

Full Name:

February 22,  
2023

**0.1** A 10 grams sample of fructose (MW=180g/mol) is burned in a constant-volume calorimeter containing 50g of water. The temperature inside the calorimeter increases  $7^{\circ}\text{C}$ . The calorimeter constant is  $10.8 \frac{\text{kJ}}{^{\circ}\text{C}}$ . Calculate the molar heat of the reaction.

**0.2** A 3 moles sample of C(s) is burned in a constant-volume calorimeter containing 40g of water. The temperature inside the calorimeter increases from  $25.0^{\circ}\text{C}$  to  $25.89^{\circ}\text{C}$ . The calorimeter constant is  $9.90 \frac{\text{kJ}}{^{\circ}\text{C}}$ . Calculate the molar heat of the reaction.

**0.3** We mix 50mL of 2M HCl with 100mL of 1.5M NaOH in a coffee-cup calorimeter. Both solutions are initially at  $20^{\circ}\text{C}$ . Calculate the final temperature of the solution in the calorimeter considering that the specific heat of the mixture is  $4.184 \frac{\text{J}}{\text{g}^{\circ}\text{C}}$  and the density of the solution is 1g/mL. The molar heat of the reaction is -56kJ/mol.

**0.4** When a 0.09-g sample of trinitrotoluene (TNT, MW=213g/mol), is burned in a bomb calorimeter, the temperature increases from  $23.5^{\circ}\text{C}$  to  $27.1^{\circ}\text{C}$ . The heat capacity of the calorimeter is  $400 \frac{\text{J}}{^{\circ}\text{C}}$ , and it contains 100 mL of water. Calculate the molar heat of the reaction. Remember that the density of water is 1g/mL.

**0.5**

**0.6** We mix 50mL of 2M HCl with 50mL of 2M NaOH in a coffee-cup calorimeter. Both solutions are initially at  $40^{\circ}\text{C}$ . Calculate the final temperature of the solution in the calorimeter considering that the specific heat of the mixture is  $4.184 \frac{\text{J}}{\text{g}^{\circ}\text{C}}$  and the density of the solution is 1g/mL. The molar heat of the reaction is -100kJ/mol.

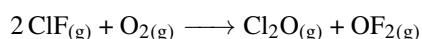
**0.7** A diet has a total caloric intake of 1400 kcal. The diet consists of 50.% carbohydrate, 35% protein, and 15% fat. The number of kcal of protein in the diet is

**0.8** A potato contains 20 g of carbohydrate. If carbohydrate has a caloric value of  $4 \text{ kcal/g}$ , how many kcal are obtained from the carbohydrate in the potato?

**0.9** One large egg contains 6 g of protein and 6 g of fat. If protein has a caloric value of  $4.0 \text{ kcal/g}$  and fat has  $9 \text{ kcal/g}$ , how many kcal are in the egg?

**0.10** A serving of fish contains 50 g of protein and 4 g of fat. If protein has a caloric value of  $4.0 \text{ kcal/g}$  and fat has  $9 \text{ kcal/g}$ , how many kcal are in the serving?

**0.11** Calculate the enthalpy of reaction for:



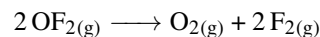
given:

$$\Delta H_f^\circ(\text{ClF}_{(\text{g})}) = -56 \text{ KJ}$$

$$\Delta H_f^\circ(\text{Cl}_2\text{O}_{(\text{g})}) = 88 \text{ KJ}$$

$$\Delta H_f^\circ(\text{OF}_{2(\text{g})}) = 25 \text{ KJ}$$

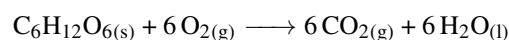
**0.12** Calculate the enthalpy of reaction for:



given:

$$\Delta H_f^\circ(\text{OF}_{2(\text{g})}) = 24.5 \text{ KJ}$$

**0.13** Calculate the enthalpy of reaction for:



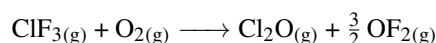
given:

$$\Delta H_f^\circ(\text{CO}_{2(\text{g})}) = -393.5 \text{ KJ}$$

$$\Delta H_f^\circ(\text{H}_2\text{O}_{(\text{l})}) = -285.8 \text{ KJ}$$

$$\Delta H_f^\circ(\text{C}_6\text{H}_{12}\text{O}_{6(\text{s})}) = -1273.3 \text{ KJ}$$

**0.14** Calculate the enthalpy of reaction for:



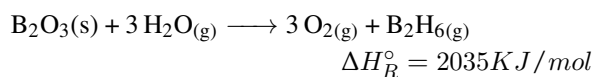
given:

$$\Delta H_f^\circ(\text{ClF}_{3(\text{g})}) = -156 \text{ KJ}$$

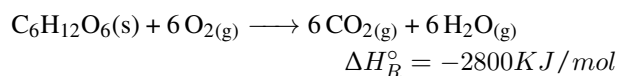
$$\Delta H_f^\circ(\text{Cl}_2\text{O}_{(\text{g})}) = 88 \text{ KJ}$$

$$\Delta H_f^\circ(\text{OF}_{2(\text{g})}) = 25 \text{ KJ}$$

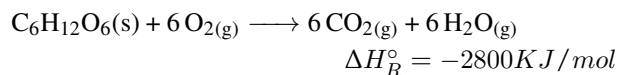
**0.15** Identify the following reaction as endothermic or exothermic.



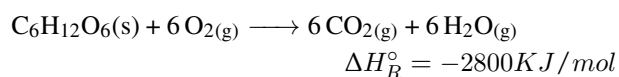
**0.16** Identify the following reaction as endothermic or exothermic.



**0.17** In the following combustion reaction:



**0.18** For the following reaction:



Fill the conversion factor:

$$\frac{\text{moles of O}_2}{-2800 \text{ KJ}}$$

**0.19** The same amount of heat is provided to a sample of two different metals, metal A ( $c_e(A) = 0.5 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ ) and metal B ( $c_e(B) = 0.4 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ ). Both samples have the same mass and are at the same temperature. Which metal A or B would reach a higher temperature?

**0.20** The same amount of heat is provided to a sample of two different metals, metal A ( $c_e(A) = 0.3 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ ) and metal B ( $c_e(B) = 0.4 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ ). Both samples have the same mass and are at the same temperature. Which metal A or B would reach a higher temperature?

**0.21** Two samples, A and B, have the same mass and are at the same temperature. If they are equally heated the final temperature of B is two times the one for A. Compare the specific heats of the samples.

**0.22** Two samples, A and B, have the same mass and are at the same temperature. If they are equally heated the final temperature of A is three times the one for B. Compare the specific heats of the samples.

**0.23** A 200g piece of iron ( $c_e = 0.1 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ ) initially at  $15^\circ\text{C}$  absorbs 1000cal. Calculate the final temperature of the metal piece.

**0.24** A 50g piece of aluminum ( $c_e = 0.214 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ ) initially at  $25^\circ\text{C}$  absorbs 100cal. Calculate the final temperature of the aluminum piece.

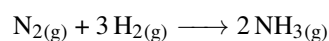
**0.25** What is the final temperature of a 35 g sample of iron at  $25^\circ\text{C}$  after receiving 50cal? Iron has a specific heat of  $0.108 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ .

**0.26** How many calories are required to raise the temperature of a 35 g sample of iron from  $25^\circ\text{C}$  to  $35^\circ\text{C}$ ? Iron has a specific heat of  $0.108 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ .

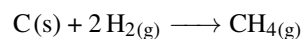
**0.27** What is the specific heat of a metal if a 100 g sample at  $25^\circ\text{C}$  warms up until  $50^\circ\text{C}$  after receiving 100cal?

**0.28** What is the initial temperature of a 50 g sample of aluminum that after receiving 50cal reaches a temperature of  $50^\circ\text{C}$ ? Al has a specific heat of  $0.2 \frac{\text{cal}}{\text{g}^\circ\text{C}}$ .

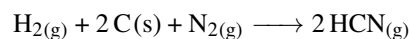
**0.29** Using the following reactions:



$$\Delta H_1 = -92 \text{KJ}$$



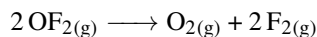
$$\Delta H_2 = -75 \text{KJ}$$



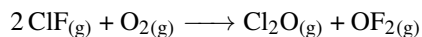
$$\Delta H_3 = 270 \text{KJ}$$

Determine the enthalpy change for:

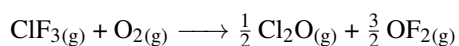
**0.30** Using the following reactions:



$$\Delta H_1 = -49 \text{ KJ}$$



$$\Delta H_2 = 225 \text{ KJ}$$

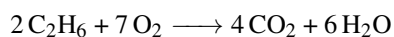


$$\Delta H_3 = 324 \text{ KJ}$$

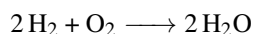
Determine the enthalpy change for:

**0.33** Carry the following conversions: (a)  $20^\circ\text{C}$  to  $^\circ\text{F}$  (b)  $300\text{K}$  to  $^\circ\text{C}$  (c)  $41^\circ\text{F}$  to  $^\circ\text{C}$

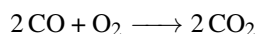
**0.31** Using the following reactions:



$$\Delta H_1 = -3120 \text{ KJ}$$



$$\Delta H_2 = -479 \text{ KJ}$$



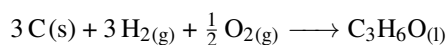
$$\Delta H_3 = -566 \text{ KJ}$$

Determine the enthalpy change for:

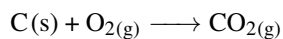
**0.34** Carry the following conversions: (a)  $100^\circ\text{C}$  to  $\text{K}$  (b)  $200^\circ\text{F}$  to  $\text{K}$  (c)  $500\text{K}$  to  $^\circ\text{F}$

**0.35** Discuss the changes in potential and kinetic energy in the following scenarios: (a) When water falls down a waterfall (b) When a person throughs away an object high up in the air

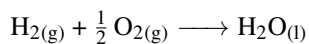
**0.32** Using the following reactions:



$$\Delta H_1 = -285 \text{ KJ}$$



$$\Delta H_2 = -394 \text{ KJ}$$



$$\Delta H_3 = -286 \text{ KJ}$$

Determine the enthalpy change for:

**0.36** Answer the following questions: (a) What is the name of the energy associated with the motion of particles in a substance? (b) What is the name of the energy stored in heigh?



**Answers** v. 20 **0.1** -1387KJ/mol **0.2** -3KJ/mol **0.3** 29°C **0.4** -6973KJ/mol **0.5** **0.6** 64°C **0.7** 490 kcal.  
**0.8** 80 cal **0.9** 78 cal **0.10** 236 cal **0.11** 225KJ **0.12** -49KJ **0.13** -2802.5KJ **0.14** 281KJ **0.15** endothermic  
**0.16** exothermic **0.17** 8400KJ **0.18** 6 **0.19** B **0.20** A **0.21**  $2 \times c_e(B)=c_e(A)$  **0.22**  $3 \times c_e(A)=c_e(B)$   
**0.23**  $T_{Final} = 65^\circ\text{C}$  **0.24**  $34.34^\circ\text{C}$  **0.25**  $38^\circ\text{C}$  **0.26** 38 cal **0.27**  $0.04\text{cal/g}^\circ\text{C}$  **0.28**  $45^\circ\text{C}$  **0.29** 256KJ **0.30** -  
187KJ **0.31** -276KJ **0.32** -1755KJ **0.33** (a)  $68^\circ\text{F}$  (b)  $27^\circ\text{C}$  (c)  $5^\circ\text{C}$  **0.34** (a) 373K (b) 366K (c)  $441^\circ\text{F}$  **0.35** (a) po-  
tential energy converts into kinetic while water falls down (b) kinetic energy converts into potential energy **0.36** (a) kinetic  
energy (b) potential energy

