

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD  
UNIVERSITY OF MALTA, MSIDA**SECONDARY EDUCATION CERTIFICATE LEVEL****SEPTEMBER 2013 SESSION**

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SUBJECT: **Chemistry**  
PAPER NUMBER: **I**  
DATE: **5<sup>th</sup> September 2013**  
TIME: **9:00 a.m. to 11:00 a.m.**

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**Useful data****Relative atomic masses: O = 16; Mg = 24****Directions to Candidates**

- Write your index number in the space at the top left-hand corner of this page.
- Answer **ALL** questions. 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.
- 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	5	4	6	6	9	6	6	6	6	6	20	20	100

**Section 1: Answer ALL questions in this Section. Write your answers in the spaces provided.**

1. Use the following terms to complete the paragraph below. Each term may be used once, more than once or not at all.

**molecules   boiling   energy   purity   melting   sublimation   condensation**

When ice is heated, its particles gain \_\_\_\_\_ and it turns into a liquid.

The temperature at which this change in state occurs is called the \_\_\_\_\_ point of the solid. On further heating the

\_\_\_\_\_ point of liquid water is reached and steam is obtained. These

two temperatures can be used to check the \_\_\_\_\_ of the water.

When solid iodine crystals are heated they undergo \_\_\_\_\_.

[Total: 5 marks]

2. (a) Petroleum (crude oil) is a mixture of hydrocarbons including natural gas, which can be separated into various parts. Name the process that can be used for this separation.

(1 mark)

- (b) Mention **two** products, apart from petrol (or gasoline), that are produced by the separation of petroleum.

(2 marks)

- (c) Long chain alkanes can be made to undergo a process to form shorter chain alkanes and ethane: petrol can be obtained by this process. Name the process.

(1 mark)

[Total: 4 marks]

5

4

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3. The table below shows experimental results that Andrea obtained during a practical at school. In this experiment, a piece of magnesium ribbon was heated in a crucible, first at low heat for 5 to 10 minutes and then at full heat with the lid half open for another 5 to 10 minutes. The crucible was then left to cool and weighed. The crucible was heated again for 5 to 10 minutes at high heat, then cooled and reweighed.

The following experimental data was obtained:

Items	Mass (g)
Crucible and lid	17.606
Crucible, lid and magnesium	17.654
Crucible, lid and oxide of magnesium produced (first heating)	17.686
Crucible, lid and oxide of magnesium produced (second heating)	17.686

- (a) Calculate the mass of magnesium used.

(1 mark)

- (b) Calculate the mass of oxide of magnesium produced.

(1 mark)

- (c) Calculate the mass of oxygen in the oxide of magnesium produced.

(1 mark)

- (d) Calculate the empirical formula of the compound between magnesium and oxygen.

(3 marks)

[Total: 6 marks]

6

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4. Carbon monoxide is a very toxic (poisonous) gas.

(a) Give a balanced equation to show how methane, CH<sub>4</sub>, can burn in air to give **carbon monoxide and water only**.

(2 marks)

(b) How can it be checked that a gas is carbon monoxide?

(1 mark)

(c) What is the effect of carbon monoxide on the body?

(1 mark)

(d) How can the reaction in (a) be improved so that carbon dioxide and not carbon monoxide is formed?

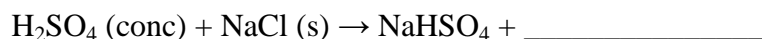
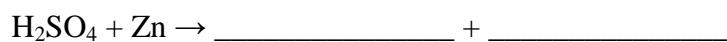
(1 mark)

(e) How can it be checked that a gas jar contains carbon dioxide?

(1 mark)

[Total: 6 marks]

5. (a) Complete the following equations which represent some properties of sulfuric acid.



(4 marks)

(b) (i) Balance the following equation:



(3 marks)

(ii) What property of sulfuric acid is being shown in this reaction?

(1 mark)

(iii) State **one** observation that can be made in this reaction.

(1 mark)

[Total: 9 marks]

6

9

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6. (a) Give ionic equations for the following reactions:

(i) iron(II) sulphate ( $\text{FeSO}_4$ ) solution reacting with sodium hydroxide ( $\text{NaOH}$ ) solution;

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(2 marks)

(ii) copper(II) chloride ( $\text{CuCl}_2$ ) solution reacting with silver nitrate ( $\text{AgNO}_3$ ) solution.

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(2 marks)

(b) Give **one** observation that can be made in (a)(i) and **one** observation in (a)(ii).

Observation in (a)(i): \_\_\_\_\_

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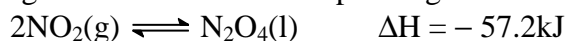
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Observation in (a)(ii): \_\_\_\_\_

(2 marks)

**[Total: 6 marks]**

7. Consider the following reaction and the corresponding  $\Delta H$  value:



Write **True** or **False** next to each of the following statements that refer to the reaction.

(a)	The symbol $\rightleftharpoons$ means that $\text{N}_2\text{O}_4$ is formed very fast.	
(b)	It is best to carry out the reaction in a fume cupboard.	
(c)	Heat is necessary to change $\text{NO}_2$ into $\text{N}_2\text{O}_4$ .	
(d)	A catalyst will produce more of the gas.	
(e)	An increase in pressure will produce more $\text{N}_2\text{O}_4$ .	
(f)	The intensity of the brown colour increases as the temperature decreases.	

**[Total: 6 marks]**

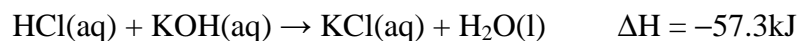
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8. In a laboratory experiment John reacted together dilute hydrochloric acid and dilute sodium hydroxide solution, according to the equation:



- (a) What does the symbol  $\Delta H$  represent?

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(2 marks)

- (b) Use 'energy' as y-axis and 'progress of reaction' as x-axis to draw a well-labelled energy level diagram for the reaction which is represented by the equation given above.

(3 marks)

- (c) During the same laboratory session, Maria carried out the same reaction as John using smaller volumes of the same solutions.  
State **one** way in which Maria's experiment will be different from John's.

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(1 marks)

[Total: 6 marks]

6

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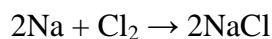
9. (a) What is the oxidation state of the underlined element:

FeCl<sub>3</sub>: \_\_\_\_\_

ZnO: \_\_\_\_\_

(2 marks)

(b) Consider the reaction below and name the substance that is oxidised and the substance that is reduced:



(i) Substance oxidised: \_\_\_\_\_

(ii) Substance reduced: \_\_\_\_\_

(2 marks)

(c) Explain briefly your conclusions.

\_\_\_\_\_  
\_\_\_\_\_

(2 marks)

**[Total: 6 marks]**

10. (a) Give the name or formula of a substance that can be obtained on a large scale from each of the following:

Air: \_\_\_\_\_

Sulfur: \_\_\_\_\_

Sea-water: \_\_\_\_\_

(3 marks)

(b) (i) Limestone mainly contains calcium carbonate. The exterior walls of buildings may get corroded as years pass. Suggest a reason why this may happen.

\_\_\_\_\_

(1 mark)

(ii) Limestone can be converted to lime and subsequently to slaked lime. Write the chemical equation that represents the conversion of lime to slaked lime.

\_\_\_\_\_

(2 marks)

**[Total: 6 marks]**

6

6





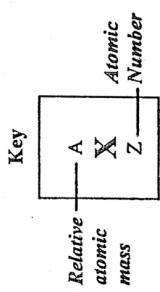






PERIODIC TABLE

I	II	III	IV	V	VI	VII	VIII
1 H 1	9 Be 4	11 Na 11	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
85 Rb 37	88 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	99 Tc 43	101 Ru 44
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
223 Fr 87	226 Ra 88	227 Ac 89	63.5 Cu 29	59 Ni 28	59 Co 27	59 Ni 28	65 Zn 30
			65 Zn 30	106 Pd 46	103 Rh 45	106 Pd 46	112 Cd 48
			119 Sn 50	122 Sb 51	122 Sb 51	127 I 53	131 Xe 54
			207 Pb 82	209 Bi 83	209 Bi 83	210 At 85	222 Rn 86
			201 Hg 80	197 Au 79	197 Au 79	201 Hg 80	
			190 Os 76	192 Ir 77	192 Ir 77	195 Pt 78	
			190 Os 76	192 Ir 77	192 Ir 77	195 Pt 78	
			186 Re 75	186 Re 75	186 Re 75	190 Os 76	
			184 W 74	184 W 74	184 W 74	190 Os 76	
			181 Ta 73	181 Ta 73	181 Ta 73	190 Os 76	
			178.5 Hf 72	178.5 Hf 72	178.5 Hf 72	181 Ta 73	
			147 Pm 61	147 Pm 61	147 Pm 61	150 Sm 62	
			144 Nd 60	144 Nd 60	144 Nd 60	147 Pm 61	
			141 Pr 59	141 Pr 59	141 Pr 59	144 Nd 60	
			140 Ce 58	140 Ce 58	140 Ce 58	141 Pr 59	
			232 Th 90	232 Th 90	232 Th 90	238 U 92	
			232 Th 90	232 Th 90	232 Th 90	238 U 92	
			238 U 92	238 U 92	238 U 92	244 Pu 94	
			238 U 92	238 U 92	238 U 92	244 Pu 94	
			252 Es 99	252 Es 99	252 Es 99	252 Es 99	
			252 Es 99	252 Es 99	252 Es 99	252 Es 99	
			257 Fm 100	257 Fm 100	257 Fm 100	257 Fm 100	
			257 Fm 100	257 Fm 100	257 Fm 100	257 Fm 100	
			258 Md 101	258 Md 101	258 Md 101	258 Md 101	
			258 Md 101	258 Md 101	258 Md 101	258 Md 101	
			259 No 102	259 No 102	259 No 102	259 No 102	
			259 No 102	259 No 102	259 No 102	259 No 102	
			260 Lr 103	260 Lr 103	260 Lr 103	260 Lr 103	
			260 Lr 103	260 Lr 103	260 Lr 103	260 Lr 103	
			169 Tm 69	169 Tm 69	169 Tm 69	173 Yb 70	
			169 Tm 69	169 Tm 69	169 Tm 69	173 Yb 70	
			167 Er 68	167 Er 68	167 Er 68	173 Yb 70	
			167 Er 68	167 Er 68	167 Er 68	173 Yb 70	
			165 Ho 67	165 Ho 67	165 Ho 67	173 Yb 70	
			165 Ho 67	165 Ho 67	165 Ho 67	173 Yb 70	
			162 Dy 66	162 Dy 66	162 Dy 66	173 Yb 70	
			162 Dy 66	162 Dy 66	162 Dy 66	173 Yb 70	
			159 Tb 65	159 Tb 65	159 Tb 65	173 Yb 70	
			159 Tb 65	159 Tb 65	159 Tb 65	173 Yb 70	
			157 Gd 64	157 Gd 64	157 Gd 64	173 Yb 70	
			157 Gd 64	157 Gd 64	157 Gd 64	173 Yb 70	
			152 Eu 63	152 Eu 63	152 Eu 63	173 Yb 70	
			152 Eu 63	152 Eu 63	152 Eu 63	173 Yb 70	
			150 Sm 62	150 Sm 62	150 Sm 62	173 Yb 70	
			150 Sm 62	150 Sm 62	150 Sm 62	173 Yb 70	
			147 Pm 61	147 Pm 61	147 Pm 61	173 Yb 70	
			147 Pm 61	147 Pm 61	147 Pm 61	173 Yb 70	
			144 Nd 60	144 Nd 60	144 Nd 60	173 Yb 70	
			144 Nd 60	144 Nd 60	144 Nd 60	173 Yb 70	
			141 Pr 59	141 Pr 59	141 Pr 59	173 Yb 70	
			141 Pr 59	141 Pr 59	141 Pr 59	173 Yb 70	
			140 Ce 58	140 Ce 58	140 Ce 58	173 Yb 70	
			140 Ce 58	140 Ce 58	140 Ce 58	173 Yb 70	
			232 Th 90	232 Th 90	232 Th 90	260 Lr 103	
			232 Th 90	232 Th 90	232 Th 90	260 Lr 103	
			238 U 92	238 U 92	238 U 92	260 Lr 103	
			238 U 92	238 U 92	238 U 92	260 Lr 103	
			252 Es 99	252 Es 99	252 Es 99	260 Lr 103	
			252 Es 99	252 Es 99	252 Es 99	260 Lr 103	
			257 Fm 100	257 Fm 100	257 Fm 100	260 Lr 103	
			257 Fm 100	257 Fm 100	257 Fm 100	260 Lr 103	
			258 Md 101	258 Md 101	258 Md 101	260 Lr 103	
			258 Md 101	258 Md 101	258 Md 101	260 Lr 103	
			259 No 102	259 No 102	259 No 102	260 Lr 103	
			259 No 102	259 No 102	259 No 102	260 Lr 103	
			260 Lr 103	260 Lr 103	260 Lr 103	260 Lr 103	
			260 Lr 103	260 Lr 103	260 Lr 103	260 Lr 103	



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

**SECONDARY EDUCATION CERTIFICATE LEVEL**

**SEPTEMBER 2013 SESSION**

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SUBJECT: **Chemistry**  
 PAPER NUMBER: IIB  
 DATE: 5<sup>th</sup> September 2013  
 TIME: 4:00 p.m. to 6:00 p.m.

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**Useful data**

**Relative atomic masses: H = 1; C = 12**

**The molar volume for gases at s.t.p. = 22.4 dm<sup>3</sup>**

**Standard temperature and pressure (s.t.p.): 0 °C and 1 atm**

**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.
- 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	6	6	6	6	20	20	20	20	100

**DO NOT WRITE ABOVE THIS LINE****Section 1: Answer all questions in this section: Write your answers in the spaces provided.**

1. (a) Air is a mixture of gases. Complete the following table with the appropriate names and approximate amounts of gases that make up air.

Gas	Percentage Amount
	0.03%
Oxygen	
	78%

(3 marks)

- (b) In the laboratory, oxygen can be prepared from hydrogen peroxide.

- (i) Write the chemical equation that shows the reaction of hydrogen peroxide to give oxygen.

(2 marks)

- (ii) Give the name or the formula of the catalyst used for this reaction.

(1 mark)

**[Total: 6 marks]**

2. Silicon has three isotopes, indicated here by **A**, **B** and **C**:  $A = {}_{14}^{28}\text{Si}$ ,  $B = {}_{14}^{29}\text{Si}$ ,  $C = {}_{14}^{30}\text{Si}$ .

- (a) How many electrons are present in an atom of isotope **A**?

(1 mark)

- (b) How many protons would be present in the nucleus of an atom of isotope **B**?

(1 mark)

- (c) Give the number of neutrons in the nucleus of: (i) Isotope **A**: \_\_\_\_\_

- (ii) Isotope **B**: \_\_\_\_\_ (iii) Isotope **C**: \_\_\_\_\_

(3 marks)

- (d) The relative atomic mass of silicon is 28.08. Which one of the three isotopes **A**, **B** and **C** is the most abundant in nature?

(1 mark)

**[Total: 6 marks]**

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3. (a) Give the structural formulae, showing **ALL** the bonds, of each of the organic compounds in the table below.

Name	Structural formula
ethene	
propene	
propane	

(3 marks)

- (b) Propane and propene belong to two different homologous series.

(i) Give the names of the two homologous series.

(1 mark)

(ii) Give a simple chemical test that can distinguish between propane and propene.

(1 mark)

- (c) Ethene and propene belong to the same homologous series. How does the boiling point vary as the chain gets longer within the series?

(1 mark)

[Total: 6 marks]

6

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4. (a) Use the Periodic Table and give the electronic configuration of the following elements:

carbon: \_\_\_\_\_

chlorine: \_\_\_\_\_

sodium: \_\_\_\_\_

(3 marks)

- (b) By drawing only the outer shell of electrons, show how atoms of carbon combine with those of chlorine to form a stable compound.

(2 marks)

- (c) Give **one** difference between the compound of carbon and chlorine and that of sodium and chlorine.

(1 mark)

[Total: 6 marks]

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6
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5. (a) Propane,  $C_3H_8$ , is an alkane. Write a balanced equation to show what happens when propane is burnt in an abundant supply of air.

(2 marks)

- (b) A sample of propane, of mass 8.8 g, is at standard temperature and pressure (STP).  
(i) Calculate the number of moles of propane.

(2 marks)

- (ii) What volume at standard temperature and pressure is occupied by 8.8 g of propane?

(2 marks)

**[Total: 6 marks]**

6. (a) Fill in the blanks in the table below:

Name or formula of oxide	Type of oxide	State in nature
Calcium oxide – CaO		
	Amphoteric oxide	Solid
	Neutral oxide	
Sulfur dioxide – $SO_2$		Gas

(3 marks)

- (b) (i) What is an amphoteric oxide?

(1 mark)

- (ii) Write the equation for the reaction of sulfur dioxide with sodium hydroxide solution.

(2 marks)

**[Total: 6 marks]**

6

6

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7. (a) Chlorine gas can be prepared by the oxidation of concentrated hydrochloric acid by manganese(IV) oxide. How can the presence of chlorine gas be tested? Indicate what would be observed.

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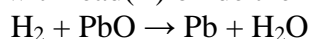
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(3 marks)

- (b) When hydrogen is heated with lead(II) oxide the following reaction takes place:



- (i) What property of hydrogen is displayed by the reaction shown above?

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(1 mark)

- (ii) Indicate an observation that can be observed when this reaction is carried out.

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(1 mark)

- (iii) What safety precaution should be taken in the laboratory to prevent the hydrogen from exploding during this experiment?

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(1 mark)

**[Total: 6 marks]**

8. (a) Indicate whether each of the following substances is acidic, alkaline or neutral:

		<b>acidic / alkaline / neutral</b>
(i)	Vinegar	
(ii)	Household bleach	
(iii)	Pure water	
(iv)	Caustic soda	

(4 marks)

- (b) Suggest a possible pH value for:

(i) pure water: \_\_\_\_\_

(ii) a fizzy soft drink: \_\_\_\_\_

(2 marks)

**[Total: 6 marks]**

6

6

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9. A Form 5 student carried out an investigation. He placed a piece of magnesium into each of three beakers containing magnesium sulfate solution, iron(II) sulfate solution and copper(II) sulfate solution respectively. Similar experiments were done with pieces of copper and iron.

He drew up the following observations:

	<b>Magnesium sulfate (aq)</b>	<b>Copper(II) sulfate (aq)</b>	<b>Iron(II) sulfate (aq)</b>
<b>Magnesium</b>		Copper precipitated	Iron precipitated
<b>Copper</b>	No reaction		No reaction
<b>Iron</b>	No reaction	Copper precipitated	

- (a) List the three metals in order of their reactivity, with the most reactive first and the least reactive last.

(3 marks)

- (b) If each of the three metals (magnesium, copper and iron) is added to a solution of sodium sulfate, no reaction takes place. What can be concluded about the reactivity of sodium compared to that of these three metals?

(1 mark)

- (c) Silver powder was added to each of the three aqueous solutions mentioned above, and no reaction was observed. What can be concluded about the reactivity of silver compared to that of the three metals?

(1 mark)

- (d) Predict what would happen if a piece of magnesium is placed in a beaker containing silver nitrate solution.

(1 mark)

[Total: 6 marks]

10. Complete the following paragraph using the following words. Each word can be used once, more than once or not all.

**no, one, two, three, four, five, allotropes, isotopes, electricity**

Diamond and graphite are two \_\_\_\_\_ of carbon. Diamond acquires its hardness because each carbon atom is held strongly by \_\_\_\_\_ covalent bonds, leaving \_\_\_\_\_ free electrons. In graphite every carbon atom is held by \_\_\_\_\_ covalent bonds, with the number of free electrons per atom being \_\_\_\_\_. Thus graphite conducts \_\_\_\_\_ while diamond does not.

[Total: 6 marks]

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**Section 2: Answer TWO questions from this section. Write your answers in the lined pages provided.**

11. When hydrochloric acid was poured over a piece of iron in a test tube, a solution **A** was formed and a colourless gas **Z** was released. The colourless gas **Z** burned with a pop. When a few drops of sodium hydroxide solution were added to **A**, a green precipitate **B** was obtained. When a few drops of silver nitrate solution were added to some hydrochloric acid, a white precipitate **C** was obtained.

A white solid **D** gave a bright yellow flame when placed on a piece of nichrome wire in the non-luminous part of a Bunsen flame. A solution of **D** gave no visible reaction with sodium hydroxide solution but gave a white precipitate **E** with barium chloride solution. On adding hydrochloric acid to precipitate **E**, there was no reaction.

- (a) Give the name or formula of **A**, **B**, **C**, **D**, **E**, and **Z**. (10 marks)
- (b) (i) Give the ionic equation for the reaction of **A** with sodium hydroxide. (3 marks)  
(ii) Give the equation for the reaction of hydrochloric acid with silver nitrate solution. Your equation should include state symbols. (2 marks)  
(iii) State what would be observed when a glass rod dipped into a concentrated ammonia solution is brought close to the mouth of a test tube containing a concentrated solution of hydrochloric acid. (1 mark)  
(iv) Write the equation of the reaction that takes place in part (iii). (2 marks)  
(v) When hydrochloric acid is added to calcium carbonate, a gas is evolved. Give the equation for this reaction. (2 marks)
- [Total: 20 marks]**

12. Human activity can unfortunately cause a lot of harm to the environment.

- (a) (i) Car engines produce oxides of nitrogen when there is no nitrogen in car fuels. Explain briefly. (2 marks)  
(ii) Mention another source, apart from cars, that produces oxides of nitrogen that are released into the atmosphere. (1 mark)  
(iii) How does a catalytic converter help to make the exhaust from cars less harmful? (2 marks)  
(iv) What health problems are associated with the presence of oxides of nitrogen in the atmosphere? (1 mark)
- (b) (i) 'Carbon dioxide is a greenhouse gas'. Explain briefly this statement. (3 marks)  
(ii) Mention **one** effect that is caused by greenhouse gases. (1 mark)
- (c) Both nitrogen dioxide and sulfur dioxide contribute to acid rain. Give balanced equations to show the reaction of nitrogen dioxide,  $\text{NO}_2$ , and sulfur dioxide,  $\text{SO}_2$ , with rainwater. (4 marks)
- (d) (i) In recent years much has been done to limit the use of certain substances in aerosols (sprays). What are such substances known as? (1 mark)  
(ii) What is the effect of such substances on the environment? (1 mark)

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(e) This question refers to the following reaction:  $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g})$   
Assuming that **all gaseous volumes are measured at the same temperature and pressure**, calculate:

(i) the volume of oxygen that is required to react with  $20 \text{ cm}^3$  of carbon monoxide;  
(2 marks)

(ii) the volume of carbon dioxide that is produced in the reaction. (2 marks)

[Total: 20 marks]

13. (a) (i) Use the copy of the Periodic Table to give the electronic configuration of the first three elements in Group 2. (3 marks)

(ii) Use the electronic configuration of these elements to explain how the reactivity of the elements in this group varies as you go down from one element to the next. (4 marks)

(iii) Based on your reasoning in part (ii), list these three elements in order of their reactivity with the most reactive first. (3 marks)

(b) (i) Explain why one would expect the elements in Group 1 to react similarly to those of Group 2. (2 marks)

(ii) Place the elements sodium, potassium, magnesium and calcium in order of the chemical reactivity. (2 marks)

(c) (i) When salts of elements in Group 2 are dissolved in water they are said to cause temporary or permanent hardness. Explain how temporary hard water is different from water that has permanent hardness. (2 marks)

(ii) List **two** disadvantages of hard water. (2 marks)

(iii) List **two** things that one can do at home to soften water with permanent hardness. (2 marks)

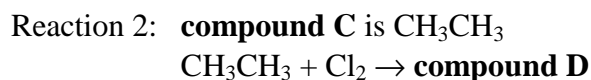
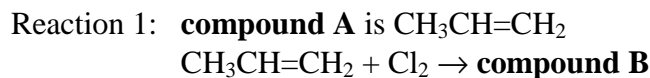
[Total: 20 marks]

*Question 14 is on the next page.*

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14. Consider the following reactions:



- (a) (i) Name compounds **A**, **C**, and **E**. (3 marks)  
(ii) Give the structures of compounds **B** and **D**. (2 marks)
- (b) What conditions are necessary for Reaction 2 to occur? (1 mark)
- (c) Ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , can react with ethanoic acid,  $\text{CH}_3\text{COOH}$ , under appropriate conditions.
- (i) What is this reaction called? (1 mark)  
(ii) What conditions are necessary for this reaction to occur? (2 marks)  
(iii) How would one know that the reaction took place? (2 marks)  
(iv) Give a balanced equation for this reaction. (2 marks)  
(v) What is the name of the organic product? (2 marks)
- (d) Ethanol reacts with sodium liberating a gas. Give a balanced equation for this reaction. (2 marks)
- (e) Ethanol can be changed into ethanoic acid using a test tube reaction.
- (i) State the reagent that can be used for this reaction. (1 mark)  
(ii) What is the colour change when this reaction occurs? (2 marks)

**[Total: 20 marks]**













