

# **Test Bank for Basics of General Organic and Biological Chemistry v3 1st Ball**

## Chapter 1

### Elements, Atoms, and the Periodic Table

#### True/False

1. The mass number of an atom is the sum of the numbers of protons and neutrons in the nucleus.  
**True; Easy**
2. There are 90 man-made elements known today.  
**False; Easy**
3. Helium is the most abundant element in the universe.  
**False; Easy**
4. Oxygen is the most abundant element on the earth and the second most abundant in the universe.  
**False; Easy**
5. The relative amounts of elements in our body are directly proportional to their abundances on Earth.  
**False; Easy**
6. 'Sn' is the chemical symbol for strontium.  
**False; Moderate**
7. Modern atomic theory states that an electron is the smallest part of an element that maintains the identity of that element.  
**False; Moderate**
8. The electron was the first subatomic particle to be discovered and has a mass of  $9.109 \times 10^{-31}$  kg.  
**True; Easy**
9. A proton and a neutron have almost the same mass.  
**True; Moderate**
10. A proton and an electron have almost the same mass.  
**False; Moderate**
11. Rutherford's experiments showed some alpha particles that were deflected straight back, indicating that electrons were concentrated in the nucleus.  
**False; Moderate**
12. The orbiting electrons in an atom account for its size.  
**True; Easy**
13. In Rutherford's experiments, the deflection of some alpha rays prove that an atom is mostly empty space.  
**False; Moderate**

14. In a neutral atom, the number of protons equal the number of electrons.  
**True; Moderate**
15. Isotopes have the same mass number but a different atomic number.  
**False; Moderate**
16. The mass of one carbon atom in atomic mass units is 12 u.  
**True; Moderate**
17. The electronic configuration of silicon is  $1s^2 2s^2 2p^6 3s^2 3p^2$ .  
**True; Moderate**
18. Elements in the same column will have similar chemical properties.  
**True; Easy**
19. Increasing the number of electrons in a given shell of an atom will increase the atomic radius of that atom.  
**False; Moderate**
20. All elements have the same abundance on Earth.  
**False; Easy**
21. The rows of the periodic table are called periods.  
**True; Easy**

### Multiple Choice Questions

22. Which is the most abundant element in the universe?  
a. helium  
b. oxygen  
c. hydrogen  
d. silicon  
e. iron  
**c; Easy**
23. Which is the most abundant element present on Earth?  
a. oxygen  
b. silicon  
c. aluminum  
d. iron  
e. hydrogen  
**d; Easy**
24. What is the chemical symbol for copper?  
a. Co  
b. Cp  
c. Ce  
d. Cr  
e. Cu  
**e; Easy**

25. The symbol of which of the following elements comes from its German name—wolfram?
- zirconium
  - strontium
  - platinum
  - lithium
  - tungsten
- e; Moderate**
26. The chemical symbol for silver is derived from:
- arsenic
  - aurum
  - argentum
  - aluminum
  - armenium
- c; Easy**
27. What is the chemical symbol for sodium?
- Su
  - So
  - S
  - Ni
  - Na
- e; Moderate**
28. The chemical symbol 'Sn' stands for:
- strontium
  - sodium
  - silicon
  - titanium
  - tin
- e; Moderate**
29. Which of the following is an element?
- wood
  - juice
  - air
  - iron
  - liquified CO<sub>2</sub>
- d; Easy**
30. What is the correct chemical symbol for gold?
- G
  - Gl
  - Sn
  - Au
  - Ag
- d; Easy**
31. Which of the following elements exist as a diatomic molecule?
- iron

- b. neon
- c. iodine
- d. carbon
- e. calcium

**c; Moderate**

32. What does the modern atomic theory state?
- a. All elements are composed of molecules.
  - b. All molecules are composed of atoms.
  - c. All elements are composed of atoms.
  - d. All compounds are composed of molecules.
  - e. All atoms are of the same size.

**c; Moderate**

33. Which of the following was an incorrect assumption made by Dalton?
- a. Elements are composed of atoms.
  - b. Compounds are composed of molecules.
  - c. All matter is composed of atoms.
  - d. Atoms cannot be divided further.
  - e. Atoms are of differing sizes.

**d; Easy**

34. Atoms are composed of \_\_\_\_\_ different kinds of particles.
- a. one
  - b. two
  - c. three
  - d. four
  - e. six

**c; Easy**

35. The relative charge of an electron, neutron and proton are:
- a. +1, 0, -1
  - b. 0, +1, -1
  - c. -1, +1, 0
  - d. -1, 0, +1
  - e. +1, -1, 0

**d; Moderate**

36. What is the mass, in kg, of a neutron?
- a.  $1.673 \times 10^{-27}$
  - b.  $9.109 \times 10^{-31}$
  - c.  $1.675 \times 10^{-27}$
  - d.  $9.109 \times 10^{-27}$
  - e.  $1.675 \times 10^{-31}$

**c; Moderate**

37. An alpha particle, a positively charged particle, is a combination of:
- a. two protons and two neutrons
  - b. two electrons and two protons
  - c. two neutrons and two electrons
  - d. one proton and two electrons

- e. two electrons and one neutron

**a; Easy**

38. What did Rutherford conclude about the internal structure of an atom?

- a. Electrons and neutrons are concentrated in the nucleus.
- b. Protons and electrons are concentrated in the nucleus.
- c. Only electrons are present in the nucleus.
- d. Only neutrons are present in the nucleus.
- e. Protons and neutrons are present in the nucleus.

**e; Moderate**

39. In Rutherford's experiments, most of the alpha particles traveled through the metal foil. Which of the following does this indicate?

- a. Protons are present in the nucleus.
- b. Neutrons are present in the nucleus.
- c. An atom consists largely of empty space.
- d. Electrons orbit the nucleus.
- e. Protons are positively charged.

**c; Easy**

40. Which of the following is the smallest?

- a. a hydrogen atom
- b. a hydrogen nucleus
- c. an electron
- d. a helium atom
- e. a helium nucleus

**c; Moderate**

41. The Rutherford model of the atom is called:

- a. the plum pudding model
- b. the gold foil model
- c. the planetary model
- d. the cloud model
- e. the Geiger Marsden model

**c; Easy**

42. If an atom is electrically neutral, then

- a. the number of electrons equals the number of neutrons.
- b. the number of neutrons equals the number of protons.
- c. the number of electrons equals the number of protons.
- d. there are fewer number of electrons than protons.
- e. there are fewer number of protons than electrons.

**c; Easy**

43. The atomic number of an atom is equal to

- a. the number of neutrons and electrons in an atom.
- b. the number of electrons in an atom.
- c. the number of neutrons in an atom.
- d. the number of protons in an atom.
- e. the number of neutrons and protons in an atom.

**d; Easy**

44. How many electrons are present in a neutral atom of carbon? (Hint: The atomic number of carbon is 6.)

- a. 12
- b. 6
- c. 3
- d. 18
- e. 9

**b; Moderate**

45. What are isotopes?

- a. atoms of an element with different number of electrons
- b. atoms of an element with different number of protons
- c. atoms of an element with different number of neutrons
- d. atoms of an element with different atomic numbers
- e. atoms of an element with different number of nuclei

**c; Moderate**

46. A neutral atom of hydrogen has a single electron and a single neutron. What is its atomic number and mass number?

- a. 1 and 1
- b. 1 and 0
- c. 1 and 3
- d. 1 and 2
- e. 0 and 1

**d; Easy**

47. Which of the following statements is true of  $^{56}_{26}\text{Fe}$ ?

- a. 56 is the number of electrons in iron.
- b. 56 is the number of protons in iron.
- c. 56 is the number of neutrons in iron.
- d. 26 is the number of protons in iron.
- e. 26 is the number of neutrons in iron.

**d; Moderate**

48. What is the number of neutrons in  $^{14}_6\text{C}$ ?

- a. 8
- b. 6
- c. 12
- d. 2
- e. 14

**a; Moderate**

49. What is  $^3_1\text{H}$  called?

- a. hydrogen
- b. cesium
- c. deuterium
- d. osmium
- e. tritium

**e; Moderate**

50. How many neutrons does U-238 have?

- a. 98
- b. 238
- c. 236
- d. 146
- e. 144

**d; Easy**

51. What is an atomic mass unit?

- a. the mass of twelve carbon atoms
- b. the mass of one carbon atom
- c. the mass of one hydrogen atom
- d. one twelfth of the mass of one carbon atom.
- e. the mass of twelve hydrogen atoms

**d; Moderate**

52. If 90% of an element 'E' exists as  $^{21}\text{E}$  and 10% as  $^{24}\text{E}$ , then its atomic mass would be:

- a. 21 u
- b. 24 u
- c. 21.3 u
- d. 22.4 u
- e. 45 u

**c; Moderate**

53. What is the average mass of an oxygen atom in grams? (Atomic mass of oxygen = 15.994 u)

- a.  $2.657 \times 10^{-23}$  g
- b. 16 g
- c. 15.995 g
- d. 8 g
- e.  $26.57 \times 10^{-23}$  g

**a; Moderate**

54. Electrons are organized according to their energies into sets called:

- a. shells
- b. orbits
- c. cellars
- d. quanta
- e. levels

**a; Moderate**

55. Which of the following has the biggest atomic radius?

- a. argon
- b. bromine
- c. chlorine
- d. phosphorus
- e. sulfur

**b; Moderate**

56. Which of the following represent the four subshells that make up a shell?

- a. *s, p, d, f*
- b. *a, b, c, d*
- c. *p, q, r, s*
- d. *k, l, p, d*
- e. *s, p, e, d*

**a; Moderate**

57. Most of the elements in the periodic table can be classified as:

- a. nonmetals
- b. metals
- c. liquids
- d. diatomic
- e. molecules

**b; Moderate**

### Essay

58. Write a brief note on elements.

An element is a substance that cannot be broken down into simpler chemical substances. There are about 90 naturally occurring elements known on Earth. Using technology, scientists have been able to create nearly 30 additional elements that do not occur in nature. Today, chemistry recognizes 118 elements—some of which were created an atom at a time.

**Easy**

59. Describe the trends in the periodic table with respect to atomic radius.

As we move down a column in the periodic table, the radius increases, while going across, the radius decreases. Going down a column adds valence shells, increasing the radius. Going across the rows adds more positively charged protons, which increases the attraction of more negative electrons pulling them closer to the nucleus, decreasing the radius.

**Easy**

60. Briefly describe the chemical symbol for elements.

By convention, the first letter of a chemical symbol is a capital letter, while the second letter (if there is one) is in lowercase. The first letter of the symbol is usually the first letter of the element's name, while the second letter is some other letter from the name. Some elements have symbols that derive from earlier, mostly Latin names, so the symbols may not contain any letters from the English name.

**Easy**

61. Briefly describe the three subatomic particles.

The first subatomic particle was identified in 1897 and called the electron. It is an extremely tiny particle, with a mass of about  $9.109 \times 10^{-31}$  kg. Experiments with magnetic fields showed that the electron has a negative electrical charge. A proton has the same amount of charge as an electron, but its charge is positive, not negative. Another major difference between a proton and an electron is mass. Although still incredibly small, the mass of a proton is  $1.673 \times 10^{-27}$  kg. The neutron is a particle with about the same mass as a proton but with no electrical charge.

**Easy**

62. Describe the setup of Rutherford's gold leaf experiment.

Rutherford and his colleagues took a very thin metal foil, such as gold or platinum, and aimed a beam of positively charged particles (called alpha particles) from a radioactive source toward the foil. Surrounding the foil was a detector—either a scintillator (a material that glows when hit by such particles) or some unexposed film (which is exposed where the particles hit it). The detector allowed the scientists to determine the distribution of the alpha particles after they interacted with the foil.

**Easy**

63. In the Rutherford metal-foil experiment, alpha particles either went straight through the metal foil, were slightly deflected, or bounced back toward the source. Explain why these three things occurred.

Because most of an atom is empty space, most of the alpha particles went straight through the thin metal foil. Some alpha particles passed close to the positively charged nucleus, which slightly repelled the positively charged alpha particles and deflected them. A small number of alpha particles went straight into the nucleus and bounced back toward their source.

**Moderate**

64. Explain the difference between mass number and atomic number.

The number of protons in the nucleus of an atom is characteristic of a particular element. This discovery was so important to our understanding of atoms that the number of protons in the nucleus of an atom is called the atomic number. The mass number of an atom is the sum of the numbers of protons and neutrons in the nucleus. Given the mass number for a nucleus (and knowing the atomic number of that particular atom), you can determine the number of neutrons by subtracting the atomic number from the mass number.

**Moderate**

65. Explain the organization of electrons in an atom.

Electrons are organized according to their energies into sets called shells. Generally, the higher the energy of a shell, the farther it is (on average) from the nucleus. Shells do not have specific, fixed distances from the nucleus, but an electron in a higher-energy shell will spend more time farther from the nucleus than does an electron in a lower-energy shell. Shells are further divided into subsets of electrons called subshells. The first shell has only one subshell, the second shell has two subshells, the third shell has three subshells, and so on. The subshells of each shell are labeled, in order, with the letters *s*, *p*, *d*, and *f*. Thus, the first shell has only an *s* subshell, the second shell has an *s* and a *p* subshell, the third shell has *s*, *p*, and *d* subshells, and so forth.

**Moderate**

66. Define core and valence electrons with an example.

Valence shell electrons (or, more simply, the valence electrons) are the electrons in the highest-numbered shell, or valence shell, while core electrons are the electrons in lower-numbered shells. We can see from the electron configuration of a carbon atom— $1s^2 2s^2 2p^2$ —that it has 4 valence electrons ( $2s^2 2p^2$ ) and 2 core electrons ( $1s^2$ ).

**Moderate**

67. Explain the classification of elements according to the periodic table.

Every element can be classified as a metal, a nonmetal, or a semimetal. A metal is a substance that is shiny, typically (but not always) silvery in color, and an excellent conductor of electricity and heat. Metals are also malleable and ductile. A nonmetal is typically dull and a poor conductor of electricity and heat. Solid nonmetals are also very brittle. Metals occupy the left three-fourths of the periodic table, while nonmetals (except for hydrogen) are clustered in the upper right-hand corner of the periodic table. The elements with properties intermediately between those of metals and nonmetals are called semimetals (or metalloids).

**Moderate**

68. What explains the similarities of elements in a periodic table?  
Starting with the first period and going from left to right, the table reproduces the order of filling of the electron subshells in atoms. Furthermore, elements in the same column share the same valence shell electron configuration. Chemistry is largely the result of interactions between the valence electrons of different atoms. Thus, atoms that have the same valence shell electron configuration will have similar chemistry.

**Moderate**

**Fill in the Blanks**

69. The most abundant element on the earth's crust is \_\_\_\_\_.  
**oxygen; Easy**
70. The chemical symbol for iron is \_\_\_\_\_.  
**Fe; Easy**
71. Another word for semimetals is \_\_\_\_\_.  
**metalloids; Easy**
72. A(n) \_\_\_\_\_ is the smallest part of an element that maintains the identity of that element.  
**atom; Easy**
73. \_\_\_\_\_ is a fundamental concept that states that all elements are composed of atoms.  
**Modern atomic theory; Easy**
74. The mass number is the sum of protons and \_\_\_\_\_.  
**neutrons; Easy**
75.  $1s^2 2s^2 2p^6 3s^1$  is the electronic configuration of \_\_\_\_\_.  
**sodium; Moderate**
76. Rutherford called his description of the atom the \_\_\_\_\_.  
**planetary model; Easy**
77. Atomic radius \_\_\_\_\_ down a row in the periodic table.  
**increases; Easy**
78. Carbon has 2 core and \_\_\_\_\_ valence electrons.  
**4; Easy**

79. The two particles that are found in the nucleus are the \_\_\_\_\_ and the \_\_\_\_\_.  
**proton, neutron; Easy**
80. Isotopes of an element differ by having different numbers of \_\_\_\_\_ in their nuclei.  
**neutrons; Easy**
81. Elements in the same column of the periodic table have similar \_\_\_\_\_ properties.  
**chemical; Easy**