Final Exam - (Summer-2020)

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Physics (II) - (201)

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Answer to the Question no — (7)(b)

(i) 39°c to °F

we know

$$\frac{C}{5} = \frac{F-32}{9}$$

$$\Rightarrow F = \frac{9C}{5} + 32$$

$$\therefore F = \frac{9 \times 39}{5} + 32$$

$$= 102.2^{\circ}F \text{ Ans.}$$

(ii) 300K to °c

we know, $C = K - 273.15$

$$C = 300K - 273.15$$

$$= 26.85^{\circ}C \text{ Ans.}$$

(iii) 25°C to °K

we know

$$C = K - 273.15$$

$$\Rightarrow K = C + 273.15$$

$$\Rightarrow K = 25^\circ + 273.15$$

$$\therefore K = 298.15^{\circ}K.$$

Answer to the Question no – (1) (a)

Here, $T_2 = 7^\circ C = (273^\circ + 7)K = 280\ K$

$$\eta = 50\% = \frac{50}{100} = 0.5$$

$$\eta' = 70\% = \frac{70}{100} = 0.7$$

$$\Delta T = T_1 - T_1' = ?$$

we know,

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

$$\Rightarrow 0.5 = 1 - \frac{280}{T_1}$$

$$\Rightarrow \frac{28}{T_1} = 1 - 0.5$$

$$\Rightarrow \frac{280}{T_1} = 0.5$$

$$\Rightarrow T_1 = \frac{280}{0.5}$$

$$\therefore T_1 = 560K$$

Again, $\eta' = 1 - \frac{280}{T_1'}$

$$\Rightarrow 0.7 = 1 - \frac{280}{T_1'}$$

$$\Rightarrow \frac{280}{T_1'} = 1 - 0.7$$

$$\Rightarrow \frac{280}{T_1'} = 0.3$$

$$\Rightarrow T_1' = \frac{280}{0.3}$$

$$\Rightarrow T_1' = 933.33K$$

$\therefore \Delta T = T_1 - T_1' = (933.33 - 560)K =$

$= 373.33K$

Answer to the Question no - (1)(b)

We know,

Steam point = 100°C = 373K = T_1

Ice point = 0°C = 273K = T_2

Now the efficiency.

$$\eta = \left(1 - \frac{T_2}{T_1}\right) \times 100$$

$$\Rightarrow \eta = \left(1 - \frac{273}{373}\right) \times 100$$

$$\Rightarrow \eta = (1 - 0.732) \times 100$$

$$\Rightarrow \eta = 0.27 \times 100$$

$$\therefore \eta = 27\% \text{ (Ans.)}$$

Answer to the Question no (2)(a)

Here, $T_1 = 80°C = (80 + 273)K = 353K$

$P_1 = 50atm$

$V_1 = V$ and $V_2 = 10V$, $P_2 = ?$

We know,

$$P_1V_1 = P_2V_2$$

$$\Rightarrow P_2V_2 = P_1V_1$$

$$\Rightarrow P_2 = \frac{P_1V_1}{V_2}$$

$$\Rightarrow P_2 = \frac{80 \times V}{10V}$$

$$\therefore P_2 = 8atm \text{ (Ans.)}$$

Answer to the Question no – (2)(b)

Here, $n = 5$ mole; Let $V_1 = V$ and $V_2 = 10V$

$T = 400K$, $R = 8.31 J mol^{-1} K^{-1}$

We know,

Work done, $W = nRT \ln\left(\frac{V_2}{V_1}\right)$

$\Rightarrow W = 5 \times 8.31 \times 400 \times \ln\left(\frac{10V}{V}\right)$

$\Rightarrow W = 5 \times 8.31 \times 400 \times \ln(10)$

$\therefore W = 38268.97 J$

or $W = 38.26897 KJ$.

Answer to the question no – (4)a

We know,

$Q_1 = ml_1$

$= 2 \times 3.36 \times 10^5$

$= 672000 J$.

$= 6.72 \times 10^5 J$

$m = 2$

$l_1 = 3.36 \times 10^5 J Kg^{-1}$

we.
Know,

$Q_2 = ms\Delta\theta$

$= 2 \times 4200 \times 0$

$= 0\,J$

Here,

$m = 2$

$s = 4200$

$\Delta\theta = \theta_2 - \theta_1$

$= 273 - 273$

$= 0$

we Know,

$Q_3 = ml_v$

$= 2 \times 2268 \times 10^5$

$= 453600\,J$

$= 45.36 \times 10^5\,J$

Here

$m = 2$

$l_v = 2268 \times 10^5$

Now we have

$Q = Q_1 + Q_2 + Q_3$

$= 672000 + 0 + 453600\,J$

$= 5208000\,J$ (Ans.)

$= 52.08 \times 10^{-6}\,J$ (Ans.)

(4)(6).

we know,

$$V = \frac{mRT}{PM}$$

$$= \frac{20 \times 10^{-3} \times 8.31 \times 300}{32 \times 10^{-3} \times 95933.38}$$

$$= 0.0162 m^3$$

Here,

$R = 8.31 JK^{-1}mol^{-1}$

$m = 20 \times 10^{-3} Kg$

$T = 27 + 273 = 300K$

$P = 0.72 \times 13596 \times 9.8$

$= 95933.38$

$M = 32 \times 10^{-3} Kg$

$V = ?$

Answer to the question no — 7(a)

we know,

$$V_2 = V_1[1 + \gamma \Delta t]$$

$$= 100[1 + 0.00018 \times 25]$$

$$= 100.45 cm^3$$

$$\Delta V = V_2 - V_1$$

$$= 100.45 - 100$$

$$= 0.45 cm^3 \text{ Ans.}$$

Here

$t_1 = 10°C$

$t_2 = 30°C$

$\gamma = 0.00018 °C^{-1}$

$V_1 = 100 cm^3$

$V_2 = ?$

$\Delta t = 35 - 10$

$= 25°C$

Answer to the Question no – (6)(b)

Given that,

$l_0 = 5m$

$l' = 0.71cm = 0.71 \times 100 = 71m$

$\alpha = ?$

$\Delta T = 50° C = (50 + 273)K = 323K$

we know,

$$\alpha = \frac{l' - l_0}{\Delta T}$$

$$= \frac{71 - 5}{323}$$

$$= \frac{66}{323}$$

$\therefore \alpha = 0.20433 mK^{-1}$

Answer to the Question no – (6) (a)

we know,

$$c = \sqrt{\frac{3P}{f}}$$

$$= \frac{3 \times 1.013 \times 10^5}{1.43 Kg}$$

$\therefore c = 461 ms^{-1}$

Given that

$f = 1.43 kg m^{-3}$

$P = 1.013 \times 10^5 N m^3$

$c = ?$

Answer to the Question no - (5)(b)

Here; $m = 5kg$, $T_1 = 10^\circ C = (10 - 273)K$

and $s = 4.2 \times 10^3 \, J kg^{-1} K^{-1}$

$T_2 = 100^\circ C = (100 + 273)K = 373K$

Entropy change $dS = ?$

we know, $dS = \int_{T_1}^{T_2} \frac{dQ}{T} = \int_{283}^{373} \frac{dQ}{T}$

Here, $dQ = ms\,dT = 5 \times 4.2 \times 10^3 \times dT = 21 \times 10^3 dT$

$\therefore dS = \int_{283}^{373} 21 \times 10^3 \times \frac{dT}{T}$

$= 21 \times 10^3 \times \int_{283}^{373} \frac{dT}{T}$

$= 21 \times 10^3 \times [\ln T]_{283}^{373}$

$= 21 \times 10^3 \times [\ln 373 - \ln 283]$

$= 21 \times 10^3 \times \ln\left(\frac{373}{283}\right)$

$= 21 \times 10^3 \times 0.276135$

$= 5798.762 \, J K^{-1}$ (Ans)