Paper Code : 1001CT102116027

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

CLASSROOM CONTACT PROGRAMME

(Academic Session : 2016 - 2017)

JEE (Main + Advanced) : ENTHUSIAST COURSE (PHASE : I)

ANSWER KEY **TEST DATE : 06-11-2016**

Test Type : MINOR Test Pattern : JEE-Main

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	4	1	4	3	4	3	3	1 or 4	1	4	3	2	2	2	4	3	3	1	4	2
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	1	2	4	2	1	1	1	4	1	1	3 or 4	1 or 3	1	1	2	3	4	3	3	1
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	4	2	2	2	2	3	1	2	2	4	3	3	1	4	4	3	3	4	3	2
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	3	4	3	2	1	1	1	3	4	3	1	1	3	2	1	4	3	3	3	2
Que.	81	82	83	84	85	86	87	88	89	90										
Ans.	2	4	2	3	2	3	1	3	2	3										

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN) path to success

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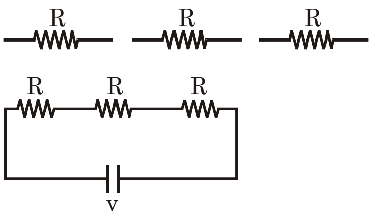
SOLUTION

1. Ans. (4)

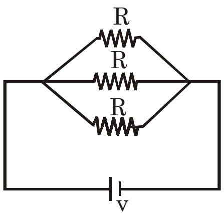
2. Ans. (1)

3. Ans. (4)

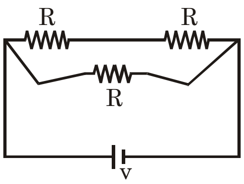
Sol.



Power dissipated in circuit = $\frac{v^2}{3R}$



Power dissipated in circuit = $\frac{v^2}{R/3}$



Power dissipated in circuit = $\frac{v^2}{2R/3}$

4. Ans. (3)

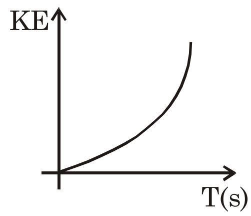
Sol. Let at t = 0 ball is dropped and at any instant of time

$v = gt$

$K.E. = \frac{1}{2}mg^2t^2$

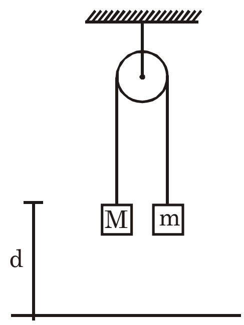
$\Rightarrow K.E. = kt^2$

Parabola opening upward



5. Ans. (4)

Sol.



When M strikes on table than due to inelastic collision. M block will come rest and m get motion under gravity when m mass return to it's initial position than M will goes upward.

velocity of m mass when it return is

$$v = \sqrt{\frac{2(M-m)gd}{M+m}}$$

velocity M for upward motion

$$v' = \left(\frac{mv}{M+m}\right)$$

acceleration of M for upward motion

$$a = \frac{(M-m)g}{M+m}$$

height h it reaches than

$v'^2 = 2ah$

$h = \frac{v'^2}{2a}$

$h = \frac{m^2v^2}{(M+m)^2 \times 2 \times \frac{(M-m)}{(M+m)} \times g}$

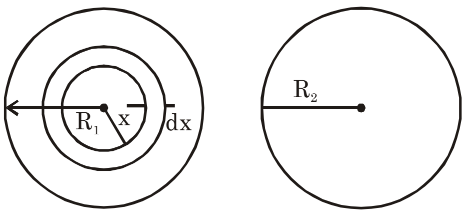
$h' = \frac{m^2v^2}{2(M+m)(M-m)g}$

$h' = \frac{m^2 \times 2(M-m)gd}{2(M+m)(M+m)(M-m)g}$

$h' = \left(\frac{m}{M+m}\right)^2 d$

6. Ans. (3)

Sol. $\rho = \frac{\rho_0}{r}$



solid sphere hollow sphere

$Q_{net} = \int \rho dv$

$Q_{net} = \int_0^{R_1} \frac{\rho_0}{x} \times 4\pi x^2 dx$, $Q_{net} = -\sigma \times 4\pi R_2^2$

$Q_{net} = 4\rho_0\pi\left[\frac{x^2}{2}\right]_0^{R_1}$

$Q_{net} = 4\rho\pi\frac{R_1^2}{2}$

$Q_{total} = 0$

$2\rho\pi R_1^2 = \sigma \times 4\pi R_2^2$

$\frac{\rho}{2\sigma} = \frac{R_2^2}{R_1^2}$

$\frac{R_2}{R_1} = \sqrt{\frac{\rho}{2\sigma}}$

7. Ans. (3)

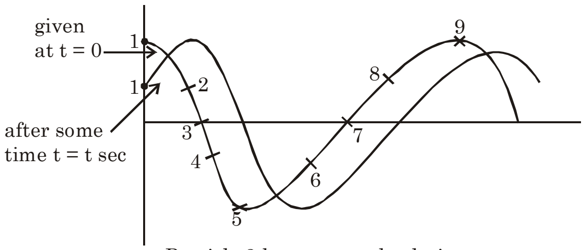
Sol. reaction energy = ΔMC^2

${}_3^7Li + {}_1^2H = 2{}_2^4He$

$\Delta m = 2(He) - 3(Li + H)$

8. Ans. (1 or 4)

Sol.



Particle 2 have upward velocity

9. Ans. (1)

Sol. Energy released = q.v.

q = area under curve = $\frac{1}{2} \times 150 \times 0.2 = \frac{30}{2}C$

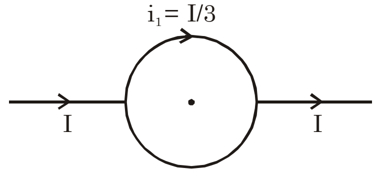
v = E. d = $400 \times 10^3 \times 1500 = 60 \times 10^7$

energy released = $60 \times 10^7 \times 15 = 900 \times 10^7$

= 9×10^9 J

10. Ans. (4)

Sol.



$B_{center} = \frac{\mu_0 I}{3 \times 4r}(-\hat{k}) + \frac{\mu_0 2I}{3 \times 4r}(\hat{k})$

$-\frac{\mu_0 I}{12r}\hat{k} + \frac{2\mu_0 I}{12r}\hat{k}$

$B_{center} = \frac{\mu_0 I}{12r}\hat{k}$

11. Ans. (3)

Sol. $\cos\phi = \frac{1}{\sqrt{2}}$

$\tan\phi = \frac{x_C - x_L}{R}$

$R = x_C - x_C$

$R = \frac{1}{c\omega} - L\omega$

$10 = \frac{1}{c \times 100} - 10 \qquad \frac{1}{c\omega} = 20$

$c = \frac{1}{2000} = 500\mu f$

12. Ans. (2)

Sol. $\frac{14_C}{12_C} = 1.3 \times 10^{-12}$

12 g contain 6.022×10^{23} atoms

No. atoms of $14_C = 6.022 \times 10^{23} \times 1.3 \times 10^{-12}$

$= 7.8286 \times 10^{11}$

$N = N_0 e^{-\lambda t}$

$\frac{dN}{dt} = N_0 e^{-\lambda t} \times \lambda$

$-\frac{dN}{dt} = N \times \lambda$

$\frac{180}{60} = 7.8286 \times 10^{11} \times \lambda$

$\frac{1}{\lambda} = \frac{7.8286 \times 10^{11}}{3}$

$\lambda = 0.3832 \times 10^{-11}$

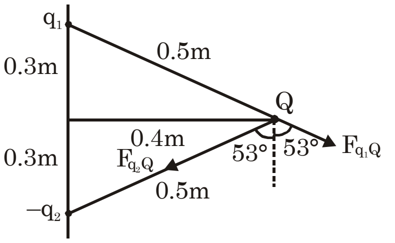
$t_{1/2} = \frac{0691}{\lambda} = \frac{0.692}{0.3832 \times 10^{-11}} = 1.80 \times 10^{11}$ sec

Half life = 1.8032×10^{11} sec

$= 0.5740 \times 10^4$ year = 5740 year

13. Ans. (2)

Sol.



$\left|F_{q_2Q}\right| = \left|F_{q_1Q}\right|$

$F_{net} = 2 \times F_{q_2Q} \times \cos 53\left(-\hat{j}\right)$

$= 2 \times \frac{9 \times 10^9 \times 8 \times 10^{-12}}{0.5 \times 0.5} \times \frac{3}{5}\left(-\hat{j}\right) = 0.34N\left(-\hat{j}\right)$

14. Ans. (2)

Sol. –ve power always diverge the rays

15. Ans. (4)

Sol. $v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{800}{\frac{2 \times 10}{1000 \times 4}}} = \sqrt{4 \times 4 \times 100 \times 100}$

= 400 m/sec.

$v = f\lambda$

$\lambda = \frac{400}{104} = 4 \times 10^{-2} = 4cm$

$\lambda = 2cm \qquad L = 40$ cm

No. of highest harmonic = 20

16. Ans. (3)

Sol. $r = \frac{mv}{qB}$

$\frac{1}{2}mv^2 = \frac{hc}{\lambda} - 2.5$

17. Ans. (3)

Sol. $\left(\frac{n_1}{n_2}\right)^3 = \frac{1}{64}$

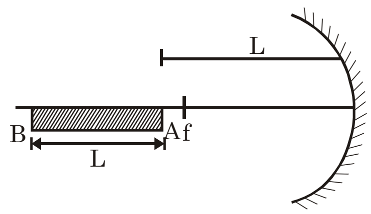
$\frac{n_1}{n_2} = \frac{1}{4}$

$n_2 = 4$

No. of resulting spectrum are = $4_{C_2} = 6$

18. Ans. (1)

Sol.



m is magnification of point A distance of image from pole = m_1x

$\left[m_1 = \frac{f}{L-f}\right] = \frac{fL}{L-f}$

Distance of image of point B from poll = $m_2 \times 2\ell$

$\left[m_2 = \frac{f}{2L-f}\right] = \frac{2Lf}{2L-f}$

image length = $-\frac{2Lf}{2L-f} + \frac{Lf}{L-f}$

$= Lf\left[\frac{-2(L-f)+(2L-f)}{(2L-f)(L-f)}\right] = \frac{Lf \times f}{(2L-f)(L-f)}$

19. Ans. (4)

Sol. $i = \frac{\varepsilon}{r}$

$\varepsilon = -\frac{d\phi}{dt}$

20. Ans. (2)

21. Ans. (1)

22. Ans. (2)

Sol. $\epsilon_1 = \frac{1240}{414} \approx 3$

$\epsilon_2 = \frac{1240}{517.5} \approx 2.4$

Stopping potential for 1 = 3 – 1.5 = 1.5

Stopping potential for 2 = 2.4 – 1.5 = 9

Ratio = $\frac{1.5}{.5} = \frac{5}{3}$

23. Ans. (4)

Sol. $13.6 + 2.4 = \frac{hc}{\lambda}$

24. Ans. (2)

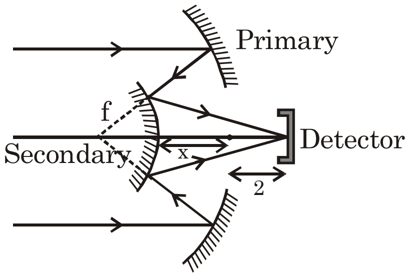
25. Ans. (1)

26. Ans. (1)

27. Ans. (1)

28. Ans. (4)

Sol.



$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$

$\frac{1}{x+2} + \frac{1}{-(2.5-x)} = \frac{1}{-1.5}$

$\frac{1}{x+2} + \frac{1}{-2.5+x} = -\frac{2}{3}$

$\frac{(x-2.5)+(x+2)}{x^2-0.5x+5} = -\frac{2}{3}$

$6x - 1.5 = -2x^2 + x + 10$

$2x^2 + 5x - 11.5 = 0$

$x = \frac{-5 \pm \sqrt{25+92}}{4}$

$= \frac{-5 \pm \sqrt{117}}{4} = 1.45$

29. Ans. (1)

Sol. In secondary rainbow colour are interchanged and in primary rainbow first colour is voilet and last color is red.

30. Ans. (1)

Sol. If we keep density high and radius same than mass will increase.

31. Ans.(3 or 4)

32. Ans.(1 or 3)

33. Ans.(1)

34. Ans.(1)

35. Ans.(2)

36. Ans.(3)

37. Ans.(4)

38. Ans.(3)

39. Ans.(3)

40. Ans.(1)

41. Ans. (4)

42. Ans. (2)

43. Ans. (2)

44. Ans. (2)

45. Ans. (2)

46. Ans. (3)

47. Ans. (1)

48. Ans. (2)

49. Ans. (2)

50. Ans. (4)

51. Ans. (3)

52. Ans. (3)

53. Ans. (1)

54. Ans. (4)

55. Ans. (4)

56. Ans. (3)

57. Ans. (3)

58. Ans. (4)

59. Ans. (3)

60. Ans. (2)

61. Ans. (3)

Using tangency condition $C=\frac{A}{M}$

we get a = 3

62. Ans. (4)

$$f'(1^+) = \lim_{h\to 0}\frac{h\sqrt{|\ell n(1+h)|}-0}{h}=0$$

$$f'(1^-) = \lim_{h\to 0}\frac{-h\sqrt{|\ell n(1-h)|}-0}{-h}=0$$

63. Ans. (3)

$$f(n)+f(n-2)=\int_0^{\pi/4}\tan^{n-2}x(1+\tan^2 x)dx$$

$$=\int_0^{\pi/4}\tan^{n-2}x\sec^2 x dx=\frac{1}{n-1}$$

$$\Rightarrow f(n)=\frac{1}{n-1}-f(n-2)\Rightarrow f(n)<\frac{1}{n-1} ...(1)$$

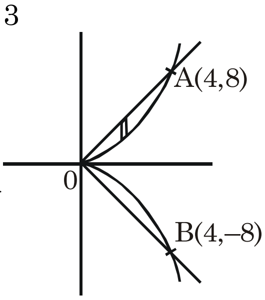
($\because f(n-2)>0$)

(1) $\Rightarrow f(n)<\frac{1}{2}$ for n = 3

64. Ans. (2)

Required area

$$=2\int_0^4(2x-x^{3/2})dx=\frac{32}{5}$$



65. Ans. (1)

Equation can be written as $\frac{xdy+ydx}{\sqrt{1-(xy)^2}}=dx$

by integrating $\sin^{-1}(xy) = x + C$

$\Rightarrow$ xy = sin(x + c)

66. Ans. (1)

For common line of intersection

$D = D_1 = D_2 = D_3 = 0$

$$\Rightarrow D=0\Rightarrow\begin{vmatrix}4 & -5 & 2\\3 & -3 & \lambda\\5 & -1 & -\lambda\end{vmatrix}=0\Rightarrow\lambda=1$$

but for $\lambda = 1$; $D_1=\begin{vmatrix}-1 & -5 & 2\\3 & -3 & 1\\-8 & -1 & -1\end{vmatrix}\neq 0$

67. Ans. (1)

$$\cos 60^\circ=\frac{9+c^2-16}{6c}\Rightarrow c^2-3c-7=0$$

68. Ans. (3)

$$y=-\frac{2a}{\sqrt{1-a^2}}x+\frac{1}{\sqrt{1-a^2}}$$

compare with y=mx+c

$$m=-\frac{2a}{\sqrt{1-a^2}},c=\frac{1}{\sqrt{1-a^2}}$$

using tangency condition $c^2 = A^2m^2+B^2$

$$\frac{1}{1-a^2}=\frac{A^2.4a^2}{1-a^2}+B^2$$

$$\Rightarrow 1=a^2(4A^2-B^2)+B^2$$

$$\Rightarrow B^2=1 \text{ and } 4A^2-B^2=0\Rightarrow A^2=\frac{1}{4}$$

$$\because A^2=B^2(1-e^2)\Rightarrow e=\frac{\sqrt{3}}{2}$$

69. Ans. (4)

$\because \vec{a},\vec{b},\vec{c}$ are coplanar $\Rightarrow[\vec{a}\ \ \vec{b}\ \ \vec{c}]=0$

70. Ans. (3)

Put z = x + iy

(x + iy) + i (|z|) = i(x – iy) + 1

$\Rightarrow$ x = y + 1 & y + |z| = x

$\Rightarrow$ x – y = 1 & x – y = |z|

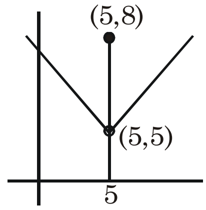
$\Rightarrow$ |z| = 1

71. Ans. (1)

$A - A^T$ is always skew-symmetric matrix

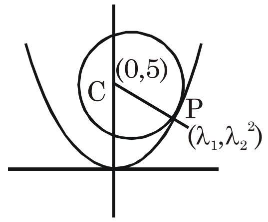
$\Rightarrow |A - A^T| = 0$.

72. Ans. (1)



Clearly x = 1 is a point of local maxima.

73. Ans. (3)



equation of normal to parabola at P

$$y-\frac{\lambda^2}{2}=-\frac{1}{\lambda}(x-\lambda)$$
$\downarrow$ (0,5)

$$\Rightarrow 5-\frac{\lambda^2}{2}=1\Rightarrow\frac{\lambda^2}{2}=4$$

$\therefore$ P = $\left(2\sqrt{2},4\right)$ $\therefore$ radius = CP = 3

74. Ans. (2)

For x > 1, $\sin^{-1}\frac{2x}{1+x^2}=\pi-2\tan^{-1}x$

and $\cos^{-1}\frac{1-x^2}{1+x^2}=2\tan^{-1}x$

$\therefore$ required derivative = –1.

75. Ans. (1)

Given conic is

$$\frac{\left(\frac{x-2y+1}{\sqrt{5}}\right)^2}{\frac{5}{4}}+\frac{\left(\frac{2x+y+2}{\sqrt{5}}\right)^2}{\frac{5}{9}}=1$$

$\because B^2 = A^2(1-e^2)$

$$\Rightarrow\frac{5}{9}=\frac{5}{4}\left(1-e^2\right)\Rightarrow e=\frac{\sqrt{5}}{3}$$

76. Ans. (4)

For continuity at $x=\frac{1}{3}$, a = 2b

also $\int_0^{1/3}2bx\,dx+\int_{1/3}^{1}b(1-x)dx=1\Rightarrow b=3$

77. Ans. (3)

$g'(x) = 3x^2 + 2ax + b$

$\therefore D = 4a^2 - 12b = 4(a^2 - 3b) < 0$

$\Rightarrow g'(x) > 0\ \forall\ x \in R \Rightarrow g(x)$ is one-one onto.

78. Ans. (3)

Given equation

$$\frac{\sqrt{3}}{2}\cos\theta-\frac{1}{2}\sin\theta=\frac{1}{2}\Rightarrow\cos\left(\theta+\frac{\pi}{6}\right)=\cos\frac{\pi}{3}$$

$$\Rightarrow\theta=2n\pi+\frac{\pi}{6},\theta=2n\pi-\frac{\pi}{2}\ \text{(rejected)}$$

$$\therefore\ \theta=\frac{\pi}{6},2\pi+\frac{\pi}{6}$$

79. Ans. (3)

$$\cos 60°=\frac{2+k+2}{\sqrt{5+k^2}.\sqrt{6}}=\frac{1}{2}\Rightarrow k^2-16k-17=0$$

(k – 17)(k + 1) = 0

$\Rightarrow$ k = –1 or 17

80. Ans. (2)

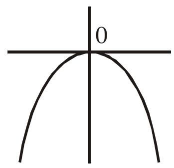
Given limit

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

$$=\lim_{n\to\infty}\sum_{n=2}^{n}\frac{1}{2}\left(\frac{1}{n(n-1)}-\frac{1}{(n+1)(n-1)}\right)$$

$$=\lim_{n\to\infty}\frac{1}{2}\left(\frac{1}{2}-\frac{1}{(n+1)(n-1)}\right)=\frac{1}{4}$$

81. Ans. (2)



$f(x) = 1 - x - e^{-x} \Rightarrow f'(x) = e^{-x} - 1$

$\therefore f(x)\uparrow$ for $x\in(-\infty,0)$ & $\downarrow$ for $x\in(0,\infty)$

82. Ans. (4)

Condition for non-trivial solution

$$\begin{vmatrix}a & b & c\\ b & c & a\\ c & a & b\end{vmatrix}=0$$

$\Rightarrow 3abc - a^3 - b^3 - c^3 = 0$

$\Rightarrow$ a + b + c = 0, also product of roots

$=\frac{c}{a}=(-)$ve

$\because$ c and a are of opposite sign.

83. Ans. (2)

series is G.P.

84. Ans. (3)

$$z=\left(\frac{1-i}{1+i}\cdot\frac{1-i}{1-i}\right)^{50}=(-i)^{50}=i^2=-1$$

$\Rightarrow \arg(z)=\pi$

85. Ans. (2)

$\because\ \vec{a}\times\left(\vec{b}\times\vec{c}\right)=\left(\vec{a}\cdot\vec{c}\right)\vec{b}-\left(\vec{a}\cdot\vec{b}\right)\vec{c}=0$

86. Ans. (3)

$\because$ line lies in the plane $\Rightarrow 2 - 2\lambda + k = 0$
and $2 - 3 + 2\lambda = 0$

$\Rightarrow \lambda = \dfrac{1}{2}$ and $k = -1$.

87. Ans. (1)

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

$$= \int \tan^{-1}\left(\frac{1-\tan x}{1+\tan x}\right)dx = \int \tan^{-1}\left(\tan\left(\frac{\pi}{4} - x\right)\right)dx = \int\left(\frac{\pi}{4} - x\right)dx$$

$$= \frac{\pi}{4}x - \frac{x^2}{2} + c$$

88. Ans. (3)

$$\lim_{h\to 0}\frac{\displaystyle\int_{\frac{1}{2}}^{\frac{1}{2}(1+h)} t.\sin^{-1} t\,dt}{h} = \lim_{h\to 0}\frac{\frac{1}{2}(1+h).\sin^{-1}\left(\frac{1}{2}(1+h)\right)}{1}.\frac{1}{2}$$

$$= \frac{1}{4}\sin^{-1}\frac{1}{2} = \frac{1}{4}.\frac{\pi}{6} = \frac{\pi}{24}$$

89. Ans. (2)

Given $e^{\lim\limits_{x\to\infty}\left(\frac{2x+3}{2x+4}-1\right).x} = e^{\lim\limits_{x\to\infty} -\frac{x}{2x+4}}$

$= e^{-1/2}$

90. Ans. (3)

$f'(x) = 1 + \ell nx = 0$

$\Rightarrow x = \dfrac{1}{e}$ is a point of local minima.