

CLS Chemistry 311

Semester One Final Exam Review

Units	Topic	Textbook Sections
Unit 01	Matter & Change	2.1-2.4
Unit 02	Scientific Measurement	3.1-3.3
Unit 03	Atomic Structure & Chemical Quantities	4.1-4.3 & 10.1-10.2
Unit 04	Electrons in Atoms	5.1-5.3
Unit 05	The Periodic Table	6.1-6.3
Unit 06	Ionic Bonding	7.1-7.2 & 10.1-10.3
Unit 07	Covalent Bonding	8.1-8.4
Unit 08	Naming & Formula Writing	9.1-9.3
Unit 09	Chemical Reactions	11.1-11.13

You will be allowed to use the following on the final exam:

- calculator (no cell phones or iPods)
- hand-written reference sheet
- periodic table & common ion sheet (this will be provided to you)
- pencil

This review is meant as a guide for you as you prepare for your final exam, it is not all inclusive. You should use all of your unit review guides, notes, labs, and practice worksheets to help you prepare for your final. Copies of all of the notes and answer keys to past review guides are posted online.

Unit One: Matter & Change

- Identify the following as a pure substance or a mixture:
 - gold
 - carbon
 - salt water
 - silver
 - carbon dioxide
- Identify each of the following as either homogeneous or heterogeneous:
 - salt water
 - Orange juice
 - Vegetable oil
- Which of the following are compounds?
 - silver
 - CO
 - C₂H₆O
 - Sulfur
 - Helium
 - NaCl
- Which of the following are physical properties and which are chemical properties?
 - alcohol is a colorless liquid
 - the boiling point of water is 100°C
 - water decomposes to give hydrogen and oxygen gases
 - sugar dissolves in water
- Which of the following involve a chemical change?
 - breaking an egg
 - exploding a firecracker
 - melting snow
 - tearing paper
 - drying a wet towel
- Which of the following changes are exothermic and which are endothermic?
 - evaporation of water from your skin - water absorbs energy to evaporate.
 - melting snow - absorbs heat to evaporate
 - steam changing to water -
 - clothes drying - Evaporation
 - freezing water
 - a burning candle
- What term is described by each of the following?
 - energy of position Potential Energy
 - energy of motion kinetic energy
 - energy stored in chemical substances Potential Energy
 - energy due to the moving molecules of a substance kinetic energy

8. Would Dihydrogen Monoxide be classified as an element or a compound?

Compound

9. Write down two examples of pure substances and two examples of mixtures.

Pure

CO₂ Gold
Cl₂ Silver

mixture

Salt water
Air
Kool-Aid

10. Write down 3 examples of a chemical change.

Burning paper
PPE formation
change in temp.
color change (due to reaction)

Unit Two: Scientific Measurement

11. How many . . .

mm in a cm? 10

g in a kg? 1000

mg in a kg? 1000

ms in a s? 1000

12. Indicate the number of significant figures in each of the following:

0.0000101 3

1.01 x 10⁻⁵ 3

1098 4

2001 4

13. Perform the following calculations, answering with the proper number of significant figures

(2.00 x 10⁶)/(3.00 x 10⁻⁷) 6.67 x 10¹²

(4.031)(0.08206)(373.1)/(0.995) 123

55.0001 + 0.0002 + 0.104 55.104

(0.15)/(280.62) 5.3

14. Perform the following conversions:

5.3 mm to cm 0.53

0.0003 km to mm 300

17 cm to mm 170

0.010 kg to g 10

15. Convert the following from scientific notation to regular notation or vice-versa

1.98 x 10⁴ 19,800

4284 4.284 x 10³

2.90433 x 10⁻⁷ 0.000000290433

0.04909 4.909 x 10⁻²

16. A sample of chlorine atoms is 75.77% Cl-35 and 24.23% Cl-37. Find the atomic mass of the sample.

$$(35 \times 0.7577) + (37 \times 0.2423)$$

$$(26.5195) + (8.9651)$$

$$\text{Atomic mass} = 35.48\text{g}$$

17. Make a measurement using the correct tolerance.



2.25 cm

18. Answer the following question and use significant figures to determine your answer:

$$(86.5 \text{ cm}) \times (3.693 \text{ cm}) = 319.4445 \rightarrow 319 \text{ cm}$$

3SF 4SF

19. Express 0.00000863 moles in proper scientific notation.

$$8.63 \times 10^{-6}$$

20. An unknown sample has a mass of 205.3 grams and a volume of 56.7 mL. Which material from the table to the right matches this data?

Material	Density (g/mL)
Kaolin	0.39
Water	1.00
Sugar	1.59
Glass	2.60
Diamond	3.26

$$\text{Density} = \frac{g}{mL}$$

$$\frac{205.3 \text{ g}}{56.7 \text{ mL}} = 3.62 \text{ g/mL}$$

Diamond!

21. A chemical reaction theoretically should produce 5.68 g of lead (II) iodide. If a student conducts this reaction in the lab, but only produces 3.21 g, what is the percent error?

$$\left| \frac{\text{measured} - \text{accepted}}{\text{accepted}} \right| \times 100 = \left| \frac{5.68 \text{ g} - 3.21 \text{ g}}{3.21 \text{ g}} \right| \times 100 = 76.9\%$$

Unit Three: Atomic Structure & Chemical Quantities

22. Complete the following table. Each row represents one individual atom of an element.

Chemical Symbol	Mass Number	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons
Sr	87	37	37	50	37
Ag	108	47	47	61	47
Nb	92	41	41	51	41
Co	59	27	27	32	27
Si	30	14	14	16	14
Cl	37	17	17	20	17

23. How many . . .

Protons in ⁴⁰₁₉K 19

Protons in a Zinc atom 30

Electrons in Sr-91 38

Electrons in a Bromine atom 35

Neutrons in ¹⁸₈O 10

Protons in a Copper atom 29

Neutrons in a ⁴⁰₁₉K atom 21

Neutrons in an Na-24 atom 13

24. How many moles in 1.20×10^{24} atoms of Sc?

$$1.20 \times 10^{24} \text{ atoms} \times \frac{1 \text{ mol Sc}}{6.02 \times 10^{23} \text{ atoms}} = \boxed{1.99 \text{ mol Sc}}$$

25. How many grams in 3.01×10^{23} atoms of S?

$$3.01 \times 10^{23} \text{ atoms} \times \frac{1 \text{ mol S}}{6.02 \times 10^{23} \text{ atoms}} \times \frac{32.974 \text{ g}}{1 \text{ mol S}} = \boxed{16.5 \text{ g S}}$$

26. How many grams in 2.41×10^{24} atoms of P?

$$2.41 \times 10^{24} \text{ atoms} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \times \frac{30.974 \text{ g}}{1 \text{ mol}} = \boxed{124 \text{ g P}}$$

27. How many atoms in 2.52 moles of Ba?

$$2.52 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} = \boxed{1.52 \times 10^{24} \text{ atoms Ba}}$$

28. What is an isotope?

Atoms of the same element that have the same number of protons but different numbers of neutrons.

29. What is the mass number of Oxygen if the isotope has 8 protons, 8 electrons, and 11 neutrons?

mass # = protons + neutrons

$8 + 11 = 19 \text{ amu}$

30. The nucleus of an atom of Iodine with a mass number of 130 contains how many protons, electrons and neutrons?

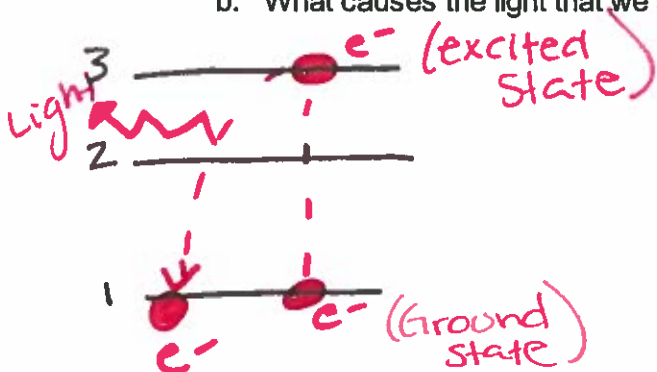
protons = atomic #
 protons = electrons
 neutrons = protons - mass #

protons = 53
 electrons = 53
 Neutrons = 77

Unit Four: Electrons in Atoms

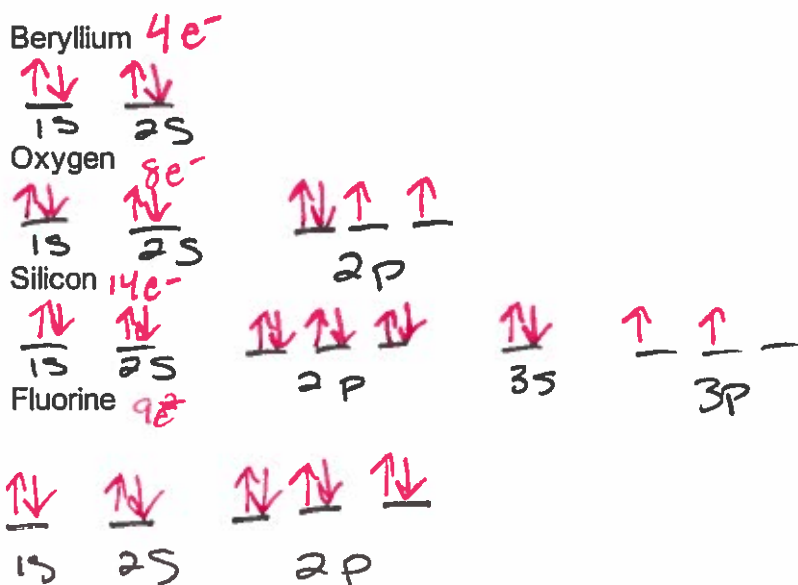
31. When zapped with electricity, a tube containing gaseous element X emits a mixture of red and violet light. In the space below draw the electron energy level transitions and label them:

- a. What causes the electron to "jump"?
- b. What causes the light that we see?



a) The zap of electricity
 b) They (electrons) give off energy in the form of light when they "fall" back to ground state.

32. Draw the orbital diagrams for the following neutral atoms:



33. Using noble gas abbreviations, give the electron configurations for the following neutral atoms:

Antimony (Sb)



Iodine



Radium (Ra)



Barium



34. How many valence electrons are in each of the above atoms?

Antimony 5 Iodine 6 Radium 2 Barium 2

35. How many unpaired electrons are in each of the above atoms?

Antimony 3 Iodine 1 Radium 0 Barium 0

36. Give the names of each of the following excited neutral atoms.

a. $[\text{Ne}] 3s^1 4s^1$ Sodium

b. $[\text{Ne}] 3s^1 3p^1$ Boron

c. $[\text{Kr}] 5s^2 4d^5 5p^1$ Indium

37. List the element that is represented by each of the following electron configurations:

a. $[\text{Ar}] 4s^2 3d^5$ Bromine (Br)

b. $[\text{Kr}] 5s^2 4d^{10} 5p^4$ Tellurium (Te)

c. $[\text{Ne}] 3s^2$ Magnesium (Mg)

38. Draw Lewis Dots for Nitrogen, Boron and Fluorine.



39. Write the electron configuration for Bromine and Aluminum.



40. Draw Lewis Dots for Nitrogen, Boron and Fluorine.

See # 38

41. What is an Isotope?

see # 28

42. What is the mass number of Oxygen if the isotope has 8 protons, 8 electrons, and 11 neutrons?

See # 29

43. The nucleus of an atom of Iodine with a mass number of 130 contains how many protons, electrons and neutrons?

see # 30

Unit Five: The Periodic Table

44. List at least three characteristics of each of the following: metal, nonmetal, metalloid

metals

- conductors
- Lustrous (shiny)
- Ductile (drawn into wire)
- malleable (hammered into shape)

nonmetals

- poor conductors
- not lustrous
- Solids are brittle

metalloids

- moderate conductivity
- properties of both.

45. Rb has properties most similar to which one of the following elements:

Co Li Be

How do you know?

Same group = Same # of valence electrons

46. Rn has properties most similar to which one of the following elements:

Ar Sr At

How do you know?

same group = same # of valence electrons

47. F has properties most similar to which one of the following elements:

Br O C

How do you know?

Same group = same # of valence e⁻.

48. What is the name of the group in the periodic table that is known for its stability and lack of reactivity?

noble gases or Group #18

49. As you go down a column in the periodic table, what happens to atomic radius?

A.R. increases

50. As you go across a period in the periodic table (left to right), what happens to atomic radius?

A.R. decreases

51. As you go down a column in the periodic table, what happens to ionization energy?

I.E. decreases

52. As you go across a period in the periodic table (left to right), what happens to ionization energy?

I.E. increases

53. As you go down a column in the periodic table, what happens to electron affinity?

E.A. decreases

54. As you go across a period in the periodic table (left to right), what happens to electron affinity?

E.A. increases

55. Circle the atom or ion in each of the following pairs which has a LARGER radius:

Li or Li⁺ Sr or Sr²⁺ Br or Br⁻ H or H⁺ S or S²⁻ N or N³⁻
Anions are larger cations are smaller

56. How many moles are there in 512 g of SiBr₄?

$$512 \text{ g SiBr}_4 \times \frac{1 \text{ mol SiBr}_4}{347.69 \text{ g SiBr}_4} = \boxed{1.47 \text{ mol SiBr}_4}$$

57. How many grams are there in 10.1 moles of Ca(OH)₂?

$$10.1 \text{ mol Ca(OH)}_2 \times \frac{74.10 \text{ g Ca(OH)}_2}{1 \text{ mol Ca(OH)}_2} = \boxed{748 \text{ g Ca(OH)}_2}$$

58. How many moles are there in 0.00199 g of Be₃N₂?

$$0.00199 \text{ g Be}_3\text{N}_2 \times \frac{1 \text{ mol Be}_3\text{N}_2}{55.05 \text{ g Be}_3\text{N}_2} = \boxed{3.61 \times 10^{-5} \text{ moles Be}_3\text{N}_2}$$

59. Calculate the % composition by mass of each element in the compound Sn(NO₂)₄.

$$\begin{aligned} \text{Sn} &= 118.71 \times 1 = 118.71 \\ \text{N} &= 14.01 \times 4 = 56.04 \\ \text{O} &= 16.00 \times 8 = 128.00 \end{aligned}$$

$$302.75$$

$$\begin{aligned} \text{Sn} &= (118.71 / 302.75) \times 100 = 39.2\% \text{ Sn} \\ \text{N} &= (56.04 / 302.75) \times 100 = 18.5\% \text{ N} \\ \text{O} &= (128.00 / 302.75) \times 100 = 42.3\% \text{ O} \end{aligned}$$

60. A compound contains 70.9% K and 29.1% S by mass. Calculate the empirical formula of the compound.

$$70.9\% \text{ K} \rightarrow 70.9 \text{ g K}$$

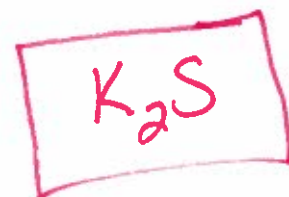
$$29.1\% \text{ S} \rightarrow 29.1 \text{ g S}$$

$$K = \frac{1.81}{0.907} = 1.99 \rightarrow 2$$

$$70.9 \text{ g K} \times \frac{1 \text{ mol}}{39.10 \text{ g}} = 1.81 \text{ mol}$$

$$29.1 \text{ g S} \times \frac{1 \text{ mol}}{32.07 \text{ g}} = 0.907 \text{ mol}$$

$$S = \frac{0.907}{0.907} = 1$$



61. On this periodic table, which element has the smallest size?

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

↑ increases
↓ decreases

62. Write down two atoms that would be bigger than silicon.

Carbon + Boron

63. As the size of the atom increases, what happens to the amount of energy it takes to remove an electron from the atom (the ionization energy), why?

The further the electron is from the nucleus the easier it is to remove the electron (As size ↑, I.E. ↓)

64. What do elements in the same family (group) have in common?

Same # of valence electrons

65. What are the group numbers for the alkali metals, alkaline earth metals, halogens and noble gases?

Alkali metals = Group #1

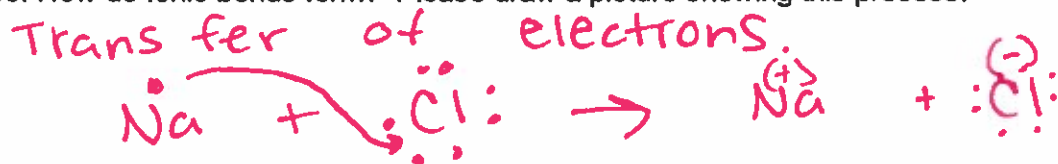
Alkali earth metals = Group #2

Halogens = Group #17

Noble gases = Group #18

Unit Six: Ionic Bonding

66. How do ionic bonds form? Please draw a picture showing this process.



67. How many Hydrogen atoms are in $\text{Al}(\text{OH})_3$?

3

68. What does Avogadro's Number tell you?

How many atoms/molecules are present in 1 mole of an atom

69. Calculate the molar mass of $\text{Pb}(\text{NO}_3)_2$

$$\begin{aligned} \text{Pb} &= (207.2) \times (1) = 207.2 \\ \text{N} &= (14.01) \times (2) = 28.02 \\ \text{O} &= (16.00) \times (6) = 96.00 \\ & \hline & 331.22 \end{aligned}$$

331.2 g

70. Calculate the percent composition of K_2CrO_4

$$\text{K} = (39.10) \times (2) = 78.2$$

$$\text{Cr} = (52.00) \times (1) = 52.00$$

$$\text{O} = (16.00) \times (4) = 64.00$$

$$\hline 194.2$$

$$\left(\frac{78.2}{194.2}\right) \times 100 =$$

40.3% K

$$\left(\frac{52.00}{194.2}\right) \times 100 =$$

26.7% Cr

$$\left(\frac{64.00}{194.2}\right) \times 100 =$$

33.0% O

71. Describe how you would convert 50 grams of gold into moles.

$$50 \text{ g Au} \times \frac{1 \text{ mol Au}}{197.0 \text{ g Au}} =$$

grams divided by molar mass

72. 46. Calculate the mass of 0.832 moles of Na_2CO_3 .

$$0.832 \text{ mol} \times \frac{105.99 \text{ g}}{1 \text{ mol}} =$$

88.2 g Na_2CO_3

$$\text{Na} = (2)(22.99) = 45.98$$

$$\text{C} = (12.01)(1) = 12.01$$

$$\text{O} = (3)(16.00) = 48.00$$

73. How many grams of dihydrogen monoxide are present in 0.0624 moles?

$$\text{H} = (2)(1.008) = 2.016$$

$$\text{O} = (1)(16.00) = 16.00$$

$$0.0624 \text{ mol} \times \frac{18.02 \text{ g}}{1 \text{ mol}} =$$

1.12 g H_2O

74. Calculate the number of moles given 3.64×10^{24} molecules of CO_2 .

$$3.64 \times 10^{24} \text{ CO}_2 \text{ molecules} \times \frac{1 \text{ mol CO}_2}{6.02 \times 10^{23} \text{ molecules}} =$$

$$\boxed{6.05 \text{ mol CO}_2}$$

75. How many molecules of HCl are present in 4.00 moles?

$$4.00 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = \boxed{2.41 \times 10^{24} \text{ molecules}}$$

76. The amount of molecules in 125 g of sodium chloride (NaCl) is.....

$$125 \text{ g NaCl} \times \frac{1 \text{ mol}}{58.44 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mol}} = \boxed{1.29 \times 10^{24} \text{ molecules}}$$

77. How many grams of KBr are present in 2.18×10^{25} molecules of KBr ?

$$2.18 \times 10^{25} \text{ molecules} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} \times \frac{119 \text{ g KBr}}{1 \text{ mol}} = \boxed{4310 \text{ g KBr}}$$

Unit Seven: Covalent Bonding

78. Why do atoms form bonds?

To form a stable octet.

79. What types of atoms are bonded to each other in a covalent bond?

metals

80. What is a diatomic molecule?

A molecule that consists of two atoms

H_2 O_2 F_2 Br_2 I_2 N_2 Cl_2

81. What is a polar molecule?

~~A covalent bond~~

A molecule where one end of the molecule is

82. What is a nonpolar molecule? slightly (+) and the other slightly (-).

A molecule where there are no dipoles.

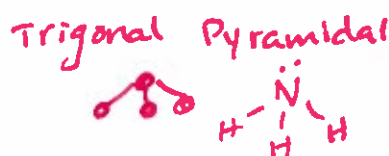
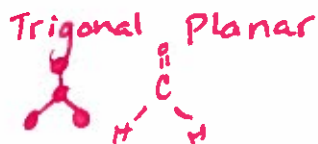
83. Explain what dipole forces, London (dispersion) forces, and hydrogen bonding are. What types of molecules are involved in each type of bonding?

Dipole = polar molecules are attracted to one another (+) and (-) ends are attracted to one another
 London = non polar molecules (caused by motion of e-)
 Hydrogen = special type of dipole, hydrogen must be bonded to O, N or F.

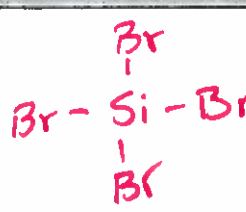
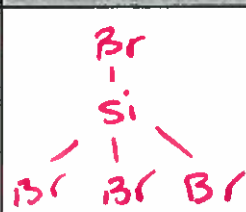


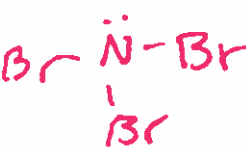

84. Rank the intermolecular forces from weakest to strongest.

London/dispersion → Dipole → Hydrogen → Ionic

85. List the five shapes that a molecule can take according to the VESPR theory. Include a drawing and example with each one.



86. Fill in the table below.

Molecule	E.N.D.	Bonds (NPC, PC, I)	Molecule Polarity	Line Structure	Name of Shape	Drawing of Shape
SiBr ₄	2.8-1.8 1.0	PC	non-polar		Tetrahedral	
H ₂ S	2.5-2.1 0.4	NPC	Polar		Bent	
NBr ₃	3.0-2.8 0.2	NPC	Polar		Trigonal Pyramidal	
CO ₂	3.5-2.5 1.0	PC	non-polar	O=C=O	Linear	O=C=O

Unit Eight: Naming & Formula Writing

87. What is the name of FeO ?

Iron (II) oxide

88. What is the name of P_6O_7 ?

Hexaphosphorus heptoxide

89. What is the name of BaBr_2 ?

Barium bromide

90. What is the name of K_3PO_3 ?

Potassium phosphite

91. What is the formula for Magnesium nitrite?

Mg_3N_2

92. What is the formula for Copper (III) Chromate?

CuCrO_4

93. What is the formula for aluminum nitride?

AlN

94. What is the correct formula trihydrogen pentasulfide?

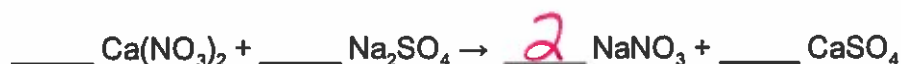
H_3S_5

95. What is the correct formula for Calcium hydroxide?

$\text{Ca}(\text{OH})_2$

Unit Nine: Chemical Reactions

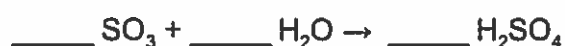
96. Balance the following equations and state the reaction type:



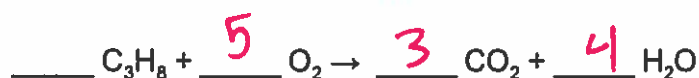
Reaction type: Double Replacement



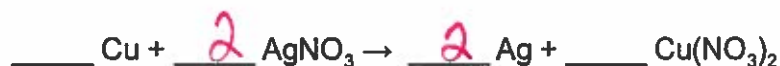
Reaction type: Synthesis



Reaction type: Synthesis



Reaction type: Combustion



Reaction type: Single Replacement.

97. Predict the products of the following reactions. Also, balance the equations and state the reaction type.



Reaction type: Combustion



Reaction type: Decomposition

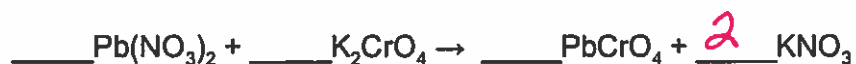


Reaction type: Single Replacement

98. How do you know when an equation is balanced?

There is the same number of each element on both sides of the reaction.

99. Balance and write down the type of equation.



Reaction type: Double Replacement

100. Balance and write down the type of equation.



Reaction type: Synthesis

101. Balance and write down the type of equation.



Reaction type: Decomposition

102. What are the reactants and products for all combustion reactions?

Reactants

Hydrocarbon

oxygen

Products

CO₂

H₂O

103. Predict the Products

