

## HW08 - Enthalpy & Fossil Fuels

You might need to grab some data from [here](#) for the bond energy problems.

1 8 points

A 1.00 g sample of n-hexane ( $C_6H_{14}$ ) undergoes complete combustion with excess  $O_2$  in a bomb calorimeter. The temperature of the 1815 g of water surrounding the bomb rises from  $26.15^\circ C$  to  $29.97^\circ C$ . The heat capacity of the hardware component of the calorimeter (everything that is not water) is  $5068 J/^\circ C$ . What is the *change in energy* for the combustion of n- $C_6H_{14}$ ? One mole of n- $C_6H_{14}$  is 86.1 g. The specific heat of water is  $4.184 J/g^\circ C$ .

- $-4.16 \times 10^3 kJ/mol$
- $-4.40 \times 10^3 kJ/mol$
- $-5.25 \times 10^3 kJ/mol$
- $-6.33 \times 10^4 kJ/mol$

2 6 points

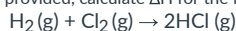
Calculate the change in enthalpy of the following reaction in kJ/mol using bond energy data:



Type your answer...

3 6 points

Using the bond energy data provided, calculate  $\Delta H$  for the following reaction:

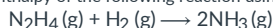


| Bond  | Bond Energy (kJ/mol) |
|-------|----------------------|
| H-H   | 436                  |
| Cl-Cl | 242                  |
| H-Cl  | 432                  |

- 246 kJ/mol
- 186 kJ/mol
- 186 kJ/mol
- 246 kJ/mol

4 6 points

Estimate the change in enthalpy of the following reaction using bond energy data:



- 850 kJ/mol
- 1469 kJ/mol
- 183 kJ/mol
- 1241 kJ/mol

5 6 points

What is the value of heat flow for the combustion of hydrogen in kJ/g?  $\Delta H^\circ$  for this process is  $-286 kJ/mol$ .

- 572 kJ/g
- 572 kJ/g
- 286 kJ/g
- 71.5 kJ/g
- 143 kJ/g

6 6 points

Which of the following is the most efficient fuel based on its combustion enthalpy per gram?

- hydrogen
- wood
- octane
- methane
- coal

7 6 points

What is the more efficient method to break a high molar mass fraction from a crude oil refinery down to a specific fuel?

- fractional distillation
- reforming
- catalytic cracking
- thermal cracking

8 6 points

An octane isomer can be made into a more efficient fuel by adding branching through the process of...

- thermal cracking
- fractional distillation
- catalytic reforming
- catalytic cracking

9 6 points

If you want to calculate the heat flow involving a temperature change, which equation will you use?

- $q = mC_s\Delta T$
- $q = mC$
- $\Sigma n \text{ bonds breaking} - \Sigma n \text{ bonds forming}$
- $q = 2(m - C_s\Delta T)$
- $q = m\Delta H$

10 6 points

If you want to calculate the heat flow involving a phase change, which equation will you use?

- $q = 2(m - C_s\Delta T)$
- $q = mC_s\Delta T$
- $\Sigma n \text{ bonds breaking} - \Sigma n \text{ bonds forming}$
- $q = m\Delta H_{trans}$
- $q = mC$

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11 8 points

Designate the sign of the heat flow (+ or -) for each of the following physical changes: Vaporization:

type your answer...

Fusion:

type your answer...

Freezing:

type your answer...

Sublimation:

type your answer...

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12 6 points

(Part 1 of 4) Draw the heating curve for the process of heating 14.0 g pure ice from  $-18.0^{\circ}\text{C}$  to  $84^{\circ}\text{C}$  and use it to answer the next four questions.

What is the heat required to heat the ice to  $0^{\circ}\text{C}$ ? **Answer in joules to the nearest whole number.**

Type your answer...

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13 6 points

(Part 2 of 4) What is the heat required to fully melt the ice at  $0^{\circ}\text{C}$ ? **Answer in joules to the nearest whole number.**

Type your answer...

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14 6 points

(Part 3 of 4) What is the heat required to heat the water from  $0^{\circ}\text{C}$  to  $84^{\circ}\text{C}$ ? **Answer in joules to the nearest whole number.**

Type your answer...

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15 6 points

(Part 4 of 4) What is the total heat applied during this process? **Answer in kilojoules (!) to three significant figures.**

Type your answer...

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16 6 points

The specific heat for liquid argon and gaseous argon is  $25.0\text{ J/mol}\cdot^{\circ}\text{C}$  and  $20.8\text{ J/mol}\cdot^{\circ}\text{C}$ , respectively. The enthalpy of vaporization of argon is  $6506\text{ J/mol}$ . How much energy is required to convert 1 mole of liquid Ar from  $5^{\circ}\text{C}$  below its boiling point to 1 mole of gaseous Ar at  $5^{\circ}\text{C}$  above its boiling point?

- 6631 J
- 125 J
- 229 J
- 6735 J
- 6610 J