Answers to Week 9 + 10

Questions

1. How many atoms of gold are found in 0.25 moles of gold?

$$N = n \times 6.02 \times 10^{23}$$
$$= 0.25 \times 6.02 \times 10^{23} = 1.505 \times 10^{23} \text{ atoms}$$

2. How many moles is in 4.5×10^{24} molecules of nitrogen gas?

$$n = \frac{N}{6.02 \times 10^{23}} = \frac{4.5 \times 10^{24}}{6.02 \times 10^{23}}$$
$$= 7.48 \text{ mol}$$

3. Determine the molar mass of the following. Show all working.
   a. $Ba(OH)_2$

$$M_r(Ba(OH)_2) = 137.3 + (2 \times 16) + (2 \times 1.008)$$
$$= 171.316 \text{ g mol}^{-1}$$
$$= 171 \text{ g mol}^{-1} \quad (3 \text{ SF})$$

   b. Copper II nitrate

$$M_r(Cu(NO_3)_2) = 63.55 + (2 \times 14.01) + (6 \times 16)$$
$$= 187.57 \text{ g mol}^{-1}$$
$$= 188 \text{ g mol}^{-1} \quad (3 \text{SF})$$

4. Determine the mass in grams of each of the following showing all working:
   a. 3.15 mol of magnesium bromide ($MgBr_2$)

$n = 3.15$ mol

$M_r = 24.31 + (2 \times 79.90)$
$= 184.11 \text{ g mol}^{-1}$

$$m = n \times M_r$$
$$= 3.15 \times 184.11$$
$$= 579.9 \text{ g}$$
$$= 5.80 \times 10^2 \text{ g} \quad (3 \text{SF})$$

   b. 12.9 mol of phosphoric acid

$n = 12.9$ mol

$$M_r(H_3PO_4) = (3 \times 1.008) + 30.97 + (4 \times 16)$$
$$= 97.994 \text{ g mol}^{-1}$$

$$m = n \times M_r$$
$$= 12.9 \times 97.994$$
$$= 1264.1 \text{ g} = 1.26 \times 10^3 \text{ g} \quad (3 \text{SF})$$

5. Determine the number of moles of each of the following showing all working.

a. 364 grams of water (H_2O)

$m = 364\ g$

$M_r(H_2O) = (2 \times 1.008) + 16$

$= 18.016\ g\ mol^{-1}$

$n = \frac{m}{M_r} = \frac{364}{18.016}$

$= 20.2\ mol$

b. 4.29 grams of ethanoic acid

$m = 4.29\ g$

$M_r(CH_3COOH) = (2 \times 12.01) + (4 \times 1.008) + (2 \times 16)$

$= 60.052\ g\ mol^{-1}$

$n = \frac{m}{M_r} = \frac{4.29}{60.052}$

$= 0.0714\ mol$

$= 7.14 \times 10^{-2}\ mol$ (3SF)

The following two questions apply to the balanced equation for the combustion of ethane below:

$$\mathbf{2}C_2H_6 + \mathbf{7}O_2 \rightarrow \mathbf{4}CO_2 + \mathbf{6}H_2O$$

6. Calculate the number of moles of:

a. CO_2 produced for the number of moles of C_2H_6 consumed.

4 moles CO_2 to every 2 moles C_2H_6

$\therefore$ 2 : 1 reaction.

b. O_2 reacted in relation to the number of moles of C_2H_6 reacted

7 moles O_2 reacted with 2 moles C_2H_6

$\therefore$ 7 : 2 reaction.

7. If 3.05 mol of ethane is combusted, use the balanced equation above to calculate:

a. number of moles of water produced

mole ratio $= \frac{n(\text{unknown})}{n(\text{known})} = \frac{6}{2} = 3$

$n(H_2O) = n(C_2H_6) \times 3$

$= 3.05 \times 3$

$= 9.15\ mol$

b. number of moles of carbon dioxide produced

mole ratio $= \frac{4}{2} = 2$

$n(O_2) = n(C_2H_6) \times 2$

$= 3.05 \times 2$

$= 6.10\ mol$

c. number of moles of oxygen gas required to react completely with it

mole ratio $= \frac{7}{2} = 3.5$

$n(O_2) = n(C_2H_6) \times 3.5$

$= 3.05 \times 3.5$

$= 10.675\ mol$

$= 10.7\ mol$ (3SF)