Thermochemistry Quiz 1

1) Write down the following statement:

I am good at chemistry and chemistry is my thing.

**Heat Capacity and Calorimetry**

1) What is the heat capacity of water?
2) On a summer day, it takes a long time for a pool to heat up whereas a piece of metal or concrete will heat up quickly. What accounts for the difference in time it takes to change the temperature of these materials?
3) Consider the states of methanol, liquid at room temperature, and silver solid at room temperature. Equal amounts of each compound absorb equal amounts of thermal energy, which substance will end up with the **lowest** temperature?

   Under the same conditions, will water or silver have a higher final temperature?

4) An Initial 25 gram sample of gold is at 27ºC. What is the final temperature of the gold after absorbing 2.35 kJ of heat? Heat capacity of gold is 0.128 J/gC

5) How much heat is required to warm 1.50 L of water from 25 ºC to 100 ºC?

6) If 212.2 J will raise the temperature of a 10.9 g of metal Jamesonium from 25ºC to 60ºC, then what is the heat capacity of Jamesonium?

7) James is walking back to his dorm from EBGBS after buying 650 ml of coffee and 170 ice cream. He places the Ice cream on top of the hot coffee and lets it sit until a final temperature has been reached.

   A) Assuming there was no heat lost to surroundings, what would the final temperature be? Assume density=1g/ml

Initial temperature of coffee: 55 degrees C — Specific heat of coffee: 1.4J/g*C

Initial temperature of ice cream: -18 degrees C — Specific heat of Ice cream: 3.1 J/g*C

   B) How much energy must be removed to create one gram of this ice cream by dropping the temperature of 25ºC to -5ºC?

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8) James decides to put ice cubes into his new water heater to let it cool quicker and make some tea. He adds 14 grams of ice into 650 grams of boiling water. The initial temperature of the ice is 0 ºC and the water is 111 ºC. What is the final temperature?

**Conceptual**

What are the differences between ΔH endothermic and exothermic process?

Which is not a state function? Heat, temperature, entropy, enthalpy, volume, work, internal energy

Identify as either endothermic (ENDO) or exothermic (EXO):

| | | | |
|---|---|---|---|
| Melting gold | boiling water | copper cooling down | crushing a pill |
| evaporation | Lighting a match | iron rusting | energy being released |
| cold packs | Water freezing | heat transferred from surrounding to system | |
| heat transferred from system to surroundings | a container feels cold | a container feels hot | |

**Stoichiometry in Thermochemistry**

1) Calculate the heat required to complete the reaction of 155g of $NH_3$

$$4\ NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)} \quad \Delta H_{rxn} = -906\ kJ$$

2) What mass of butane in grams is necessary to produce $1.5 \times 10^3$ kJ of heat? What mass of $CO_2$ is produced?

$$C_4H_{10(g)} + 13/2\ O_{2(g)} \rightarrow 4CO_2 + 5H_2O_{(g)} \quad \Delta H_{rxn} = -2658\ kJ$$

3) According to the reaction

$$4Al + 3MnO_2 \rightarrow 2Al_2O_3 + 3Mn \quad \Delta H_{rxn} = -1789\ kJ/mol\ rxn$$

a) Determine the energy released if 266 g of $P_4$ are used.
b) What mass of Mn forms when 1000 kJ is detected?