IQRA NATIONAL UNIVERSITY

Basic Electro Mechanical Engineering

Final Term Examination
(Summer 2020)

Name = Mujahid Afridi

I.D. = (7775)

Section = (A)

Teacher = ENGR.SYED ASHRAF ALI

Dated = 26/09/2020

Date: 26/ 09/ 20

Q 1:(a) What is Diode? Differentiate between Half-wave rectification and full-wave.

Ans: **Diode:**

A diode is an electronic component that;

=> has two terminal's
=> limits current to one direction.

- Diodes have an 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.

Differentiate b/w Half-wave and full-wave rectification.

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	Half-wave rectification	Full-wave rectification
1)	A half-wave rectifier is an electronic circuit which converts only one-half of the AC cycle into pulsating DC.	A rectifier converts AC voltage into pulsating DC voltage.
2)	It utilizes only half AC cycle for the conversion process	Full-wave rectifier is an electronic circuit which converts entire cycle of AC into pulsating DC.
3)	The half-wave rectifier is unidirectional; it means it will allow the conduction in one direction only. That's why either it can convert positive half only or negative half only into DC voltage. This is reason called half-wave rectification	Full-wave rectifier is bi-directional, it conducts for positive half as well as negative half of the cycle. Thus, it is termed as full wave rectification.

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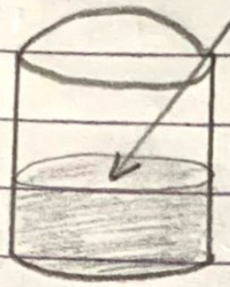
(1) (b) A 97.0 g sample - - - - - - - - - - - - - - - - - 4.184 J/g°C.



T= 785°C
mass = 97.0 g

T= 15.0°C
mass= 323g

- Lose heat = Gain heat

$-[(C\,Au)(mass)(\Delta T)] = (C\,H_2O)(mass)(\Delta T)$

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

$-[(12.5)(T_f - 785°C)] = (1.35\times10^3)(T_f - 15°C)]$

$-12.5\,T_f + 9.82\times10^3 = 1.35\times10^3\,T_f - 2.02\times10^4$

$3\times10^4 = 1.36\times10^3\,T_f$

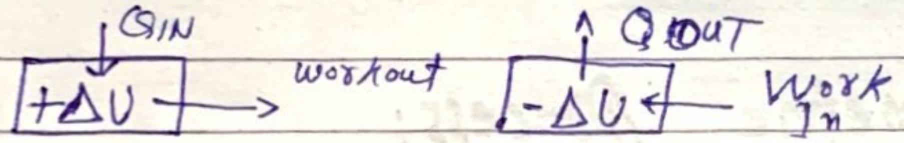
$T_f = 22.1°C$

Q2:- E
(a) Explain the Isobaric process, Isometric process, Isothermal Process and adiabatic.
Process on the basis of first law of thermodynamics.

Isobaric Process:

Constant pressure, $\Delta P = 0$

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

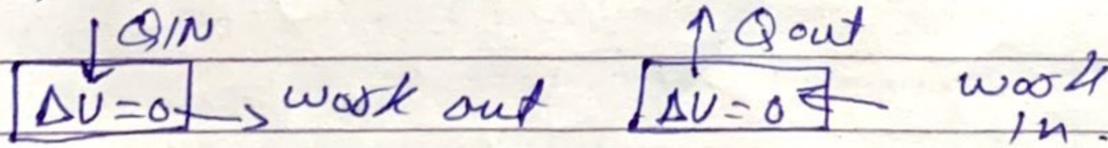


Heat IN = Wout + Increase in internal energy
Heat OUT = Wout + Decrease in internal energy

Isothermal process:

Const. Temperature, $\Delta T = 0$, $\Delta U = 0$

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



Net heat input = work output
Work input = Net heat out

ADIABATIC PROCESS:

No heat exchange, $\Delta Q = 0$

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

$\Delta W = -\Delta U$ $\Delta U = -\Delta W$

$\boxed{-\Delta U}$ work out, $\Delta Q = 0$ $\boxed{+\Delta U}$ work in

Isometric Process:

An Isometric process, also called a constant-volume process, an isovolumetric process, or an isometric process, is a thermodynamic process during which the volume of the closed system undergoing such a process remains constant.

2(b) A steam engine - - - - - - - - - - - - - is done.

Sol..

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

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

$e = 40\%$

Actual $e = 0.50 i = 20\%$

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

$W = eQ_H = 0.20 (600j)$

Work $= 120j$

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Q3(a) Differentiate b/w internal combustion engine and external combustion engine.

	Internal Combustion Engine	External Combustion Engine
1)	In an internal combustion engine, the combustion chamber lies right in the middle of the engine.	In an external combustion engine, the fuel isn't burned inside the engine.
2)	Internal combustion engines rely on the explosive power of the fuel within the engine to produce work.	External engine have a working fluid that is heated by the fuel.
3)	Two types 1) Ignition gasoline engine 2) Diesel engine.	Types Stirling engines.

~~Mostly~~ ~~four~~
four strokes

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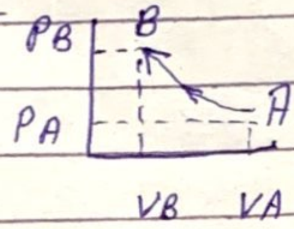
3(b) A diatomic gas - - - - - - -
- - - - . - . - - - ($\gamma = 1.4$).

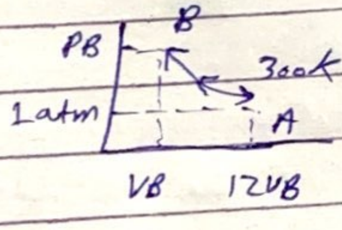
Sol:-



$P_A V_A^{\gamma} = P_B V_B^{\gamma}$

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

Find P_B



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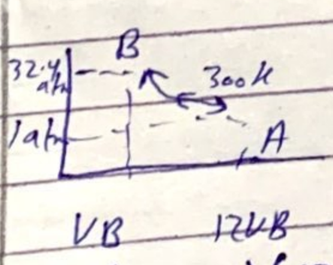
$P_A V_A = P_B V_B$
Solve for P_B

$P_B = P_A \left(\frac{V_A}{V_B}\right)^{\gamma}$

$P_B = 32.4$ atm
or 3284 kPa



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

Solve for T_B

$\frac{(1\,atm)(12V_B)}{300k} = \frac{(32.4\,atm)(1V_B)}{T_B}$

$\boxed{T_B = 810\,k}$

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Q.4(a) Differentiate b/w conduction and convection.

	Conduction	Convection
1)	Energy transferred by direct contact.	Occurs in gases and liquids.
2)	Energy flows directly from warmer to cooler objects.	Movement of large number of particles in same direction.
3)	Continues until object temperature are equal.	Cycle occurs while temperature differences exist.

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4(b) A 75.0 g piece — — — — — — — — — — — mixture?

Sol:-

$$Q_{water} = -Q_{pb}$$

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

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

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

$$+9.75T_f + 12017.5 \qquad +9.75T_f + 12017.5$$

$$532.25T_f = 16258.75$$

$$T_f = 30.5°C$$

Q5:- The roof of an - is \$0.2/kWh.

Sol:-

~~Noth~~ Noting that heat transfer through the roof is by conduction and the area of the roof is;

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

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

$\dot{Q} = kA(T_1 - T_2)/L = (0.8)(48)(25-0)/0.25$
$= 3840\,W = 3.84\,kW$.

The amount of heat lost through the roof during a 10-hour period and its cost are determined from;

$Q = \dot{Q} \cdot \Delta t = (3.84\,kW)(10\,h) = 38.4\,kWh$

Cost/day = (Amount of energy)(unit cost of ~~mone~~ energy).

= (38.4 kWh)(\$0.2/kWh) = \$7.68

Cost/month = (cost/day) x (30 day/month) =
= \$7.68 X 30 = \$230.4