**Testbank**

to accompany

**Chemistry 4e**

by

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**Chapter 1**

**The atom**

**True/False questions**

1. Removing an electron from a sodium atom (Na) gives the Na – anion.

a. True

\*b. False

*Answer: b*

*Learning objective 1.1 - define atoms, molecules, ions, elements and compounds.*

2. Adding an electron to a fluorine atom (F) gives the F– anion.

\*a. True

b. False

*Answer: a*

*Learning objective 1.1 - define atoms, molecules, ions, elements and compounds.*

3. In a chemical reaction, no detectable gain or loss of mass occurs.

\*a. True

b. False

*Answer: a*

*Learning objective 1.2 - explain how the concept of atoms developed.*

4. In Dalton’s atomic theory, atoms are destructible and can be broken down into separate parts.

a. True

\*b. False

*Answer: b*

*Learning objective 1.2 - explain how the concept of atoms developed.*

5. In a given chemical compound, the elements are always combined in the same proportions by mass.

\*a. True

b. False

*Answer: a*

*Learning objective 1.2 - explain how the concept of atoms developed.*

6. The charge of an electron was determined by Ernest Rutherford.

a. True

\*b. False

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

7. Protons are positively charged subatomic particles.

\*a. True

b. False

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

8. Neutrons are negatively charged subatomic particles.

a. True

\*b. False

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

9. All atoms possess the same number of protons, but are distinguished by the difference in the number of electrons.

a. True

\*b. False

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

10. All carbon atoms possess the same number of protons, but are distinguished by the difference in the number of neutrons.

\*a. True

b. False

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

11. All carbon atoms possess the same atomic number, but are distinguished by the difference in the number of protons.

a. True

\*b. False

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

12. Mendeleev devised his periodic table by ordering the elements according to their atomic number.

a. True

\*b. False

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

13. Arsenic has a higher atomic mass than gold.

a. True

\*b. False

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

14. Sulfur has a higher atomic mass than boron.

\*a. True

b. False

*Answer: a*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

15. Metals are good conductors of heat and electricity.

\*a. True

b. False

*Answer: a*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

16. All gold atoms which exist possess the same number of protons.

\*a. True

b. False

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

17. The symbol for the element, potassium, is Po.

a. True

\*b. False

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

18. The symbol for the element, tungsten, is W.

\*a. True

b. False

*Answer: a*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

19. The symbol for the element, tin, is Ti.

a. True

\*b. False

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

20. Carbon has a higher atomic number than copper.

a. True

\*b. False

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

21. The element, rutherfordium (Rf), was discovered by Ernest Rutherford.

a. True

\*b. False

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

22. The element, erbium (Er), was named after the Swedish town of Ytterby.

\*a. True

b. False

*Answer: a*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

**Multiple-choice questions**

23. Which of the following is NOT a subatomic particle?

a. Proton

\*b. Boron

c. Electron

d. Neutron

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

24. Which of the following subatomic particles is positively charged?

\*a. Proton

b. Neutron

c. Electron

d. All of the above

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

25. Which of the following subatomic particles is negatively charged?

a. Proton

b. Neutron

\*c. Electron

d. All of the above

*Answer: c*

*Learning objective 1.3 - describe the structure of the atom.*

26. Which of the following contributes to the charge but does NOT contribute significantly to the mass of an atom?

\*a. Electron

b. Neutron

c. Proton

d. Photon

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

27. Polonium exists in nature in the form of several isotopes; the different isotopes have different:

a. atomic numbers.

b. charges.

c. numbers of protons.

\*d. numbers of neutrons.

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

28. Which answer below best describes all atoms of a given isotope of a particular element?

a. They posses the same number of neutrons.

b. They possess the same number of electrons.

c. They possess the same numbers of protons.

\*d. All of the above.

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

29. Which answer below best describes all atoms of a particular element?

a. They possess the same atomic mass, the same number of electrons, the same atomic number, but nothing else in common.

\*b. They possess the same number of electrons, the same atomic number, the same chemical properties, but not necessarily the same mass.

c. They possess the same chemical properties and the same mass, but nothing else in common.

d. They possess the same atomic number and the same mass, but have nothing else in common.

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

30. Which atom shown below has 24 neutrons?

a. 

b. 

c. 

\*d. 

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

31. Which atom shown below has 24 protons?

\*a. 

b. 

c. 

d. 

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

32. The atom, , has the same number of neutrons as:

a. 

b. 

c. 

\*d. 

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

33. Consider the atoms of  and . Both of these atoms have the same:

a. number of electrons.

b. mass number.

c. number of protons.

\*d. number of neutrons.

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

34. Compare  and . In what respect do these atoms differ?

a. Number of electrons **and** number of protons

b. Number of neutrons **and** number of protons

\*c. Mass number **and** number of protons

d. Mass number **and** number of electrons

*Answer: c*

*Learning objective 1.3 - describe the structure of the atom.*

35. Consider the atoms of 59Co and 60Co. Both of these atoms have the same:

a. number of electrons.

b. mass number.

c. number of neutrons.

\*d. number of protons.

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

36. Consider the atoms of 65Cu and 65Zn. Both of these atoms have the same:

a. number of electrons.

\*b. mass number.

c. number of neutrons.

d. number of protons.

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

37. A neutral iodine atom has an mass number of 131. Which description below fits this atoms?

\*a. 53 protons, 78 neutrons, 53 electrons

b. 39 protons, 78 neutrons, 39 electrons

c. 53 protons, 131 neutrons, 53 electrons

d. 53 protons, 131, neutrons, 78 electrons

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

38. Which description below fits the  ion?

a. 29 protons, 65 neutrons, 29 electrons

\*b. 29 protons, 36 neutrons, 27 electrons

c. 31 protons, 34 neutrons, 29 electrons

d. 29 protons, 36, neutrons, 34 electrons

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

39. Which description below fits the  ion?

a. 48 protons, 64 neutrons, 48 electrons

b. 48 protons, 62 neutrons, 48 electrons

\*c. 48 protons, 64 neutrons, 46 electrons

d. 50 protons, 64, neutrons, 48 electrons

*Answer: c*

*Learning objective 1.3 - describe the structure of the atom.*

40. The discovery of the electron is credited to:

a. James Chadwick.

b. Hans Geiger.

c. Ernest Rutherford.

\*d. J.J Thomson.

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

41. The discovery of the neutron is credited to:

\*a. James Chadwick.

b. Hans Geiger.

c. Ernest Rutherford.

d. J.J Thomson.

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

42. The discovery of the atomic nucleus and the existence of the atomic nucleus and electrons as separate entities in the atom is credited to:

\*a. Ernest Rutherford.

b. Hans Geiger.

c. James Chadwick.

d. J.J Thomson.

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

43. The symbol, Si, is used to represent the element:

a. silver.

\*b. silicon.

c. sodium.

d. sulfur.

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

44. The symbol, Fe, is used to represent the element:

a. fermium.

b. fendium.

c. copper.

\*d. iron.

*Answer: d*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

45. The symbol, Ca, is used to represent the element:

a. cadmium.

\*b. calcium.

c. californium.

d. carolinium.

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

46. Sodium and caesium are an example of two elements that belong to the same:

a. class.

b. gender.

\*c. group.

d. period.

*Answer: c*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

47. Silver and antimony are an example of two elements that belong to the same:

a. class.

b. gender.

c. group.

\*d. period.

*Answer: d*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

48. Which set of elements below are all in the same period?

\*a. Na, Al, P, Ar

b. Fr, U, Am, Ca

c. K, Na, Li, Cs

d. Ba, Pb, As, Sn

*Answer: a*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

49. Which one of the pairs below contains elements from the same period?

\*a. Silver, tin

b. Silver, sulfur

c. Sodium, manganese

d. Copper, tin

*Answer: a*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

50. Which one of the pairs below contains elements from the same period?

a. Iron, barium

b. Potassium, gold

c. Potassium, barium

\*d. Potassium, iron

*Answer: d*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

51. Which one of the pairs below contains elements from the same group?

a. Tin, zirconium

b. Potassium, sulfur

\*c. Potassium, caesium

d. Potassium, nitrogen

*Answer: c*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

52. Which one of the pairs below contains elements from the same group?

a. Manganese, barium

\*b. Zinc, mercury

c. Copper, iron

d. Cerium, radium

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

53. Which set of elements below includes only known elements that are metals?

\*a. uranium, americium, praseodymium, zinc

b. molybdenum, neptunium, xenon, barium, silicon

c. nitrogen, silicon, sulfur, arsenic

d. lead, bismuth, bromine, magnesium

*Answer: a*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

54. Which set of elements below includes mostly nonmetals?

a. barium, calcium, strontium

b. lanthanum, lutetium, rhodium

\*c. oxygen, selenium, tellurium

d. silicon, zinc, strontium

*Answer: c*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

55. Which set below features one alkali, one alkaline earth, one halogen, one lanthanide and one actinide element?

a. cesium, barium, bromine, erbium, samarium

\*b. francium, beryllium, iodine, terbium, berkelium

c. lithium, manganese, fluorine, lanthanum, vanadium

d. potassium, radium, iodine, lutetium, platinum

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

56. Which set below includes TWO and only two actinide elements?

a. gallium, germanium, iron, barium, tellurium

b. lithium, sodium, potassium, rubidium, francium

c. magnesium, gallium, fluorine, mercury, neptunium

\*d. uranium, francium, gallium, plutonium, titanium

*Answer: d*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

57. Which set below includes only alkali metal elements?

a. gallium, germanium, iron, barium, tellurium

\*b. lithium, sodium, potassium, rubidium, francium

c. magnesium, gallium, flluorine, mercury, neptunium

d. radium, polonium, actinium, platinum, selenium

*Answer: b*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

58. Which set below does not include at least one transition metal element?

a. gallium, germanium, iron, barium, tellurium

b. lithium, sodium, potassium, rubidium, francium

\*c. magnesium, gallium, boron, argon, iodine

d. palladium, mercury, gold, aluminum, tin

*Answer: c*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

59. Which of the sets below includes the largest number of elements?

a. alkali metals

b. alkaline earth elements

c. halogens

\*d. lanthanides

*Answer: d*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

60. The present form of the periodic table evolved from the pioneering work, in this area, of:

a. John Dalton.

b. J.J. Thomson.

c. Isaac Newton.

\*d. Dmitri Mendeleev.

*Answer: d*

*Learning objective 1.4 - explain the basis of the periodic table of the elements.*

61. A naturally occurring element consists of three isotopes:  
  
isotope 1       46.972 **u** 69.472%  
isotope 2       48.961 **u**      21.667%  
isotope 3      49.954 **u** 8.861%  
  
What is the average atomic mass of this naturally occurring element?

\*a. 47.667 **u**

b. 47.699 **u**

c. 48.629 **u**

d. 48.961 **u**

*Answer: a*

*Learning objective 1.3 - describe the structure of the atom.*

62. A naturally occurring element consists of three isotopes:  
  
isotope 1       146.9672 **u** 64.792%  
isotope 2       148.9638 **u**      26.117%  
isotope 3      149.9592 **u** 9.0910%  
  
What is the average atomic mass of this naturally occurring element?

a. 149.25 **u**

b. 147.80 **u**

c. 148.63 **u**

\*d. 147.76 **u**

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

63. A naturally occurring element consists of three isotopes:  
  
isotope 1       187.9122 **u** 10.861%  
isotope 2       190.9047 **u**      12.428%  
isotope 3      192.8938 **u** 76.711%  
  
What is the average atomic mass of this naturally occurring element?

a. 190.57 **u**

b. 190.67 **u**

c. 192.08 **u**

\*d. 192.11 **u**

*Answer: d*

*Learning objective 1.3 - describe the structure of the atom.*

64. A naturally occurring element consists of three isotopes:  
  
isotope 1       147.9554 **u** 10.563%  
isotope 2       150.9496 **u**      70.811%  
isotope 3      152.9461 **u** 18.626%  
  
What is the average atomic mass of this naturally occurring element?

a. 150.62 **u**

b. 150.12 **u**

\*c. 151.01 **u**

d. 151.80 **u**

*Answer: c*

*Learning objective 1.3 - describe the structure of the atom.*

65. A naturally occurring element consists of two isotopes:  
  
isotope 1       68.5257 **u** 60.226%  
isotope 2       70.9429 **u**      ??????%  
  
What is the average atomic mass of this naturally occurring element?

a. 69.743 **u**

\*b. 69.487 **u**

c. 69.972 **u**

d. 69.934 **u**

*Answer: b*

*Learning objective 1.3 - describe the structure of the atom.*

**Short-answer questions**

66. What are the three classes of elements?

*Answer: Metals, nonmetals and metalloids.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

67. Which elements make up the Noble gasses?

*Answer: He, Ne, Ar, Kr, Xe, Rn, (Uuo).  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

68. The horizontal rows of the periodic table are known as what?

*Answer: Periods.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

69. What is the atomic number and atomic mass of nickel?

*Answer: Atomic number – 28, atomic mass – 58.69.  
Learning objective 1.3 – describe the structure of the atom.*

70. What is the atomic number and atomic mass of gold?

*Answer: Atomic number – 79 atomic mass – 197.0.*

*Learning objective 1.3 – describe the structure of the atom.*

71. The vertical columns of the periodic table are known as what?

*Answer: Groups.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

72. List the halogen elements in increasing atomic mass number.

*Answer: F, Cl, Br, I, (At).  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

73. What are the properties of metals?

*Answer: ductile, malleable, good conductors of heat, good conductors of electricity.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

74. What property of metals allows them to be drawn into wire?

*Answer: Ductile.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

75. What property of metals allows them to be beaten into thin sheets?

*Answer: Malleable.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

76. For which two metals does the atomic mass number decrease with increasing atomic number?

*Answer: Co and Ni.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

77. How many elements are there in the lanthanide series?

*Answer: 15.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

78. Why are some atomic masses given in parentheses?

*Answer: These elements are unstable and undergo spontaneous radioactive decay.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

79. The value listed for the average atomic mass of bromine is 79.909 **u**. It consists of two isotopes, one with a mass of 78.9183 **u** and one with a mass of 80.9163 **u**. What is the percent, by mass, of the more abundant isotope in naturally occurring bromine?

*Answer: 50.415 %  
Learning objective 1.3 – describe the structure of the atom.*

80. The value listed for the average atomic mass of indium is 114.82 **u**. It consists of two isotopes, one with a mass of 112.9043 **u** and one with a mass of 114.9041 **u**. What is the percent, by mass, of the less abundant isotope in naturally occurring indium?

*Answer: 4.205 %  
Learning objective 1.3 – describe the structure of the atom.*

81. List the five statements of Dalton’s atomic theory.

*Answer:*

*i. Matter consists of tiny particles called atoms  
ii. Atoms are indestructible. In chemical reactions, the atoms rearrange but they do not themselves break apart.  
iii. In any sample of a pure element, all the atoms are identical in mass and other properties.  
iv. The atoms of different elements differ in mass and other properties.  
v. When atoms of different elements combine to form a given compound, the constituent atoms in the compound are always present in the same fixed numerical ratio.*

*Learning objective 1.2 – explain how the concept of atoms developed.*

82. What are isotopes?

*Answer: Isotopes are atoms of an element with the same number of protons but different numbers of neutrons.  
Learning objective 1.3 – describe the structure of the atom.*

83. Common table salt, sodium chloride, contains 2.87 g of sodium for every 4.43 g of chloride. If a sample of sodium chloride contains 7.12 g of chloride, what mass of sodium does it contain?

*Answer: 4.62 g  
Learning objective 1.2 – explain how the concept of atoms developed.*

84. Magnesium chloride, contains 6.08 g of magnesium for every 17.73 g of chloride. If a sample of magnesium chloride contains 3.47 g of magnesium, what mass of chloride does it contain?

*Answer: 10.13 g  
Learning objective 1.2 – explain how the concept of atoms developed.*

85. Lithium fluoride, contains 4.75 g of fluoride for every 1.74 g of lithium. If a sample of lithium fluoride contains 0.77 g of lithium, what mass of fluoride does it contain?

*Answer: 2.11 g  
Learning objective 1.2 – explain how the concept of atoms developed.*

86. What is the name given to chemical reactions that involve the transfer of one or more electrons between chemical species?

*Answer: Redox reactions.   
Learning objective 1.5 – detail the role of electrons in atoms.*

87. What does the acronym IUPAC stand for?

*Answer: International Union for Pure and Applied Chemistry.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

88. The atomic mass unit is defined as 1/12 of what element?

*Answer: 12C   
Learning objective 1.3 – describe the structure of the atom.*

89. What is the mass of an electron?

*Answer: 9.109 x 10-31 kg  
Learning objective 1.3 – describe the structure of the atom.*

90. What are the two commonly known spin states of an electron?

*Answer: Spin up and spin down.  
Learning objective 1.5 – detail the role of electrons in atoms.*

91. What metalloids are commonly used in silicon chips and transistors?

*Answer: Silicon and Germanium.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

92. What is the minimum number of atoms in a molecule?

*Answer: Two.  
Learning objective 1.1 – define atoms, molecules, ions, elements and compounds.*

93. In chemistry, the term **compound** refers to what?

*Answer: Compounds are substances containing two or more elements in a definite and unchanging proportion.  
Learning objective 1.1 – define atoms, molecules, ions, elements and compounds.*

94. Which French chemist proposed the law of conservation of mass?

*Answer: Antoine Lavoisier.  
Learning objective 1.1 – define atoms, molecules, ions, elements and compounds.*

95. Briefly describe the basis of ordering elements in Mendeleev’s original periodic table.

*Answer: Mendeleev ordered the elements by increasing atomic mass.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

96. Briefly describe the basis of ordering elements in the modern periodic table.

*Answer: Elements are ordered by increasing atomic number.  
Learning objective 1.4 - explain the basis of the periodic table of the elements.*

97. Briefly describe Rutherford's model of the atom.

*Answer: Every atom has a tiny positively charged central core, a nucleus, and this constitutes most of the mass of an atom. Negatively charged electrons surround the nucleus, occupying a large volume.  
Learning objective 1.3 – describe the structure of the atom.*