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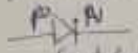
Subject Basic Electromechanics Section A

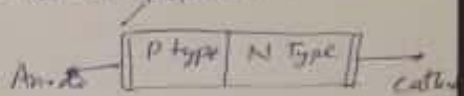
Teacher Engr. Ashraf

Q1(a) What is diode? Differentiate between full wave & Half wave rectifier

Answer: Diode is a device which is used to convert A.C to D.C. It is also used as a rectifier and it consists of two terminals. It maintained the current in one direction therefore it is used as a rectifier. Parts of Diode ① Anode (Positive Terminal) Diode is used component to protect ② Cathode (negative Terminal) the circuit from harmful voltage or current

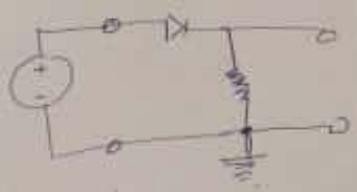


Symbolistic representation



(a) Half wave rectifier:

It convert the the A.C into pulsating D.C



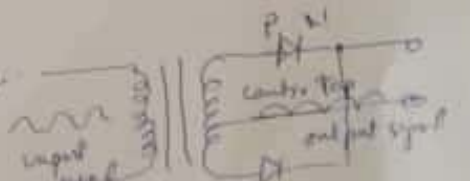

input signal


output signal
= pulsating D.C

(b) Fullwave Rectifier

It consist of Two Diodes D_1 & D_2 input signal is A.C while output signal is D.C pulses

For D_1 P is +ve & N is -ve Then it is Forward Biased and pass the sign.



For other half negative cycle of AC when in D_2 P is +ve & N is negative again Forward Biased Then this signal also is passed and both the signal are received.

(b) Data

mass of gold $= m_1 = 97\,g$

Temp of Cold Body = Initial Temperature $= t_1 = 15^\circ C$

Temp of mix = Final Temperature $t_f = ?$

Temp of Hot Body $= t_2 = 785^\circ C$

C_{Au} = Specific heat of gold $= 0.129\,J/g^\circ C$

specific heat of water $= 4.184\,J/g^\circ C$

mass of water $m_w = 321\,g$

Solution:

According to law of Transfer of heat

heat lost = heat gained

$\Delta Q_L = \Delta Q_G$

$-C_{Au} m_1 \Delta T = C m \Delta T$

For Gold (Hot Body) — For water (Cold body)

$-C_{Au} m_1 (t - t_1) = C_w m_w (t - t_2)$

$-(0.129)(97)(t - 785) = 4.184\,(321)(t - 15)$

$-(12.5)(t - 785) = (1.35 \times 10^3)(t - 15)$

$1.36 \times 10^3 t = 3 \times 10^4$

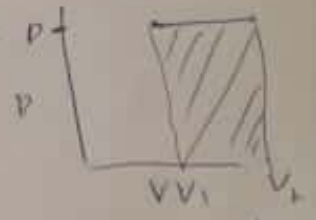
$t = 22.1^\circ C$ Answer

Q:- (a) Is. baric process, Is. chori. process, Is. thermal & Adiabatic.

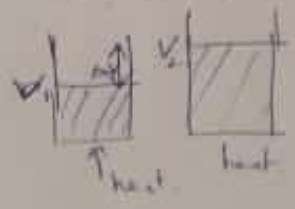
Solution:- Isobaric Process:- It is that process in which pressure remains constant. In this process the system consist of heat insulating wall, heat conducting base and movable piston containing a gas is placed on stove of heat. Let V_1 is the initial volume of the gas and when heat is given its value becomes V_2 and in order to keep the pressure constant volume increases the pressure is constant & work is done. $\Delta W = P\Delta V$

According to 1st law of Thermodynamics
$\Delta Q = \Delta U + \Delta W$
$\Delta Q = \Delta U + P\Delta V$

$W = F.d$
$= PAd.$
$\boxed{\Delta W = P\Delta V}$

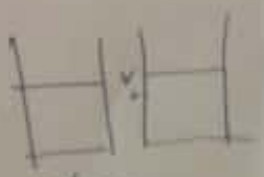


$\frac{V_A}{T_A} = \frac{V_B}{T_B}$

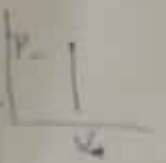


Isochoric:- It is the process in which volume remains constant or no work is done

According to 1st law of Thermodynamics
$\Delta Q = \Delta U + \Delta W$
$\Delta Q = \Delta U$
So all the heat increases the internal energy



$\Delta V = 0$
$\Delta W = P\Delta V = 0$



② Adiabatic process

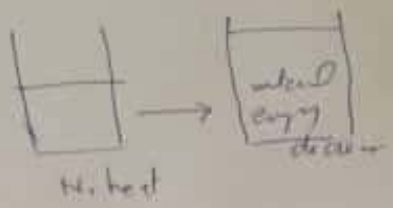
No heat is transferred into the system or out of the system. The system is totally isolated and all the boundaries are insulating material with movable piston

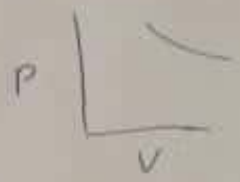
So $\Delta Q = \Delta U + \Delta W$

$\Delta Q = 0$ (no heat)

$-\Delta U = \Delta W$

$\Delta U = -\Delta W$





③ Isothermal process

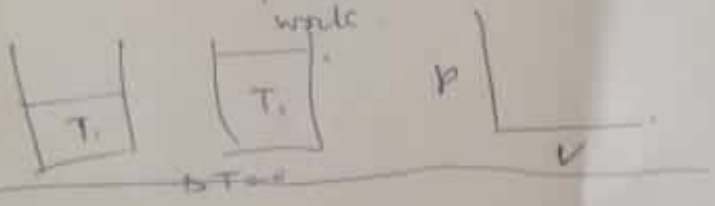
That process in which Temp remain constt. So heat is given to the system Temp increases and in order to keep the Temp constt work is done and $\Delta W = P\Delta V$

But since Temp is constt $\Delta U = 0$.

$\Delta Q = \Delta U + \Delta W$

$\Delta Q = \Delta W$

All the heat is used in doing work



(b)

$T_1 = 500k$

$T_2 = 300k$

$V_1 = 5:1$

efficiency $= 1 - \frac{T_2}{T_1}$

$= 1 - \frac{300}{500}$

$e = \frac{200}{500} = 4:1$

$\eta = \left(\frac{T_1}{T_2} - 1\right)$

$\frac{1}{4} = \left(\frac{500}{300} - 1\right)$

$\frac{1}{4} = \frac{200}{300}$

Actual $= e = 0.25 = 25\%$

$e = W/Q$

Ans $W = eQ = 0.25 \times 500$

Q4 (5)

Conduction & convection :-

Conduction is the mode of transfer of heat from more energetic particle of a substance to the less energetic ~~energetic~~ ~~energetic~~ ones as a result of interaction between particles. Conduction takes place in solids by vibration of KE of the molecules of the solid substance.

Convection is a mode of transfer of heat by actual motion of molecules like in gases & liquids in which low energy molecules get heat energy & move upward and upper molecules move downward

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(b)

$$Q_{\text{water}} = -Q_{\text{Pb}}$$

$$(mC\Delta T)_{w} = -(mC\Delta T)_{Pb}$$

$$125(4.18)(T_f - 23) = -75(0.13)(T_f - 415)$$

$$522.5T_f - 12017.5 = -9.75T_f + 4241.25$$

$$\boxed{T_f = 30.5\,^{\circ}C}$$

(5) (a) Internal combustion Engine :- An internal combustion engine is one in which the combustion of fuel is occuring with an oxidizer in a combustion chamber.

External Combustion Engine :- It is a heat engine where a working fluid contained internally is heated by combustion in an external source through the engine wall or a heat exchanger. The fluid is then expanding and act as a mechanism of the engine produces motion & work.

(b) Solution :-

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(1\ \text{atm})(12 V_2)}{300\text{k}} = \frac{3.24\ \text{at}\ 1 V_2}{T_2}$$

$$\boxed{T_2 = 800\text{k}}$$ Answer

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(5) Solution of the problem

Area of the roof $= A = 6 \times 8 = 48 m^2$

$K = 0.8 W/m$

$T_1 = 15 ^\circ C$

$T_2 = 4 ^\circ C$

$L = 0.25 m$

cost of Electricity $= 0.08 \$/KWh$

Formula:

$$Q = KA \frac{T_1 - T_2}{L}$$

$$= (0.8)(48)\left(\frac{(15-4)}{0.25}\right)$$

$$= 1.69 KW$$

Time = 10 hours

$$Q' = \Delta t Q$$

$$= (10)(1.69)$$

$$= (16.9) KWh$$

Total cost $= Q' \times rate$

$$= 16.9 (0.08)$$

$$= 1.35 \$$$

(All the questions done)