

Unit 3A Quiz #1: Atomic Structure

Name: _____ **35 total points**

Block: _____ Date: _____

I. Matching: Each scientist may be used once or more than once.

- A. James Chadwick
- B. Ernest Rutherford
- C. Democritus

- D. Louis de Broglie
- E. Neil Bohr
- F. J. J. Thompson

- G. John Dalton
- H. Robert Millikan
- I. Werner Heisenburg

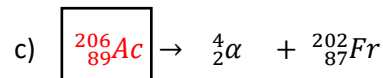
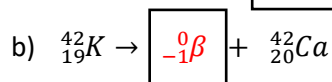
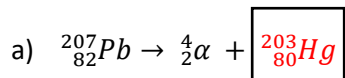
- F 1. Proposed the Plum Pudding Model
- C 2. Argued that matter was composed of “atomos”
- G 3. Claimed “All atoms of a given element are identical in mass and properties.”
- H 4. Performed the Oil Drop Experiment
- F 5. Proved that cathode rays were negatively charged particles
- B 6. Performed the Gold Foil Experiment
- A 7. Bombarded beryllium atoms with alpha particles and noticed neutral particles were produced.
- D 8. Predicted wave functions of electron orbitals
- B 9. Experiment proved atoms have dense positive nucleus
- I 10. Position and the velocity of an object cannot both be measured exactly
- E 11. Proposed the Planetary Model
- G 12. Developed First Atomic Theory
- E 13. Proposed that energy is transferred only in certain well defined quantities.

II. Short Answer and Fill-in-the-Blank.

- 1. The mass number of an atom is equal to the number of protons and neutrons in the nucleus.
- 2. Which two subatomic particles are relatively the same size? protons and neutrons
- 3. In order for an atom to be neutral, the number of protons must equal the number of electrons.
- 4. Explain what isotopes are and draw examples in the space below. Isotopes are atoms that have equal number protons but a different number of neutrons. $^{12}_6\text{C}$ $^{13}_6\text{C}$ $^{14}_6\text{C}$
- 5. An isotope with an atomic number of 10 and a mass number of 22 would belong to which element? Neon
- 6. How many neutrons are present in an isotope of $^{30}_{14}\text{Si}$? 16
- 7. What is the isotopic notation for an atom containing 19 protons, 20 neutrons, and 18 electrons? $^{39}_{19}\text{K}^{+1}$

8. Write the complete isotopic notation for a sulfur atom with 50 subatomic particles. ${}^{34}_{16}\text{S}$

9. Balance the following nuclear equations:



III. Calculations - Must show work to earn credit.

1. An element has one stable isotope with a relative mass of 68.9257 amu at 60.4% abundance and another stable isotope with a relative mass of 70.9249 amu at 39.6% abundance. Calculate its average atomic mass to two decimal places, and identify the element using the periodic table.

$$AAM = (68.9257 \times 0.604) + (70.9249 \times 0.396) = 69.7$$

Gallium is 69.72 amu

2. Silver exists as two stable isotopes and has an atomic mass of 107.868. Silver-107 makes up 51.839% of all naturally occurring silver atoms. What is the mass of the other isotope to three significant figures?

$$100\% - 51.839\% = 48.161\%$$

$$107.868 = (107 \times 0.51839) + (Mass \times 0.48161)$$

$$\frac{107.868 - (107 \times 0.51839)}{0.48161} = Mass = 108.8 \text{ amu} \approx 109 \text{ amu}$$

3. Carbon-14, a radioactive isotope with a half-life of 5730 years, is used to date ancient artifacts. How old is an artifact, if three half-lives have occurred?

$$5730 \times 3 = 17,190 \text{ years old}$$

4. How many half-lives will it take for 150 g of radioactive Californium-252 to decay to *less than 15 grams*?

$$150 \rightarrow 75 \rightarrow 37.5 \rightarrow 18.75 \rightarrow 9.375 \quad 4 \text{ half-lives}$$

5. Bromine (Br) has two stable isotopes, ${}^{79}\text{Br}$ and ${}^{81}\text{Br}$, and 30 known radioisotopes, the most stable of which is ${}^{77}\text{Br}$, with a half-life of 57.036 hours. If a 120 gram sample of ${}^{77}\text{Br}$ was tested after 285.18 hours, how many half-lives have passed?

$$285.18 \text{ hr} \div 57.036 \text{ hr} = 5 \text{ half-lives have passed}$$