

AP Exam Practice Answers – Day 1

1a) Across the period from Li to Ne the number of protons is increasing in the nucleus hence the nuclear charge is increasing with a consequently stronger attraction for electrons and an increase in I.E.

1b) The e⁻ ionized in the case of Be is a 2s electron whereas in the case of B it is a 2p electron. 2p electrons are higher in energy than 2s electrons because 2p electrons penetrate the core to a lesser degree

1c) The e⁻ ionized in O is paired with another electron in the same orbital, whereas in N the electron comes from a singly—occupied orbital. The ionization energy of the O electron is less because of the repulsion

1d) The ionization energy of Na will be less than those of both Li and Ne because the electron removed comes from an orbital which is farther from the nucleus, therefore less tightly held.

2a) The freezing point depression (or any other colligative effect) that occurs when a mole of salt is dissolved is greater than when a mole of a non-dissociating substance is dissolved.

2b) When a salt is dissolved in water, the solution conducts electricity.

2c) Neutralization between a strong monoprotic acid and a strong base involves the reaction

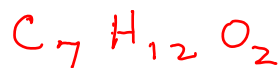


Regardless of the acid or base used because both the acid and base completely dissociate. Spectator ions have no appreciable effect.

2d) Water-because of its polar nature, is capable of solvating the ions which result from the dissociation, whereas the non-polar benzene interacts very weakly with these ions

3a) assume 100g

$$\begin{array}{l} \text{C } 65.60\text{g} \left(\frac{1\text{ mole}}{12.01\text{g}} \right) = 5.462\text{ mole C} = 3.50 \\ \text{H } 9.44\text{g} \left(\frac{1\text{ mole}}{1.01\text{g}} \right) = \frac{1.560}{1.560} 9.347\text{ mole H} = 6.00 \\ \text{O } 24.96\text{g} \left(\frac{1\text{ mole}}{16.00\text{g}} \right) = \frac{1.560}{1.560} 1.560\text{ mole O} = 1 \end{array}$$



3b)

$$\Delta T_f = i \cdot m \cdot K_f$$

$$15.2^\circ\text{C} = (1)(m)(40.0 \frac{\text{kg} \cdot \text{K}}{\text{mole}})$$

$$m = 0.38 \quad m = \frac{x \text{ mole}}{0.01608 \text{ kg}}$$

$$x = 0.0061 \text{ mole}$$

$$\frac{1.570\text{g}}{0.0061 \text{ mole}} = \frac{257.4\text{g/mole}}{128} = 2 \quad \text{C}_{14}\text{H}_{24}\text{O}_4$$

3c) $PV = nRT$

$$(1.00 \text{ atm})(0.577\text{L}) = n \left(0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mole} \cdot \text{K}} \right) (573\text{K})$$

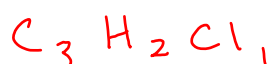
$$n = 0.0123 \text{ mole}$$

$$\frac{1.570\text{g}}{0.0123 \text{ mole}} = 127.6 \text{ g/mole}$$

3d) the compound dimerizes since the mm is double that in the gas phase or it dissociates in the gas phase

4 a) assume 100g

$$\begin{array}{l} \text{C } 49.02\text{g} \left(\frac{1\text{mole}}{12.01\text{g}} \right) = \frac{4.082}{1.361} \text{ mole} = 3 \\ \text{H } 2.743\text{g} \left(\frac{1\text{mole}}{1.01\text{g}} \right) = \frac{2.716}{1.361} \text{ mole} = 2 \\ \text{Cl } 48.23\text{g} \left(\frac{1\text{mole}}{35.45\text{g}} \right) = \frac{1.361}{1.361} \text{ mole} = 1 \end{array}$$



b) $\Delta T_F = i m K_F$

$$4.38^\circ\text{C} = (1)(m)\left(5.12\frac{^\circ\text{C}}{m}\right)$$

$$m = 0.855 = \frac{x\text{mole}}{0.0250\text{kg}}$$

$$x = 0.0214 \text{ mole}$$

$$\frac{3.150\text{g}}{0.0214\text{mole}} = 147 \text{ g/mole}$$

c) mole fraction = $\frac{\text{mole Benzene}}{\text{total moles}}$

$$25.00\text{g} \left(\frac{1\text{mole}}{78.11\text{g}} \right) = 0.32 \text{ mole}$$

$$\frac{0.32}{(0.32 + 0.0214)} = 0.94$$

d) $P_{\text{solution}} = P_{\text{pure}} \times \text{mole fraction}$
 $(150)(0.94) = 141 \text{ mmHg}$



$$b) \quad 10.0 \text{ g } C_3H_8 \left(\frac{1 \text{ mol } C_3H_8}{44.11 \text{ g } C_3H_8} \right) \left(\frac{5 \text{ mol } O_2}{1 \text{ mol } C_3H_8} \right) = 1.13 \text{ mol } O_2$$

$$PV = nRT$$

$$(1 \text{ atm})(V) = (1.13 \text{ mol})(0.0821 \frac{\text{atm} \cdot \text{L}}{\text{mol} \cdot \text{K}})(303 \text{ K})$$

$$V = 28.1 \text{ L } O_2 \left(\frac{100 \text{ L air}}{21.0 \text{ L } O_2} \right) = \boxed{134 \text{ L air}}$$

$$c) \quad \Delta H_{rxn} = \sum \Delta H_f \text{ prod} - \sum \Delta H_f \text{ react}$$

$$-2,220.1 \text{ kJ} = [3(-393.5 \frac{\text{kJ}}{\text{mol}}) + 4(-285.3 \frac{\text{kJ}}{\text{mol}})] -$$

$$[1(x) + 5(0 \frac{\text{kJ}}{\text{mol}})]$$

$$-2,220.1 \text{ kJ} = -2321.7 \text{ kJ} - x$$

$$\boxed{x = -101.6 \text{ kJ}}$$

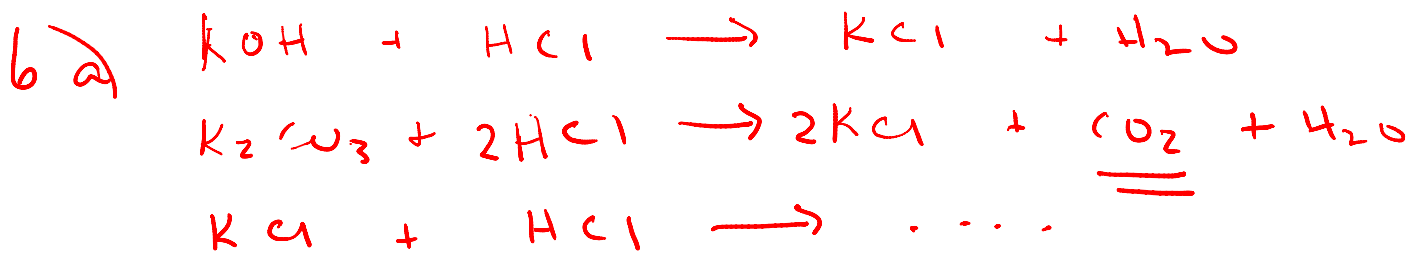
$$d) \quad 30.0 \text{ g } C_3H_8 \left(\frac{1 \text{ mol } C_3H_8}{44.11 \text{ g } C_3H_8} \right) = 0.680 \text{ mol } C_3H_8$$

$$q = 0.680 \text{ mol} (-2220.1 \frac{\text{kJ}}{\text{mol}}) = -1509.7 \text{ kJ}$$

$$q = m \Delta T c_p$$

$$1.5097 \times 10^6 \text{ J} = (8000 \text{ g})(x)(4.18 \frac{\text{J}}{\text{g} \cdot \text{K}})$$

$$\boxed{\Delta T = 45.1 \text{ K}}$$



$$PV = nRT \\
 (740 \text{ torr})(0.249 \text{ L}) = n \left(62.4 \frac{\text{torr} \cdot \text{L}}{\text{mol} \cdot \text{K}} \right) (295 \text{ K})$$

$$n = 0.0100 \text{ mole CO}_2$$

$$0.0100 \text{ mole CO}_2 \left(\frac{1 \text{ mole K}_2\text{CO}_3}{1 \text{ mole CO}_2} \right) \left(\frac{139.2 \text{ g K}_2\text{CO}_3}{1 \text{ mole K}_2\text{CO}_3} \right) = 1.39 \text{ g}$$

$$\% \text{ K}_2\text{CO}_3 = \frac{1.39}{5.00 \text{ g}} \times 100 = \underline{\underline{27.8 \%}}_{\text{K}_2\text{CO}_3}$$

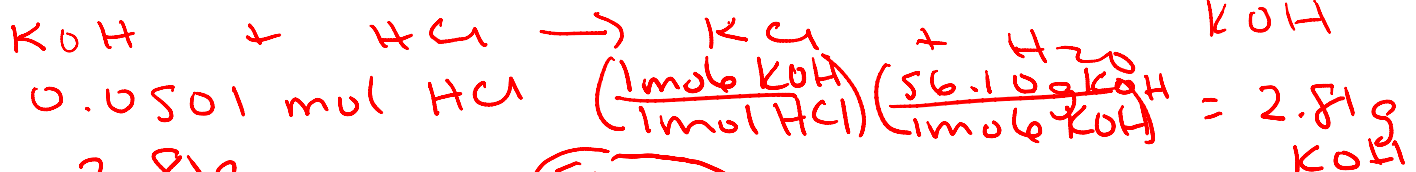
$$\text{b)} \quad 0.0100 \text{ mole CO}_2 \left(\frac{2 \text{ mole HCl}}{1 \text{ mole CO}_2} \right) = 0.0200 \text{ mole HCl reacts w/ K}_2\text{CO}_3$$



$$1.5 \text{ M} = \frac{x}{0.0866 \text{ L}}$$

$$0.1299 \text{ mole NaOH} \left(\frac{1 \text{ mole HCl}}{1 \text{ mole NaOH}} \right) = 0.1299 \text{ mole HCl}$$

$$0.200 \text{ mole HCl} - (0.0200 + 0.1299) = 0.0501 \text{ mole HCl reacts w/ KOH}$$



$$\frac{2.81 \text{ g}}{5.00 \text{ g}} \times 100 = \underline{\underline{56.2 \%}}_{\text{KOH}}$$

$$100 - 27.8 - 56.2 = \underline{\underline{16.0 \% KCl}}$$