JEE MAIN-2017 PHYSICS Code-C Solution

61. (2)

$\frac{f_0}{f_s} = \sqrt{\frac{c-v}{c+v}}$, Here v is positive, when moving away and v is negative when approaching

$$f_0 = f_s\sqrt{\frac{c-\left(-\frac{c}{2}\right)}{c+\left(-\frac{c}{2}\right)}}$$

$f_0 = f_s \times \sqrt{3}$

$f_0 = 17.3$ Ghz

62. (1)

$$T = \frac{rhg}{2}$$

$$\frac{\Delta T}{T} \times 100 = \frac{\Delta r}{r} \times 100 + \frac{\Delta h}{h} \times 100$$

after solving = 1.5%

63. (3)

$$-E + \frac{4}{3}E = \left(\frac{1}{3}E = \frac{hc}{\lambda_2}\right) \Rightarrow \lambda_2 = \frac{3\lambda c}{E} \qquad \dots (1)$$

$$-E + 2E \Rightarrow E = \frac{hc}{\lambda_1} \Rightarrow \lambda_1 = \frac{hc}{E} \qquad \dots (2)$$

$$\frac{\lambda_1}{\lambda_2} = \frac{hc}{E} \times \frac{E}{3hc} = \frac{1}{3}$$

64. (2)

$$\because \frac{1}{2}mv^2 = \frac{\frac{1}{8}}{4}mv_0^2; \quad v = \frac{v_0}{2} = 5\text{ m/s};$$

$$f = -kv^2;\ m\frac{dv}{dt} = -kv^2; \quad \int_{10}^{5}\frac{dv}{v^2} = -\int_0^{10}\frac{k}{m}dt$$

$$\frac{v^{-2+1}}{-2+1} = \frac{-k}{m}[t]_0^{10}, \quad \left[\frac{-1}{v}\right]_{10}^{5} = \frac{-k}{m} \times 10$$

$$-\frac{1}{5} + \frac{1}{10} = -\frac{k}{m} \times 10; \quad -\frac{1}{10} = \frac{-k}{10^{-2}} \times 10$$

$$k = \frac{10^{-2}}{100} = 10^{-4}\text{ kg/m}$$

65. (2)

$C_P - C_V = R$ (does not depend on the nature of gas)

66. (4)

$$I = \frac{mR^2}{2} + \frac{ml^2}{3} = \frac{mR^2}{2} + \frac{m}{3} \times \frac{V^2}{\pi^2 R^4}$$

Volume of cylinder

$$V = \pi R^2 l;\ \ l = \frac{V}{\pi R^2}$$

For minima

$$\frac{dI}{dR} = 0; \qquad \Rightarrow mR + \frac{mv^2}{3\pi^2}\frac{(-4)}{R^5} = 0;\ R = \frac{4V^2}{3\pi^2 R^5}$$

After putting the value of V

$$\frac{l}{R} = \frac{\sqrt{3}}{2}$$

67. (1)

At time t

$$\frac{N_B}{N_A} = .3 \Rightarrow N_B = .3\,N_A$$

also let initially there are total N_0 number of nuclei $N_A + N_B = N_0$

$$N_A = \frac{N_0}{1.3}$$

Also as we know

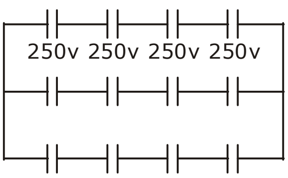
$$N_A + N_0 e^{-\lambda t};\ \frac{N_0}{1.3} = N_0 e^{-\lambda t};\ \frac{1}{1.3} = e^{-\lambda t} \Rightarrow \ell n(1.3) = \lambda t \text{ or } t = \frac{\ell n(1.3)}{\lambda}$$

$$t = \frac{\ell n(1.3)}{\frac{\ell n(2)}{T}} = \frac{\ell n(1.3)}{\ell n(2)}T$$

68. (1)

In balanced cond null point will not disturb.

69. (3)



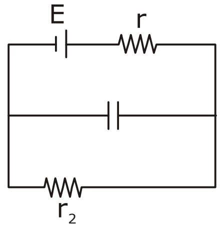
There should be + capacitor in series and voltage across each capacitor $= \frac{1000}{4} = 250$ V.

capacitance of each capacitor $= 1\ \mu F$; capacitance of combination of 4 capacitor $= \frac{1}{4}\ \mu F$

no. of branches $= \frac{2\mu F}{\frac{1}{4}\mu F} = 8$; There should be 8 branches and each has 4 capacitor

$\therefore$ Total no. of capacitor required $= 8 \times 4 = 32$

70. (2)



$$i = \frac{E}{r + r_2}\ ;\ V_C = ir_2;\ V_C = \frac{Er_2}{r + r_2}\ ;\ q = \frac{CEr_2}{r + r_2}$$

71. (3)

Applying KVL I = 0

72. (4)

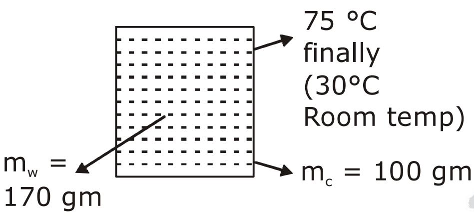
ω_m does not present in modulated wave.

73. (3)

In npn common input transister phase difference in input and output voltage is 180°.

74. (1)

m = 100 gm (T)



$(ms\Delta T)_{Cu} = (ms\Delta T)_{Cal} + (ms\Delta T)_{Water}$

$100 \times 1 \times (T - 75) = 100 \times 1 \times (75 - 30) + 170 \times 1 \times (75 - 30)$

$10T - 750 = 450 + 7650$

$10T = 8100 + 750$

$= 8850$

$T = 885\ °C$

75. (1)

$n_1\lambda_1 = n_2\lambda_2\ ;\ n_1 \times 650 = n_2 \times 520$

$$\frac{n_1}{n_2} = \frac{4}{5}$$

for minimum value of

$n_1 = 4,\ n_2 = 5$

$$y_1 = \frac{n_1\lambda_1 D}{d} = \frac{4 \times 650 \times 10^{-9} \times 150}{.5 \times 10^{-3}}\ ;\ y = 7.8\ \text{mm}$$

76. (2)

$\vec{p} = p\cos\theta\hat{i} + p\sin\theta\hat{j}$

$\vec{T_1} = (p\cos\theta\hat{i} + p\sin\theta\hat{j}) \times (E\hat{i});\ \vec{T_1} = -pE\sin\theta\hat{k}$

$\vec{T_2} = (p\cos\theta\hat{i} + p\sin\theta\hat{j}) \times \sqrt{3}E\hat{i}\ ;\ = \sqrt{3}\,p\,E\cos\theta\hat{k}$

$T_1 = -T_2$

$-pE\sin\theta = -\sqrt{3}\,pE\cos\theta$

$\tan\theta = \sqrt{3}\ ;\ \theta = 60°$

77. (4)

$$I\alpha = Mg \times \frac{L}{2}\sin\theta$$

$$\frac{ML^2}{3} \times \alpha = Mg \times \frac{L}{2}\sin\theta$$

$$\alpha = \frac{3g}{2L}\sin\theta$$

78. (4)

$$\Delta v = v\gamma\,\Delta T; \quad \frac{\Delta v}{v} = 3\alpha\Delta T$$

$$K = \frac{P}{\left(\frac{\Delta v}{v}\right)} = \frac{P}{3\alpha\Delta T}; \quad \Delta T = \frac{P}{3\alpha K}$$

79. (4)

$$\frac{1}{F} = \frac{1}{-25} + \frac{1}{20} + \frac{15}{25 \times 20}$$

$$F = \frac{-4+5+15}{100}; \quad F = \frac{16}{100}$$

$$F = \frac{4}{25} = +ve$$

means real for converging lens

u = –40 cm

v = ?, f = 20 cm

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}; \quad \frac{1}{20} = \frac{1}{v} - \frac{1}{40}; \quad \frac{1}{v} = \frac{1}{20} - \frac{1}{40}; \quad \frac{1}{v} = \frac{1}{40}; \ v = 40 \text{ cm}$$

from converging lens.

80. (4)

$$ev = \frac{hc}{\lambda}$$

log ev = log hc – log λ

this equation is like

y = mx – c

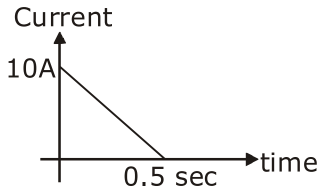
81. (3)

$$n_2 - n_1 = \frac{Pv}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right) = \frac{10^5 \times 30}{8.31}\left(\frac{1}{300} - \frac{1}{290}\right)$$

No. of molecules

$(n_2 - n_1) \times 6.23 \times 10^{23} = -2.5 \times 10^{25}$

82. (2)



$q = \frac{\Delta\phi}{R}$; $\Delta\phi$ = change in flux

$q = \int I dt$

= Area of current - time graph

$= \frac{1}{2} \times 10 \times 0.5 = 2.5$ columb

$q = \frac{\Delta\phi}{R}$

$\Delta\phi = 2.5 \times 100 = 250$ wb

83. (4)

$10 = 5 \times 10^{-3}(x + 15)$

$x = 1.985 \times 10^{3}\,\Omega$

84. (4)

F = 6t

$\Delta P = mv$

$\left|\frac{6t^2}{2}\right|_0^1 \Rightarrow \frac{3}{1} = v = 3$

$W = \frac{1}{2} mv^2 = \frac{1}{2} \times 1 \times 9$

= 4.5 J

85. (4)

$I\alpha = MB\sin\theta$

$I\alpha = MB\theta$

$\alpha = \frac{MB}{I}\theta$

$\omega = \sqrt{\frac{MB}{I}}$

$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{I}{MB}}$

$T = 2 \times 3.14 \sqrt{\frac{7.5 \times 10^{-6}}{6.7 \times 10^{-2} \times 0.01}}$

$10\,T = 2 \times 3.14 \times 10^{-1} \sqrt{1.1194} = 6.64$ sec

86. (3)

Inside the earth

$g \alpha r$

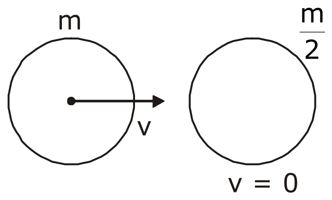
outside the earth

$g \alpha \frac{1}{r^2}$

87. (2)

At particular time the direction of velocity is opposite which is clear option 2.

88. (1)



$$v_1' = \frac{(m_1 - m_2)}{(m_1 + m_2)}; \quad v_2' = \frac{2m_1 v_1}{m_1 + m_2}$$

$$v_1' = \frac{\frac{m}{2} v}{\frac{3m}{2}} = \frac{v}{3}, \quad v_2' = \frac{2mv}{\frac{3m}{2}} = \frac{4v}{3}$$

$$\lambda = \frac{h}{p} \Rightarrow \frac{\lambda_A}{\lambda_B} = \frac{p_B}{p_A}; \frac{\lambda_A}{\lambda_B} = 2$$

89. (3)

Time per of K.E. is $\frac{T}{2}$ and K.E. is max at t = 0

90. (4)

$$\text{Stress} = \frac{F}{A} = \frac{mg}{A} = \frac{V\rho g}{A} = \frac{Al\rho g}{A}$$

stress $\alpha\ \ell$