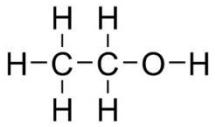
Dougherty Valley HS Chemistry - AP
Thermochemistry Study Materials
Quick Checks #1-4

S-7, 8, 9, 10

Name: **Period:** **Seat#:**

Directions: Try these problems. If you can DO them, check the box (☑).
If you CANNOT do them, write some notes TO YOURSELF about what you need to study to succeed at these problems.

S7 – Quick Check #1



Ethyl alcohol, molar mass = 46.08 g/mol
The heat of fusion of ethyl alcohol, ΔH_{fus}, is 4.98 kJ/mol.
The heat of vaporization of ethyl alcohol alcohol, ΔH_{vap}, is 39.40 kJ/mol.

☐ **Phase Change Equations**

Write an equation for alcohol vaporizing. Include the energy value.

☐ **Change on the Particulate Level**

If alcohol molecules looked like ⬭, draw a before and after picture of alcohol vaporizing.

Before (liquid) **After (gas)**

☐ **Calculations**

How much heat is needed to boil 10.0 grams of ethyl alcohol? (Show work as a single line equation.)

How much heat is released when 25.0 grams of liquid ethyl alcohol freezes?
(Show work as a single line equation.)

Struggled? Got some wrong? Do some self-study!

S8 – Quick Check #2

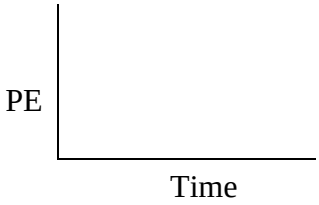
☐ **Exothermic & Endothermic**

When a solution of NaOH is neutralized by a solution of HCl, the solution gets very hot.

Is the water in the solution the ***system*** or the ***surroundings***? _____

Add "heat" to this molecular equation: $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

Draw the Potential Energy curve for this reaction.



☐ **Calorimetry**

How much energy does it take to heat 150. grams of aluminum metal from 25 °C to 150. °C? The specific heat of aluminum is 0.900 J/g·°C. (Show your work!)

If 375 J of energy is added to 25.0 mL of water at 20.0 °C, what is the final temperature of the water? The specific heat of water is 4.18 J/g·°C. (Show your work!)

S9 – Quick Check #3

The specific heat of water is 4.18 J/g·°C. ***The molar mass of C_3H_8 = 44.09 g/mol.***

☐ **Calculating Enthalpy (ΔH) from Data:**

A 3.00 gram sample of propane, C_3H_8, is burned and warms 100. g of water from 20.0°C to 100.0°C.

What is the ΔH of combustion for C_3H_8? _____ What is the sign of the ΔH? ____

☐ **Heating Curves**

Consider the following heating curve of ice at -30 °C to steam at 130 °C.

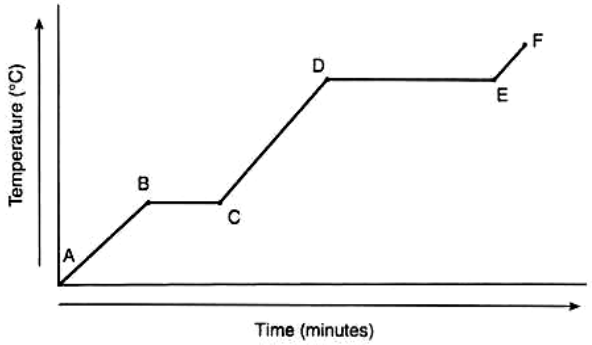
a) Label the graph with "solid", "liquid", and "gas"

b) In which segment is ***boiling of the water*** occurring? ____

c) Where on this curve would you use the formula, $q = mC\Delta T$? _____

d) Describe what is happening to the H_2O as you move from point B to point D.

_____



e) ΔH_{fus} would be used as the H_2O goes from Point _____ to Point _____

S10 – Quick Check #4

1 – EXOTHERMIC AND ENDOTHERMIC

Classify each statement as talking about an [EXO]thermic or [ENDO]thermic reaction:

_____	surroundings get hot	_____	ΔH is negative
_____	PE diagram is uphill	_____	PE diagram is downhill
_____	energy is a product	_____	surroundings get cold
_____	ΔH is positive	_____	products have more energy
_____	reactants have more energy	_____	energy is a reactant

2 – HEAT CALCULATIONS

A 45.0 mL sample of water is heated from 15.0°C to 35.0°C. How many joules of energy have been absorbed by the water? (Show work)	If 5430 J of energy is used to heat 1.25 L of room temperature water (23.0°C), what is the final temperature of the water?

3 – HOT AND COLD OBJECTS

A 100. gram sample of aluminum (specific heat = 0.900 $J \cdot g^{-1} \cdot °C^{-1}$) in boiling water is added to an insulated cup containing 50.0 grams of water at 5.00°C. What will the final temperature of the mixture be? The specific heat of water is 4.184 $J \cdot g^{-1} \cdot °C^{-1}$.

4 – HEATS OF FUSION & VAPORIZATION

Knowing that the ΔH_{fus} for water is 6.02 $kJ \cdot mol^{-1}$, calculate the following:

How much energy (in kJ) is absorbed by 45.0 g of ice as it melts?

What mass of ice can be melted with 75.0 kJ of energy?

5 – ΔH FROM DATA

When 10.0 grams of C_5H_{12} is burned, 453 kJ of energy is released.

What is the $\Delta H_{combustion}$ for C_5H_{12}?

When 10.0 grams of aluminum melts, 3.929 kJ of energy is required. What is the ΔH_{fus} of Al?

Iron ore can be converted to iron metal with CO gas.

$FeO(s) + CO(g) \rightarrow Fe(s) + CO_2(g)$

Calculate the standard enthalpy change for this reaction from these reactions of iron oxides with CO :

(1) $3\,Fe_2O_3(s) + CO(g) \rightarrow 2\,Fe_3O_4(s) + CO_2(g)$ $\quad \Delta H° = -47\ kJ$

(2) $Fe_2O_3(s) + 3\,CO(g) \rightarrow 2\,Fe(s) + 3\,CO_2(g)$ $\quad \Delta H° = -25\ kJ$

(3) $Fe_3O_4(s) + CO(g) \rightarrow 3\,FeO(s) + CO_2(g)$ $\quad \Delta H° = 19\ kJ$

7 – HESS'S LAW – SHORTCUT

chemical	$CO_2(g)$	$H_2O(l)$	$C_5H_{12}(l)$	$C_2H_5OH(l)$
$\mathbf{\Delta H_f}$	$-393.5\ kJ\cdot mol^{-1}$	$-285.8\ kJ\cdot mol^{-1}$	$-173.1\ kJ\cdot mol^{-1}$	$-277.6\ kJ\cdot mol^{-1}$

Given the above $\Delta H_f°$'s, calculate the $\Delta H_{combustion}$ of pentane, C_5H_{12}.

Calculate the $\Delta H_{combustion}$ of ethyl alcohol, $C_2H_5OH(l)$

8 – MORE HESS'S LAW

chemical	$CO_2(g)$	$H_2O(l)$	$C_8H_{18}(l)$
$\mathbf{\Delta H_f}$	$-393.5\ kJ\cdot mol^{-1}$	$-285.8\ kJ\cdot mol^{-1}$	??? $kJ\cdot mol^{-1}$

Knowing that the $\Delta H_{combusion}$ of octane, C_8H_{18}, is $-5508.9\ kJ\cdot mol^{-1}$ calculate the ΔH_f of octane.