Index Number:_____ SEC06/1.15s

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

SEPTEMBER 2015 SESSION

SUBJECT:	**Chemistry**
PAPER NUMBER:	I
DATE:	31st August 2015
TIME:	9:00 a.m. to 11:00 a.m.

Useful data:

Relative atomic masses: H = 1; C = 12

Q = I t

Faraday constant = 96500 C mol^{-1}

The molar volume for gases at standard temperature and pressure (STP) = 22.4 dm^3

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.*
- *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**	**7**	**8**	**8**	**5**	**4**	**6**	**5**	**5**	**20**	**20**	**100**

Section A: Answer ALL questions in this Section. Write your answers in the spaces provided.

1. In nature there are two types of bromine atoms. One type has a mass number of 79 and the other has a mass number of 81.

   (a) Fill in the table below to indicate the number of protons and neutrons of these two atoms.

Atom	$^{79}_{35}Br$	$^{81}_{35}Br$
Number of **protons** in the atom		
Number of **neutrons** in the atom		
Number of **electrons** in the atom		

(3 marks)

   (b) What is the scientific name given to these types of atoms?

_____

(1 mark)

   (c) The percentage relative abundance of these two forms is shown below.

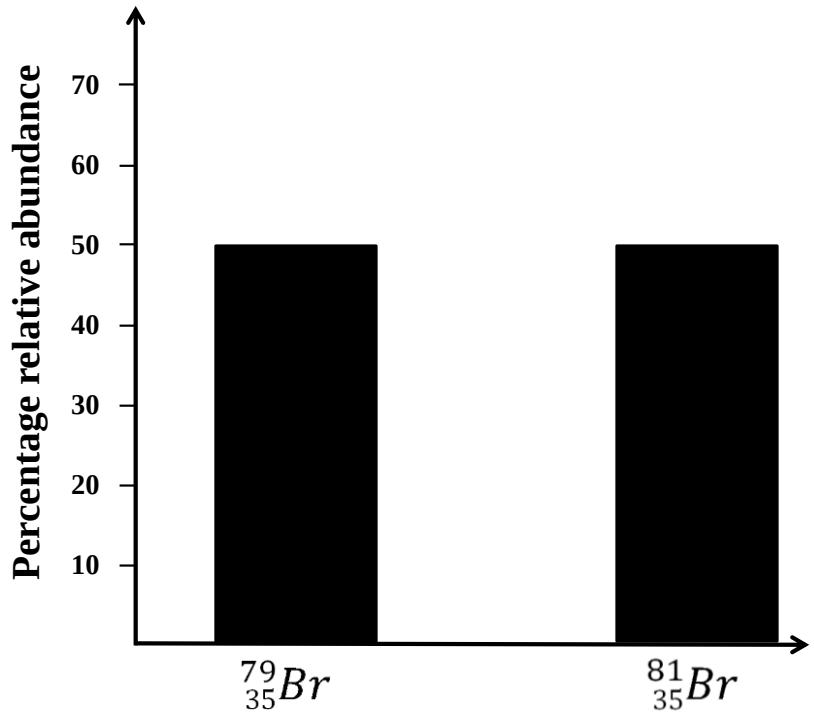


Figure 1.

Using the graph of the relative abundance of the two forms (Figure 1), calculate the relative atomic mass of bromine.

(2 marks)
[Total: 6 marks]

6

2. Carbon is present in nature as graphite and diamond. The following diagram (Figure 2) shows how the carbon atoms are arranged in diamond.

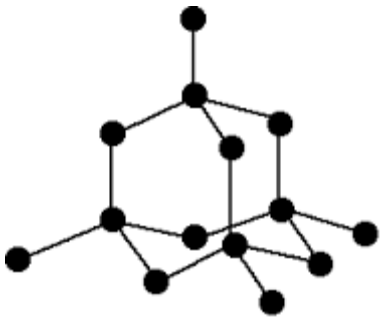


Figure 2.

(a) Diamond is one of the strongest natural materials and does not conduct electricity.

Use Figure 2 to describe how:

(i) Diamond is one of the strongest natural materials.

(1 mark)

(ii) Diamond does not conduct electricity.

(1 mark)

(b) Using the properties mentioned in part (a), suggest ONE industrial use of diamond?

_____

(1 mark)

(c) Carbon has two oxides, carbon monoxide and carbon dioxide.

(i) Give the chemical formula of these two oxides.

carbon monoxide: _____ carbon dioxide: _____

(1 mark)

(ii) Describe how carbon monoxide can be separated from a mixture of carbon monoxide and carbon dioxide.

_____

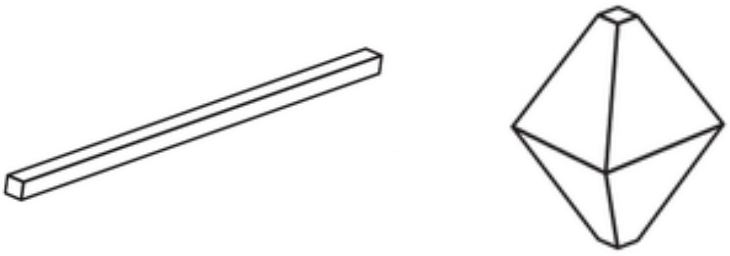
_____

_____

(2 marks)
[Total: 6 marks]

6

3. Sulfur is an element that occurs as TWO forms at room temperature.



Form A **Form B**

Figure 3.

(a) (i) Identify these TWO forms.

Form A: _____ Form B: _____

(2 marks)

DO NOT WRITE ABOVE THIS LINE

(ii) What is the scientific term used to indicate the occurrence of an element that like sulfur has different forms?

_____

(1 mark)

(b) (i) Give the **name** or **chemical formula** of the substance formed when some iron filings are heated with sulfur in a test-tube.

_____

(1 mark)

(ii) Give the chemical equation for the reaction that takes place when some hydrochloric acid is added to the product mentioned in part (b)(i).

_____

(3 marks)
[Total: 7 marks]

7

4. (a) (i) Air is mainly a mixture of nitrogen and oxygen. In what percentage proportion are these gases present in air?

Nitrogen: _____ Oxygen: _____

(1 mark)

(ii) Mention another gas that may be present in air that is **NOT** considered to be a pollutant.

_____

(1 mark)

(iii) How may this complex mixture of gases be separated to obtain its different constituents?

_____

_____

(2 marks)

(b) While this mixture of gases is essential for all living things, it may also contain other substances that may be harmful to life itself. Give the name of **TWO** substances and say why their presence in air is undesirable.

Substance 1: _____

Undesirable effect of substance 1: _____

_____

Substance 2: _____

Undesirable effect of substance 2: _____

_____

(4 marks)
[Total: 8 marks]

8

5. (a) Most soluble salts may be made by the action of a dilute acid on a solid.

(i) Give the chemical equation for the reaction of magnesium metal with sulfuric acid to produce magnesium sulfate solution.

_____

(1 mark)

(ii) List **TWO other methods** that can be used to prepare a sample of magnesium sulfate solution in the laboratory.

Method 1: _____

_____

Method 2: _____

_____

(2 marks)

(iii) Briefly explain how crystals of magnesium sulfate can be obtained from the magnesium sulfate solution prepared in part (a)(i).

(2 marks)

(b) (i) What type of reaction is used to obtain a sample of an insoluble salt in the lab?

(1 mark)

(ii) Barium sulfate is an insoluble salt. Write a chemical equation for the reaction you would carry out in the laboratory to prepare a sample of barium sulfate from sulfuric acid.

(2 marks)
[Total: 8 marks]

8

6. Water is solvent for many substances.

(a) (i) Give the **name** or **chemical formula** of a substance which dissolves in rain water before it reaches the ground.

(1 mark)

(ii) Ground water consists of water which has passed through the different layers of rock and has collected over clay. Give the **name** or **chemical formula** of an ionic substance which is commonly present in ground water of the Maltese Islands.

(1 mark)

(iii) Give **ONE** disadvantage of using water with the substance mentioned in part (a)(ii).

(1 mark)

DO NOT WRITE ABOVE THIS LINE

(b) In Malta seawater is purified from most of its solutes, namely sodium chloride, on a large scale to provide fresh water supply.

(i) Give the **name** or **chemical formula** of a solute, other than sodium chloride, present in seawater.

(1 mark)

(ii) Give the name of the industrial process by which seawater is purified from most of its solutes in Malta.

(1 mark)
[Total: 5 marks]

5

7. The following equation is a redox reaction. It contains two reagents, one of which acts as a reducing agent while the other one acts as an oxidizing agent.

$$3\ Fe + 4\ H_2O \rightarrow Fe_3O_4 + 4\ H_2$$

(a) What is meant by the term *oxidizing agent*?

(1 mark)

(b) Identify the oxidizing agent and the reducing agent in the above reaction.

Oxidizing agent: _____ Reducing agent: _____

(2 mark)

(c) Explain how the oxidation number of iron changes in the above reaction.

(1 mark)
[Total: 4 marks]

4

8. Compound **A** has the following composition by mass: carbon 85.7%, hydrogen 14.3%

(a) Calculate the empirical formula of compound **A**.

(3 marks)

(b) The formula mass of compound **A** is 84. Give the chemical formula of compound **A.**

(3 marks)
[Total: 6 marks]

6

9. The diagram below represents the energy profile for the reaction between ethene and hydrogen to form ethane.

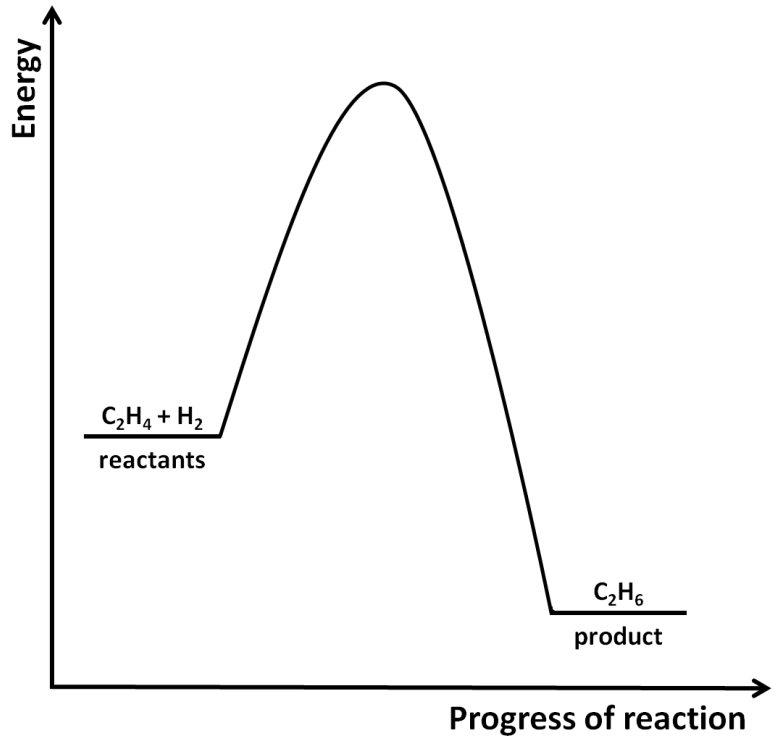


Figure 4.

(a) Is the reaction represented in Figure 4 an exothermic or an endothermic reaction? Explain your answer.

(2 marks)

(b) Using Figure 4, label the activation energy of the reaction between ethene and hydrogen.

(1 mark)

(c) When carried out in the lab, a catalyst is added to the ethene and hydrogen mixture.

(i) What catalyst is used?

(1 mark)

(ii) Why is the catalyst used?

(1 mark)
[Total: 5 marks]

5

10. Ethanol can be converted to ethanoic acid using an oxidizing agent.

(a) Give the **name** or **chemical formula** of the chemical used and the **conditions** required to convert ethanol to ethanoic acid.

(2 marks)

(b) Give a simple chemical test that can be used to distinguish between ethanol and ethanoic acid.

(3 marks)
[Total: 5 marks]

5

Section B: Answer ALL questions in this Section. Write your answers in the spaces provided.

11. When a grey solid **A** was added to water, the solid effervesced on the surface of the water giving off gas **B** and solution **C.** Gas **B** burns with a pop. **A** reacts similarly with ethanol to give off gas **B** while forming substance **D**.

    When a solution of **C** was added to a white solid **E** and warmed, the heated mixture produced a pungent smelling gas **F**. Gas **F** turns moist red litmus blue. An aqueous solution of **E** gives a white precipitate **G** when added to barium chloride solution. **G** is insoluble in dilute hydrochloric acid.

    (a) Give the name or formula of the substances labelled **A**, **B**, **C**, **D**, **E**, **F**, and **G**.

Label of substance	Name or formula of substance
A	
B	
C	
D	
E	
F	
G	

(7 marks)

    (b) Give the chemical equation for the reaction of:

    (i) solid **A** with ethanol

_____

(2 marks)

    (ii) **E** with barium chloride

_____

(2 marks)

DO NOT WRITE ABOVE THIS LINE

(iii) **E** with a solution of **C**

(2 marks)

(iv) **F** with water

(2 marks)

(c) (i) Give a chemical test for gas **F** and write the equation for the reaction that takes place.

(3 marks)

(ii) List **TWO** uses of gas **F.**

(2 marks)
[**Total: 20 marks]**

20

12. A current of 2 amperes was passed through a concentrated solution of sodium chloride using inert electrodes for 5 minutes. The products at electrode were collected and their quantity measured. A few drops of red litmus solution were also added to the solution.

(a) Draw a diagram of the apparatus one would use for this experiment.

(3 marks)

(b) (i) Calculate the quantity of electricity that passed through the experiment.

(1 mark)

(ii) How many moles of electrons passed through each electrode during the experiment mentioned above?

(2 marks)

(c) (i) Write the half equation for the reaction that takes place at each of the electrodes.

Half equation at the cathode: _____

Half equation at the anode: _____

(4 marks)

(ii) Calculate the volume of product at STP that one would expect to obtain at the cathode in this experiment.

(3 marks)

(iii) How would you expect the quantity of product collected at anode, under the same conditions of temperature and pressure, to vary from that obtained at the cathode?

(1 mark)

(d) What colour would the solution have at end of the experiment? Explain your answer.

(3 marks)

(e) (i) This experiment forms the basis of a very important industrial process. State **ONE** large scale use of each of the product obtained at the electrode.

Use of gas at cathode: _____

Use of gas at anode: _____

(2 marks)

(ii) Give **ONE** large scale use of the main constituent of the resulting solution.

_____

(1 mark)

[**Total: 20 marks]**

20

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Please turn the page for the Periodic Table on Page 16.

PERIODIC TABLE

I	II										III	IV	V	VI	VII	VIII
																4 **He** 2
7 **Li** 3	9 **Be** 4										11 **B** 5	12 **C** 6	14 **N** 7	16 **O** 8	19 **F** 9	20 **Ne** 10
23 **Na** 11	24 **Mg** 12										27 **Al** 13	28 **Si** 14	31 **P** 15	32 **S** 16	35.5 **Cl** 17	40 **Ar** 18
39 **K** 19	40 **Ca** 20	45 **Sc** 21	48 **Ti** 22	51 **V** 23	52 **Cr** 24	55 **Mn** 25	56 **Fe** 26	59 **Co** 27	59 **Ni** 28	63.5 **Cu** 29	65 **Zn** 30	70 **Ga** 31	73 **Ge** 32	75 **As** 33	79 **Se** 34	80 **Br** 35	84 **Kr** 36
85 **Rb** 37	88 **Sr** 38	89 **Y** 39	91 **Zr** 40	93 **Nb** 41	96 **Mo** 42	99 **Tc** 43	101 **Ru** 44	103 **Rh** 45	106 **Pd** 46	108 **Ag** 47	112 **Cd** 48	115 **In** 49	119 **Sn** 50	122 **Sb** 51	128 **Te** 52	127 **I** 53	131 **Xe** 54
133 **Cs** 55	137 **Ba** 56	139 **La** 57	178.5 **Hf** 72	181 **Ta** 73	184 **W** 74	186 **Re** 75	190 **Os** 76	192 **Ir** 77	195 **Pt** 78	197 **Au** 79	201 **Hg** 80	204 **Tl** 81	207 **Pb** 82	209 **Bi** 83	209 **Po** 84	210 **At** 85	222 **Rn** 86
223 **Fr** 87	226 **Ra** 88	227 **Ac** 89															

Key

Relative atomic mass — A
X
Z — *Atomic Number*

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

Index Number:_____ SEC06/2B.15s

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

SEPTEMBER 2015 SESSION

SUBJECT:	**Chemistry**
PAPER NUMBER:	IIB
DATE:	31st August 2015
TIME:	4:00 p.m. to 6:00 p.m.

Useful data

Specific heat capacity of water = 4.2 J g^{-1} °C^{-1}

$\Delta H = mc\Delta\Theta$

Directions to Candidates

- *Write your index number in the space at the top left-hand corner of this page.*
- *Answer **ALL questions in Section A** and any **TWO questions from Section B**. Write 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.*
- *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	13	14	**Total**
Score															
Maximum	6	6	6	6	6	6	8	6	6	4	20	20	20	20	**100**

DO NOT WRITE ABOVE THIS LINE

Section A: Answer ALL questions in this Section. Write your answers in the spaces provided.

1. (a) Hydrated copper(II) sulfate crystals have the formula $CuSO_4.5H_2O$

(i) Give a balanced chemical equation to show the action of gentle heat on hydrated copper(II) sulfate crystals.

(2 marks)

(ii) State **ONE** observation that can be noted in (a)(i)

(1 mark)

(b) A student burned some alcohol, C_2H_5OH on a crucible lid, in the presence of excess air.

(i) Give a balanced chemical equation for the reaction that occurs.

(2 marks)

(ii) State **ONE** observation that can be noted in (b)(ii).

(1 mark)
[Total: 6 marks]

6

2. (a) Balance the following equations and state **ONE** observation for each reaction.

(i) ___ Fe + ___ Cl_2 $\rightarrow$ ___ $FeCl_3$

Observation: _____

(2 marks)

DO NOT WRITE ABOVE THIS LINE

(ii) ___ Cu + ___ O_2 → ___ CuO

Observation: _____

_____

(2 marks)

(b) Some bromine gas is bubbled into two separate beakers containing a solution of potassium iodide, KI (aq) and sodium choride, NaCl (aq)
Tick (✓) the appropriate box in the Table.

	Reacts with Br_2	**Does not react with Br_2**
potassium iodide		
sodium chloride		

(2 marks)
[Total: 6 marks]

6

3. 21.5 g of hydrated magnesium sulfate, $MgSO_4.\mathbf{x}H_2O$, were heated until no further change in mass was noted. At the end of the experiment the mass of magnesium sulfate left was 10.5 g. [Molar mass of anhydrous magnesium sulfate = 120 g mol^{-1} ; Molar mass of water = 18 g mol^{-1}]

(a) What is the mass of the anhydrous magnesium sulfate?

_____

(1 mark)

(b) What is the mass of the water of crystallization?

_____

(1 mark)

(c) Find the value of '**x**' in $MgSO_4.\mathbf{x}H_2O$.

_____

_____

_____

_____

(4 marks)
[Total: 6 marks]

6

4. The following setup (Figure 3) is used to separate **TWO** miscible liquids that have different boiling points.

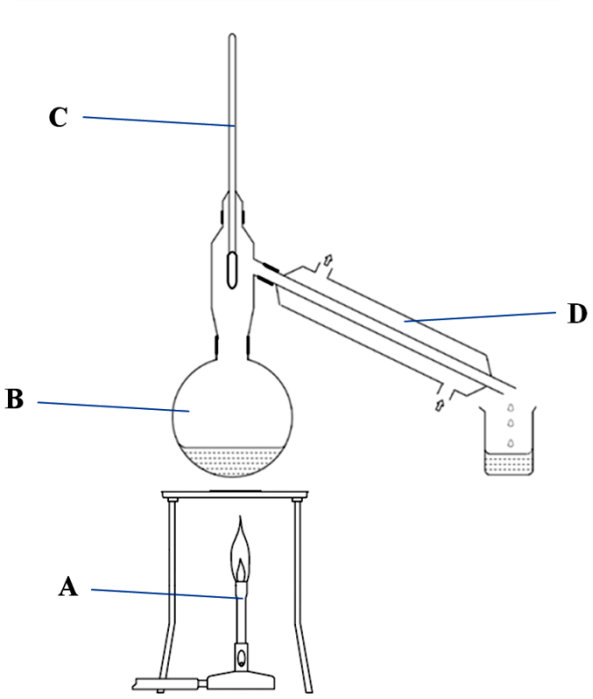

Figure 3

(a) Give the name of the technique that is carried out through the use of the setup shown in Figure 3.

_____

(1 mark)

(b) Give the name of the labelled apparatus.

Label A : _____ **Label B :** _____

Label C : _____ **Label D :** _____

(4 mark)

(c) Which equipment or technique can be used to separate **TWO** immiscible liquids?

_____

(1 mark)

[Total: 6 marks]

6

DO NOT WRITE ABOVE THIS LINE

5. (a) What type of bonding is present in the following chemicals?

Chemical	Type of bonding
methane, CH_4	
potassium chloride, KCl	

(2 marks)

(b) Showing **outer electrons only**, draw dot-cross diagrams for the following compounds:

(i) methane, CH_4

(2 marks)

(ii) potassium chloride, KCl

(2 marks)
[Total: 6 marks]

6

6. A friend of yours says that an iron window frame in their house is rusting.

(a) Mention **TWO** factors which are necessary for rusting to occur.

(2 marks)

(b) Suggest **TWO** methods that may be used on the window frame so that rusting does not continue to occur.

(2 marks)

(c) Suggest **TWO** materials that can be used for window frames and which do not corrode as easily as iron does.

(2 marks)
[Total: 6 marks]

6

7. Explain each of the following statements.

(a) Milk of magnesia is used to lower the amount of acid in the stomach.

(2 marks)

(b) Liquid alkanes can be used as solvents for stains caused by tar at the beach but water does not remove such stains.

(2 marks)

(c) Caustic soda (chemical name sodium hydroxide) may be bought from the ironmonger or from a supermarket to unblock kitchen drains but using such a substance is also very dangerous.

(2 marks)

(d) Hydrogen chloride in water behaves differently from hydrogen chloride in methylbenzene.

(2 marks)

[Total: 8 marks]

8

8. (a) When some granulated zinc is placed in a boiling tube containing some copper(II) sulfate solution, it is noticed that after some time a reaction occurs.

(i) Give a balanced chemical equation for the reaction that occurs.

(2 marks)

(ii) Give an ionic equation, including state symbols, for the reaction in part (a)(i).

(2 marks)

(b) When the reaction in part (a) is repeated, using silver particles instead of zinc, no reaction occurs. Explain this difference in behaviour.

(2 marks)
[Total: 6 marks]

6

9. Give the name or chemical formula of **ONE** substance that can be obtained on a large scale from:

(a) nitrogen: _____

(b) bauxite: _____

(c) crude oil: _____

(d) haematite: _____

(e) limestone: _____

(f) air: _____

[Total: 6 marks]

6

10. Oxygen can be prepared from the reaction of H_2O_2 with MnO_2. Briefly explain the procedure that can be used to collect the oxygen generated from this reaction.

[Total: 4 marks]

4

Section B: Answer TWO questions from this section. Write your answers in the lined pages provided (indicate clearly the question numbers being answered).

11. (a) Sodium and potassium are Group 1 elements that usually form white compounds.

(i) Both sodium and potassium react with water. Which of these two elements reacts most vigorously with water?

(1 mark)

(ii) Why is it extremely dangerous to react sodium or potassium with acids even if the acid is dilute?

(1 mark)

(b) Maria has two white compounds which are unlabelled but which are known to be potassium chloride and sodium chloride.

(i) Name a simple laboratory test that Maria could use to tell the two compounds apart.

(1 mark)

(ii) Describe in detail the laboratory test mentioned in part (b)(i)

(5 marks)

(c) Magnesium and calcium are in Group 2 of the Periodic Table.

(i) What term is used for the elements found in Group 2?

(1 mark)

(ii) Calcium reacts with water. Would you expect the reaction to be more or less vigorous than that of potassium with water?

(1 mark)

(iii) Give a balanced chemical equation for the reaction of calcium with water, including state symbols.

(3 marks)

(iv) Mention **TWO** observations that can be noted in the reaction in part (c)(iii).

(2 marks)

(v) Describe a simple lab test that can be used to test for the gas given off in part (c)(iii).

(1 mark)

(vi) Paul has two white compounds which are unlabelled but which are known to be magnesium nitrate and calcium nitrate. Describe a chemical test that Paul can use to be able to distinguish between the two compounds.

(4 marks)

[Total: 20 marks]

12. (a) 25.00 cm^3 of 0.2 mol dm^{-3} sulfuric acid were placed in a conical flask and titrated with 21.00 cm^3 of dilute sodium hydroxide solution for complete neutralization, using phenolphthalein as an indicator.

$$H_2SO_4\ (aq) + 2\ NaOH\ (aq) \rightarrow Na_2SO_4\ (aq) + 2\ H_2O\ (l)$$

(i) Explain the method that a scientist would use to find the titre value in the titration mentioned above.

(8 marks)

(ii) How many moles of sulfuric acid were placed in the conical flask?

(2 marks)

(iii) How many moles of sodium hydroxide were used in the titration to neutralize the sulfuric acid?

(2 marks)

(iv) Given that the moles of sodium hydroxide were in 21.00 cm^3, what was the concentration of the sodium hydroxide solution?

(2 marks)

(b) Another scientist had two plastic cups containing 0.03 moles of hydrochloric acid solution and 0.04 moles of sodium hydroxide solution. The temperature of the solutions in both cups was 25 °C. Then the scientist transferred the hydrochloric acid solution into the sodium hydroxide solution, and using a stirrer he mixed well the mixture. On so doing, he noted that the temperature of the mixture went up to 33 °C.

(i) What was the temperature change during this experiment?

(1 mark)

(ii) Given that the final volume of the mixture was 50 cm^3, and assuming that the solutions used have the same density as water, of 1 g cm^{-3}, calculate the amount of heat given out during this experiment.
[The specific heat capacity of water = 4.2 J g^{-1} °C^{-1}]

(3 marks)

(iii) The heat given off during the experiment was due to the formation of 0.03 moles of water. How much heat would be given off if 1 mole of water is produced?

(2 marks)

[Total: 20 marks]

13. (a) A scientist wanted to carry out esterification, so she mixed ethanol and ethanoic acid in the presence of concentrated sulfuric acid and closed the container. She knows that this reaction is a reversible reaction that reaches dynamic equilibrium after a couple of hours.

C_2H_5OH (l)	+	CH_3COOH (l)	$\rightleftharpoons$	$CH_3COOCH_2CH_3$ (l)	+	H_2O (l)
ethanol		ethanoic acid		ethylethanoate (ester)		water

(i) What is meant by the term *dynamic equilibrium*?

(2 marks)

(ii) What happens to the equilibrium if more ethanol is added to the mixture? Briefly explain your answer.

(3 marks)

(iii) What happens to the equilibrium if the experiment is carried out at a higher pressure? Briefly explain your answer.

(2 marks)

(iv) When this experiment was carried out in the laboratory the scientist used concentrated sulfuric acid. What is the role of concentrated sulfuric acid in this reaction?

(1 mark)

(v) Mention **ONE** use of ethylethanoate**.**

(1 mark)

(b) Another reaction that occurs at dynamic equilibrium is the following:

$$2\ SO_2\ (g) + O_2\ (g) \rightleftharpoons 2\ SO_3\ (g)$$

(i) Which industrial process makes use of the above reaction?

(1 mark)

(ii) What conditions are used in industry to ensure fast and high yields of SO_3?

(3 marks)

(iii) Give the reactions and explain the steps that follow this dynamic equilibrium to complete the process mentioned in part (b)(i).

(4 marks)

(iv) Mention **THREE** uses of the final product of the process mentioned in part (b)(i).

(3 marks)

[Total: 20 marks]

14. Consider **REACTION A** and **REACTION B** to answer the following questions.

REACTION A: C_2H_4 (compound **W**) + Br_2 $\rightarrow$ compound **X**

REACTION B: Compound **Y** + Br_2 $\rightarrow$ CH_3Br + Compound **Z**

(a) (i) Give the chemical formula of the product, compound **X**.

(1 mark)

(ii) Give **ONE** observation that can be noted in **REACTION A**.

(1 mark)

(b) (i) Give the chemical formula of compound **Y**.

(1 mark)

(ii) Give the chemical formula of compound **Z**.

(1 mark)

(iii) What conditions are necessary for **REACTION B** to occur?

(1 mark)

(c) Which of the reactions, **REACTION A** or **REACTION B**, occurs more easily?

(1 mark)

(d) Give the **name and chemical formula** of another compound that can give a similar reaction to **REACTION A**.

(2 marks)

(e) Molecules of Compound **W** can join together to form larger molecules.

(i) What is the **name** given to such processes?

(1 mark)

(ii) Give a **balanced chemical equation** to show how compound **W** can produce much larger molecules.

(2 marks)

(iii) Give the **chemical name** of the much larger molecule formed in part (e)(ii).

(1 mark)

(iv) Give **TWO** uses for the product in part (e)(iii).

(2 marks)

(f) Ethanol, C_2H_5OH, has an isomer which belongs to a different homologous series.

(i) Draw the structural formula of C_2H_5OH.

(1 mark)

(ii) What is meant by the term *isomer*?

(1 mark)

(iii) Draw the structural formula of the isomer of C_2H_5OH.

(2 marks)

(iv) Give a **balanced chemical equation** for the reaction of C_2H_5OH in the presence of concentrated sulfuric acid at 180°C.

(2 marks)
[Total: 20 marks]

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PERIODIC TABLE

I	II										III	IV	V	VI	VII	VIII
																4 **He** 2
7 **Li** 3	9 **Be** 4										11 **B** 5	12 **C** 6	14 **N** 7	16 **O** 8	19 **F** 9	20 **Ne** 10
23 **Na** 11	24 **Mg** 12										27 **Al** 13	28 **Si** 14	31 **P** 15	32 **S** 16	35.5 **Cl** 17	40 **Ar** 18
39 **K** 19	40 **Ca** 20	45 **Sc** 21	48 **Ti** 22	51 **V** 23	52 **Cr** 24	55 **Mn** 25	56 **Fe** 26	59 **Co** 27	59 **Ni** 28	63.5 **Cu** 29	65 **Zn** 30	70 **Ga** 31	73 **Ge** 32	75 **As** 33	79 **Se** 34	80 **Br** 35	84 **Kr** 36
85 **Rb** 37	88 **Sr** 38	89 **Y** 39	91 **Zr** 40	93 **Nb** 41	96 **Mo** 42	99 **Tc** 43	101 **Ru** 44	103 **Rh** 45	106 **Pd** 46	108 **Ag** 47	112 **Cd** 48	115 **In** 49	119 **Sn** 50	122 **Sb** 51	128 **Te** 52	127 **I** 53	131 **Xe** 54
133 **Cs** 55	137 **Ba** 56	139 **La** 57	178.5 **Hf** 72	181 **Ta** 73	184 **W** 74	186 **Re** 75	190 **Os** 76	192 **Ir** 77	195 **Pt** 78	197 **Au** 79	201 **Hg** 80	204 **Tl** 81	207 **Pb** 82	209 **Bi** 83	209 **Po** 84	210 **At** 85	222 **Rn** 86
223 **Fr** 87	226 **Ra** 88	227 **Ac** 89															

Key

Relative atomic mass — A; X; Z — *Atomic Number*

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