

**Test Bank - Chapter 2**  
**Atoms, Molecules and Ions**

- 1) The gold-foil experiment performed by Rutherford showed that atoms have:
  - A. evenly distributed positive charge throughout the atom
  - B. a small, dense, positively charged nucleus
  - C. electrons embedded in a positive "pudding"
  - D. isotopes of different charge
  - E. no internal structure
  
- 2) Who discovered the electron by experiments with cathode rays?
  - A. Ernest Rutherford
  - B. J. J. Thomson
  - C. James Chadwick
  - D. Robert Millikan
  - E. Niels Bohr
  
- 3) Millikan's oil-drop experiment measured which fundamental quantity?
  - A. the electron mass
  - B. the electron charge
  - C. the proton charge
  - D. Avogadro's number
  - E. the neutron mass
  
- 4) Which subatomic particle has approximately the same mass as a proton but no charge?
  - A. Electron
  - B. Alpha particle
  - C. Neutron
  - D. Positron
  - E. Beta particle
  
- 5) Which statement is correct about where most of an atom's mass is located?
  - A. In the electron cloud
  - B. In the orbitals only
  - C. Spread uniformly throughout the atom
  - D. In the nucleus
  - E. In the valence electrons
  
- 6) The atomic number of an element is defined as:
  - A. the number of neutrons in the nucleus
  - B. the number of protons in the nucleus
  - C. the mass number minus the number of electrons
  - D. the total number of nucleons plus electrons
  - E. the average atomic mass rounded to the nearest whole number
  
- 7) Isotopes are atoms of the same element that have:
  - A. the same number of neutrons but different numbers of protons

- B. different numbers of protons but same chemical properties
- C. the same number of protons but different numbers of neutrons
- D. different numbers of electrons but same mass number
- E. identical masses but different charges

8) For the neutral atom  $^{35}\text{Cl}$ , how many protons, neutrons, and electrons does it have?

- A. 17 p, 18 n, 17 e
- B. 17 p, 18 n, 18 e
- C. 18 p, 17 n, 17 e
- D. 35 p, 0 n, 35 e
- E. 17 p, 35 n, 17 e

9) An isotope has 117 neutrons and a mass number of 195. What is its atomic number (Z)?

- A. 78
- B. 195
- C. 117
- D.  $195 - 78$
- E. 312

10) An element has two stable isotopes: mass = 10.012 amu (20.00% abundance) and mass = 11.009 amu (80.00% abundance). Its average atomic mass (amu) is closest to:

- A. 10.01
- B. 10.81
- C. 10.60
- D. 11.00
- E. 11.20

11) Which instrument is used to measure the masses and relative abundances of isotopes?

- A. Mass spectrometer
- B. Gas chromatograph
- C. NMR spectrometer
- D. UV-Vis spectrophotometer
- E. Calorimeter

12) Which of the following best describes an isotope?

- A. Different elements with the same mass number
- B. Same element with different atomic numbers
- C. Same element with same protons and neutrons
- D. Same element with different numbers of neutrons
- E. Different elements with identical chemical behaviour

13) Which group (IUPAC numbering) contains the halogens?

- A. Group 1
- B. Group 2
- C. Group 14
- D. Group 17
- E. Group 18

14) Which property most directly determines the chemical reactivity of an element?

- A. Total number of nucleons
- B. Number of valence electrons
- C. Atomic mass expressed in amu
- D. Melting point
- E. Density

15) Which of these is a metalloid?

- A. Sodium (Na)
- B. Argon (Ar)
- C. Silicon (Si)
- D. Oxygen (O)
- E. Bromine (Br)

16) Which element normally exists as a diatomic molecule under standard conditions?

- A. Neon (Ne)
- B. Sodium (Na)
- C. Oxygen (O)
- D. Argon (Ar)
- E. Carbon (C)

17) Which statement best distinguishes ionic from molecular (covalent) compounds?

- A. Ionic compounds form only from nonmetals; molecular from metals.
- B. Ionic compounds are composed of cations and anions held by electrostatic forces; molecular compounds are discrete molecules held together by shared electrons.
- C. Ionic compounds are always gases; molecular compounds are always solids.
- D. Ionic compounds have low melting points; molecular have high melting points.
- E. Ionic compounds never conduct electricity in solution.

18) Which of the following is a monatomic cation?

- A.  $O^{2-}$
- B.  $Na^+$
- C.  $NO_3^-$
- D.  $NH_4^+$
- E.  $SO_4^{2-}$

19) Which of the following is a common polyatomic anion?

- A.  $K^+$
- B.  $Cl^-$
- C.  $OH^-$
- D.  $Fe^{3+}$
- E.  $Mg^{2+}$

20) An ion contains 24 protons and 22 electrons. What is its symbol?

- A.  $Cr^{2-}$
- B.  $Cr^{2+}$

- C.  $\text{Mn}^{2+}$
- D.  $\text{Fe}^{2+}$
- E.  $\text{Zn}^{2+}$

21) The empirical formula of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) is:

- A.  $\text{C}_6\text{H}_{12}\text{O}_6$
- B.  $\text{CH}_2\text{O}$
- C.  $\text{C}_3\text{H}_6\text{O}_3$
- D.  $\text{CHO}$
- E.  $\text{C}_2\text{H}_4\text{O}_2$

22) What is the formula for magnesium phosphate?

- A.  $\text{MgPO}_4$
- B.  $\text{Mg}_2\text{PO}_4$
- C.  $\text{Mg}_3(\text{PO}_4)_2$
- D.  $\text{Mg}(\text{PO}_4)_3$
- E.  $\text{Mg}_3\text{PO}_4$

23) Which formula represents an ionic compound?

- A.  $\text{CO}_2$
- B.  $\text{H}_2\text{O}$
- C.  $\text{FeCl}_3$
- D.  $\text{CH}_4$
- E.  $\text{CCl}_4$

24) The empirical formula of  $\text{C}_2\text{H}_6$  is:

- A.  $\text{C}_2\text{H}_6$
- B.  $\text{CH}_3$
- C.  $\text{C}_2\text{H}_3$
- D.  $\text{CH}_2$
- E.  $\text{C}_2\text{H}$

25) Which compound's molecular formula is the same as its empirical formula?

- A.  $\text{C}_2\text{H}_4\text{O}_2$
- B.  $\text{N}_2\text{O}_4$
- C.  $\text{CH}_4$
- D.  $\text{C}_6\text{H}_6$
- E.  $\text{H}_2\text{O}_2$

26) What is the systematic name of  $\text{Na}_2\text{CrO}_4$ ?

- A. Sodium chromite
- B. Sodium chromate
- C. Sodium dichromate
- D. Chromium(II) oxide
- E. Sodium chromide

27)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  is named:

- A. Copper sulfate hydrate
- B. Copper(II) sulfate pentahydrate
- C. Copper sulfate (aqueous)
- D. Copper(II) sulfite hydrate (V)
- E. Copper monohydrate sulfate

28) Why does  $\text{SeCl}_2$  use the prefix “di-” in its systematic name (selenium dichloride) while  $\text{SrCl}_2$  (strontium chloride) does not use prefixes?

- A.  $\text{SeCl}_2$  is ionic and  $\text{SrCl}_2$  is molecular.
- B.  $\text{SeCl}_2$  is molecular (covalent) and prefixes indicate number of atoms;  $\text{SrCl}_2$  is ionic so charges determine formula—prefixes aren’t used.
- C. Se is a metal; Sr is a nonmetal.
- D. Prefixes are used only for organic compounds.
- E.  $\text{SrCl}_2$  is empirical so prefixes are forbidden.

29) The name for  $\text{HBr(g)}$  vs  $\text{HBr(aq)}$  is respectively:

- A. hydrobromic acid; hydrobromic acid
- B. hydrogen bromide; hydrogen bromide
- C. hydrogen bromide; hydrobromic acid
- D. hydrobromous gas; hydrobromic acid
- E. bromine hydride; bromic acid

30) The formula  $\text{HCl}$  can represent different systems. Which additional information removes the ambiguity?

- A. The temperature of the sample
- B. The molar concentration
- C. The method of measurement
- D. The atomic mass of chlorine used
- E. Whether the sample is in the gaseous state or dissolved in water

31) What is the correct name of  $\text{FeCl}_3$ ?

- A. Iron(I) chloride
- B. Iron(II) chloride
- C. Iron(III) chloride
- D. Ferrous chloride
- E. Iron trichloride

32) What is the formula for copper(I) oxide?

- A.  $\text{CuO}$
- B.  $\text{Cu}_2\text{O}$
- C.  $\text{Cu}_2\text{O}_2$
- D.  $\text{CuO}_2$
- E.  $\text{Cu(OH)}_2$

33) Which of the following is named tin(IV) sulfate?

- A.  $\text{SnSO}_4$
- B.  $\text{Sn}_2(\text{SO}_4)_4$

- C.  $\text{Sn}(\text{SO}_4)_2$
- D.  $\text{Sn}_2\text{SO}_4$
- E.  $\text{Sn}_2(\text{SO}_4)_3$

34) What is the correct name for  $\text{P}_2\text{O}_5$ ?

- A. Diphosphorus pentoxide
- B. Phosphorus(V) oxide
- C. Phosphorus pentoxide
- D. Phosphoric oxide
- E. Phosphate

35) Which formula corresponds to dinitrogen tetrahydride?

- A.  $\text{N}_4\text{H}_2$
- B.  $\text{NH}_3$
- C.  $\text{N}_2\text{H}_2$
- D.  $\text{N}_2\text{H}_4$
- E.  $\text{NH}_4^+$

36) The name hydrosulfuric acid corresponds to which formula?

- A.  $\text{H}_2\text{SO}_4$
- B.  $\text{H}_2\text{SO}_3$
- C.  $\text{H}_2\text{S}(\text{aq})$
- D.  $\text{HS}^-$
- E.  $\text{H}_2\text{SO}_2$

37) Which acid contains the chlorite ion ( $\text{ClO}_2^-$ )?

- A. Hypochlorous acid
- B. Chlorous acid
- C. Chloric acid
- D. Perchloric acid
- E. Hydrochloric acid

38) What is the correct name of  $\text{Ba}(\text{OH})_2$ ?

- A. Barium hydroxide
- B. Barium dihydroxide
- C. Barium(II) hydroxide
- D. Barium oxide
- E. Dihydrogen barium oxide

39) Which of the following is the formula for ammonium hydroxide?

- A.  $\text{NH}_3$
- B.  $(\text{NH}_4)_2\text{O}$
- C.  $\text{NH}_4\text{O}_2$
- D.  $\text{NH}_4\text{OH}$
- E.  $\text{NH}_2\text{OH}$

40) The name calcium sulfate dihydrate corresponds to which formula?

- A.  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- B.  $\text{CaSO}_4 \cdot \text{H}_2\text{O}$
- C.  $\text{Ca}_2\text{SO}_4 \cdot \text{H}_2\text{O}$
- D.  $\text{Ca}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$
- E.  $\text{CaSO}_3 \cdot 2\text{H}_2\text{O}$

41) Which name correctly represents  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ ?

- A. Sodium carbonite decahydrate
- B. Disodium carbonate hydrate
- C. Sodium bicarbonate
- D. Sodium carbonate monohydrate
- E. Sodium carbonate decahydrate

42) When a hydrate is gently heated, water is lost and the compound becomes:

- A. A perhydrate
- B. A hydride
- C. A hydroacid
- D. An anhydride
- E. A peroxide

43) Which of the following names is incorrect according to the Stock system?

- A.  $\text{Cu}_2\text{O}$  — copper(I) oxide
- B.  $\text{CuO}$  — copper(II) oxide
- C.  $\text{Fe}_2\text{O}_3$  — iron(III) oxide
- D.  $\text{PbO}_2$  — lead(II) oxide
- E.  $\text{SnCl}_4$  — tin(IV) chloride

44) Which compound below is named aluminum hydroxide?

- A.  $\text{AlOH}$
- B.  $\text{Al}(\text{OH})_2$
- C.  $\text{Al}(\text{OH})_3$
- D.  $\text{Al}_2(\text{OH})_3$
- E.  $\text{Al}_3(\text{OH})_2$

### Answer Key:

|       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|
| 1) B  | 2) B  | 3) B  | 4) C  | 5) D  | 6) B  |
| 7) C  | 8) A  | 9) A  | 10) B | 11) A | 12) D |
| 13) D | 14) B | 15) C | 16) C | 17) B | 18) B |
| 19) C | 20) B | 21) B | 22) C | 23) C | 24) B |
| 25) C | 26) B | 27) B | 28) B | 29) C | 30) E |
| 31) C | 32) B | 33) C | 34) A | 35) D | 36) C |
| 37) B | 38) A | 39) D | 40) A | 41) E | 42) D |
| 43) D | 44) C |       |       |       |       |