

ISOTOPES IN CHEMISTRY



Name : _____

Date : _____

1. Given the following isotopes. Determine the number of protons, neutrons, and electrons and calculate the atomic mass.

a) Carbon-12

b) Oxygen-16

c) Uranium-235

d) Hydrogen-3 (also known as Tritium)

e) Neon-20

f) Iron-56

2. Calculate the atomic mass of elements 'X' and 'Y' from the given information:

i. Isotope X-25 has an abundance of 80% and a mass of 25 amu.
Isotope X-27 has an abundance of 20% and a mass of 27 amu.

ii. Isotope Y-30 has an abundance of 60% and a mass of 30 amu.
Isotope Y-32 has an abundance of 40% and a mass of 32 amu.

3. Answer the following questions:

a) Why do isotopes of an element have different atomic masses?

b) How are isotopes represented in terms of their atomic notation?

c) Discuss one practical application of isotopes in science or industry

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Answers

1. Given the following isotopes. Determine the number of protons, neutrons, and electrons and calculate the atomic mass.

a) Carbon-12

Protons: 6 Neutrons: 6 Electrons: 6 Atomic Mass: 12 amu

b) Oxygen-16

Protons: 8 Neutrons: 8 Electrons: 8 Atomic Mass: 16 amu

c) Uranium-235

Protons: 92 Neutrons: 143 Electrons: 92 Atomic Mass: 235 amu

d) Hydrogen-3 (also known as Tritium)

Protons: 1 Neutrons: 2 Electrons: 1 Atomic Mass: 3 amu

e) Neon-20

Protons: 10 Neutrons: 10 Electrons: 10 Atomic Mass: 20 amu

f) Iron-56

Protons: 26 Neutrons: 30 Electrons: 26 Atomic Mass: 56 amu

2. Calculate the atomic mass of elements 'X' and 'Y' from the given information:

i. Isotope X-25 has an abundance of 80% and a mass of 25 amu.
Isotope X-27 has an abundance of 20% and a mass of 27 amu.

ii. Isotope Y-30 has an abundance of 60% and a mass of 30 amu.
Isotope Y-32 has an abundance of 40% and a mass of 32 amu.

Atomic Mass = (Abundance of Isotope 1 * Mass of Isotope 1) + (Abundance of Isotope 2 * Mass of Isotope 2)

i. Atomic Mass of X = $(0.80 * 25 \text{ amu}) + (0.20 * 27 \text{ amu}) = 20 \text{ amu} + 5.4 \text{ amu} = 25.4 \text{ amu}$

ii. Atomic Mass of Y = $(0.60 * 30 \text{ amu}) + (0.40 * 32 \text{ amu}) = 18 \text{ amu} + 12.8 \text{ amu} = 30.8 \text{ amu}$

3. Answer the following questions:

a) Why do isotopes of an element have different atomic masses?

Isotopes of an element have different atomic masses because they contain a different number of neutrons, which contribute to the overall mass of the atom.

b) How are isotopes represented in terms of their atomic notation?

Isotopes are represented in their atomic notation by indicating the element's name, followed by its mass number and atomic number. For example, Carbon-12 is represented as $^{12}_6\text{C}$

c) Discuss one practical application of isotopes in science or industry

One practical application of isotopes is in radiometric dating, where the decay of isotopes determines the age of archaeological artifacts or geological samples