Nomenclature and unit conversions

1. Provide the name (problems a-f) or formula (problems g-l) for the following compounds.

(a) $Ca(NO_3)_2$	(d) K_2SO_4	(g) Silicon dioxide	(j) Nickel(III) hydroxide
(b) PCl_5	(e) S_2Br_2	(h) Copper(II) bromide	(k) Cobalt(II) nitrite
(c) $Pb(CO_3)_2$	(f) AlF_3	(i) Sodium sulfite	(l) Strontium phosphide

2. Provide the name (problems a-c) or formula (problems d-f) for the following acids.

(a) HBr	(d) Hydrofluoric acid
(b) H_3PO_4	(e) Sulfurous acid
(c) $HClO_2$	(f) Nitric Acid

3. Acetone has a density of 0.7857 g/mL.
   a. What is the mass in grams of 28.56 mL of acetone?
   b. What is the volume in milliliters of 6.54 g of acetone?

4. Perform the following unit conversions:
   a. 3,400 m in km
   b. 0.0000250 g in µg
   c. 78.3 L in gallons
   d. 24 mi/hr in m/s

5. A paperback book has the dimensions 5.8 in x 2.0 in x 7.85 in. What is its volume in cubic centimeters (cm^3)?

Chemical equations

6. Balance the following equations:

   a. ___C_2H_6 + ___O_2 → ___CO_2 + ___H_2O

   b. ___PCl_5 + ___H_2O → ___H_3PO_4 + ___HCl

7. A chemist adds a solution of hydrochloric acid to a solid sample of manganese(IV) oxide, and observes the formation of chlorine gas, liquid water, and aqueous manganese(II) chloride. Write a balanced equation for this reaction with phase labels.

Stoichiometry and moles

8. How many formula units of magnesium chloride are in a sample weighing 27.88 g? How many chloride ions are in the sample?

9. For the following reaction: $2\mathrm{Cr_2O_3(s)} + 3\mathrm{C\,(s)} \rightarrow 4\mathrm{Cr(s)} + 3\mathrm{CO_2(g)}$
   a. Find the moles of $\mathrm{CO_2(g)}$ produced when 62.6 g of $\mathrm{Cr_2O_3(s)}$ are reacted with excess C.
   b. How many grams of C would be needed to produce 25 g of Cr?

10. Write the balanced reaction for the combustion of C_4H_{10}(g) with oxygen gas. How many grams of water are produced when 43.8 g of C_4H_{10}(g) are reacted with 200. g of O_2(g)? What is the limiting reactant?

Lewis structures

11. Draw the Lewis dot diagrams for the following elements:
    (a) Lithium (b) Sulfur (c) Nitrogen

12. Use Lewis Theory to determine the formula for the compound that forms from:
    (a) Sr and S (b) Al and O

13. Draw Lewis structures for the following compounds:
    a. CO_2
    b. PCl_3
    c. ClNO (N is the central atom)

Gas laws

14. Convert 46.38 kilopascals to bars.

15. A balloon at 24°C has a volume of 14 L and a pressure of 785 mmHg. Assuming the balloon doesn't pop, what will its volume be on the on the summit of Mount Denali, where the temperature is 1.0°C and the pressure is 350.5 mmHg?

Intermolecular forces

16. Which intermolecular forces do each of the following exhibit?
    (a) HCl
    (b) HF
    (c) CCl_4

17. Which hydrocarbon has the highest boiling point: methane (CH_4), ethane (C_2H_6), or propane (C_3H_8)?

Solutions

18. Calculate the molarity of a solution that contains 67.9 g of NaCl in 2.00 L of solution.

19. Calculate the mass of NaCl in a 60.0 mL sample of 1.7 M NaCl.

20. What volume of 12.0 M HCl is needed to prepare 250.0 mL of 0.500 M HCl?

21. What is the concentration of a solution prepared by diluting 25.0 mL of 2.0 M NaOH to a volume of 500.0 mL?

Acids and bases

22. Identify the following as an acid or base by the Arrhenius definition
    (a) $\mathrm{HNO_3}$
    (b) KOH

23. An aqueous solution has $[OH^-]$ = 3.3×10^{-5}M. What is the $[H_3O^+]$ of the solution?

24. Calculate the pH of the following solutions:
    (a) 1.95×10^{-3} M HBr
    (b) 1.48×10^{-3} M KOH
    (c) 1.56×10^{-4} M $Sr(OH)_2$

ANSWERS

1.

(a) Calcium nitrate	(d) Potassium sulfate	(g) SiO_2	(j) $Ni(OH)_3$
(b) Phosphorous pentachloride	(e) Disulfur dibromide	(h) $CuBr_2$	(k) $Co(NO_2)_2$
(c) Lead(IV) carbonate	(f) Aluminum fluoride	(i) Na_2SO_3	(l) Sr_3P_2

2.

(a) hydrobromic acid	(d) HF
(b) phosphoric acid	(e) H_2SO_3
(c) chlorous acid	(f) HNO_3

3. (a) 22.44 g (b) 8.32 mL

4. (a) 3.4 km (b) 25.0 µg (c) 20.7 gallons (d) 11 m/s

5. 1500 cm^3

6. (a) **2** C_2H_6 + **7** O_2 → **4** CO_2 + **6** H_2O (b) PCl_5 + **4** H_2O → H_3PO_4 + **5** HCl

7. 4 HCl(aq) + MnO_2(s) → Cl_2(g) + 2 H_2O(l) + $MnCl_2$(aq)

8. 1.763×10^{23} formula units of $MgCl_2$ and 3.527×10^{23} Cl^- ions

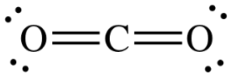
9. (a) 0.618 mol CO_2 (b) 4.3 g C

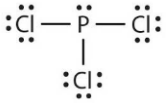
10. balanced equation: **2** C_4H_{10} + **13** O_2 → **8** CO_2(g) + **10** H_2O (g); C_4H_{10} is limiting, so 67.9 g of H_2O produced.

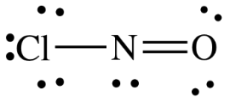
11. (a)  (b)  (c) 

12. (a) SrS (b) Al_2O_3

13.







14. 0.4638 bar

15. 29 L

16. (a) dispersion, dipole-dipole interactions (b) dispersion, dipole-dipole interactions, hydrogen bonding (c) dispersion

17. propane

18. 0.581 M

19. 6.0 g

20. 10.4 mL

21. 0.10 M

22. (a) acid (b) base

23. 3.0×10^{-10} M

24. (a) 2.710 (b) 11.170 (c) 10.494