PHYS102.10
Quiz # 3

Name: Key Id#:

A thermometer of mass 60 g and specific heat 836 J/kg K reads 10 °C. It is then completely immersed in 150 g of water of specific heat 4190 J/kg K. The final temperature reading of the thermometer in the water is 45 °C. Find the initial temperature of the water assuming no heat losses from the system to the environment.

$$Q_{gained} + Q_{lost} = 0$$

$$m\, C_{therm}\, \Delta T + m\, C_{water}\, \Delta T = 0$$

$$0.06 \times 836 \times (45-10) + 0.15 \times 4190 \times (45-T) = 0$$

$$1755.6 + 628.5\,(45-T) = 0$$

$$45 - T = -2.8$$

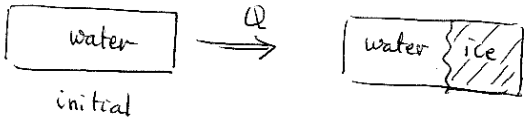
$$\boxed{T = 47.8\ ^\circ C}$$

PHYS102.11
Quiz # 3

Name: Key Id#:

How much water remains unfrozen after 50 kJ is transferred as heat from 500 g of water initially at 10 °C. Specific heat of water = 4190 J/kg K and the heat of transformation of ice is 333 kJ/kg.

$m = 500\,g \quad Q = 50\,kJ \quad T_i = 10^\circ C \quad T_f = 0^\circ C$



Change 500g of water from 10°C to 0°C

$$Q = mC\Delta T = 0.5 \times 4190 \times (0-10) = -20950\,J$$

Remaining heat $50kJ - 20950J = 29050J$

This heat will be used to freeze water

$$29050 = mL_f = m \times 333 \times 10^3$$

$$\Rightarrow m = 0.087\,kg = 87\,g$$

So out of 500g of water initially

87g becomes ice

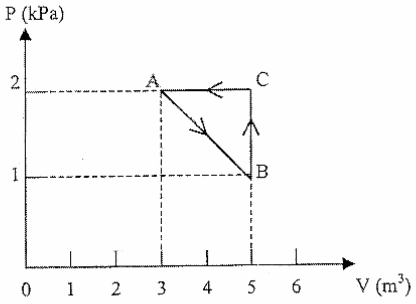
and 413g remains water

PHYS102.12
Quiz # 3

Name: Key Id#:

A gas is taken through the cyclic process shown in the figure. What is

a. the work done on/by the gas? Is work done on the gas or by the gas? Explain.
b. the heat gained/lost by the gas? Is heat gained or lost by the gas? Explain.
c. the change in internal energy of the gas during the cycle?



a) Work = area enclosed

$= \frac{1}{2}(5-3)(2-1)\times 10^3$

$= 1\times 10^3\ J$

Since the cycle is counterclockwise $W = -1000\ J$

Work done on the gas

b) $\Delta E_{int} = 0$ for any cyclic process

b) $Q = W = -1000\ J$ heat lost by the gas.