

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

NAME: Key ID# \_\_\_\_\_ SECTION# \_\_\_\_\_

A glass window has an area of  $0.50 \text{ m}^2$  and a thickness of  $0.60 \text{ cm}$ . The rate of heat flow between the faces is  $2000 \text{ W}$ . If the outside temperature is  $-5^\circ\text{C}$ , find the inside temperature. The thermal conductivity of glass =  $0.80 \text{ W/m}\cdot\text{C}^\circ$ .

$$P = \frac{Q}{t} = k \frac{A (T_H - T_C)}{L}$$

$$\frac{PL}{kA} = T_H - T_C$$

$$T_H = T_C + \frac{PL}{kA}$$

$$= -5 + \frac{2000 \times 0.6 \times 10^{-2}}{0.8 \times 0.5} = \boxed{25^\circ\text{C}}$$

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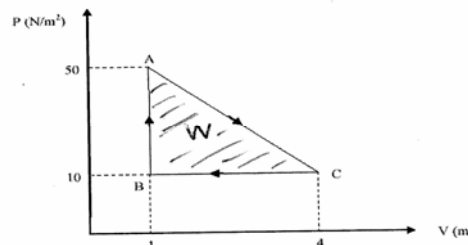
- (a) Consider that 500 cal of work is done by the gas and 100 J of heat is extracted from the gas. What is the change in internal energy (in joules) of the gas?

$$W = 500 \times 4.186 = 2093 \text{ J}$$

$$Q = -100 \text{ J}$$

$$\Delta E_{\text{int}} = Q - W = -100 - 2093 = \boxed{-2193 \text{ J}}$$

- (b) A gas within a closed chamber undergoes the cycle shown in the p-V diagram. Calculate the net energy added to the system as heat during one complete cycle.



For a cycle  $\Delta E_{\text{int}} = 0$

$$\Delta E_{\text{int}} = Q - W = 0$$

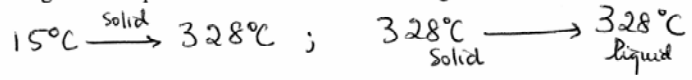
$$\Rightarrow Q = W = \text{area enclosed}$$

$$Q = \frac{1}{2} \times 40 \times 3 = \boxed{60 \text{ J}}$$

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Calculate the amount of energy, in Joules, required to completely melt 130 g of lead initially at temperature of 15.0 °C. Melting point of lead  $T_m = 328$  °C, latent heat of fusion of lead  $L_f = 2.32 \times 10^4$  J/kg and the specific heat of lead  $c = 128$  J/kg/K.



$$Q = m L_f + m c \Delta T$$

$$= 0.13 \times 2.32 \times 10^4 + 0.13 \times 128 \times (328 - 15)$$

$$= 3016 + 5208 = \boxed{8224 \text{ J}}$$