

What are Isotopes and Isobars?

Worksheet

Isotopes: same element, different mass number (e.g., C and C both have 6 protons, but 6 and 8 neutrons respectively). Isobars: different elements, same mass number (e.g., K and Ar both have mass 40, but different proton counts). Isotopes have different physical properties (half-life, density); isobars are chemically different.

Questions

1. Oxygen-16 (O) has 8 protons. How many neutrons?

- A) 8
- B) 16
- C) 24
- D) 0

2. Carbon-12 and Carbon-14 are

- A) Isobars
- B) Isotopes
- C) Different elements
- D) Noble gases

3. K and Ar have the same

- A) Atomic number
- B) Number of protons
- C) Mass number
- D) Neutron count

4. Why do isotopes of an element have similar chemical properties?

- A) Same mass number
- B) Same neutron count
- C) Same electron count
- D) Same nuclear charge

5. Carbon has three main isotopes: C, C, and C. All have 6 protons. What are their neutron counts?

6. Potassium-40 (K) and Argon-40 (Ar) are isobars. How many protons and neutrons does each have?

7. Why is C radioactive while C is stable?

8. Define: What are isotopes?

9. Define: What are isobars?

10. Define: Example of isotopes?

Answer Key

1. A) $8 - A = Z + N$ $16 = 8 + N$ $N = 8$ neutrons.
2. B) Isotopes - Both have $Z=6$ (carbon), but different mass numbers ($A=12$ vs 14). Isotopes share the same element.
3. C) Mass number - Both have $A=40$ (isobars). K has $Z=19$; Ar has $Z=18$. Different protons, same mass.
4. C) Same electron count - Bonding depends on electrons (Z), not neutrons. Isotopes have the same Z same electron config same chemistry.
5. C: $A = 12$ $Z + N = 12$ $6 + N = 12$ $N = 6$ neutrons C: $A = 13$ $6 + N = 13$ $N = 7$ neutrons C: $A = 14$ $6 + N = 14$ $N = 8$ neutrons All are carbon ($Z=6$); only neutrons differ.
6. K: $Z = 19$ (potassium), $A = 40$ $N = 40 - 19 = 21$ neutrons Ar: $Z = 18$ (argon), $A = 40$ $N = 40 - 18 = 22$ neutrons Same mass number ($A=40$), different elements (Z), different neutrons.
7. Both are carbon ($Z=6$), but C has 8 neutrons ($N=8$), C has 6 ($N=6$). The ratio of neutrons to protons determines stability. C ($N/Z = 1.33$) is outside the stable band unstable, decays C ($N/Z = 1$) is stable no decay
8. Atoms of the same element (same Z) with different numbers of neutrons, and thus different mass numbers (A).
9. Atoms with different atomic numbers (Z) but the same mass number (A). Different elements, same total nucleons.
10. Carbon-12 (C, $6p+6n$) and Carbon-14 (C, $6p+8n$). Same element, different mass.

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