

HW08 - Enthalpy & Fossil Fuels

You might need to grab some data from [here](#) for the bond energy problems. Stuck on bomb calorimeters? Here's a video: [Thermodynamics - Calorimetry Pt II - Bomb Calorimeter Example](#)

Still feel like you aren't fully there with the conceptual part of calorimetry? Here's a video: [Thermodynamics - Calorimetry - Part I](#)

1 6 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°C to 29.97°C. The heat capacity of the hardware component of the calorimeter (everything that is not water) is 5068 J/°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°C.

- 6.33 x 10⁴ kJ/mol
- 4.40 x 10³ kJ/mol
- 4.16 x 10³ kJ/mol
- 5.25 x 10³ kJ/mol

2 5 points

Fill in the blanks to receive credit for each part of this question.

An unknown fuel distilled in a refinery (molar mass 64.0 g/mol) is combusted in a bomb calorimeter holding 991 mL water. When 0.182 grams of the fuel source is combusted in the bomb calorimeter, the temperature of the surroundings raises from 25.0 °C to 27.2 °C. The heat capacity for the hardware component is 2.260 kJ/ °C. The heat capacity of water is 4.184 J/ g °C.

In a bomb calorimeter, the thermometer is in the .

The combustion of the fuel that we are measuring here is

. The enthalpy of this reaction is equal to

kJ. The enthalpy per gram of this reaction is about

kJ/g. The enthalpy per mole of this reaction is closest to

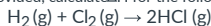
kJ/mol.

3 6 points

Calculate the change in enthalpy of the following reaction in kJ/mol using bond energy data:
 $ClF + CO \rightarrow COClF$

4 6 points

Using the bond energy data provided, calculate ΔH for the following reaction:

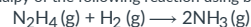


Bond	Bond Energy (kJ/mol)
H-H	436
Cl-Cl	242
H-Cl	432

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

5 6 points

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



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

6 6 points

What is the value of heat flow for the combustion of hydrogen in kJ/g? ΔH° for this process is -286 kJ/mol.

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

7 6 points

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

- wood
- octane
- methane
- hydrogen
- coal

8 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?

- reforming
- fractional distillation
- thermal cracking
- catalytic cracking

9 6 points

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

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

10 4 points

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

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

11 4 points

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

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

12 4 points

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

Vaporization:

Fusion:

Freezing:

Sublimation:

13 5 points

What is the heat required to completely melt a 11.33 g sample of silicon (Si, molar mass = 28.09 g/mol) solid that is already at its melting point? $\Delta H_{fus} = 50.2 \text{ kJ/mol}$. Answer in units of kJ and round to one decimal place.

14 6 points

(Part 1 of 4) Draw the heating curve for the process of heating 14.0 g pure ice from -18.0°C to 84°C and use it to answer the next four questions.

What is the heat required to heat the ice to 0°C ? **Answer in joules to the nearest whole number.**

15 6 points

(Part 2 of 4) What is the heat required to fully melt the ice at 0°C ? **Answer in joules to the nearest whole number.**

16 6 points

(Part 3 of 4) What is the heat required to heat the water from 0°C to 84°C ? **Answer in joules to the nearest whole number.**

17 6 points

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

18 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 J/mol . How much energy is required to convert 1 mole of liquid Ar from 5°C below its boiling point to 1 mole of gaseous Ar at 5°C above its boiling point?

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