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Subject:: Basic Electromechanical Engg.

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FINAL TERM EXAM.

Q2) Ans (a):- Diode:-

A Diode is an electronic component that has two terminals and limits current to one direction.

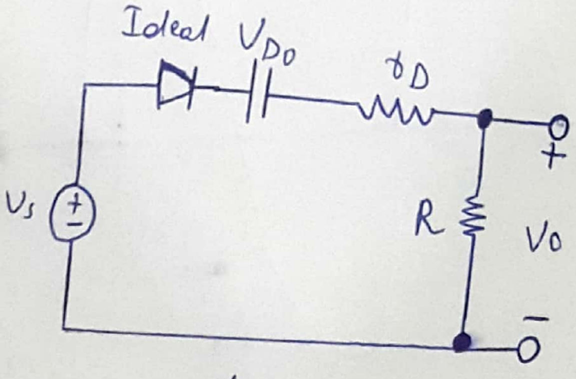
→ Diode have and anode and a cathode.

→ Positive current normally flows from the anode to the cathode.

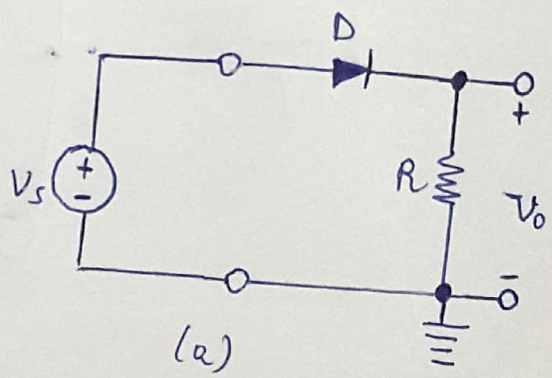
→ Diodes are useful for protecting circuitry from harmful voltage or current.

→ Diodes are a basic building block of the charge-collecting element in many detectors.

Difference b/w Half and Full-wave Rectifier:-



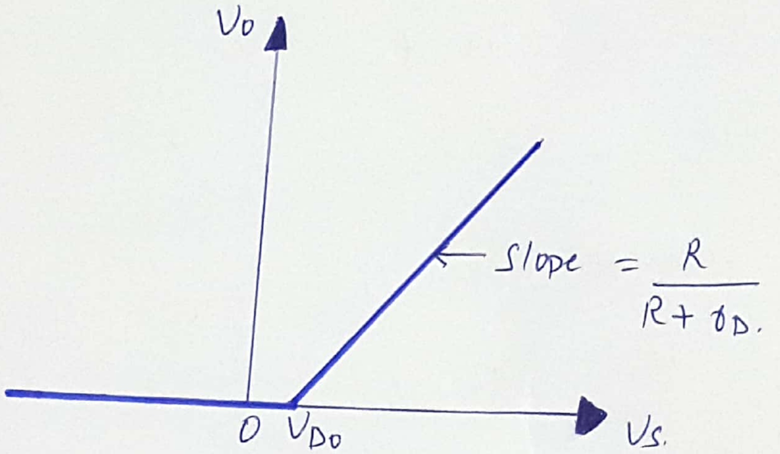
(b)



(a)

a) A Half-wave Rectifier.

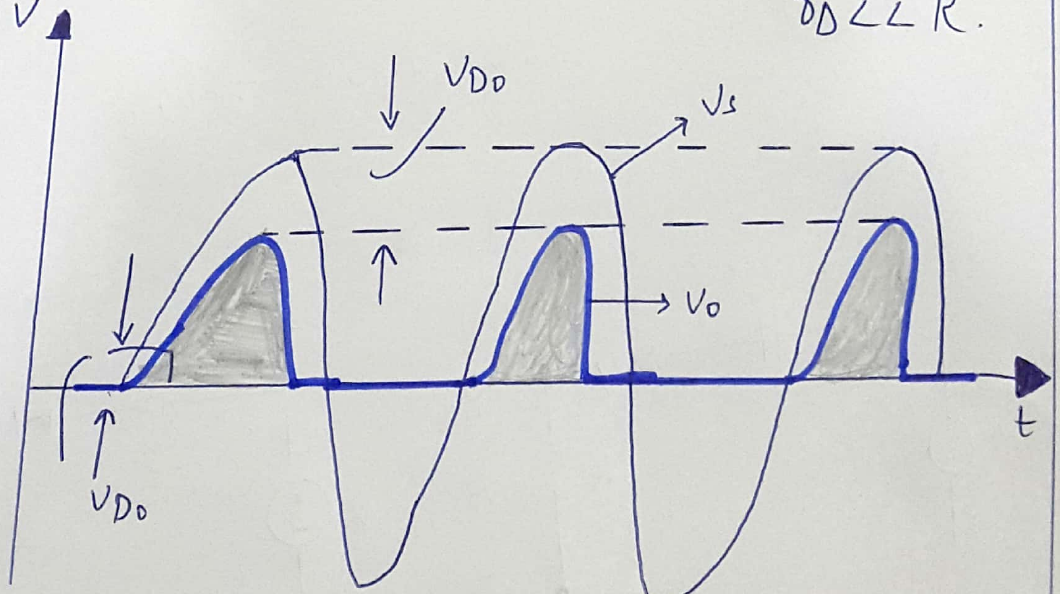
b). Equivalent circuit of the half-wave rectifier with the diode replaced with it's battery-plus resistance model.



(c).

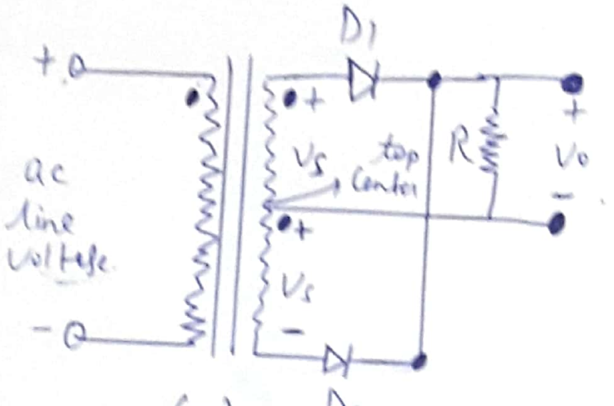
(C) Transfer characteristic of the rectifier circuit.

(d). Input and output waveforms, assuming that, $r_D << R$.

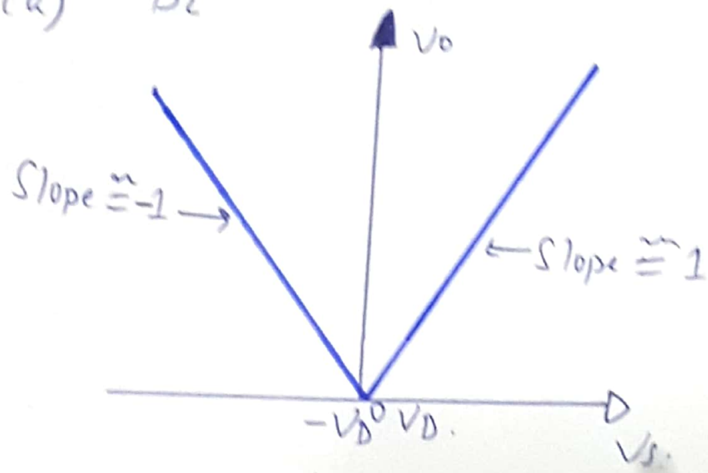


(d)

Full-wave Rectifier:



(a)



(b)

a). Circuit

b). transfer characteristic assuming a constant-voltage drop model for it's diodes.

Q2)b): Given Data:

$T = 785°C$

mass $(m) = 97.0g$.

$T = 15°C$

mass $(m) = 323g$.

Water Specific Heat $= (4.184 J/g°C)$.

– Lose heat = Gain Heat.

$$-[(C_{CuAu})(mass)(\Delta T)] = (C_{H_2O})(mass)(\Delta T).$$

Putting values.

$$-[(0.129) J/g°C)(97g)(T_f - 785°C) = (4.184 J/g°C)(323)(T_f - 15°C)].$$

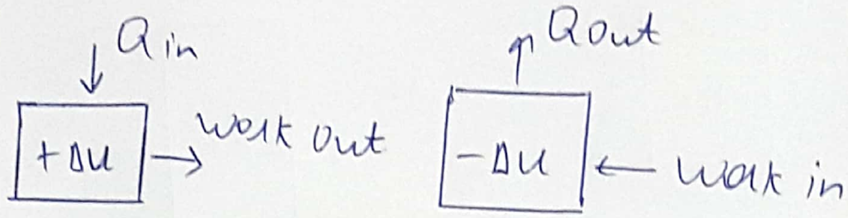
$$-[(12.5)(T_f - 785°C)] = (1.35 \times 10^3)(T_f - 15°C)]$$

$$-12.5 T_f + 9.82 \times 10^3 = 1.35 \times 10^3 T_f - 2.02 \times 10^4$$

$$3 \times 10^4 = 1.36 \times 10^3 T_f.$$

$$\boxed{T_f = 22.1°C}$$

Q No: 2) Ans. Isobaric Process:.



Constant Pressure, $\Delta P = 0$

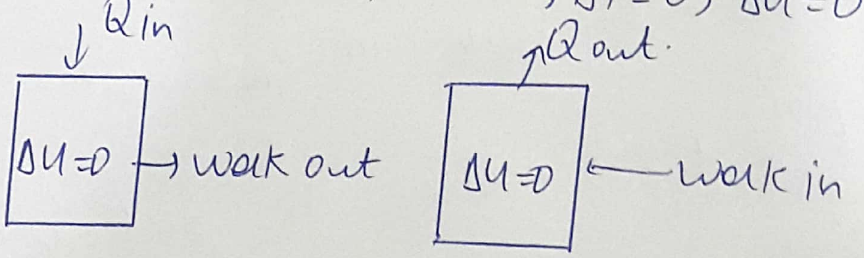
$\Delta Q = \Delta U + \Delta W$ But $\Delta W = P \Delta V$

Heat In = Wout + Increase in Internal Energy.

Heat Out = Wout + Decrease in Internal Energy.

• Isothermal Process:.

Constant Temperature, $\Delta T = 0$, $\Delta U = 0$

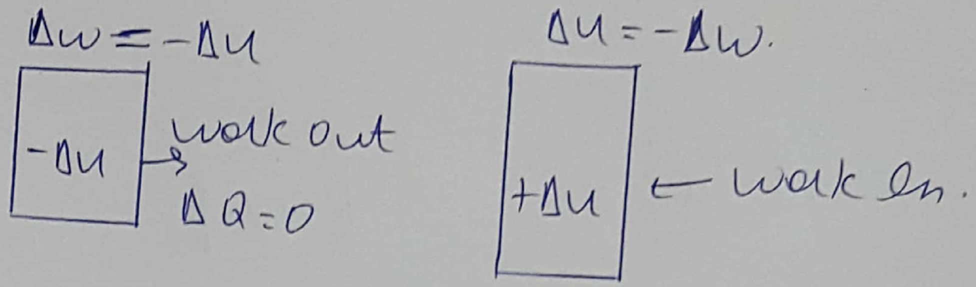


Net heat Input = Work Output.

Work Input = Net Heat Out.

Adiabatic Process.

$\Delta Q = \Delta U + \Delta W$; $\Delta W = -\Delta U$ or $\Delta U = -\Delta W$



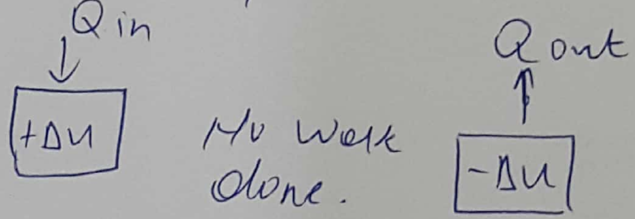
work done at Expense of Internal Energy

Input work Increases internal Energy.

ISOCHORIC PROCESS.

Constant Volume, $\Delta V = 0$, $\Delta W = 0$

$\Delta Q = \Delta U + \Delta W^{0}$ so that $\Delta Q = \Delta U$.



Heat In = Increase in Internal Energy.

Heat out = Decrease in Internal Energy.

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QNo: 2 b): Given Data:

$$e = 1 - \frac{T_L}{T_H}$$

$$e = 1 - \frac{300k}{500k}.$$

$$\boxed{e = 40\%}$$

Actual $e = 0.5 e_i = 20\%$.

$$e = \frac{W}{Q_H}.$$

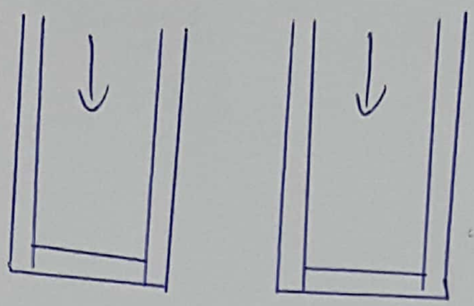
$$W = e Q_H = 0.20(600J)$$

$\boxed{\text{Work} = 120J}$ Answer.

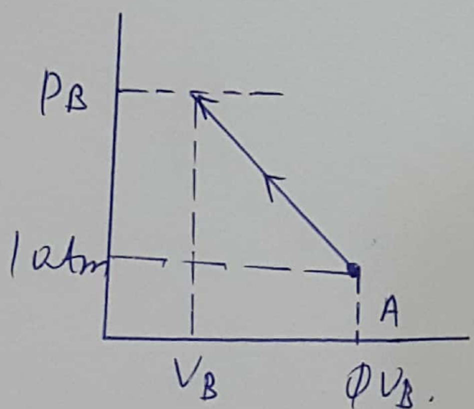
QNo: 3 a). Difference Btw Internal and External Combustion Engine:

Internal Combustion Engine	External Combustion Engine.
1). Combustion Take place inside the cylinder.	Combustion take place outside the cylinder.
2). Temperature is higher.	Temperature is lower.
3). Pressure in higher.	Pressure in lower.
4). Lighter in weight	Heavy in weight.
5). Fuel tank required to store fuel.	Boiler and water storage required to generate steam.

QNo: 3 b): Given Data.



$\Delta Q = 0$



$$P_A V_A^{T} = P_B V_B^{T}$$

Solve for P_B.

$$P_B = P_A \left[\frac{V_A}{V_B}\right]^{T}$$

$P_B = 32.4$ atm.

or

$P_a = 3284$ kPa

Q4) a).

Conduction	Convection.
Energy transffered by direct contact.	Occurs in Gases and liquids.
Energy flows directly from warmer to cooler objects.	movement of large number of particles in same direction.
Continues unit objects temperatures are equal.	Cycle occurs while temperature differences exists.

Q4) b). Given Data:.

$$Q_{water} = -Q_{Pb}.$$

$$m_{water} C_{water} = -(m_{pb} C_{pb} \Delta T_{pb})$$

$$125(4.18)(T_f - 23) = -75(0.13)(T_f - 435)$$

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

$$+9.75T_f + 12017.5 = +9.75T_f + 12017.5$$

$$532.25T_f = 16258.75$$

$$\boxed{T_f = 30°C}$$

Q5) Given Data:.

Solution:

Nothing that heat transfer through the roof is by conduction and area of the roof is.

$A = 6m \times 8m = 48m^2$.

The steady rate of heat transfer through the roof is determined to be,

$Q = kA(T_1 - T_2)/L$

$Q = (0.8)(48)(25-0)/0.25$

$Q = 3840 W$

or

$Q = 3.84 kW$.

After 10 hrs period amount of heat and it's cost =!

$Q = Q \cdot \Delta t = (3.84 kW)(10) = 38.4 kWh$.

$$\text{Cost / day} = \frac{\text{Amount of energy}}{\text{Unit Cost of energy}}$$

$$\text{Cost / day} = \frac{(38.4\,\text{kWh})}{\$0.2/\text{k.w/hr}} = \$7.68$$

cost / month = (cost / day) x (30 day/ month)

Cost / Month = \$7.68 x 30.

Cost / month = \$230.4.