

Chapter 2

- 2.6 Protons, ${}^1_1\text{p}^+$, +1 charge
Electron, ${}^0_0\text{e}^-$, -1 charge
Neutron, ${}^1_0\text{n}$, no charge
- 2.7 Nearly all of the mass is located in the nucleus, because this is the portion of the atom where the proton and the neutron are located.
- 2.10 (a) mass number (b) atomic number
- 2.11 (a) ${}^{131}_{53}\text{I}$ (b) ${}^{90}_{38}\text{Sr}$ (c) ${}^{137}_{55}\text{Ce}$ (d) ${}^{18}_9\text{F}$
- 2.14 Strontium and calcium are in the same Group of the periodic table, so they are expected to have similar chemical properties. Strontium should therefore form compounds that are similar to those of calcium, including the sorts of compounds found in bone.
- 2.18 See Figure in the margin of page 50.
- 2.19 (a) Li
(b) I
(c) W
(d) Xe
(e) Sm
(f) Pu
(g) Mg
- 2.22 The noble gases: He, Ne, Ar, Kr, Xe, and Rn
- 2.25 See figure 2.7
- 2.31 The smallest particle that is representative of a particular element is the atom of that element. A molecule is a representative unit that is made up of two or more atoms linked together.
- 2.33 A chemical reaction is balanced when there is the same number of each kind of atom on both the reactant and product side of the equation; and the total charges on both the reactant and product sides of the equation are the same. These conditions must be met due to the law of conservation of matter.
- 2.34 Reactants are the substances to the left of the arrow in a reaction that are present before the reaction begins. Products are the substances to the right of the arrow in a reaction and they are formed during the reaction and are present when the reaction is over.
- 2.35 (a) Magnesium reacts with oxygen to give (yield) magnesium oxide.
(b) The reactants are Mg and O₂.
(c) The product is MgO.
(d) $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{MgO}(s)$
- 2.39 Nonmetals
- 2.48 All of the elements are nonmetals, and the formula is not in the smallest whole number ratio.
- 2.54 An ion is a charged particle. It can be monatomic or polyatomic, and it can have either a positive or a negative charge. It is derived from an atom or a molecule by gain or loss of electrons. Atoms and molecules are neutral.
- 2.57 (a) Na, Na⁺
(b) These particles have the same number of nucleons.

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- (c) These particles have the same number of protons
 (d) These particles could have different numbers of neutrons, if they are different isotopes.
 (e) These particles do not have the same number of electrons; Na^+ has one less electron.
- 2.58 A cation is a positively charged ion with one or fewer electrons than its neutral atom. An anion is a negatively charged ion with one or more electrons than its neutral atom. A polyatomic ion is made up of more than one atom; the whole unit is the ion.
- 2.59 Titanium lost four electrons to form Ti^{4+} ; it has 22 protons and 18 electrons.
- 2.62 Rb forms a +1 cation (Rb^+) and Cl forms a -1 anion (Cl^-), so the formula should be RbCl . The cation is first in the formula, therefore the formula should be Na_2S .
- 2.65 The incorrect ones are a, d, and e.
- 2.66 (a) CN^- (b) NH_4^+ (c) NO_3^-
 (d) SO_3^{2-} (e) ClO_3^- (f) SO_4^{2-}
- 2.67 (a) OCl^- (b) HSO_4^- (c) PO_4^{3-}
 (d) H_2PO_4^- (e) MnO_4^- (f) $\text{C}_2\text{O}_4^{2-}$
- 2.68 (a) dichromate ion (b) hydroxide ion (c) acetate ion
 (d) carbonate ion (e) cyanide ion (f) perchlorate ion
- 2.72 Binary compounds, such as CCl_4 contain two elements only. A diatomic substance is composed of molecules having two atoms, such as HCl or N_2 . In the latter, the two atoms may or may not be the same.
- 2.73 When naming the compound, molecular compounds need the prefixes to specify the number of atoms in the molecule. Ionic compounds made with transition metals or post-transition metals need to have the charge of the metal specified.
- 2.75 (a) Greek prefixes are used to specify the number of atoms of each element in a molecular compound (PCl_5 is phosphorous pentachloride; specify the number of water molecules in a hydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is copper sulfate pentahydrate); specify the number of atoms in polyatomic ions; and organic compounds use Greek prefixes to specify the number of carbon atoms in the compound (pentane has five carbons).
 (b) Roman numerals are used in the name of transition metal compounds to specify the charge of the metal.
- 2.87 $(0.7899 \times 23.9850 \text{ u}) + (0.1000 \times 24.9858 \text{ u}) + (0.1101 \times 25.9826 \text{ u}) = 24.31 \text{ u}$
- 2.89
- | | | <u>electrons</u> | <u>protons</u> | <u>neutrons</u> |
|-----|-------------------|------------------|----------------|-----------------|
| (a) | Cesium-137 | 55 | 55 | 82 |
| (b) | ^{238}U | 92 | 92 | 146 |
| (c) | Iodine-131 | 53 | 53 | 78 |
| (d) | ^{197}Au | 79 | 79 | 118 |
- 2.91 3 Ca, 5 Mg, 8 Si, 24 O, 2 H
- 2.93 $\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$
- 2.107 (a) $\text{Zn}(\text{OH})_2$ (b) Ag_2CrO_4 (c) BaSO_3
 (d) Rb_2SO_4 (e) LiHCO_3

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- 2.111 (a) chlorine trifluoride (b) disulfur dichloride
(c) dinitrogen pentoxide (d) arsenic pentachloride
- 2.113 (a) sodium fluoride (b) magnesium carbide
(c) lithium nitride (d) aluminum oxide
(e) potassium selenide
- 2.115 (a) manganese(III) oxide (b) mercury(I) chloride
(c) lead(II) sulfide (d) chromium(III) chloride tetrahydrate
- 2.117 (a) potassium phosphate (b) ammonium acetate
(c) iron(III) carbonate (d) sodium thiosulfate pentahydrate
- 2.119 (a) ionic vanadium(III) nitrate
(b) ionic cobalt(II) acetate
(c) ionic gold(III) sulfide
(d) ionic gold(I) sulfide
(e) molecular germanium tetrabromide
(f) ionic potassium chromate
(g) ionic iron(II) hydroxide
(h) molecular diiodine tetraoxide
(i) molecular tetraiodine nonaoxide
(j) molecular tetraphosphorus triselenide
- 2.121 (a) Al_2Cl_6 (b) As_4O_{10} (c) $\text{Mg}(\text{OH})_2$
(d) $\text{Cu}(\text{HSO}_4)_2$ (e) NH_4SCN (f) $\text{K}_2\text{S}_2\text{O}_3$
(g) I_2O_5
- 2.123 (a) $\text{Hg}(\text{C}_2\text{H}_3\text{O}_2)_2$ (b) $\text{Ba}(\text{HSO}_3)_2$ (c) BCl_3
(d) Ca_3P_2 (e) $\text{Mg}(\text{H}_2\text{PO}_4)_2$ (f) CaC_2O_4
(g) XeF_4
- 2.125 diphosphorous pentasulfide
- 2.126 (a) Metal
(b) ${}^{55}_{25}\text{Mn}$
(c) 30 neutrons
(d) 25 electrons
(e) $\frac{54.9380}{12.000} = 4.578$ times heavier than a C-12 atom
- 2.128 $(0.0580 \times 53.9396 \text{ u}) + (0.9172 \times 55.9349 \text{ u}) + (0.0220 \times 56.9354 \text{ u}) + (0.0028 \times 57.9333 \text{ u}) = 55.85 \text{ u}$
- 2.133 (a) CaO HBr CuCl₂ AsH₃ NO₂
(b) NO₂
(c) Cl₂ HBr AsH₃ NO₂
(d) Cl₂ CaO HBr
(e) CaO CuCl₂
(f) Cl₂ HBr AsH₃ NO₂
(g) CaO CuCl₂ NaNO₃