1. HNO_3

H	1.01
N	14.01
3×O	48.00
	63.02 g/mol

2. Fe_2O_3

2Fe	111.70
3O	48.00
	159.70 g/mol

3. H_3PO_4

3H	3.03
P	30.97
4O	64.00
	98.00 g/mol

4. NH_4NO_3

2N	28.02
4H	4.04
3O	48.00
	80.06 g/mol

5. Rb_2SO_3

2Rb	170.94
S	32.07
3O	48.00
	251.01 g/mol

6. given: 46.6 g Na_3PO_3 need: ? molecules
molar mass of Na_3PO_3 = 147.97 g/mol

$$46.6\text{ g } Na_3PO_3 \times \frac{6.022\times10^{23}\text{ molecules}}{147.97\text{ g}} = \boxed{1.90\times10^{23}\text{ molecules}}$$

7. a) given 12.04×10^{23} molecules need: ? moles

$$12.04\times10^{23}\text{ molecules} \times \frac{1\text{ mole}}{6.022\times10^{23}\text{ molecules}} = \boxed{1.999\text{ moles}}$$

b) given: 12.04×10^{23} molecules AgBr need: grams
molar mass of AgBr = 187.80 g/mol

$$12.04\times10^{23}\text{ molecules} \times \frac{187.80\text{ g}}{6.022\times10^{23}\text{ molecules}} = \boxed{375.4\text{ g AgBr}}$$

8. given: 20.45g $CaSO_4$ need: moles
molar mass of $CaSO_4$ = 136.15 g/mol

$$20.45\text{g} \times \frac{1\text{ mole}}{136.15\text{g}} = \boxed{0.1502\text{ moles } CaSO_4}$$

9. given: 250.2g Fe_2O_3 need: moles
molar mass of Fe_2O_3 = 159.70 g/mol

$$250.2\text{g } Fe_2O_3 \times \frac{1\text{ mole}}{159.70\text{g}} = \boxed{1.567\text{ moles } Fe_2O_3}$$

10. given: 25.9g SO_2 need: molecules
molar mass SO_2 = 64.07 g/mol

$$25.9\text{g } SO_2 \times \frac{6.022\times10^{23}\text{ molecules}}{64.07\text{g}} = \boxed{2.43\times10^{23}\text{ molecules}}$$

11. ~~bf~~ given: 68.3g H_2S need: liters
molar mass = 34.09 g/mol

$$68.3\text{g } H_2S \times \frac{22.4\text{L}}{34.09\text{g}} = \boxed{44.9\text{L}}$$

12. given: 48.0L Cl_2 need: molecules

$$48.0\text{L} \times \frac{6.022\times10^{23}\text{ molecules}}{22.4\text{L}} = \boxed{1.29\times10^{24}\text{ molecules}}$$

1 mole
6.022×10^{23} atoms – or – molecules
22.4L of a gas
molar mass in grams (Per. Table)

given: _____ need: _____

amt given $\times$ $\frac{\text{needed label}}{\text{given label}}$

11. given: $68.3\text{g } H_2S$ need: ? L m.m. = 34.09g/mol

$$68.3\text{g } H_2S \times \frac{22.4\text{ L } H_2S}{34.09\text{ g } H_2S} = \boxed{44.9\text{L } H_2S}$$

3sf

6. given: $46.6\text{g } Na_3PO_3$ need: ? molecules

bottom: molar mass | top: 6.022×10^{23} molecules

$$46.6\text{g } Na_3PO_3 \times \frac{6.022 \times 10^{23}\text{ molecules}}{147.97\text{g}} = 1.90 \times 10^{23}\text{ molecules } Na_3PO_3$$

3sf

$$\frac{xy}{x} = y$$

13. given: 4.86×10^{19} molecules Hg_2S need: ? grams

4.86×10^{19} molec. $Hg_2S \times \frac{433.27 g}{6.022 \times 10^{23} \text{ molecules}} = 0.0350 g\ Hg_2S$

14. given: 50.4g ZnO need: ? mol

$50.4 g\ ZnO \times \frac{1 mol}{81.38 g} = 0.619 \text{ mol } ZnO$

15. given: 60.0g Ne need: ? L

$60.0 g\ Ne \times \frac{22.4 L}{20.18 g} = 66.6 L\ Ne$

16.

C	12.01	$(12.01/31.07) \times 100 = 38.65\%$ C
H_5	6.05	$(5.05/31.07) \times 100 = 16.25\%$ H
N	14.01	$(14.01/31.07) \times 100 = 45.09\%$ N
	31.07 g/mol	

17.

C_6	72.06	$(72.06/78.12) \times 100 = 92.24\%$ C
H_6	6.06	$(6.06/78.12) \times 100 = 7.76\%$ H
	78.12 g/mol	

18.

Ag	107.9	$(107.9/143.35) \times 100 = 75.27\%$ Ag
Cl	35.45	$(35.45/143.35) \times 100 = 24.73\%$ Cl
	143.35 g/mol	

19.

Na	23.00	$(23.00/40.01) \times 100 = 57.49\%$ Na
O	16.00	$(16.00/40.01) \times 100 = 39.99\%$ O
H	1.01	$(1.01/40.01) \times 100 = 2.52\%$ H
	40.01 g/mol	

20. C_3 36.03 — (36.03/44.11) × 100 = 81.68% C
H_8 8.08 — (8.08/44.11) × 100 = 18.32% H
44.11 g/mol

21. Cu 63.55 — (63.55/159.62) × 100 = 39.81% Cu
S 32.07 — (32.07/159.62) × 100 = 20.09% S
O_4 64.00 — (64.00/159.62) × 100 = 40.10% O
159.62 g/mol

22. C_2 24.02 — (24.02/62.08) × 100 = 38.69% C
H_6 6.06 — (6.06/62.08) × 100 = 9.76% H
O_2 32.00 — (32.00/62.08) × 100 = 51.55% O
62.08 g/mol

23. C 12.01 — (12.01/119.37) × 100 = 10.06% C
H 1.01 — (1.01/119.37) × 100 = 0.85% H
Cl_3 106.35 — (106.35/119.37) × 100 = 89.09% Cl
119.37 g/mol

24. Br_3 239.70 — (239.70/268.80) × 100 = 89.17% Br
H 1.01 — (1.01/268.80) × 100 = 0.38% H
Si 28.09 — (28.09/268.80) × 100 = 10.45% Si
268.80 g/mol

25. H 1.01 — (1.01/63.02) × 100 = 1.60% H
N 14.01 — (14.01/63.02) × 100 = 22.23% N
O_3 48.00 — (48.00/63.02) × 100 = 76.17% O
63.02 g/mol

26. B 27. B 28. B 29. D 30. C

3/9

Empirical & Molecular Formula

↑ simplest ratio ↑ actual formula

88.8% Cu 11.2% O

① Divide each % by elements molar mass (creates ratio)

② Divide each ratio # by the smallest # in the ratio (creates whole #)

* ③ (if needed) if step 2 yields decimals:

- .8 or higher round up
- .75 multiply all ratios by 4
- .66 " " " 3
- .5 " " " 2
- .33 " " " 3
- .25 " " " 4
- .2 or less round off

$$\frac{88.8\%\ Cu}{63.55} \qquad \frac{11.2\%\ O}{16.00}$$

$$\frac{1.4}{0.7} \qquad \frac{0.7}{0.7}$$

2 1

Subscripts

ans Cu_2O

Practice

1. $\frac{40.0\%\ C}{12.01}$ $\frac{6.67\%\ H}{1.01}$ $\frac{53.33\%\ O}{16.00}$

$\frac{3.33}{3.33}$ $\frac{6.60}{3.33}$ $\frac{3.33}{3.33}$

1 2 1

CH_2O

30.03 g/mol

molecular mass = 180.18 g/mol

$C_6H_{12}O_6$

2. $\frac{70.0\%\ Iron}{55.85}$ $\frac{30.0\%\ O}{16.00}$

$\frac{1.25}{1.25}$ $\frac{1.88}{1.25}$

1 (2) 1.5 (2)

2 3

Fe_2O_3

3. $\frac{10.1\%\ C}{12.01}$ $\frac{0.9\%\ H}{1.01}$ $\frac{89.1\%\ Cl}{35.45}$

$\frac{0.84}{0.84}$ $\frac{0.89}{0.84}$ $\frac{2.51}{0.84}$

1 1 3

$CHCl_3$

4. $\frac{12.6\%\ H}{1.01}$ $\frac{37.5\%\ C}{12.01}$ $\frac{50.0\%\ O}{16.00}$

$\frac{12.48}{3.12}$ $\frac{3.12}{3.12}$ $\frac{3.13}{3.12}$

4 1 1

H_4CO

Practice Set 2

1. K_2SO_4
2. HgO
3. $MgCl_2$