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| e.g. <b>(2)</b> .<br>There are 20 p<br>A Periodic Tab | pages in this                               | s questi             | on pape |                 | ,  | •      | •                                 |         |        | iown i | n round brackets:                           |                    |          |
| Advice to Ca  | <u>andidat</u> es                           |                      |         |                 |  |        |                                   |         |        |        |   |                    |          |

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Write your answers neatly and in good English.

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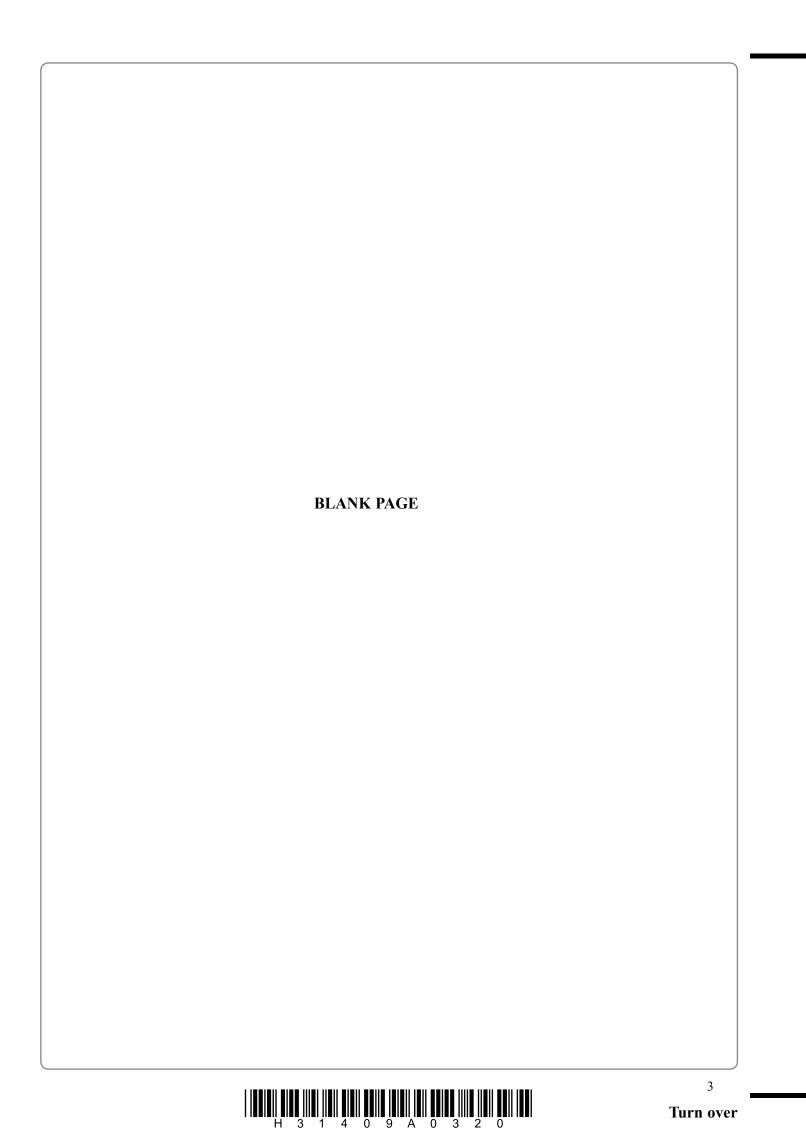




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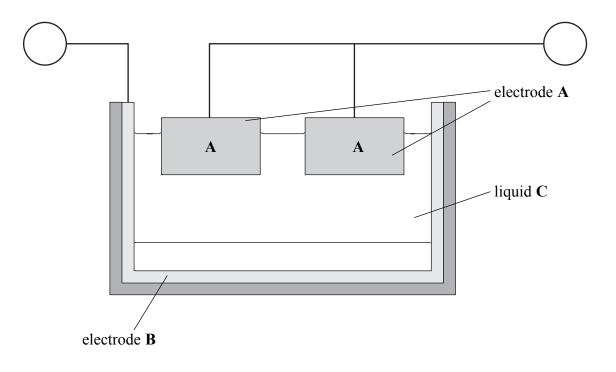
|                    | 0             | Helium 2 | Neon 10 4 Argon                                     | Krypton 36 36 Xenon 54 84  | Radon 86   |  |
|--------------------|---------------|----------|---|--|--|--|
|                    | 7             |          | Fluorine 9 35.5 Chlorine                            | 80<br>Branine 35<br>127<br>127<br>Iodine 53  | Astatine 85                                      |  |
|                    | 9             |          | 16<br>Oxygen<br>32<br>Sulphur                       | Selenium 34 128 Tellurium 52 55  | 210<br>Polonium<br>84                            |  |
|                    | 22            |          | Nitrogen 7 31 31 Phosphorus                         | Arsenic 33 122 Sb Antimony 51  | 209<br>Bismuth<br>83                             |  |
|                    | 4             |          | Carbon Carbon 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 | Germanium 32 Sn Tin 50   | Pb<br>Pb<br>Lead<br>82                           |  |
|                    | ო             |          |   | Gallium 31 115 Indium Indium 149   |  |  |
|                    |               |          |   | 65 Zn Zinc 30 112 Cd Cadmium 48  |  |  |
| THE PERIODIC TABLE |               |          |   | 63.5<br>Cu<br>Copper<br>29<br>108<br>Ag<br>Silver<br>47  |  |  |
| IODIC              |               |          |   | Nickel<br>Nickel<br>28<br>106<br>Palladium<br>46   | Platinum 78                                      |  |
| E PER              |               |          |   | Co Cobait 27 103 Rhodium 45  | 1  |  |
| <u>F</u>           |               |          |   | 56<br>Fe Iron 26<br>101<br>Ruthenium 4   |  | و  |
|                    | Group         | Hydrogen |   | Mn<br>langanese<br>25<br>99<br>T C<br>echnetium  | 186<br>Remium<br>75                              | Key Relative atomic mass Symbol Name Atomic number |
|                    | J             |          |   | 52 55 Cr Mn Chromium Manganese 24 25 89 Molyddenum Technetium 42 44 43 44 44 44 44 44 44 44 44 44 44 44  | Tungslen 74                                      |  |
|                    |               |          |   | Vanadium C 23 93 Niobium M 41  |  |  |
|                    |               |          |   | 48 Ti Ttanium 22 91 Zirconium 40   |  |  |
|                    |               |          |   | Scandium 2   |  |  |
|                    | 8             |          | 9<br>BBe<br>Beryllium<br>4<br>24<br>Mg<br>Magnesium | Calcium S Calcium S S Calcium S Calc | Barium La Se |  |
|                    | <del>v-</del> |          | Lithium B 3 3 23 Sodium Mg                          |  | 133 CS Caesium 55 223 Francium 187               |  |
|                    |               | Period 1 | α σ   | 4 rv   | 9 7  |  |
|                    |               |          |   |  |  |  |



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## **SECTION A**

1. The diagram shows how aluminium is extracted on an industrial scale.



(a) (i) Name the process used to extract aluminium.

| <br> |
|------|
| (1)  |

(ii) Name the material used for the electrodes A and B.

| <br> | <br> |
|------|------|
|      | (1)  |

(iii) Using the symbols + and – identify the polarity of the electrodes A and B.Write one symbol in each circle in the diagram above.

(1)

(iv) Identify the two compounds present in liquid C.

| 1 | •• |
|---|----|
| 2 |    |

(v) State **one** major cost that makes this process more expensive than the extraction of iron.

**(1)** 

**(2)** 

| (i) Identify the element.  (ii) Identify the compound and explain how it forms.  Compound     | (ii) Identify the compound and explain how it forms.  Compound                                | (ii) Identify the compound and explain how it forms.  Compound                                | (ii) Identify the compound and explain how it forms.  Compound                                |
|---|---|---|---|
| (ii) Identify the compound and explain how it forms.  Compound  Explanation of formation  (2) | (ii) Identify the compound and explain how it forms.  Compound  Explanation of formation  (2) | (ii) Identify the compound and explain how it forms.  Compound  Explanation of formation  (2) | (ii) Identify the compound and explain how it forms.  Compound  Explanation of formation  (2) |
| Compound  Explanation of formation  |
| Explanation of formation  | Explanation of formation  | Explanation of formation  | Explanation of formation  |
| (2)   | (2)   | (2)   | (2)   |
| (2)   | (2)   | (2)   | (2)   |
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|    |      | e characteristic of a homologous series is that all its members have the same eral formula. |
|----|------|---|
|    | (i)  | State <b>two</b> other characteristics of a homologous series.                              |
|    |      | 1   |
|    |      |   |
|    |      | 2   |
|    |      | (2)   |
|    | (ii) | What is the name of the homologous series to which ethene belongs?                          |
|    | ` /  |   |
|    |      | (1)   |
| b) | (1)  | Use the Periodic Table to help you complete the diagrams to show the electronic             |
|    |      | configuration of hydrogen and of carbon.  |
|    |      | H) (C)  |
|    |      | H  (2)  |
|    |      | (H) (C)   |

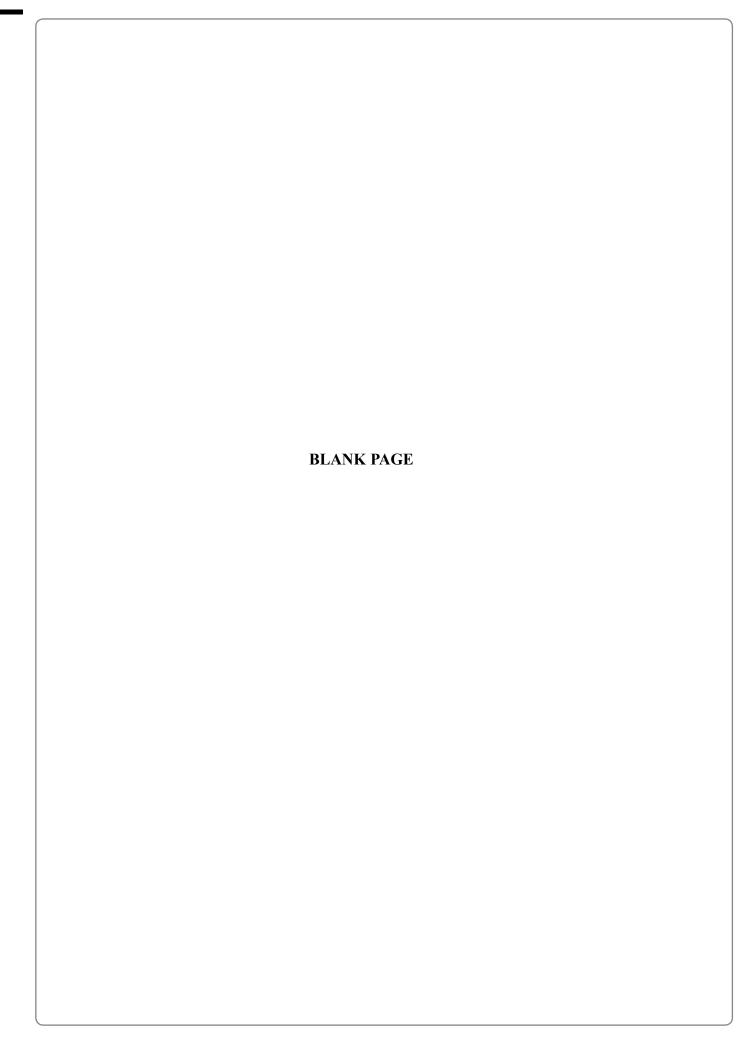
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|-----|------|--|-------|
|     | (ii) | Draw a dot and cross diagram to show the covalent bonding in a methane molecule.   | blank |
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|     |      |  |       |
|     |      | (2)  |       |
| (c) | The  | e alkane $C_4H_{10}$ exists as two isomers.  |       |
|     |      | What are isomers?  |       |
|     | (1)  | , in the case is said to the case of the c |       |
|     |      |  |       |
|     |      | (2)  |       |
|     | (ii) | Draw the displayed formula of each isomer.   |       |
|     |      |  |       |
|     |      |  |       |
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|     |      | (2)  | Q2    |
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| . Ca | lcium | and magnesium are metals in Group 2 of the Periodic Table.   |
|------|-------|--|
| (a)  | the   | tudent adds a piece of calcium to some cold water in a beaker. The products of reaction are calcium hydroxide and hydrogen. Some of the calcium hydroxide solves in the water and some does not. |
|      | (i)   | Describe <b>two</b> observations that the student could make during the reaction.  |
|      |       | 1  |
|      |       |  |
|      |       | 2  |
|      |       | (2)  |
|      | (ii)  | Give the formula of calcium hydroxide.   |
|      |       | (1)  |
|      | (iii) | When the reaction is complete, a piece of litmus paper is added to the solution in the beaker. State the final colour of the litmus paper and what this colour indicates about the solution.     |
|      |       | Final colour of litmus   |
|      |       |  |

| (b)    | The diagram shows apparatus for reacting magnesium with steam.  | Leave<br>blank |
|--------|---|----------------|
|        | magnesium ribbon  |                |
| steam_ |   |                |
|        | heat  |                |
|        | The products of this reaction are magnesium oxide and hydrogen.   |                |
|        | (i) State the colour of magnesium and of magnesium oxide.   |                |
|        | Magnesium   |                |
|        | Magnesium oxide(2)  |                |
|        | (ii) State <b>two</b> ways in which the hydrogen could be collected.  1                                     |                |
|        | 2   |                |
|        | (2)   |                |
|        | (iii) The hydrogen gas can be burned as it leaves the heated tube. Write a word equation for this reaction. |                |
|        | (1)<br>(Total 10 marks)   | Q3             |
|        | TOTAL FOR SECTION A: 30 MARKS   |                |
|        |   |                |
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| 4. (a) A crystal of copper(II) sulphate is dropped into a test tube full of water. The crystal sinks to the bottom and starts to dissolve, turning the water blue.  (i) Name the process that occurs after the copper(II) sulphate has dissolved.  (1)  (ii) Describe how this process occurs.  (2)  (b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.  (i) Describe what you would see as ammonia solution is added.  (3)  (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution. |    |     |      | SECTION B   | Lea<br>blar |
|--|----|-----|------|---|-------------|
| (i) Name the process that occurs after the copper(II) sulphate has dissolved.  (1)  (ii) Describe how this process occurs.  (2)  (b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.  (i) Describe what you would see as ammonia solution is added.  (3)  (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.   | 4. | (a) |      |   |             |
| (ii) Describe how this process occurs.  (2)  (b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.  (i) Describe what you would see as ammonia solution is added.  (3)  (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.   |    |     |      |   |             |
| (b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.  (i) Describe what you would see as ammonia solution is added.  (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.   |    |     |      | (1)   |             |
| (b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.  (i) Describe what you would see as ammonia solution is added.  (3)  (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.  |    |     | (ii) | Describe how this process occurs.                         |             |
| (b) A sample of the solution is removed from the test tube. Dilute ammonia solution is slowly added to the sample until in excess.  (i) Describe what you would see as ammonia solution is added.  (3)  (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.  |    |     |      |   |             |
| slowly added to the sample until in excess.  (i) Describe what you would see as ammonia solution is added.  (3)  (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.   |    |     |      | (2)   |             |
| (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.  (1) Q4  |    | (b) |      |   |             |
| (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.  (1) Q4  |    |     | (i)  | Describe what you would see as ammonia solution is added. |             |
| (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.  (1) Q4  |    |     |      |   |             |
| (ii) Give the formula of the copper-containing species present after the addition of excess ammonia solution.  (1) Q4  |    |     |      |   |             |
| excess ammonia solution.  (1) Q4   |    |     |      | (3)   |             |
|  |    |     | (ii) |   |             |
|  |    |     |      | (1)   | 04          |
| (Total 7 marks)  |    |     |      | (Total 7 marks)   |             |
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| (a) | (i)   | Describe what is seen when a small piece of sodium is dropped onto water.   |
|-----|-------|---|
|     |       |   |
|     |       |   |
|     |       |   |
|     |       |   |
|     |       | (3)   |
|     | (ii)  | Write a chemical equation for the reaction.   |
|     |       | (2)   |
|     | (iii) | Give <b>one</b> observation that will be different if rubidium is used in place of sodium.  |
|     |       | (1)   |
|     |       | (-)   |
| (b) | Sod   | ium reacts readily with oxygen to form the ionic compound sodium oxide.   |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms react with oxygen atoms. |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms                          |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms                          |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms                          |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms                          |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms                          |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms                          |
| (b) |       | The diagram shows the electron configuration of an atom of sodium and an atom of oxygen. Describe, in terms of electrons, what happens when sodium atoms                          |

| (11) | Sodium oxide has a melting point of 1275 °C. Explain why sodium oxide has a high melting point. |  |
|------|---|--|
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|      | (3)   |  |
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| 6. | (a) | Magnesium chloride is a soluble salt that can be made by reacting magnesium carbonate with dilute hydrochloric acid. Magnesium carbonate is insoluble in water.   | Oldlik      |
|    |     | Describe how you could make a dry sample of magnesium chloride crystals from magnesium carbonate and dilute hydrochloric acid.  |             |
|    |     |   |             |
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|    |     | (5)   |             |
|    | (b) | Some dilute sulphuric acid is placed in a conical flask. A few drops of phenolphthalein indicator are added to the acid. Dilute sodium hydroxide solution is then added gradually.  The chemical equation for the reaction is |             |
|    |     | $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$  |             |
|    |     | What colour change is seen when the acid is neutralised?  |             |
|    |     | (2)   | Q6          |
|    |     | (Total 7 marks)   |             |
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|    |     |   |             |
|    |     |   |             |
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| a) (i) | Describe the test, and the positive result expected, that she can do to see if the solid is a carbonate.                              |
|--------|---|
|        |   |
|        |   |
|        | (2)   |
| (ii)   | Carbon dioxide reacts with sodium hydroxide solution to form sodium carbonate and water. Write a chemical equation for this reaction. |
|        | (2)   |
| ` '    | lium carbonate is also formed when sodium hydrogencarbonate is heated strongly. e chemical equation for the reaction is               |
|        | $2NaHCO3(s) \rightarrow Na2CO3(s) + H2O(g) + CO2(g)$  |
| 4.2    | g of sodium hydrogencarbonate is heated until it is fully decomposed.   |
| (i)    | Calculate the amount, in moles, of sodium hydrogencarbonate used.   |
|        |   |
|        | (3)   |
| (ii)   | Calculate the amount, in moles, of carbon dioxide formed.   |
|        |   |
|        | (1)   |
| (iii)  | Calculate the volume, in dm <sup>3</sup> , measured at room temperature and pressure (rtp),   |
|        | of carbon dioxide formed.<br>The volume of one mole of any gas at rtp is 24 dm <sup>3</sup> .   |
|        | (1)   |
|        |   |

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**8.** The table gives some information about elements in Group 7 of the Periodic Table.

| Name     | State at room temperature | Boiling point/°C |  |
|----------|---------------------------|------------------|--|
| chlorine | gas                       | -35              |  |
| bromine  | liquid                    |                  |  |
| iodine   | solid                     | 184              |  |

| (1)               |  |                        |  |      |
|-------------------|--|------------------------|--|------|
|                   |  |                        |  | T.C. |
| nt reaction takes | ed to sunlight a viole                                 |                        | mixture of hydrogen e. The only product: |      |
|                   |  | ation for the reaction | Write a chemical equ                     | (i)  |
|                   |  |                        |  | (-)  |
| (2)               |  |                        |  |      |
|                   | s into separate sample<br>quid with universal<br>case. | e then tests each l    |  |      |
|                   |  | water                  | Hydrogen chloride in                     |      |
|                   |  |                        |  |      |
|                   |  |                        |  |      |
|                   |  |                        |  |      |
|                   |  | methylbenzene          | Hydrogen chloride ir                     |      |
|                   |  | j                      | <i>y C</i>                               |      |
|                   |  |                        |  |      |
|                   |  |                        |  |      |
| (4)               |  |                        |  |      |
| (Total 7 marks)   | (  |                        |  |      |
|                   | (  |                        |  |      |

| The | e list gives the order of reactivity of some metals.   |
|-----|--|
|     | most reactive magnesium zinc iron copper least reactive silver   |
| (a) | Iron is sometimes coated with zinc to prevent the iron rusting. The iron does not rust even if the coating of zinc becomes damaged.  |
|     | (i) What is the name given to this method of rust prevention?  |
|     | (ii) Give <b>one</b> example where this method of rust prevention is used.   |
|     | (ii) Give one example where this inclined of fust prevention is used.  |
|     | (1)  |
|     | (iii) Explain how this method of rust prevention works.  |
|     |  |
|     | (2)  |
| (b) | The reaction that occurs when zinc is added to silver nitrate solution is  |
|     | $Zn + 2Ag^+ \rightarrow Zn^{2+} + 2Ag$   |
|     | State, with a reason, which substance is oxidised.   |
|     |  |
| (-) | (2)  |
| (c) | A student is given some solid nickel nitrate and several small pieces of magnesium, zinc, iron, copper and silver. Describe and explain how he can find the position of nickel in the reactivity series given above. |
|     |  |
|     |  |
|     |  |
|     | (3)  |
|     | (Total 9 marks)  |

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| l. 1 1 . |  |

10. (a) Ethanol can be dehydrated to form ethene.

$$C_2H_5OH \rightleftharpoons C_2H_4 + H_2O$$
  $\Delta H = +35 \text{ kJ/mol}$ 

State, with a reason, the effect of increasing the temperature on the equilibrium yield of  $C_2H_4$ .

.....

**(2)** 

(b) Ethene forms an addition polymer, poly(ethene).

Draw the structure of poly(ethene), showing at least 4 carbon atoms in your structure.

**(2)** 

(c) An organic compound has the composition 38.7% carbon, 9.70% hydrogen and 51.6% oxygen by mass. The relative formula mass of the compound is 62. Calculate the empirical and molecular formulae of the compound.

Q10

(Total 9 marks)

**(5)** 

**TOTAL FOR SECTION B: 60 MARKS** 

**TOTAL FOR PAPER: 90 MARKS** 

**END** 

