

## CHAPTER 4

## STUDY GUIDE FOR CONTENT MASTERY

## Section 4.3 How Atoms Differ

In your textbook, read about atomic number.

For each statement below, write *true* or *false*.

1. The number of neutrons in an atom is referred to as its atomic number.  
false
2. The periodic table is arranged by increasing atomic number.  
true
3. Atomic number is equal to the number of electrons in an atom.  
true
4. The number of protons in an atom identifies it as an atom of a particular element.  
true
5. Most atoms have either a positive or a negative charge.  
false

Answer the following questions.

6. Lead has an atomic number of 82. How many protons and electrons does lead have?  
82 protons; 82 electrons
7. Oxygen has 8 electrons. How many protons does oxygen have? 8 protons
8. Zinc has 30 protons. What is its atomic number? 30
9. Astatine has 85 protons. What is its atomic number? 85
10. Rutherfordium has an atomic number of 104. How many protons and electrons does it have?  
104 protons; 104 electrons
11. Polonium has an atomic number of 84. How many protons and electrons does it have?  
84 protons; 84 electrons
12. Nobelium has an atomic number of 102. How many protons and electrons does it have?  
102 protons; 102 electrons

In your textbook, read about isotopes and mass number.

Determine the number of protons, electrons, and neutrons for each isotope described below.

13. An isotope has atomic number 19 and mass number 39.  
19 protons, 19 electrons, 20 neutrons
14. An isotope has 14 electrons and a mass number of 28.  
14 protons, 14 electrons, 14 neutrons
15. An isotope has 21 neutrons and a mass number of 40.  
19 protons, 19 electrons, 21 neutrons

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16. An isotope has an atomic number 51 and a mass number 123.  
51 protons, 51 electrons, 72 neutrons

Answer the following question.

17. Which of the isotopes in problems 13–16 are isotopes of the same element? Identify the element.  
The two isotopes with atomic number 19 are both isotopes of potassium.

Write each isotope below in symbolic notation. Use the periodic table to determine the atomic number of each isotope.

18. neon-22  ${}_{10}^{22}\text{Ne}$
19. helium  ${}_{2}^4\text{He}$
20. cesium-133  ${}_{55}^{133}\text{Cs}$
21. uranium-234  ${}_{92}^{234}\text{U}$

Label the mass number and the atomic number on the following isotope notation.

22. mass number  $\overbrace{24}^{\text{Mg}}$
23. atomic number  $\underbrace{12}_{\text{Mg}}$

In your textbook, read about mass of individual atoms.

Circle the letter of the choice that best completes the statement.

24. The mass of an electron is
  - a. smaller than the mass of a proton.
  - b. smaller than the mass of a neutron.
  - c. a tiny fraction of the mass of an atom.
  - d. all of the above.
25. One atomic mass unit is
  - 1/12 the mass of a carbon-12 atom.
  - 1/16 the mass of an oxygen-16 atom.
  - exactly the mass of one proton.
  - approximately the mass of one proton plus one neutron.

26. The atomic mass of an atom is usually not a whole number because it accounts for

- a. only the relative abundance of the atom's isotopes.
- b. only the mass of each of the atom's isotopes.
- c. the mass of the atom's electrons.
- d. both the relative abundance and the mass of each of the atom's isotopes.

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Use the figures to answer the following questions.

Osmium 76 Os 190.2	Niobium 41 Nb 92.906
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27. What is the atomic number of osmium? 76
28. What is the chemical symbol for niobium? Nb
29. What is the atomic mass of osmium? 190.2
30. What units is the atomic mass reported in? atomic mass units
31. How many protons and electrons does an osmium atom have? A niobium atom?  
**osmium: 76 protons, 76 electrons; niobium: 41 protons, 41 electrons**

Calculate the atomic mass of each element described below. Then use the periodic table to identify each element.

Isotope	Mass (amu)	Percent Abundance
<sup>63</sup> X	62.930	69.17
<sup>65</sup> X	64.928	30.83

Mass contribution = (mass)(percent abundance)

<sup>63</sup>X: (62.930 amu)(69.17%) = 43.53 amu

<sup>65</sup>X: (64.928 amu)(30.83%) = 20.02 amu

Atomic mass of X = 43.53 amu + 20.02 amu = 63.55 amu

The element is copper.

Isotope	Mass (amu)	Percent Abundance
<sup>35</sup> X	34.969	75.77
<sup>37</sup> X	36.966	24.23

Mass contribution = (mass)(percent abundance)

<sup>35</sup>X: (34.969 amu)(75.77%) = 26.50 amu

<sup>37</sup>X: (36.966 amu)(24.23%) = 8.957 amu

Atomic mass of X = 26.50 amu + 8.957 amu = 35.46 amu

The element is chlorine.

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**Section 4.4 Changes to the Nucleus—Nuclear Reactions**

In your textbook, read about radioactivity.

For each item in Column A, write the letter of the matching item in Column B.

**Column A**

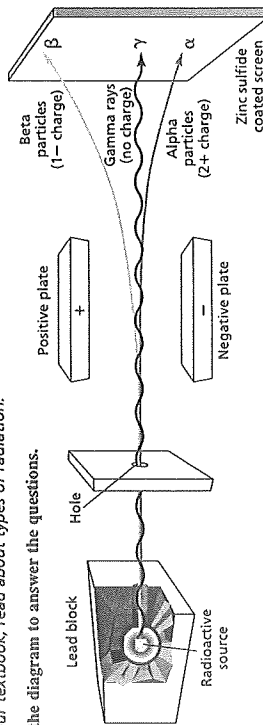
- C** \_\_\_\_\_ 1. The rays and particles that are emitted by a radioactive material
- a** \_\_\_\_\_ 2. A reaction that involves a change in an atom's nucleus
- d** \_\_\_\_\_ 3. The process in which an unstable nucleus loses energy spontaneously
- b** \_\_\_\_\_ 4. Fast-moving electrons

**Column B**

- a.** nuclear reaction
- b.** beta radiation
- c.** radiation
- d.** radioactive decay

In your textbook, read about types of radiation.

Use the diagram to answer the questions.



5. Which plate do the beta particles bend toward? Explain.  
**the positive plate, because beta particles are negatively charged**

6. Explain why the gamma rays do not bend.  
**Gamma rays have no charge.**

7. Explain why the path of the beta particles bends more than the path of the alpha particles.  
**The beta particles have less mass than the alpha particles and are more greatly affected by the electric field.**

Complete the following table of the characteristics of alpha, beta, and gamma radiation.

Radiation Type	Composition	Symbol	Mass (amu)	Charge
8. Alpha	Helium nuclei, or alpha particles	${}^4_2\text{He}$	4	2+
9. Beta	Electrons, or beta particles	${}^0_{-1}\beta$	1/1840	1-
10. Gamma	High-energy electromagnetic radiation	${}^0_0\gamma$	0	0