**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**

The mass of calcium that has the same number of atoms as 20 g of helium will be closest to, in g,

1. 2
2. 40
3. 100
4. 200

**Question 2**

Which of the following is not 1.0 mole of the substance?

**A**. 31 g of phosphorous

**B**. 6.02 × 1023 atoms of oxygen

**C**. 16 g of water, H2O

**D**. 16 g of methane, CH4

**Question 3**

42 g of nitrogen reacts exactly with 96 g of oxygen. The compound formed will be

**A**. NO

**B**. NO2

**C**. N2O

**D**. N2O5

**Question 4**

The principle behind the operation of a mass spectrometer is that

**A**. the larger the atom, the faster it moves.

**B**. the heavier an atom, the harder it to deflect.

**C**. faster atoms will deflect more than slower ones.

**D**. the heavier an atom is, the more its path will bend in a magnetic field.

**SECTION A –** continued

**TURN OVER**

**Question 5**

Select the alternative that gives the best explanation of a mole

**A**. amount of an element that has the same number of particles as 12 g. of carbon-12

**B**. amount of substance that has the same number of particles as 12 g of carbon-12

**C**. amount of a substance that has the same number of particles as 12 g of natural carbon

**D**. 12 grams of any substance

**Question 6**

The formula of glucose is C6H12O6. The mass of 1 mole of glucose will be, in gram,

**A**. 30

**B**. 72

**C**. 144

**D**. 180

**Question 7**

The relative formula mass of ammonium sulfate, (NH4)2SO4 is closest to

**A**. 114

**B**. 114 g

**C**. 132

**D**. 132 g

**Question 8**

A sample of NO2 contains 5.4 × 1024 atoms. The number of mole of NO2 will be

**A**. 3

**B**. 4

**C**. 6

**D**. 9

**Question 9**

In a 1.0 kg sample of methane, the mass of hydrogen will be, in g,

**A**. 250

**B**. 500

**C**. 750

**D**. 800

**SECTION A –** continued

**Question 10**

Which of the following represents the greatest number of mole of oxygen atoms?

**A**. 96 g of oxygen atoms

**B**. 2.5 mole of ozone, O3

**C**. 2.4 × 1024 atoms of oxygen

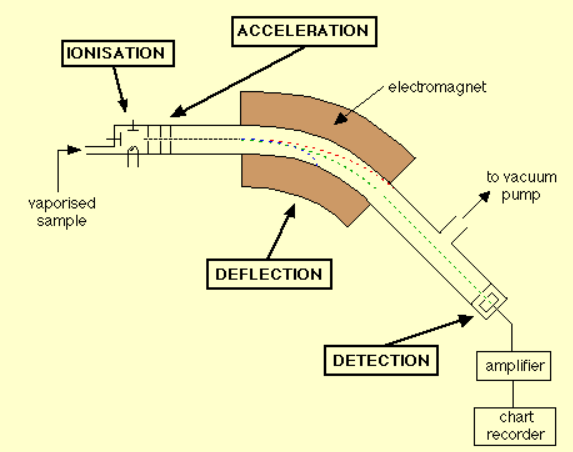
**D**. 72 g of water

**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** (8 marks)

A schematic diagram of a mass spectrometer is shown below.



**a**. Elements can be passed into a mass spectrometer where they become charged.

**i**. What process is used to charge atoms in a mass spectrometer? 1 mark

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**ii**. What two variables determine the degree to which an ion is deflected? 1 mark

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**SECTION B –** continued

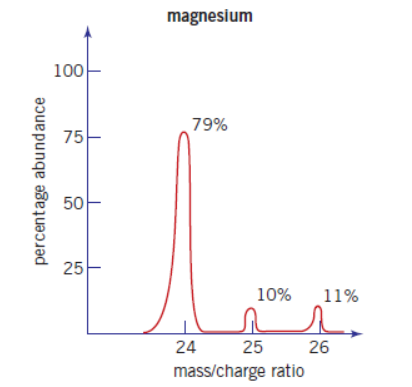
**iii**. When a sample of tin is passed into a mass spectrometer, there are ten different peaks

shown on its spectrum. What does this tell you about the element tin? 1 mark

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**b**. A mass spectrum of magnesium is shown below.



**i**. Use the mass spectrum to complete the table below for magnesium 3 marks

|  |  |  |
| --- | --- | --- |
| Isotope | Relative isotopic mass | Percentage abundance |
|  |  |  |
|  |  |  |
|  |  |  |

**ii**. Use the data provided to determine the relative atomic mass of magnesium. 2 marks

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**SECTION B –** continued

**TURN OVER**

**Question 2** (8 marks)

The following questions refer to carbon dioxide, CO2.

**a**. **i**. Calculate the relative molecular mass of carbon dioxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**ii**. Calculate the molar mass of carbon dioxide. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**b**. Calculate the percentage oxygen in carbon dioxide. 2 marks

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**c**. In 132 g of carbon dioxide,

**i**. how many molecules of carbon dioxide are there? 2 marks

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**ii**. how many atoms are there? 2 marks

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**Question 3** (4 marks)

**a**. Determine the number of mole of sulfur in 200 g 1 mark

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**b**. How many mole of sulfur is 1.28 x 1025 atoms of sulfur? 1 mark

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**c**. Determine the number of mole of sulfur in 128 g of sulfur dioxide 1 mark

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**d**. How many atoms of sulfur in 128 g of sulfur dioxide? 1 mark

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**Question 4** (5 marks)

A 5.232 g sample of a compound contains 1.392 gram of potassium, 1.992 g of oxygen and the remainder is chromium.

**a**. Calculate the empirical formula of this compound. 3 marks

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**b**. What is the percentage mass of oxygen in this compound? 2 marks

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**Question 5** (5 marks)

The molar mass of calcium phosphate, Ca3(PO4)2, is 310.3 gmol-1.

In 500 g, what is the

**a**. number of mole \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**b**. number of mole of phosphorous atoms \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**c**. number of mole of calcium ions \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**d**. number of mole of oxygen atoms \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**e**. number of oxygen atoms \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 mark

**Question 6** (5 marks)

Calculate the mass of

**a**. 3.56 mole of copper

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**b**. 0.50 mole of sulfur dioxide, SO2 2 marks

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**c**. 0.380 mole of barium chloride, BaCl2 2 marks

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**Question 7** (5 marks)

Calculate the number of mole in

**a**. 68.0 g of aluminium

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**b**. 28.4 g of sulfur dioxide, SO2  2 mark

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**c**. 4.50 tonne ( 1 tonne = 106 g) of carbon dioxide, CO2  2 marks

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