

AP Chemistry
Specific Heat

Name _____

Solve the following problems for heat showing the proper units. Use the table of specific heats shown below. Show all work.

Substance	specific heat(J/ g·°C)
H ₂ O	4.18
Fe	0.452
Pb	0.130

1. How much heat in kJ will be needed to warm 500. g of iron from 30 °C to 34 °C?

$$q = m c \Delta T$$

$$= (500. \text{ g}) \left(\frac{0.452 \text{ J}}{\text{g} \cdot ^\circ\text{C}} \right) (34.0^\circ\text{C} - 30.0) = 904 \text{ J} = \boxed{0.904 \text{ kJ}}$$

2. What is the specific heat of tin if 18.27 cal of heat are released when 282 g of tin is cooled from 26.3 °C to 25.1 °C?

$$q = m c \Delta T$$

$$18.27 \text{ cal} \left| \frac{4.184 \text{ J}}{1 \text{ cal}} \right| = 76.44 \text{ J}$$

$$-76.44 \text{ J} = (282 \text{ g})(c)(25.1^\circ\text{C} - 26.3^\circ\text{C})$$

$$\boxed{c = 0.226 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}}$$

3. A 111 g piece of platinum is heated to 112 °C and placed into 50.0 mL water that has been sitting at room temperature (21.0 °C). The temperature gets raised to 27 °C. What is the specific heat of the platinum

$$-m c \Delta T = m c \Delta T$$

$$-((111 \text{ g})(c)(27^\circ\text{C} - 112^\circ\text{C})) = (50.0 \text{ g}) \left(\frac{4.184 \text{ J}}{\text{g} \cdot ^\circ\text{C}} \right) (27^\circ\text{C} - 21.0^\circ\text{C})$$

$$\boxed{c = 0.119 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}}}$$

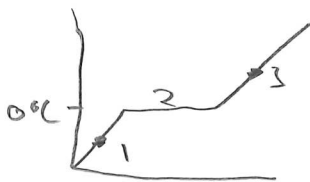
4. A chunk of lead at 60.0 °C is dropped into 40.0 mL of water at 25.5 °C. The final temperature is found to be 29.7 °C. What is the mass of the lead?

$$-m c \Delta T = m c \Delta T$$

$$-((m)(0.130 \frac{\text{J}}{\text{g} \cdot ^\circ\text{C}})(29.7^\circ\text{C} - 60.0^\circ\text{C})) = (40.0 \text{ g}) \left(\frac{4.184 \text{ J}}{\text{g} \cdot ^\circ\text{C}} \right) (29.7^\circ\text{C} - 25.5^\circ\text{C})$$

$$\boxed{m = 178 \text{ g Pb}}$$

5. How much heat (in ^{KJ}J) is required to change 296 g of ice from -6.0 °C to its liquid form at 55. °C?



$$1) q = mc\Delta T$$

$$q = (296g)(2.060 \frac{J}{g \cdot ^\circ C})(0^\circ C - -6^\circ C) = 3700 J$$

$$2) q = mH_{fus}$$

$$= (296g)(333 \frac{J}{g})$$

$$= 99000 J$$

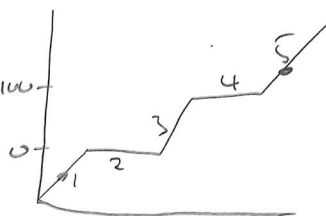
$$= 170000 J$$

$$3) q = mc\Delta T$$

$$= (296g)(4.184 \frac{J}{g \cdot ^\circ C})(55 - 0^\circ C) = 68000 J$$

$$= 170 KJ$$

6. How much heat in kJ is required if 31.0 g of ice starts at -10.0 °C and changes to steam with a temperature of 117 °C?



$$1) q = mc\Delta T$$

$$= (31.0g)(2.060 \frac{J}{g \cdot ^\circ C})(0.0^\circ C - -10^\circ C) = 639 J$$

$$2) q = mH_{fus}$$

$$= (31.0g)(333 \frac{J}{g})$$

$$= 10300 J$$

$$3) q = mc\Delta T$$

$$= (31.0g)(4.184 \frac{J}{g \cdot ^\circ C})(100.0^\circ C - 0.0^\circ C) = 12970 J$$

$$4) q = mH_{vap}$$

$$= (31.0g)(2256 \frac{J}{g})$$

$$= 69900 J$$

$$5) q = mc\Delta T$$

$$= (31.0g)(2.020 \frac{J}{g \cdot ^\circ C})(117^\circ C - 100^\circ C) = 1060 J$$

$$94900 J$$

$$94.9 KJ$$