

Name: _____

Chapter 1: Atomic Review

-
- _____ 1. According to the modern model of the atom, the nucleus of an atom is surrounded by one or more
- 1) **electrons** 3) positrons
2) neutrons 4) protons
- _____ 2. Compared to the charge of a proton, the charge of an electron has
- 1) a greater magnitude and the same sign
2) a greater magnitude and the opposite sign
3) the same magnitude and the same sign
4) **the same magnitude and the opposite sign**
- _____ 3. Which particle has *no* charge?
- 1) electron 3) positron
2) **neutron** 4) proton
- _____ 4. What is the approximate mass of a proton?
- 1) **1 u** 3) 1 g
2) 0.0005 u 4) 0.0005 g
- _____ 5. What is the overall charge of an ion that has 12 protons, 10 electrons, and 14 neutrons?
- 1) 2- 2) **2+** 3) 4- 4) 4+
- _____ 6. Which phrase describes an atom?
- 1) a negatively charged nucleus surrounded by positively charged protons
2) a negatively charged nucleus surrounded by positively charged electrons
3) a positively charged nucleus surrounded by negatively charged protons
4) **a positively charged nucleus surrounded by negatively charged electrons**
- _____ 7. Which particles have approximately the same mass?
- 1) an electron and an alpha particle
2) an electron and a proton
3) a neutron and an alpha particle
4) **a neutron and a proton**
- _____ 8. As a result of the gold foil experiment, it was concluded that an atom
- 1) contains protons, neutrons, and electrons
2) **contains a small, dense nucleus**
3) has positrons and orbitals
4) is a hard, indivisible sphere
- _____ 9. The gold foil experiment led to the conclusion that each atom in the foil was composed mostly of empty space because most alpha particles directed at the foil
- 1) **passed through the foil**
2) remained trapped in the foil
3) were deflected by the nuclei in gold atoms
4) were deflected by the electrons in gold atoms
- _____ 10. Which conclusion was a direct result of the gold foil experiment?
- 1) **An atom is mostly empty space with a dense, positively charged nucleus.**
2) An atom is composed of at least three types of subatomic particles.
3) An electron has a positive charge and is located inside the nucleus.
4) An electron has properties of both waves and particles.
- _____ 11. All phosphorus atoms have the same
- 1) **atomic number**
2) mass number
3) number of neutrons plus the number of electrons
4) number of neutrons plus the number of protons
- _____ 12. Which electron configuration represents the electrons in an atom of Ga in an excited state?
- 1) 2-8-17-3 3) 2-8-18-3
2) **2-8-17-4** 4) 2-8-18-4
- _____ 13. Which quantity represents the number of protons in an atom?
- 1) **atomic number**
2) oxidation number
3) number of neutrons
4) number of valence electrons
- _____ 14. What is the charge of the nucleus of an oxygen atom?
- 1) 0 2) -2 3) **+8** 4) +16
- _____ 15. An atom of any element must contain
- 1) an equal number of protons and neutrons
2) **an equal number of protons and electrons**
3) more electrons than neutrons
4) more electrons than protons
- _____ 16. In an atom of argon-40, the number of protons
- 1) **equals the number of electrons**
2) equals the number of neutrons
3) is less than the number of electrons
4) is greater than the number of electrons
- _____ 17. Which quantity can vary among atoms of the same element?
- 1) **mass number**
2) atomic number
3) number of protons
4) numbers of electrons
-

18. What is the mass number of a carbon atom that contains six protons, eight neutrons, and six electrons?

- 1) 6 2) 8 **3) 14** 4) 20

19. The mass of 12 protons is approximately equal to

- 1) 1 atomic mass unit
2) 12 atomic mass units
3) the mass of 1 electron
4) the mass of 12 electrons

20. The greatest composition by mass in an atom of $^{17}_8\text{O}$ is due to the total mass of its

- 1) electrons 3) positrons
2) neutrons 4) protons

21. The numbers of protons and neutrons in each of four different atoms are shown in the table below.

**Protons and Neutrons in
Four Different Atoms**

Atom	Number of Protons	Number of Neutrons
A	8	8
D	9	9
E	9	10
G	10	10

Which two atoms represent isotopes of the same element?

- 1) A and D **3) E and D**
2) A and G 4) E and G

22. The table below indicates the stability of six nuclides.

Stability of Six Nuclides

Nuclide	Stability
C-12	stable
C-14	unstable
N-14	stable
N-16	unstable
O-16	stable
O-19	unstable

All atoms of the unstable nuclides listed in this table have

- 1) an odd number of neutrons
2) an odd number of protons
3) more neutrons than protons
4) more protons than neutrons

23. Atoms of different isotopes of the same element differ in their total number of

- 1) electrons 3) protons
2) neutrons 4) valence electrons

24. The nucleus of an atom of cobalt-58 contains

- 1) 27 protons and 31 neutrons**
2) 27 protons and 32 neutrons
3) 59 protons and 60 neutrons
4) 60 protons and 60 neutrons

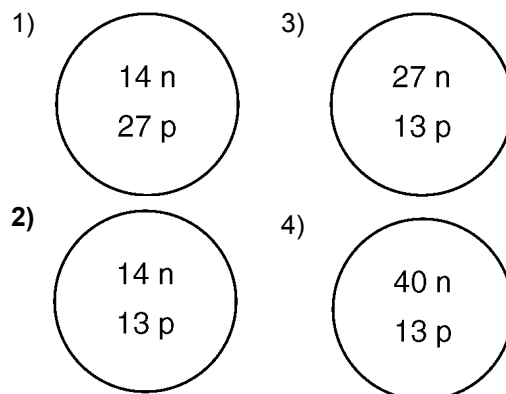
25. What is the total number of neutrons in an atom of O-18?

- 1) 18 2) 16 **3) 10** 4) 8

26. Which isotopic notation represents an atom of carbon-14?

- 1) ^6_8C 2) ^8_6C 3) $^{6}_{14}\text{C}$ **4) $^{14}_6\text{C}$**

27. Which diagram represents the nucleus of an atom of $^{27}_{13}\text{Al}$?



28. Which notation represents an atom of sodium with an atomic number of 11 and a mass number of 24?

- 1) $^{24}_{11}\text{Na}$** 3) $^{13}_{11}\text{Na}$
2) $^{11}_{24}\text{Na}$ 4) $^{35}_{11}\text{Na}$

29. What information is necessary to determine the atomic mass of the element chlorine?

- 1) the atomic mass of each artificially produced isotope of chlorine, only
2) the relative abundance of each naturally occurring isotope of chlorine, only
3) the atomic mass and the relative abundance of each naturally occurring isotope of chlorine
4) the atomic mass and the relative abundance of each naturally occurring and artificially produced isotope of chlorine

-
30. The atomic mass of element A is 63.6 atomic mass units. The only naturally occurring isotopes of element A are A-63 and A-65. The percent abundances in a naturally occurring sample of element A are closest to
- 1) 31% A-63 and 69% A-65
 - 2) 50% A-63 and 50% A-65
 - 3) **69% A-63 and 31% A-65**
 - 4) 100% A-63 and 0% A-65
31. The average isotopic mass of chlorine is 35.5. Which mixture of isotopes (shown as percents) produces this average mass?
- 1) 50% ^{12}C and 50% ^{13}C
 - 2) 50% ^{35}Cl and 50% ^{37}Cl
 - 3) **75% ^{35}Cl and 25% ^{37}Cl**
 - 4) 75% ^{12}C and 25% ^{13}C
32. An orbital is defined as a region of the most probable location of
- 1) **an electron**
 - 2) a neutron
 - 3) a nucleus
 - 4) a proton
33. Which atom in the ground state has an outermost electron with the most energy?
- 1) **Cs**
 - 2) K
 - 3) Li
 - 4) Na
34. Compared to an electron in the first electron shell of an atom, an electron in the third shell of the same atom has
- 1) less mass
 - 2) less energy
 - 3) more mass
 - 4) **more energy**
-

35. Given the table below that shows student's examples of proposed models of the atom:

Proposed Models of the Atom

Model	Location of Protons	Location of Electrons
A	in the nucleus	specific shells
B	in the nucleus	#174 ions of most probable location
C	dispersed throughout the atom	specific shells
D	dispersed throughout the atom	#174 ions of most probable location

Which model correctly describes the locations of protons and electrons in the wave-mechanical model of the atom?

- 1) A **2) B** 3) C 4) D

36. An electron in a sodium atom gains enough energy to move from the second shell to the third shell. The sodium atom becomes

- 1) a positive ion
2) a negative ion
3) an atom in an excited state
4) an atom in the ground state

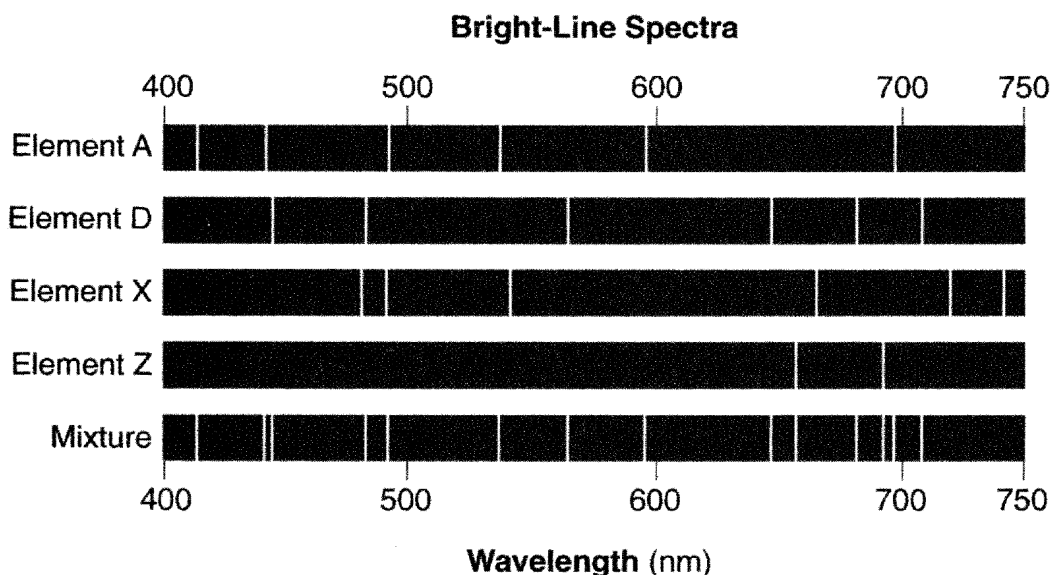
37. A bromine atom in an excited state could have an electron configuration of

- 1) 2-8-18-6 3) 2-8-17-7
2) 2-8-18-7 **4) 2-8-17-8**

38. Which electron configuration is possible for a nitrogen atom in the excited state?

- 1) 2-5 **2) 2-4-1** 3) 2-6 4) 2-4
-

39. The diagram below represents the bright-line spectra of four elements and a bright-line spectrum produced by a mixture of three of these elements.



Which element is *not* present in the mixture?

- 1) A 2) D 3) X 4) Z

40. The bright-line spectrum of an element in the gaseous phase is produced as

- 1) protons move from lower energy states to higher energy states
- 2) protons move from higher energy states to lower energy states
- 3) electrons move from lower energy states to higher energy states
- 4) **electrons move from higher energy states to lower energy states**

41. Which electron configuration represents the electrons of an atom in an excited state?

- 1) 2-8-1 3) **2-8-17-6**
- 2) 2-8-6 4) 2-8-18-5

42. In the wave-mechanical model of the atom, an orbital is defined as

- 1) a region of the most probable proton location
- 2) **a region of the most probable electron location**
- 3) a circular path traveled by a proton around the nucleus
- 4) a circular path traveled by an electron around the nucleus

43. According to the electron-cloud model of the atom, an orbital is a

- 1) circular path traveled by an electron around the nucleus
- 2) spiral path traveled by an electron toward the nucleus
- 3) region of the most probable proton location
- 4) **region of the most probable electron location**

44. Compared to the energy and charge of the electrons in the first shell of a Be atom, the electrons in the second shell of this atom have

- 1) less energy and the same charge
- 2) less energy and a different charge
- 3) **more energy and the same charge**
- 4) more energy and a different charge

45. Which electron configuration represents a selenium atom in an excited state?

- 1) 2-7-18-6 3) 2-8-18-6
- 2) **2-7-18-7** 4) 2-8-18-7

46. Base your answer to the following question on the information below and on your knowledge of chemistry.

Illuminated **EXIT** signs are used in public buildings such as schools. If the word **EXIT** is green, the sign may contain the radioisotope tritium, hydrogen-3. The tritium is a gas sealed in glass tubes. The emissions from the decay of the tritium gas cause a coating on the inside of the tubes to glow.

State, in terms of neutrons, how an atom of tritium *differs* from an atom of hydrogen-1.

Base your answers to questions 47 through 50 on the information below and on your knowledge of chemistry.

A student compares some models of the atom. These models are listed in the table below in order of development from top to bottom.

Models of the Atom

Model	Observation	Conclusion
Dalton model	Matter is conserved during a chemical reaction.	Atoms are hard, indivisible spheres of different sizes.
Thomson model	Cathode rays are deflected by magnetic/electric fields.	Atoms have small, negatively charged particles as part of their internal structure.
Rutherford model	Most alpha particles pass straight through gold foil but a few are deflected.	An atom is mostly empty space with a small,dense,positively as part of their nucleus.
Bohr model	Unique spectral lines are emitted by excited gaseous elements.	Packets of energy are absorbed or emitted by atoms when an electron changes shells.

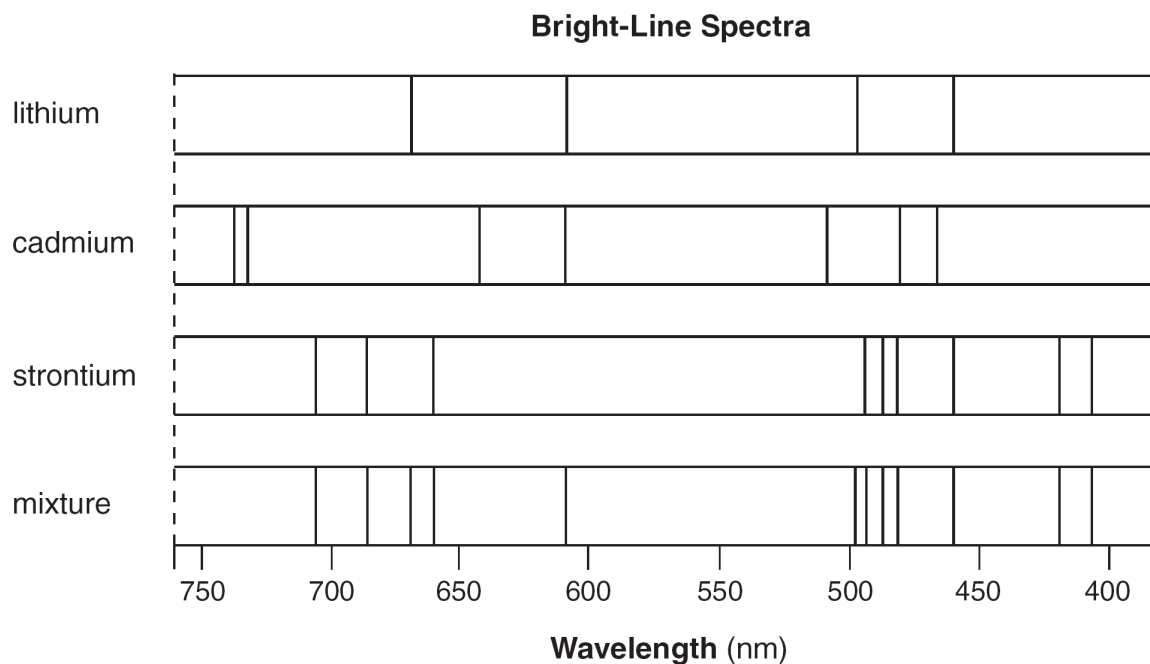
47. State *one* way in which the Bohr model agrees with the Thomson model.

48. Using the conclusion from the Rutherford model, identify the charged subatomic particle that is located in the nucleus.

49. State *one* conclusion about the internal structure of the atom that resulted from the gold foil experiment.

50. State the model that first included electrons as subatomic particles.

Base your answers to questions **51** through **53** on the information below.
The bright-line spectra for three elements and a mixture of elements are shown below.



- _____ 51. State the total number of valence electrons in a cadmium atom in the ground state.
- _____ 52. Identify *all the elements in the mixture*.
- _____ 53. Explain, in terms of *both electrons and energy*, how the bright-line spectrum of an element is produced.
- _____ 54. Explain, in terms of protons and neutrons, why U-235 and U-238 are different isotopes of uranium.

Base your answers to questions **55** and **56** on the information below.

In the gold foil experiment, a thin sheet of gold was bombarded with alpha particles. Almost all the alpha particles passed straight through the foil. Only a few alpha particles were deflected from their original paths.

- _____ 55. Explain, in terms of charged particles, why some of the alpha particles were deflected.
- _____ 56. State *one* conclusion about atomic structure based on the observation that almost all alpha particles passed straight through the foil.
- _____ 57. Naturally occurring boron is composed of two isotopes. The percent abundance and the mass of each isotope are listed below.
- 19.9% of the boron atoms have a mass of 10.013 atomic mass units.
 - 80.1% of the boron atoms have a mass of 11.009 atomic mass units.
- Calculate the atomic mass of boron. Your response must include *both* a correct numerical setup and the calculated result.

_____ atomic mass units

Answer Key

Chapter 1 Atomic

1. 1
2. 4
3. 2
4. 1
5. 2
6. 4
7. 4
8. 2
9. 1
10. 1
11. 1
12. 2
13. 1
14. 3
15. 2
16. 1
17. 1
18. 3
19. 2
20. 2
21. 3
22. 3
23. 2
24. 1
25. 3
26. 4
27. 2
28. 1
29. 3
30. 3
31. 3
32. 1
33. 1
34. 4
35. 2
36. 3
37. 4
38. 2
39. 3
40. 4
41. 3
42. 2
43. 4
44. 3
45. 2
46. –A tritium atom has two neutrons and an H-1 atom has no neutrons. –Only the tritium atom has neutrons. –H-1 has no neutrons.
47. –Atoms have electrons. –Atoms have small, negatively charged particles. –Both models show an internal structure. –Atoms are neutral.
48. –proton $-p$ $-p^+$ $-1p$ -1^1H $-H^+$
49. –An atom is mainly empty space. –It has a nucleus. –The small, dense nucleus is positively charged.
50. –Thomson model
–Thomson –plum pudding model
51. – 2
52. – lithium and strontium
53. – When electrons in an excited state return to a lower energy state, specific amounts of energy are emitted. These energies are associated with specific wavelengths of light that are characteristic of the bright-line spectrum of an element. – Energy is emitted when excited electrons fall back to lower shells.
54. – A U-235 atom has 92 protons and 143 neutrons, and a U-238 atom has 92 protons and 146 neutrons. – A U-235 atom and a U-238 atom have the same number of protons but a different number of neutrons.
55. –Alpha particles are positive and are repelled by the nucleus that is also positive.
–Both protons and alpha particles are positively charged so they repel each other.
–Protons and alpha particles have the same charge.
56. Atoms are mostly empty space
57. • *Correct Numerical Setup Examples:*
— $(10.013)(0.199) + (11.009)(0.801)$
— $\frac{(19.9)(10.013) + (80.1)(11.009)}{100}$

— $(10.013)(19.9\%) + (11.009)(80.1\%)$
• *Calculated Result Examples:* —10.8 atomic mass units;
—10.81 atomic mass units; —10.8108 atomic mass units