Assignment #2 KEY

April 9, 2018 10:17 AM

17. $$\text{Moles of NaOH} = 50.0\ \text{L}\ H_2 \times \frac{1\ \text{mol}\ H_2}{22.4\ \text{L}\ H_2} \times \frac{2\ \text{mol NaOH}}{3\ \text{mol}\ H_2} = 1.488\ \text{mol}$$

$$\text{volume of NaOH} = \frac{n}{c} = \frac{1.488\ \text{mol}}{3.00\ \text{mol/L}} = \mathbf{0.496\ L}$$

18. The neutralization equation is: $HCl + NaOH \longrightarrow NaCl + H_2O$.

$$\text{moles of NaOH} = 0.318 \frac{\text{mol}}{\text{L}} \times 0.0250\ \text{L} = 7.95 \times 10^{-3}\ \text{mol} = \text{moles HCl}$$

$$\text{volume of HCl} = \frac{n}{c} = \frac{0.00795\ \text{mol}}{0.250\ \text{mol/L}} = \mathbf{0.0318\ L\ (31.8\ mL)}$$

19. (a) $$\text{moles of } Cl^- = 0.0148 \frac{\text{mol}}{\text{L}} \times 0.0154\ \text{L} = 2.279 \times 10^{-4}\ \text{mol}$$

$$\text{moles of } Hg^{2+} = 2.279 \times 10^{-4}\ \text{mol } Cl^- \times \frac{1\ \text{mol } Hg^{2+}}{2\ \text{mol } Cl^-} = 1.140 \times 10^{-4}\ \text{mol}$$

$$= \text{moles } HgCl_2 \quad \text{(for second part of problem)}$$

$$[Hg^{2+}] = \frac{n}{V} = \frac{1.140 \times 10^{-4}\ \text{mol}}{0.0250\ \text{L}} = \mathbf{4.56 \times 10^{-3}\ M}$$

(b) $$\text{mass of } HgCl_2 = 1.140 \times 10^{-4}\ \text{mol} \times \frac{271.6\ \text{g}}{1\ \text{mol}} = \mathbf{0.0310\ g}$$

20. (a) The neutralization reaction is: $Ca(OH)_2 + 2\,HCl \longrightarrow CaCl_2 + 2\,H_2O$.

$$\text{moles of HCl} = 0.0156 \frac{\text{mol}}{\text{L}} \times 0.0235\ \text{L} = 3.666 \times 10^{-4}\ \text{mol}$$

$$\text{moles of } Ca(OH)_2 = 3.666 \times 10^{-4}\ \text{mol HCl} \times \frac{1\ \text{mol } Ca(OH)_2}{2\ \text{mol HCl}} = 1.833 \times 10^{-4}\ \text{mol}$$

$$[Ca(OH)_2] = \frac{n}{V} = \frac{1.833 \times 10^{-4}\ \text{mol}}{0.0100\ \text{L}} = \mathbf{0.0183\ M}$$

(b) $$\text{mass of } Ca(OH)_2 = 0.01833 \frac{\text{mol}}{\text{L}} \times 0.2500\ \text{L} \times \frac{74.1\ \text{g}}{1\ \text{mol}} = \mathbf{0.340\ g}$$

21. (a) $$\text{moles of } H_2O_2 = 1.24 \frac{\text{mol}}{\text{L}} \times 0.00200\ \text{L} = 2.48 \times 10^{-3}\ \text{mol}$$

$$\text{moles of } MnO_4^- = 2.48 \times 10^{-3}\ H_2O_2 \times \frac{2\ \text{mol } MnO_4^-}{5\ \text{mol } H_2O_2} = 9.92 \times 10^{-4}\ \text{mol}$$

$$\text{volume of } MnO_4^- = \frac{n}{c} = \frac{9.92 \times 10^{-4}\ \text{mol}}{0.0496\ \text{mol/L}} = \mathbf{0.0200\ L\ (20.0\ mL)}$$

(b) $$\text{volume of } O_2 = 9.92 \times 10^{-4}\ \text{mol } MnO_4^- \times \frac{5\ \text{mol } O_2}{2\ \text{mol } MnO_4^-} \times \frac{22.4\ \text{L } O_2}{1\ \text{mol } O_2} = \mathbf{0.0556\ L}$$

22. (a) $$\text{moles of NaOH} = 0.853 \frac{\text{mol}}{\text{L}} \times 0.0438\ \text{L} = 0.03736\ \text{mol}$$

$$\text{moles of } H_3PO_4 = 0.03736\ \text{mol NaOH} \times \frac{1\ \text{mol } H_3PO_4}{2\ \text{mol NaOH}} = 0.01868\ \text{mol}$$

$$[H_3PO_4] = \frac{n}{V} = \frac{0.01868\ \text{mol}}{0.00100\ \text{L}} = \mathbf{18.7\ M}$$

(b) $$\text{density} = 18.68 \frac{\text{mol}}{\text{L}} \times \frac{98.0\ \text{g}}{1\ \text{mol}} = \mathbf{1.83 \times 10^3\ \frac{g}{L}}$$

23. (a) moles of $Cr_2O_7^{2-} = 0.125 \frac{mol}{L} \times 0.0176\ L = 2.20 \times 10^{-3}\ mol$

$$\text{moles of } Fe^{2+} = 2.20 \times 10^{-3}\ mol\ Cr_2O_7^{2-} \times \frac{6\ mol\ Fe^{2+}}{1\ mol\ Cr_2O_7^{2-}} = 0.0132\ mol$$

$$[Fe^{2+}] = \frac{n}{V} = \frac{0.0132\ mol}{0.0250\ L} = \mathbf{0.528\ M}$$

(b) $$\text{mass of Fe} = \text{mass of } Fe^{2+} = 0.01320\ mol \times \frac{55.8\ g}{1\ mol} = \mathbf{0.737\ g}$$