

HW set 9

1.] The potential energy becomes kinetic as the stuff falls, then converts to thermal, via friction, as the stuff is slowed to a stop.

3.] Joule investigated the relationship between heat and mechanical energy, or work.

7.] Work and heat both change the energy of a system - work is done on, and heat flows to. In both cases, energy is transferred.

8.] I might guess that the water is hotter at the bottom, for similar reasons as in question 4.

11.] ~~If the buckets have the same temperature, then~~

The buckets are in equilibrium if, when placed in contact, no heat flows. It is not necessary that the buckets have any contact at the current moment for them to be defined as 'in equilibrium'. By definition, they have the same temperature if they are in equilibrium, so you could just check the temps to determine whether it is so.

25.] Specific heat refers to the change in (energy per mass) ~~for~~ for a certain temperature change. The energy lost by A is gained by B, and both have the same mass. Since A experienced a smaller temp. change, it has a greater specific heat.

35] If I mixed equal masses of two liquids, I would expect the temp. to fall half-way between the initial temps of the liquids. Here, though, some energy is used to melt the ice, so the mixture will not be as hot. The temp will be less than 40°C .

38.] Cause steam gets in your face. Also, at 100°C , the gas has more internal energy than the liquid.

40.] The high humidity means less moisture evaporates from your lungs and skin.

$$E1] \text{ heat} = \left(\text{specific}_{\text{heat}} \right) \cdot (\text{mass}) \cdot (\text{change in Temp}) = \left(1 \frac{\text{cal}}{\text{g}^{\circ}\text{C}} \right) (400\text{g}) (10^{\circ}\text{C}) = 4000_{\text{cal}}$$

$$3] W = Fd = (200\text{ N})(6\text{ m}) = 1200\text{ J}$$

$$\text{heat} = (1200\text{ J}) \cdot \left(\frac{1\text{ cal}}{4.2\text{ J}} \right) = 286\text{ cal}$$

$$5.] \left(40 \frac{\text{kJ}}{\text{min}} \right) \left(\frac{1}{4.2} \frac{\text{cal}}{\text{J}} \right) = .95 \frac{\text{kcal}}{\text{min}}, \quad \text{time} = \frac{4 \cdot 10^5 \text{ cal}}{950 \frac{\text{cal}}{\text{min}}} = 42 \text{ min.}$$

$$7.] \Delta U = Q + W = 26\text{ J} - 12\text{ J} = 14\text{ J}$$

$$9.] \Delta U = \Delta W + \Delta Q = 10000\text{ J} - 2000\text{ J} = 8,000\text{ J}$$

$$\Delta T = \frac{\Delta U}{cm} = \frac{8000\text{ J}}{(1000\text{ J/kg}^{\circ}\text{C})(1\text{ kg})} = 8^{\circ}\text{C} \rightarrow T_{\text{final}} = 28^{\circ}\text{C}$$

$$11.] \quad c = \frac{\Delta Q}{m \Delta T} = \frac{250 \text{ cal}}{(90 \text{ g})(10^\circ \text{C})} = \underline{0.278 \frac{\text{cal}}{\text{g}^\circ \text{C}}}$$

$$15.] \quad \Delta T_x = \frac{\Delta Q_x}{c_x m_x} = \left(\frac{Q}{m}\right) \frac{1}{c} = \left(\frac{2 \text{ cal}}{\text{g}}\right) \frac{1}{2 \frac{\text{cal}}{\text{g}^\circ \text{C}}} = -1^\circ \text{C}$$

$$\Delta T_y = \left(\frac{\Delta Q}{m}\right)_y \frac{1}{c_y} \quad \text{X has twice as many grams, and each gram gave two cal, so}$$

$$\left(\frac{\Delta Q}{m}\right)_y \left(\frac{1}{c_y}\right) = (4) \frac{\text{cal}}{\text{g}} \frac{1}{1 \frac{\text{cal}}{\text{g}^\circ \text{C}}} = \underline{4^\circ \text{C}}$$

$$17.] \quad \text{a. } \Delta Q_{\text{hot}} = cm \Delta T = \left(1 \frac{\text{cal}}{\text{g}^\circ \text{C}}\right) (80 \text{ g})(-20^\circ \text{C}) = -1600 \text{ cal}$$

$$\text{b. } \Delta Q_{\text{cold}} = cm \Delta T = +1600 \text{ cal}$$

c. Total energy does not change.

$$21.] \quad Q = cm \Delta T = \left(900 \frac{\text{J}}{\text{kg}^\circ \text{C}}\right) (2 \text{ kg})(640^\circ \text{C}) = \underline{1.15 \times 10^6 \text{ J}}$$