

## **Classifying Knowledge, Extra Exercises**

Complete the table below with the correct definitions.

**Table 1 Definitions of Terms**

Term	Definition	Examples/Notes
observation		
qualitative observation		
quantitative observation		
interpretation		
empirical knowledge		
theoretical knowledge		
empirical hypothesis		
empirical definition		
generalization		
scientific law		

**Student Worksheet Solutions      LSM 1.1B**

**Solutions for Classifying Knowledge,  
Extra Exercises**

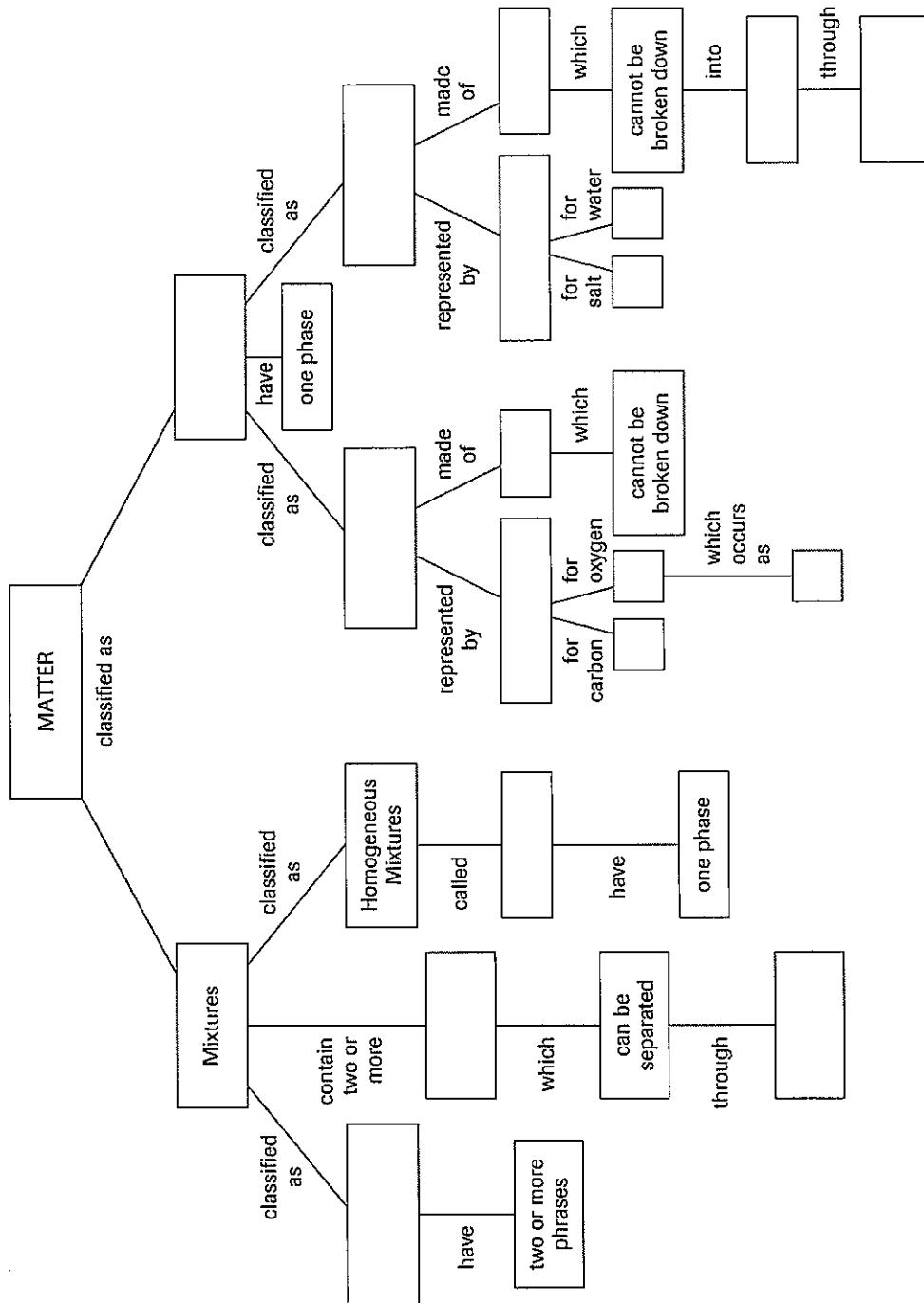
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**Table 1 Definitions of Terms**

Term	Definition	Example
observation	a direct form of knowledge obtained by means of one of the five senses	colour, physical state, or mass
qualitative observation	an observation describing changes of state or physical qualities of matter (not involving a quantity)	change from solid to liquid; colour
quantitative observation	an observation involving the quantity of matter or the measured degree of change	length, mass, or temperature
interpretation	an indirect form of knowledge that builds on a concept or an experience to further describe or explain an observation	Light and heat are released from burning magnesium, so a chemical reaction is likely taking place.
empirical knowledge	knowledge gained by observation	Magnesium burns with a white flame.
theoretical knowledge	knowledge that arises from interpreting observations, using ideas, and theories	Magnesium atoms lose electrons to form magnesium ions, while oxygen atoms gain electrons to form oxide ions.
empirical hypothesis	a preliminary generalization that requires further testing	The mass of the product of a reaction will, perhaps, always vary directly with the mass of a reacting substance.
empirical definition	a statement that defines an object or a process in terms of observable properties	A metal is a shiny, flexible solid.
generalization	a statement that summarizes a limited number of empirical results	Many metals slowly react with oxygen from the air in a process known as corrosion.
scientific law	a statement of a major concept based on a large body of empirical knowledge; more important, and summarizing more empirical knowledge, than a generalization	The burning of magnesium illustrates the law of conservation of mass.

# Classification of Matter, Extra Exercises

Complete the following concept map.

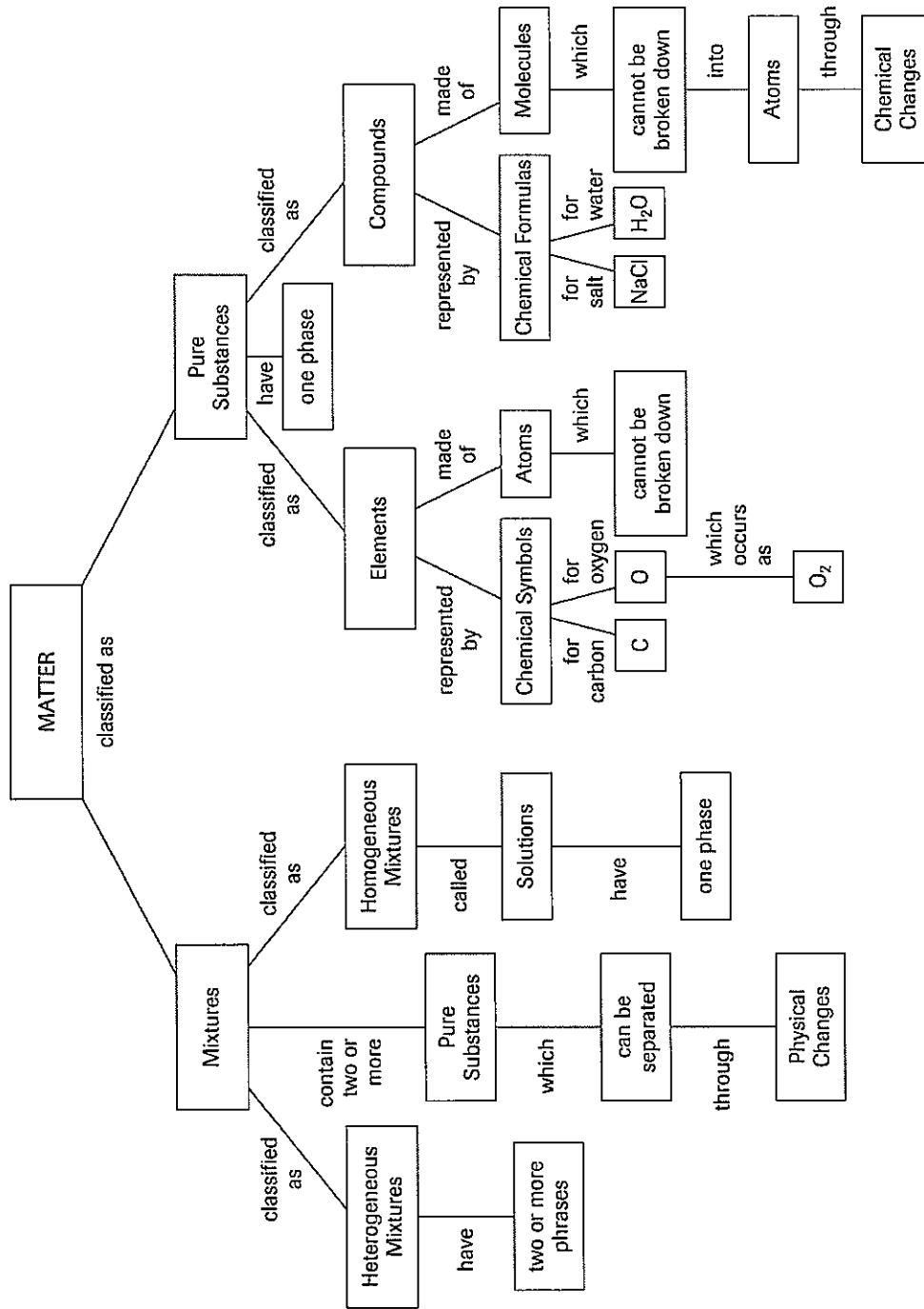


**Student Worksheet Solutions**      **LSM 1.2D**

**Solutions for Classification of Matter,  
Extra Exercises**

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Complete the following concept map.



## **Student Worksheet**

LSM 1.3A

## **Make a Periodic Table, Extra Exercises**

Follow the instructions to complete the blank periodic table below.

1. (a) Label the groups (at the top of each group) from 1 to 18 and in the Roman Numeral system (IA to VIIIA and IB to VIIIB).  
(b) Label the periods at both sides of the table.
  2. (a) Lightly shade the metals with a light colour.  
(b) Lightly shade the nonmetals with another colour.  
(c) Leave the metalloids unshaded.
  3. Label the transition metals, lanthanides, actinides, alkali metals, alkaline-earth metals, halogens, and noble gases.
  4. Outline the “staircase” with a thick black line and label it.
  5. (a) Circle the elements that are liquid at SATP.  
(b) Outline the elements with a thick black line that are gases at SATP.

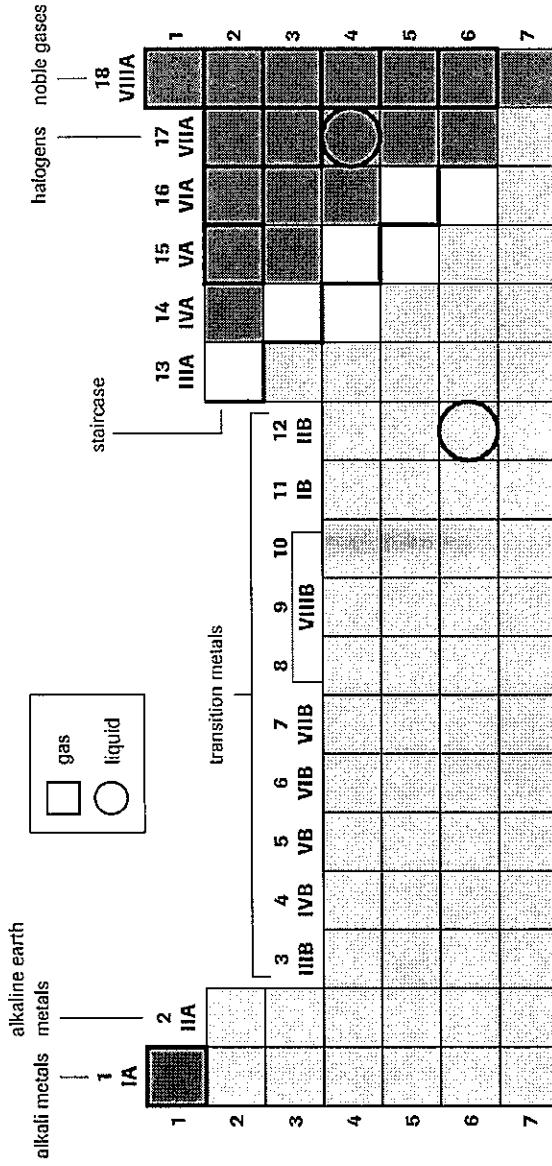
A large, empty 10x10 grid consisting of 100 small squares, intended for drawing or writing practice.

**Answer the following questions:**

1. Define the following terms: period; group or family.
  2. What does the “staircase” indicate?
  3. How many elements are solid at SATP? Liquids at SATP? Gases at SATP?

**Student Worksheet Solutions**      **LSM 1.3B**  
**Solutions for Make a Periodic Table, Extra Exercises**

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- Define the following terms: period; group or family.  
 A period is a row of elements in the periodic table. Elements in a period have properties that change from metallic on the left to nonmetallic on the right.  
 A group or family is a column of elements in the periodic table. The elements in a group or family have similar chemical properties.
- What does the "staircase" indicate?  
 The staircase separates metals (to the left) and nonmetals (to the right).
- How many elements are solid at SATP? Liquids at SATP? Gases at SATP?  
 102 elements are solid, 2 are liquid, and 11 are gases.

# Student Worksheet

# LSM 1.3C

## Periodic Table, Extra Exercises

Use the periodic table on the inside front cover of your textbook to complete the following table

**Table 1 Properties and Descriptions of Elements**

	Element name	Chemical symbol	Atomic number	Group number	Period number	Metal (m) or nonmetal (nm)	State at SATP	Family/Series names
1.	chlorine							
2.	magnesium							
3.			30					
4.		N						
5.				17	5			
6.			79					
7.					3			alkali metals
8.	thorium			—				
9.				12			liquid	
10.		Br						
11	argon							
12.				11	5			
13.			19					
14.	calcium							
15.				1			gas	
16.			58	—				

# Student Worksheet Solutions      LSM 1.3D

## Solutions for Periodic Table, Extra Exercises

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Use the periodic table on the inside front cover of your textbook to complete the following table.

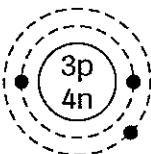
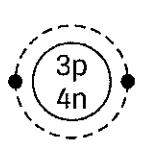
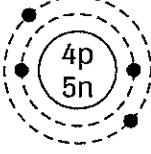
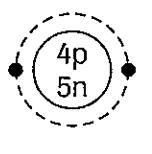
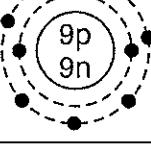
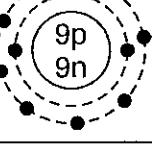
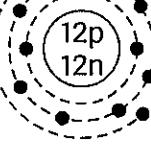
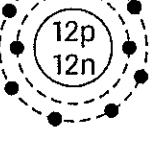
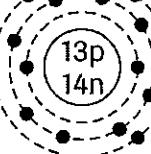
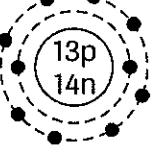
**Table 1 Properties and Descriptions of Elements**

Element name	Chemical symbol	Atomic number	Group number	Period number	Metal (m) or nonmetal (nm)	State at SATP	Family/Series names
1. chlorine	Cl	17	17	3	nm	gas	halogens
2. magnesium	Mg	12	2	3	m	solid	alkaline-earths
3. zinc	Zn	30	12	4	m	solid	transition elements
4. nitrogen	N	7	15	2	nm	gas	representative elements
5. iodine	I	53	17	5	nm	solid	halogens
6. gold	Au	79	11	6	m	solid	transition elements
7. sodium	Na	11	1	3	m	solid	alkali metals
8. thorium	Th	90	—	7	m	solid	actinides
9. mercury	Hg	80	12	6	m	liquid	transition elements
10. bromine	Br	35	17	4	nm	liquid	halogens
11. argon	Ar	18	18	3	nm	gas	noble gases
12. silver	Ag	47	11	5	m	solid	transition elements
13. potassium	K	19	1	4	m	solid	alkali metals
14. calcium	Ca	20	2	4	m	solid	alkaline-earths
15. hydrogen	H	1	1	1	nm	gas	representative elements
16. cerium	Ce	58	—	6	m	solid	lanthanides

**Student Worksheet****LSM 1.4A****Bohr Diagrams and Energy Level Diagrams,  
Extra Exercises**

Element name and symbol	Bohr diagram of atom	Energy level diagram of atom	# of valence electrons	Bohr diagram of ion	Energy level diagram of ion	Ionic charge (if an ion forms)
lithium						
beryllium						
F						
magnesium						
Al						

# Solutions for Bohr Diagrams and Energy Level Diagrams, Extra Exercises

Element name and symbol	Bohr diagram of atom	Energy level diagram of atom	# of valence electrons	Bohr diagram of ion	Energy level diagram of ion	Ionic charge (if an ion forms)
lithium Li		$\frac{1 e^-}{2 e^-}$ $3 p^+$ Li	1		$\frac{2 e^-}{3 p^+}$ Li	1+
beryllium Be		$\frac{2 e^-}{2 e^-}$ $4 p^+$ Be	2		$\frac{2 e^-}{4 p^+}$ Be	2+
fluorine F		$\frac{7 e^-}{2 e^-}$ $9 p^+$ F	7		$\frac{8 e^-}{2 e^-}$ $9 p^+$ F	1-
magnesium Mg		$\frac{2 e^-}{8 e^-}$ $2 e^-$ $12 p^+$ Mg	2		$\frac{8 e^-}{2 e^-}$ $12 p^+$ Mg	2+
aluminium Al		$\frac{3 e^-}{8 e^-}$ $2 e^-$ $13 p^+$ Al	3		$\frac{8 e^-}{2 e^-}$ $13 p^+$ Al	3+

## Ionic Compounds, Extra Exercises

1. Write the formulas for the following compounds.

(a) magnesium oxide \_\_\_\_\_

(b) sodium fluoride \_\_\_\_\_

(c) aluminium nitride \_\_\_\_\_

(d) potassium sulfide \_\_\_\_\_

(e) lithium iodide \_\_\_\_\_

(f) calcium bromide \_\_\_\_\_

(g) beryllium oxide \_\_\_\_\_

(h) nickel chloride \_\_\_\_\_

(i) magnesium nitride \_\_\_\_\_

(j) aluminium sulfide \_\_\_\_\_

(k) copper(I) bromide \_\_\_\_\_

(l) tin(II) iodide \_\_\_\_\_

(m) iron(III) chloride \_\_\_\_\_

(n) calcium phosphide \_\_\_\_\_

(o) lead(II) oxide \_\_\_\_\_

(p) lead(IV) fluoride \_\_\_\_\_

(q) tin(IV) bromide \_\_\_\_\_

(r) copper(II) sulfide \_\_\_\_\_

(s) iron(II) oxide \_\_\_\_\_

(t) calcium nitride \_\_\_\_\_

2. Write the names for the following compounds.

(a) Li<sub>2</sub>O \_\_\_\_\_

(b) AlCl<sub>3</sub> \_\_\_\_\_

(c) MgS \_\_\_\_\_

(d) CaO \_\_\_\_\_

(e) KBr \_\_\_\_\_

(f) BeF \_\_\_\_\_

(g) Na<sub>3</sub>N \_\_\_\_\_

(h) Al<sub>2</sub>O<sub>3</sub> \_\_\_\_\_

(i) CuCl<sub>2</sub> \_\_\_\_\_

(j) FeBr<sub>3</sub> \_\_\_\_\_

(k) PbS \_\_\_\_\_

(l) SnO<sub>2</sub> \_\_\_\_\_

(m) Na<sub>2</sub>S \_\_\_\_\_

(n) Mg<sub>3</sub>P<sub>2</sub> \_\_\_\_\_

(o) NiO \_\_\_\_\_

(p) CuI \_\_\_\_\_

(q) PbCl<sub>4</sub> \_\_\_\_\_

(r) FeP \_\_\_\_\_

(s) CaF<sub>2</sub> \_\_\_\_\_

(t) K<sub>3</sub>P \_\_\_\_\_

**Solutions for Ionic Compounds, Extra Exercises**

1. Write the formulas for the following compounds.

- (a) magnesium oxide
- (b) sodium fluoride
- (c) aluminium nitride
- (d) potassium sulfide
- (e) lithium iodide
- (f) calcium bromide
- (g) beryllium oxide
- (h) nickel chloride
- (i) magnesium nitride
- (j) aluminium sulfide
- (k) copper(I) bromide
- (l) tin(II) iodide
- (m) iron(III) chloride
- (n) calcium phosphide
- (o) lead(II) oxide
- (p) lead(IV) fluoride
- (q) tin(IV) bromide
- (r) copper(II) sulfide
- (s) iron(II) oxide
- (t) calcium nitride

MgO      NaF      AlN      K<sub>2</sub>S      LiI      CaBr<sub>2</sub>      BeO      NiCl<sub>2</sub>      Mg<sub>3</sub>N<sub>2</sub>      Al<sub>2</sub>S<sub>3</sub>      CuBr      SnI<sub>2</sub>      FeCl<sub>3</sub>      Ca<sub>3</sub>P<sub>2</sub>      PbO      PbF<sub>4</sub>      SnBr<sub>4</sub>      CuS      FeO      Ca<sub>3</sub>N<sub>2</sub>

2. Write the names for the following compounds.

- (a) Li<sub>2</sub>O      lithium oxide
- (b) AlCl<sub>3</sub>      aluminium chloride
- (c) MgS      magnesium sulfide
- (d) CaO      calcium oxide
- (e) KBr      potassium bromide
- (f) BeF      beryllium fluoride
- (g) Na<sub>3</sub>N      sodium nitride
- (h) Al<sub>2</sub>O<sub>3</sub>      aluminium oxide
- (i) CuCl<sub>2</sub>      copper(II) chloride
- (j) FeBr<sub>3</sub>      iron(III) bromide
- (k) PbS      lead(II) sulfide
- (l) SnO<sub>2</sub>      tin(IV) oxide
- (m) Na<sub>2</sub>S      sodium sulfide
- (n) Mg<sub>3</sub>P<sub>2</sub>      magnesium phosphide
- (o) NiO      nickel oxide
- (p) CuI      copper(I) iodide
- (q) PbCl<sub>4</sub>      lead(IV) chloride
- (r) FeP      iron(III) phosphide
- (s) CaF<sub>2</sub>      calcium fluoride
- (t) K<sub>3</sub>P      potassium phosphide

## Molecular Compounds, Extra Exercises

1. Write the formulas for the following compounds.

(a) carbon dioxide \_\_\_\_\_

(b) silicon dioxide \_\_\_\_\_

(c) water \_\_\_\_\_

(d) carbon disulfide \_\_\_\_\_

(e) sulfur trioxide \_\_\_\_\_

(f) ammonia \_\_\_\_\_

(g) carbon tetrachloride \_\_\_\_\_

(h) hydrogen peroxide \_\_\_\_\_

(i) methane \_\_\_\_\_

(j) ozone \_\_\_\_\_

(k) diphosphorus trioxide \_\_\_\_\_

(l) nitrogen monoxide \_\_\_\_\_

(m) chlorine dioxide \_\_\_\_\_

(n) dinitrogen oxide \_\_\_\_\_

(o) carbon monoxide \_\_\_\_\_

(p) arsenic tribromide \_\_\_\_\_

(q) phosphorus pentabromide \_\_\_\_\_

(r) dinitrogen tetroxide \_\_\_\_\_

(s) silicon carbide \_\_\_\_\_

(t) sulfur dioxide \_\_\_\_\_

2. Write the names for the following compounds.

(a)  $\text{CF}_4$  \_\_\_\_\_

(b)  $\text{NH}_3$  \_\_\_\_\_

(c)  $\text{PBr}_3$  \_\_\_\_\_

(d)  $\text{O}_3$  \_\_\_\_\_

(e)  $\text{F}_2(\text{g})$  \_\_\_\_\_

(f)  $\text{CS}_2$  \_\_\_\_\_

(g)  $\text{N}_2\text{O}_4$  \_\_\_\_\_

(h)  $\text{H}_2\text{O}_2$  \_\_\_\_\_

(i)  $\text{CO}$  \_\_\_\_\_

(j)  $\text{SiC}$  \_\_\_\_\_

(k)  $\text{P}_2\text{O}_5$  \_\_\_\_\_

(l)  $\text{CH}_4$  \_\_\_\_\_

(m)  $\text{SO}_3$  \_\_\_\_\_

(n)  $\text{H}_2\text{O}$  \_\_\_\_\_

(o)  $\text{SiO}_2$  \_\_\_\_\_

(p)  $\text{PCl}_5$  \_\_\_\_\_

(q)  $\text{I}_2(\text{g})$  \_\_\_\_\_

(r)  $\text{NO}_2$  \_\_\_\_\_

(s)  $\text{SF}_4$  \_\_\_\_\_

(t)  $\text{H}_2(\text{g})$  \_\_\_\_\_

**Student Worksheet Solutions      LSM 1.6B**  
**Solutions for Molecular Compounds,  
Extra Exercises**

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1. Write the formulas for the following compounds.

(a) carbon dioxide	$\text{CO}_2$
(b) silicon dioxide	$\text{SiO}_2$
(c) water	$\text{H}_2\text{O}$
(d) carbon disulfide	$\text{CS}_2$
(e) sulfur trioxide	$\text{SO}_3$
(f) ammonia	$\text{NH}_3$
(g) carbon tetrachloride	$\text{CCl}_4$
(h) hydrogen peroxide	$\text{H}_2\text{O}_2$
(i) methane	$\text{CH}_4$
(j) ozone	$\text{O}_3$
(k) diphosphorus trioxide	$\text{P}_2\text{O}_3$
(l) nitrogen monoxide	$\text{NO}$
(m) chlorine dioxide	$\text{ClO}_2$
(n) dinitrogen oxide	$\text{N}_2\text{O}$
(o) carbon monoxide	$\text{CO}$
(p) arsenic tribromide	$\text{AsBr}_3$
(q) phosphorus pentabromide	$\text{PBr}_5$
(r) dinitrogen tetroxide	$\text{N}_2\text{O}_4$
(s) silicon carbide	$\text{SiC}$
(t) sulfur dioxide	$\text{SO}_2$

2. Write the names for the following compounds.

(a) $\text{CF}_4$	<b>carbon tetrafluoride</b>
(b) $\text{NH}_3$	<b>ammonia</b>
(c) $\text{PBr}_3$	<b>phosphorus tribromide</b>
(d) $\text{O}_3$	<b>ozone</b>
(e) $\text{F}_2(\text{g})$	<b>fluorine gas</b>
(f) $\text{CS}_2$	<b>carbon disulfide</b>
(g) $\text{N}_2\text{O}_4$	<b>dinitrogen tetroxide</b>
(h) $\text{H}_2\text{O}_2$	<b>hydrogen peroxide</b>
(i) $\text{CO}$	<b>carbon monoxide</b>
(j) $\text{SiC}$	<b>silicon carbide</b>
(k) $\text{P}_2\text{O}_5$	<b>diphosphorus pentoxide</b>
(l) $\text{CH}_4$	<b>methane</b>
(m) $\text{SO}_3$	<b>sulfur trioxide</b>
(n) $\text{H}_2\text{O}$	<b>water</b>
(o) $\text{SiO}_2$	<b>silicon dioxide</b>
(p) $\text{PCl}_5$	<b>phosphorus pentachloride</b>
(q) $\text{I}_2(\text{g})$	<b>iodine gas</b>
(r) $\text{NO}_2$	<b>nitrogen dioxide</b>
(s) $\text{SF}_4$	<b>sulfur tetrafluoride</b>
(t) $\text{H}_2(\text{g})$	<b>hydrogen gas</b>

## Writing Chemical Formulas, Extra Exercises

1. How many atoms, and of which kind, do the following symbols represent?
- (a) Ca

(b) N<sub>2</sub>

(c) Ba<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>

(d) 2 H<sub>2</sub>O

(e) 3 FeSO<sub>4</sub>

(f) 4 Cu(NO<sub>3</sub>)<sub>2</sub>

2. Complete the tables, specifying how many atoms of each type are in one molecule of the compound specified.

(a) K<sub>2</sub>CrO<sub>4</sub>

Type of atom	# of atoms
potassium	
chromium	
oxygen	
Total	

(b) 2 (NH<sub>4</sub>)<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>

Type of atom	# of atoms
nitrogen	
hydrogen	
chromium	
oxygen	
Total	

**Student Worksheet Solutions      LSM 2.2D**  
**Solutions for Writing Chemical Formulas,**  
**Extra Exercises**

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1. (a) Ca = 1 atom of calcium  
(b) N<sub>2</sub> = 2 atoms of nitrogen in the molecule  
(c) Ba<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> = 1 molecule of barium phosphate, which includes  
    3 atoms of barium  
    2 atoms of phosphorus  
    8 atoms of oxygen  
    Total number of atoms = 13  
(d) 2 H<sub>2</sub>O = 2 molecules of water, which includes  
    4 atoms of hydrogen  
    2 atoms of oxygen  
    Total number of atoms = 6  
(e) 3 FeSO<sub>4</sub> = 3 molecules of iron(II) sulfate, which includes  
    3 atoms of iron  
    3 atoms of sulfur  
    12 atoms of oxygen  
    Total number of atoms = 18  
(f) 4 Cu(NO<sub>3</sub>)<sub>2</sub> = 4 molecules of copper(II) nitrate, which includes  
    4 atoms of copper  
    8 atoms of nitrogen  
    24 atoms of oxygen  
    Total number of atoms = 36
2. (a) K<sub>2</sub>CrO<sub>4</sub>

Type of atom	# of atoms
potassium	2
chromium	1
oxygen	4
Total	7

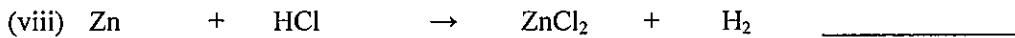
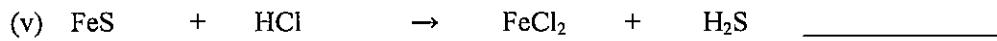
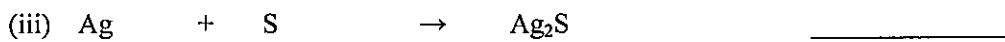
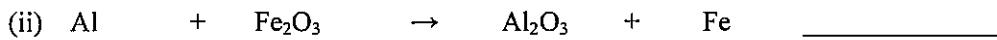
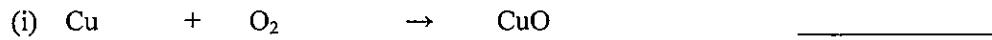
- (b) 2 (NH<sub>4</sub>)<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>

Type of atom	# of atoms
nitrogen	4
hydrogen	16
chromium	4
oxygen	14
Total	38

# Classifying Chemical Reactions

1. (a) Classify each of the following reactions as formation, simple decomposition, single replacement, or double replacement reactions.

- (b) Balance each equation and add symbols to indicate states of matter for all reactants and products.



2. Write balanced chemical equations for the following:

- (a) The decomposition reaction of hydrogen sulfide.

- (b) The single displacement reaction of copper metal and silver nitrate.

- (c) The synthesis reaction of sodium and fluorine.

- (d) The double displacement reaction of aluminium sulfate and calcium hydroxide.

**Student Worksheet Solutions      LSM 2.6C**  
**Solutions for Classifying Chemical Reactions,  
Extra Exercises**

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1. (a)  $2 \text{Cu(s)} + \text{O}_2\text{(g)} \rightarrow 2 \text{CuO(s)}$  formation 8  
(b)  $2 \text{Al(s)} + \text{Fe}_2\text{O}_3\text{(s)} \rightarrow \text{Al}_2\text{O}_3\text{(s)} + 2 \text{Fe(s)}$  single replacement  
(c)  $16 \text{Ag(s)} + \text{S}_8\text{(s)} \rightarrow 8 \text{Ag}_2\text{S(s)}$  formation  
(d)  $2 \text{H}_2\text{O(l)} + \text{electricity} \rightarrow 2 \text{H}_2\text{(g)} + \text{O}_2\text{(g)}$  simple decomposition  
*38* (e)  $\text{FeS(s)} + 2 \text{HCl(aq)} \rightarrow \text{FeCl}_2\text{(aq)} + \text{H}_2\text{S(g)}$  double replacement  
(f)  $2 \text{NaCl(s)} \rightarrow 2 \text{Na(s)} + \text{Cl}_2\text{(g)}$  simple decomposition  
(g)  $\text{NaOH(aq)} + \text{HCl(aq)} \rightarrow \text{H}_2\text{O(l)} + \text{NaCl(aq)}$  double replacement  
(h)  $\text{Zn(s)} + 2 \text{HCl(aq)} \rightarrow \text{ZnCl}_2\text{(aq)} + \text{H}_2\text{(g)}$  single replacement
2. (a) The decomposition reaction of hydrogen sulfide  
 $8 \text{H}_2\text{S(g)} \rightarrow 8 \text{H}_2\text{(g)} + \text{S}_8\text{(s)}$   
(b) The single displacement reaction of copper metal and silver nitrate  
 $\text{Cu(s)} + 2 \text{AgNO}_3\text{(aq)} \rightarrow \text{Ag(s)} + \text{Cu(NO}_3)_2\text{(aq)}$   
(c) The synthesis reaction of sodium and fluorine  
 $2 \text{Na(s)} + \text{F}_2\text{(g)} \rightarrow 2 \text{NaF(aq)}$   
(d) The double replacement reaction of aluminium sulfate and calcium hydroxide  
 $\text{Al}_2(\text{SO}_4)_3\text{(aq)} + 3 \text{Ca(OH)}_2\text{(aq)} \rightarrow 2 \text{Al(OH)}_3\text{(s)} + 3 \text{CaSO}_4\text{(s)}$

## Molar Mass and Conversions



**Table 1** Molar Calculations

Substance	Molar mass (g/mol)	Mass (g)	Chemical amount (mol)
CaCl <sub>2</sub> (s)		18.6	
Al <sub>2</sub> O <sub>3</sub> (s)			0.267
Mg(OH) <sub>2</sub> (s)		35.00	
Na <sub>2</sub> CO <sub>3</sub> •10H <sub>2</sub> O(s)			0.150

**Student Worksheet Solutions      LSM 2.4B**  
**Solutions for Molar Mass and Conversions,**  
**Extra Exercises**

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1. Determine the molar mass of each of the following substances:

(a) MgI <sub>2</sub> (s)	(b) Al(OH) <sub>3</sub> (s)
278.11 g/mol	78.01 g/mol
(c) (NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub> (s)	(d) CoCl <sub>2</sub> •6H <sub>2</sub> O(s)
96.11 g/mol	237.95 g/mol

2. Convert each of the following masses into its chemical amount:

(a) 8.40 g of NaOH(s)

$$n_{\text{NaOH}} = 8.40 \text{ g} \times \frac{1 \text{ mol}}{40.00 \text{ g}}$$

$$= 0.210 \text{ mol}$$

(b) 4.2 kg of H<sub>2</sub>O(l)

$$n_{\text{H}_2\text{O}} = 4.2 \text{ kg} \times \frac{1 \text{ mol}}{18.02 \text{ g}}$$

$$= 0.23 \text{ kmol}$$

3. Convert each of the following amounts into a mass in grams of the given substance:

(a) 0.456 mol of Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>(s)

$$m_{\text{Al}_2(\text{SO}_4)_3} = 0.456 \text{ mol} \times \frac{342.14 \text{ g}}{1 \text{ mol}}$$

$$= 156 \text{ g}$$

(b) 0.518 mmol of CuSO<sub>4</sub>•5H<sub>2</sub>O(s)

$$m_{\text{CuSO}_4 \cdot 5\text{H}_2\text{O}} = 0.518 \text{ mmol} \times \frac{249.71 \text{ g}}{1 \text{ mol}}$$

$$= 0.129 \text{ g}$$

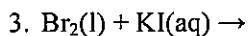
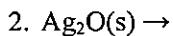
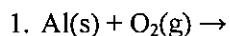
4. Complete the following table.

**Table 1** Molar Calculations

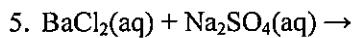
Substance	Molar Mass (g/mol)	Mass (g)	Chemical Amount (mol)
CaCl <sub>2</sub> (s)	110.98	18.6	0.168
Al <sub>2</sub> O <sub>3</sub> (s)	101.96	27.2	0.267
Mg(OH) <sub>2</sub> (s)	58.33	35.00	0.6000
Na <sub>2</sub> CO <sub>3</sub> •10H <sub>2</sub> O(s)	286.19	42.9	0.150

## Predicting Chemical Reactions, Extra Exercises

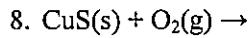
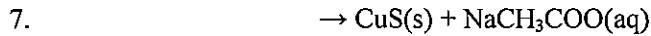
For each of the following questions, classify the reaction type (formation, simple decomposition, combustion, single replacement, double replacement, or other), and predict the balanced chemical equation. Provide a word equation as well.



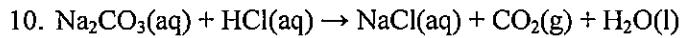
4. A strip of zinc metal is placed into a copper(II) nitrate solution.



6. Sulfuric acid is neutralized by aqueous sodium hydroxide.



9. Propane burns in air.



## Solutions for Predicting Chemical Reactions, Extra Exercises

For each of the following questions, classify the reaction type (synthesis, decomposition, combustion, single replacement, double replacement, or other), and predict the balanced chemical equation. Provide a word equation as well.

1.  $4 \text{Al(s)} + 3 \text{O}_2\text{(g)} \rightarrow 2 \text{Al}_2\text{O}_3\text{(s)}$   
**formation or combustion**  
**aluminium + oxygen → aluminium oxide**
2.  $2 \text{Ag}_2\text{O(s)} \rightarrow 4 \text{Ag(s)} + \text{O}_2\text{(g)}$   
**simple decomposition**  
**silver oxide → silver + oxygen**
3.  $\text{Br}_2\text{(l)} + 2 \text{KI(aq)} \rightarrow \text{I}_2\text{(s)} + 2 \text{KBr(aq)}$   
**single replacement**  
**bromine + potassium iodide → iodine + potassium bromide**
4. A strip of zinc metal is placed into a copper(II) nitrate solution.  
 $\text{Zn(s)} + \text{Cu}(\text{NO}_3)_2\text{(aq)} \rightarrow \text{Cu(s)} + \text{Zn}(\text{NO}_3)_2\text{(aq)}$   
**single replacement**  
**zinc + copper(II) nitrate → copper + zinc nitrate**
5.  $\text{BaCl}_2\text{(aq)} + \text{Na}_2\text{SO}_4\text{(aq)} \rightarrow \text{BaSO}_4\text{(s)} + 2 \text{NaCl(aq)}$   
**double replacement**  
**barium chloride + sodium sulfate → barium sulfate + sodium chloride**
6. Sulfuric acid is neutralized by aqueous sodium hydroxide.  
 $\text{H}_2\text{SO}_4\text{(aq)} + 2 \text{NaOH(aq)} \rightarrow 2 \text{HOH(l)} + \text{Na}_2\text{SO}_4\text{(aq)}$   
**double replacement**  
**sulfuric acid + sodium hydroxide → water + sodium sulfate**
7.  $\text{Na}_2\text{S(aq)} + \text{Cu}(\text{CH}_3\text{COO})_2\text{(aq)} \rightarrow \text{CuS(s)} + 2 \text{NaCH}_3\text{COO(aq)}$   
**double replacement**  
**sodium sulfide + copper(II) acetate → copper(II) sulfide + sodium acetate**
8.  $2 \text{CuS(s)} + 3 \text{O}_2\text{(g)} \rightarrow 2 \text{CuO(s)} + 2 \text{SO}_2\text{(g)}$   
**combustion**  
**copper(II) sulfide + oxygen → copper(II) oxide + sulfur dioxide**
9. Propane burns in air.  
 $\text{C}_3\text{H}_8\text{(g)} + 5 \text{O}_2\text{(g)} \rightarrow 3 \text{CO}_2\text{(g)} + 4 \text{H}_2\text{O(g)}$   
**combustion**  
**propane + oxygen → carbon dioxide + water**
10.  $\text{Na}_2\text{CO}_3\text{(aq)} + 2 \text{HCl(aq)} \rightarrow 2 \text{NaCl(aq)} + \text{CO}_2\text{(g)} + \text{H}_2\text{O(l)}$   
**other**  
**sodium carbonate + hydrochloric acid → sodium chloride + carbon dioxide + water**