



L-Università  
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE  
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL  
2023 SUPPLEMENTARY SESSION**

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SUBJECT: **Chemistry**  
 PAPER NUMBER: I  
 DATE: 29<sup>th</sup> August 2023  
 TIME: 9:00 a.m. to 11:05 a.m.

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**Useful data:**

Standard temperature and pressure (stp): 0 °C and 1 atm (760 mm Hg)

The molar volume for gases at stp = 22.4 dm<sup>3</sup>

Specific heat capacity of water = 4.2 J g<sup>-1</sup> °C<sup>-1</sup>

Faraday constant = 96500 C mol<sup>-1</sup>

Avogadro constant, L = 6.02 x 10<sup>23</sup>

$\Delta H = mc\Delta\theta$

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**Directions to Candidates**

- Write your index number in the space at the top left-hand corner of this page.
- Answer **ALL** questions. Write all your answers in the spaces provided in this booklet.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated in brackets.
- You are reminded of the necessity for orderly presentation in your answers.
- In calculations you are advised to show all the steps in your working, giving your answer at each stage.
- The use of electronic calculators is permitted.
- A Periodic Table is printed on the back of this booklet.

**For examiners' use only:**

Question	1	2	3	4	5	6	7	8	9	10	11	12	Total
Score													
Maximum	6	6	6	6	4	6	6	6	6	8	20	20	100

**Section A: Answer ALL questions.**

1. The statements in the Table below are not all correct. Next to each statement write True (T) or False (F).

	<b>Statement</b>	<b>T or F</b>
a.	Distillation can be used to separate a mixture of sand and sugar.	
b.	Chromatography shows the colours present in black ink.	
c.	In chromatography a solvent must be used.	
d.	In filtration a condenser is required.	
e.	In chromatography a plastic strip may be used instead of filter paper.	
f.	Ammonium chloride and sodium chloride may be separated by sublimation.	

**(Total: 6 marks)**

6

2. a. Magnesium reacts violently with oxygen. State **ONE** observation that can be made during this reaction.

\_\_\_\_\_ (1)

- b. Calcium is in the same group as magnesium in the Periodic Table. In an experiment, small amounts of calcium and magnesium are placed in two different test tubes. Dilute hydrochloric acid is added dropwise to each of the test tubes.

- i. Which is the more reactive, calcium or magnesium?

\_\_\_\_\_ (1)

- ii. Explain your answer to part 2(b)(i) with reference to the electronic structure (configuration) of the elements.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (2)

- iii. Give a balanced equation for the reaction of magnesium with dilute hydrochloric acid.

\_\_\_\_\_ (2)

**(Total: 6 marks)**

6

3. From the word bank below, choose the appropriate term to fill the empty spaces in the paragraph below.  
The terms may be used once or not at all.

number	mass	decreases	charged	similar	increases
neutral	lightest	different	heaviest	halogens	metals

The Periodic Table shows the elements in order of atomic \_\_\_\_\_. Down a group the atomic radius \_\_\_\_\_. The atoms of all the elements are \_\_\_\_\_. The elements in the same group have \_\_\_\_\_ properties. Hydrogen is the \_\_\_\_\_ element. The elements in Group 7 are called \_\_\_\_\_.

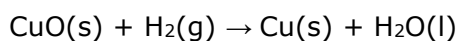
(Total: 6 marks)

6

4. a. Copper metal reacts with oxygen to form copper(II) oxide, CuO. Give a balanced equation for the reaction including state symbols.

\_\_\_\_\_ (3)

- b. When hydrogen gas is passed over heated copper(II) oxide a redox reaction occurs according to the equation



- i. State **ONE** observation that can be made for this reaction.

\_\_\_\_\_ (1)

- ii. Give the name or formula of the substance oxidised in the reaction.

\_\_\_\_\_ (1)

- iii. Explain your answer to part (b)(ii).

\_\_\_\_\_ (1)

(Total: 6 marks)

6

5. Crude oil contains many substances and some of them can be made to break down.
- a. On strong heating  $C_3H_8$  breaks down and forms two products. Fill in the missing formula in the equation:



- b. Which of the substances  $CH_4$  and  $C_3H_8$  has the lower boiling point?

\_\_\_\_\_ (1)

- c.  $CH_4$  and  $C_3H_8$  do not dissolve in water. Give **ONE** reason for this.

\_\_\_\_\_ (1)

- d. Both  $CH_4$  and  $C_3H_8$  may be used as fuels. Give **ONE** reason for this.

\_\_\_\_\_ (1)

**(Total: 4 marks)**

4

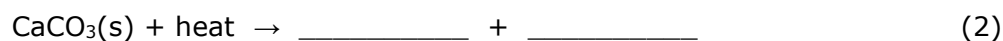
6. Carbon dioxide is a colourless, odourless gas which does not support combustion.

- a. Describe a chemical test which can prove the presence of carbon dioxide. No equation is necessary.

\_\_\_\_\_  
\_\_\_\_\_ (2)

- b. Limestone [ $CaCO_3$ ] can be converted to quicklime [ $CaO$ ] and subsequently to slaked lime [ $Ca(OH)_2$ ].

- i. Complete the following equation:



- ii. Give the equation for the conversion of quicklime to slaked lime.

\_\_\_\_\_ (2)

**(Total: 6 marks)**

6

7. Plastic bottles have a long life and can last between 400 to 1000 years. This causes big problems and for this reason we must cut down on the use of plastics or else use biodegradable plastics.

a. What does biodegradable mean?

\_\_\_\_\_ (1)

b. Give **TWO** reasons why we must cut down on using plastics.

Reason 1: \_\_\_\_\_ (1)

Reason 2: \_\_\_\_\_ (1)

c. The monomer ethene can be used to make poly(ethene).

i. To what homologous series does ethene belong?

\_\_\_\_\_ (1)

ii. Give the formula of ethene.

\_\_\_\_\_ (1)

iii. Why is ethane, C<sub>2</sub>H<sub>6</sub>, **not** used to make polymers?

\_\_\_\_\_ (1)

**(Total: 6 marks)**

6

8. Choose the appropriate metal from the box below. Write the name of the metal next to the statement. Each metal can be used only once.

aluminium	magnesium	iron	lead	potassium	copper
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a. This metal reacts slowly with water but vigorously with steam. \_\_\_\_\_

b. This metal is too reactive with an acid. \_\_\_\_\_

c. This metal forms an instant oxide layer at room temperature which is difficult to penetrate and difficult to burn. \_\_\_\_\_

d. This metal is extracted from the ore using carbon. \_\_\_\_\_

e. When heated, the nitrate of this metal makes a crackling sound. \_\_\_\_\_

f. This metal has salts that dissolve in water to give a blue solution. \_\_\_\_\_

**(Total: 6 marks)**

6

9. Nitrogen dioxide is a reddish-brown gas that reacts to form colourless dinitrogen tetroxide as indicated in the equation below.



- a. What term is used to describe a reaction that can go both forward and backward?

\_\_\_\_\_ (1)

- b. Is the forward reaction endothermic or exothermic?

\_\_\_\_\_ (1)

- c. For the changes stated below underline right or left to indicate the correct answer.

- i. The pressure of the system is increased.

Ans: The equilibrium will shift to the (right / left). (1)

- ii. More nitrogen dioxide is added to the system.

Ans: The equilibrium will shift to the (right / left). (1)

- iii. The temperature of the system is increased.

Ans: The equilibrium will shift to the (right / left). (1)

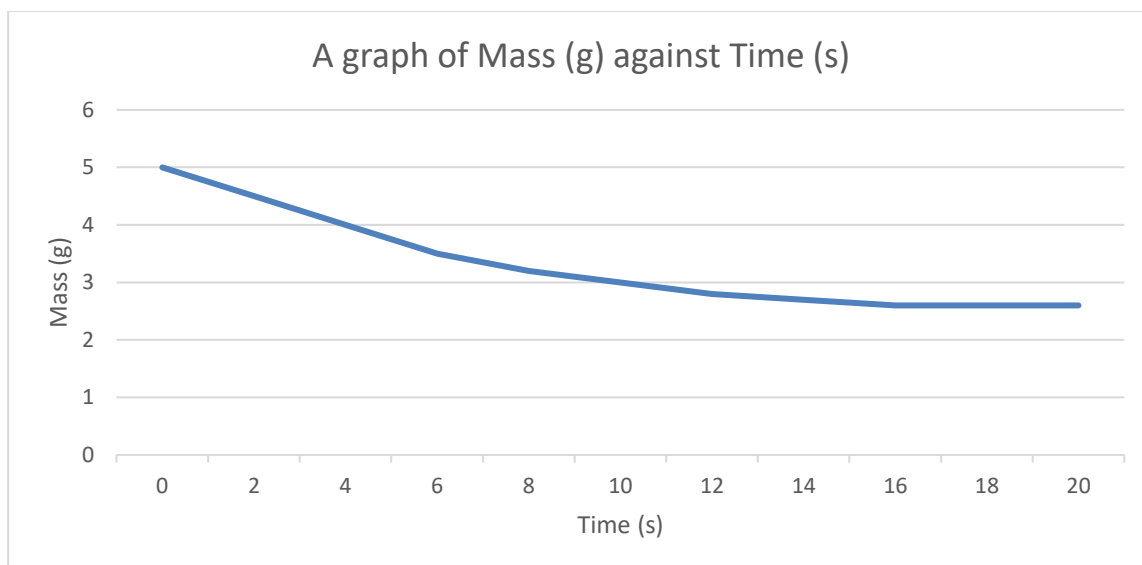
- iv. A change in pressure caused the reaction mixture to become more reddish-brown.

Ans: The equilibrium will shift to the (right / left). (1)

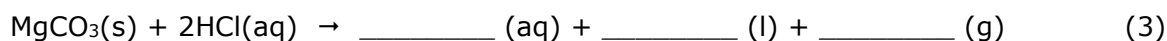
**(Total: 6 marks)**

6

10. A student investigated the rate of the reaction between magnesium carbonate and hydrochloric acid using different concentrations of acid. The graph below shows the change in mass against time when hydrochloric acid of concentration  $0.1 \text{ mol dm}^{-3}$  was used.



- a. Complete the reaction below:



- b. What was the initial mass used in the experiment?

\_\_\_\_\_ (1)

- c. What was the time taken for the reaction to stop?

\_\_\_\_\_ (1)

- d. Why did the mass decrease during the reaction?

\_\_\_\_\_ (1)

- e. On the same graph sketch the curve that would be obtained if the experiment was carried out with the same mass of magnesium carbonate but instead using hydrochloric acid of concentration  $0.3 \text{ mol dm}^{-3}$ . Label this graph as **Z**. (2)

**(Total: 8 marks)**

8

***Please turn the page.***

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**Section B: Answer ALL questions.**

11. This question deals with some properties of carbon.

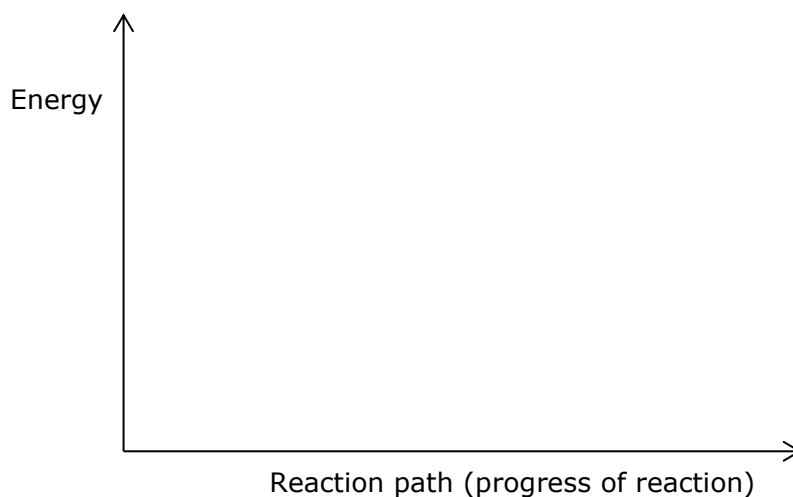
- a. i. Give a balanced equation to show the reaction that occurs when carbon burns completely in oxygen.

\_\_\_\_\_ (2)

- ii. Is the reaction exothermic or endothermic?

\_\_\_\_\_ (1)

- b. On the diagram below draw a labelled energy level diagram to show the energy changes that occur when carbon burns. Your labelled diagram must show (i) the reactants and products, (ii) the activation energy and (iii) the heat change of reaction.



(3)

- c. Define energy change of combustion.

\_\_\_\_\_  
\_\_\_\_\_ (2)

- d. i. In an experiment some students burn a small amount of carbon in a crucible to estimate the heat of combustion of the reaction. Which is the better choice, powdered carbon or chunks of carbon?

\_\_\_\_\_ (1)

- ii. Give **TWO** reasons to explain your answer to part(d)(i).

Reason 1: \_\_\_\_\_ (1)

Reason 2: \_\_\_\_\_ (1)

- iii. Identify the colour of the flame when carbon burns.

\_\_\_\_\_ (1)



iv. Mention **ONE** important precaution that must be followed when carbon burns.

\_\_\_\_\_ (1)

v. Explain your answer to part(d)(iv).

\_\_\_\_\_ (1)

e. Coal contains carbon but coal is not a clean fuel. Give **TWO** reasons for this.

Reason 1: \_\_\_\_\_ (1)

Reason 2: \_\_\_\_\_ (1)

f. Give a dot-cross diagram to show the bonding in carbon dioxide.

(2)

g. A mixture of gases contains carbon dioxide and carbon monoxide. The gases are passed through sodium hydroxide solution.

i. Which gas is removed by sodium hydroxide?

\_\_\_\_\_ (1)

ii. Give **ONE** reason for your answer in part(g)(i).

\_\_\_\_\_ (1)

**(Total: 20 marks)**

20

***Please turn the page.***

12. a. Consider the following substances:

**A** = Potassium chloride

**B** = Water

**C** = Zinc

**D** = Ammonia

**E** = Graphite

**F** = Nitrogen

Use the substances given above to fill in the spaces below. Each substance may be used more than once.

		Letter or name
i.	A solid non-metal that conducts electricity.	
ii.	A substance with a giant ionic lattice.	
iii.	A substance that has allotropes.	
iv.	A substance that boils at 100 °C.	
v.	A gaseous substance that is odourless.	
vi.	A gas that has a pungent smell.	
vii.	A compound that has a melting point of 770 °C.	
viii.	A substance that can be used as a lubricant.	
ix.	A substance that has an oxidation state +2 in its compounds.	
x.	A gas that is very unreactive.	
xi.	A substance which has a white oxide that turns yellow on heating.	
xii.	A gas that forms dense white fumes with hydrogen chloride gas.	

(12)

b. i. Showing outer electrons only draw a dot-cross diagram for ammonia,  $\text{NH}_3$ .

(2)

ii. Name the bonding present in ammonia.

(1)

c. Ammonia is very soluble in water and forms two oppositely charged ions.

i. Give the formula of the positive ion in ammonia solution: \_\_\_\_\_ (1)

ii. Give the formula of the negative ion in ammonia solution: \_\_\_\_\_ (1)

d. Give a balanced ionic equation to show the reaction between potassium chloride solution,  $\text{KCl}(\text{aq})$ , and silver nitrate solution,  $\text{AgNO}_3(\text{aq})$ . Include state symbols.

(3)

**(Total: 20 marks)**

20





SUBJECT:	<b>Chemistry</b>
PAPER NUMBER:	IIB
DATE:	29 <sup>th</sup> August 2023
TIME:	4:00 p.m. to 6:05 p.m.

**Useful data:**

Relative atomic masses: H = 1, N = 14, O = 16, Na = 23, Cl = 35.5, Ag = 108

Standard temperature and pressure (stp): 0 °C and 1 atm (760 mm Hg)

The molar volume for gases at stp = 22.4 dm<sup>3</sup>

Specific heat capacity of water = 4.2 J g<sup>-1</sup> °C<sup>-1</sup>

Faraday constant = 96500 C mol<sup>-1</sup>

Avogadro constant, L = 6.02 x 10<sup>23</sup>

$\Delta H = mC\Delta\theta$

**Directions to Candidates**

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- Answer **ALL** questions from Section A. Write all your answers for Section A in the spaces provided in this booklet.
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Score														
Maximum	8	7	6	8	8	5	6	6	6	20	20	20	20	100

**Section A: Answer ALL questions.**

1. Water is a very important substance.

a. Give **ONE** test to show that a liquid is pure water.

\_\_\_\_\_ (2)

b. Explain why pure water is classified as a compound.

\_\_\_\_\_ (1)

c. Name the type of bond between oxygen and hydrogen atoms in water.

\_\_\_\_\_ (1)

d. Fill in the spaces in the paragraph below.

When pure water is heated, it changes from the \_\_\_\_\_ state to the \_\_\_\_\_ state. The process is known as \_\_\_\_\_. If the temperature of water is lowered, it eventually \_\_\_\_\_ to form a solid. (4)

**(Total: 8 marks)**

8

2. Zinc sulfite,  $\text{ZnSO}_3$ , is a white powder which reacts with dilute hydrochloric acid.

a. Write a balanced chemical equation for this reaction. Include state symbols.

\_\_\_\_\_ (3)

b. Name the gas produced during this reaction and describe a test which could be used to identify it.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2)

c. Name and draw the apparatus which can be used to collect and measure the volume of gas produced.

\_\_\_\_\_

**(Total: 7 marks)**

7

3. Underline the correct answer:

- a. Electric current flows in salt solutions by:
- i. the movement of the water molecules
  - ii. the movement of the ions of the salt
  - iii. the movement of the electrons in the solution. (1)
- b. Typical properties of ionic compounds include:
- i. good electrical conductivity in the solid state
  - ii. good electrical conductivity when dissolved in water
  - iii. do not conduct electricity under any circumstances. (1)
- c. During electrolysis of a dilute salt solution, a graphite electrode is used so that:
- i. it does not take part in the reaction
  - ii. it reacts with the water in the solution
  - iii. it reacts with any gas produced. (1)
- d. In electrolysis compounds are:
- i. melted and dissolved in water
  - ii. separated from the solvent
  - iii. broken down by means of an electric current. (1)
- e. Sodium chloride is an electrolyte because:
- i. it is a white solid with a high melting point
  - ii. it forms ions when dissolved in water
  - iii. it dissolves in water. (1)
- f. During electrolysis of acidified sulfuric acid using inert electrodes:
- i. oxygen and hydrogen are produced
  - ii. oxygen and sulfur are produced
  - iii. sulfur and hydrogen are produced. (1)

(Total: 6 marks)

6

***Please turn the page.***

4. During an experiment silver nitrate solution was added to a solution of sodium chloride. A precipitate was formed which when collected and dried weighed 2.4 g.

a. Write an ionic equation for the reaction between  $\text{AgNO}_3$  and  $\text{NaCl}$  solutions.

\_\_\_\_\_ (3)

b. State the name of the precipitate formed.

\_\_\_\_\_ (1)

c. Calculate the number of moles of precipitate present in the 2.4 g collected.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (2)

d. i. By referring to your equation in part (a) state how many moles of  $\text{NaCl}$  were present in the original solution.

\_\_\_\_\_  
 \_\_\_\_\_ (1)

ii. Calculate the mass of  $\text{NaCl}$  present in the original solution.

\_\_\_\_\_  
 \_\_\_\_\_ (1)

8

**(Total: 8 marks)**

5. Complete the following paragraph by choosing the correct words from the box below.

boiling	potassium	manganese	transition	green	copper
melting	alkali	oxidation	unreactive	blue	acid

When a \_\_\_\_\_ solution of  $\text{FeSO}_4$  is left open to the atmosphere it turns brown due to aerial \_\_\_\_\_. The property of iron compounds to exist in different colours is also shown by other metals such as \_\_\_\_\_ and \_\_\_\_\_. This is a characteristic of \_\_\_\_\_ metals. Such metals are also relatively \_\_\_\_\_ and usually have high \_\_\_\_\_ and \_\_\_\_\_ points.

8

**(Total: 8 marks)**



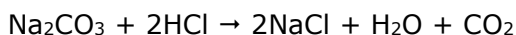
6. Mark the following statements as True (T) or False (F).

	Statement	T or F
a.	The pH of hydrochloric acid is smaller than 3.	
b.	Ethanoic acid is a weak acid because it does not react with metals.	
c.	Ethanoic acid is a carboxylic acid.	
d.	Sodium is an alkali metal because it forms an alkaline solution with water.	
e.	Acid rain forms because of nitrogen in the air.	

(Total: 5 marks)

5

7. A quantity of anhydrous sodium carbonate, 0.23 moles, was reacted completely with dilute hydrochloric acid. The equation for this reaction is:



a. Find the volume of carbon dioxide produced at stp.

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(3)

b. What will be the volume of carbon dioxide if the temperature is changed to 25 °C at constant pressure?

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(3)

(Total: 6 marks)

6

**Please turn the page.**

8. Explain each of the following statements:

a. Carbon has two allotropes, and they both have a giant molecular structure.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (2)

b. Graphite is a good conductor of electricity.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (2)

c. Oxygen has two allotropes too.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (2)

**(Total: 6 marks)**

6

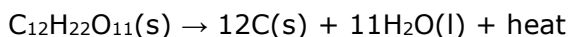
9. a. Concentrated sulfuric acid has several properties. Refer to the statements and/or equations below and fill in the blanks with the appropriate term.

i. Copper does not react with acids but does so with concentrated sulfuric acid to give copper(II) sulfate, water, and sulfur dioxide.



Concentrated sulfuric acid is acting as an \_\_\_\_\_. (1)

ii. When concentrated sulfuric acid is added to sugar a black mass of carbon is observed.



Concentrated sulfuric acid is acting as a \_\_\_\_\_. (1)

iii. Concentrated sulfuric acid is used to remove water vapour from a mixture of gases in the lab.

Concentrated sulfuric acid is acting as a \_\_\_\_\_. (1)

iv. Concentrated sulfuric acid absorbs water vapour from the air, so that its volume increases, and its concentration decreases.

Concentrated sulfuric acid is a \_\_\_\_\_ substance. (1)

b. Dilute sulfuric acid reacts with metal oxides to give salt and water. Write a balanced equation for the reaction between dilute sulfuric acid and magnesium oxide.

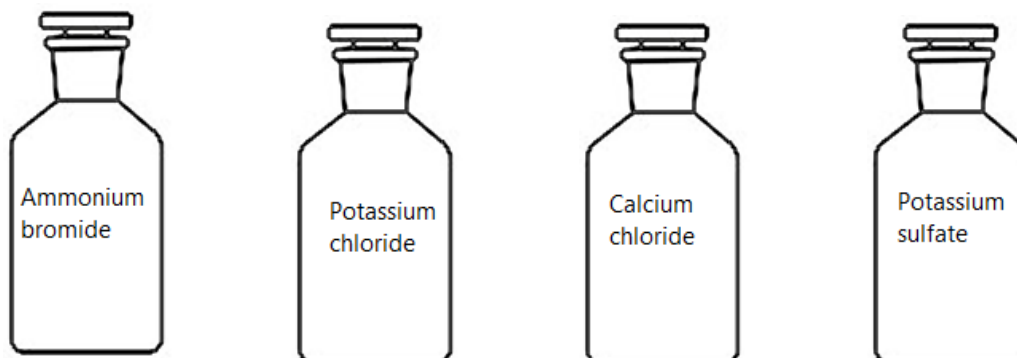
\_\_\_\_\_ (2)

**(Total: 6 marks)**

6

**SECTION B: Answer TWO questions from this section.**

10. A series of tests were done on four reagents: ammonium bromide, potassium chloride, calcium chloride and potassium sulfate. These tests are described below:

**Reagent Bottle A:**

- A sample of the substance was taken, and a flame test was performed. A lilac flame was observed.
- Another sample was taken and dissolved in some distilled water. Some barium chloride solution was added, and a white precipitate **R** was produced.

**Reagent Bottle B:**

- A sample of the substance was taken, and a flame test was performed. A lilac flame was observed.
- Another sample was taken and dissolved in some distilled water. Some acidified silver(I) nitrate solution was added, and a white precipitate **S** was produced.

**Reagent Bottle C:**

- A sample of the substance was taken, and a flame test was performed. No colour was given to the flame.
- Another sample was taken and dissolved in some distilled water. The solution was reacted with sodium hydroxide solution and heated. A pungent gas **T** was released which formed white fumes **U** with concentrated hydrochloric acid.
- Some of the solution was also reacted with acidified silver(I) nitrate solution was added and a cream precipitate **V** was produced.

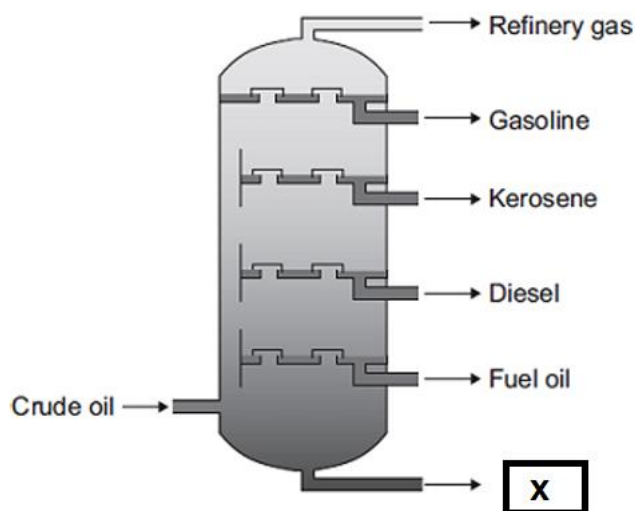
**Reagent Bottle D:**

- A sample of the substance was taken and dissolved in some distilled water. The solution was reacted with sodium hydroxide solution to give a white precipitate **W**.
- Some acidified silver nitrate solution was added, and a white precipitate **S** was produced.

- Identify reagent bottles **A**, **B**, **C** and **D**. (4)
- Identify substances **R**, **S**, **T**, **U**, **V**, and **W** (6)
- Describe another test rather than the one mentioned to identify gas **T**. (1)
- Describe how a flame test is performed. (3)
- What flame colour would be observed, if any, if a flame test is performed to the substance in reagent bottle **D**? (1)
- Write a balanced equation, including state symbols, between the substance in reagent bottle **D** and sodium hydroxide solution. (3)
- Copy and complete the ionic equation for the reaction of substance in reagent bottle **A** with barium chloride solution. (2)

**(Total: 20 marks)**

11. Crude oil is a mixture of hydrocarbons, mostly alkanes which are saturated compounds. Crude oil is not very useful until it has been processed. This process is known as refining.
- Define the terms hydrocarbons and saturated. (2)
  - The first step of the refining process involves the separation of crude oil into several useful fractions as shown below.



(Adapted from: [www.revise4science.com](http://www.revise4science.com))

- What is the process shown in the picture above called? (1)
  - Name fraction **X**. (1)
  - Is fraction **X** a solid, liquid or gas at room temperature and pressure? (1)
  - How does the boiling point of the fraction changes as one goes from Refinery gas to **X**? (1)
  - Give **ONE** use of Kerosene. (1)
- c. Another part of the refinery process is catalytic cracking.
- Explain the term catalytic cracking. (2)
  - Give **ONE** use of catalytic cracking in industry. (1)
  - When decane ( $C_{10}H_{22}$ ) is cracked, octane and substance **T** are produced. Give the formula of the substance **T**. (1)
  - Draw the display structure (structural formula) of **T**, showing **all** the atoms and bonds. (2)
  - Give the general formula of the homologous series to which **T** and octane belong. (2)
- d. The burning of fractions obtained from crude oil contribute to air pollution. Gasoline, for example, is blended with other fractions to make petrol.
- Taking the formula of petrol as  $C_8H_{18}$ , write a balanced equation for the complete combustion of petrol. (2)
  - Leaded petrol has lead (Pb) mixed with the fuel, which when burnt contributes to lead particles in the surrounding air and soil. Give **ONE** disadvantage of lead poisoning. (1)
  - Name **TWO** other pollutants produced by engines which use petrol. (2)

**(Total: 20 marks)**

12. a. A laboratory technician wanted to prepare a 1 litre solution of sodium hydroxide of concentration  $0.25 \text{ mol dm}^{-3}$ . The required amount of solid sodium hydroxide was weighed and placed in a 1 litre volumetric flask. Some distilled water was added, and the contents were mixed well. The solution was left to stand overnight to cool down.
- Calculate the mass of sodium hydroxide required to produce 1 litre of solution of concentration  $0.25 \text{ mol dm}^{-3}$ . (3)
  - When the technician was weighing the NaOH pellets, the reading on the electronic balance kept increasing slowly. Explain why this happens and state the name of this process. (2)
  - Why did the technician use distilled water instead of tap water to make this solution? (1)
  - Draw a diagram of a volumetric flask. (1)
  - Is the reaction of sodium hydroxide with water endothermic or exothermic? (1)
- b. The next morning, he topped up the volume with more water and took three  $25 \text{ cm}^3$  samples. He placed the samples in different conical flasks and titrated them against dilute hydrochloric acid of concentration  $0.3 \text{ mol dm}^{-3}$  using phenolphthalein as indicator. The average titre value was found to be  $20.0 \text{ cm}^3$ .
- Write a balanced chemical equation for the reaction which occurs during titration. (2)
  - Explain why the technician took three samples of the solution for testing. (1)
  - Explain the use of the indicator in the titration and give a rough indication of the amount which should be added to each of the  $25 \text{ cm}^3$  samples in the conical flasks. (2)
  - Calculate the moles of acid used. (2)
  - Find the number of moles of alkali present in the  $25 \text{ cm}^3$  samples. (1)
  - Calculate the concentration of the sodium hydroxide solution which was prepared by the technician. (2)
  - Calculate the mass of NaOH which was used to prepare this solution. (2)

**(Total: 20 marks)**

13. This question is about organic chemistry.
- a. Two straight chain hydrocarbons Y and Z have empirical formula  $\text{CH}_2$  and  $\text{C}_3\text{H}_7$  respectively. Their relative molecular masses are 42 and 86 respectively.
- Work out the molecular formula of compounds Y and Z. (4)
  - Draw the display structures (structural formulae) of the **TWO** compounds and name them. (4)
  - Name the different homologous series to which compounds Y and Z belong. (2)
  - Food containers and water bottles are usually made of a polymer which originates from compound Y. Name this polymer and draw its repeating unit. (3)
- b. When ethanol and ethanoic acid are heated together in the presence of a few drops of concentrated sulfuric acid, a reaction occurs and a compound with a particular smell is formed.
- $$\text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$$
- Choose the most appropriate name for this reaction from the following list: precipitation, esterification or polymerisation. (1)
  - State **ONE** function of the concentrated sulfuric acid in this reaction. (1)
  - Name the organic product which is formed. (1)
  - A similar reaction occurs between propan-1-ol and propanoic acid. Write a balanced chemical equation for this reaction. (2)
  - Draw the display structure (structural formula) of the positional isomer of propan-1-ol. (2)

**(Total: 20 marks)**









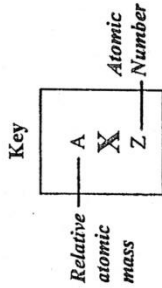






PERIODIC TABLE

I	II	III	IV	V	VI	VII	VIII	
1 H 1	9 Be 4						19 F 9	20 Ne 10
7 Li 3	24 Mg 12						32 S 16	40 Ar 18
23 Na 11	40 Ca 20	27 Al 13	12 C 6	14 N 7	16 O 8	35.5 Cl 17	84 Kr 36	
39 K 19	45 Sc 21	70 Ga 31	28 Si 14	31 P 15	73 Ge 32	75 As 33	127 I 53	
85 Rb 37	88 Sr 38	115 In 49	77 Zn 30	79 Se 34	119 Sn 50	122 Sb 51	131 Xe 54	
133 Cs 55	137 Ba 56	204 Tl 81	65 Cu 29	63.5 Ni 28	112 Cd 48	127 Ag 47	222 Rn 86	
223 Fr 87	226 Ra 88	201 Hg 80	59 Co 27	59 Ni 28	197 Au 79	209 Po 84		
			56 Fe 26	59 Co 27	195 Pt 78	210 At 85		
			55 Mn 25	59 Co 27	197 Au 79			
			52 Cr 24	59 Co 27	195 Pt 78			
			51 V 23	59 Co 27	192 Ir 77			
			48 Ti 22	56 Fe 26	192 Os 76			
			91 Zr 40	55 Mn 25	190 Os 76			
			93 Nb 41	56 Fe 26	192 Ir 77			
			96 Mo 42	55 Mn 25	190 Os 76			
			101 Ru 44	56 Fe 26	192 Ir 77			
			103 Rh 45	55 Mn 25	190 Os 76			
			106 Pd 46	56 Fe 26	192 Ir 77			
			112 Cd 48	55 Mn 25	190 Os 76			
			119 Sn 50	56 Fe 26	192 Ir 77			
			122 Sb 51	55 Mn 25	190 Os 76			
			127 I 53	56 Fe 26	192 Ir 77			
			207 Pb 82	55 Mn 25	190 Os 76			
			81	56 Fe 26	192 Ir 77			
			82	55 Mn 25	190 Os 76			
			83	56 Fe 26	192 Ir 77			
			84	55 Mn 25	190 Os 76			
			85	56 Fe 26	192 Ir 77			
			86	55 Mn 25	190 Os 76			



140 Ce	141 Pr	144 Nd	147 Pm	150 Sm	152 Eu	157 Gd	159 Tb	162 Dy	165 Ho	167 Er	169 Tm	173 Yb	175 Lu
58	59	60	61	62	63	64	65	66	67	68	69	70	71
232 Th	231 Pa	238 U	237 Np	244 Pu	243 Am	247 Cm	247 Bk	251 Cf	252 Es	257 Fm	258 Md	259 No	260 Lr
90	91	92	93	94	95	96	97	98	99	100	101	102	103