

Chapter 2 Atoms Molecules and Ions

Student:

NOTE: A periodic table is required to work many of the problems in this chapter.

- The elements in a column of the periodic table are known as
 - metalloids.
 - a period.
 - noble gases.
 - a group.
 - nonmetals.
- Which of these materials are usually poor conductors of heat and electricity?
 - metals
 - metalloids
 - nonmetals
 - alkaline earth metals
 - alkali metals
- Which of these elements is most likely to be a good conductor of electricity?
 - N
 - S
 - He
 - Cl
 - Fe
- An *anion* is defined as
 - a charged atom or group of atoms with a net negative charge.
 - a stable atom.
 - a group of stable atoms.
 - an atom or group of atoms with a net positive charge.
- The scientist who determined the magnitude of the electric charge of the electron was
 - John Dalton.
 - Robert Millikan.
 - J. J. Thomson.
 - Henry Moseley.
 - R. Chang.

6. When J. J. Thomson discovered the electron, what physical property of the electron did he measure?
- A. its charge, e
 - B. its charge-to-mass ratio, e/m
 - C. its temperature, T
 - D. its mass, m
 - E. its atomic number, Z
7. Which of these scientists developed the nuclear model of the atom?
- A. John Dalton
 - B. Robert Millikan
 - C. J. J. Thomson
 - D. Henry Moseley
 - E. Ernest Rutherford
8. Rutherford's experiment with alpha particle scattering by gold foil established that
- A. protons are not evenly distributed throughout an atom.
 - B. electrons have a negative charge.
 - C. electrons have a positive charge.
 - D. atoms are made of protons, neutrons, and electrons.
 - E. protons are 1840 times heavier than electrons.
9. What percentage of the mass of a carbon-12 atom is contributed by its electrons? Given the mass of an electron is $(1/1836)$ amu.
- A. 0.027%
 - B. 6.0%
 - C. 33.0%
 - D. 50.0%
 - E. 99.97%
10. Atoms of the same element with different mass numbers are called
- A. ions.
 - B. neutrons.
 - C. allotropes.
 - D. chemical families.
 - E. isotopes.
11. How many neutrons are there in an atom of lead whose mass number is 208?
- A. 82
 - B. 126
 - C. 208
 - D. 290
 - E. none of them

12. An atom of the isotope sulfur-31 consists of how many protons, neutrons, and electrons?
(p = proton, n = neutron, e = electron)
- A. 15 p, 16 n, 15 e
 - B. 16 p, 15 n, 16 e
 - C. 16 p, 31 n, 16 e
 - D. 32 p, 31 n, 32 e
 - E. 16 p, 16 n, 15 e
13. Give the number of protons (p), electrons (e), and neutrons (n) in one atom of chlorine-37.
- A. 37 p, 37 e, 17 n
 - B. 17 p, 17 e, 37 n
 - C. 17 p, 17 e, 20 n
 - D. 37 p, 17 e, 20 n
 - E. 17 p, 37 e, 17 n
14. Which one of these species is an ion?
- A. B^{3+}
 - B. NaCl
 - C. He
 - D. ^{14}C
 - E. none of these
15. Two isotopes of an element differ only in their
- A. symbol.
 - B. atomic number.
 - C. atomic mass.
 - D. number of protons.
 - E. number of electrons.
16. A magnesium ion, Mg^{2+} , has
- A. 12 protons and 13 electrons.
 - B. 24 protons and 26 electrons.
 - C. 12 protons and 10 electrons.
 - D. 24 protons and 22 electrons.
 - E. 12 protons and 14 electrons.
17. An aluminum ion, Al^{3+} , has:
- A. 13 protons and 13 electrons
 - B. 27 protons and 24 electrons
 - C. 16 protons and 13 electrons
 - D. 13 protons and 10 electrons
 - E. 10 protons and 13 electrons

18. An oxide ion, O^{2-} , has:
- 8 protons and 10 electrons
 - 10 protons and 8 electrons
 - 8 protons and 9 electrons
 - 8 protons and 7 electrons
 - 10 protons and 7 electrons
19. A sulfide ion, S^{2-} , has:
- 16 protons and 16 electrons
 - 32 protons and 16 electrons
 - 16 protons and 14 electrons
 - 16 protons and 18 electrons
 - 32 protons and 18 electrons
20. How many protons and electrons are present in one Br^- ion?
- 35 p, 35 e
 - 80 p, 81 e
 - 35 p, 34 e
 - 35 p, 36 e
 - 80 p, 34 e
21. Which of these pairs of elements would be most likely to form an ionic compound?
- P and Br
 - Cu and K
 - C and O
 - O and Zn
 - Al and Rb
22. Which pair of elements would be most likely to form an ionic compound?
- P and Br
 - Zn and K
 - F and Al
 - C and S
 - Al and Rb
23. What is the formula for the ionic compound formed by calcium ions and nitrate ions?
- Ca_3N_2
 - $Ca(NO_3)_2$
 - Ca_2NO_3
 - Ca_2NO_2
 - $CaNO_3$

24. What is the formula for the ionic compound formed by calcium and selenium?
- A. CaSe
 - B. Ca_2Se
 - C. CaSe_2
 - D. Ca_3Se
 - E. CaSe_3
25. What is the formula for the ionic compound formed by magnesium and iodine?
- A. MgI
 - B. Mg_2I
 - C. MgI_2
 - D. MgI_3
 - E. Mg_3I
26. What is the formula for the binary compound formed by potassium and nitrogen?
- A. KN
 - B. K_2N
 - C. NK_2
 - D. K_3N
 - E. NK_3
27. Which is the correct formula for copper(II) phosphate?
- A. Cu_2PO_4
 - B. $\text{Cu}_3(\text{PO}_4)_2$
 - C. Cu_2PO_3
 - D. $\text{Cu}(\text{PO}_4)_2$
 - E. $\text{Cu}(\text{PO}_3)_2$
28. The chemical name for ClO_3^- is "chlorate ion". Therefore, the name of HClO_3 is
- A. hydrochloric acid.
 - B. chloroform.
 - C. hydrogen trioxychloride.
 - D. chlorous acid.
 - E. chloric acid.
29. The chemical name for ClO_2^- is "chlorite ion". Therefore, the name of HClO_2 is
- A. hydrochloric acid.
 - B. chloroform.
 - C. hydrogen dioxychloride.
 - D. chlorous acid.
 - E. chloric acid.

30. Which of these choices is the formula for hydrobromic acid?

- A. KBr
- B. HBr
- C. HBrO
- D. HBrO₂
- E. HBrO₃

31. The formula for calcium phosphate is

- A. CaPO₄.
- B. Ca₃(PO₄)₂.
- C. Ca₂(PO₄)₃.
- D. Ca₃P₂.
- E. Ca₃(PO₃)₂.

32. The formula for magnesium sulfate is

- A. MnS.
- B. MgS.
- C. MnSO₃.
- D. MgSO₄.
- E. MnSO₃.

33. The formula for sodium sulfide is

- A. NaS.
- B. K₂S.
- C. NaS₂.
- D. Na₂S.
- E. SeS.

34. The correct name for NH₄NO₃ is

- A. ammonium nitrate.
- B. ammonium nitrogen trioxide.
- C. ammonia nitrogen oxide.
- D. hydrogen nitrogen oxide.
- E. hydrogen nitrate.

35. The correct name for Ba(OH)₂ is

- A. barium hydrogen oxide.
- B. boron hydroxide.
- C. barium hydrate.
- D. beryllium hydroxide.
- E. barium hydroxide.

36. The correct name for KHCO_3 is
- calcium bicarbonate.
 - calcium carbonate.
 - potassium carbonate.
 - calcium hydrogen carbon trioxide.
 - potassium hydrogen carbonate.
37. The Stock system name for Mn_2O_7 is
- dimanganese heptaoxide.
 - magnesium oxide.
 - manganese(VII) oxide.
 - manganese(II) oxide.
 - manganese(III) oxide.
38. The Stock system name for As_2S_5 is
- arsenic(V) sulfide.
 - diarsenic pentasulfide.
 - arsenic(III) sulfide.
 - arsenic(V) sulfate.
 - diarsenic sulfate.
39. Consistent with vanadium being a transition metal, the name for VSO_4 should be
- vanadium sulfide.
 - vanadium (I) sulfite.
 - vanadium (I) sulfate.
 - vanadium (II) sulfate.
 - vanadium sulfur tetraoxide.
40. Which is the correct formula for lead(IV) chloride?
- Pb_4Cl
 - PbCl_2
 - PbCl_3
 - PbCl_4
 - Pb_2Cl_4
41. The chemical formula for iron(II) nitrate is
- $\text{Fe}_2(\text{NO}_3)_3$.
 - $\text{Ir}(\text{NO}_2)_2$.
 - Fe_2N_3 .
 - $\text{Fe}(\text{NO}_3)_2$.
 - $\text{Fe}(\text{NO}_2)_2$.

42. The Stock system name for CrSO_3 is
- chromium sulfide.
 - chromium(II) sulfite.
 - chromium(II) sulfate.
 - chromium(III) sulfite.
 - chromium sulfur oxide.
43. The Stock system name for CrO_3 is
- chromium oxide.
 - chromium(II) oxide.
 - chromium(III) trioxide.
 - chromium(III) oxide.
 - chromium(VI) oxide.
44. The Stock system name for Cr_2O_3 is
- chromium(III) oxide.
 - dichromium trioxide.
 - chromium(VI) oxide.
 - chromium trioxide.
 - chromium(II) oxide.
45. The mineral pyrolusite is a compound of manganese-55 and oxygen-16. If 63% of the mass of pyrolusite is due to manganese, what is the empirical formula of pyrolusite?
- MnO
 - Mn_2O
 - Mn_2O_2
 - MnO_2
 - none of these
46. The mineral manganosite is a compound of manganese-55 and oxygen-16. If 77% of the mass of manganosite is due to manganese, what is the empirical formula of manganosite?
- MnO
 - Mn_2O
 - Mn_2O_2
 - MnO_2
 - none of these

47. The mineral hausmannite is a compound of manganese-55 and oxygen-16. If 72% of the mass of hausmannite is due to manganese, what is the empirical formula of hausmannite?
- A. MnO
 - B. Mn_3O
 - C. Mn_3O_4
 - D. Mn_4O_3
 - E. MnO_3
48. The total number of electrons present in a sulfate ion is
- A. 2.
 - B. 26.
 - C. 32.
 - D. 48.
 - E. 50.
49. The total number of electrons present in a molecule of vanadium(III) chloride is
- A. 40.
 - B. 57.
 - C. 74.
 - D. 86.
 - E. 157.
50. The most abundant isotope of uranium is ^{238}U , while all naturally occurring fluorine is ^{19}F . A molecule of UF_6 formed from these isotopes contains
- A. 146 neutrons.
 - B. 152 neutrons.
 - C. 200 neutrons.
 - D. 206 neutrons.
 - E. 352 neutrons.
51. A commonly occurring isotope of tin is tin-118, while most oxygen occurs in nature as oxygen-16. A molecule of tin(IV) oxide formed from these isotopes contains
- A. 66 neutrons.
 - B. 84 neutrons.
 - C. 76 neutrons.
 - D. 58 neutrons.
 - E. 150 neutrons.

52. Zircon is a mineral with the empirical formula ZrSiO_4 . If all the zirconium is ^{90}Zr , all the silicon is ^{28}Si , and all the oxygen is ^{16}O , what mass of oxygen is present in 10. g of zircon?
- A. 0.88 g
 - B. 1.2 g
 - C. 1.8 g
 - D. 3.5 g
 - E. 5.4 g
53. The mineral orpiment, having the empirical formula As_2S_3 , was used in ancient times as a cosmetic. What mass of arsenic is present in 5.0 g of orpiment? [Given: naturally occurring arsenic is all arsenic-75; assume that all naturally occurring sulfur is sulfur-32 (only approximately true)]
- A. 0.61 g
 - B. 3.0 g
 - C. 1.5 g
 - D. 2.0 g
 - E. 3.5 g
54. Which of these elements is chemically similar to magnesium?
- A. sulfur
 - B. calcium
 - C. iron
 - D. nickel
 - E. potassium
55. Which of these elements is chemically similar to oxygen?
- A. sulfur
 - B. calcium
 - C. iron
 - D. nickel
 - E. sodium
56. Which of these elements is chemically similar to potassium?
- A. calcium
 - B. arsenic
 - C. phosphorus
 - D. cerium
 - E. cesium

Chapter 2 Atoms Molecules and Ions **Key**

1.D	26.D	51.B
2.C	27.B	52.D
3.E	28.E	53.B
4.A	29.D	54.B
5.B	30.B	55.A
6.B	31.B	56.E
7.E	32.D	
8.A	33.D	
9.A	34.A	
10.E	35.E	
11.B	36.E	
12.B	37.C	
13.C	38.A	
14.A	39.D	
15.C	40.D	
16.C	41.D	
17.D	42.B	
18.A	43.E	
19.D	44.A	
20.D	45.D	
21.D	46.A	
22.C	47.C	
23.B	48.E	
24.A	49.C	
25.C	50.D	