

**Naming Compounds**

1. Provide the name (problems a-h) or formula (problems i-q) for the following compounds.

- |                                |   |                        |                           |
|--------------------------------|---|------------------------|---------------------------|
| (a) $\text{Ca}(\text{NO}_3)_2$ | (e) $\text{K}_2\text{SO}_4$                       | (j) silver phosphate   | (n) nickel(III) hydroxide |
| (b) $\text{PCl}_5$             | (f) $\text{Cu}(\text{ClO}_3)_2$                   | (k) copper(II) bromide | (o) cobalt(II) nitrate    |
| (c) $\text{Pb}(\text{CO}_3)_2$ | (g) $\text{Ba}(\text{C}_2\text{H}_3\text{O}_2)_2$ | (l) sodium sulfite     | (p) strontium phosphide   |
| (d) $\text{S}_2\text{Br}_2$    | (h) $\text{AlF}_3$                                | (m) silicon dioxide    |                           |

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

- |                             |                       |
|-----------------------------|-----------------------|
| (a) $\text{HBr}$            | (d) hydrofluoric acid |
| (b) $\text{H}_3\text{PO}_4$ | (e) sulfurous acid    |
| (c) $\text{HClO}_2$         | (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. A paperback book has the dimensions 5.8 in x 2.0 in x 7.85 in. What is its volume in cubic centimeters ( $\text{cm}^3$ )?

**Chemical Equations**

5. Balance the following equations:



6. 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

7. How many molecules of magnesium chloride are in a sample weighing 27.88 g? How many atoms of *just* chloride are in the sample?
8. For the following reaction:  $2 \text{Cr}_2\text{O}_3(s) + 3 \text{C}(s) \rightarrow 4 \text{Cr}(s) + 3 \text{CO}_2(g)$
- (a) Find the moles of  $\text{CO}_2(g)$  produced when we react 62.6 g of  $\text{Cr}_2\text{O}_3(s)$ .
  - (b) How many grams of C would be needed to produce 25 g of Cr?
9. Write the balanced reaction for the combustion of  $\text{C}_4\text{H}_{10}(g)$  with oxygen gas. Then, find how many grams of water are produced when 43.8 g of  $\text{C}_4\text{H}_{10}(g)$  are reacted with 200. g of  $\text{O}_2(g)$ . What's the limiting reactant?
10. A solution contains an unknown mass of dissolved barium ions. When sodium sulfate is added to the solution, a white precipitate forms. The precipitate is filtered and dried and then found to have a mass of 258 mg. What mass of barium was in the original solution? (Assume that all of the barium was precipitated out of solution by the reaction.)
11. Draw the Lewis structure 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. For the following compounds, draw a Lewis dot structure, determine its electron geometry\* and molecular geometry\*.

Formula	Lewis structure	Electron Geometry*	Molecular Geometry*
CO <sub>2</sub>			
PCl <sub>3</sub>			
CINO			

\*Not covered in all 1020 sections

14. Classify these molecules as polar or nonpolar. If you did not cover molecular geometry in your section, consult the key for the 3D shapes of these molecules.

(a) CO<sub>2</sub>

(b) PCl<sub>3</sub>

(c) CINO

### Gas Laws

15. Convert 46.38 kilopascals to barr.

16. A balloon at 24°C has a volume of 14 L and a pressure of 785 mmHg. Assuming the balloon does not 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?

**Organic Chemistry**

17. Draw the three isomers of hexyne.

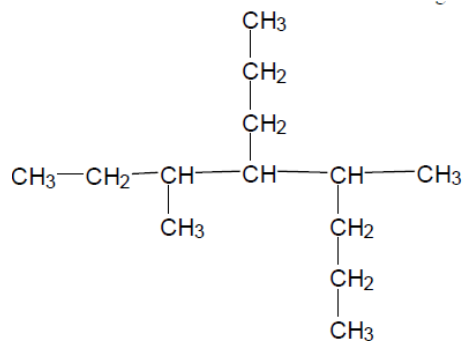
18. Classify each of the following as an alkane, an alkene, or an alkyne.

(a)  $C_4H_8$

(b)  $C_{10}H_{22}$

(c)  $C_3H_4$

19. Give the IUPAC name for each of the following:



(a)

(b)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{-C}\equiv\text{CCH}_3$

20. Classify each of the following as an alcohol, aldehyde, carboxylic acid, ester, ether, or ketone:

(a) 3-pentanol

(b)  $\text{H}_3\text{C-CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_3$

(c) octanal

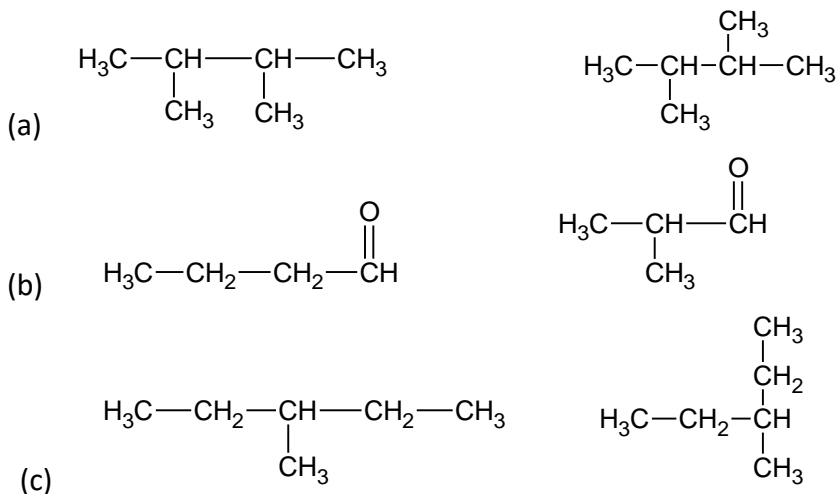
(d)  $\text{H}_3\text{C-CH}_2\text{-CH}_2\text{-OH}$

(e) 3-hexanone

(f)  $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{CH}_3$

(g)  $\text{CH}_3\text{CH}_2\text{CH}_2\overset{\text{O}}{\parallel}{\text{C}}\text{OH}$

21. For each of the following, determine whether the two structures are isomers or the same molecule drawn in two different ways.



### Liquids, Solids, and Intermolecular Forces

22. What kind of intermolecular forces do each of the following exhibit?

- (a) HCl
- (b) HF
- (c) CCl<sub>4</sub>

23. Which has the highest boiling point: methane, ethane, or propane?

### Solutions

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

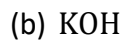
25. Calculate the mass of NaCl in a 60.0 mL sample of 1.7 M NaCl.

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

27. 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?

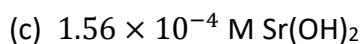
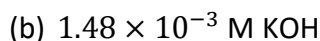
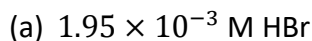
**Acids and Bases**

28. Identify the following as an acid or base by the Arrhenius definition

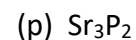
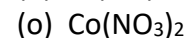
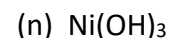
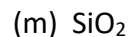
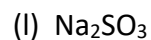
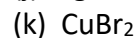
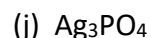
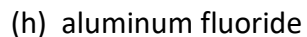
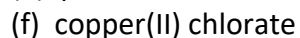
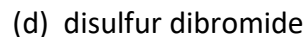
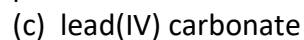
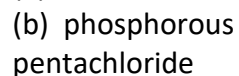


29. An aqueous solution has  $[\text{OH}^-] = 3.3 \times 10^{-5}\text{M}$ . What is the  $[\text{H}_3\text{O}^+]$  and pH of the solution?

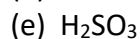
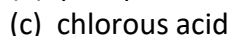
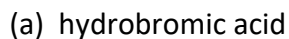
30. Calculate the pH of the following solutions:

**Answers**

1.



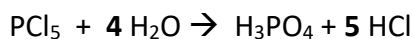
2.



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

4.      1500  $\text{cm}^3$

5.       $2\text{ C}_2\text{H}_6 + 7\text{ O}_2 \rightarrow 4\text{ CO}_2 + 6\text{ H}_2\text{O}$



6.       $4\text{ HCl}(aq) + \text{MnO}_2(s) \rightarrow \text{Cl}_2(g) + 2\text{ H}_2\text{O}(l) + \text{MnCl}_2(aq)$

7.       $1.763 \times 10^{23}$  molecules of  $\text{MgCl}_2$  and  $3.527 \times 10^{23}$  atoms of  $\text{Cl}^-$

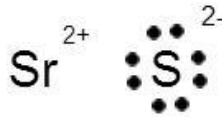
8. (a)  $6.18 \times 10^{-1}$  mol  $\text{CO}_2$  (b) 4.3g C

9. Balanced equation:  $2 \text{C}_4\text{H}_{10} + 13 \text{O}_2 \rightarrow 8 \text{CO}_2(g) + 10 \text{H}_2\text{O}(g)$ ;  $\text{C}_4\text{H}_{10}$  is limiting, so 67.9 g of  $\text{H}_2\text{O}$  produced.

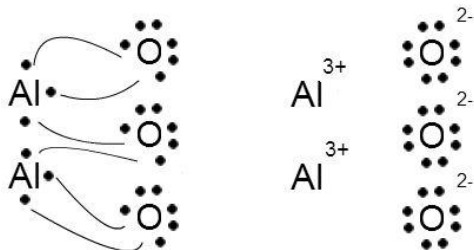
10. 0.152 g  $\text{Ba}^{2+}$

11.  $\text{Li}^\bullet$  (a)  $\text{:}\ddot{\text{S}}\text{:}$  (b)  $\cdot\ddot{\text{N}}\cdot$  (c)

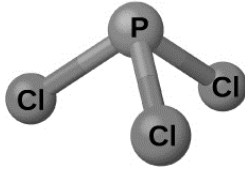
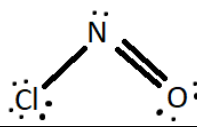
12. (a) SrS



(b)  $\text{Al}_2\text{O}_3$



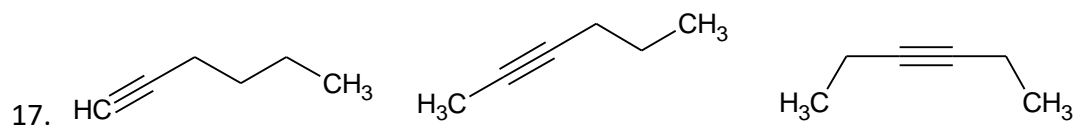
13. Lewis structures for covalent compounds. Fill in the table

Formula	Lewis structure	Electron Geometry	Molecular Geometry
$\text{CO}_2$	$\text{:}\ddot{\text{O}}=\text{C}=\ddot{\text{O}}\text{:}$	Linear	Linear (same as lewis dot structure)
$\text{PCl}_3$	$\begin{array}{c} \text{:}\ddot{\text{Cl}}-\ddot{\text{P}}-\ddot{\text{Cl}}\text{:} \\   \\ \text{:}\ddot{\text{Cl}}\text{:} \end{array}$	Tetrahedral	Trigonal pyramidal 
$\text{ClNO}$	$\begin{array}{c} \cdot\cdot \\ \text{:}\ddot{\text{Cl}}-\ddot{\text{N}}=\ddot{\text{O}}\text{:} \\ \cdot\cdot \quad \cdot\cdot \quad \cdot\cdot \end{array}$	Trigonal planar	Bent 

14. (a) nonpolar (b) polar (c) polar

15. 0.4638 bar

16. 29 L



18. (a) alkene

(b) alkane

(c) alkyne

19. (a) 3,5-dimethyl-4-propyloctane (b) 2-hexyne

20. (a) alcohol

(b) ether

(c) aldehyde

(d) alcohol

(e) ketone

(f) ester

(g) carboxylic acid

21. (a) same

(b) isomers

(c) same

22. (a) dispersion, dipole-dipole

(b) dispersion, dipole-dipole, hydrogen bonding

(c) dispersion

23. propane ( $\text{CH}_3\text{CH}_2\text{CH}_3$ )

24. 0.581 M

25. 6.0 g NaCl

26. 10.4 mL of 12.0 M HCl needed

27. 0.10 M NaOH

28. (a) acid

b. base

29.  $3.0 \times 10^{-10}$  M

pH = 9.52

30. a. 2.710

b. 11.170

c. 10.494