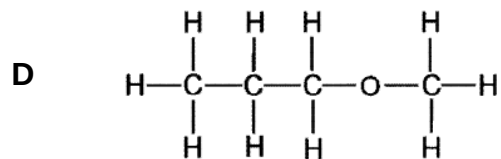
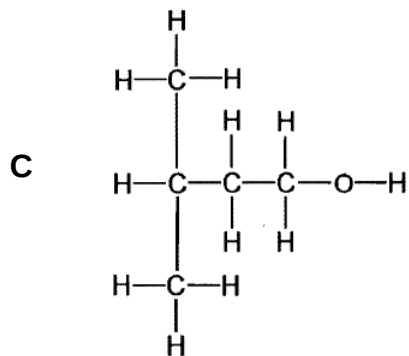
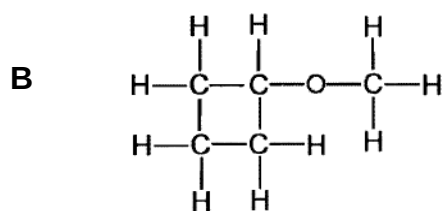
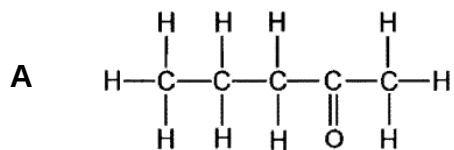
36 An ester with molecular formula $C_6H_{12}O_2$ undergoes hydrolysis to form an alcohol **G** and an acid **H**. Alcohol **G** can be oxidised to acid **H** by warming with acidified potassium manganate(VII). The formula of the ester is

- A** $HCOOC_5H_{11}$
- B** $CH_3COOC_4H_9$
- C** $C_2H_5COOC_3H_7$
- D** $C_3H_7COOC_2H_5$

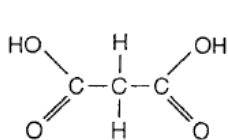
37 The structural formula of compound **X** is shown.



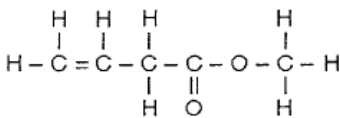
Which of the following compounds is an isomer of compound **X**?



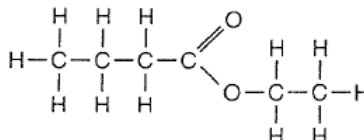
- 38** Which of the following tests can be used to distinguish the following organic compounds, I, II and III separately from each other?



I



II



III

test	1	Adding aqueous bromine.
	2	Adding powdered magnesium.
	3	Warming with acidified potassium manganate(VII).

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

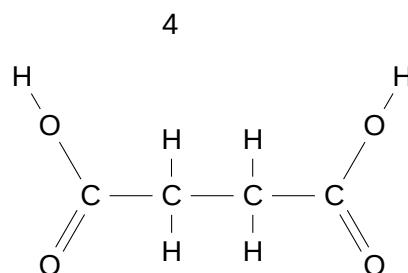
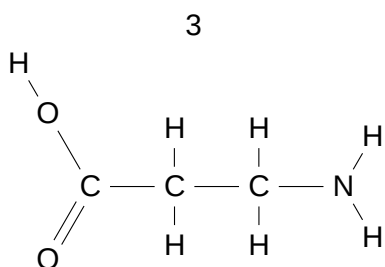
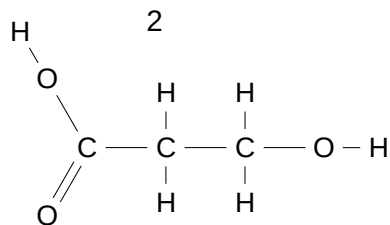
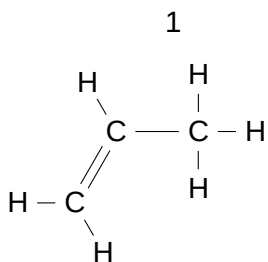
- 39** A pure fat molecule has a relative molecular mass of 300.

75 g of the fat reacts with 120 g aqueous bromine.

How many double bonds are there in each fat molecule?

- A** 2
B 3
C 4
D 6

- 40 Which of the following compounds would undergo polymerisation on their own?



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

– The End –