

Summer Study Session

① circumference of earth = 25000 miles = ? km = ? m

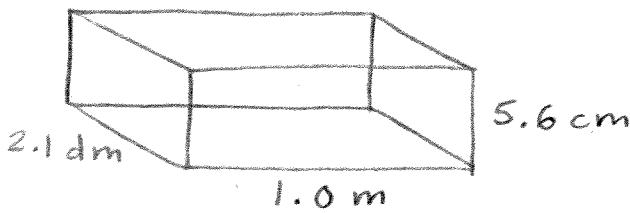
$$1.609 \text{ km} = 1 \text{ mile}$$

$$\frac{25000 \text{ miles}}{1 \text{ mile}} \left| \begin{array}{c} 1.609 \text{ km} \\ \hline 1 \text{ mile} \end{array} \right. = 40225 \text{ km} = \boxed{4.0 \times 10^4 \text{ km}}$$

$$1 \text{ km} = 1000 \text{ m}$$

$$\frac{40225 \text{ km}}{1 \text{ km}} \left| \begin{array}{c} 1000 \text{ m} \\ \hline 1 \text{ km} \end{array} \right. = 40225000 = \boxed{4.0 \times 10^7 \text{ m}}$$

②



$$V = ? \text{ cm}^3$$

$$V = lwh$$

$$V = (21 \text{ cm})(100 \text{ cm})(5.6 \text{ cm})$$

$$\frac{2.1 \text{ dm}}{1 \text{ dm}} \left| \begin{array}{c} 10 \text{ cm} \\ \hline 1 \text{ dm} \end{array} \right. = 21 \text{ cm}$$

$$V = 11760 \text{ cm}^3$$

$$\boxed{V = 1.2 \times 10^4 \text{ cm}^3}$$

$$\frac{1.0 \text{ m}}{1 \text{ m}} \left| \begin{array}{c} 100 \text{ cm} \\ \hline 1 \text{ m} \end{array} \right. = 100 \text{ cm}$$

③ 1 marathon = 26 miles and 385 yards = ? km = ? m

$$\frac{26 \text{ miles}}{1 \text{ mile}} \left| \begin{array}{c} 1.609 \text{ km} \\ \hline 1 \text{ mile} \end{array} \right. = 41.834 \text{ km}$$

$$\frac{385 \text{ yards}}{1.094 \text{ yd}} = \frac{351.9 \text{ m}}{1000 \text{ m}} \left| \begin{array}{c} 1 \text{ m} \\ \hline 1000 \text{ m} \end{array} \right. = 0.3519 \text{ km}$$

$$41.834 \text{ km} + 0.3519 \text{ km} = 42.1859 \text{ km} = \boxed{42 \text{ km} = 42000 \text{ m}}$$

④ 1 capsule = 0.65 g

a) $\frac{15.6 \text{ g}}{0.65 \text{ g}} \left| \begin{array}{c} 1 \text{ capsule} \\ \hline 0.65 \text{ g} \end{array} \right. = \boxed{24 \text{ capsules}}$

b) $\frac{20 \text{ capsules}}{1 \text{ capsule}} \left| \begin{array}{c} 0.65 \text{ g} \\ \hline 1 \text{ capsule} \end{array} \right. = \boxed{13 \text{ g}}$

⑤ Is 65 km/h > 45 mi/h ?

$$\frac{65 \text{ Km}}{1 \text{ h}} \left| \begin{array}{c} 1 \text{ mi} \\ \hline 1.609 \text{ Km} \end{array} \right. = 40.3978 \text{ mi/h}$$

No, a car at 65 km/h would not exceed the speed limit of 45 mi/h

⑥ $d_{\text{water}} = 1.0 \text{ g/mL} = 1.0 \text{ g/cm}^3$

 Block
 350 lb
 $1.2 \times 10^4 \text{ in}^3$

$$M = \frac{350 \text{ lb}}{\text{block}} \left| \begin{array}{c} 453.6 \text{ g} \\ \hline 1 \text{ lb} \end{array} \right. = 158760 \text{ g}$$

$$d_{\text{block}} = \frac{\text{mass}_{\text{block}}}{\text{volume}_{\text{block}}}$$

$$V = \frac{1.2 \times 10^4 \text{ in}(in)(in)}{\text{block}} \left| \begin{array}{c} 2.54 \text{ cm} \\ | \\ 1 \text{ in} \end{array} \right. \left| \begin{array}{c} 2.54 \text{ cm} \\ | \\ 1 \text{ in} \end{array} \right. \left| \begin{array}{c} 2.54 \text{ cm} \\ | \\ 1 \text{ in} \end{array} \right.$$

$$= 1.966 \times 10^5 \text{ cm}^3$$

$$d_{\text{block}} = \frac{158760 \text{ g}}{1.966 \times 10^5 \text{ cm}^3} = 0.81 \text{ g/cm}^3$$

The block will float on water

⑦ 1 carat = 0.200 g

$$d_{\text{diamond}} = 3.51 \text{ g/cm}^3$$

$$\frac{5 \text{ carat}}{1 \text{ carat}} \frac{0.200 \text{ g}}{1 \text{ carat}} = 1 \text{ g diamond}$$

a) 5.0 carat diamond = ? cm³

$$d = \frac{m}{V}$$

$$\frac{3.51 \text{ g}}{\text{cm}^3} = \frac{1 \text{ g}}{V}$$

$$V = 0.28 \text{ cm}^3$$

b) 2.8 mL diamond = ? carat diamond

$$2.8 \text{ mL diamond} = 2.8 \text{ cm}^3 \text{ diamond}$$

$$d = \frac{m}{V} \Rightarrow 3.51 \frac{\text{g}}{\text{cm}^3} = \frac{m}{2.8 \text{ cm}^3} \Rightarrow m = 9.8 \text{ g}$$

$$\frac{9.8 \text{ g}}{0.200 \text{ g}} = 49 \text{ carat}$$

⑧ $d = \frac{m}{V}$ $m = 33.42 \text{ g}$
 $V = ?$

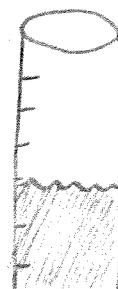
$$d = \frac{33.42 \text{ g}}{8.9 \text{ mL}}$$

$$V = V_{\text{final}} - V_{\text{initial}}$$

$$V = 21.6 \text{ mL} - 12.7 \text{ mL}$$

$$d = 3.8 \text{ g/mL}$$

$$V = 8.9 \text{ mL}$$



Initial
Volume
12.7 mL



final
Volume
21.6 mL

$$\textcircled{9} \quad 1.00 \text{ carat} = 0.200 \text{ g C}$$

$$\text{a) } 1.00 \text{ carat diamond} = ? \text{ mol C}$$

$$\frac{1.00 \text{ carat}}{1 \text{ carat}} \left| \begin{array}{c} 0.200 \text{ g C} \\ \hline \end{array} \right. = \frac{0.200 \text{ g C}}{12.01 \text{ g C}} \left| \begin{array}{c} 1 \text{ mol C} \\ \hline \end{array} \right. = \boxed{0.0167 \text{ mol C}}$$

$$\text{b) } 1.50 \text{ carat diamond} = ? \text{ atoms C}$$

$$\frac{1.50 \text{ carat}}{1 \text{ carat}} \left| \begin{array}{c} 0.200 \text{ g C} \\ \hline \end{array} \right. \left| \begin{array}{c} 1 \text{ mol C} \\ \hline 12.01 \text{ g C} \end{array} \right. = 0.0250 \text{ mol C}$$

$$\frac{0.0250 \text{ mol C}}{1 \text{ mol C}} \left| \begin{array}{c} 6.02 \times 10^{23} \text{ atoms C} \\ \hline \end{array} \right. = \boxed{1.50 \times 10^{22} \text{ atoms C}}$$

$$\textcircled{10} \quad \text{a) } 150.0 \text{ g Fe}_2\text{O}_3 = ? \text{ mol Fe}_2\text{O}_3$$

$$\frac{150.0 \text{ g Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} \left| \begin{array}{c} 1 \text{ mol Fe}_2\text{O}_3 \\ \hline \end{array} \right. = \boxed{0.9393 \text{ mol Fe}_2\text{O}_3}$$

$$\text{b) } 10.0 \text{ mg NO}_2 = ? \text{ mol NO}_2$$

$$\frac{10.0 \text{ mg NO}_2}{1000 \text{ mg}} \left| \begin{array}{c} 1 \text{ g} \\ \hline \end{array} \right. \left| \begin{array}{c} 1 \text{ mol NO}_2 \\ \hline 46.01 \text{ g NO}_2 \end{array} \right. = \boxed{2.17 \times 10^{-4} \text{ mol NO}_2}$$

$$\text{c) } 1.5 \times 10^{16} \text{ molecules BF}_3 = ? \text{ mol BF}_3$$

$$\frac{1.5 \times 10^{16} \text{ molecules BF}_3}{6.02 \times 10^{23} \text{ molecules BF}_3} \left| \begin{array}{c} 1 \text{ mol BF}_3 \\ \hline \end{array} \right. = \boxed{2.5 \times 10^{-8} \text{ mol BF}_3}$$

(11) a) $M\text{M}_{\text{C}_6\text{H}_8\text{O}_6} = (12.01)(6) + (1.01)(8) + (16)(6) = \boxed{176.14 \text{ g/mol}}$

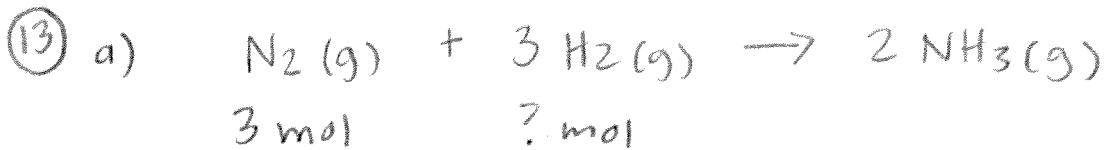
b) 1 tablet = 500.0 mg vitamin C

i) $\frac{500.0 \text{ mg Vitamin C}}{1000 \text{ mg Vitamin C}} \times \frac{1 \text{ g Vitamin C}}{176.14 \text{ g Vitamin C}} \times \frac{1 \text{ mol Vitamin C}}{1 \text{ mol Vitamin C}} = \boxed{2.839 \times 10^{-3} \text{ mol Vitamin C}}$

ii) $\frac{2.839 \times 10^{-3} \text{ mol Vitamin C}}{1 \text{ mol Vitamin C}} \times \frac{6.02 \times 10^{23} \text{ molecules Vitamin C}}{1 \text{ mol Vitamin C}} = \boxed{1.709 \times 10^{21} \text{ molecules Vitamin C}}$

(12) a) choose the balance. The student should convert 0.21 mols CuSO_4 to grams of CuSO_4 then use the balance to measure the necessary mass of CuSO_4 .

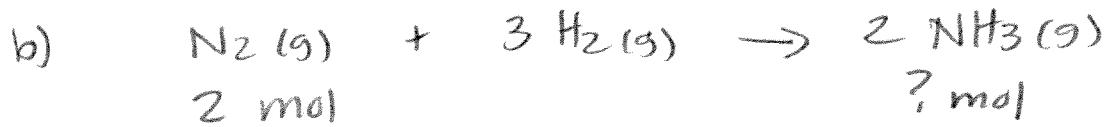
b) $\frac{0.21 \text{ mol CuSO}_4}{1 \text{ mol CuSO}_4} \times \frac{159.62 \text{ g CuSO}_4}{1 \text{ mol CuSO}_4} = 33.5202 \text{ g} = \boxed{34 \text{ g CuSO}_4}$



For every one mole N_2 , three mole H_2 react

$$\therefore 3 \text{ mol } \text{N}_2 \text{ reacts with } 3(3) \text{ mol } \text{H}_2 = \boxed{9.0 \text{ mol } \text{H}_2}$$

OR
$$\frac{3 \text{ mol } \text{N}_2}{1 \text{ mol } \text{N}_2} \left| \begin{array}{c} 3 \text{ mol } \text{H}_2 \\ \hline \end{array} \right. = 9 \text{ mol } \text{H}_2$$



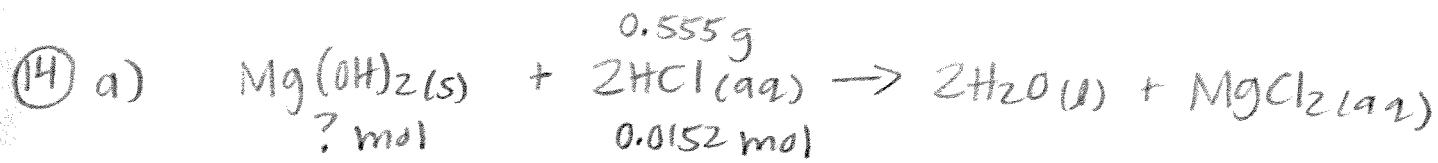
For every one mole N_2 , two mole NH_3 produced

$$\therefore 2 \text{ mol } \text{N}_2 \text{ reacts to produce } 2(2) \text{ mol } \text{NH}_3 = \boxed{4.0 \text{ mol } \text{NH}_3}$$

OR
$$\frac{2 \text{ mol } \text{N}_2}{1 \text{ mol } \text{N}_2} \left| \begin{array}{c} 2 \text{ mol } \text{NH}_3 \\ \hline \end{array} \right. = 4 \text{ mol } \text{NH}_3$$

c) 2 mol N_2 produces 4 mol NH_3

$$\frac{4 \text{ mol } \text{NH}_3}{1 \text{ mol } \text{NH}_3} \left| \begin{array}{c} 17.04 \text{ g } \text{NH}_3 \\ \hline \end{array} \right. = 68.16 \text{ g} = \boxed{68 \text{ g } \text{NH}_3}$$



$$\frac{0.555 \text{ g HCl}}{36.46 \text{ g HCl}} \times \frac{1 \text{ mol HCl}}{1 \text{ mol HCl}} = 0.0152 \text{ mol HCl}$$

$$\frac{0.0152 \text{ mol HCl}}{2 \text{ mol HCl}} \times \frac{1 \text{ mol Mg(OH)}_2}{1 \text{ mol Mg(OH)}_2} = 0.00761 \text{ mol Mg(OH)}_2$$

$$\frac{0.00761 \text{ mol Mg(OH)}_2}{1 \text{ mol Mg(OH)}_2} \times \frac{58.33 \text{ g Mg(OH)}_2}{1 \text{ mol Mg(OH)}_2} = 0.444 \text{ g Mg(OH)}_2$$

b) $\frac{0.0152 \text{ mol HCl}}{2 \text{ mol HCl}} \times \frac{1 \text{ mol MgCl}_2}{1 \text{ mol MgCl}_2} = 0.00761 \text{ mol MgCl}_2$

$$\frac{0.00761 \text{ mol MgCl}_2}{1 \text{ mol MgCl}_2} \times \frac{95.21 \text{ g MgCl}_2}{1 \text{ mol MgCl}_2} = 0.725 \text{ g MgCl}_2$$



$$\frac{2.98 \text{ g H}_2}{2.02 \text{ g H}_2} \left| \begin{array}{l} 1 \text{ mol H}_2 \\ \hline 2.02 \text{ g H}_2 \end{array} \right. = 1.475 \text{ mol H}_2$$

$$\frac{3.21 \text{ g CO}}{28.01 \text{ g CO}} \left| \begin{array}{l} 1 \text{ mol CO} \\ \hline 28.01 \text{ g CO} \end{array} \right. = 0.1146 \text{ mol CO}$$



B 1.475 mol 0.1146 mol 0 mol

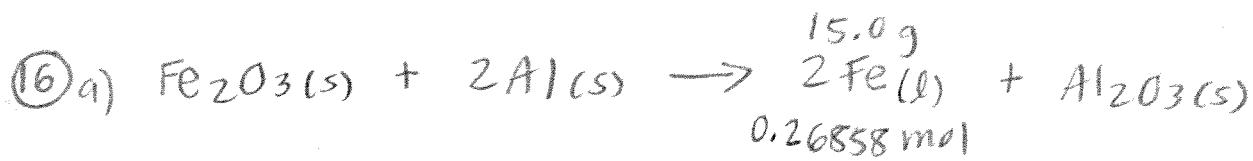
C $-2(0.1146) \text{ mol}$ -0.1146 mol $+ 0.1146 \text{ mol}$

A 1.246 mol	0 mol	$0.1146 \text{ mol CH}_3\text{OH}$
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b) $0.1146 \text{ mol CH}_3\text{OH} \left| \begin{array}{l} 32.05 \text{ g CH}_3\text{OH} \\ \hline 1 \text{ mol CH}_3\text{OH} \end{array} \right. = 3.67 \text{ g CH}_3\text{OH}$

c) % yield = $\frac{\text{experimental}}{\text{theoretical}} \times 100$

% yield = $\frac{3.52 \text{ g CH}_3\text{OH}}{3.67 \text{ g CH}_3\text{OH}} \times 100 = 95.9\%$

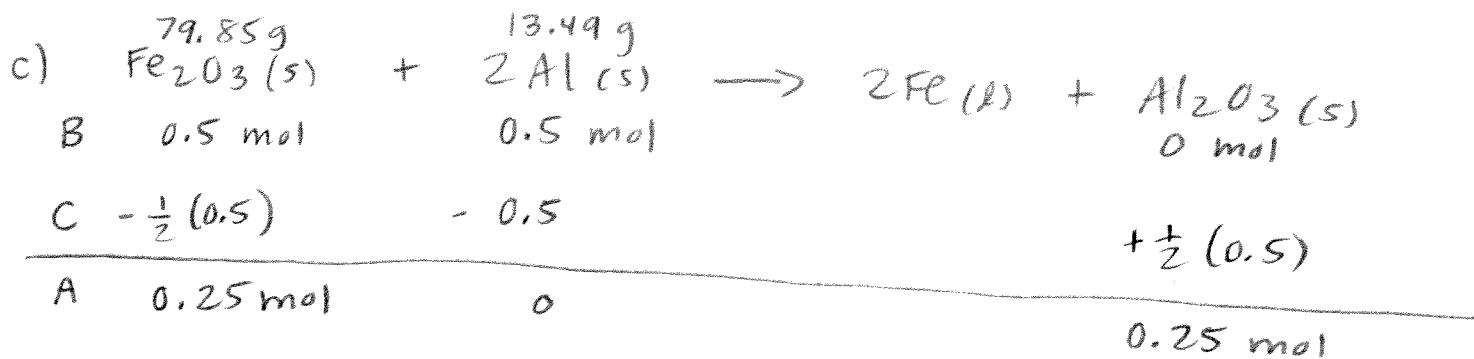


$$\frac{15.0 \text{ g Fe}}{55.85 \text{ g Fe}} \times \frac{1 \text{ mol Fe}}{1 \text{ mol Fe}} = 0.26858 \text{ mol Fe}$$

$$\frac{0.26858 \text{ mol Fe}}{2 \text{ mol Fe}} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{1 \text{ mol Fe}} \times \frac{159.7 \text{ g Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} = 21.4 \text{ g Fe}_2\text{O}_3$$

$$\frac{0.26858 \text{ mol Fe}}{2 \text{ mol Fe}} \times \frac{2 \text{ mol Al}}{1 \text{ mol Fe}} \times \frac{26.98 \text{ g Al}}{1 \text{ mol Al}} = 7.25 \text{ g Al}$$

$$\text{b) } \frac{0.26858 \text{ mol Fe}}{2 \text{ mol Fe}} \times \frac{1 \text{ mol Al}_2\text{O}_3}{1 \text{ mol Fe}} \times \frac{101.96 \text{ g Al}_2\text{O}_3}{1 \text{ mol Al}_2\text{O}_3} = 13.7 \text{ g Al}_2\text{O}_3$$



$$\frac{79.85 \text{ g Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{1 \text{ mol Fe}_2\text{O}_3} = 0.5 \text{ mol Fe}_2\text{O}_3$$

$$\frac{13.49 \text{ g Al}}{26.98 \text{ g Al}} \times \frac{1 \text{ mol Al}}{1 \text{ mol Al}} = 0.5 \text{ mol Al}$$

$$\frac{0.25 \text{ mol Al}_2\text{O}_3}{1 \text{ mol Al}_2\text{O}_3} \times \frac{101.96 \text{ g Al}_2\text{O}_3}{1 \text{ mol Al}_2\text{O}_3} = 25.49 \text{ g Al}_2\text{O}_3$$

