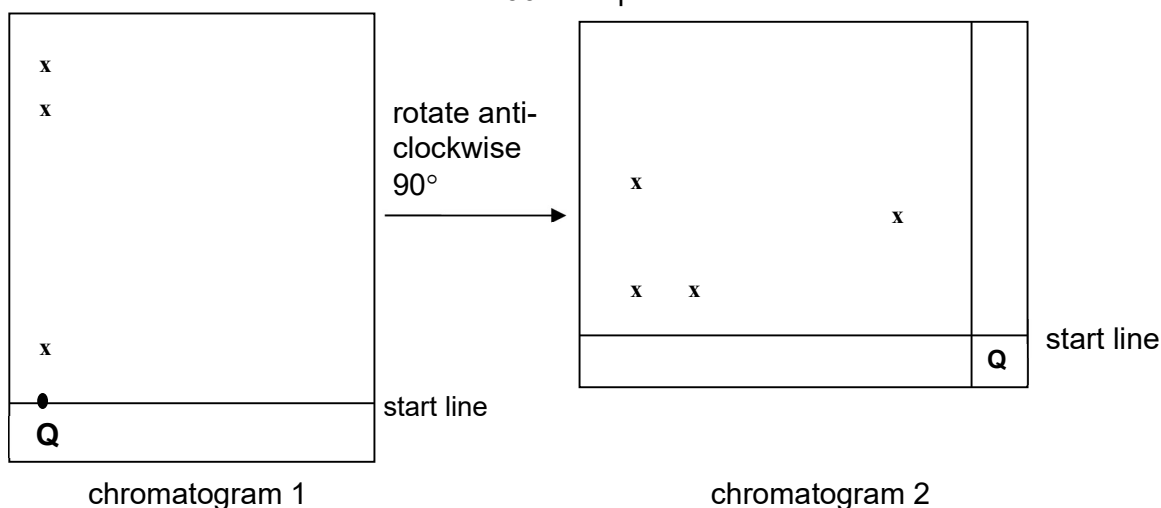


SECTION A

Answer **all** questions in this section in the multiple choice answer sheet provided.
The total mark for this section is 30.

- 1 In an experiment, a student reacts silver nitrate solution with dilute hydrochloric acid to prepare silver chloride. Which of the following procedures should he perform to recover the silver chloride from the reaction mixture?
- A** Add water and carry out distillation on the mixture.
B Filter and evaporate filtrate to dryness.
C Filter and recover silver chloride on the filter paper.
D Filter the solution obtained till saturated and then cool to obtain the crystals.
- 2 Chromatogram 1 below shows the results of separation of the coloured inks in a mixture **Q**, using solvent A. Chromatogram 2 shows the results using **the same piece of paper** but after it has been rotated anti-clockwise 90° and placed in solvent B.

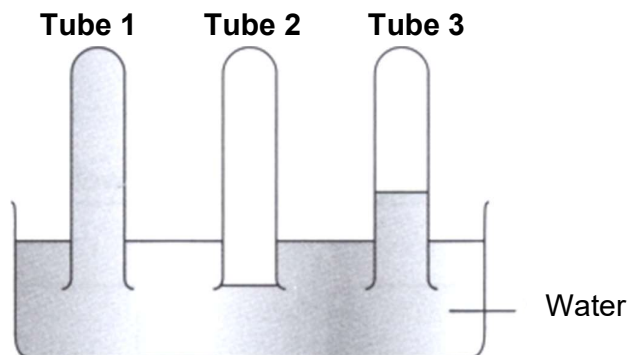


How many different inks are present in mixture **Q**?

- A** 3
B 4
C 5
D 6

[Turn over

- 3 Dry test-tubes 1 to 3 are each filled with a different gas and placed in a trough of water. After a short time, the water had risen in test tubes 1 and 3 as shown below.



Which gases could the tubes have contained?

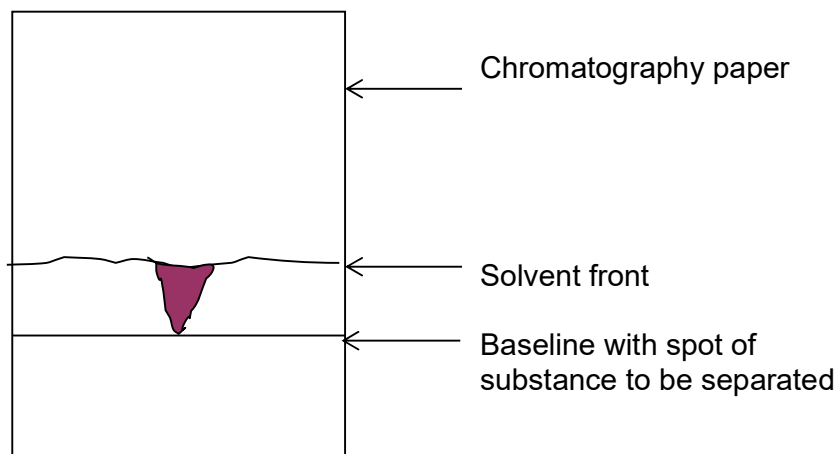
	Tube 1	Tube 2	Tube 3
A	ammonia	carbon dioxide	hydrogen
B	ammonia	hydrogen	carbon dioxide
C	carbon dioxide	hydrogen	ammonia
D	hydrogen	ammonia	carbon dioxide

- 4 Which of the following solids will not leave any solid residue when heated on an evaporating dish?

(i) silver oxide (ii) ammonium carbonate (iii) ammonium chloride

- A (i) only
B (i) and (ii) only
C (ii) only
D (ii) and (iii) only

- 5 A student tried to separate a mixture of food dyes by chromatography. Separation was poor, as shown in the chromatogram below.



Which change to the process would improve the result?

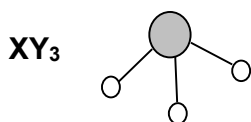
- A Allowing the solvent to rise further up the paper.
 - B Putting a larger spot of the dye mixture onto the paper.
 - C Using enough solvent to cover the baseline.
 - D Using a larger piece of chromatography paper.
- 6 An ion L^{2-} contains 31 nucleons and 18 electrons. What does its nucleus contain?
- A 15 protons and 15 neutrons.
 - B 16 protons and 15 neutrons.
 - C 18 protons and 13 neutrons.
 - D 21 protons and 10 neutrons.

[Turn over

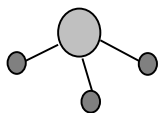
- 7 The proton numbers of elements, X, Y and Z are 4, 6 and 8 respectively. Which of the following lists give the correct formulae of the compounds formed between them?

- A XZ YZ_2 XYZ_2
B XZ YZ_2 XYZ_3
C X_2Z YZ XYZ_3
D X_2Z YZ XYZ_4

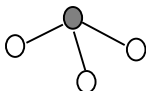
- 8 The models and formulae for two molecules are shown below.



Which of the following, A, B, C or D, shows the correct model of a molecule for the compound formed between Y and Z?



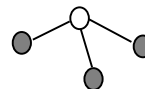
A



B



C



D

- 9 The boiling point of water is 100°C . The melting point of potassium chloride is 770°C . What is most likely the boiling point of a sample of water containing a small quantity of potassium chloride?

- A 90°C
B 104°C
C 456°C
D 773°C

10 Consider the following chemical equation:



Which row is correct?

	u	v	w	x	y
A	1	2	3	2	1
B	1	1	2	3	2
C	2	3	3	3	1
D	2	3	1	2	2

11 **TUV** is a new indicator that changes colour according to the pH range shown below:

pH range	Colour
0 - 2	Yellow
3 - 6	Blue
7 - 14	Colourless

Which pair of substances present in a mixture can be distinguished by the addition of **TUV** to each sample separately?

- A** Aqueous ammonia and sodium chloride solution
- B** Dilute carbonic acid and potassium chloride solution
- C** Dilute ethanoic acid and rainwater
- D** Dilute hydrochloric acid and dilute sulfuric acid

[Turn over

12 The following diagrams are used to illustrate different substances I to IV.

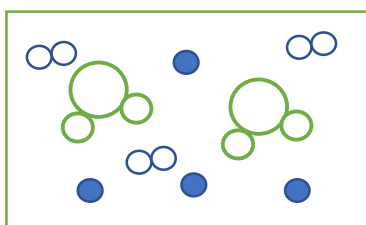


Diagram I

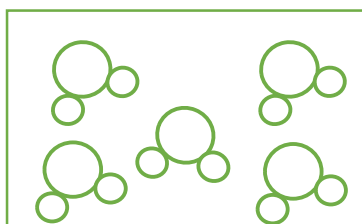


Diagram II

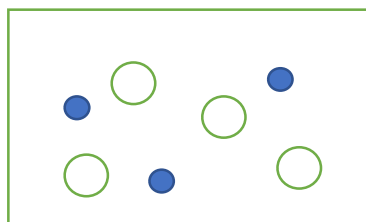


Diagram III

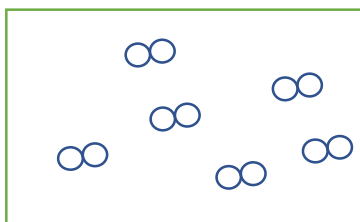


Diagram IV

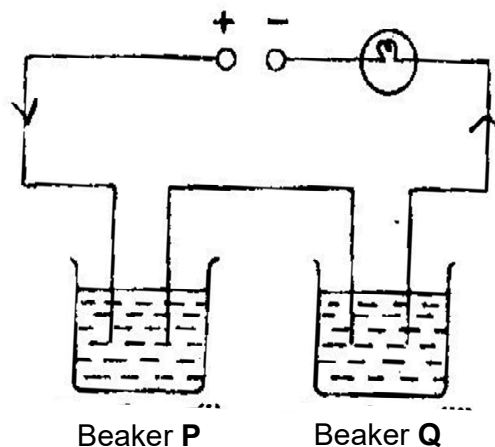
Which row identifies the correct diagrams?

	a mixture of elements and compounds	a mixture of elements	molecules of an element	molecules of a compound
A	I	III	IV	II
B	I	III	II	IV
C	III	I	IV	II
D	III	I	II	IV

- 13 The table shows the melting and boiling points of sulfur, lead(II) bromide and dilute sulfuric acid.

Substance	Melting Point/ °C	Boiling Point/ °C
Sulfur	119	445
Lead(II) bromide	370	910
Dilute sulfuric acid	-2	102

The bulb lights up when the apparatus shown is set up.



Which of the following correctly describes the substances present in beaker P and beaker Q?

	Beaker P at 20 °C	Beaker Q at 450 °C
A	Dilute sulfuric acid	Sulfur
B	Dilute sulfuric acid	Lead(II) bromide
C	Lead(II) bromide	Dilute sulfuric acid
D	Sulfur	Dilute sulfuric acid

- 14 Which of the following substances contains both ionic and covalent bonds?

- A Calcium carbonate
- B Iron (II) sulfide
- C Sodium chloride
- D Sulfur dioxide

[Turn over

15 Which of the following does **not** contain the same number of electrons as a sulfide ion, S^{2-} ?

- A Al^{3+}
- B Ar
- C H_2S
- D P^{3-}

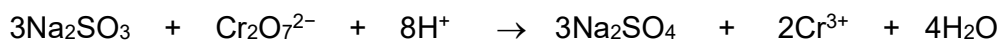
16 The chemical formulae of antimony oxide and potassium phosphate are Sb_2O_3 and K_3PO_4 , respectively. What will be the formula of antimony phosphate?

- A $SbPO_4$
- B Sb_2PO_4
- C $Sb_2(PO_4)_3$
- D Sb_3PO_4

17 What is the oxidation state of sulfur in $S_2O_3^{2-}$?

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

18 Which of the following statements about the reaction shown is **incorrect**?



- A Na_2SO_3 is acting as a reducing agent.
- B The oxidation state of sulfur is increased from +4 to +6.
- C The solution changes from orange to green.
- D The oxidation state of chromium is increased from -6 to +3.

19 Which of the following statements describing acids is **correct**?

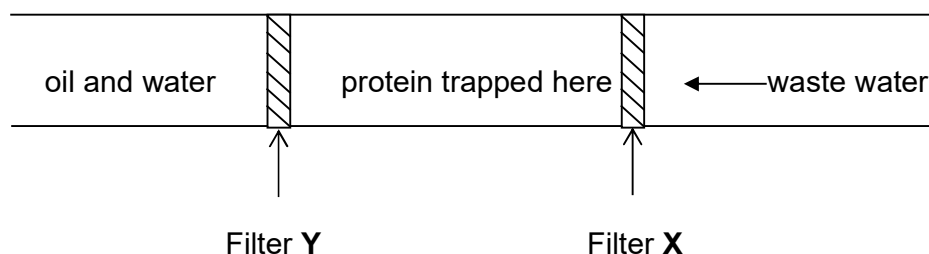
- I All acids are liquids.
- II All acids consist of oxygen.
- III All acids react with any metals to give hydrogen gas.
- IV All acids produce hydrogen ions when ionized in water.

- A** IV only
- B** I and IV only
- C** III and IV only
- D** I, II, III and IV

20 The diameters of some particles are shown in the table.

Particle	Size in nm (10^{-9}m)
Water molecule	0.2
Oil molecule	1.0
Protein	10.0
molecule	50.0
Virus particle	

An aqueous waste liquid contains a suspension of visible sand particles mixed with oil, protein, and viruses. By using two filters with pores of different sizes, it is intended to separate the mixture to obtain the protein.



Which row shows the suitable diameter of the pores in each filter?

	Filter X	Filter Y
A	20.0 nm	0.2 nm
B	20.0 nm	2.0 nm
C	100.0 nm	2.0 nm
D	100.0 nm	10.0 nm

[Turn over

21 Which of the following solutions will have the lowest pH?

- A** 0.1 mol/dm³ hydrochloric acid
- B** 0.1 mol/dm³ sodium hydroxide
- C** 0.1 mol/dm³ sulfuric acid
- D** 0.2 mol/dm³ ethanoic acid (CH₃COOH)

22 When a salt **Y** is heated with sodium hydroxide solution, a gas that turns moist red litmus paper blue is produced. **Y** could be

- A** ammonium chloride
- B** calcium nitrate
- C** sodium chloride
- D** potassium iodide

23 The following statements about dilute sulfuric acid are all correct. Which pair of statements describe the acidic nature of dilute sulfuric acid solution?

- i. A white precipitate is formed when aqueous barium chloride is added.
- ii. The solution turns anhydrous copper (II) sulfate from white to blue.
- iii. Addition of Universal Indicator shows that the solution has a pH value of less than 7.0.
- iv. The solution reacts with copper (II) oxide, forming a blue solution.

- A** i and ii
- B** ii and iii
- C** ii and iv
- D** iii and iv

24 The table below gives information about three indicators.

Indicator	Colour in strongly acidic solution	pH at which colour changes	Colour in strongly alkaline solution
Methyl yellow	Red	3	Yellow
Bromocresol green	Yellow	5	Blue
Thymolphthalein	Colourless	9	Blue

What is observed when a mixture containing all three indicators is added to a solution with pH 4? (Assume there is no reaction between the different indicators.)

- A blue
- B green
- C orange
- D yellow

25 Small portions of aqueous potassium iodide and acidified aqueous potassium manganate(VII) are added separately to four solutions. The colour changes observed are shown in the table.

solution number	potassium iodide	potassium manganate(VII)
1	colourless to red	purple to colourless
2	colourless to red	no change
3	no change	purple to colourless
4	no change	no change

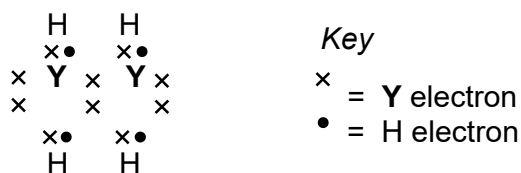
Which pair of solutions each contains an oxidising agent?

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

[Turn over

- 26** The structure of a compound containing an element **Y** and hydrogen can be represented as shown in the diagram. Only outer shell electrons are shown.

For which Group of the Periodic Table does element **Y** belong?



- A** III
- B** IV
- C** V
- D** VI
- 27** Which reaction shows no change in the oxidation state of sulfur?
- A** $\text{Cu(s)} + \text{S(s)} \rightarrow \text{CuS(s)}$
- B** $\text{SO}_3\text{(g)} + \text{H}_2\text{O(l)} \rightarrow 2\text{H}^+\text{(aq)} + \text{SO}_4^{2-}\text{(aq)}$
- C** $2\text{SO}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2\text{SO}_3\text{(g)}$
- D** $\text{SO}_2\text{(g)} + \text{Cl}_2\text{(g)} + 2\text{H}_2\text{O(l)} \rightarrow 4\text{H}^+\text{(aq)} + \text{SO}_4^{2-}\text{(aq)} + 2\text{Cl}^-\text{(aq)}$
- 28** Which of the following enables steam to change into liquid water during condensation?
- A** covalent bonds
- B** intermolecular forces
- C** both covalent bonds and intermolecular forces
- D** neither covalent bonds nor intermolecular forces

Questions **29** and **30**:

Methylamine, CH_3NH_2 is a gas that resembles ammonia.
Methylamine has the following properties.

- alkaline
- denser than air
- soluble in water
- burns readily in air

29 Which substance is used to prepare Methylamine when heated with $\text{CH}_3\text{NH}_3^+\text{Cl}^-$?

- A** aqueous ammonia
- B** dilute hydrochloric acid
- C** sodium chloride solution
- D** sodium hydroxide solution

30 Which of the following is used to distinguish between methylamine and ammonia?

- A** a glowing splint
- B** a lighted splint
- C** litmus paper
- D** universal indicator

[Turn over

Section B

Answer **all** questions in this section in the spaces provided.
The total mark for this section is 40

B1 A list of oxides is given below.

Sulfur dioxide	Potassium oxide	Copper (II) oxide
Zinc oxide	Nitrogen monoxide	Carbon monoxide
Magnesium oxide	Carbon dioxide	Calcium oxide

a Choose the oxide that best fits the following descriptions.
Each oxide can only be used once.

(i) It dissolves in water to produce an acidic solution of pH 2.

..... [1]

(ii) It is insoluble in water, acids, and alkalis.

..... [1]

(iii) It dissolves readily in water to form a solution which turns Universal Indicator violet.

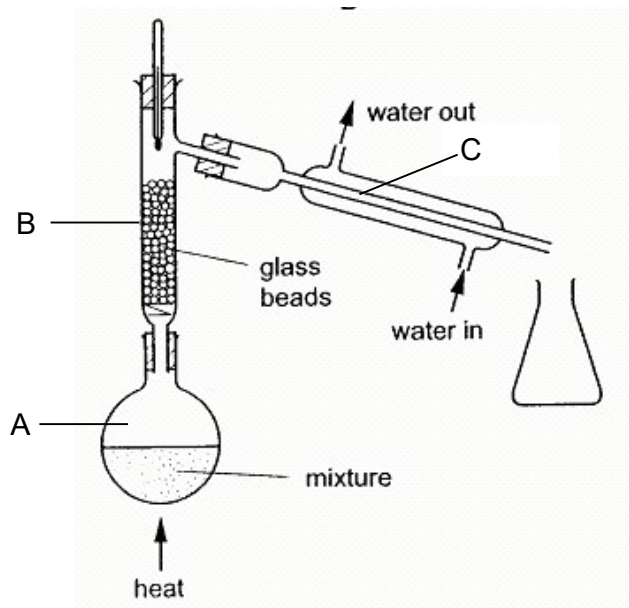
..... [1]

b Write a balanced chemical equation for the reaction described in a(iii).

..... [1]

c Draw a “dot and cross” diagram to show the bonding in potassium oxide.

B2 A mixture containing equal volumes of P, Q, R is separated using fractional distillation. The boiling points of P, Q and R, are 50°C , 78°C and 100°C respectively.



- a** Which part of the fractionating column, A, B or C gives the least proportion of R at 50°C ?

..... [1]

- b** Sketch the graph of temperature versus volume of distillate collected. Label the axes of the curve. All information must be reflected in the curve.



[3]

B3 An electrolyte is a liquid substance which acts as a medium to conduct electricity.
Hydrochloric acid, like all acids, is an electrolyte.

- a (i)** Apart from acids, give the name of one other type of substance that can conduct electric current.

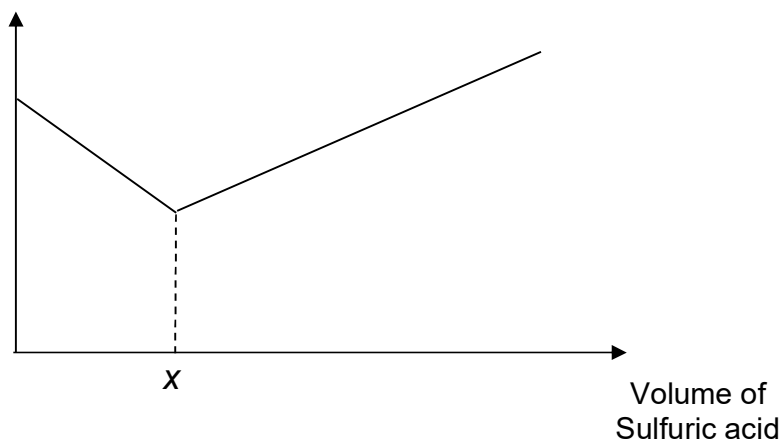
..... [1]

- a (ii)** Name the particles responsible for conducting electrical current in the type of substance you have answered in **a(i)**.

..... [1]

- b** The graph shows the changes in the electrical conductivity for a 25.0 cm^3 solution of 0.1 mol dm^{-3} aqueous sodium hydroxide as dilute sulfuric acid is added.

Electrical conductivity



- (i)** What is this method of salt preparation known as?

..... [1]

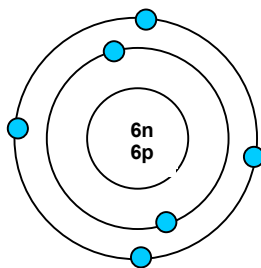
- (ii)** Write the chemical equation for the reaction.

..... [1]

- (iii) With the help of an ionic equation, explain why the electrical conductivity decreases and then increases as sulfuric acid is added?

.....
.....
.....
.....
.....
..... [3]

B4 The electronic structure of an atom of element **Q** is shown below:



Key: **n** for neutron, **p** for proton and ● for electron

- a** (i) What is the mass number of element **Q**?

..... [1]

- (ii) There are about 700 different kinds of atoms even though only about 100 different elements are known. Suggest a reason why there are many more different atoms than there are elements.

.....
.....
..... [1]

[Turn over

b Element **Q** reacts with chlorine to form compound **R**.

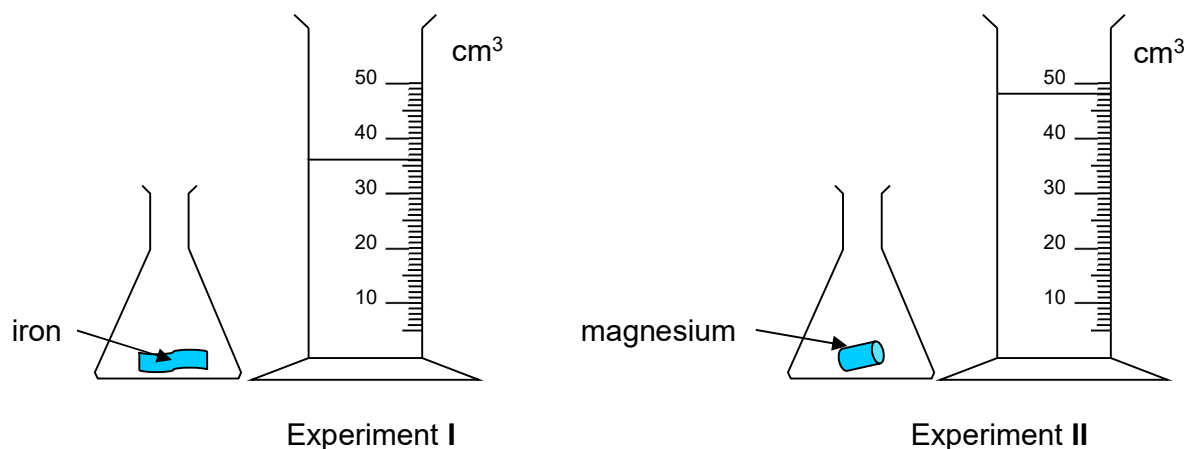
- (i) Draw a “dot and cross” diagram to show the bond present in **R**. [Show only the outer shell electrons]

[1]

b (ii) state two physical properties of compound **R**.

.....
.....
..... [2]

B5 The diagram shows the experiments **I** and **II** used to test the reactivities of two metals, iron and magnesium with dilute hydrochloric acid.



A stopwatch is used to measure the time taken for reaction in each experiment to come to a complete stop.

a (i) State the volume of dilute hydrochloric acid used in each experiment.

..... [1]

(ii) How do you know when the reaction has stopped?

..... [1]

(iii) Write the ionic equation, including the state symbols, of the reaction between iron and dilute hydrochloric acid.

..... [1]

b Is the reaction between magnesium with hydrochloric acid an example of a redox reaction? Explain your answer in terms of oxidation state.

.....
.....
..... [2]

[Turn over

- c Suggest why the time taken for each reaction to come to a complete stop **cannot** be used to compare the reactivity of iron and magnesium.

.....
..... [1]

B6 a Complete the table.

Particle	No of proton	No of electrons	Electronic Configuration
A	16	18	
B	7		2.5
C	19	18	
D		19	2.8.8.1
E	20		2.8.8

[2]

- b (i)** Pick out the particle(s) that react to form an ionic compound to give the highest melting point.

..... [1]

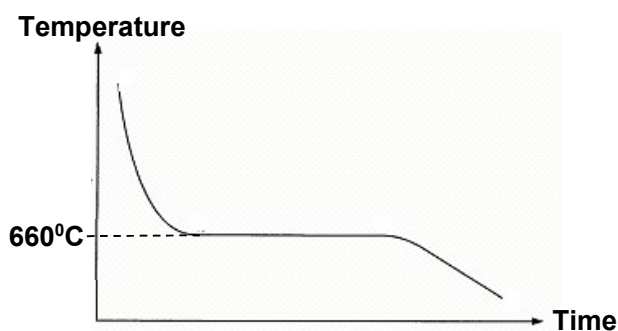
- (ii)** Write the formula of the compound mentioned in **b(i)**.

..... [1]

- (iii)** Explain why the compound in **(bi)** has got the highest melting point.

.....
.....
..... [2]

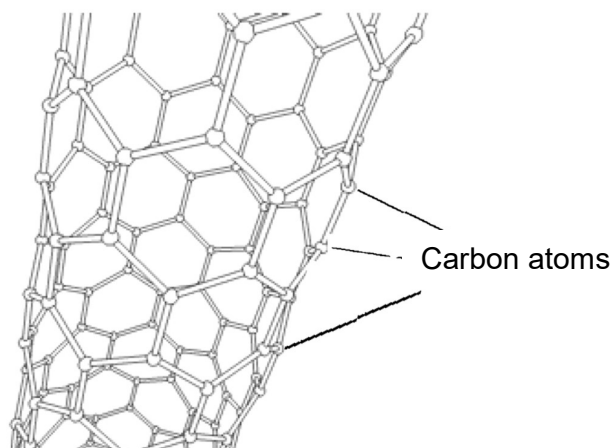
B7 A sample of aluminium is heated until it is completely molten. It is then allowed to cool until it solidifies. The graph below shows how the temperature of aluminium changes with time.



a Describe how the arrangement and movement of particles in the aluminium change as the temperature cools from 661°C to 659°C.

.....
.....
..... [2]

B8 In recent years, scientists have made tube-shaped structures of carbon called nanotubes. Carbon nanotubes (CNTs) are **allotropes of carbon** with a nanostructure that can have a length-to-diameter ratio greater than 1,000,000. These cylindrical carbon molecules contains extraordinary strength and unique electrical properties and are efficient conductors of heat. The diagram below shows the structure of carbon nanotubes.



[Turn over

- a (i)** State two **differences** between the arrangement of carbon atoms in carbon nanotubes and in diamond.

.....
.....
..... [2]

- (ii)** Carbon nanotubes are fifty times stronger than steel. Use ideas about structure and bonding to suggest why these nanotubes are so strong.

.....
.....
..... [2]

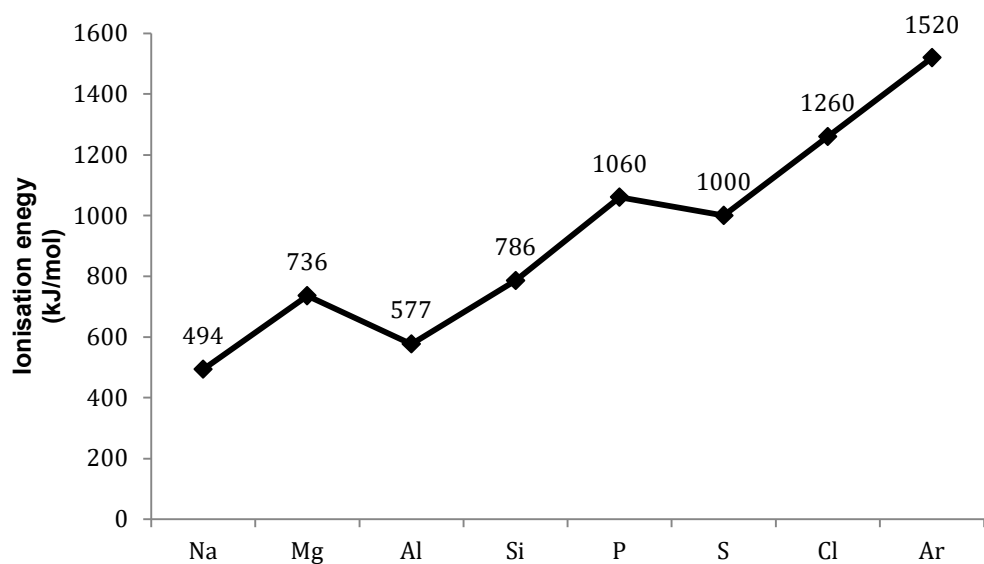
Section C

Answer **all** questions in this section in the spaces provided.
The total mark for this section is 20.

- C1 a** A titration experiment was carried out using hydrochloric acid in the burette and sodium hydroxide solution in the conical flask. **State** and **explain** how the results would be affected if the conical flask was rinsed with the alkali before the titration.

.....
.....
..... [2]

- b** Ionisation energy is the amount of energy required to remove an electron from an atom in the gaseous state forming a positive ion. The graph shows the ionisation energy of the elements in Period 3.



- (i) Which element in Period 3 loses its electrons the most easily?

..... [1]

[Turn over

- b (ii)** Compare the ionisation energy between Na and Ar. State the difference in ionisation energy between sodium and argon. Give a reason for this difference.

.....
.....
..... [2]

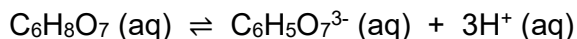
- (iii)** With reference to the graph, describe the general trend for the ionisation energy of the elements across Period 3 and explain why such a trend is observed.

.....
..... [2]

- (iv)** The second ionisation energy is the energy required to remove an electron from a positive ion. Will the second ionisation energy of elements across Period 3 be higher than the first ionisation energy? Give a reason for your answer.

.....
.....
.....
.....
..... [2]

C2 Oranges, lemons and limes are known as citrus fruits because they contain an acid known as citric acid, $\text{C}_6\text{H}_8\text{O}_7$. Citric acid is a weak tribasic acid. It is commonly sold in the market as solid citric acid crystals. In aqueous condition, the following reaction occurs.



- a** Explain the term 'weak acid'.

.....
..... [2]

- b (i)** Describe a test (excluding the use of indicators) that can distinguish citric acid from nitric acid.

.....

.....

.....

.....

.....

.....

..... [3]

- b (ii)** A toilet cleanser contains the salt, sodium dihydrogen phosphate, NaH_2PO_4 . Explain why sodium dihydrogen phosphate is both an 'acid' and a 'salt'.

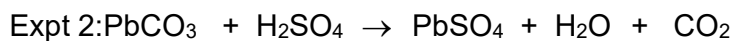
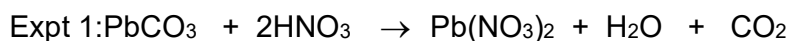
.....

.....

..... [2]

- c** A student carried out **two** experiments to investigate the volume of carbon dioxide gas produced when two different acids act on 267g of lead(II) carbonate.
The acids, 0.2 mol/dm^3 of each nitric acid and sulfuric acid were added in excess in two separate reactions.

The equations for the reactions are:



The results are as follows:

Experiment	Mass of of PbCO_3 used/g	Volume of CO_2
1	267	24 dm^3
2	267	600 cm^3

[Turn over

- c (i)** Explain the difference in the volume of carbon dioxide produced in the two reactions.

.....
.....
.....
.....
..... [2]

- (ii)** Due to the low yield observed, experiment 2 is found to be unsuitable for preparation of lead(II) sulfate. Describe how you could obtain the maximum yield of pure lead(II) sulfate starting with 100g of lead(II) carbonate.

.....
.....
.....
..... [2]

