Chemistry 534
Pretest 2.1v2011 **Feeling Exo? Or Endo?__**

1. Find the molar heat of combustion, in kJ/mole, of magnesium(Mg) if a 1.00 g sample warms one liter of water from 10.00 ^{o}C to 17.83 ^{o}C. (4 marks)

2. What temperature change will be experienced by a 250.0 mL mixture (final volume) if it resulted from the neutralization of equal amounts of NaOH and HI?

   Molar heat of neutralization of NaOH= -200.0 kJ/mole

   Concentration of NaOH = 0.30 g/L (4 marks)

3. The *Café Entropy* makes cappuccino.
   Cappuccino is a mixture of coffee and milk.

   The *Café Entropy* has determined that the best temperature for cappuccino is 45.5°C.

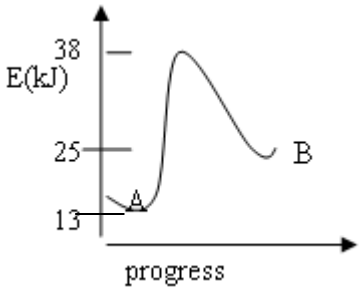
   The initial temperature of hot coffee without milk is 70.5°C.

   What volume of milk, at 4.0°C, must be added to 160.0 mL of hot coffee in order to obtain the desired temperature of 45.5°C?

   (**note:** Assume coffee and milk have the same density and specific heat capacity as water.)
   (4 marks)

4. a. Write a balanced equation for the combustion of cyclohexane, C_6H_{12}.
   b. Identify the fuel, the oxide(s), agent of combustion and include heat on the appropriate side of the equation.
   c. Draw a reaction profile for this reaction.

5. Cotton burns at 266 ^{o}C, no less. What is its kindling point?
6. a. Calculate the activation energy for the following reaction.



b. Suppose that the above reaction was reversible; in other words suppose it could start with product B and revert back to A. What would be the activation energy for the reverse reaction?

7. The minimum energy with which particles must collide in order for the collision to be effective is known as the _____energy.

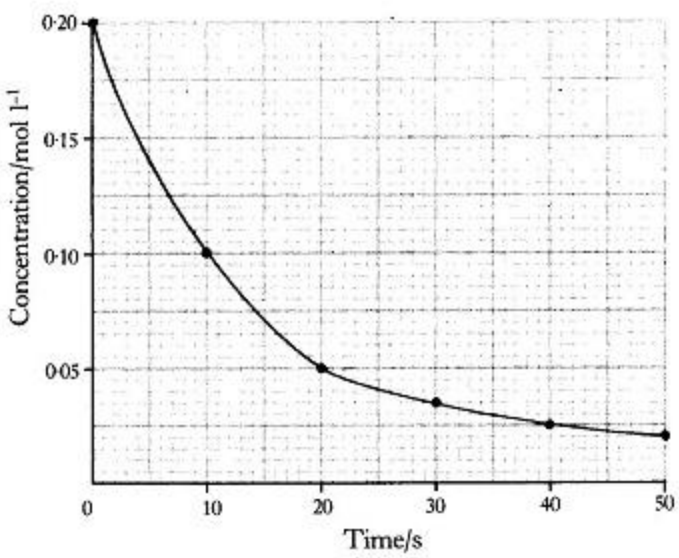
8. When oil that was to be used to cook French fries became too hot and ignited, a home-ec student removed the pan from the burner and sprayed the flames with an extinguisher. The fire was put out by eliminating two key ingredients of combustion. Name them.

9. Use the graph to answer the following questions:

a) During which 10 second interval is the reaction the slowest?
b) Why?
c) What is the average rate between 10.0 s and 20.0s?
d) If the concentrations represented the remaining mol/L of H_2 in the following reaction:

$H_{2(g)} + Br_{2(g)} \rightarrow 2\ HBr(g)$

At what rate is HBr being produced during the first 10.0 seconds?



ANSWERS

1.

Reactant = Mg	Env = water
1.00/24.3g/mole = 0.0411522…moles Mg $\Delta H = -Q = -32807.7\ \text{J}$ $\frac{\Delta H}{n} = \frac{-32807.7\ \text{J}}{0.0411522\ \ldots\ \text{moles Mg}}$ = -797 kJ/mole of Mg	$Q = mc\Delta T$ =1000.g(4.19J/(g°C)(17.83-10.00) = 32807.7 J

2.

Reactant = NaOH	Env = water
Since equal amounts of acid and base were used, volume of NaOH = 250.0 ml/2 = 125 ml = 0.125 L m = CV = 0.30 g/L(0.125 L) = 0.0375 g NaOH 0.0375 g NaOH/(40.0 g/mole)= 9.375 X10^{-4} moles ΔH = 9.375 X 10^{-4} moles*(-200.0 kJ/mole) = -0.1875 kJ	$-\Delta H = Q = +0.1875\ \text{kJ} = 187.5\ \text{J}$ We assume that solutions are aqueous and with density of 1.00g/ml $Q = mc\Delta T$ 187.5 J =250.0g(4.19J/(g°C)(ΔT) ΔT = 0.18 °C The reason the temp change is so small is because 0.30 g/L is a very dilute solution. In the lab we used 2.0g/0.100L = 20g/L, which is over 60 times stronger.

3.

$$-Q_{hot} = Q_{cold}$$

$$-(mc\Delta T)hot = (mc\Delta T)cold$$

$$-(160.0\ g(4.19)(45.5 - 70.5) = m(4.19)(45.5 - 4)$$

Notice that 4.19 cancels

$$4000 = 41.5m$$

m = 96 g of milk = 96 ml

4. a) $C_6H_{12} + 9\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ + heat

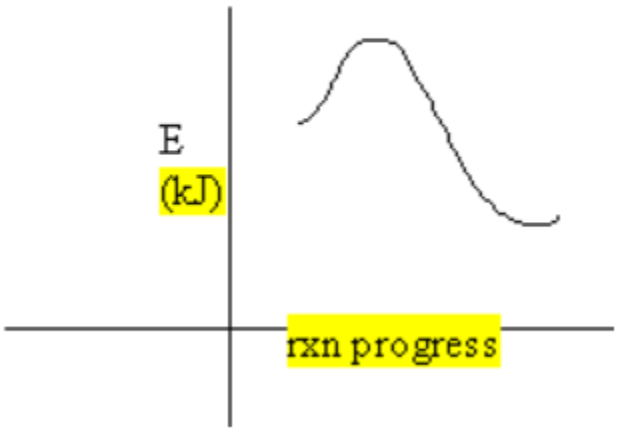
b) Fuel: C_6H_{12}

Agent of combustion: oxygen

Oxides or products of combustion: carbon dioxide and water

Heat: on the right hand side

c)



5. 266^{o}C

6. a.

38 – 13 = 25 kJ

b.

38 – 25 = 13 kJ

7. activation

8. Heat and oxygen

9.

a) between 40 s and 50s.

b) The concentration of reactants has decreased, making it less likely for a successful encounter between hydrogen and bromine.

c) $average\ rate\ = \frac{(0.05-0.10)}{20-10}\frac{mol/L}{s}$ = -0.005 $\frac{mol/L}{s}$

$d) average\ rate\ of\ H_2\ consumption$ during first 10 seconds=
$\frac{(0.10-0.20)}{10-0}\frac{mol/L}{s} = -0.010\frac{mol/L}{s} H_2 \left(\frac{2\ HBr}{-1 H_2}\right) = 0.020\frac{mol/L}{s} HBr$