MAJOR TEST # 04 | **DATE : 19 - 03 - 2013**

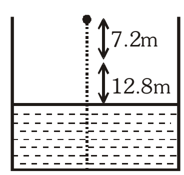
SYLLABUS : SECTION – 4

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	1	3	4	1	3	3	4	3	2	2	1	4	3	2	2	3	2	2	2	3
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	3	1	1	3	3	2	2	4	4	4	1	3	2	4	4	3	2	1	2	1
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	4	4	2	3	3	1	1	1	4	2	3	4	4	3	3	4	1	4	2
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	2	3	1	1	2	3	3	2	3	4	2	3	4	2	4	1	2	4	4	4
Que.	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	4	4	1	2	2	1	3	4	2	2	3	2	3	3	2	3	4	1	3	2
Que.	101	102	103	104	105															
Ans.	3	3	2	2	3															

HINT – SHEET

8. $v^2 - u^2 = 2as$



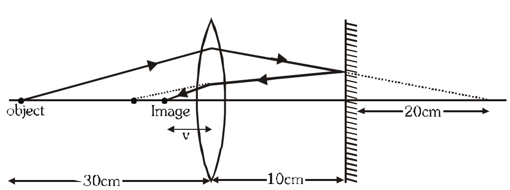
$v^2 = 2(g)(7.2)$

$v = 12$ m/s

$X_{b/f} = \mu x$

$$\frac{dX_{(B/f)}}{dt} = \mu\frac{dx}{dt} \Rightarrow \frac{4}{3}(12m/s) \Rightarrow 16 \text{ m/s}$$

9.



$$\frac{1}{v}+\frac{1}{30}=\frac{1}{15}\Rightarrow\frac{1}{v}=\frac{1}{30} \text{ and}$$

$$\frac{1}{v}-\frac{1}{10}=\frac{1}{15}\Rightarrow\frac{1}{v}=\frac{1}{15}+\frac{1}{10}$$

$v = 6$

10. $\frac{1}{v}+\frac{1}{u}=\frac{1}{f}\Rightarrow f=\frac{R}{2}=-10m$

From 1st condition

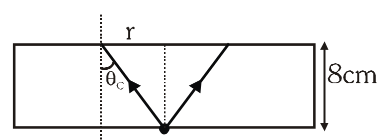
$$\frac{-3}{25}+\frac{1}{u_1}=\frac{-1}{10}\Rightarrow u_1=50m$$

From 2nd condition

$$\frac{-7}{50}+\frac{1}{u_2}=-\frac{1}{10}\Rightarrow u_2=25m$$

$$\text{Velocity} = \frac{\Delta u}{\Delta t}=\frac{25}{30}\times\frac{18}{5}=3km/h$$

11.



$$\sin\theta_C=\frac{3}{4}\Rightarrow\theta_C=37°$$

$$\therefore\frac{r}{8}=\tan 37°=\frac{3}{4}\Rightarrow r=6cm$$

12. Fringe width is given by $(\beta)=\frac{D\lambda}{d}$ and order of wavelength in electromagnetic spectrum is given by $\lambda_R > \lambda_G > \lambda_B$

13. Snell's law : $\frac{\sin\theta_1}{\sin\theta_2}=\frac{n_2}{n_1}$ so, $\sin\theta_2=\frac{n_1\sin\theta_1}{n_2}$

For Air & meta material $\sin\theta_2=\frac{1\sin\theta_1}{(-n)}$, θ_2 is (–ve)

14. By definition of n : $V=\frac{C}{|n|}$

15. $\lambda \propto \frac{1}{\sqrt{K}}$

16. $2\pi r_n = n\lambda$

$n = \frac{2\pi r_n}{\lambda} = \frac{2\times 3.14\times 4.8\times 10^{-11}10^{-11}}{10^{-10}} \approx 3$

17. $K_A = hf - \phi$ ...(1)

$K_B = 2hf - 2\phi$ ...(2)

$\Rightarrow \frac{K_A}{K_B}$ 1 : 2

18. $ev_s = \frac{hc}{\lambda} - \phi$

$\Rightarrow 4.8 = \frac{hc}{\lambda} - \phi$ ...(1)

$\Rightarrow 1.6 = \frac{hc}{2\lambda} - \phi$ ...(2)

eq. $\frac{(1)}{(2)}$ $\frac{4.8}{1.6}=\frac{\frac{hc}{\lambda}-\phi}{\frac{hc}{2\lambda}-\phi}$

$\Rightarrow \phi = \frac{hc}{4\lambda} \Rightarrow \lambda_0 = 4\lambda$

19. Energy = 1.7×10^{-13} J

$= \frac{1.7\times 10^{-13}}{1.6\times 10^{-13}}$ MeV = 1.0625 MeV

$\Rightarrow$ Pair production will take place

20. $\lambda = \frac{h}{\sqrt{2mE}} \Rightarrow \lambda = \frac{C}{\sqrt{E}}$ where C = constant

$\log\lambda = \log C - \frac{1}{2}\log E \Rightarrow y = C - mx$

22. In ground state, $\frac{mv^2}{r}=\frac{e^2}{4\pi\epsilon_0 r^2}$

$v = \frac{e}{\sqrt{4\pi\epsilon_0 r}} = \frac{e}{\sqrt{4\pi\epsilon_0 a_0 m}}$

$\because v \propto \frac{z}{n}$

$\therefore$ velocity in first excited state (n = 2)

$v_2 = \frac{v}{2}=\frac{1}{2}\times\frac{e}{\sqrt{4\pi\epsilon_0 a_0 m}}=\frac{e}{4\sqrt{\pi\epsilon_0 a_0 m}}$

23. $\frac{N_A}{N_B}=\left(\frac{N_{OA}}{2^{48/2}}\right)\times\left(\frac{2^{48/16}}{N_{OB}}\right)$

$=\frac{N_{OA}}{N_{OB}}=\frac{2^3}{2^4}$

$=\frac{2}{1}\times\frac{1}{2}$ = 1 : 1

24. $\frac{R}{R_0} = e^{-\lambda t} \Rightarrow \frac{1}{3} = e^{-\lambda(9)}$ ...(1)

$\therefore \frac{R'}{R_0} = e^{-\lambda(18)} = [e^{-\lambda(9)}]^2 = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$

25. ${}_{19}K^{40} \longrightarrow {}_{20}Ar^{40} + {}_{-1}e^0 + \bar{\nu}$

(N_0) (0)

(N_1) $(N_2 = N_0 - N_1)$

given $\frac{N_2}{N_1} = 10.3 \Rightarrow \frac{N_0 - N_1}{N_1} = 10.3$

$\Rightarrow \frac{N_1}{N_0} = \frac{1}{11.3} = e^{-\lambda t}$

$\Rightarrow \lambda t = \ell n 11.3$

$\Rightarrow t = 4.37 \times 10^9$ yrs

26. fission rate = $\dfrac{5w}{200\times1.6\times10^{-13}J}$

$= 1.56 \times 10^{11}\ s^{-1}$

27. $r \propto A^{1/3}$

$\dfrac{r}{r_{He}}=\left(\dfrac{A}{4}\right)^{1/3} = (14)^{1/3} \Rightarrow A = 56$

$A = Z + N = 56 \Rightarrow Z = 56 - 30 = 26$

28. Energy released

= BE of product – reactant

$= 2 \times 4 \times 7.06 - 7 \times 5.60 = 17.28$ MeV

29. $f_m = 12$ kHz and $f_c = 2.51$ MHz = 2510 kHz

$\therefore$ USB = $f_c + f_m = 2510 + 12 = 2522$ kHz

LSB = $f_c - f_m = 2510 - 12 = 2498$ kHz

30. In one half cycle D_1 conducts and in another half D_2 conducts. But current through R is changing directions in both half cycle

$\Rightarrow$ variable output but different peak values

31. $A_V = \alpha\dfrac{R_L}{R_{in}}$

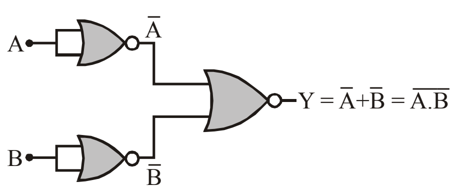
$= 0.98 \times \dfrac{5\Omega}{70\Omega} = 70$

and $A_P = \alpha A_V$

$= 0.98 \times 70$

$= 68.6$

32.



Behaving like NAND gate.

$\therefore$ A = 1001100

B = 1010101

A·B = 1000100

$\therefore$ Y = $\overline{A\cdot B}$ = 0111011

33. $f = \dfrac{1}{2\pi\sqrt{LC}}$

$= \dfrac{1}{2\pi\sqrt{\dfrac{10}{\pi^2}\times10^{-3}\times4\times10^{-8}}}$

$= \dfrac{1}{4} \times 10^5$ Hz

$= 25$ kHz

38. $\nu = 3.29 \times 10^{15} \left\{\dfrac{1}{n_1^2}-\dfrac{1}{n_1^2}\right\} sec^{-1}$

$\nu = 3.29 \times 10^{15} \left\{\dfrac{1}{1^2}-\dfrac{1}{4^2}\right\}$

$= 3.29 \times 10^{15} \times \dfrac{15}{16} sec^{-1} = 3.08 \times 10^{15}\ sec^{-1}$

41. In bcc,

$2(r_{NH_4^+} + r_{Cl^-}) = \sqrt{3}a$

43. As we know,

$\Delta T_f = i.K_f.m$

So, $T_f^{\circ} - T_f = K_f.m$

$0.149 = i \times (1.86) \times (0.020)$

Hence, i = 4

$\therefore$ the compound having the value of i = 4 is i.e., $[Cr(NH_3)]Cl_3$.

Which will have a freezing point of –0.149°C.

48. $d = \dfrac{n\times m}{a^3\times N_A}$

50. $\dfrac{\text{No. of atoms}}{N_A}$ = mole = $\dfrac{\text{wt.}}{\text{Atomic mass}}$

$\dfrac{3.011\times10^{22}}{6.023\times10^{23}} = \dfrac{1.15}{\text{Atomic mass}}$

77. $I = \displaystyle\int \frac{1}{\tan^2 x(\cot x + x)^2}dx = \int \frac{\cot^2 x}{(\cot x + x)^2}dx$

$= \displaystyle\int \frac{-(1-\operatorname{cosec}^2 x)}{(\cot x + x)^2}dx$

$= \displaystyle\int \frac{-d(x+\cot x)}{(x+\cot x)^2}dx$

$= \dfrac{1}{(x+\cot x)^2} + C$

$\therefore$ f(x) = cot x

78. $I = \displaystyle\int \underset{I}{(\cos x)^{-2005}}.\underset{II}{\operatorname{cosec}^2 x}\,dx - 2005\int\frac{1}{\cos^{2005}x}dx$

$= (\cos x)^{-2005}.-\cot x - \displaystyle\int(-2005)(\cos x)^{-2006}.-\sin x(-\cot x)\,dx$

$- 2005\displaystyle\int \cos^{-2005}x\ dx$

$= \dfrac{-\cot x}{(\cos x)^{2005}} + 2005\displaystyle\int\cos^{-2005}x\ dx - 2005\int\cos^{-2005}x$ dx

$= \dfrac{-\cot x}{(\cos x)^{2005}} + C$

80. $\dfrac{dy}{dx} \quad \dfrac{y}{3x\log_e x} = \dfrac{2}{3x}$

I.F. $= e^{\int \frac{1}{3x\log_e x}dx} = e^{\frac{1}{3}\ell n(\log_e x)} = e^{\log_e(\log_e x)^{1/3}}$

$= (\log_e x)^{1/3}$

82. Putting $x = \dfrac{1}{y}$ in I_1 gives $\rightarrow I_2$

$\therefore I_1 = I_2$

83. $\dfrac{1}{\sqrt{1-y^2}}\dfrac{dy}{dx} = x^3 - 2x\sin^{-1}y$

$\dfrac{1}{\sqrt{1-y^2}}\dfrac{dy}{dx} + 2x\sin^{-1}y = x^3$

let $\sin^{-1}y = t$

$\dfrac{1}{\sqrt{1-y^2}}\dfrac{dy}{dx} = \dfrac{dt}{dx}$

$\dfrac{dt}{dx} + 2xt = x^3$

I.F. $= e^{\int 2xdx} = e^{x^2}$

$\therefore$ solution is given by

$t(e^{x^2}) = \int x^3.e^{x^2}dx + c$ let $x^2 = t$

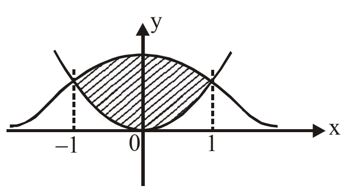
$\sin^{-1}y\ e^{x^2} = \int \underset{I}{t}\ \underset{II}{e^t}.\dfrac{dt}{2} + c$ $2ndx = dt$

$\Rightarrow 2\sin^{-1}y\,e^{x^2} = \left(t.e^t - \int e^t dt\right) + 2C$

$\Rightarrow 2\sin^{-1}y\,e^{x^2} = (x^2-1)e^{x^2} + K$

$\Rightarrow 2\sin^{-1}y = (x^2-1) + ke^{x^2}$

84. Point of intersection of both curves are $x = 1$ & $x = -1$

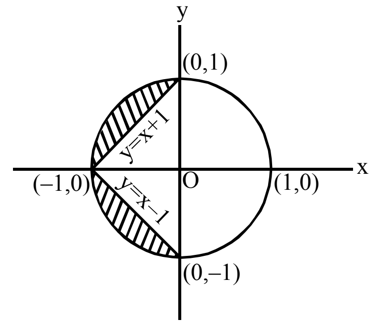


Area $= 2\displaystyle\int_0^1\left(\frac{4}{1+x^2} - 2x^2\right)dx$

$= 2\left[4\tan^{-1}x - 2\dfrac{x^3}{3}\right]_0^1 = 2\left[\pi - \dfrac{2}{3}\right]$

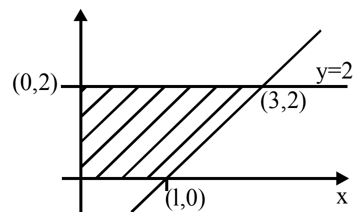
$= \left(2\pi - \dfrac{4}{3}\right)$

85.



Required Area $= \dfrac{1}{2}\pi(1)^2 - 2\left\{\dfrac{1}{2}\cdot1\cdot1\right\} = \dfrac{\pi}{2} - 1$

87.



Required area $= \dfrac{1}{2}(1+3)\times 2 = 4$

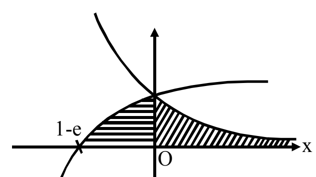
88. $\dfrac{dy}{dx} = \dfrac{x+y-1}{x+y+1}$ put $x + y = v$

$1 + \dfrac{dv}{dx} = \dfrac{v-1}{v+1} \Rightarrow (1+v)\,dv = -2dx$

$\dfrac{v^2}{2} + v = -2x + c$

$\dfrac{(x+y)^2}{2} + (x+y) = -2x + c$

89.



$y = \log(x+e)$

$y = e^{-x}$

Required Area $= \displaystyle\int_{1-e}^{0}\log(x+e)dx + \int_0^{\infty}e^{-x}dx = 2$

98. Median of 21 terms will be 11th term in increasingly arranged series. If smallest 8 terms are decreased by 5, even then 11th term will be unaltered.

99. Given statement $r \leftrightarrow (p \wedge q)$

Negation ! $[r \leftrightarrow (p \wedge q)] \equiv \sim(p \wedge q) \leftrightarrow r$

$\equiv (\sim p \vee \sim q) \leftrightarrow r$

103. $\alpha, 1+\alpha, 2+\alpha, \ldots\ldots\ldots(n+\alpha)$

$0, 1, 2, \ldots\ldots\ldots\ldots\ldots\ldots\ldots n$

$1, 2, 3 \ldots\ldots\ldots\ldots\ldots\ldots\ldots (nH)$

variance $= \dfrac{(n+1)^2 - 1}{12}$