Chapter 13 - Heat Transfer

Conduction $Q = \underline{kA\Delta T t}$

Convection

Radiation $Q = e\sigma A t T^4$

L

ass of molecule

Chapter 14 -

Moles $n = N/N_A,\ m$

Ideal gas Law $PV = nRT$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

Kinetic Theory $\overline{KE} = \frac{3}{2}kT$

$$v_{rms} = \sqrt{\frac{3kT}{m}}$$

$$U = \frac{3}{2}nRT$$

(monatomic ideal gas)

Chapter 15 - Laws of Thermodynamics

First Law $\Delta U = Q - W$

Thermal Processes

Isobaric $W = P\Delta V$

Isochoric $W = 0$

Isothermal $\begin{cases} W = nRT \ln(V_2/V_1) \\ \Delta U = 0 \end{cases}$

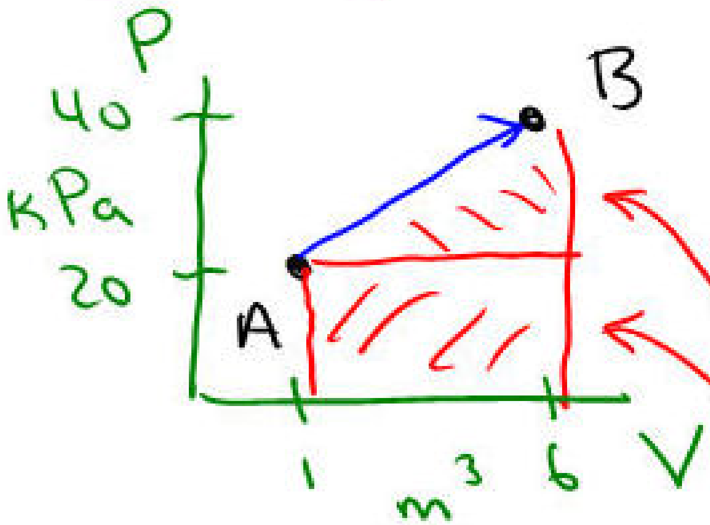
Adiabatic
$Q = 0$

We did not get to Section 5.6!

Other Things to Know

$Q = mc\Delta T$, $m = \rho V$ ...

Work from PV diagram - See Sample Quiz



Work for A to B

Expansion $\Rightarrow W > 0$

Area Under curve

$\frac{1}{2}bh = 50\,kJ$

$bh = 100\,kJ$

Total $= 150\,kJ$

Note: Ideal Monatomic gas

$$\Delta U = \frac{3}{2} n R \Delta T$$

Problems

b. The temperature of 2.0 moles of a monatomic ideal gas is increased from 150°C to 250°C by a process in which 1500J of heat is added to the system. What is the change in internal energy?

$$\Delta U = \frac{3}{2}(2)(8.31)(250-150)$$

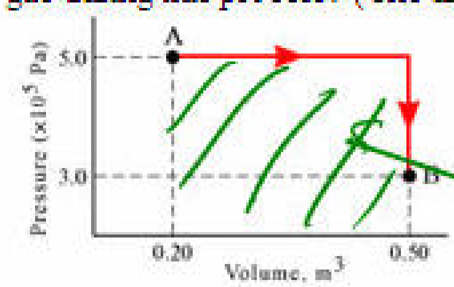
Can now get W (not asked for)

$$W = Q - \Delta U$$

e Standard temperature and pressure conditions (STP) are 0 °C and one atmosphere. Use the ideal gas law to find the volume occupied by one mole of an ideal gas at STP conditions.

$$PV = nRT \Rightarrow V = \frac{nRT}{P} = \frac{1(8.31)273}{1.013\times10^5}$$

f. The pressure-volume graph shows a process in which a gas is taken from A to B. The internal energy of the gas at the two points is $U_A = 360$ kJ and $U_B = 560$ kJ. What is the heat transferred to the gas during this process? (The units are in 10^5 Pa and m^3.)



area

$$\Delta U = Q - W$$

$$Q = \Delta U + W$$

$$= (560-360)\times10^3 + P\Delta V$$

$$= 200\times10^3 + (5\times10^5)(.5-.2)$$

$$= 350\text{ kJ}$$