THERMODYNAMICS

AT THERMODYNAMICS (12)

Directions: Solve the following problems. Each is worth 3 point. Show all work and circle your answer.

1) 0.04 kg of water in a container is shaken resulting in the water warming by 2°C. Determine how much work was done to the water by shaking it.

$W = Q = mc\Delta T$

$W = Q = (.04kg)(4190 J/kg°C)(2°C)$

$W = 335 J$

2) A particular heat engine is 28% thermally efficient and is used to lift a person. Determine the thermal energy that is required to lift a 65 kg person to a height of 2 m. (Remember the horsepower activity? 65kg is a typical mass for a person, and 2 m was the height in the stairwell)

$\text{therm Eff} = \frac{W}{Q_H}$

$Q_H = \frac{W}{\text{thermEff}} = \frac{Fx}{\text{thermE}} = \frac{(65kg)(9.8 m/s^2)(2m)}{.28}$

$Q_H = 4550 J$

3) A refrigerator has a Coefficient of Performance of 1.8. Determine the work that must be completed to freeze a liter of water.

1 l = 1 kg of water

$$C.P. = \frac{Q_c}{W}$$

$$W = \frac{Q_c}{C.P.} = \frac{mL}{C.P} = \frac{(1\text{kg})(3.3\times10^5\ \text{J/kg})}{(1.8)} = 1.86\times10^5\ \text{J}$$

4) Determine the work done during an adiabatic process where 2 kg of ice melts to water at zero degrees Celsius.

Internal Energy - Energy of phase & Temp

$$Q = W = \Delta U$$

$$mL = W$$

$$(2\text{kg})(3.3\times10^5\ \text{J/kg}) = 6.6\times10^5\ \text{J}$$

& Const. Volume

5) Determine the work done during an isochoric process where 2 kg of ice melts to water at zero degrees Celsius.

Zero

6) Determine the work done during an isothermal process where 2 kg of ice melts to water at zero degrees Celsius.

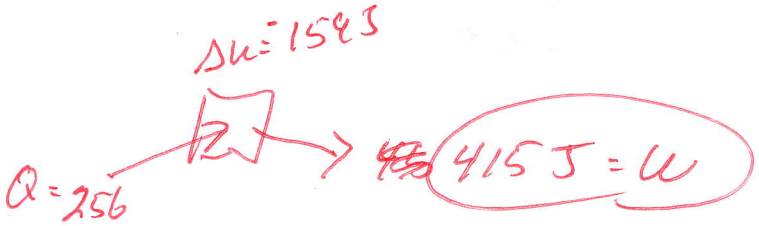
$\Delta U = \text{Zero}$

$W = Q$

$W = mL = (2\text{kg})(3.3\times10^5\ \text{J/kg})$

$6.6\times10^5\ \text{J}$

7) Determine the work done (to or by the gas) if the internal energy decreases by 159 J and 256 J of heat are added to the gas.



Level I Key Pd 1

8) Determine the thermal efficiency of a heat engine that takes in a gas at 460°C and exhausts a gas at 320°C.

733K

593K

Therm Eff: $\frac{W}{Q_H} = \frac{T_H - T_C}{T_H} =$ ~~593K~~ $\frac{733K - 543K}{733K} = 19\%$