Date:

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1) What is diode? Differentiate between half-wave & Full wave rectification?

## Diode

1) Two - terminal electronic component that only conducts current in one direction. is called diode.

| | Half-Wave | Full wave |
|---|---|---|
| i) | Converts only one-half of the AC cycle into pulsating DC. | i) An electronic circuit which converts entire cycle of AC into pulsating DC. |

(1b) A 97.0 g sample of gold at 785°C ........ (water specific heat = 4.184J/g°C) ?

Sol:

[illegible]

Required :- Final temperature of mixture

Solution:-

$$-\text{Lose}_{heat} = \text{Gain}_{heat}$$

$$-[(0.129\,J/g^\circ C)(97g)(T_f - 785^\circ C)] = [(4.184\,J/g^\circ C)(323)(T_f - 15^\circ C)]$$

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

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

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

$$\boxed{T_f = 22.1\,C}$$ Ans

Q2)

a) Explain the Isobaric process, Isometric process, and adiabatic process on the basis of first law of thermodynamics?

Isobaric Process

•) The pressure stays constant : $\Delta P = 0$.

•) The heat transferred to the system ~~~~ ~~~~ does work.

•) Also changes the internal energy of the system.

Isometric Process

•) The volume of the closed system undergoing such a process remains constant.

•) System is confined by mechanically rigid boundaries.

Adiabatic Process

•) Occurs without transferring heat or mass between a thermodynamic system & it's surroundings.

•) Transfers energy to the surroundings only as work.

## Isothermal Process

•) The Temperature of a system remains constant.

•) The transfer of heat into or out of the system happens so slowly that thermal equilibrium is maintained.

2b) A steam egine absorbs 600J ... how much work is done?

Given,

$Q_H = 600J$.

$T_C = 300K$

$T_H = 500K$

Required:

Work = ?

Soln

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

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

$$e = 40\%$$

Actual $e = 0.5 e_i = 20\%$

Now

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

$$W = e Q_H$$

$$= 0.20 (600J)$$

Work = 120 J

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Q3) Differentiate b/w internal combustion engine and External combustion engine.

| Internal Combustion Engine | External Combust Engine |
|---|---|
| It Rely on the expolsive power of the fuel within the engine to produce work. | Have a working fluid that is heated by the fuel |

3b) A diatomic gas at 300K and 1 atm ........... ........ What is the new pressure and temperature?

Data

$T_A = 300K$
$P_A = 1\ atm$
$V = 1/12 \quad (V_A = 12 V_B)$

Required

$T_B = ?$

$P_B = ?$

Formulas :- $P_A V_A^{\gamma} = P_B V_B^{\gamma}$

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

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

Solⁿ.

For $P_B = ?$

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

$$P_B = P_A \left[ \frac{12 V_B}{V_B} \right]^{1.4}$$

$$P_B = (1 atm)(12)^{1.4}$$

$P_B = 32.4$ atm or 3284 Pa

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Now

$T_B = ?$

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

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

$T_B = 810\,K$

Q4)
a) Differentiate between conduction and convection

| Conduction | Convection |
|---|---|
| Heat transfer takes place between objects by direct contact. | The heat transfer take within the fluid. The heat transfer occurs through a heated solid objet. |

4B) A 75.0g piece of lead (specific heat = 0.130 J/g°C) ...................... What is the final temperature of the mixture?

Data:

$M_{water} = 125 g.$

$C_{water} = 4.18$

$C_{Pb} = 0.13 J/gC$

$M_{Pb} = 75 g.$

Required:

$T_f = ?$

Sol:

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

$(M_{water})(C_{water})(\Delta T_{water}) = -(M_{Pb} C_{Pb} \Delta T_{Pb})$

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

$$522.5(T_f - 23) = -(9.75)(T_f - 435)$$

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

$$522.5\,T_f + 9.75\,T_f = 4241.25 + 12017.5$$

$$523.25\,T_f = 16258.75$$

$$T_f = \frac{16258.75}{532.25}$$

$$T_f = 30.5\,C$$

Date:

Q5) The roof of an electrically heated home is 6m long. 8m wide, and 0.25 m thick

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--- is $0.2/KWh.

Area of roof is

$A = 6m \times 8m = 48m$

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

$Q = KA(T-T)/L$

$= \frac{(0.8)(48)(25-0)}{0.25}$

$= 3840$ W

$= 3.84$ KW.

The amount of heat loss through the roof during a 10-hour period and it's cost are determined.

From;

$Q = \dot{Q} \cdot \Delta t$

$= (3.84\ kW)(10h)$

$= 38.4\ kWh.$

Cost / day = (Amount of energy) (unit cost of energy)

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

$= \$7.68$

Cost / month = (Cost / day) x (30 days / month)

$= \$7.68 \times 30$

$= \$230.4$ An