AVIRAL CLASSES

IIT-JEE | NEET | FOUNDATIONS

ULTIMATE TEST SERIES JEE MAIN -2020

TEST-08 ANSWER KEY

Test Date :17-03-2020

[PHYSICS]

1. Using equation of continuity

सांतत्यता समीकरण लगाने पर

$A_1V_1 = A_2V_2 \quad \Rightarrow$

$$\frac{V_1}{V_2} = \frac{A_2}{A_1} = \left(\frac{4.8}{6.4}\right)^2 = \frac{9}{16}$$

2. Energy density in magnetic field = $\frac{B^2}{2\mu_0}$

$$= \frac{\text{Force} \times \text{displacement}}{(\text{displacement})^3} = \frac{MLT^{-2}.L}{L^3} = ML^{-1}\,T^{-2}$$

चुम्बकीय क्षेत्र में ऊर्जा घनत्व = $\frac{B^2}{2\mu_0}$

$$= \frac{\text{बल} \times \text{विस्थापन}}{(\text{विस्थापन})^3} = \frac{MLT^{-2}.L}{L^3} = ML^{-1}\,T^{-2}$$

3. **A**

4. $V_g = i_g R_g = 0.1$ V

V = 10 V

$$R = R_g\left(\frac{V}{V_g} - 1\right) = 100 \times 99 = 9.9\ K\Omega$$

5. Pitch पिच = $\frac{3}{6}$ = 0.5 mm

$$L.C. = \frac{0.5\ mm}{50} = \frac{1}{100}\ mm = 0.01\ mm$$

= 0.001 cm

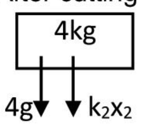
6. $r = \frac{mV}{qB} \Rightarrow P = QBr \Rightarrow \qquad K.E = \frac{Q^2B^2r^2}{2m}$

7. $K_2\,x_2 = 2g$ .....(i)

$T = k_2\,x_2 + 4g$ .....(ii)

$K_1\,x_1 = T + 2g$ .....(iii)

After cutting



$k_2x_2 + 4g = 4a$

$2g + 4g = 4a$

$4a = 6g$

$A = 15\ m/s^2$

8. $\frac{N}{N_0} = e^{-\lambda t_1} = \frac{1}{5}$ and $\frac{4}{5} = e^{-\lambda t_1}$

$\frac{1}{5} \times \frac{5}{4} = e^{\lambda(t_2 - t_1)} \qquad \Rightarrow \ln\frac{1}{4} = \lambda(t_2 - t_1)$

$\ln 4 = \lambda\,(t_1 - t_2)$

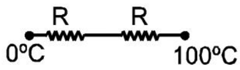
9. **D**

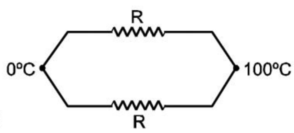
10. $n_1 = \frac{3V}{4L_1}$, $n_2 = \frac{3V}{2L_2}$

11. . $Z = \sqrt{R^2 + (x_C - x_L)^2}$

$$= \sqrt{R^2 + \left(\frac{R}{2} - R\right)^2} = \sqrt{R^2 + \frac{R^2}{4}},\ \tan\phi = (1/2)$$

12.





$$\frac{Q_1}{t_1} = i_{H_1} = \frac{100 - 0}{2R} = \frac{50}{R}$$

$$i_{H2} = \frac{100}{R/2} = \frac{200}{R} = \frac{Q_2}{t_2}$$

$Q_1 = Q_2 = 10$ cal.

$$\frac{50}{R} \times (2) = \frac{200}{R} \times t_2 \qquad \Rightarrow \qquad t_2 = \frac{1}{2}\ \text{min.}$$

13. **C**

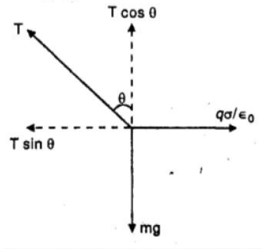
14. $\Delta u = nC_v\Delta T = n\frac{R}{\gamma-1}\Delta T = \frac{p\Delta V}{\gamma-1} = \frac{pV}{\gamma-1}$

15. We know that $\mu = \frac{\sin i}{\sin\frac{A}{2}}$ $\therefore \sqrt{2} = \frac{\sin i}{\sin 60}$

$\therefore \sin i = \sqrt{2}\times\frac{1}{2}$ $\therefore$ i = 45°

16. From the figure, $T\sin\theta = \frac{\sigma q}{\varepsilon_0}$ ...(i)

where 'q' is the charge on the ball,



Also

T cos θ = mg ...(ii)

From eqn (i) and (ii)

$\frac{T\sin\theta}{T\cos\theta} = \frac{\sigma q}{\varepsilon_0 mg} \Rightarrow \tan\theta = \frac{\sigma\theta}{\varepsilon_0 mg} \Rightarrow \sigma \propto \tan\theta$

i.e., the surface charge density σ of the sheet is proportional to tan θ.

17. The capacitance of a parallel plate capacitor in the absence of the dielectric is $C_0 = \frac{\varepsilon_0 A}{d}$ ... (1)

where A is the area of each plate and d is the distance between them

the capacitance of a parallel plate capacitor in the presence of dielectric slab of thickness t and dielectric constant K, is

$$C = \frac{\varepsilon_0 A}{(d-t)+\left(\frac{t}{K}\right)} = \frac{\varepsilon_0 A}{\left(d-\frac{3}{4}d\right)+\left(\frac{3d}{4K}\right)}$$

$$C = \frac{\varepsilon_0 A}{\frac{d}{4}+\frac{3d}{4K}} = \frac{4K\varepsilon_0 A}{d(K+3)} \quad \text{... (2)}$$

Divide (2) by (1), we get

$$\frac{C}{C_0} = \frac{4K\varepsilon_0 A}{d(K+3)}\times\frac{d}{\varepsilon_0 A} = \frac{4K}{K+3}$$

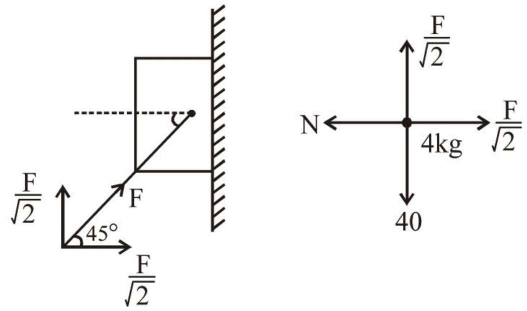
18. The magnetic field due to AB and ED is zero because, the point O lies on the same line. Both the magnetic fields produced due to BC and EF at O are directed out of the plane of paper (By right hand Clasp rule). Therefore the resultant field

$B = B_1 + B_2 = \frac{\mu_0 I}{4\pi d} + \frac{\mu_0 I}{4\pi d} = \frac{\mu_0 I}{2\pi d}$.

19. $\omega = \frac{v}{r}$. Further, $v \propto \frac{1}{n}$ and $r \propto n^2$

$\therefore \omega \propto \left(\frac{1}{n^3}\right)$

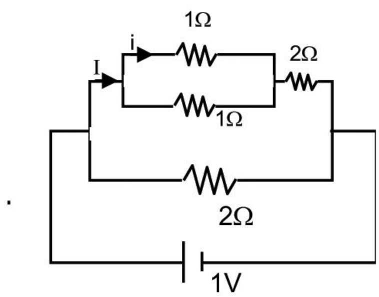
20.



$\frac{F}{\sqrt{2}} = 40 = N$

INTEGER

21.



I = $\frac{1}{2.5}$ = 0.4A ⇒ i = $\frac{I}{2}$ = 0.2A

22. Diode is in forward bias, so it will behave as simple wire so,

डायोड अग्र बायस अवस्था में है, अतः यह साधारण तार की तरह कार्य करेगा।

23. $\frac{I_1}{I_2} = 4$

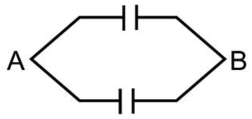
$I_{min} = \left(\sqrt{I_1} - \sqrt{I_2}\right)^2 = (\sqrt{I_2})^2 = I_2$

$I_{max} = \left(\sqrt{I_1} + \sqrt{I_2}\right)^2 = \left(\sqrt{4I_2} + \sqrt{I_2}\right)^2$

$\left(3\sqrt{I_2}\right)^2 = 9I_2 \quad \Rightarrow \quad \frac{I_{min}}{I_{max}} = \frac{1}{9}$

$\therefore \frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{9-1}{9+1} = \frac{8}{10} = \frac{4}{5}$

24.



$C_{eq} = \frac{2A\varepsilon_0}{d}$

25. T $(4\pi r)$ = mg

[CHEMISTRY]

26. **C**

27. $\Delta T_f = \frac{1000K_f w}{mW}$

ΔT_f = 0.19ºC ; = 5.08 K kg mo^{-1} , w = 1 g ; W = 80 g

m = $\frac{1000\ K_f w}{\Delta T_f W} = \frac{1000 \times 5.08 \times 1}{0.19 \times 80}$ = 334.21

Atomic weight of As = 74.92

Hence, number of atoms = $\frac{334.21}{74.92}$ = 4

Hence, the formula of arsenic is As_4

28. **B**

29. **D**

30. **A**

31. $N_2 + O_2 \rightarrow 2NO$

$3O_2 \rightarrow 2O_3$

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

$AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$

32. **C**

33. **A**

34. A

35. D

36. **D**

37. **B**

38. **D**

39. **C**

40. **D**

41. **A**

42. **C**

43. Reimer-Tiemann reaction involves a carbene intermediate.

44. **B**

45. **D**

INTEGER

46. 7

47. **8**

48. 3

49. **2**

50. 4

[MATHEMATICS]

51. **Ans. (2)**

Using $\int_0^1 f(x)dx = \int_0^1 f(1-x)dx$

$$I = \int_0^1 \sqrt[3]{x^2(2x-3)+(1-x)}\,dx$$

$$= \int_0^1 \sqrt[3]{(1-x)^2(-1-2x)+x}\,dx$$

$$= -\int_0^1 \sqrt[3]{(x^2-2x+1)(1+2x)-x}\,dx$$

$$= -\int_0^1 \sqrt{2x^3-3x^2-x+1}\,dx = -I$$

$2I = 0 \qquad \therefore \quad I = 0$

52. **Ans. (2)**

Given $I = \prod_{r=1}^{59}\left(1 - \frac{\cos(60° + r°)}{\cos r°}\right)$

$$= \prod_{r=1}^{59} \frac{\sin(30° + r°)}{\cos r°}$$

$$= \frac{\sin 31°.\sin 32°......\sin 89°}{\cos 1°.\cos 2.......\cos 59°} = 1$$

53. Ans. (3)

$$\left(\frac{2\sin x-1}{2\sin x}\right)\cos^2 2x=\frac{2\sin^2 x-3\sin x+1}{\sin x}$$

$$=\frac{(2\sin x-1)(\sin x-1)}{\sin x}$$

$$\Rightarrow \quad \sin x=\frac{1}{2} \quad \text{or} \quad \frac{1}{2}\cos^2 2x=\sin x-1$$

$\Downarrow$ ≥ 0 ≤ 0

4 solutions   Hence no solution

54. Ans. (4)

$$I=\int\frac{\text{cosec}^2x}{(\text{cosec}x+\cot x)^{9/2}}dx$$

Put cosecx + cotx = z

$$\text{cosec}x-\cot x=\frac{1}{z}.$$

$$-2\text{cosec}^2x\,dx=\left(1+\frac{1}{z^2}\right)dz$$

$$\therefore \quad I=-\frac{1}{2}\int\frac{1+\frac{1}{z^2}}{z^{9/2}}dz=-\frac{1}{2}\left[\int z^{-9/2}dz+\int z^{\frac{-13}{2}}dz\right]$$

$$=-\frac{1}{2}\left[\frac{z^{-7/2}}{(-7)}2+\frac{z^{-11/2}}{(-11)}2\right]+C$$

$$=z^{\frac{-7}{2}}\left[\frac{1}{7}+\frac{z^{-3}}{11}\right]+C$$

$$=(\text{cosec}x-\cot x)^{\frac{7}{2}}\left(\frac{1}{7}+\frac{(\text{cosec}x-\cot x)^2}{11}\right)+C$$

55. Ans. (1)

$(1+t^2)^{10}(1+t^{10}+t^{20}+t^{30})$

$=(1+{}^{10}C_1t^2+{}^{10}C_2t^4+.....+{}^{10}C_{10}t^{20})$

$(1+t^{10}+t^{20}+t^{30})$

$\therefore$ Coefficient $={}^{10}C_{10}+{}^{10}C_5+{}^{10}C_0=2+{}^{10}C_5$

56. Ans. (4)

$$P(z)=\frac{1}{6} \qquad P(\bar{z})=\frac{5}{6}$$

$\therefore$ P(2comes in even trial)

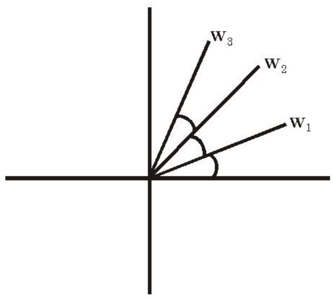
$=P(\bar{z}z \text{ or } \bar{z}\bar{z}\bar{z}z \text{ or } ....\infty)$

$$=\frac{5}{6}\times\frac{1}{6}+\left(\frac{5}{6}\right)^3.\frac{1}{6}+......\infty$$

$$=\frac{\frac{5}{6}\times\frac{1}{6}}{1-\left(\frac{5}{6}\right)^2}=\frac{5}{11}$$

57. Ans. (2)

$$\frac{|w_3-w_2|+|w_5-w_4|+|w_7-w_6|+.....+|w_{17}-w_{16}|}{|w_2-w_1|+|w_5-w_9|+|w_8-w_7|+|w_{11}-w_{10}|}$$



$\therefore \quad |w_1-w_2|=|w_2-w_3|=.....=a$

$$\therefore \quad \text{Ratio}=\frac{8a}{4a}=2$$

58. Ans. (3)

$$\sum_{n=2}^{\infty}\frac{n}{1+n^4-2n^2}=\frac{1}{4}\sum_{n=2}^{\infty}\frac{(n+1)^2-(n-1)^2}{(n+1)^2\times(n-1)^2}$$

$$=\frac{1}{4}\sum_{n=2}^{\infty}\left(\frac{1}{(n-1)^2}-\frac{1}{(n+1)^2}\right)=\frac{5}{16}$$

59. Ans. (2)

Use A.M. $\ge$ G.M.

$$\frac{x^{2017}+y^{2017}+z^{2017}+\underbrace{1+1+....+1}_{2014\text{ times}}}{2017}$$

$$\ge\left(z^{2017}.y^{2017}.z^{2017}.1.1....1\right)^{\frac{1}{2017}}$$

$\therefore \quad E\ge-2014$

60. Ans. (4)

Since $A^2 = A \Rightarrow A^3 = A \Rightarrow A^4 = A$

$\therefore (I + A)^4$

$= {}^4C_0 I^4 + {}^4C_1 A + {}^4C_2 A^2 + {}^4C_3 A^3 + {}^4C_4 A^4$

$= I + 15A$

61. Ans. (4)

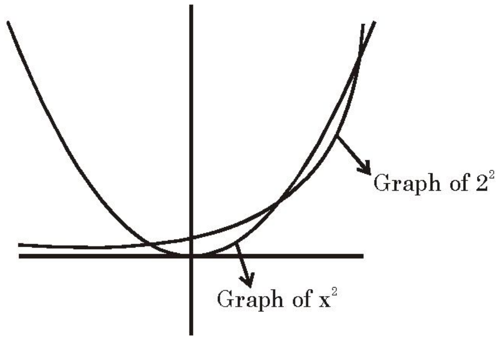
$\sin A\cos B\cos C + \sin B\cos C\cos A + \sin C\cos A\cos B$

$= \cos A\cos B\cos C(\tan A + \tan B + \tan C)$

$= \cos A\cos B\cos C \cdot \tan A\tan B\tan C$

$= \sin A\sin B\sin C$

62. Ans. (3)



63. Ans. (3)

Clearly $\sin^{-1}\sqrt{x} \Rightarrow x \in [0, 1]$

Also $\cos^{-1}\sqrt{x^2-1} \Rightarrow 0 \le x^2 - 1 \le 1$

$x^2 \in [1, 2]$

$\therefore$ Possible value of $x = 1$

$\therefore$ Equation becomes $\frac{\pi}{2}+\frac{\pi}{2}+\tan^{-1}\tan y = a$

$\therefore$ for solution $a \in \left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$

$\therefore$ integral values are 2, 3, 4

64. Ans. (2)

Line AB $\frac{x-\sqrt{3}}{\cos 60°} = \frac{y}{\sin 60°} = r$

$x = \sqrt{3} + \frac{r}{2},\ y = \frac{r\sqrt{3}}{2}$

$\therefore$ Point $\left(\sqrt{3}+\frac{r}{2}, \frac{r\sqrt{3}}{2}\right)$ lies on $2y^2 = 2x + 3$

$\therefore \frac{3r^2}{2} = 2\sqrt{3} + r + 3$

$\Rightarrow 3r^2 - 2r - \left(6+4\sqrt{3}\right) = 0$

PA and –PB are roots

$\therefore PA - PB = \frac{2}{3}$

$PA.PB = \frac{6+4\sqrt{3}}{3}$

65. Ans. (1)

Given curve is $(x - 5)(y - 7) = 35$

$\therefore$ Length of LR $= 2\sqrt{(2)(35)} = \sqrt{280}$

66. Ans. (3)

Symmetric and transitive but not reflexive

67. Ans. (3)

$\lim\limits_{x\to 1}\frac{(x-1)(x+1)}{\sin^2 x - \sin^2 1}$

$\lim\limits_{x\to 1}\frac{(x-1)(x+1)}{\sin(x-1)\sin(x+1)}$

$\frac{2}{\sin 2}$

68. Ans. (4)

$\begin{vmatrix} 1-x & 1 & 1 \\ 1 & 1-y & 1 \\ 1 & 1 & 1-z \end{vmatrix} = 0$

on solve we get $\frac{1}{x}+\frac{1}{y}+\frac{1}{z} = 1$

69. **Ans. (3)**

$$f'(x)=\begin{cases}e^{3x}(1+3x), & x\le 0\\ 1+6x-3x^2, & x>0\end{cases}$$

$\therefore$ $f'(x)$ is continuous at $x=0$

$$f''(x)=\begin{cases}e^{3x}(6+9x), & x\le 0\\ 6-6x, & x>0\end{cases}$$

for $\uparrow$ fn : $6+9x>0$ or $6-6x>0$

$x>-\frac{6}{9}$ $\quad$ $x<1$

$\therefore$ $x\in\left(-\frac{6}{9},1\right)$

70. **Ans. (1)**

2 diff. 2 same : ${}^6C_1.{}^5C_2.2!.{}^3C_2=360$

2 same 2 same : ${}^6C_2.2=30$

Total 390

INTEGER

71. $y=(c_1+c_2)\cos(x+c_3)-c_4e^{x+c_5}$

$y_1=-(c_1+c_2)\sin(x+c_3)-c_4e^{x+c_5}$

$y_2=-(c_1+c_2)\cos(x+c_3)-c_4e^{x+C_5}=-y-2c_4e^{x+c_5}$

$\Rightarrow y_3=-y_1-2c_4e^{x+c_5}=-y_1+y_2+y$

Hence the differential equation is $y_3-y_2+y_1-y=0$, which is of order 3.

72. From the given equation, $\left(\left(\frac{d^2y}{dx^2}\right)^2-y^3\right)^2=\frac{dy}{dx}$.

Hence, it is obvious from the equation that degree is 4.

73. $\int_0^{\pi/4}\frac{\sqrt{\tan x}}{\sin x\cos x}dx=\int_0^{\pi/4}\frac{\sec^2 x}{\sqrt{\tan x}}dx=\int_0^1\frac{1}{\sqrt{t}}dt$

$=[2\sqrt{t}]_0^1=2-0=2$.

74. $f(x)=x-[x]$, $-1\le x<0\Rightarrow f(x)=x+1$

$0\le x<1\Rightarrow f(x)=x$

$\int_{-1}^1 f(x)dx=\int_{-1}^0 f(x)dx+\int_0^1 f(x)dx=\int_{-1}^0(x+1)dx+\int_0^1 x\,dx$

$=\left(\frac{x^2}{2}+x\right)_{-1}^0+\left(\frac{x^2}{2}\right)_0^1=0-\left[\frac{(-1)^2}{2}-1\right]+\frac{1}{2}=1$.

75. $\lim\limits_{x\to 0}\frac{\frac{d}{dx}\int_0^{x^2}\sec^2 t\,dt}{\frac{d}{dx}(x\sin x)}=\lim\limits_{x\to 0}\frac{\sec^2 x^2.2x}{\sin x+x\cos x}$

By L-Hospital's rule, $\lim\limits_{x\to 0}\frac{2\sec^2 x^2}{\left(\frac{\sin x}{x}+\cos x\right)}=\frac{2\times 1}{1+1}=1$.