9) A

a)

i. $P_1 = I_1{}^2R = \left(\frac{P}{V}\right)^2 R$

$= \left(\frac{25\times10^6}{25\times10^3}\right)^2 10 = 10\times10^6W = 10MW$ ———— **02**

ii. $P_1 = \left(\frac{25\times10^6}{25\times10^4}\right)^2 10 = 10\times10^4W = 0.1MW$ ———— **02**

b)

i. DC current cannot be stepped up or stepped down, so , power dissipation is high ———— **02**

ii. $25000 - V_X = 1000\times10$

$V_X = 15000V$ ———— **01**

iii. $250000 - V_Y = 100\times10$

$V_Y = 249000\ V$ ———— **01**

c)

i. $V_{peak} = 380\times10^3\sqrt{2}\ V$ ———— **01**

ii. $E = -\frac{\delta V}{\delta x} = \frac{380\times10^3\sqrt{2}}{3.5}$ ———— **02**

d)

i. If humidity is high ,more crackling sound because breaking field strength is low for moisture air ———— **02**

ii. For the explanation of corona discharge ———— **02**

Marks -15

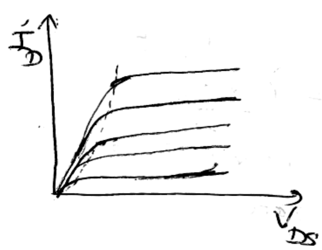
9) B

a)

JFET	BJT
One p-n junction	two p-n junction
Charge carrier electron or hole	Charge carrier both electron and hole
Controlled by field	Controlled by current ———— **02**

b)

i.



———— **02**

ii. V_{GS}-Gate –source voltage ———— 01

iii. Marking linear region, saturation region and cut off region all correct ———— 01

c)

i. Identifying zero gate current ,I_G =0

Voltage drop across R_G =0 ($I_G R_G$=0)

V_G =0 ———— **01**

ii. $I_D = I_S$ ———— **01**

$V_S = I_D R_S$ ———— **01**

$V_{GS} = V_G - V_S = 0 - I_D R_S$

$$I_D = \frac{-V_{GS}}{R_S}$$

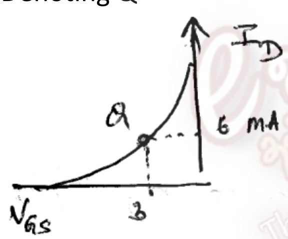
iii. Applying the Kirchhoff's laws $V_{DS} = V_{DD} - I_D(R_D + R_S)$ ———— **01**

d)

i. Cut-off voltage $V_{GS(off)} = -8V$

$I_{DSS} = 16mA$ } ———— **01**

ii. Denoting Q ———— **01**



iii. $V_{GS} = -3V(accept\ value\ between -2.5\ to -3.5)$ ———— **01**

$I_D = \frac{-V_{GS}}{R_S}$

$$-6 \times 10^{-3} = \frac{-3}{R_S}$$

$R_S = 500\Omega$ ———— **01**

iv. $V_{DS} = V_{DD} - I_D(R_D + R_S)$

$= 10 - 6 \times 10^{-3}(500 + 500) = 4V$ ———— **01**

Marks -15

10) A

i. $Pv = \frac{w}{m} RT$ ———— **01**

$$w = \frac{PVm}{RT} = 1 \times \frac{10^5 \times 100 \times 10^{-6} \times 30 \times 10^{-3}}{8.3 \times 300}$$

$$= 0.12 \times 10^{-4} kg$$ ———— **01**

ii. $Q = ms\theta = 0.12 \times 10^{-4} \times 1000 \times 150 \times 750 = 1350J$ ———— **01**

iii. $Q = ms\theta = 1 \times 250 \times 150 = 3.75 \times 10^4$J ———— **01**

iv. $P = \frac{1350+3.75\times10^4}{60}$ ———— **01**

$P = \frac{3.885\times10^4}{60} = 0.06 \times 10^4 W = 0.6\, kW$ ———— **01**

v. $\frac{P_2}{T_2} = \frac{P_1}{T_1}$

$$\frac{P_2}{450} = \frac{1 \times 10^5}{300}$$

$P_2 = 1.5\times 10^5 Pa$ ———— **01**

Additional thrust = $(P_2 - P_1)A = (1.5 \times 10^5 - 1 \times 10^5) \times 20 \times 10^{-4} = 100N$ ———— **01**

vi. $P_1V_1 = P_2V_2$

$1.5\times 10^5 \times 100 = 1 \times 10^5 V_2$

$V_2 = 150cm^3$ ———— **01**

vii. $P = P\, \Delta V \times \frac{750}{60}$ ———— **01**

$P = 1 \times 10^5 \times 50 \times 10^{-4} \times \frac{750}{60} = 12.5W$ ———— **01**

viii. $\frac{Q}{t} = \frac{ms\theta}{t}$

$\frac{3.75\times10^4}{60} = \frac{m}{t} \times 4200 \times 60$ ———— **01**

$\frac{m}{t} = 2.48 \times 10^{-3} kgs^{-1}$ ———— **01**

ix. Increase the area ———— **01**

x. Specific heat capacity of water is high ———— **01**

Marks -15

10) **B**

a)

i. Nuclear fusion — Nuclear fission

Assembling less weight nucleus into heavy nucleus — Splitting heavy nucleus into lighter nucleus ________ **01**

Take place at high temperature — Bombardment by slowly moving neutrons with nucleus ________ **01**

ii. $4{}_{1}^{1}H \rightarrow {}_{2}^{4}He + 2{}_{+1}^{0}e + energy$ ________ **01**

iii. Defect mass=(4X1.007825u-4m$_e$) – (4.002603u-2m$_e$)+2m$_e$ ________ **01**

=4.0313u- 4.002603u

=0.02867u ________ **01**

Released energy = 931 $\frac{MeV}{c^2}$X0.02876Xc^2 =26.69X10^{6}X1.6X10^{-19}J=42.71X10^{-13} J ________ **01**

iv. The rate of consumed Hydrogen =$\frac{4\times1\times10^6}{42.71\times10^{-13}} = 9.37 \times 17/_{sec}$ ________ **01**

b)

i. For the suitable explanation. ________ **01**

ii. $x = 3$ ________ **01**

iii. $Intial\ mass = (392.61 \times 10^{-27} + 1.685 \times 10^{-27})kg$

$Final\ mass = (388.94 \times 10^{-27} + 3 \times 1.685 \times 10^{-27})kg$

$Defect\ mass = 0.307 \times 10^{-27}kg$ ________ **01**

iv. $E = \Delta mc^2$

$E = 0.307 \times 10^{-27}(3 \times 10^8)^2$ ________ **01**

$E = 2.763 \times 10^{-11}J$ ________ **01**

v. $2.763 \times 10^{-11} \times \frac{10}{100} \times \frac{25}{100} = \frac{2.763}{4} \times 10^{-12}J$ ________ **01**

$The\ energy\ converted\ into\ electricity\ in\ one\ second = 6.907 \times 10^{-13}J$

$The\ energy\ obtained\ by\ 1\ U\ nucleus = 6.9 \times 10^{-13}J$

$The\ energy\ converted\ into\ electricity\ in\ one\ second\ by\ 392.617 \times 10^{-27}kg\ U\ nucleus$

$= 6.9 \times 10^{-13}J$ ________ **01**

$Mass\ of\ U = \frac{300\times10^6}{6.9\times10^{-13}} \times 392.617 \times 10^{-27}kgs^{-1} = 170.69 \times 10^{-6}kgs^{-1}$ ________ **01**

Marks -15