HW08

Question 1

1 pts

In a few strange studies, the specific heat capacity of a bed bug was measured to be around 3.18 J/g °C. An average bed bug has a mass equal to 3 mg. Suppose you round up all the bed bugs in UTC. (let's call it 15,000 bed bugs) into a small room and apply heat to terminate the bed bugs. How much energy would it take to raise the average temperature of the bed bugs from 25 °C to 46 °C?

Answer in units of kJ to only two significant figures.

Question 2

1 pts

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 10^4 kJ/mol
- -4.40 x 10^3 kJ/mol
- -4.16 x 10^3 kJ/mol
- -5.25 x 10^3 kJ/mol

Question 3

1 pts

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

$$ClF + CO \longrightarrow COClF$$

Question 4

1 pts

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

$$H_2\,(g) + Cl_2\,(g) \rightarrow 2HCl\,(g)$$

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

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

Question 5

1 pts

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

$$N_2H_4\,(g) + H_2\,(g) \longrightarrow 2NH_3\,(g)$$

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

Question 6

1 pts

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

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

Question 7

1 pts

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

- octane
- hydrogen
- wood
- methane
- coal

Question 8

1 pts

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

- catalytic cracking
- thermal cracking
- fractional distillation
- reforming

Question 9

1 pts

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

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

Question 10

1 pts

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

- Σn bonds breaking - Σn bonds forming
- q = mΔH
- q = mC$_p\Delta$T
- q = mC
- q = 2(m - C$_p\Delta$T)

Question 11

1 pts

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

- q = mC$_p\Delta$T
- Σn bonds breaking - Σn bonds forming
- q = 2(m - C$_p\Delta$T)
- q = mC
- q = mΔH$_{trans}$

Question 12

1 pts

If you want to calculate the heat flow involving bond energy data, which equation should you use?

- q = mΔH$_{trans}$
- q = mC
- q = 2(m - C$_p\Delta$T)
- q = mC$_p\Delta$T
- Σn bonds breaking - Σn bonds forming

Question 13

1 pts

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

Vaporization:

Fusion:

Freezing:

Sublimation:

Question 14

1 pts

(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.**

Question 15

1 pts

(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.**

Question 16

1 pts

(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.**

Question 17

1 pts

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

Question 18

1 pts

The specific heat for liquid argon and gaseous argon is 25.0 J/mol·°C and 20.8 J/mol·°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?

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