Unit 6 Review

1. How many atoms are in 0.711 moles of Helium?

2. What is the molar mass of Barium Fluoride?

3. What is the percent composition by mass of the elements in $AgNO_3$?

4. What is the empirical formula for a compound that is 57.14% C, 6.16% H, 9.52% N, and 27.18% O?

5. What is the molecular formula for a compound with an empirical formula of C_4H_4O and a molar mass of 136 g/mol?

6. Balance the following equation:

7. What is the name for $CdSO_4$?

8. How many chlorate ions are in 3.62 moles of Calcium Chlorate?

9. How many molecules are in 4.60 moles of Sulfur Trioxide gas?

10. A 0.41g sample of a compound containing Carbon, Nitrogen, and Oxygen was burned. The sample contained 0.13g of Oxygen. What is the percentage of Oxygen in this compound?

11. What is the empirical formula for a compound that is 67.1% Zinc and 32.9% Oxygen?

12. What is the molecular formula for a compound with an empirical formula of C_2OH_4 and a molar mass of 88 g/mol?

13. What is the missing reactant when the following equation is balanced?

$$\underline{1}\ GaF_3 + \underline{3}\ Cs \rightarrow 3\_\_\_\_\_ + \underline{1}\ Ga$$

14. What is the chemical formula for Carbonic Acid?

15. How many moles are in 5.91×10^{27} atoms of Xenon?

16. How many moles are in 6.19×10^{34} molecules of Diphosphorus Nonanitride?

17. What is the percent composition by mass of the elements in Aluminum Nitrate?

18. What is the empirical formula for a compound that is 44.82% Potassium, 18.39% Sulfur, and 36.79% Oxygen?

19. What is the molecular formula for a compound with an empirical formula of C_2H_8N and a molar mass of 46 g/mol?

20. What is the coefficient for Calcium Carbonate when the following equation is balanced?

$$\_\_Ca(OH)_2 + \_\_\_CO_2 \rightarrow \_\_\_CaCO_3 + \_\_\_H_2O$$

21. What is the molar mass of Lithium Perchlorate?

Problem Solutions:

1. 4.28×10^{23} atoms

   Moles → atoms (single element)

$$0.711 \text{ moles x } \frac{6.02 \text{ x } 10^{23} \text{ atoms}}{1 \text{ mole}} = 4.28 \text{ x } 10^{23} \text{ atoms}$$

2. 175.324 g/mol

   Barium Fluoride = BaF_2

   Molar mass = 1(137.328) + 2(18.998) = 175.324 g/mol

3. 63.5% Ag, 8.2% N, 28.3% O

   Molar mass = 1(107.868) + 1(14.007) + 3(15.999) = 169.872 g/mol

$$\% \text{ Ag} = \frac{107.868}{169.872} \text{ x } 100\% = 63.5\%$$

$$\% \text{ N} = \frac{14.007}{169.872} \text{ x } 100\% = 8.2\%$$

$$\% \text{ O} = \frac{3(15.999)}{169.872} \text{ x } 100\% = 28.3\%$$

4. $C_{14}H_{18}N_2O_5$

Step 1: Convert percent to grams	C = 57.14g	H = 6.16g	N = 9.52g	O = 27.18g
Step 2: Convert grams to moles	$C = \frac{57.14}{12.011}$ = 4.76 moles	$H = \frac{6.16}{1.008}$ = 6.11 moles	$N = \frac{9.52}{14.007}$ = 0.68 moles	$O = \frac{27.18}{15.999}$ = 1.70 moles
Step 3: Divide by the smallest number of moles to get the mole ratios	$C = \frac{4.76}{0.68}$ = 7	$H = \frac{6.11}{0.68}$ = 9	$N = \frac{0.68}{0.68}$ = 1	$O = \frac{1.70}{0.68}$ = 2.5
Step 4: Multiply subscripts (if necessary) to make whole numbers	7 x 2 = 14	9 x 2 = 18	1 x 2 = 2	2.5 x 2 = 5
Formula:	$C_{14}H_{18}N_2O_5$			

5. $C_8H_8O_2$

   Mass of Empirical Formula = 4(12.011) + 4(1.008) + 1(15.999) = 68.075 g/mol

$$\frac{136}{68.075} \approx 2\ (C_4H_4O) = C_8H_8O_2$$

6. $\underline{1}\ Na_3PO_4 + \underline{3}\ KOH \rightarrow \underline{3}\ NaOH + \underline{1}\ K_3PO_4$

7. Cadmium (II) Sulfate

8. 4.36 x 10^{24} Chlorate ions

   Moles → Formula Units → ions

   Calcium Chlorate = $Ca(ClO_3)_2$

$$3.62 \text{ moles x } \frac{6.02 \text{ x } 10^{23} \text{ formula units}}{1 \text{ mole}} \text{x } \frac{2 \text{ chlorate ions}}{1 \text{ formula unit}}$$

$$= 4.36 \text{ x } 10^{24} \text{ ions}$$

9. 2.77 x 10^{24} molecules

   Moles → molecules

$$4.60 \text{ moles x } \frac{6.02 \text{ x } 10^{23} \text{ molecules}}{1 \text{ mole}} = 2.77 \text{ x } 10^{24} \text{ molecules}$$

10. 32% O

$$\% \text{ O} = \frac{0.13}{0.41} \text{ x } 100\% = 32\%$$

11.ZnO_2

Step 1: Convert percent to grams	Zn = 67.1g	O = 32.9g
Step 2: Convert grams to moles	$Zn = \frac{67.1}{65.38}$ = 1.03 moles	$O = \frac{32.9}{15.999}$ = 2.06 moles
Step 3: Divide by the smallest number of moles to get the mole ratios	$Zn = \frac{1.03}{1.03}$ = 1	$O = \frac{2.06}{1.03}$ = 2
Step 4: Multiply subscripts (if necessary) to make whole numbers	N/A	N/A
Formula:	ZnO_2	

12.$C_4O_2H_8$

Mass of Empirical Formula = 2(12.011) + 1(15.999) + 4(1.008) = 44.053 g/mol

$$\frac{88}{44.053} \approx 2\ (C_2OH_4) = C_4O_2H_8$$

13. 1 GaF_3 + 3 Cs → 3 CsF + 1 Ga

Missing part is 3 CsF

14. H_2CO_3

15.9820 moles

Atoms (single element) → moles

$$5.91 \times 10^{27}\text{atoms} \times \frac{1\text{ mole}}{6.02 \times 10^{23}\text{ atoms}} = 9820\text{ moles}$$

16.1.03 x 10^{11} moles

Molecules → moles

$$6.19 \times 10^{34} \text{molecules} \times \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ molecules}} = 1.03 \times 10^{11} \text{ moles}$$

17.12.7% Al, 19.7% N, 67.6% O

Aluminum Nitrate = $Al(NO_3)_3$

Molar mass = 1(26.982) + 3(14.007) + 9(15.999) = 212.994 g/mol

$$\% \text{ Al} = \frac{26.982}{212.994} \times 100\% = 12.7\%$$

$$\% \text{ N} = \frac{3(14.007)}{212.994} \times 100\% = 19.7\%$$

$$\% \text{ O} = \frac{9(15.999)}{212.994} \times 100\% = 67.6\%$$

18.K_2SO_4

Step 1: Convert percent to grams	K = 44.82g	S = 18.39g	O = 36.79g
Step 2: Convert grams to moles	$K = \frac{44.82}{39.098}$ = 1.146 moles	$S = \frac{18.39}{32.066}$ = 0.574 moles	$O = \frac{36.79}{15.999}$ = 2.300 moles
Step 3: Divide by the smallest number of moles to get the mole ratios	$K = \frac{1.146}{0.574}$ = 2	$S = \frac{0.574}{0.574}$ = 1	$O = \frac{2.300}{0.574}$ = 4
Step 4: Multiply subscripts (if necessary) to make whole numbers	N/A	N/A	N/A
Formula:	K_2SO_4		

19.C_2H_8N

Mass of Empirical Formula = 2(12.011) + 8(1.008) + 1(14.007) = 46.093 g/mol

$$\frac{46}{46.093} \approx 1\ (C_2OH_4) = C_2H_8N$$

20. 1 $Ca(OH)_2$ + 1 CO_2 → 1 $CaCO_3$ + 1 H_2O

Coefficient for Calcium Carbonate ($CaCO_3$) is 1

21.106.390 g/mol

Lithium Perchlorate = $LiClO_4$

Molar mass = 1(6.941) + 1(35.453) + 4(15.999) = 106.390 g/mol