

Heat Problems

1. If 10.5g of iron, at 25.0°C, absorbs 128J of heat, what will the final temperature of the metal be? (The specific heat of iron is $0.449 \frac{J}{g \cdot ^\circ C}$)
[52.2°C]
2. Calculate the molar heat capacity of ethanol, C₂H₅OH. The specific heat of ethanol is $2.46 \frac{J}{g \cdot ^\circ C}$.
[113 $\frac{J}{mol \cdot ^\circ C}$]
3. 39.0g of an unknown metal at 94.0°C is dropped into 100g of water at 25.0°C. The final temperature of the mixture is found to be 28.1°C. What is the specific heat of the unknown metal?
[0.504 $\frac{J}{g \cdot ^\circ C}$]
4. A 450g piece of glass ($C=0.840 \frac{J}{g \cdot ^\circ C}$) at 75.0°C is placed in 220g of water. If the final temperature of the mixture is 38.0°C, what is the initial temperature of the water?
[22.8°C]
5. A 24.6g sample of copper ($C=0.380 \frac{J}{g \cdot ^\circ C}$) is heated to 110.0°C and then placed in 125g of water at 23.0°C. After the copper cools, determine the final temperature of the metal and water.
[24.5°C]
6. How much water at 80.0°C must be added to 200g of water at 10.0°C to give a final temperature of 36.0°C?
[118g]
7. When 500g of water at 90.0°C is mixed with 1000g of water at 10.0°C, what is the final temperature?
[36.7°C]

8. If a gold bar ($C=0.128\frac{J}{g\cdot^{\circ}C}$) at $99.0^{\circ}C$ is dropped into $90.0g$ of water at $24.0^{\circ}C$ the final temperature of the gold bar and the water is found to be $25.0^{\circ}C$. What was the mass of the gold bar?

[39.7g]

9. In a laboratory experiment in calorimetry, $100mL$ of a $0.500\frac{mol}{L}$ acetic acid solution is mixed with $100mL$ of a $0.0500\frac{mol}{L}$ sodium hydroxide solution in a calorimeter. The temperature rises from $25.00^{\circ}C$ to $27.55^{\circ}C$. The heat capacity of the calorimeter is $150.48\frac{J}{^{\circ}C}$, and the density of the resulting solution is $1.034\frac{g}{mL}$. Given the specific heat of the resulting $0.250\frac{mol}{L}$ solution of sodium acetate is $4.034\frac{J}{g\cdot^{\circ}C}$, calculate the enthalpy of neutralization of acetic acid.

$$[\Delta H_{neutralization} = -50.2\frac{kJ}{mol}]$$

10. A sample of $0.850g$ of carbon in the form of graphite is burned in oxygen in a bomb calorimeter. The temperature of the calorimeter increases from $25.72^{\circ}C$ to $27.85^{\circ}C$. The bomb calorimeter contains $2500g$ of water and the bomb has a rated heat capacity of $950\frac{J}{^{\circ}C}$. Determine how much heat was released for this reaction and the $\Delta H_{combustion}$ for carbon.

$$[q = -24.3 kJ]$$

$$[\Delta H_{combustion} = -343\frac{kJ}{mol}]$$

11. The combustion of benzoic acid is often used in experiments designed to determine the heat capacity of a bomb calorimeter assembly. If the combustion of a $1.500g$ sample of benzoic acid (C_6H_5COOH) causes the temperature to increase by $7.44^{\circ}C$ when a bomb calorimeter contains $1085g$ of water, what is the heat capacity of the bomb calorimeter? A handbook lists the heat of combustion of benzoic acid as $26.42\frac{kJ}{g}$.

$$[C_{bomb} = 790\frac{J}{^{\circ}C}]$$