JEE (MAIN) : ENTHUSIAST COURSE

TARGET : JEE (MAIN) 2015

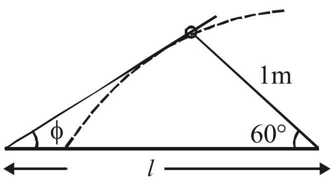
SCORE – II	DATE : 19 - 02 - 2015
Full Syllabus	Test Pattern : JEE (Main)

ANSWER KEY

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

HINT – SHEET

1. For maximum value of ϕ, θ is 60°. In this situation rod Q is tangent on the circle on which ring attached to P moves.



$l \cos 60 = 1$

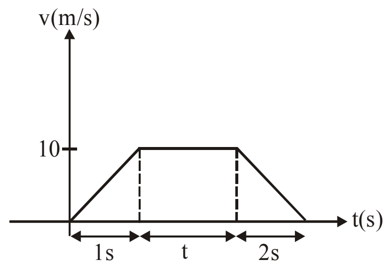
$l = 2m$

2. for $r < a$, $E = 0$

for $a < r < b$, $\vec{E} = \frac{kQ}{r}\hat{r}$

for $r > b$, $\vec{E} = -\frac{kQ}{r^2}\hat{r}$

3.

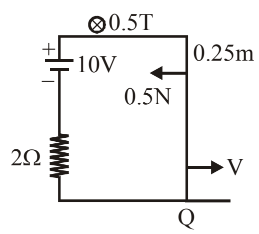


$\frac{1}{2}(1+2)(10) + 10t = 135$

$t = 12s$

4. Induced e.m.f. = $B\ell v = 0.125$ V

current $I = \frac{10-e}{R} = \frac{10-0.125V}{2}$



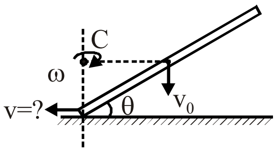
Force $Bl\ell$

$= 0.5\left(\frac{10-0.125V}{2}\right)0.25 = 0.5N(\text{given})$

Solving V = 16 m/s.

5. $\omega\frac{L}{2}\cos\theta = v_0$

$\omega\frac{L}{2}\sin\theta = v$



$\therefore v = v_0\tan\theta$

6. Let intensities aer I & $I + \delta I$.

$I_{minima} = \left[\sqrt{I+\delta I} - \sqrt{I}\right]^2 = I\left\{\left(1+\frac{\delta I}{I}\right)^{1/2} - 1\right\}^2$

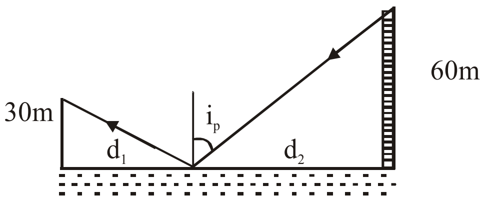
$= \frac{(\delta I)^2}{4I} = \frac{I}{4}\left(\frac{\delta I}{I}\right)^2 = \frac{I}{4}\left(10^{-4}\right)$

7. $y = \overline{A+B}\cdot B$

8. Wave is propagating along +ve X-axis

9. $\tan i_p = \mu = \frac{4}{3}$

$i_{p = 53^\circ}$



$\frac{30}{d_1} = \frac{3}{4} \Rightarrow d_1 = 40m$

$\frac{30}{d_2} = \frac{3}{4} \Rightarrow d_2 = 80m$

Width = 120m (1)

12. $40 \times 10^{-3} = mv_p^{\,2}\, v = 50 \times 10^{-3} \times v_p^{\,2} \times 20$

$\frac{4}{100} = v_p^{\,2} \Rightarrow 0.2 \text{ m/s} = v_p = 20 \text{ cm/s}$

14. $F = \eta A\frac{V-0}{y} + 4\eta A\frac{V-0}{d-y}$

$\frac{dF}{dy} = 0$

$-\frac{\eta}{y^2} + \frac{4\eta}{(d-y)^2} = 0$

$\frac{d-y}{y} = 2$

$y = \frac{d}{3}, \Rightarrow d_1 = \frac{d}{3}, d_2 = \frac{2d}{3}$

$\frac{d_2}{d_1} = 2$

15. $\overrightarrow{v_{cm}} = \frac{m\overrightarrow{v_1} + m\overrightarrow{v_2}}{2m} = \frac{1}{2}\left(\overrightarrow{v_1} + \overrightarrow{v_1}\right)$

$\overrightarrow{v_{1cm}} = \vec{v}_1 - \vec{v}_{cm} = \frac{\overrightarrow{v_1} - \vec{v}_2}{2}$

$\left|\vec{v}_{1cm}\right| = \frac{\left|\overrightarrow{v_1} - \vec{v}_2\right|}{2} = \frac{v_1 = v_2}{2}$

$\lambda_{req} = \frac{h}{mv_{1cm}} = \frac{2h}{mv_1} = 2\lambda$

16. $Ft = 2mv$ (i)

$t = \frac{T}{2} = \frac{2\pi}{2}\sqrt{\frac{m}{k}}$

$t = \pi\sqrt{\frac{m}{2k}}$

$F\pi\sqrt{\frac{m}{2k}} = 2mv$

$v = \frac{F\pi}{2}\sqrt{\frac{1}{2km}}$

17. 1msd = 200 × 0.005 = 1mm

2r = 4 × 1 + 25 × 0.005 – 5 × 0.005

= 4.1

r = 2.05 mm

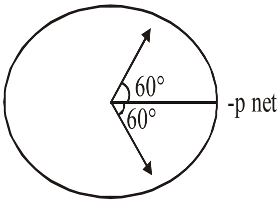
18. $\frac{W}{Q} = \frac{nR\Delta T}{nC_p\Delta T} = \frac{32}{80} = \frac{2}{5}$

$5R = 2C_p = 2\left[C_v + R\right]$

$C_v = \frac{3R}{2}$

$\therefore(1)$

19. $\vec{p} = \sum q_i \vec{d_i}$



20. $W = \frac{\phi C}{cop} = \frac{60\times10^3}{60\times1.2} J/s = \frac{10^3}{1.2} J/s$

No of units consumed

$= \frac{\left(\frac{10^3}{1.2}\right)(4)(30)}{1000}$ = 100 units

Cost of energy = (6) (100) = 600 Rs

21. Let and corrections at A and B α and β

$\frac{15}{42+\alpha} = \frac{20}{58+\beta} \Rightarrow \frac{58+\beta}{42+\alpha} = \frac{4}{3}$

$\Rightarrow 3\beta + 174 = 168 + 4\alpha$

$4\alpha - 3\beta = 6$ ...(i)

$\frac{20}{57+\alpha} = \frac{15}{43+\beta} \Rightarrow \frac{57+\alpha}{43+\beta}$

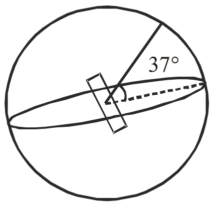
$= \frac{4}{3} \Rightarrow 171 + 3\alpha = 172 + 4\beta$

$3\alpha - 4\beta = 1$ ...(ii)

from (i) and (ii)

$\alpha = 3$ cm, $\beta = 2$ cm

22. At magnetic equator



$\frac{\mu_0}{4\pi}\frac{M}{r^3} = 5$

at magnetic lattitude of 37°

$\frac{\mu_0}{4\pi}\frac{M}{r^3}\sqrt{1+3\cos^2 53^\circ} = \sqrt{52}$ units

24. 2fm = 10 kHZ

FM = 5 kHZ

$f_{LSB} = f_c - f_m = 95$ kHZ

$f_{USB} = f_c - f_m = 105$ kHZ

27. $L = 10\log\frac{I}{I_0}$

$I = I_0(10)^{\frac{L}{10}} = I_0 e^{(\ln 10)\frac{L}{10}}$

$\frac{dI}{dL} = \frac{\ln 10}{10} I$

$\frac{dI}{I} = \frac{\ln 10}{10} dL$

$\int_I^{2I} \frac{dI}{I} = \frac{\ln 10}{10}\int_0^t \frac{dL}{dt} dt$

$\ln 2 = \frac{\ln 10}{10}\int_0^t (1)\, dt$

$t \simeq 3$ years

28. Let decay constants for two modes are λ_α and λ_b respectively.

$\frac{dN_\alpha}{dt} = -\lambda_\alpha N$

$\frac{dN_\beta}{dt} = -\lambda_\beta N$

$\frac{dN_\alpha/dt}{dN_\beta/dt} = 2 \Rightarrow \frac{\lambda_\alpha}{\lambda_\beta} = 2$ (i)

Also $\frac{\ln 2}{\lambda_\alpha + \lambda_\beta} = 60$

$\frac{\ln 2}{\lambda_\alpha + \frac{\lambda_\alpha}{2}} = 60$

$\frac{\ln 2}{\lambda_\alpha}$ = 90 years.

31. $\frac{h}{\sqrt{2m\times q}} = \frac{1}{2}$

$\frac{6\times10^{-34}}{\sqrt{2\times m\times1.6\times10^{-19}}} = \frac{1}{2}$

$36 \times 10^{-68} \times 4 = 2 \times 1.6 \times 10^{-19} \times m$

$m = 45 \times 10^{-49}$ kg Ans.

32. $C_nH_{2n+2} + \frac{(3n+1)}{2} O_2 \longrightarrow nCO_2 + (n+1) H_2O$

$\frac{0.3}{n}$ mole 0.3 mole

$CO_2 + 2NaOH \rightarrow Na_2CO_3 + H_2O$

0.3 mole 0.6 mole

$\frac{0.3}{n} = \frac{4.3}{(14n+2)} \Rightarrow n = 6$

34. $NH_3 \rightleftharpoons \frac{1}{2} N_2 + \frac{3}{2} H_2$

Eq. $(1-\alpha)$ $\quad \frac{\alpha}{2} \quad \frac{3\alpha}{2}$

$$K_P = \frac{\left(\frac{\alpha}{2}\right)^{\frac{1}{2}}\left(\frac{3\alpha}{2}\right)^{\frac{3}{2}}}{(1-\alpha)} \cdot \frac{P^o}{(1+\alpha)}$$

Solving :

$$\alpha = \left(1+\frac{3\sqrt{3}P^o}{4K_P}\right)^{-\frac{1}{2}}$$

35. m. moles of salt = $\frac{5.076}{94} \times 1000 = 54$

m. moles of weak base = 120 × 0.225 = 27

$$pOH = pK_b + \log\frac{[Salt]}{[Base]} \Rightarrow 4 - \log 4 + \log\frac{54}{27}$$

pOH = 3.7

pH = 10.3

37. $PbCl_2(s) \rightleftharpoons Pb^{+2}$ (aq.) + $2Cl^-$ (aq)

s 2s

$4s^3 = 4 \times 10^{-6}$

$s = 10^{-2}$

$\Delta T_f = 3 \times 2 \times 10^{-2} = 0.06$

38. Number of faraday of electricity

$$= \frac{0.01 \times 3 \times 60 \times 60}{96500}$$

$$\frac{0.01 \times 3 \times 60 \times 60}{96500} = \frac{0.072}{192} \times x$$

x = 2.98

x = 3

61. $x_1x_2 = 18^2 = 12.27$

$$\frac{2x_1x_2}{x_1+x_2} = \frac{216}{13} \Rightarrow x_1 + x_2 = \frac{26.18^2}{216} = 39 = 27 + 12$$

62. Required coefficient is

= (1 + 2+...+10) + (2 + 3 + ... +11) +...

...+(11+12+...+20)

= 5(11 + 13 + ...+31) = 1155.

63. $\alpha_r = r^2,\ \beta_r = \alpha^3$

$$\Rightarrow \sum(3\alpha_r + 2\beta_r) = 3\sum r^2 + 2\sum r^3$$

64. $z\bar{z} - z(1-i) - \bar{z}(1+i) + (1+i)(1-i) = 0$

$(z-(1+i))(\bar{z}-(1-i)) = 0$

$\Rightarrow z = 1+i, \bar{z} = 1-i$

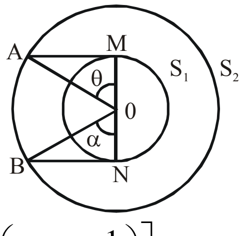
65. $\frac{1}{2}\left(\sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}}\right) \geq 1 \Rightarrow \sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = 2 \Rightarrow x = y$

66. $\cot\theta = -\sqrt{3} \Rightarrow \theta = n\pi - \frac{\pi}{6}$

$\text{cosec}\ \theta = -2 \Rightarrow \theta = n\pi - (-1)^{n+1}\frac{\pi}{6}$

$\Rightarrow \theta$ is in IV quadrant $\Rightarrow \theta = 2n\pi - \frac{\pi}{6}$

67. $\cos\theta = \frac{OM}{OA} = \frac{1}{2} \Rightarrow \theta = \frac{\pi}{3}$



$\cos\alpha = \frac{1}{2} \Rightarrow \alpha = \frac{\pi}{3}$

arc(AB) = $\frac{\pi}{3}.2r$

68. $\tan^{-1}\left[\cos\left(2\tan^{-1}\frac{3}{4}\right) + \sin\left(2\cot^{-1}\frac{1}{2}\right)\right]$

$= \tan^{-1}\left(1+\frac{2}{25}\right) > \frac{\pi}{4}$

69. S_1 is wrong and S_2 is right

70. $x + \frac{336}{x} \leq 50 \Rightarrow (x-8)(x-42) \leq 0$

$x \in [8,42]$

required probability $= \frac{35}{50} = \frac{7}{10}$

71. $\cos^2 3t = \frac{1}{2}(1+\cos 6t)$

$\sin^2 3t = \frac{1}{2}(1-\cos 6t)$

Both are periodic with period $\frac{\pi}{3}$

$$f(x) = \int_0^x (2\cos^2 3t + 3\sin^2 3t)dt$$

$$+ \int_x^{x+\pi} (2\cos^2 3t + 3\sin^2 3t)dt$$

$$= f(x) + \int_0^{\pi} (2\cos^2 3t + 3\sin^2 3t)dt$$

$f(x) + f(\pi)$

72. $\theta = \cos^{-1}x$

$$f(x) = \tan^{-1}\sqrt{\frac{1-x}{1+x}} = \frac{1}{2}\left(\frac{\pi}{2} - \sin^{-1}x\right)$$

required derivative $= -\frac{1}{2}$

73. $\begin{vmatrix} 2 & 3 & a \\ b & 5 & -1 \\ 1 & 1 & 3 \end{vmatrix} = ab - 5a - 9b + 29 = 0$ and $2b - a = 5$

solving $\Rightarrow$ a = 1 and b = 3 or a = 13, b = 9

74. (1,1) is the point of intersecting of two lines and it also lies on circle $\Rightarrow$ equation of tangent is $2x - y - 1 = 0$

75. $\begin{vmatrix} q_1 & q_2 & q_3 \\ q_2 & q_3 & q_1 \\ q_3 & q_1 & q_2 \end{vmatrix} \to C_1 + C_2 + C_3$

$$= (q_1 + q_2 + q_3)\begin{vmatrix} 1 & q_2 & q_3 \\ 1 & q_3 & q_1 \\ 1 & q_1 & q_2 \end{vmatrix}$$

= 0 ($\because$ sum of roots is zero)

76. $T_{p+1} = {}^nC_p\left(x^3\right)^{n-p}\left(x^{-4}\right)^b = {}^nC_p x^{3n-7p}$

r = 3n – 7p

$\Rightarrow p = \frac{3n-r}{7}$

77. $f(x) = \begin{cases} 4x^2 - x & , \quad -\frac{1}{2} \le x < 0 \\ ax^2 - bx & , \quad 0 \le x < \frac{1}{2} \end{cases}$

$f'(0^-) = -1$, $f'(0^+) = -b$

$\Rightarrow$ if b = 1 $\Rightarrow$ $f(x)$ is differentiable.

and $f(x)$ is continuous always.

78. numbers starting with 2 $= \frac{6!}{3!} = 120$

numbers starting with 3 $= \frac{6!}{(2!)^2} = 180$

numbers starting with 4 = $= \frac{6!}{3!2!} = 60$

total numbers are 360.

79. $\alpha\vec{a} + \beta\vec{b} + \gamma\vec{c} = -3(\hat{i} - \hat{k})$

$\alpha(1,2,3) + \beta(2,3,1) + \gamma(3,1,2) = -3(1,0,-1)$

$\Rightarrow \alpha + 2\beta + 3\gamma = -3$

$\Rightarrow 2\alpha + 3\beta + \gamma = 0$

$\Rightarrow 3\alpha + \beta + 2\gamma = 3$

$\Rightarrow \alpha = 2, \beta = -1, \gamma = -1$

80. The equation can be

written $\left(y^2 + 2\right)\left(y - \frac{\cos x}{1 + \sin x}\right) = 0$

$$\Rightarrow y = \frac{\cos x}{1 + \sin x} = \frac{1 - \tan^2\frac{x}{2}}{1 + \tan^2\frac{x}{2} + 2\tan\frac{x}{2}}$$

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

$= \frac{2}{1 + \tan\frac{x}{2}} - 1$, Let $\tan\frac{x}{2} = t$

$$y'(t) = -\frac{2}{(1+t)^2}$$

at $x = \frac{\pi}{2} \Rightarrow t = 1$

$\Rightarrow y'(1) = -\frac{1}{2}$

81. $A^{-1} = \frac{(\text{adj}A)^T}{|A|} = \begin{bmatrix} \cos x & \sin x & 0 \\ -\sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}^T$

$$= \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix} = f(-x)$$

82. Product of length of perpendiculars drawn from foci on any tangent to hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is b^2.

83. a = 13, b = 15, $s = 14 + \frac{c}{2}$

$$84 = \sqrt{\left(14+\frac{c}{2}\right)\left(1+\frac{c}{2}\right)\left(\frac{c}{2}-1\right)\left(14-\frac{c}{2}\right)}$$

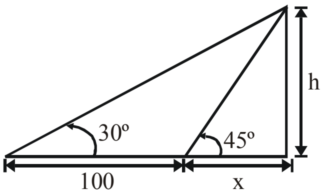
$$\equiv \sqrt{\left(196-\frac{c^2}{4}\right)\left(\frac{c^2}{4}-1\right)}$$

$$\frac{c^2}{4} = 148; 49$$

c = 14 or $4\sqrt{37}$

84. 100 + x = h cot30º

x = hcot45º



$100 = h\left(\sqrt{3}-1\right)$

$\Rightarrow h = 50\left(\sqrt{3}+1\right)$

85. Last digit of $(843)^{843}$ is 7.

Last digit of $(492)^{295}$ is 8.

$\Rightarrow$ Last digit is = 5

86. If $f(x) = ax^2 + bx + c$

$$\int_0^1 f(x)dx = \frac{1}{6}(2a+3b+6c)$$

$f(0) = c,\ f\left(\frac{1}{2}\right) = \frac{a}{4}+\frac{b}{2}+c$

$f(1) = a + b + c$

$\Rightarrow f(0) + 4f\left(\frac{1}{2}\right) + f(1) = 2a+3b+6c$

87. $\frac{x^2}{a^2}+\frac{y^2}{b^2} = c \Rightarrow \frac{2x}{a^2}+\frac{2yy'}{b^2} = 0$

$$\frac{1}{a^2}+\frac{yy''+(y')^2}{b^2} = 0$$

Eliminating

$$\frac{b^2}{a^2}, yy' = x\left(yy''+(y')^2\right) \Rightarrow \frac{y''}{y'}+\frac{y'}{y}-\frac{1}{x} = 0$$

88. $n\left(\bar{A}\cap\bar{B}\right) = n\left(\overline{A\cup B}\right)$

$= n(u) - n(A \cup B)$

$= 600 - (n(A) + n(B) - n(A \cap B))$

$= 600 - 100 - 200 + 50 = 350$

89. Median is (5.5x) = a

$$\text{Mean deviation} = \frac{\sum|x_i - a|}{10} = 30$$

$$\frac{2(4.5x+3.5x+2.5x+1.5x+.5x)}{10} = 30$$

$$\frac{2(12.5)|x|}{10} = 30$$

$|x| = 12$

90.

p	q	−q	p → q	q → p	p → −q	−q → p	p ↔ q	p ↔ −q'
T	T	F	T	T	F	T	T	F
T	F	T	F	T	T	T	F	T
F	T	F	T	F	T	T	F	T
F	F	T	T	T	T	F	T	F