

Objective 8: Energy and heat 1: predict heat in a physical heat transfer. Apply heat equations ($q = m\Delta T$, heat gained = heat lost)

Quiz Practice problems:

Key ideas:

Heat is the energy transferred between two objects due to a difference in temperature.

Three factors determine the amount of heat transferred: mass, specific heat, and temperature.

Skills: Use heat equations to determine heat transferred.

Heat gained = - heat lost.

Identify what is gaining heat and what is losing heat.

$q = m s \Delta T$ where m = mass in g, s = specific heat in $J/g\ ^\circ C$, and $\Delta T = T_{\text{final}} - T_{\text{initial}}$ = difference in temperature.

1. a. If two objects at the same temperature touch each other, is heat transferred?
b. You shake your lab partner's hand. Your hand is warmer than your lab partner's. Which hand loses heat?
c. Specific heat is the amount of energy required to raise 1 g of a substance $1^\circ C$. The specific heat of water is $4.18 J/g\ ^\circ C$. The specific heat of iron is $0.44 J/g\ ^\circ C$. You have 100 g of water at $100^\circ C$ and 100 g of iron at $100^\circ C$. Each object is placed on a table at $25^\circ C$. Which object cools faster?
2. a. 1 cup (240 ml) of water is heated from $25^\circ C$ to $75^\circ C$. Calculate q . (Answer: approximately 50,000 J)
b. 1 cup (240 ml) ethanol (specific heat = $2.46 J/g\ ^\circ C$) is heated from $25^\circ C$ to $75^\circ C$. Calculate q .
c. Why does water require more heat than ethanol?
3. Add 50 ml of water at $25^\circ C$ to 50 ml of water at $100^\circ C$.
a. heat gained by _____ water = - heat lost by _____ water
 $m s (T_f - T_i) = - m s (T_f - T_i)$
b. What quantities are you given?
c. What quantity is not known?
d. Fill in equation. Solve for unknown.
4. a. 200 ml of water at $25^\circ C$ is added to 850 ml of water at $100^\circ C$. Calculate T_f .
b. Your coffee is way too hot. You have 200 ml of coffee (assume it is water) at $150^\circ F$ (= $65.5^\circ C$). How much $25^\circ C$ water should you add to cool the coffee to $110^\circ F$ (= $43.3^\circ C$)? (Hint: What equation should you use?)
5. 20.0 g of a metal at $100^\circ C$ is added to 60 ml of water at $25^\circ C$. T_f of the water and metal is $27.5^\circ C$.
a. Calculate the specific heat of the metal. (Hint: What equation should you use?)
b. What is the identity of the metal?
c. If you want to see a bigger temperature change in the metal, should you use more water or less water? Give reasons.
6. A rock and gold cup lie in the middle of the Mojave desert in the middle of a hot, sunny day. Which object contains more heat? Give reasons.