AP Midterm Topic Review Answers

Station 1 - Stoichiometry

$1\ C_2H_5 + 8\ O_2 \rightarrow 5\ CO_2 + 6\ H_2O$ combustion

$2\ H_2O_2 \rightarrow 2\ H_2O + 1\ O_2$ decomposition

$2\ AgNO_3 + 1\ K_2CO_3 \rightarrow 1\ Ag_2CO_3 + 2\ KNO_3$ double replacement

$$11.0\ gC_5H_{12} \times \frac{1\ \text{mole}\ C_5H_{12}}{72.17\ g} \times \frac{5\ \text{mole}\ C0_2}{1\ \text{mol}\ C_5H_{12}} \times \frac{44.01\ g}{1\ \text{mol}\ CO_2} = \mathbf{33.5g\ CO_2}$$

$$10.0g\ H_2 \times \frac{1\ \text{mole}\ H_2}{2.02\ g\ H_2} \times \frac{2\ \text{mol}\ NH_3}{3\ \text{mol}\ H_2} \times \frac{17.04\ g\ NH_3}{1\ \text{mol}\ NH_3} = 56.237g\ NH_3 = \mathbf{56.2g\ NH_3}$$

$$50.0g\ N_2 \times \frac{1\ \text{mol}\ N_2}{28.02\ g} \times \frac{2\ \text{mol}\ NH_3}{1\ \text{mol}\ N_2} \times \frac{17.04\ g\ NH_3}{1\ \text{mol}\ NH_3} = \mathbf{60.813\ g\ NH_3}$$

Station 2 – Predicting Reactions

A.) $H^+ + SO_4^{2-} + Ba^{2+} + C_2H_3O_2^- \rightarrow HC_2H_3O_2 + BaSO_4$

B.) $Fe + Fe^{3+} \rightarrow Fe^{2+}$

C.) $Cl_2 + Br^- \rightarrow Br_2 + Cl^-$

Station 3 – Energy & Hess's Law

$\Delta H_{rxn} = \Sigma\ \Delta H_{products} - \Sigma\ \Delta H_{reactants} = -153.9$ kJ/ mole

(82.1 kJ/mol + 34.0 kJ/mol) – 3(90 kJ/mol) = **-153.9 kJ/ mole**

$q = mc\Delta T = (2.00g)(.902\ J/g\ ^\circ C)(5\ ^\circ C) =$ **9.02** J

Station 4 – e^- Configuration & Periodicity

Atom	Mass	# p^+	# n	# e^-	
Na	23	11	12	11	
Mg	24	12	12	12	
F	19	9	10	9	
Mg^{2+}	24	12	12	10	

Energy needed to raise an electron from n=1 to n=5 = **$+2.09 \times 10^{-18}$ J**

Notice that this is a + value because you are adding energy to move from level 1 to level 5.

4p orbital so n=4, l=1, m_l=0 (or -1 or +1) and m_s = +½ (or -½)

The largest ionization energy is N. As far as general trends, you might choose Oxygen (the furthest up and right) but O is less than N because the electron you are removing is coming from an orbital with two electrons in it... therefore there will be electron repulsion lowering the ionization energy.

Station 5 – Carbon Chemistry

C_3H_8	C_9H_{18}	C_5H_{10}	C_6H_{14}	C_4H_6
Propane	Nonene	Pentene	Hexane	Butyne

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  C  C
  |  |
C-C-C-C-C-C-C-C
     |
     C
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2, 3, 3-trimethyloctane

Name of the hydrocarbon: **3-methylhexane**

Aldehyde	Ether	Ester	Alcohol	Carboxylic Acid	Ketone

Station 6 – Properties of Gases

PV=nRT

$$N=\frac{PV}{RT} = x \; \frac{700\text{mmHg}}{62.4\frac{\text{L}\cdot\text{mmHg}}{\text{mol}\cdot\text{K}}} \; x \; \frac{84.50\text{ L}}{293\text{ K}} = 3.24 \text{ moles He } x \; \frac{4.00\text{ g He}}{1\text{ mol He}} = \mathbf{12.9g\ He}$$

$$\frac{V_{He}}{V_{SO_2}} = \sqrt{\frac{MM_{SO_2}}{MM_{He}}} = \sqrt{\frac{64}{4}} = \sqrt{16} = \mathbf{4\ times}$$

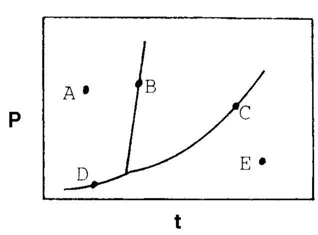
$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$V_2 = \frac{P_1V_1}{T_1} \; x \; \frac{T_1}{P_2} \; x \; \frac{(745\text{ mmHg})(2.50\text{ L})(273\text{ K})}{(293\text{ K})(760\text{ mmHg})} \quad \mathbf{2.28\ L}$$

Station 7 – IMF's and Phase Diagrams

Circle the chemical with the weakest IMF? H_2O, **H_2S**, H_2Se, H_2Te

O_2	SO_2	CH_3OH	SiO_2
London dispersion forces	dipole-dipole	H-Bonding	Covalent Network



Normal boiling point = **~80° C**

Solid is most dense phase

Sublimation

A is solid; between B & C is liquid, E is gas.

Station 8 – Concentration Units & Solutions

$$\frac{1.84\ \text{mol FeCl}_3}{1\ \text{kg water}} \times \frac{162.22\ \text{g FeCl}_2}{1\ \text{mol FeCl}_3} = 298.48\text{g FeCl}_3 \qquad \% = \frac{298.48\ \text{g FeCl}_3}{1000 + 298.5\text{g}} \times 100 = \mathbf{22.99\%}$$

(1000 g water)

$$25.0\ \text{g HCl} \times \frac{1\ \text{mol HCl}}{36.46\ \text{g HCL}} = \underline{.686\ \text{mol HCl}}$$

$$100\ \text{g solution} \times \frac{1\ \text{mL}}{1.08\ \text{g}} \times \frac{1\ \text{L}}{1000\ \text{mL}} = \underline{.0926\ \text{L}}$$

$$\underline{M} = \frac{.686}{.0926} = \mathbf{7.40\ \underline{M}}$$

Answer (e) because 1 *m* Na_2S has the most particles (i=3)

Station 9 – Kinetics

$$.75\ \text{mol}\cdot\text{L}^{-1}\cdot\text{min}^{-1} \times \frac{3\ \text{mol CO}_2}{5\ \text{mol O}_2} = 0.45\ \text{mol}\cdot\text{L}^{-1}\cdot\text{min}^{-1}$$

Rate= R $[N_2]$ $[H_2]^2$

In experiments 1 and 2, $[H_2]$ doubles and the rate quadruples… H_2 is second order.

In experiments 2 and 3, $[N_2]$ doubles and the rate doubles… N_2 is first order.

The graph will be downhill overall with an activation energy hill that is 40 kJ high.