

Tro Chapter 6

1. Which one of the following is a unit of energy?
 - A) pascal
 - B) newton
 - C) joule
 - D) watt
 - E) ampere

2. Chemical energy is
 - A) the kinetic energy resulting from violent decomposition of energetic chemicals
 - B) the heat energy associated with combustion reactions
 - C) the electrical energy produced by fuel cells
 - D) the potential energy which resides in chemical bonds
 - E) the energy living plants receive from solar radiation

3. How much kinetic energy (KE) does an object with a mass of 900 g traveling in a straight line with a speed of 40 m s⁻¹ possess?
 - A) 0.72 kJ
 - B) 1.44 kJ
 - C) 2.88 kJ
 - D) 16.2 kJ
 - E) 18 kJ

4. A chemical reaction has just occurred in an insulated isolated system which caused an overall increase in the potential energy of the system. Which statement below is true?
 - A) Heat was taken in from the surroundings by the system.
 - B) Heat was given off to the surroundings by the system.
 - C) The temperature of the system increased.
 - D) The temperature of the system decreased.
 - E) The total energy of the system increased.

5. A 350.0 gram sample of copper is initially at 25.0 °C. It absorbs 12.50 kJ of heat from its surroundings. What is its final temperature, to the nearest tenth of a degree?
(specific heat = 0.3874 J g⁻¹ °C⁻¹ for copper)
 - A) 38.8 °C
 - B) 67.2 °C
 - C) 92.2 °C
 - D) 117.2 °C
 - E) 156.7 °C

6. A calorimeter consists of metal parts with a heat capacity of $925.0 \text{ J } ^\circ\text{C}^{-1}$ and 1100 grams of oil with a specific heat of $2.814 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$. What is the heat capacity, in joules per degree, of the *entire* assembly?
- A) $1321 \text{ J } ^\circ\text{C}^{-1}$
 - B) $2028 \text{ J } ^\circ\text{C}^{-1}$
 - C) $3703 \text{ J } ^\circ\text{C}^{-1}$
 - D) $4020 \text{ J } ^\circ\text{C}^{-1}$
 - E) $5698 \text{ J } ^\circ\text{C}^{-1}$
7. A coffee cup calorimeter contains 480.0 grams of water at $25.00 \text{ } ^\circ\text{C}$. To it are added:
380.0 grams of water at $53.5 \text{ } ^\circ\text{C}$
525.0 grams of water at $65.5 \text{ } ^\circ\text{C}$
Assuming the heat absorbed by the styrofoam is negligible, calculate the expected final temperature. The specific heat of water is $4.184 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$.
- A) $38.2 \text{ } ^\circ\text{C}$
 - B) $48.2 \text{ } ^\circ\text{C}$
 - C) $67.6 \text{ } ^\circ\text{C}$
 - D) $88.7 \text{ } ^\circ\text{C}$
 - E) $94.4 \text{ } ^\circ\text{C}$
8. A calorimeter has metal parts (heat capacity of $925.0 \text{ J } ^\circ\text{C}^{-1}$) and 1100 grams of oil (specific heat = $2.824 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$), both at $25.40 \text{ } ^\circ\text{C}$. Adding a 550 g slug, at $220.0 \text{ } ^\circ\text{C}$ caused the temperature to rise to $35.2 \text{ } ^\circ\text{C}$. Find the specific heat of the metal!
- A) $0.365 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$
 - B) $0.389 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$
 - C) $0.395 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$
 - D) $0.551 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$
 - E) $1.20 \text{ J g}^{-1} \text{ } ^\circ\text{C}^{-1}$
9. An exothermic chemical reaction has just occurred in an insulated isolated system. Which statement below is true?
- A) Heat was taken in from the surroundings by the system.
 - B) Heat was given off to the surroundings by the system.
 - C) The potential energy of the system increased.
 - D) The potential energy of the system decreased.
 - E) The total energy of the system increased.

10. Given the reaction, $4B + 3A \rightarrow 4C + 7D$, and some standard enthalpies of formation, ΔH_f° :
- A: $+15.7 \text{ kJ mol}^{-1}$ B: $-86.4 \text{ kJ mol}^{-1}$ C: $-52.7 \text{ kJ mol}^{-1}$ D: $-71.6 \text{ kJ mol}^{-1}$
- What is the standard enthalpy of reaction, in kJ for the reaction shown?
- A) -53.6 kJ
B) -413.5 kJ
C) -515.6 kJ
D) -853.6 kJ
E) -908.4 kJ
11. The thermochemical equation which is associated with ΔH_f° , the standard enthalpy of formation, for glucose, $\text{C}_6\text{H}_{12}\text{O}_6(s)$, is
- A) $6 \text{ C}(s) + 6 \text{ H}_2\text{O}(l) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(s)$
B) $6 \text{ C}(s) + 12 \text{ H}(g) + 6 \text{ O}(g) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(s)$
C) $6 \text{ C}(s) + 6 \text{ H}_2(g) + 3 \text{ O}_2(g) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(s)$
D) $2 \text{ C}_2\text{H}_5\text{OH}(l) + 2 \text{ CO}_2(g) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(s)$
E) $6 \text{ C}(g) + 6 \text{ H}_2(g) + 3 \text{ O}_2(g) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(s)$
12. The standard enthalpy of combustion for xylene, $\text{C}_8\text{H}_{10}(l)$, is $-3908 \text{ kJ mol}^{-1}$. Using this data and the standard enthalpies of formation, ΔH_f° : $\text{H}_2\text{O}(l) = -285.9 \text{ kJ mol}^{-1}$; $\text{CO}_2(g) = -393.5 \text{ kJ mol}^{-1}$, calculate the standard enthalpy of formation of $\text{C}_8\text{H}_{10}(l)$, in kJ mol^{-1} .
- A) -669.5 kJ
B) $+3228.6 \text{ kJ}$
C) -3228.6 kJ
D) $+4587.4 \text{ kJ}$
E) $+8485.5 \text{ kJ}$

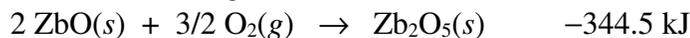
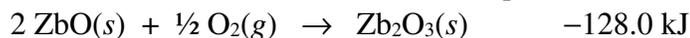
13. Complete combustion of hydrocarbons, or compounds with C,H, and O as the only elements, gives CO₂ and H₂O as the only products. If carried out under standard conditions, the CO₂ is a gas while the H₂O is a liquid. Given these standard enthalpies of **combustion**:



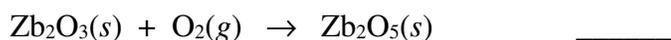
Calculate the standard enthalpy of reaction for the process, $\text{C}_2\text{H}_2(g) + \text{H}_2(g) \rightarrow \text{C}_2\text{H}_4(g)$

- A) -174.47 kJ
 B) +397.33 kJ
 C) -961.47 kJ
 D) -2424.83 kJ
 E) -2996.63 kJ
14. Given the thermochemical equation, $2 \text{M}_2\text{O}_5(s) \rightarrow 4 \text{MO}_2(s) + \text{O}_2(g)$ with a standard enthalpy of reaction = +74.2 kJ, calculate a value for the standard enthalpy of reaction in the thermochemical reaction, $2 \text{MO}_2(s) + \frac{1}{2} \text{O}_2(g) \rightarrow \text{M}_2\text{O}_5(s)$ _____

15. Use these reactions and standard enthalpies, ΔH°



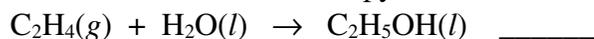
find the value for



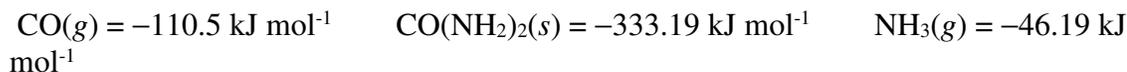
16. Using the standard enthalpies of formation, ΔH_f° :



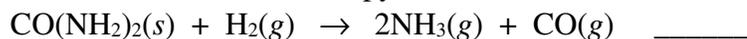
calculate the standard enthalpy of reaction for



17. Using the standard enthalpies of formation, ΔH_f° :



calculate the standard enthalpy of reaction for



18. 600.0 ml of 0.240 molar perchloric acid, $\text{HClO}_4(\text{aq})$ was added to a high quality insulated calorimeter containing 400.0 ml of 0.300 molar $\text{KOH}(\text{aq})$. Both solutions have a density of 1.000 g ml^{-1} and a specific heat of $4.184 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$. The calorimeter had a heat capacity of $950.0 \text{ J }^\circ\text{C}^{-1}$. The temperature of the *entire* system rose from $25.30 \text{ }^\circ\text{C}$ to $26.59 \text{ }^\circ\text{C}$. Calculate the heat of reaction, in kJ, per mole of $\text{NaOH}(\text{aq})$.

19. The standard enthalpy of combustion for oxalic acid, $\text{H}_2\text{C}_2\text{O}_4(\text{s})$, is $-251.9 \text{ kJ mol}^{-1}$. Using this data and the standard enthalpies of formation, ΔH_f° :



calculate the standard enthalpy of formation of $\text{H}_2\text{C}_2\text{O}_4(\text{s})$, in kJ mol^{-1} . _____

20. Using the standard enthalpies of formation, ΔH_f° :



calculate the standard enthalpy of reaction for



Answer Key

1. C
2. D
3. A
4. D
5. D
6. D
7. B
8. B
9. D
10. B
11. C
12. A
13. A
14. -37.1 kJ
15. -216.5 kJ
16. -44.0 kJ
17. 130.3 kJ
18. 55.2 kJ
19. -821.0 kJ
20. -41.7 kJ