WKS
Specific Heat & Energy

Name Answer Key
Period ______

Read Ch. 16.1 pp. 488-495 and answer the following questions/solve the following problems. Use **Table 16-2** on pg. 492 and Table B of your reference pack when needed.

1. Explain what is meant by energy and list two units in which energy is measured.
   Energy is the ability to do work or produce heat. Joules and calories are two common units of energy.

2. Distinguish between kinetic and potential energy in the following examples: two separated magnets; an avalanche of snow; books on library shelves; a mountain stream; a stock car race; separation of charge in a battery.
   Kinetic energy: avalanche, mountain stream (converting PE to KE), stock car race (converting chemical PE energy to KE); Potential energy: separated magnets, books, separation of charge (chemical PE)

3. If 200. grams of water is to be heated from 24.0°C to 100.0°C to make a cup of tea, how much heat must be added?
   $\Delta T = 100.0°C - 24.0°C = 76.0°C$
   $$q = mC\Delta T = (200.\ g)(4.184\ J/g \cdot °C)(76.0°C) = \boxed{63{,}600\ J}$$

4. What is the specific heat of a substance that absorbs 2.5×10^3 joules of heat when a sample of 1.0×10^2 g of the substance increases in temperature from 10.0°C to 70.0°C?
   $\Delta T = 70.0°C - 10.0°C = 60.0°C$
   $$q = mC\Delta T \Rightarrow C = \frac{q}{m\Delta T} = \frac{2.5\times10^3\ J}{(1.0\times10^2\ g)(60.0°C)} = \boxed{0.417\ J/g \cdot °C}$$

5. How many grams of water would require 2.20×10^4 joules of heat to raise its temperature from 34.0°C to 100.0°C?
   $\Delta T = 100.0°C - 34.0°C = 66.0°C$
   $$q = mC\Delta T \Rightarrow m = \frac{q}{C\Delta T} = \frac{2.20\times10^4\ J}{\left(4.184\frac{J}{g \cdot °C}\right)(66.0°C)} = \boxed{79.7\ g}$$

6. A 140. g block of aluminum is cooled from 98.4°C to 62.2°C with the release of 4580 joules of heat. From this data, calculate the specific heat of aluminum.

$\Delta T = 98.4°C - 62.2°C = 36.2°C$

$$q = mC\Delta T \Rightarrow C = \frac{q}{m\Delta T} = \frac{4580\text{ J}}{(140.\text{ g})(36.2°C)} = \boxed{0.904\text{ J/g}\cdot°C}$$

7. A 192.4 g cube of gold is cooled from 100.0°C with the release of 1770. joules of heat. The specific heat of gold is 0.129 J/g·°C. What was the final temperature of the gold?

$$q = mC\Delta T \Rightarrow \Delta T = \frac{q}{mC} = \frac{1770.\text{ J}}{(192.4\text{ g})\left(0.129\frac{\text{J}}{\text{g}\cdot°C}\right)} = 71.3°C$$

Since the sample is cooled, subtract ΔT : $T_{final} = 100.0°C - 71.3°C = \boxed{28.7°C}$

8. A total of 224.0 joules of heat are absorbed as 58.3 g of an unknown dull gray metal is heated from 12.0°C to 42.0°C. From these data, what is the specific heat of the metal? Use Table 16-2 to identify the metal.

$\Delta T = 42.0°C - 12.0°C = 30.0°C$

$$q = mC\Delta T \Rightarrow C = \frac{q}{m\Delta T} = \frac{224.0\text{ J}}{(58.3\text{ g})(30.0°C)} = \boxed{0.128\text{ J/g}\cdot°C}$$

According to Table 16-2, both gold and lead have C = 0.129 J/g·°C, but only lead is dull gray.

9. What is the total amount of heat needed to change 2.25 kg of silver at 0.0°C to 200.0°C? The specific heat of silver is 0.233 J/g·°C

$\Delta T = 200.0°C - 0.0°C = 200.0°C$

$$q = mC\Delta T = \left(2.25\text{ kg} \times \frac{1\times10^3\text{ g}}{1\text{ kg}}\right)(0.233\text{ J/g}\cdot°C)(200.0°C) = \boxed{105{,}000\text{ J (105 kJ)}}$$

10. A 55.0 kg block of granite has an original temperature of 15.0°C. Granite has a specific heat of 0.790 kJ/kg·°C (watch the units!). What will be the final temperature of this granite if 4.50×10^4 kJ of heat energy are added to the granite?

Since C is in units if kJ/kg·°C, and mass is given in kg and energy in kJ, no conversions are needed:

$$q = mC\Delta T \Rightarrow \Delta T = \frac{q}{mC} = \frac{4.50\times10^4\text{ kJ}}{(55.0\text{ kg})(0.790\text{ kJ/kg}\cdot°C)} = 1036°C$$

Since energy is added, add ΔT: $T_{final} = 15.0°C + 1036°C = \boxed{1050°C}$