Science 10
Chemistry Practice Booklet

Lesson 1: Properties and Classification of Matter/History of Chemistry

1. Pg. 17 # 1, 3, 4, 6. Pg. 25 # 10, 11. Read: Pg. 6-26.

Lesson 2: The Periodic Table and Atomic Structure

Element Name	Symbol	Period	Group	Metal or Non Metal
chromium	Cr	4	6	Metal
bromine	Br	4	17	Non-metal
phosphorus	P	3	15	Non-metal
helium	He	1	18	Non-metal
bohrium	Bh	7	7	Metal
bismuth	Bi	6	15	Metal
carbon	C	2	14	Non metal
tin	Sn	5	14	Metal
chlorine	Cl	3	17	Non-metal
niobium	Nb	5	5	Metal

1. The elements in the periodic table are arranged in metals and non-metals. The elements are put into these two categories based on their physical properties. The columns are called groups and the rows are called periods.

2. How many groups exist on the periodic table?

18

3. How many periods exist on the periodic table?

7

4. What is the first element in group 16?

Oxygen (O_2)

5. What is the first element in period 4?

potassium (K)

6. According to the periodic table in your databook what does each square contain
   a. atomic #
   b. name of element
   c. atomic mass
   d. symbol
   e. ion charge
   f. IUPAC stock name

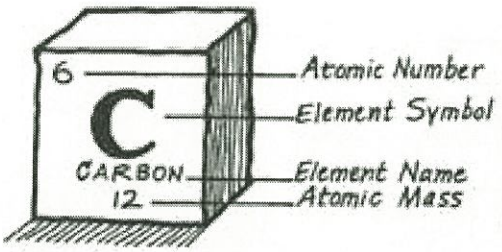
11. What on the periodic table separates the metals from the non-metals?

staircase

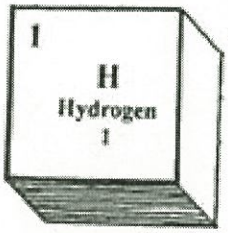
11. Metals are found on the left side of the table.

12. Non-metals are found on the right side of the table.

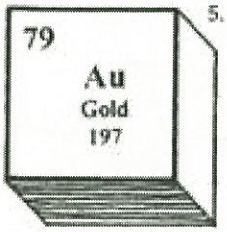
13. Fill in the following missing information:



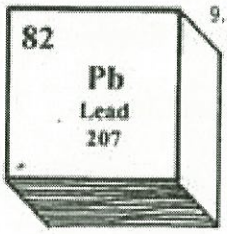
REMEMBER:
atomic mass = protons + neutrons
atomic number = # protons
protons = # electrons



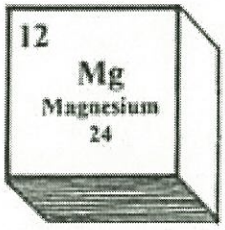
1. a. atomic number 1
   b. atomic mass 1.01



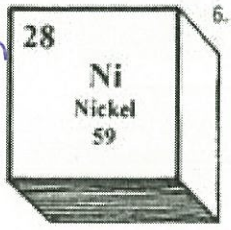
5. a. # electrons 79
   b. # protons 79
   c. atomic number 79
   d. name of element gold



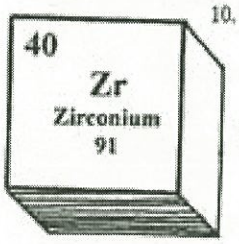
9. a. element name lead
   b. # protons 82



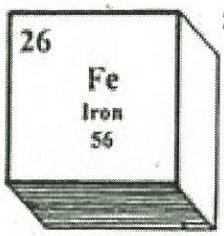
2. a. element name magnesium
   b. atomic number 12



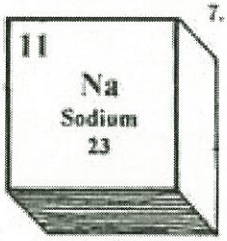
6. a. atomic mass 58.69
   b. element symbol Ni



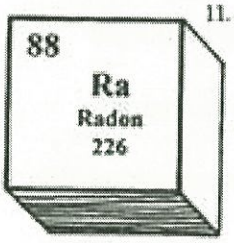
10. a. # electrons 40
    b. atomic mass 91.22



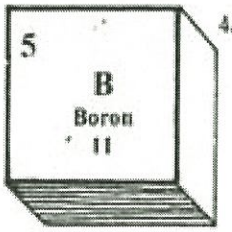
3. a. # protons 26
   b. element symbol Fe



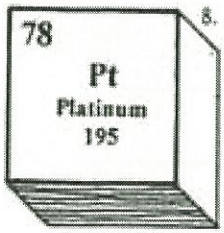
7. a. element symbol Na
   b. # neutrons 12
   c. element name sodium



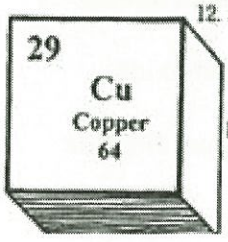
11. a. atomic number 88
    b. # neutrons 138



4. a. atomic number 5
   b. element name boron



8. a. atomic number 78
   b. # neutrons 117



12. a. atomic mass 63.55
    b. # neutrons 35

Lesson 3: Atomic Theory

Pg. 39 # 1-7.

Lesson 4: Ionic Compounds

Give the formula for each of the following:

1. potassium chloride $KCl_{(s)}$
2. cesium phosphide $Cs_3P_{(s)}$
3. gadolinium oxide $Gd_2O_{3(s)}$
4. calcium nitride $Ca_3N_{2(s)}$
5. aluminum fluoride $AlF_{3(s)}$
6. sodium sulfide $Na_2S_{(s)}$
7. erbium arsenide $ErAs_{(s)}$
8. magnesium selenide $MgSe_{(s)}$
9. zinc astatide $ZnAt_{2(s)}$
10. lithium hydride $LiH_{(s)}$
11. barium bromide $BaBr_{2(s)}$
12. terbium chloride $TbCl_{3(s)}$
13. francium oxide $Fr_2O_{(s)}$
14. lanthanum phosphide $LaP_{(s)}$
15. hydrogen nitride $H_3N_{(s)}$
16. thorium oxide $ThO_{2(s)}$
17. scandium fluoride $ScF_{3(s)}$
18. strontium sulfide $SrS_{(s)}$
19. beryllium oxide $BeO_{(s)}$

20. californium hydride — 3+ − — $CfH_3(s)$

21. actinium phosphide — 3+ 3- — $AcP(s)$

22. yttrium hydride — 3+ − — $YH_3(s)$

23. fermium astatide — 3+ − — $FmAt_3(s)$

24. neptunium chloride — 5+ − — $NpCl_5(s)$

Given the formula, supply the correct name.

1. Ag_2O — silver oxide
2. RbCl — rubidium chloride
3. KF — potassium fluoride
4. Ca_3N_2 — calcium nitride
5. DyP — dysprosium phosphide
6. MgO — magnesium oxide
7. Na_2S — sodium sulfide
8. Nd_2Se_3 — neodymium selenide
9. CsI — cesium iodide
10. $BaBr_2$ — barium bromide
11. Al_2O_3 — aluminium oxide
12. ZnF_2 — zinc fluoride
13. $HoCl_3$ — holmium chloride
14. LiH — lithium hydride
15. H_2S — hydrogen sulfide

16. $SrAt_2$ strontium astatide

17. YI_3 yttrium iodide

18. Pm_2O_3 promethium oxide

19. CmF_3 curium fluoride

20. Na_3P sodium phosphide

21. ScO scandium oxide

22. Fr_3N francium nitride

23. Cs_2O cesium oxide

24. KCl potassium chloride

25. $AlBr_3$ aluminium bromide

Lesson 5: Multi-Charge Ionic Compounds

Use your data book. Remember that spelling mistakes are ERRORS.

A. Name each of the following:

1. HgF mercury (I) fluoride
2. $FeCl_3$ iron(III) chloride
3. VCl_4 vanadium(IV) chloride
4. Cu_2O copper(I) oxide
5. CrN chromium(III) nitride
6. PtO_2 platinum (IV) oxide
7. AmO_2 americium(IV) oxide
8. PoF_4 polonium(IV) fluoride

NiO nickel(II) oxide

Bi_2O_5 bismuth (V) oxide

PbS_2 lead(IV) sulfide

Sn_3P_4 tin(IV) phosphide

Tl_3As thallium(I) arsenide

SmF_3 samarium(III) fluoride

PbO lead(II) oxide

Bk_2O_3 berkelium(III) oxide

9. FeI_3 iron(III) iodide Au_3P gold(I) phosphide

10. SmH_3 samarium(III) hydride $PaCl_5$ protactinium(V) chloride

11. PuS_2 plutonium(IV) sulfide CuH copper(I) hydride

12. Ni_2S_3 nickel(III) sulfide PdSe palladium(II) selenide

13. NoN nobelium(III) nitride BiP bismuth(III) phosphide

14. $CoBr_3$ cobalt(III) bromide Ni_2Te_3 nickel(III) telluride

15. PoS polonium(II) sulfide AmH_4 americium(IV) hydride

B. Give the formula for each.

16. iron (III) telluride Fe_2Te_3 copper (II) phosphide Cu_3P_2

17. manganese (IV) oxide MnO_2 bismuth (V) fluoride BiF_5

18. samarium (III) chloride $SmCl_3$ tin (II) fluoride SnF_2

19. gold (I) sulfide Au_2S berkelium (IV) selenide $BkSe_2$

20. cobalt (II) sulfide CoS manganese (II) iodide MnI_2

21. gold (III) arsenide $AuAs$ uranium (VI) oxide UO_3

22. tin (IV) bromide $SnBr_4$ plutonium (VI) phosphide PuP_2

23. vanadium (IV) hydride VH_4 iron (II) nitride Fe_3N_2

24. mercury (II) fluoride HgF_2 ruthenium (III) oxide Ru_2O_4

25. platinum (IV) phosphide Pt_3P_4 cobalt (III) telluride Co_2Te_3

26. antimony (III) sulfide Sb_2S_3 niobium (V) nitride Nb_3N_5

27. titanium (III) sulfide Ti_2S_3 gold (I) hydride AuH

28. titanium (IV) phosphide Ti_3P_4 bismuth (V) chloride $BiCl_5$

29. niobium (III) arsenide $NbAs$ tin (II) chloride $SnCl_2$

30. manganese (IV) sulfide MnS_2 cobalt (III) oxide Co_2O_3

Lesson 6: Polyatomic Ionic Compounds

Use your data book. Remember that spelling mistakes and missing brackets are ERRORS.

A. Name each of the following:

1. $NaCl$ sodium chloride $Ba(NO_3)_2$ barium nitrate

2. SnF_2 tin(II) fluoride $Al(OH)_3$ aluminium hydroxide

3. $Fe(NO_3)_3$ iron(III) nitrate SrO strontium oxide

4. $CuSO_4$ copper(II) sulfate SnS_2 tin(IV) sulfide

5. $MgSO_4$ magnesium sulfate $AgHSO_3$ silver hydrogen sulfite

6. $CuMnO_4$ copper(I) permanganate $AlPO_4$ aluminium phosphate

7. $AuNO_3$ gold (I) nitrate — PtO platinum (II) oxide

8. $BiCl_3$ bismuth (III) chloride — MnO_2 manganese (IV) oxide

9. $Fe(ClO)_3$ iron (III) hypochlorite — ZnO zinc oxide

10. $Nb(CN)_5$ niobium (V) cyanide — $OsBr_4$ osmium bromide

11. $Pb(NO_3)_2$ lead (II) nitrate — $CuHSO_3$ copper (I) hydrogensulfite

12. NiO nickel (II) oxide — $Pd(NO_2)_2$ palladium (II) nitrite

13. CsF cesium fluoride — $Al(OH)_3$ aluminium hydroxide

14. $Cr(MnO_4)_2$ chromium (II) permanganate — $NiPO_4$ nickel (III) phosphate

15. $Fe(CN)_2$ iron (II) cyanide — $Ir(C_6H_5COO)_4$ iridium benzoate

16. $NaCH_3COO$ sodium acetate — $Al_2(SO_4)_3$ aluminium sulfate

17. $(NH_4)_2SO_3$ ammonium sulfite — $Ni(HCO_3)_3$ nickel (III) hydrogen carbonate

18. $Mn(CO_3)_2$ manganese (IV) carbonate — $LiClO_3$ lithium chlorate

19. $Pb(CN)_4$ lead (IV) cyanide — $(NH_4)_3PO_4$ ammonium phosphate

20. $Fe(ClO)_3$ iron (III) hypochlorite — NaH_2PO_4 sodium dihydrogen phosphate

21. $KMnO_4$ potassium permanganate — $Cu_3(PO_4)_2$ copper (II) phosphate

22. RbClO rubidium hypochlorite — $Al(CN)_3$ aluminium cyanide

23. $(NH_4)_2HPO_4$ ammonium hydrogen phosphate $Al(NO_3)_3$ aluminium nitrate

24. $CuCrO_4$ copper(II) chromate $MgCrO_4$ magnesium chromate

25. KHS potassium hydrogen sulfide AgOH silver hydroxide

26. Au_2HPO_4 gold(I) hydrogen phosphate $SnSiO_3$ tin(II) silicate

27. $(NH_4)_2Cr_2O_7$ ammonium dichromate $AgNO_2$ silver nitrite

28. $Ba(OH)_2$ barium hydroxide HgOH mercury(I) hydroxide

29. $Cr(CN)_3$ chromium(III) cyanide $TlPO_4$ thallium(III) phosphate

30. $Zn(ClO)_2$ zinc hypochlorite $Pb(C_6H_5COO)_2$ lead(II) benzoate

Give the formula for each.

16. potassium sulfate K_2SO_4 copper (II) chlorate $Cu(ClO_3)_2$

17. zinc bromide $ZnBr_2$ bismuth (III) oxide Bi_2O_3

18. aluminium hypochlorite $Al(ClO)_3$ ammonium benzoate $NH_4C_6H_5COO$

19. copper (II) carbonate $CuCO_3$ calcium carbonate $CaCO_3$

20. copper (II) hydrogen sulfide $Cu(HS)_2$ magnesium carbonate $MgCO_3$

21. silver dichromate $Ag_2Cr_2O_7$ barium chlorate $Ba(ClO_3)_2$

22. ruthenium (III) sulfide Ru_2S_3 strontium bromide $SrBr_2$

23. calcium hydroxide $Ca(OH)_2$ iron (III) nitrate $Fe(NO_3)_3$

24. mercury (II) fluoride HgF_2 indium oxide In_2O_3

25. platinum (IV) chloride $PtCl_4$ rhenium chloride $ReCl_7$

26. polonium (II) sulfite $PoSO_3$ platinum (IV) thiosulfate $Pt(S_2O_3)_2$

27. titanium (III) sulfate $Ti_2(SO_4)_3$ silver hydroxide $AgOH$

28. zinc phosphate $Zn_3(PO_4)_2$ cadmium borate $Cd_3(BO_3)_2$

29. gallium hydroxide $Ga(OH)_3$ tin (II) acetate $Sn(CH_3COO)_2$

30. potassium chromate $K_2(CrO_4)$ cobalt (III) hydride CoH_3

31. aluminium sulfite $Al_2(SO_3)_3$ tin (II) acetate $Sn(CH_3COO)_2$

32. zinc hydrogen sulfide $Zn(HS)_2$ silver dichromate $Ag_2Cr_2O_7$

33. aluminium borate $AlBO_3$ sodium benzoate NaC_6H_5COO

34. copper (II) carbonate $CuCO_3$ cobalt (III) nitrate $Co(NO_3)_3$

35. ammonium dichromate $(NH_4)_2Cr_2O_7$ manganese (IV) nitrate $Mn(NO_3)_4$

36. cesium hydroxide $CsOH$ strontium cyanide $Sr(CN)_2$

37. lead (II) carbonate $PbCO_3$ germanium hypochlorite $Ge(ClO)_4$

38. calcium hydrogencarbonate $Ca(HCO_3)_2$ iron (III) chromate $Fe_2(CrO_4)_3$

39. ammonium cyanide NH_4CN vanadium (V) permanganate $V(MnO_4)_5$

40. gold (III) nitrite $Au(NO_2)_3$ platinum (IV) carbonate $Pt(CO_3)_2$

41. beryllium silicate $BeSiO_3$ potassium hypochlorite $KClO$

42. aluminium hydrogensulfate $Al(HSO_4)_3$ actinium nitrate $Ac(NO_3)_3$

43. iron (II) phosphate $Fe_3(PO_4)_2$ platinum (II) borate $Pt_3(BO_3)_2$

44. gold (I) hydroxide $AuOH$ indium phosphate $InPO_4$

45. zirconium nitrite $Zr(NO_2)_4$ magnesium silicate $MgSiO_3$

Lesson 7: Molecular Compounds

Provide the name or the formula for each.

1. SiC silicon monocarbide PI_3 phosphorus triiodide

2. $TeBr_2$ tellurium dibromide NCl_3 nitrogen trichloride

3. P_4S_6 tetraphosphorus hexasulfide Si_3P_4 trisilicon tetraphosphide

4. N_2O dinitrogen monoxide $TeBr_4$ tellurium tetrabromide

5. SiH_4 Silicon tetrahydride SO_2 Sulfur dioxide

6. NO_2 nitrogen dioxide S_2Br_2 disulfur dibromide

7. SiF_4 Silicon tetrafluoride N_2O_3 dinitrogen trioxide

8. P_2O_3 diphosphorus trioxide ClO_3 Chlorine trioxide

9. KrF_2 Krypton difluoride NO nitrogen monoxide

10. CO carbon monoxide CH_4 carbon tetrahydride

11. nitrogen trifluoride NF_3 diarsenic pentasulfide As_2S_5

12. tetraboron monocarbide B_4C silicon tetrabromide $SiBr_4$

13. diphosphorous trichloride P_2Cl_3 tellurium tetraoxide TeO_4

14. dicarbon hexahydride C_2H_6 hydrogen dioxide HO_2

15. carbon monoxide CO hexacarbon hexahydride C_6H_6

16. sulfur trioxide SO_3 dinitrogen tetraoxide N_2O_4

17. diarsenic trisulfide As_2S_3 sulfur monochloride SCl

18. selenium difluoride SeF_2 boron tribromide BBr_3

19. tellurium tetraiodide TeI_4 phosphorous dioxide PO_2

20. trisulfur tetrabromide S_3Br_4 silicon pentaiodide SiI_5

Molecular and Ionic Compounds

Use your data book. Remember that spelling mistakes and missing brackets are ERRORS.

Name each of the following:

1. ^{+-}NaF sodium fluoride $Ra(NO_2)_2$ radium nitrite
2. $^{2+-}SnF_2$ tin(II) fluoride $Bi(OH)_3$ bismuth (III) hydroxide
3. C_2H_6 dicarbon hexahydride $Am(C_6H_5COO)_4$ americium (IV) benzoate
4. $Cu_2(SO_4)$ copper (II) sulfate $SnSO_3$ tin(II) sulfite
5. $CrSO_4$ chromium (II) sulfate $TlHSO_3$ thallium (I) hydrogen sulfite
6. $KMnO_4$ potassium permanganate SeP_5 selenium pentaphosphide
7. $Au(NO_3)_3$ gold(III) nitrate PbO lead(II) oxide
8. Si_2F_3 disilicon trifluoride RuO_2 manganese (II) oxide
9. $Fe(ClO)_3$ iron(III) hypochlorite $Po(CN)_2$ polonium(II) cyanide
10. $IrBr_4$ iridium bromide PI_6 phosphorus hexaiodide

Molecular and Ionic Compounds

Name Key

Use your data book. Remember that spelling mistakes and missing brackets are ERRORS.

A. Name each of the following:

1. NaF sodium fluoride $Ra(NO_2)_2$ radium nitrite
2. SnF_2 tin(II) fluoride $Bi(OH)_3$ bismuth(III) hydroxide
3. C_2H_6 dicarbon hexahydride $Am(C_6H_5COO)_4$ americium(IV) benzoate
4. $Cu_2(SO_4)$ copper(II) sulfate $SnSO_3$ tin(II) sulfite
5. $CrSO_4$ chromium(II) sulfate $TlHSO_3$ thallium(I) hydrogen sulfite
6. $KMnO_4$ potassium permanganate SeP_5 selenium pentaphosphide
7. $Au(NO_3)_3$ gold(III) nitrate PbO lead(II) oxide
8. Si_2F_3 disilicon trifluoride ~~RuO_2~~ MnO_2 manganese(II) oxide
9. $Fe(\text{~~OCl~~ ClO})_3$ iron(III) hypochlorite $Po(CN)_2$ polonium(II) cyanide
10. $IrBr_4$ iridium bromide PI_6 phosphorus hexaiodide
11. $Ba(NO_3)_2$ barium nitrate $CuHSO_3$ copper(I) hydrogen sulfite
12. NiO nickel(II) oxide $Pd(ClO_3)_2$ palladium(II) chlorate
13. N_2O_5 dinitrogen pentaoxide $LaPO_4$ lanthanum phosphate
14. $BeCl_2$ beryllium chloride $Nd(OH)_3$ neodymium hydroxide
15. $Fe(NO_3)_2$ iron(II) nitrate S_6H_3 hexasulfur trihydride

B. Give the formula for each.

16. lithium sulfite Li_2SO_3 copper (II) hypochlorite $Cu(ClO)_2$

17. strontium bromide $SrBr_2$ bismuth (V) oxide Bi_2O_5

18. ammonium fluoride NH_4F dinitrogen monoxide N_2O

19. silver carbonate Ag_2CO_3 calcium carbonate $CaCO_3$

20. cobalt (II) sulfide CoS magnesium carbonate $MgCO_3$

21. oxygen difluoride OF_2 sulfur trichloride SCl_3

22. tin (II) iodide SnI_2 strontium bromide $SrBr_2$

23. vanadium (IV) hydroxide $V(OH)_4$ iron (II) nitrite $Fe(NO_2)_2$

24. tricarbon difluoride C_3F_2 Krypton dihydride KrH_2

25. platinum (IV) phosphide Pt_3P_4 rhenium chloride $ReCl_7$

26. antimony (III) sulfite $Sb_2(SO_3)_3$ triphosphourous monoxide P_3O

27. titanium (III) sulfide Ti_2S_3 pentasulfur tetrachloride S_5Cl_4

28. zinc hydrogen phosphate $ZnHPO_4$ scandium borate $ScBO_3$

29. gallium silicate $Ga_2(SiO_3)_3$ nitrogen dichloride NCl_2

30. ammonium sulfate $(NH_4)_2SO_4$ cobalt (III) oxide Co_2O_3

11. $Ba(NO_3)_2$ barium nitrate $CuHSO_3$ copper(I) hydrogen sulfite

12. NiO nickel(II) oxide $Pd(ClO_3)_2$ palladium (II) chlorate

13. N_2O_5 dinitrogen pentaoxide $LaPO_4$ lanthanum phosphate

14. $BeCl_2$ beryllium chloride $Nd(OH)_3$ neodymium hydroxide

15. $Fe(NO_3)_2$ iron(II) nitrate S_6H_3 hexasulfur trihydride

Give the formula for each.

16. lithium sulfite Li_2SO_3 copper (II) hypochlorite $Cu(ClO)_2$

17. strontium bromide $SrBr_2$ bismuth (V) oxide Bi_2O_5

18. ammonium fluoride NH_4F dinitrogen monoxide N_2O

19. silver carbonate Ag_2CO_3 calcium carbonate $CaCO_3$

20. cobalt (II) sulfide CoS magnesium carbonate $MgCO_3$

21. oxygen difluoride OF_2 sulfur trichloride SCl_3

22. tin (II) iodide SnI_2 strontium bromide $SrBr_2$

23. vanadium (IV) hydroxide $V(OH)_4$ iron (II) nitrite $Fe(NO_2)_2$

24. tricarbon difluoride C_3F_2 krypton dihydride KrH_2

25. platinum (IV) phosphide Pt_3P_4 rhenium chloride $ReCl_7$

26. antimony (III) sulfite $Sb_2(SO_3)_3$ triphosphorous monoxide P_3O

27. titanium (III) sulfide Ti_2S_3 pentasulfur tetrachloride S_5Cl_4

28. zinc hydrogen phosphate $ZnHPO_4$ scandium borate $ScBO_3$

29. gallium silicate $Ga_2(SiO_3)_3$ nitrogen dichloride NCl_2

30. ammonium sulfate $(NH_4)_2SO_4$ cobalt (III) oxide Co_2O_3

Lesson 8: Solubility Table

Use your textbook p. 54 -75 to answer the following questions.

1. Ionic compounds share many properties. Define the following terms.
   a. High Melting Point
   b. Crystal Shape
   c. Solubility in Water
   d. Conductivity in Solution
      more conductive with greater concentration of ions in solution
   e. Solubility
      dissolve in water or other solvent
2. Determine the solubility of the following using the table on p. 57. Use the subscript $_{(aq)}$ for those very soluble and the subscript $_{(s)}$ for those slightly soluble.

$(NH_4)_2S_{(aq)}$	$AgCl_{(s)}$	$PbSO_{4(s)}$	$Sr(OH)_{2(aq)}$	$Fe(OH)_{3(s)}$
$Au(NO_3)_{3(aq)}$	$PbI_{4(aq)}$	$Na_3PO_{4(aq)}$	$CuS_{(s)}$	$AgCH_3COO_{(s)}$

3. Determine the chemical formula for each of the following and if it is soluble or slightly soluble in water.
4.

Chemical	Formula and Solubility
potassium carbonate	$K_2CO_{3(aq)}$

iron (II) nitrate	$Fe(NO_3)_{2(aq)}$
Copper (I) chloride	$CuCl_{(s)}$
barium hydroxide	$Ba(OH)_{2(aq)}$
ammonium sulfite	$(NH_4)_2SO_{3(aq)}$
calcium sulfite	$CaSO_{3(s)}$
lead (IV) bromide	$PbBr_{4(aq)}$

5. Describe these properties of molecular compounds:

   a. Covalent bonds : strong bonds formed when non-metall atoms share electrons

   b. Melting points : lower than ionic compounds

   c. Crystalline shape : molecular crumble easily

   d. Conduct electricity : molecular do not conduct electricity as a solid or in solution

6. Read the section on p. 60 and describe how a water molecule is formed.
   liquid water molecules are held together through the attractions caused by each molecule being slightly polar (one pos. & one neg. end)

7. How does water act during the summer and winter months?
   Summer: oceans a heat sink, absorbing heat from Sun and air

   Winter: Oceans act as a heat source, radiating stored heat.

8. Describe how ice is formed.
   molecules spread out and line up in a 3D array that contains 6-sided rings, hence we have 6-sided snowflakes

9. An acid has a pH lower than 7 and a base has a pH higher than 7.

10. pH measures hydrogen ions in a solution.

11. Why is your saliva slightly basic?
so your teeth won't dissolve in acids like fruit juices

12. Your stomach makes hydrochloric acid. What does this acid do?
acts like a chemical switch turning enzymes into pepsin, speeding up digestion

13. What does the pancreas produce and why is it important?
sodium hydrogen carbonate, a base like baking soda that neutralizes stomach acid, deactivating the pepsin

14. Define buffer.
keeps pH of a solution nearly constant despite the addition of small amounts of acid or base

15. Using litmus paper acids turn the paper red and bases turn the paper blue.

16. What is a universal indicator?
a mixture of several different indicators that change colour as acidity changes

17. A solution of pH 9 is 10 times more basic than a solution of pH 8.

18. A solution of pH 1 is 10 times more acidic than a solution of ph 2.

19. Fill in the following chart.

Property	Acid	Base
Taste	sour	bitter
Touch	not slippery	slippery
Reaction with Metals	metal corrodes, H_2 bubbles	no reaction

Litmus Indicator	red	blue
Electrical Conductivity	conductive	conductive
pH of solution	<7	>7

20. How are acids named?

H on left $HCl_{(aq)}$

1) Only 2 elements: ionic name hydrogen becomes hydro- and add -ic to end (eg.) hydrobromic acid)
2) More than 2: -ite becomes -ous, -ate becomes -ic HBR

21. How are bases named?

H on right $KOH_{(aq)}$

end in hydroxide (eg. NaOH sodium hydroxide)

22. List 2 examples of common household acids and 2 examples of common household bases.

Acids: Vinegar, battery acid Bases: drain cleaner, antacid.

23. Describe what neutralization is.

when acids and bases react together and both acidic and basic properties disappear.

24. Determine whether the following substances are an acid, base, or neither.

Substance	Type
$KOH_{(aq)}$	base
$H_2SO_{4(aq)}$	acid
$NaCl_{(aq)}$	neither
$CH_3COOH_{(aq)}$	acid
$HCl_{(aq)}$	acid
$Mg(OH)_{2(aq)}$	base
$C_6H_5COOH_{(aq)}$	acid

25. Mercury is used in batteries. How is mercury harmful to our environment?

it's a poison, bad for environment, animals, and humans who eat animals

26. What are chlorofluorocarbons (CFC) and how are they harmful to our environment?

non-toxic chemicals used in cooling systems, when released into atmosphere they act as a catalyst causing the destruction of the ozone layer.

27. Alcohol can be a chemical toxin.

a. What type of alcohol do people drink, name and formula?

ethanol: $CH_3CH_2OH_{(l)}$

b. What does alcohol destroy?

liver, kidney, and brain cells.

c. Alcohol use can become an addiction; describe the physical and psychological effects an alcohol addiction can have on a person.

physical: body needs the drug to function

psychological: drug is linked to moods/feelings

28. Nicotine and other tobacco products:

a. What is the most common source of nicotine?

Cigarettes

b. Cigarette smoke contains carbon monoxide, which is more dangerous than polluted air.

c. How many chemicals are in cigarette smoke? ~3000

29. List 4 things benzene is used for.

- dyes, detergents, medicines, plastics.

Lesson 9: Chemical Change

No questions.

Lesson 10: Chemical Equations

1. Balance the following chemical equations:

a) 4 $Na_{(s)}$ + ____ $O_{2(g)}$ → 2 $Na_2O_{(s)}$

b) 2 $Al_{(s)}$ + 3 $Cl_{2(g)}$ → 2 $AlCl_{3(s)}$

c) ____ $N_{2(g)}$ + 2 $O_{2(g)}$ → 2 $NO_{2(g)}$

d) 2 $HI_{(g)}$ → ____ $H_{2(g)}$ + ____ $I_{2(s)}$

e) 2 $NH_{3(g)}$ → 3 $H_{2(g)}$ + ____ $N_{2(g)}$

f) 8 $Al_2S_{3(s)}$ → 16 $Al_{(s)}$ + 3 $S_{8(s)}$

g) 2 $BN_{(s)}$ + 3 $Cl_{2(g)}$ → 2 $BCl_{3(g)}$ + ____ $N_{2(g)}$

h) 3 $SnF_{4(aq)}$ + 4 $Cr_{(s)}$ → 4 $CrF_{3(aq)}$ + 3 $Sn_{(s)}$

i) ____ $Mg_{(s)}$ + 2 $HCl_{(aq)}$ → ____ $MgCl_{2(aq)}$ + ____ $H_{2(g)}$

j) 2 $(NH_4)_3PO_{4(aq)}$ + 3 $CaBr_{2(aq)}$ → ____ $Ca_3(PO_4)_{2(s)}$ + 6 $NH_4Br_{(aq)}$

k) ____ $Pb(NO_3)_{4(aq)}$ + 2 $K_2Cr_2O_{7(aq)}$ → ____ $Pb(Cr_2O_7)_{2(s)}$ + 4 $KNO_{3(aq)}$

l) 3 $AgClO_{4(aq)}$ + ____ $Na_3PO_{4(aq)}$ → 3 $NaClO_{4(aq)}$ + ____ $Ag_3PO_{4(s)}$

m) 2 $HCl_{(aq)}$ + ____ $Ca(OH)_{2(s)}$ → ____ $CaCl_{2(aq)}$ + 2 $H_2O_{(l)}$

n) 2 $CH_3COOH_{(aq)}$ + ____ $Ba(OH)_{2(aq)}$ → ____ $Ba(CH_3COO)_{2(aq)}$ + 2 $H_2O_{(l)}$

o) ____ $C_3H_{8(g)}$ + 5 $O_{2(g)}$ → 3 $CO_{2(g)}$ + 4 $H_2O_{(g)}$

p) 2 $C_6H_{14(l)}$ + 19 $O_{2(g)}$ → 12 $CO_{2(g)}$ + 14 $H_2O_{(g)}$

q) ____ $C_3H_6OS_{2(s)}$ + 6 $O_{2(g)}$ → 3 $CO_{2(g)}$ + 3 $H_2O_{(g)}$ + 2 $SO_{2(g)}$

2. Balance the following chemical equations:

a) 2 $Pb_{(s)}$ + ____ $O_{2(g)}$ → 2 $PbO_{(s)}$

b) ____ $N_{2(g)}$ + 3 $H_{2(g)}$ → 2 $NH_{3(g)}$

c) 2 $Na_{(s)}$ + 2 $H_2O_{(l)}$ → 2 $NaOH_{(aq)}$ + ____ $H_{2(g)}$

d) 2 $C_4H_{10(g)}$ + 13 $O_{2(g)}$ → 8 $CO_{2(g)}$ + 10 $H_2O_{(g)}$

e) ____ $H_3PO_{4(aq)}$ + 3 $KOH_{(aq)}$ → ____ $K_3PO_{4(aq)}$ + 3 $H_2O_{(l)}$

f) ____ $C_5H_{12(l)}$ + 8 $O_{2(g)}$ → 5 $CO_{2(g)}$ + 6 $H_2O_{(g)}$

g) ____ $Zn_3N_{2(s)}$ + 6 $H_2O_{(l)}$ → 3 $Zn(OH)_{2(aq)}$ + 2 $NH_{3(g)}$

h) ____ $Fe_3O_{4(s)}$ + 4 $H_{2(g)}$ → 3 $Fe_{(s)}$ + 4 $H_2O_{(l)}$

i) 2 $Al_{(s)}$ + 3 $H_2SO_{4(aq)}$ → 3 $H_{2(g)}$ + ____ $Al_2(SO_4)_{3(aq)}$

j) 2 $CrS_{(s)}$ + 3 $O_{2(g)}$ → 2 $CrO_{(s)}$ + 2 $SO_{2(g)}$

k) ____ $HClO_{3(aq)}$ + 5 $HCl_{(aq)}$ → 3 $H_2O_{(l)}$ + 3 $Cl_{2(g)}$

l) 3 $CaC_{2(s)}$ + 2 $AsBr_{3(aq)}$ → 6 $C_{(s)}$ + 2 $As_{(s)}$ + 3 $CaBr_{2(aq)}$

m) ____ 4 $NH_{3(g)}$ + ____ 5 $O_{2(g)}$ → ____ 4 $NO_{(g)}$ + ____ 6 $H_2O_{(l)}$

n) 2 $HNO_{3(aq)}$ + ____ $NO_{(g)}$ → 3 $NO_{2(g)}$ + ____ $H_2O_{(l)}$

o) ____ $Al(NO_3)_{3(aq)}$ + 3 $NaOH_{(aq)}$ → 3 $NaNO_{3(aq)}$ + ____ $Al(OH)_{3(s)}$

p) ____ $C_2H_5OH_{(l)}$ + 3 $O_{2(g)}$ → 2 $CO_{2(g)}$ + 3 $H_2O_{(g)}$

q) 2 $NaIO_{3(s)}$ → 2 $NaI_{(s)}$ + 3 $O_{2(g)}$

Lesson 11: Formation Reactions

Provide either the balanced reaction using symbols or provide the word equation.

1. sodium and chlorine make sodium chloride

$2Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$

2. manganese, carbon and oxygen make manganese (II) carbonate

$2Mn_{(s)} + 2C_{(s)} + 3O_{2(g)} \rightarrow 2MnCO_{3(s)}$

3. lithium, nitrogen and oxygen make lithium nitrite

$2Li_{(s)} + N_{2(g)} + 2O_{2(g)} \rightarrow 2LiNO_{2(s)}$

4. chromium, carbon and nitrogen make chromium (III) cyanide

$2Cr_{(s)} + 6C_{(s)} + 3N_{2(g)} \rightarrow 2Cr(CN)_{3(s)}$

5. iron, phosphorus, and oxygen make iron (III) phosphate

$4Fe_{(s)} + P_{4(s)} + 8O_{2(g)} \rightarrow 4FePO_{4(s)}$

6. zinc, silicon and oxygen make zinc silicate

$2Zn_{(s)} + 2Si_{(s)} + 3O_{2(g)} \rightarrow 2ZnSiO_{3(s)}$

7. magnesium, hydrogen and sulfur make magnesium hydrogen sulfide

$4Mg_{(s)} + 4H_{2(g)} + S_{8(s)} \rightarrow 4Mg(HS)_{2(s)}$

8. nickel, oxygen, and hydrogen make nickel (III) hydroxide

$2Ni_{(s)} + 3O_{2(g)} + 3H_{2(g)} \rightarrow 2Ni(OH)_{3(s)}$

9. potassium, sulfur and oxygen make potassium sulfite

$16K_{(s)} + S_{8(s)} + 12O_{2(g)} \rightarrow 8K_2SO_{3(aq)}$

10. copper, chromium, and oxygen make copper (I) chromate

$2Cu_{(s)} + Cr_{(s)} + 2O_{2(g)} \rightarrow Cu_2CrO_{4(s)}$

11. $\underline{2}\ Na_{(s)} + \underline{\ \ }\ Cl_{2(g)} \rightarrow \underline{2}\ NaCl_{(s)}$

12. 3 $V_{(s)}$ + 4 $B_{(s)}$ + 6 $O_{2(g)}$ → ___ $V_3(BO_3)_{4(s)}$

13. 2 $Ag_{(s)}$ + ___ $N_{2(g)}$ + 3 $O_{2(g)}$ → 2 $AgNO_{3(s)}$

14. ___ $S_{8(s)}$ + 12 $O_{2(g)}$ → 8 $SO_{3(g)}$

15. 4 $Au_{(s)}$ + 4 $H_{2(g)}$ + ___ $P_{4(s)}$ + 8 $O_{2(g)}$ → 4 $AuH_2PO_{4(s)}$

16. ___ $Sn_{(s)}$ + 2 $Cl_{2(g)}$ + 6 $O_{2(g)}$ → ___ $Sn(ClO_3)_{4(s)}$

Lesson 12: Decomposition Reactions

Provide either the balanced reaction using symbols or provide the word equation.

1. barium hydroxide decomposes to barium, hydrogen and oxygen

$Ba(OH)_{2(s)} \rightarrow Ba_{(s)} + H_{2(g)} + O_{2(g)}$

2. aluminium carbonate decomposes to aluminium, carbon and oxygen

$2Al_2(CO_3)_{3(s)} \rightarrow 4Al_{(s)} + 6C_{(s)} + 9O_{2(g)}$

3. mercury (II) nitrite decomposes to mercury, nitrogen and oxygen

$Hg(NO_3)_{2(aq)} \rightarrow Hg_{(s)} + N_{2(g)} + 3O_{2(g)}$

4. antimony (V) cyanide decomposes to antimony, carbon and nitrogen

$2Sb(CN)_{5(s)} \rightarrow 2Sb_{(s)} + 10C_{(s)} + 5N_{2(g)}$

5. scandium borate decomposes to scandium, boron and oxygen

$2ScBO_{3(s)} \rightarrow 2Sc_{(s)} + 2B_{(s)} + 3O_{2(g)}$

6. sodium dichromate decomposes to sodium, chromium and oxygen

$2Na_2Cr_2O_{7(s)} \rightarrow 4Na_{(s)} + 4Cr_{(s)} + 7O_{2(g)}$

7. francium chloride decomposes to francium and chlorine

$2FrCl_{(s)} \rightarrow 2Fr_{(s)} + Cl_{2(g)}$

8. propane decomposes to carbon and hydrogen $C_3H_{8(g)} \rightarrow 3C_{(s)} + 4H_{2(g)}$

9. ____ $C_6H_{6(l)}$ → __6__ $C_{(s)}$ + __3__ $H_{2(g)}$

10. __2__ $H_2O_{(l)}$ → __2__ $H_{2(g)}$ + ____ $O_{2(g)}$

11. ____ $Mg(NO_3)_{2(s)}$ → ___ $Mg_{(s)}$ + ____ $N_{2(g)}$ + 3 ____ $O_{2(g)}$

12. ___ $C_6H_{12}O_{6(s)}$ → 6 ___ $C_{(s)}$ + 3 ___ $O_{2(g)}$ + 6 ____ $H_{2(g)}$

13. 2 ____ $AuOH_{(s)}$ → 2 ___ $Au_{(s)}$ + ___ $O_{2(g}$ + ____ $H_{2(g)}$

14. 8 ____ $FeSO_{4(s)}$ → 16 ____ $O_{2(g)}$ + 8 ___ $Fe_{(s)}$ + ____ $S_{8(s)}$

15. 2 ____ $Zn_3(PO_4)_{2(s)}$ → ___ $P_{4(s)}$ + 8 ___ $O_{2(g)}$ + 6 ____ $Zn_{(s)}$

16. ___ $Sn(CN)_{2(s)}$ → ____ $N_{2(g)}$ + ___ $Sn_{(s)}$ + 2 ____ $C_{(s)}$

Lesson 13: Single Replacement Reactions

Provide the balanced reaction using symbols.

1. tin reacts with copper (II) sulfate to form copper and tin (IV) sulfate

$$Sn_{(s)} + 2CuSO_{4(aq)} \rightarrow 2Cu_{(s)} + Sn(SO_4)_{2(aq)}$$

2. aluminium reacts with iron (III) nitrate to form iron and aluminium nitrate

$$Al_{(s)} + Fe(NO_3)_{3(aq)} \rightarrow Fe_{(s)} + Al(NO_3)_{3(aq)}$$

3. nitrogen reacts with lithium fluoride to form fluorine and lithium nitride

$$N_{2(g)} + 6LiF_{(s)} \rightarrow 3F_{2(g)} + 2Li_3N_{(s)}$$

4. chromium reacts with manganese (II) oxide to form manganese and chromium (III) oxide

$$2Cr_{(s)} + 3MnO_{(s)} \rightarrow 3Mn_{(s)} + Cr_2O_{3(s)}$$

5. mercury reacts with calcium chlorate to form calcium and mercury (II) chlorate

$$Hg_{(l)} + Ca(ClO_3)_{2(aq)} \rightarrow Ca_{(s)} + Hg(ClO_3)_{2(aq)}$$

6. gold reacts with barium silicate to form barium and gold (III) silicate

$$2Au_{(s)} + 3BaSiO_{3(s)} \rightarrow 3Ba_{(s)} + Au_2(SiO_3)_3$$

7. magnesium chloride reacts with oxygen to form magnesium oxide and chlorine

$$2MgCl_{2(s)} + O_{2(g)} \rightarrow 2MgO_{(s)} + 2Cl_{2(g)}$$

8. zinc reacts with nickel (III) hydroxide to form nickel and zinc hydroxide

$$3Zn_{(s)} + 2Ni(OH)_{3(s)} \rightarrow 2Ni_{(s)} + 3Zn(OH)_2$$

9. $\_1\_\ Zn_{(s)} + \_1\_\ Mg(OH)_{2(s)} \rightarrow \_1\_\ Mg_{(s)} + \_\_\_\_\ Zn(OH)_{2(s)}$

10. ____$P_{4(s)}$ + 6 $Na_2O_{(s)}$ → 3 $O_{2(g)}$ + 4 $Na_3P_{(s)}$

11. ____ $Mg_{(s)}$ + 2 $AgNO_{3(s)}$ → 2 $Ag_{(s)}$ + ____ $Mg(NO_3)_{2(s)}$

12. 4 $Cr_{(s)}$ + 3 $SnO_{2(s)}$ → 3 $Sn_{(s)}$ + 2 $Cr_2O_{3(s)}$

13. 2 $AuH_{3(s)}$ + 3 $Cl_{2(g)}$ → 2 $AuCl_{3(s)}$ + 3 $H_{2(g)}$

14. 1 $FeSO_{4(s)}$ + 1 $Zn_{(s)}$ → 1 $ZnSO_{4(s)}$ + 1 $Fe_{(s)}$

15. ____ $V(NO_3)_{5(s)}$ + 5 $Ag_{(s)}$ → ____ $V_{(s)}$ + 5 $AgNO_{3(s)}$

16. ____ $S_{8(s)}$ + 16 $LiF_{(s)}$ → 8 $F_{2(g)}$ + 8 $Li_2S_{(s)}$

Lesson 14: Double Replacement Reactions

Provide the balanced reaction using symbols.

1. tin (IV) oxide reacts with nickel (II) sulfate to form tin (IV) sulfate and nickel (II) oxide

$$SnO_{2(s)} + 2NiSO_{4(aq)} \rightarrow Sn(SO_4)_{2(aq)} + 2NiO_{(s)}$$

2. aluminium hydroxide reacts with iron (III) nitrate to form iron (III) hydroxide and aluminium nitrate

$$Al(OH)_{3(s)} + Fe(NO_3)_{3(aq)} \rightarrow Fe(OH)_{3(s)} + Al(NO_3)_{3(aq)}$$

3. manganese (II) nitride reacts with lithium fluoride to form manganese (II) fluoride and lithium nitride

$$Mn_3N_{2(s)} + 6LiF_{(s)} \rightarrow 3MnF_{2(s)} + 2Li_3N_{(s)}$$

4. chromium (II) nitrite reacts with manganese (IV) oxide to form manganese (IV) nitrite and chromium (II) oxide

$$2Cr(NO_2)_{2(s)} + MnO_{2(s)} \rightarrow Mn(NO_2)_{4(s)} + 2CrO_{(s)}$$

5. mercury (I) hydrogen sulfate reacts with calcium chlorate to form calcium hydrogen sulfate and mercury (I) chlorate

$$2HgHSO_{4(s)} + Cu(ClO_3)_{2(aq)} \rightarrow Ca(HSO_4)_{2(s)} + 2HgClO_{3(aq)}$$

6. gold (III) acetate reacts with barium silicate to form barium acetate and gold (III) silicate

$$2Au(CH_3COO)_{3(aq)} + 3BaSiO_{3(s)} \rightarrow 3Ba(CH_3COO)_{2(aq)} + Au_2(SiO_3)_{3(s)}$$

7. magnesium chloride reacts with aluminium borate to form magnesium borate and aluminium chloride

$$3MgCl_{2(s)} + 2AlBO_{3(s)} \rightarrow Mg_3(BO_3)_{2(s)} + 2AlCl_{3(s)}$$

8. zinc phosphate reacts with nickel (III) hydroxide to form nickel (III) phosphate and zinc hydroxide

$$Zn_3(PO_4)_{2(s)} + 2Ni(OH)_{3(s)} \rightarrow 2NiPO_{4(s)} + 3Zn(OH)_{2(s)}$$

9. 2 $AlPO_{4(s)}$ + 3 $Mg(OH)_{2(s)}$ → ____ $Mg_3(PO_4)_{2(s)}$ + 2 $Al(OH)_{3(s)}$

10. ____ $Sr(NO_3)_{2(s)}$ + ____ $K_2O_{(s)}$ → ____ $SrO_{(g)}$ + 2 $KNO_{3(s)}$

11. 1 $HgH_{(s)}$ 1 $AgNO_{3(s)}$ → 1 $AgH_{s)}$ + 1 $HgNO_{3(s)}$

12. 4 $AuF_{3(s)}$ + 3 $SnO_{2(s)}$ → 3 $SnF_{4(s)}$ + 2 $Au_2O_{3(s)}$

13. 2 $AuH_{3(s)}$ + 3 $Cl_{2(g)}$ → 2 $AuCl_{3(s)}$ + 3 $H_{2(g)}$

14. ____ $Fe_2(SO_4)_{3\,(s)}$ + 3 $ZnBr_{2(s)}$ → 3 $ZnSO_{4(s)}$ + 2 $FeBr_{3(s)}$

15. 2 $V(NO_3)_{5(s)}$ + 5 $FeCl_{2(s)}$ → 2 $VCl_{5(s)}$ + 5 $Fe(NO_3)_{2\,(s)}$

16. ____ $MgS_{(s)}$ + 2 $LiF_{(s)}$ → ____ $MgF_{2(s)}$ + ____ $Li_2S_{(s)}$

Lesson 15: Combustion Reactions

Write and balance the combustion equations for the following.

1. Methane

$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$

2. Ethane

$2C_2H_{6(g)} + 7O_{2(g)} \rightarrow 4CO_{2(g)} + 6H_2O_{(g)}$

3. Propane

$C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$

4. Butane

$2C_4H_{10(g)} + 13O_{2(g)} \rightarrow 8CO_{2(g)} + 10H_2O_{(g)}$

5. Pentane

$C_5H_{12(l)} + 8O_{2(g)} \rightarrow 5CO_{2(g)} + 6H_2O_{(g)}$

6. Hexane

$2C_6H_{14(l)} + 19O_{2(g)} \rightarrow 12CO_{2(g)} + 14H_2O_{(g)}$

7. Octane

$2C_8H_{18(l)} + 25O_{2(g)} \rightarrow 16CO_{2(g)} + 18H_2O_{(g)}$

8. Glucose

$C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 6CO_{2(g)} + 6H_2O_{(g)}$

9. Ethanol

$C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(g)}$

10. Methanol $2CH_3OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 4H_2O_{(g)}$

Lesson 16: The Mole

Fill in the missing values below:

	Formula	Name	Molar Mass

1	C_3H_{10}	tricarbon decahydride	3(12.01)+10(1.01) = 46.13g/mol
2	NaCl	Sodium chloride	22.99+35.45 = 58.44g/mol
3	CH_4	methane	12.01+4(1.01) = 16.05g/mol
4	$Mg(CN)_{2(s)}$	magnesium cyanide	24.31+2(12.01)+2(14.01) = 76.35g/mol
5	MnO_2	Manganese (IV) oxide	54.94+2(16.00) = 86.94g/mol
6	$Ca(NO_3)_{2(s)}$	calcium nitrate	40.08+2(14.01)+6(16.00) = 164.10g/mol
7	NO_3	Nitrogen trioxide	14.01+3(16.00) = 62.01g/mol
8	$KBr_{(s)}$	potassium bromide	39.10+79.90 = 119.00g/mol
9	$NiCl_2$	Nickel (II) chloride	58.69+2(35.45) = 129.59g/mol
10	$ZnCO_3$	Zinc Carbonate	65.41+12.01+3(16.00) = 125.42g/mol

2. Fill in the missing information using the formula $n = \frac{m}{M}$

						DEFINED	MEASURED	MEASURED
	Formula	Name				M (g\mol)	mass (g)	Moles (mol)
1	Li_2CO_3	lithium carbonate	Li	2	6.94	73.89	25.0	0.338
		+ 2−	C	1	12.01			
			O	3	16.00			
2	$MgSO_4$	magnesium sulfate	Mg			120.38	300	2.49
			S					
			O					
3	C_6H_6	benzene	C			78.12	117.18	1.50
			H					
4	$NiCl_3$	nickel (III) chloride	Ni			165.04	412.60	2.5
		3+ −	Cl					
5	$Na_2OOCCOO$	sodium oxalate	Na	2		134.00	500	3.73
			O	4				
			C	2				
6	H_2O	water	H			18.02	64.90	3.60
			O					
7	HNO_3	hydrogen nitrate	H			63.02	100	1.59
			N					
			O					
8	$Sn(ClO)_4$	tin(IV) hypochlorite	Sn			324.51	150	0.462
	−		Cl					
			O					
9	$Pb(CO_3)_2$	lead (IV) carbonate	Pb			327.22	490.83	1.50
			C					
			O					
10	K_3PO_4	potassium phosphate	K			212.27	50	0.236
			P					
			O					