Unit 8: Thermo 1/27

Topic: Application of Q + W.E. Theorum

A hot water bath is made for a lab. Access to 5 L of 20°C + 45 L of 110°C water are the only avail. (V_c, T_{ci}, V_h, T_{hi})

What T + how much can be made?

$D = \frac{m}{V}$ — same

hot → cold
- looses, gains +

$$-Q_{out} = Q_{in}$$

$$-(m_h c_h \Delta T_h) = m_c c_c \Delta T_c$$

$$-(V_h \Delta T_h) = V_c \Delta T_c$$

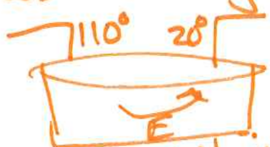
$$-(45(T_f - 110)) = 5(T_f - 20)$$

$$-45T_f + 4950 = 5T_f - 100$$

$$+45T_f + 100 = +45T_f + 100$$

$$\frac{5050 = 50T}{50}$$

$$101 = T_f$$



Equilibrium

$T_{h_f} = T_f = T_{c_f}$

Application of 2nd Law

E transferred hiE → low E

transfer of E from heat is not 100% efficient

E → heat (flow E) 100%

E → E 100%

heat (flow E) → E Never 100% lose = waste

Relate v & T

2 substances of same T have dif v

$$T_1 = T_2$$

$$KE_1 = KE_2$$

$$\cancel{\tfrac{1}{2}}_1 m_1 v_1^2 = \cancel{\tfrac{1}{2}}_2 m_2 v_2^2$$

$$m_1 v_1^2 = m_2 v_2^2$$

$KE = \frac{1}{2} m v^2$

[v] ↑

smallest mass = fastest ↑ v

sample size
molar mass, formula mass
any measure of mass

Application E transfer (2nd Law)

Work Energy Theorum
= E is avail when W is done

$W = F \cdot d$ $\quad$ $W \rightarrow E$

$E = W = F \cdot d$

Hanson slides a book .12 m (d) across a table by 12 N (F) of Force. How much work did he do & how much E is available.

$E = W = F \cdot d$

$= 12 \cdot .12\,m$

$= 1.44\,J$ E is avail

1.44 W