**Unit 1 Chemistry Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

 **2023 Trial exam: 90 mins**

**SECTION A – Multiple-choice questions**

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| **Instructions for Section A** Answer **all** questions.Choose the response that is **correct** or **best answers** the question. A correct answer scores 1, an incorrect answer scores 0. No mark will be given if more than one answer is completed for any question. Marks will **not** be deducted for incorrect answers. |

**Question 1**

Which of the following processes is likely to have the least impact upon the environment?

**A**. Using car tyres in place of coal in the manufacture of steel.

**B**. Manufacture of a compostable polymer from fruit waste.

**C**. Manufacture of polyethene from bioethanol.

**D**. Manufacture of a compostable plastic from crude oil.

**Question 2**

The electron configuration of an ion is 1s22s22p63s23p6. The ion could be

**A**. F-

**B**. K+

**C**. Cl

**D**. Ar

**Question 3**

Which of the following metals is the most reactive?

**A**. nickel

**B**. calcium

**C**. lithium

**D**. potassium

**Question 4**

I am an element.

I am in Group 14.

I am a non-metal.

I am used as a standard on a relative scale.

I am most likely to be

**A**. silicon.

**B**. lead.

**C**. hydrogen.

**D**. carbon.

**Question 5**

A sample of calcium will conduct electricity because

**A**. each atom contributes a delocalised electron to the structure.

**B**. the electrons in each atom are free to move throughout the structure.

**C**. the calcium ions are free to move through the structure.

**D**. two outer shell electrons from each atom are delocalised in the structure.

**Question 6**

An ionic compound has the formula X2(CO3)3. The electrovalence of element X is likely to be

**A**. X-

**B**. X2+

**C**. X3+

**D**. X4+

**Question 7**

Hydrogen and oxygen can react to form a compound other than water. The compound is hydrogen peroxide, H2O2. The electrovalences in this compound will be

**A**. H+ and O-

**B**. H- and O-

**C**. H2+ and O2-

**D**. H+ and O2-

*Use the following diagram to answer Questions 8 and 9*



**Question 8**

When aluminium and oxygen react to form a compound

**A**. 3 electrons from each aluminium atom move to oxygen atoms.

**B**. 3 electrons from each aluminium atom move to each oxygen atom.

**C**. 2 aluminium atoms share 6 electrons with 3 oxygen atoms.

**D**. each aluminium atom shares 3 electrons with each oxygen atom.

**Question 9**

Given that oxygen exists as O2 gas, a balanced equation for the reaction between aluminium and oxygen is

**A**. Al + O2 🡪 AlO2

**B**. 2Al + 3O 🡪 Al2O3

**C**. 2Al + 3O2 🡪 Al2O3

**D**. 4Al + 3O2 🡪 2Al2O3

**Question 10**

The structure of potassium chloride is modelled in the

diagram shown.

Select the correct statement about the electrical conductivity of potassium chloride.

**A**. KCl will not conduct in any form.

**B**. KCl will not conduct as a solid but will conduct as a liquid or as a solution.

**C**. KCl will not conduct as a solid or as a liquid but it will as a solution.

**D**. KCl will conduct as a solid or a liquid.

**Question 11**

Which of the following represents the greatest mass?

**A**. 0.1 mol of Pb

**B**. 5.0 mol of H2 gas

**C**. 6.02 x 1023 molecules of H2 gas

**D**. 1.0 mol of C

**Question 12**

 The number of atoms in 3.0 mol of AlCl3 will be

**A**. 3

**B**. 3 x 6.02 x 1023

**C**. 3 x 3 x 6.02 x 1023

**D**. 3 x 4 x 6.02 x 1023

**Question 13**

A molecule has an empirical formula of CH2O and a molar mass of 60 g mol-1. The molecule could be

**A**. ethanol.

**B**. ethanoic acid.

**C**. propanol.

**D**. propanoic acid.

**Question 14**

An alkane is found to be 80 % carbon by mass. The alkane is

**A**. methane.

**B**. ethane.

**C**. propane.

**D**. butane.

**Question 15**

Element X shown in the Lewis diagram above is most likely to be

**A**. oxygen.

**B**. carbon.

**C**. chlorine.

**D**. phosphorous.

**Question 16**

Which two molecules have same empirical formula?

**A**. ethane and butane

**B**. ethene and butene

**C**. pentane and pentene

**D**. ethane and ethene

**Question 17**

Which of the following liquids will form hydrogen bonds?

**A**. ethanol

**B**. chloroethane

**C**. ethane

**D**. 1,2-dichloroethane

**Question 18**

A condensation polymer can be formed when

**A**. the monomer used contains a carbon-to-carbon double bond.

**B**. the monomer used has a functional group on each end.

**C**. the monomer used contains a functional group on at least one end.

**D**. a compound such as ethanol reacts with a compound such as ethanoic acid..

**Question 19**



The systematic name for this molecule is

**A**. 2-ethylhexane

**B**. 2-ethylheptane

**C**. 3-methylheptane

**D**. 3-methylhexane

**Question 20**



The monomer used to produce the polymer segment shown is

**A**. CHCHOH

**B**. CH2CH2OH

**C**. CH2CHOH

**D**. CH3CHOH

**Section A 20 marks \_\_\_\_**

**Total Section B 66 marks \_\_\_\_**

**Total exam 86 marks \_\_\_\_**

**SECTION B – Short-answer questions**

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| **Instructions for Section B** Questions must be answered in the spaces provided in this book.To obtain full marks for your responses you should* give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks.
* show all workings in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of the working.
* make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example, H2(g); NaCl(s)
 |

**Question 1** (6 marks)

New Zealand physicist Ernest Rutherford is famous for his gold foil experiment. An outline of the experiment is shown below, where he directed fast moving, positively charged α-particles at a thin layer of gold foil.

1. Use the template provided to state

 two conclusions Rutherford was able

 to draw from this experiment.

 4 marks

Conclusion 1: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Observation that led to this conclusion.

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Conclusion 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Observation that led to this conclusion:

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**b**. Write the electron configuration of 35Br: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**c**. Use atomic notation to represent an atom of uranium that has 92 protons and 146

 neutrons.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**Question 2** (8 marks)

The Periodic Table can be used to predict the properties of

elements that you might not be familiar with.

The arrow shown on the right is an example of a guide for

predicting properties.

**a. i**. What is ‘first ionisation energy’? 1 mark

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 **ii**. Why does it drop as you move down a group? 2 marks

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**b.** The graph shown refers to one of the above properties.



 Which property is it, and explain why the trend is as shown? 2 marks

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**c.** The Transition Metals are in the middle of the Periodic Table.

 **i**. Explain why there are ten elements in each row of the Periodic Table. 1 mark

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 **ii**. Why are there several rows of Transition metals? 1 mark

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**d**. Name the element in period 4 and group 16. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**Question 3** (10 marks)

A student sets up the experiment ahown to determine the empirical formula of the oxide that forms between magnesium and oxygen. She sits a piece of magnesium ribbon in the crucible and heats it until it starts to burn. The oxide formed is trapped in the crucible. The student’s data is recorded below.

****

mass of crucible: 42.00 g

mass of crucible and magnesium: 42.90 g

mass of crucible and oxide: 43.41 g

**a**. Use the data provided to

 **i**. determine the mass of magnesium \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

 **ii**. determine the mass of oxygen in the oxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

 **iii**. determine the emprical formula of magnesium oxide 2 marks

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 **iv**. You may have found the last step of the previous question on the empirical formula

 difficult. Explain why. 1 mark

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**b**. Use your knowledge of electron configurations to suggest what the empirical formula of

 magnesium oxide should be. Justify your answer. 2 marks

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**c**. List three properties of magnesium oxide. 3 marks

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**Question 4** (8 marks)

**a**. Give the correct name for each of the following ionic compounds

 **i**. Ba(OH)2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **ii**. AgBrO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 **iii**. NH4Cl \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **iv**. Na2CO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**b**. Write a chemical formula for each of the following.

 **i**. sodium oxide \_\_\_\_\_\_\_\_\_\_\_\_ **ii**. sodium hydroxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 iii. aluminium carbonate \_\_\_\_\_\_\_\_ **iv**. calcium iodide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Question 5** (11 marks)

The table below has been produced from the mass spectrum of magnesium.



**a**. Use the axes provided to draw the mass spectrum. 2 marks



**b**. Calculate the relative atomic mass of magnesium from the data provided. 2 marks

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**c**. Use a diagram to explain the structure in a strip of magnesium. 3 marks

**d**. Given a 80 g sample of Mg(OH)2, calculate

 **i**. the amount, in mol, of Mg(OH)2 2 marks

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 **ii**. the amount, in mol, of oxygen atoms 1 mark

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 **iii**. the number of hydrogen atoms. 1 mark

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**Question 6** (8 marks)

Four categories of molecule shapes are shown below.







 **V-shape tetrahedral linear pyramidal**

Use the following molecules to answer this question:

carbon tetrachloride CCl4 water H2O ammonia NH3 carbon dioxide CO2

Each of the above molecules belongs to a different category in the table. Select the correct molecule for each category and draw an electron dot diagram to support your answer.

|  |  |  |
| --- | --- | --- |
| Category | molecule | Electron dot diagram |
| V-shape |  |  |
| Tetrahedral |  |  |
| Linear |  |  |
| Pyramidal |  |  |

**Question 7** (9 marks)

**a. i**. Draw an ethene molecule. 1 mark

 **ii**. What is its empirical formula? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

 **iii**. Use ethene to explain what a homologous series is. 2 marks

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**b**. Ethene can form a polymer.

 **i**. Draw a segment of a polyethene molecule to show what the repeating structure is.

 1 mark

 **ii**. Use the diagram below to discuss the

 structure and properties of the two

 common forms of polyethene.

 4 marks

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**Question 8** (6 marks)

Diamond and graphite are allotropes of carbon. A model of each is shown below.



 graphite diamond

**a**. List the type(s) of forces present in

 **i**. graphite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

 **ii**. diamond \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**b**. Explain why graphite conducts electricity but diamond does not. 2 marks

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**c**. Diamond is one of the hardest substances known yet it is brittle. Explain why. 1 mark

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**d**. Graphite can be used as a lubricant, an unusual property for a solid. Explain how

 graphite acts as a lubricant. 1 mark

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**END OF EXAM**