Isotope Practice Worksheet Questions and Answers PDF

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Part 1: Building a Foundation

What defines an isotope of an element?

Hint: Consider the particles that make up an atom.

- ◯ Different number of electrons
- ◯ Different number of protons
- ◯ **Different number of neutrons ✓**
- ◯ Different atomic number

> An isotope is defined by having a different number of neutrons compared to other isotopes of the same element.

Which of the following statements are true about isotopes?

Hint: Think about the characteristics that define isotopes.

- ☐ **Isotopes have the same number of protons. ✓**
- ☐ Isotopes have different atomic numbers.
- ☐ **Isotopes have different mass numbers. ✓**
- ☐ Isotopes have the same number of neutrons.

> Isotopes have the same number of protons but different mass numbers due to varying numbers of neutrons.

Explain how isotopes of an element are similar and how they are different.

Hint: Consider their atomic structure and properties.

Isotopes of an element are similar in that they have the same number of protons and electrons, but they differ in the number of neutrons, which affects their mass and stability.

List two examples of isotopes and their applications.

Hint: Think about common isotopes used in various fields.

1. Example 1 and application

Carbon-14, used in radiocarbon dating.

2. Example 2 and application

Iodine-131, used in thyroid cancer treatment.

Examples include Carbon-14 used in dating archaeological finds and Iodine-131 used in medical treatments.

Part 2: Comprehension and Application

Which isotope is commonly used in carbon dating?

Hint: Consider the isotopes of carbon.

- ◯ Carbon-12
- ◯ Carbon-13
- ◯ **Carbon-14 ✓**
- ◯ Carbon-15

> Carbon-14 is the isotope commonly used in carbon dating due to its radioactive properties.

Which of the following are applications of isotopes?

Hint: Think about various fields where isotopes are utilized.

- [x] **Medical imaging ✓**
- [x] **Archaeological dating ✓**
- [x] **Nuclear energy ✓**
- [ ] Plastic manufacturing

> Isotopes are used in medical imaging, archaeological dating, and nuclear energy.

Describe the role of isotopes in medical diagnostics.

Hint: Consider how isotopes are used in imaging and treatment.

> **Isotopes are used in medical diagnostics for imaging techniques such as PET scans and for treatment in therapies like radiation therapy.**

If an element has an atomic number of 8 and a mass number of 18, how many neutrons does it have?

Hint: Use the formula: Neutrons = Mass number - Atomic number.

- ○ 8
- ○ **10 ✓**
- ○ 18
- ○ 26

> The element has 10 neutrons, calculated by subtractin the atomic number from the mass number.

Which isotopes would be suitable for use in a nuclear reactor?

Hint: Consider the isotopes that are known for their fission properties.

- [x] **Uranium-235 ✓**
- [x] **Uranium-238 ✓**
- [ ] Carbon-14
- [ ] Hydrogen-1

> Uranium-235 and Uranium-238 are suitable for use in nuclear reactors due to their fission capabilities.

Explain how isotopic abundance affects the calculation of atomic weight.

Hint: Consider the average mass of isotopes in a sample.

> **Isotopic abundance affects atomic weight by determining the weighted average of the masses of an element's isotopes based on their relative abundances.**

Part 3: Analysis, Evaluation, and Creation

Which factor primarily determines the stability of an isotope?

Hint: Think about the relationship between protons and neutrons.

- ○ Number of electrons
- ○ **Ratio of protons to neutrons ✓**
- ○ Total number of protons
- ○ Atomic number

> The stability of an isotope is primarily determined by the ratio of protons to neutrons.

Analyze the following isotopes and identify which are likely to be radioactive:

Hint: Consider the stability of the isotopes listed.

- [ ] Carbon-12

- [ ] **Carbon-14 ✓**
- [ ] **Uranium-235 ✓**
- [ ] Helium-4

> Carbon-14 and Uranium-235 are likely to be radioactive, while Carbon-12 and Helium-4 are stable.

Compare and contrast the isotopes Uranium-235 and Uranium-238 in terms of their uses and stability.

Hint: Think about their applications in energy and weapons.

> **Uranium-235 is used as fuel in nuclear reactors and is fissile, while Uranium-238 is more abundant and is used in breeding plutonium but is not fissile.**

Which isotope would be most suitable for treating cancer through radiation therapy?

Hint: Consider isotopes known for their therapeutic properties.

- ◯ **Iodine-131 ✓**
- ◯ Carbon-12
- ◯ Helium-4
- ◯ Oxygen-16

> Iodine-131 is most suitable for treating cancer through radiation therapy due to its ability to target thyroid tissue.

Evaluate the following isotopes for their potential environmental impact:

Hint: Consider the isotopes' radioactivity and stability.

- [ ] **Plutonium-239 ✓**
- [ ] Tritium
- [ ] Lead-206
- [ ] **Radon-222 ✓**

> Plutonium-239 and Radon-222 have significant environmental impacts due to their radioactivity, while Tritium and Lead-206 are less concerning.

Propose a new application for isotopes in technology or industry, explaining the rationale behind your proposal.

Hint: Think about innovative uses of isotopes.

> **A new application could be the use of isotopes in advanced imaging techniques for non-destructive testing in manufacturing, enhancing safety and quality control.**