

Dilutions Answer Key – Additional Problems

Answer Key for Dilutions

① a) M of $\text{Fe}_2(\text{SO}_4)_3$

$$\begin{array}{r} \text{Fe} = 55.85 \text{ g/mol} \times 2 = 111.7 \\ \text{S} = 32.06 \text{ g/mol} \times 3 = 96.18 \\ \text{O} = 16 \text{ g/mol} \times 12 = 192 \\ \hline 399.88 \text{ g/mol} \end{array}$$

$$(0.25 \text{ g}) \left(\frac{1 \text{ mol}}{399.88 \text{ g}} \right) \left(\frac{1}{1.50 \text{ L}} \right) = \boxed{4.168 \cdot 10^{-4} \text{ M}}$$

$$\text{b) w/v \%} = \frac{0.25 \text{ g}}{1500 \text{ mL}} \cdot 100 = \boxed{0.0167 \% \text{ (w/v)}}$$

$$\text{c) ppm} = \frac{250 \text{ mg}}{1.5 \text{ L}} = \boxed{166.67 \text{ ppm}}$$

② a) M of $\text{K}_4\text{Fe}(\text{CN})_6$

$$\begin{array}{r} \text{K} = 39.1 \text{ g/mol} \times 4 = 156.4 \\ \text{Fe} = 55.85 \text{ g/mol} \times 1 = 55.85 \\ \text{C} = 12 \text{ g/mol} \times 6 = 72 \\ \text{N} = 14 \text{ g/mol} \times 6 = 84 \\ \hline 368.25 \text{ g/mol} \end{array}$$

$$3c) \text{ v/v } \% = \frac{\text{Vol of solute, mL}}{\text{Vol of solution, mL}} \cdot 100$$

$$8\% (\text{v/v}) = \frac{x}{400} \cdot 100$$

$$x = 32 \text{ mL}$$

$$\therefore \boxed{32 \text{ mL EtOH} \text{ in } \text{H}_2\text{O} \\ \text{in } 400 \text{ mL}}$$

$$d) 16\% (\text{w/v}) = \frac{x}{5000 \text{ mL}} \cdot 100$$

$$x = 800 \text{ g} \therefore \boxed{800 \text{ g PEG} \text{ in } \text{H}_2\text{O} \text{ in } 5000 \text{ mL}}$$

$$e) 16\% (\text{w/w}) = \frac{x}{5000 \text{ mL}} \cdot 100$$

$$\boxed{800 \text{ g PEG} \text{ in } \text{H}_2\text{O} \text{ in } 5 \text{ kg}}$$

$$f) 16\% (\text{v/v}) = \frac{x}{5000 \text{ mL}} \cdot 100$$

$$\boxed{800 \text{ g PEG} \text{ in } \text{H}_2\text{O} \text{ in } 5 \text{ L}}$$

$$g) 34\% (\text{w/v}) = \frac{x}{1200 \text{ mL}} \cdot 100$$

$$x = 408 \text{ g}$$

$$\therefore \boxed{408 \text{ g HAc} \text{ in } \text{H}_2\text{O} \text{ in } 1200 \text{ mL}}$$

2a cont'd)

$$(0.565 \text{ g}) \left(\frac{1 \text{ mol}}{368.25 \text{ g}} \right) \left(\frac{1}{1.375 \text{ L}} \right) = 1.116 \cdot 10^{-3} \text{ M}$$

$$b) \frac{0.565 \text{ g}}{1.375 \text{ mL}} \cdot 100 = 0.0411\% \text{ (w/v)}$$

$$c) \frac{565 \text{ mg}}{1.375 \text{ L}} = 410.9 \text{ ppm}$$

$$\textcircled{3} a) \text{ w/v \%} = \frac{\text{wt of solute, g}}{\text{vol soln, mL}} \cdot 100$$

$$8\% \text{ (w/v)} = \frac{x}{400} \cdot 100$$

$$8 = \frac{1}{4}x$$

$$32 = x$$

$$\therefore \boxed{32 \text{ g EtOH } \tau \text{ H}_2\text{O} \text{ } \overline{\text{}} \text{ } 400 \text{ mL}}$$

$$b) \text{ w/w \%} = \frac{\text{wt of solute, g}}{\text{wt of solution, g}} \cdot 100$$

$$8\% \text{ (w/w)} = \frac{x}{400^*} \cdot 100$$

$$* 1 \text{ g H}_2\text{O} \cong 1 \text{ mL}$$

$$\therefore \boxed{32 \text{ g EtOH } \tau \text{ H}_2\text{O} \text{ } \overline{\text{}} \text{ } 400 \text{ g}}$$

3h) 34% (w/w)

$$408 \text{ g HOAc} \pm \text{H}_2\text{O} \text{ g s } 1200 \text{ g}$$

i) 34% (v/v)

$$408 \text{ mL HOAc} \pm \text{H}_2\text{O} \text{ g s } 1200 \text{ mL}$$

④ a) 1:4 is 5 parts total. ∴

$$\frac{1}{5} \cdot 500 = 100 \text{ mL HNO}_3$$

$$\frac{4}{5} \cdot 500 = 400 \text{ mL H}_2\text{O}$$

b) $\frac{2}{5} \cdot 500 = 200 \text{ mL HNO}_3$

$$\frac{3}{5} \cdot 500 = 300 \text{ mL H}_2\text{O}$$

c) $\frac{4}{9} \cdot 500 = 222.2 \text{ mL HNO}_3$

$$\frac{5}{9} \cdot 500 = 277.8 \text{ mL H}_2\text{O}$$

d) $\frac{1}{17} \cdot 500 = 29.41 \text{ mL HNO}_3$

$$\frac{16}{17} \cdot 500 = 470.59 \text{ mL H}_2\text{O}$$

$$4e) \frac{1}{25} \cdot 500 = 20 \text{ mL HNO}_3$$

$$\frac{24}{25} \cdot 500 = 480 \text{ mL H}_2\text{O}$$

$$4f) \frac{1}{3} \cdot 500 = 166.67 \text{ mL HNO}_3$$

$$\frac{2}{3} \cdot 500 = 333.33 \text{ mL H}_2\text{O}$$

$$\textcircled{5} a) \frac{1}{4} \cdot 750 = 187.5 \text{ mL HNO}_3$$

$$\frac{3}{4} \cdot 750 = 562.5 \text{ mL H}_2\text{O}$$

$$b) \frac{2}{3} \cdot 750 = 500 \text{ mL HNO}_3$$

$$\frac{1}{3} \cdot 750 = 250 \text{ mL H}_2\text{O}$$

$$c) \frac{4}{5} \cdot 750 = 600 \text{ mL HNO}_3$$

$$\frac{1}{5} \cdot 750 = 150 \text{ mL H}_2\text{O}$$

$$d) \frac{1}{16} \cdot 750 = 46.88 \text{ mL HNO}_3$$

$$\frac{15}{16} \cdot 750 = 703.12 \text{ mL H}_2\text{O}$$

$$5e) \frac{1}{24} \cdot 750 = 31.25 \text{ mL HNO}_3$$

$$\frac{23}{24} \cdot 750 = 718.75 \text{ mL H}_2\text{O}$$

$$f) \frac{1}{2} \cdot 750 = 375 \text{ mL HNO}_3$$

$$\frac{1}{2} \cdot 750 = 375 \text{ mL H}_2\text{O}$$