

Honors Chemistry – Calorimetry Practice

1. If the temperature of 34.4 g ethanol increases from 25.0 °C to 78.8°C, how much heat was absorbed the ethanol? (C_p ethanol = 2.44 J/g°C)
2. A 155 g sample of an unknown substance was heated from 25.0 °C to 40.0 °C by absorbing 5696 J of energy. What is the specific heat of the substance?
3. A piece of aluminum absorbs 345 J when heated from 298 K to 368 K. What is the mass of the aluminum? (C_p aluminum = 0.9025 J/gK)
4. A 45.5 g piece of aluminum is heated to 87.5 °C and placed into a Styrofoam cup calorimeter containing 350. g of water at an initial temperature of 23.0 °C. What is the final temperature of the system? (C_p aluminum = 0.9025 J/g°C)
5. A piece of gold is heated to 65.4°C and placed in a calorimeter containing 160. g of water at 25.5°C. The final temperature of the metal and water is 27.8°C. What is the mass of the gold? (C_p gold = 0.13 J/g°C)

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Key

1. If the temperature of 34.4 g ethanol increases from 25.0 °C to 78.8 °C, how much heat was absorbed the ethanol? (C_p ethanol = 2.44 J/g °C)

$$q = mc\Delta T$$

$$x = (34.4g)(2.44 J/g \cdot ^\circ C)(78.8 - 25.0^\circ C)$$

$$(34.4g)(2.44 J/g \cdot ^\circ C)(53.8^\circ C)$$

$$x = 4515.7568 J \Rightarrow \boxed{4520 J}$$

2. A 155 g sample of an unknown substance was heated from 25.0 °C to 40.0 °C by absorbing 5696 J of energy. What is the specific heat of the substance?

$$q = mc\Delta T$$

$$5696 J = (155g)(x)(40.0 - 25.0)$$

$$5696 J = (155g)(x)(15^\circ C)$$

$$\frac{5696 J}{2325g \cdot ^\circ C} = \frac{2325g \cdot x}{2325}$$

$$x = 2.45 J/g \cdot ^\circ C$$

3. A piece of aluminum absorbs 345 J when heated from 298 K to 368 K. What is the mass of the aluminum? (C_p aluminum = 0.9025 J/gK)

$$q = mc\Delta T$$

$$345 J = (x)(0.9025 J/gK)(368 - 298 K)$$

$$345 J = (x)(0.9025 J/gK)(70 K)$$

$$\frac{345 J}{63.175} = \frac{63.175 J/g(x)}{63.175}$$

$$x = 5.4610209$$

$$\boxed{5.46 g}$$

4. A 45.5 g piece of aluminum is heated to 87.5 °C and placed into a Styrofoam cup calorimeter containing 350. g of water at an initial temperature of 23.0 °C. What is the final temperature of the system? (C_p aluminum = 0.9025 J/g °C)

lost = q gained

$$-(45.5g)(0.9025 J/g \cdot ^\circ C)(x - 87.5^\circ C) = (350. g)(4.18 J/g \cdot ^\circ C)(x - 23.0^\circ C)$$

$$-(41.06375)(x - 87.5) = 1463(x - 23.0)$$

$$-41.06375x + 3593.0781 = 1463x - 33649$$

$$37242.078 = 1504.0637x$$

$$x = 24.760971 = \boxed{24.8^\circ C}$$

5. A piece of gold is heated to 65.4 °C and placed in a calorimeter containing 160. g of water at 25.5 °C. The final temperature of the metal and water is 27.8 °C. What is the mass of the gold? (C_p gold = 0.13 J/g °C)

$$-(x)(0.13 J/g \cdot ^\circ C)(27.8 - 65.4) = (160. g)(4.18 J/g \cdot ^\circ C)(27.8 - 25.5^\circ C)$$

$$-(x)(0.13 J/g \cdot ^\circ C)(-37.6^\circ C) = (160g)(4.18 J/g \cdot ^\circ C)(2.3^\circ C)$$

$$\frac{4.888x}{4.888} = \frac{1538.24 J}{4.888}$$

$$x = 314.69721 \Rightarrow \boxed{x = 315 g}$$