Specific Heat and Heat Capacity Worksheet

DIRECTIONS: Use \( q = (m)(C_p)(\Delta T) \) to solve the following problems. Show all work and units.

Ex: How many joules of heat are needed to raise the temperature of 10.0 g of aluminum from 22°C to 55°C, if the specific heat of aluminum is 0.90 J/g°C?

1. The temperature of 335 g of water changed from 24.5°C to 26.4°C. How much heat did this sample absorb? C for water = 4.18 J/g°C

2. How much heat in kilojoules has to be removed from 225g of water to lower its temperature from 25.0°C to 10.0°C?

3. To bring 1.0kg of water from 25°C to 99°C takes how much heat input?

4. An insulated cup contains 75.0g of water at 24.00°C. A 26.00g sample of metal at 82.25°C is added. The final temperature of the water and metal is 28.34°C. What is the specific heat of the metal?

5. A calorimeter has a heat capacity of 1265 J/oC. A reaction causes the temperature of the calorimeter to change from 22.34°C to 25.12°C. How many joules of heat were released in this process?
6. What is the specific heat of silicon if it takes 192 J to raise the temperature of 45.0 g of Si by 6.0 °C?

7. Aqueous silver ion reacts with aqueous chloride ion to yield a white precipitate of solid silver chloride. When 10.0 mL of 1.00 M AgNO₃ solution is added to 10.0 mL of 1.00 M NaCl solution at 25 °C in a calorimeter a white precipitate of AgCl forms and the temperature of the aqueous mixture increases to 32.6 °C. Assuming that the specific heat of the aqueous mixture is 4.18 J/g°C, that the density of the mixture is 1.00 g/mL, and that the calorimeter itself absorbs a negligible amount of heat, calculate the amount of heat absorbed in kJ/mol of Ag⁺.

8. Assuming that Coca-Cola has the same specific heat as water (4.18 J/g°C), calculate the amount of heat in kJ transferred when one can (about 350 g) is cooled from 25 °C to 3 °C.

9. What is the specific heat of lead if it takes 96 J to raise the temperature of a 75 g block by 10 °C?

10. Sodium metal is sometimes used as a cooling agent in heat exchange units because of its relatively high molar heat capacity of 28.2 J/mol°C. What is the specific heat of sodium in J/g°C?
11. Titanium metal is used as a structural material in many high-tech applications such as jet engines. What is the specific heat of titanium in J/g°C if it takes 89.7 J to raise the temperature of a 33.0 g block by 5.20°C? What is the molar heat capacity of titanium in J/mol °C?

12. When 25 mL of 1.0 M H₂SO₄ is added to 50 mL of 1.0 M NaOH at 25°C in a calorimeter, the temperature of the aqueous solution increases to 33.9°C. Assuming that the specific heat of the solution is 4.18 J/g°C, that its density is 1.00 /mL, and that the calorimeter itself absorbs a negligible amount of heat, calculate the amount of heat absorbed for the reaction.

13. A 0.3 g piece of copper is heated and fashioned into a bracelet. The amount of energy transferred by heat to the copper is 66,300 J. If the specific heat of copper is 390 J/g °C, what is the change of the copper's temperature?

14. A 15.75-g piece of iron absorbs 1086.75 joules of heat energy, and its temperature changes from 25°C to 175°C. Calculate the specific heat capacity of iron.

15. Calculate the specific heat capacity of a piece of wood if 1500.0 g of the wood absorbs 67,500 joules of heat, and its temperature changes from 32°C to 57°C.