

The Structure of the Atom

Section 4.1 Early Theories of Matter

In your textbook, read about the philosophers, John Dalton, and defining the atom.

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

- _____ 1. Ancient philosophers regularly performed controlled experiments.
- _____ 2. Philosophers formulated explanations about the nature of matter based on their own experiences.
- _____ 3. Both Democritus and Dalton suggested that matter is made up of atoms.
- _____ 4. Dalton's atomic theory stated that atoms separate, combine, or rearrange in chemical reactions.
- _____ 5. Dalton's atomic theory stated that matter is mostly empty space.
- _____ 6. Dalton was correct in thinking that atoms could not be divided into smaller particles.
- _____ 7. Dalton's atomic theory stated that atoms of different elements combine in simple whole-number ratios to form compounds.
- _____ 8. Dalton thought that all atoms of a specific element have the same mass.
- _____ 9. Democritus proposed that atoms are held together by chemical bonds, but no one believed him.
- _____ 10. Dalton's atomic theory was based on careful measurements and extensive research.
- _____ 11. There are no instruments powerful enough to magnify atoms so that they can be seen.
- _____ 12. The smallest particle of an element that retains the properties of that element is called an atom.

CHAPTER 4 STUDY GUIDE FOR CONTENT MASTERY

Section 4.2 Subatomic Particles and the Nuclear Atom

In your textbook, read about discovering the electron and the nuclear atom.

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

Column A

- _____ 1. Proposed the nuclear atomic model
- _____ 2. Determined the mass-to-charge ratio of an electron
- _____ 3. Calculated the mass of an electron

Column B

- a. Thomson
- b. Millikan
- c. Rutherford

Draw and label a diagram of each atomic model.

- 4. plum pudding model

- 5. nuclear atomic model

In your textbook, read about the discovery of protons and neutrons.

Complete the following table of proton, electron, and neutron characteristics.

Particle	Symbol	Location	Relative Charge	Relative Mass
6. Proton				
7.	n^0			
8.				1/1840

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

Answer the following questions.

6. Lead has an atomic number of 82. How many protons and electrons does lead have?

7. Oxygen has 8 electrons. How many protons does oxygen have? _____

8. Zinc has 30 protons. What is its atomic number? _____

9. Astatine has 85 protons. What is its atomic number? _____

10. Rutherfordium has an atomic number of 104. How many protons and electrons does it have?

11. Polonium has an atomic number of 84. How many protons and electrons does it have?

12. Nobelium has an atomic number of 102. How many protons and electrons does it have?

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.

14. An isotope has 14 electrons and a mass number of 28.

15. An isotope has 21 neutrons and a mass number of 40.

Section 4.3 *continued*

16. An isotope has an atomic number 51 and a mass number 123.
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Answer the following question.

17. Which of the isotopes in problems 13–16 are isotopes of the same element? Identify the element.
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Write each isotope below in symbolic notation. Use the periodic table to determine the atomic number of each isotope.

18. neon-22 _____

20. cesium-133 _____

19. helium _____

21. uranium-234 _____

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

22. _____ \rightarrow $^{24}_{12}\text{Mg}$

23. _____ \rightarrow

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
- smaller than the mass of a proton.
 - smaller than the mass of a neutron.
 - a tiny fraction of the mass of an atom.
 - 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
- only the relative abundance of the atom's isotopes.
 - only the mass of each of the atom's isotopes.
 - the mass of the atom's electrons.
 - both the relative abundance and the mass of each of the atom's isotopes.

CHAPTER 4**STUDY GUIDE FOR CONTENT MASTERY****Section 4.3** *continued*

Use the figures to answer the following questions.

Osmium
76
Os
190.2

Niobium
41
Nb
92.906

27. What is the atomic number of osmium? _____
28. What is the chemical symbol for niobium? _____
29. What is the atomic mass of osmium? _____
30. What units is the atomic mass reported in? _____
31. How many protons and electrons does an osmium atom have? A niobium atom?

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

32.

Isotope	Mass (amu)	Percent Abundance
^{63}X	62.930	69.17
^{65}X	64.928	30.83

33.

Isotope	Mass (amu)	Percent Abundance
^{35}X	34.969	75.77
^{37}X	36.966	24.23