KING FAHD UNIVERSITY OF PERTOLEUM & MINERALS
PHYSICS DEPARTMENT
QUIZ #3- CHAPTER 18

NAME: Key ID# SECTION#

50 g of ice at –15 °C is mixed with 150 g of water at 25 °C in an insulated container. What quantity of ice will melt? The heat of fusion of water is 333 kJ/kg and the specific heat of ice is 2220 J/kg·K and water is 4190 J/kg·K.

Heat lost by 150g water from $25^\circ C \rightarrow 0^\circ C$

$$|Q| = |m c \Delta T| = |0.15 \times 4190 \times (0 - (+25))|$$

$$= 15713 \text{ J}$$

Heat gained by ice from $-15^\circ C \rightarrow 0^\circ C$ still ice

$$Q = mc\Delta T = 0.05 \times 2220 \times (0 - (-15))$$

$$= 1665 \text{ J}$$

Heat remaing to melt the ice $= 15713 - 1665$

$$= 14048 \text{ J}$$

mass of ice melted:

$$Q = 14048 = m' L_f = m' (333 \times 10^3)$$

$$m' = 0.042 \text{ Kg}$$

$$\boxed{m' = 42 \text{ g}} \leftarrow \text{melted!}$$

$$\boxed{m'' = 8 \text{ g}} \leftarrow \text{remains ice!}$$

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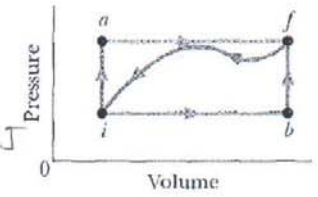
When a system is taken from state i to state f along path iaf, Q = 70 J and W = 30 J. Along path ibf, Q = ~~40~~ 60 J.



(a) What is the work done along path ibf?

$$\Delta E_{iaf} = Q_{iaf} - W_{iaf} = 70 - 30 = 40\,J$$

$$\Delta E_{ibf} = \Delta E_{iaf} = Q_{ibf} - W_{ibf}$$

$$40 = 60 - W_{ibf} \Rightarrow \boxed{W_{ibf} = 20\,J}$$

(b) If the work done along path fi is – 25 J, what is the heat energy for this path?

$$\Delta E_{fi} = -40\,J = Q_{fi} - W_{fi}$$

$$= Q_{fi} - (-25)$$

$$Q_{fi} = -40 - 25 = -65\,J$$

$$\boxed{Q_{fi} = -65\,J}$$

(c) If $E_{int,i} = 10$ J, What is $E_{int,f}$?

$$\Delta E_{if} = E_f - E_i$$

$$40 = E_f - 10 \Rightarrow \boxed{E_f = 50\,J}$$

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A brass ring is 3.992 cm in diameter at 25 °C. A steel rod has a diameter of 4.000 cm at 25 °C. At what common temperature will the ring just slide onto the rod?
Given: α steel = 11×10^{-6} /C°, α brass = 19×10^{-6} /C°.

$$D_{final,\,ring} = D_{final,\,rod}$$

$$D_{final} = D_{initial}(1 + \alpha \Delta T)$$

$$3.992(1 + 19\times10^{-6}\,\Delta T) = 4.0(1 + 11\times10^{-6}\,\Delta T)$$

$$0.998(1 + 19\times10^{-6}\,\Delta T) = 1 + 11\times10^{-6}\,\Delta T$$

$$0.998 + 18.962\times10^{-6}\,\Delta T = 1 + 11\times10^{-6}\,\Delta T$$

$$\Delta T(18.968 - 11)\times10^{-6} = 1 - 0.998 = 0.002$$

$$\Delta T = 251\ C^\circ$$

$$T_f - T_i = 251\ C^\circ \Rightarrow T_f = T_i + 251^\circ$$

$$\boxed{T_f = 276\ ^\circ C}$$