**SECTION A: Multiple-choice questions (1 mark each)**

**Question 1**

*Answer:* D

*Explanation:*

Calcium is 10 times heavier than helium (40:4), therefore 200 g of calcium is required to match the number of particles in 20 g of helium.

**Question 2**

*Answer:* C

*Explanation:*

Water has a molar mass of 18 g, so C will not be 1 mole

**Question 3**

*Answer:* B

*Explanation:*

** =** 3:6 = 1:2. Therefore NO2

**Question 4**

*Answer:* B

*Explanation:*

The particles are accelerated into a magnetic field. The heavier the particle, the harder it is to deflect.

**Question 5**

*Answer:* B

*Explanation:*

Although option A is very similar, a mole does not necessarily refer to an element

**Question 6**

*Answer:* D

*Explanation:*

Mass = 16 × 6 + 12 × 1 + 6 ×16 = 180 g

**Question 7**

*Answer:* C

*Explanation:*

Relative formula mass = 14 × 2 + 8 × 1 + 32 + 16 x 4 = 132

This answer will NOT be in grams

**Question 8**

*Answer:* A

*Explanation:*

n =  = 9 mole of atoms

Since each molecule of NO2 contains 3 atoms, the number of mole will be 9/3 = 3

**Question 9**

*Answer:* A

*Explanation:*

% mass of hydrogen in methane =  = 25 %

25% of 1000 = 250 g

**Question 10**

*Answer:* B

*Explanation:*

Each alternative needs to be evaluated

A: 96 g of oxygen = 96/16 = 6 mol

B: 2.5 × 3 = 7.5 mol

C: 2.4 × 1024 atoms is 4 mol

D: 22 g water = 72/18 = 4 mol

**SECTION B: Short-answer questions**

**Question 1** (8 marks)

**a**.  **i**. A beam of electrons is used to bombard a sample and dislodge an electron. This

 creates positive ions. 1 mark

 **ii**. mass and charge of the ion. 1 mark

 **iii**. Tin has ten different isotopes\*. It also tells you the relative abundance of each. 1 mark

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

|  |  |  |
| --- | --- | --- |
| Isotope  | Relative isotopic mass | Percentage abundance |
| Magnesium-24 | 24 | 79 |
| Magnesium-25 | 25 | 10 |
| Magnesium-26 | 26 | 11 |

\* For each correct row

 **ii**. RAM = \* = 24.3\* 2 marks

**Question 2** (8 marks)

**a**. **i**. CO2  = 12 + 16 × 2 = 44 1 mark

 **ii**. 44 g mol-1 1 mark

**b**. percentage oxygen =  \*= 72.7% \* 2 marks

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

 **i**. 132 g =  = 3 mol. \* 2 marks

 3 mol = 3 × 6.02×1023 = 1.81 ×1024 molecules \*

 **ii**. there are 3 atoms in each molecule\* =>

 number of atoms = 3 ×1.81 ×1024 = 5.43 ×1024\* 2 marks

**Question 3** (4 marks)

**a**. n =   = 6.23

1 mark

**b**. n =  = 21.3 mol

1 mark

**c**. n =  = 2 mol \*

1 mark

**d**. n atoms of sulfur = 2 × 6.02 × 1023  = 1.20 × 1024  1 mark

**Question 4** (5 marks)

**a**. \* = 0.0356 :0.1245 :0,0355\* = 1: 3.5:1 = 2:7:2

 formula K2Cr2O7\*

3 marks

**b**. %oxygen = \* =38.1% \* 2 marks

**Question 5** (5 marks)

**a**. number of mole =  =1.62 mol

1 mark

**b**. number of mole of phosphorous atoms = 1.62 × 2 = 3.24 mol

1 mark

**c**. number of mole of calcium ions = 1.62 × 3 = 4.86 mol

1 mark

**d**. number of mole of oxygen atoms = 1.62 × 8 = 12.9 mol

1 mark

**e**. number of oxygen atoms = 12.9 ×6.02 × 1023 = 7.77 × 1024 1 mark

**Question 6** (5 marks)

**a**. 3.56 ×63.5 = 226 g 1 mark

**b**. 0.50 × 64.1\* = 32.1 g\* 2 marks

**c**. 0.38 × (137.3 + 35.5× 2)\* = 79.2 g\* 2 marks

**Question 7** (5 marks)

**a**. n =  =2.52 mol

1 mark

**b**. n = \* = 0.443 mol \*

2 marks

**c**. n =  \*= 1.02 × 105 mol\*

2 marks