KRISHNA MURTHY IIT ACADEMY

MODEL TEST FOR IIT(JEE)-2010

KEY – UNIT – 5 – PAPER – 2 – IIT(JEE) – 02-02-2010

CHE. : 1) B, 2) C, 3) A, 4) D, 5) C, 6) D, 7) D, 8) AB, 9) D, 10) A–PS, B–PQRS, C–PS, D– PS, 11) A – PQS, B – PRS, C – Q, D – Q; 12) 6, 13) 2, 14) 3, 15) 0, 16) 1, 17) 3, 18) 5, 19) 1

MAT. : 20) B, 21) B, 22) B, 23) A, 24) AB, 25) C, 26) BC, 27) ABC, 28) CD, 29) A–R, B–S, C –P, D–Q, 30) A–Q, B–P, C–S, D – R; 31) 3, 32) 5, 33) 6, 34) 8, 35) 6, 36) 6, 37) 9, 38) 4.

PHY. : 39) B, 40) D, 41) A, 42) D, 43) ABD, 44)ACD, 45)CD, 46) BC, 47)ACD, 48)A–Q, B–Q, C–Q, D–R; 49)A–S, B–Q, C–S, D–Q; 50) 8, 51) 5, 52) 3, 53) 8, 54) 0, 55) 9, 56) 3, 57) 4.

ANSWERS AND SOLUTIONS :

CHEMISTY :

1. Ans. : B

Sol. It depends on number of unpaired electrons.

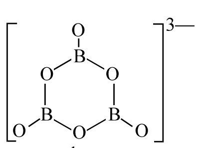
2. Ans. : C

3. Ans. : A

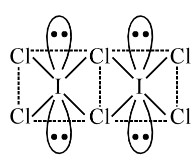
4. Ans. : D

Sol. Mn^{++} (25): [Ar] $3d^5$; 5 unpaired electrons and hence highest magnetic moment.

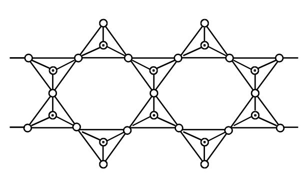
5. Ans. : C

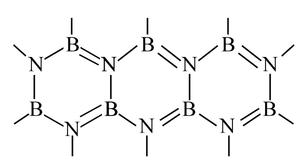


planar
B : sp^2



Planar
I : sp^3d^2





in sheet silicates althought one tetrahedron is linked to other three tetrahedrons but the SiO_4^{4-} layer/ sheet obtained is not planar, as fourth oxygn atom is projecting away from sheet.

6. Ans. : D

7. Ans. : D

8. Ans. : AB

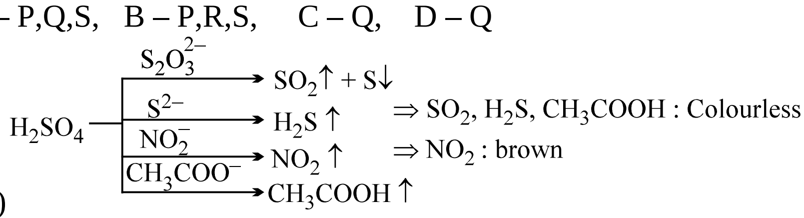
9. Ans. : D

Sol. Due to weak ligand present in $[NiCl_4]^{-2}$

10. A – P,S, B – P,Q,R,S, C – P,S, D – P,S

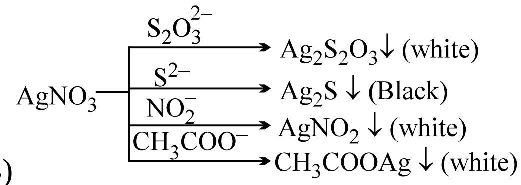
Sol. $2KMnO_4 + 3H_2SO_4 + 5H_2S \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 5S$
$3SO_2 \rightarrow 2\ SO_3 + S$ (disproportionation)
SO_2 can be used as bleaching agent.
$2KMnO_4 + 3H_2SO_4 + 10NO_2 + 2H_2O \rightarrow K_2SO_4 + 2MnSO_4 + 10HNO_3$
$2KMnO_4 + 3H_2SO_4 + 5HNO_2 \rightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5HNO_3$

11. A – P,Q,S, B – P,R,S, C – Q, D – Q

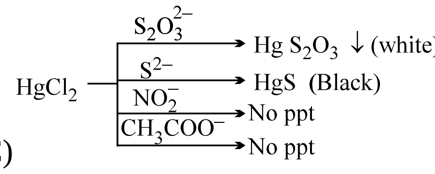


Sol. (A)

(B)



(C)



(D) Ag_2S is insoluble in NH_3 solution

12. Ans. : 6

Sol. $[CO(NH_3)_4(NO_3)_2]BR_2$, $[CO(NH_3)_4Br_2](NO_3)_2$
$[CO(NH_3)_4(NO_3)Br]\,Br(NO_3)$
$[CO(NH_3)_2Br_2(NO_3)_2](NH_3)_2$
$[CO(NH_3)_3\,Br\,(NO_3)_2]Br$
$[CO(NH_3)_3\,Br_2(NO_3)]\,NO_3$.

13. Ans. : 2

14. Ans. : 3

15. Ans. : 0

16. Ans. : 1

Sol. $Cu + 3HNO_3 \rightarrow NO_2 + Cu(NO_3)_2 + H_2O$.

17. Ans. : 3

Sol. $2Al + Cr_2O_3 \rightarrow Al_2O_3 + 2Cr$.

18. Ans. : 5

Sol. Volume strength = M × 11.2,

19. Ans. : 1

SOLUTIONS MATHEMATICS PAPER 2: VECTORs- 3D

Section 1: (Multiple choice questions) (Single option correct) (4 Questions)

20. Ans. : B

Sol. Let $\vec{a}\times\vec{b} = l,\ \vec{b}\times\vec{c} = m, \vec{c}\times\vec{a} = n$

$$[l-n, m+2l, n-3m] = \begin{vmatrix} 1 & 0 & -1 \\ 2 & 1 & 0 \\ 0 & -3 & 1 \end{vmatrix}[l,m,n] = 7[a,b,c]^2$$

21. Ans. : B

Sol. $\left(\vec{r}-\vec{a}\right).\left(\vec{a}\times\vec{b}\right) = 0 \quad \Rightarrow [\vec{r}\,\vec{a}\,\vec{b}] = 0$

22. Ans. : B

Sol. Determinant correspondent to $\hat{\alpha}, \hat{\beta}, \hat{\gamma}$ is

$$\begin{vmatrix} 1 & 2 & -0 \\ 2 & a & 10 \\ 12 & 2a & a \end{vmatrix} = a^2 - 24a + 240 > 0 \quad \text{for all values of a.}$$

23. Ans. : A

Sol. Let O (0, 0, 0), A (3, 4, 7), and (5, 2, 6) be given points.

Area of $\triangle OAB = \frac{1}{2} OA.OB.\sin(\angle AOB)$

Now OA = $\sqrt{3^2+4^2+7^2} = \sqrt{74}$ OB = $\sqrt{5^2+2^2+6^2} = \sqrt{65}$

Also Dc sod the line OA and OB are $\frac{3}{\sqrt{74}}, \frac{4}{\sqrt{74}}, \frac{7}{\sqrt{74}}$ and $\frac{5}{\sqrt{65}}, \frac{2}{\sqrt{65}}, \frac{6}{\sqrt{65}}$

$$\cos\angle AOB = \frac{3}{\sqrt{74}}\times\frac{5}{\sqrt{65}} + \frac{4}{\sqrt{74}}\times\frac{2}{\sqrt{65}} + \frac{7}{\sqrt{74}}\times\frac{6}{\sqrt{65}} = \sqrt{\frac{65}{74}}$$

$$\therefore \sin\angle AOB = \sqrt{1-\frac{65}{74}} = \frac{3}{\sqrt{74}}$$

$\therefore$ Required area $= \frac{1}{2} \times \sqrt{74} \times \sqrt{65} \times \frac{3}{\sqrt{74}} = \frac{3}{2}\sqrt{65}$

Section 2: Multiple choice questions (more than one correct) (5 questions)

24. Ans. : AB

Sol. The given line is $\vec{r} = 2\hat{i} - 2\hat{j} + 3\hat{k} + \lambda\left(\hat{i} - \hat{j} + 4\hat{k}\right)$ or $\vec{r} = \vec{a} + \lambda\vec{b}$ where $\vec{a} = 2\hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = \hat{i} - \hat{j} + 4\hat{k}$. The given plane is $\vec{r} = (\hat{i} + 5\hat{j} + \hat{k}) = 5$ or $\vec{r}\vec{n} = d$ .Where $\vec{n} = (\hat{i} + 5\hat{j} + \hat{k})$.

Since $\vec{b}\vec{n} = \left(\hat{i} - \hat{j} + 4\hat{k}\right).(\hat{i} + 5\hat{j} + \hat{k})$ = 1-5 +4 = 0.Therefore, the line is parallel to the plane.

Thus, the distance between the line and the plane is equal to the length of the $\perp$ from a point $\vec{a} = 2\hat{i} - 2\hat{j} + 3\hat{k}$ on the line to the given plane.

Hence the required distance = $= \left|\frac{\left(2\hat{i} - 2\hat{j} + 3\hat{k}\right)(\hat{i} - 5\hat{j} + \hat{k}) - 5}{\sqrt{1 + 25 + 1}}\right| = \left|\frac{2 - 10 + 3 - 5}{\sqrt{27}}\right| = \frac{10}{3\sqrt{3}}$

25. Ans. : C

Sol. We have, $\vec{r} = (1 + \lambda - \mu)\hat{i} + (2 - \lambda)\hat{j} + (3 - 2\lambda + 2\mu)\hat{k}$

$\Rightarrow \vec{r} = \left(\hat{i} + 2\hat{j} + 3\hat{k}\right) + \lambda\left(\hat{i} - \hat{j} - 2\hat{k}\right) + \mu(-\hat{i} + 2\hat{k})$ which is a plane passing through $\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$ and parallel to the vectors $\vec{b} = \hat{i} - \hat{j} - 2\hat{k}$ and $\vec{c} = -\hat{i} + 2\hat{k}$

Therefore, it is $\perp$ to the vector $\vec{n} = \vec{b} \times \vec{c} = 2\hat{i} - \hat{k}$

Hence its vector equation is $\left(\vec{r} - \vec{a}\right).\vec{n} = 0 \Rightarrow \vec{r}.\vec{n} = \vec{a}.\vec{n} \Rightarrow \vec{r}(-2\hat{i} - \hat{k}) = -2 - 3$

$\Rightarrow \vec{r}(2\hat{i} + \hat{k}) = 5$

So, the Cartesian equation is $(x\hat{i} + y\hat{j} + z\hat{k}).(2\hat{i} + \hat{k}) = 5$ or $2x + z = 5$

26. Ans. : BC

Sol. Let the line be $\frac{x - \alpha}{l} = \frac{y - \beta}{m} = \frac{z - \gamma}{n}$, then $\begin{vmatrix} 3 & 3 & 0 \\ 2 & 1 & 1 \\ l & m & n \end{vmatrix} = 0 \Rightarrow l - m - n = 0$

Again, $\frac{2l + m + n}{\sqrt{6(l^2 + m^2 + n^2}} = \pm\cos 60^\circ \Rightarrow 5l^2 - m^2 - n^2 + 4mn + 8\ln + 8lm = 0$

Eliminating l we get, $2m^2 + 5mn + 2n^2 = 0 \Rightarrow m = -2n$ or $m = -\frac{n}{2}$

So, $m = -2n, l = -n$ or $\text{l} = -m$ .The desired direction ratios are 1, 2, -1 and 1, -1 ,2.

27. Ans. : ABC

Sol. Let $\overrightarrow{OA} = \vec{a}, \overrightarrow{OB} = \vec{b}, \overrightarrow{OC} = \vec{c}$, then we have

$\vec{a}.\vec{a} + (\vec{b} - \vec{c}).(\vec{b} - \vec{c}) = \vec{b}.\vec{b} + (\vec{c} - \vec{a}).(\vec{c} - \vec{a})$

$\Rightarrow -2\vec{b}.\vec{c} = -2\vec{c}.\vec{a} \Rightarrow (\vec{a} - \vec{b}).\vec{c} = 0$ or $\overrightarrow{BA}.\overrightarrow{OC} = 0$

Hence, AB is perpendicular to OC. Similarly, BC is perpendicular to OA and CA is perpendicular to OB.

28. Ans. : CD

$\begin{vmatrix} 2 & 3 & 4 \\ 1 & \alpha & 2 \\ 1 & 2 & \alpha \end{vmatrix} = 15 \Rightarrow 2(\alpha^2 - 4) + 3(2 - \alpha) + 4(2 - \alpha) = 15$

$\Rightarrow 2\alpha^2 - 7\alpha - 9 = 0 \Rightarrow \alpha = -1, \frac{9}{2}$

Section 3: Match the following

29. Ans. : A – R, B – S, C – P, D – Q

Sol. A) Required vector $= \vec{a} \times \left(\vec{a} \times \vec{b}\right) = -2\left(2\hat{i} - \hat{j} + \hat{k}\right)$

$\vec{a} \times \vec{b} = -2\hat{j} - 2\hat{k}$

$\vec{b} \times \vec{c} = -\hat{i} + 2\hat{j} + 3\hat{k}$

$\vec{a}\times\left(\vec{a}+\vec{c}\right)=\vec{a}\times\vec{a}+\vec{a}\times\vec{c}=\vec{a}\times\vec{c}=\hat{i}+\hat{k}$

30. . Ans. : A – Q, B – P, C – S, D – R.

Sol. A) $\frac{x-2}{3}=\frac{y-7}{7}=\frac{z+5}{2}$ passes through through (2, 7, -5)

B) Direction ratios of given line is same as the direction ratios of the normal of $3x+4y+2z=1$

C) The point (5, -2, 2) , through which the given line passes lies on 7x –y – z =35. In addition , the sum of the products of the D.Rs of the line and the normal to the plane is 1(7) +3(-1) +4(-1) =0

D) The DRs are 2, 5, 1

$\sqrt{2^2+5^2+1^2}=\sqrt{30}$ $\therefore$ DCs are $\frac{2}{\sqrt{30}},\frac{5}{\sqrt{30}},\frac{1}{\sqrt{30}}$

Section 4: Integer Answer Type

31. Ans. : 3

Sol.

$$\triangle=\begin{vmatrix}2 & p & 6\\1 & 2 & q\\1 & 1 & 3\end{vmatrix}=(p-2)(q-3)\qquad \triangle_x=\begin{vmatrix}8 & p & 6\\5 & 2 & q\\4 & 1 & 3\end{vmatrix}=(p-2)(4q-15)$$

$$\triangle_y=\begin{vmatrix}2 & 8 & 6\\1 & 5 & q\\1 & 4 & 3\end{vmatrix}=0\qquad \triangle_z=\begin{vmatrix}2 & p & 8\\1 & 2 & 5\\1 & 1 & 4\end{vmatrix}=p-2$$

For the system to have no solution $\triangle=0$ and atleast one of $\triangle_x,\triangle_y,\triangle_z\neq 0$

$\therefore$ When $p\neq 2$ and $q=3$ the system has no solution.

32. Ans. : 5

Sol. For point of intersection,

$\vec{a}-2\vec{b}+\lambda(\vec{b}+2\vec{a})=(2\vec{a}-\vec{b})+\mu(\vec{a}+2\vec{b})$

$\Rightarrow\lambda=1/3,\mu=-1/3\ \therefore\ \vec{r}=\frac{5}{3}(\vec{a}-\vec{b})$

33. Ans. : 6

Sol. Let the vertices of the cube be (0, 0, 0), (a, 0, 0),(a, a, 0),(0, a, 0),(0, 0, a),(a, 0, a),(a, a, a), (0, a, a).

If solid diagonal $=a\hat{i}+a\hat{j}+a\hat{k}$

The plane diagonal is $\vec{r}=a\hat{i}+a\hat{j}$

$$\cos\theta=\frac{(a\hat{i}+a\hat{j}+a\hat{k}).(a\hat{i}+a\hat{j})}{\left|a\hat{i}+a\hat{j}+a\hat{k}\right|\left|a\hat{i}+a\hat{j}\right|}=\frac{2}{\sqrt{6}}$$

34.. Ans. : 8

Sol. $\vec{d}.\vec{a}=\mu[\vec{a}\,\vec{b}\,\vec{c}]=\mu/8$, $\vec{d}.\vec{b}=\gamma[\vec{b}\,\vec{c}\,\vec{a}]=\gamma/8$, $\vec{d}.\vec{c}=\lambda[\vec{c}\,\vec{a}\,\vec{b}]=\lambda/8$

$\therefore\vec{d}.(\vec{a}+\vec{b}+\vec{c})=\frac{\lambda+\mu+\gamma}{8}=8\Rightarrow\sqrt{\lambda+\mu+\gamma}=8$

35. Ans. : 6

Sol. Given $(\vec{a}\times\vec{b})+\vec{c}=\vec{0}$

$\vec{a}\times[(\vec{a}\times\vec{b})+\vec{c}]=0\Rightarrow\vec{a}\times(\vec{a}\times\vec{b})+\vec{a}\times\vec{c}=0$

$(\vec{a}.\vec{b})\vec{a}-\left|\vec{a}\right|^2\vec{b}+2\hat{i}-\hat{j}-\hat{k}=0$

$2\vec{b}=2\hat{i}+2\hat{j}-4\hat{k}=4\left|\vec{b}\right|^2=24\Rightarrow\left|\vec{b}\right|^2=6$

36. Ans. : 6

Sol. Volume of tetrahedron $=\frac{1}{6}\left|[\vec{a}\,\vec{b}\,\vec{c}]\right|$, where three sides with a common vertex are $\vec{a}$, $\vec{b}$, $\vec{c}$.

37. Ans. : 9

Sol. Area $=\frac{1}{2}\left|\overrightarrow{AB}\times\overrightarrow{AD}\right|+\frac{1}{2}\left|\overrightarrow{CB}\times\overrightarrow{CD}\right|$

38. Ans. : 4

Sol. For coplanarity, $[\overrightarrow{AB}\ \overrightarrow{AC}\ \overrightarrow{AD}] = 0$

$$\Rightarrow \begin{vmatrix} -2 & 3 & (k-3) \\ 0 & 2 & -2 \\ -2 & 2 & 2 \end{vmatrix} = 0 \Rightarrow k = 4$$

PHYSICS : ANSWERS AND SOLUTIONS ;

39. Ans. : B

Sol. $m = +\frac{6}{10}$ $\qquad \frac{1}{v}+\frac{1}{u} = \frac{1}{+30}$ $\qquad -\frac{v}{u} = +\frac{3}{5}$

$\therefore$ u = - 20 cm.

40. Ans. : D

Sol. Air-glass refraction $\frac{15}{v}-\frac{1}{\infty} = \frac{15-1}{-30}$ $\qquad$ v = –90

Air-glass reflection $\frac{1}{v}+\frac{1}{-90} = \frac{2}{+30}$ $\qquad v = \frac{90}{7}$

Glass to air refraction $\frac{1}{v}-\frac{1.5}{\left(-\frac{90}{7}\right)} = \frac{1-15}{+30}$

$v = -\frac{15}{2}$

$\therefore$ final virtual image at a distance 7.5 cm right of silvered surface.

41. Ans. : A

Sol. $\frac{dy}{D} = n\lambda_1$ $\qquad \frac{dy'}{D} = m\lambda_2$

$y = y'$ $\qquad n\lambda_1 = m\lambda_2$ $\qquad$ n(6500) = m(5200)

$\frac{n}{m} = \frac{4}{5}$

$\therefore$ least n = 4, $y = \frac{4\lambda_1 D}{d}$ = 1.56 mm

42. Ans. : D

Sol. (–1.51) – (–13.6) = 12.09eV

$\therefore$ H-atom is raised to n = 3

$\therefore$ Transitions possible are n = 3 to 2, 3 to 1 and 2 to 1.

43. Ans. : ABD

Sol. $\Delta E = \frac{hC}{\lambda} = \frac{hC}{1500}\left(1-\frac{1}{n^2}\right)(10)^{10}$ J.

$\left(1eV = 1.6\times10^{-19}\text{J}\right) = 8.28\left(1-\frac{1}{n^2}\right)$eV

$\therefore E_n = -\frac{9.28}{n^2}$eV

$E_1 = -8.28$eV

$\Delta E = E_n - E_1$ $\qquad$ maximum energy photon n = ∞ to n = 1

minimum energy n = 2 to n = 1.

$n \to \infty$ $\qquad \lambda = 1500$ Å

n = 2 $\qquad \lambda = \frac{1500(4)}{4-1} = 2000$ Å

Ground state energy = – 8.28eV

$\therefore$ Ionisation potential = 8.28V.

44. Ans. : ACD

45. Ans. : CD

Sol. $\frac{dN}{dt} = \alpha - \lambda N$ $\qquad$ where $\lambda = \frac{\ln 2}{T}$

$$\int_{N_0}^{N} \frac{dN}{\alpha - \lambda N} = \int_0^t dt$$

$\therefore$ N = $\frac{1}{\lambda}\left[\alpha - \left(\alpha - \lambda N_0\right)e^{-\lambda t}\right]$

As $t \to \infty$ N $\to \frac{\alpha}{\lambda} = \frac{\alpha T}{\ln 2}$

Rate of decay = Activity = λN.

46. Ans. : BC

Sol. $i = 45^o$, $\sin \theta_C = \frac{1}{\mu}$

for T I R at AB $i > \theta_C$ $\frac{1}{\sqrt{2}} > \frac{1}{\mu}$

$\therefore \mu > \sqrt{2}$

When immersed in water

$\sin \theta_C = \frac{4/3}{\sqrt{2}} = \frac{4}{3\sqrt{2}} = \frac{2\sqrt{2}}{3}$

$\therefore$ i = 45° C θ_C $\sin 45^o = \frac{1}{\sqrt{2}} < \frac{4}{3\sqrt{2}}$

$\therefore$ T I R will not take place

$\therefore \sqrt{2}\ \sin 45^o = \frac{4}{3}\sin r$ $\sin r = \frac{3}{4}$

$r = \sin^{-1}\left(\frac{3}{4}\right)$.

47. Ans. : ACD

Sol. $K = 4.25 - \phi_A$

$K - 1.5 = 4.70 - \phi_B$

$\lambda = \frac{h}{\sqrt{2mK}}$ $2\lambda = \frac{h}{\sqrt{2m(K-15)}}$

$\therefore \sqrt{\frac{K}{K-1.5}} = 2,$ K = 2

K – 1.5 = 0.5eV $\phi_A = 2.25$eV, $\phi_B = 4.2$eV.

48. Ans. : A – Q, B – Q, C – Q, D – R;

Sol. Lens 1 : $\frac{1}{v} - \frac{1}{-24} = \frac{1}{6}$ v = 8 cm

$m_1 = \frac{v}{u} = \frac{8}{-24} = -\frac{1}{3}$

Lens 2 : $\frac{1}{v} - \frac{1}{+4} = \frac{1}{-6}$ v = 12 cm

$m_2 = \frac{12}{+4} = +3$

Lens 3 : $\frac{1}{v} - \frac{1}{+6} = \frac{1}{+12}$ v = 4 cm

$m_3 = \frac{4}{6} = +\frac{2}{3}$.

49. Ans. : A – S, B – Q, C – S, D – Q

Sol. At O $E_r^2 = E_0^2 + 4E_0^2 = 5E_0^2 \propto I_0$

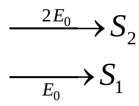
$I_{min} \propto E_0^2$; $I_{min} = \frac{I_0}{5}$

$I_{max} \propto (3E_0)^2 = 9E_0^2$ $I_{max} = \frac{9I_0}{5}$

At P $\frac{d\left(\frac{d}{2}\right)}{D} = \frac{d}{4000}$

$\therefore \Delta\phi = \frac{2\pi}{\lambda}.\frac{5000\lambda}{4000} = \frac{5\pi}{2}$ S_2 lagging S_1

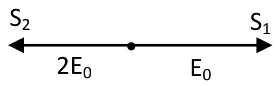
Initial phase difference $\frac{\pi}{2}$ S_2 leading

$\therefore$ 

$I_P \propto 9E_0^2$ $\quad$ $I_P = \frac{9I_0}{5}$

At Q $\quad$ $(4x)_Q = \frac{d}{4000}$

$\Delta\phi = \frac{2\pi}{\lambda}(4x)_Q = \frac{5\pi}{2}$ $\quad$ S_2 leading S_1



$I_Q \propto E_0^2$ $\quad$ $I_Q = \frac{I_0}{5}$

50. Ans. : 8

Sol. Image by lens $\frac{1}{v} - \frac{1}{-10} = \frac{1}{-20}$. $\quad$ $v = -\frac{20}{3}$ cm

$m_1 = \frac{-20/3}{-10} = \frac{2}{3}$

Image by mirror $m_2 = -\frac{3}{2}$

Again image by lens $m_3 = 8$

$\therefore m = m_1 m_2 m_3 = 8$.

51. Ans. : 5

Sol. $m = -\frac{1}{2}$ $\quad$ $v = -\frac{x}{2}$

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ $\quad$ $-\frac{2}{x} - \frac{1}{x} = \frac{1}{f}$

The shift is 10 cm away from the pole.

$\therefore u = -(x + 10)$

$m = -\frac{1}{4} = -\frac{v}{u}$ $\quad$ $\therefore v = -\frac{(x+10)}{4}$

$\therefore -\frac{4}{x+10} - \frac{1}{x+10} = \frac{1}{f}$

$\therefore f = -5$ m

52. Ans. : 3

Sol. $\mu = \frac{3\times10^8}{2\times10^8} = 1.5$

$\frac{1}{f} = (\mu-1)\left(\frac{1}{R} - \frac{1}{\infty}\right) = \frac{\mu-1}{R}$

R = Radius of the spherical surface = 15 cm

$\therefore f = 30$ cm

53. Ans. : 8

Sol. $\frac{dy}{D} = \frac{11\lambda}{2}$ $\quad$ $\beta = \frac{\lambda D}{d} = \frac{2y}{11} = \frac{2(4.4)}{11} = \frac{8}{10}$ mm.

54. Ans. : 0

Sol. $I_R = 4I\cos^2(\phi/2)$

Central maxima $\phi = 0$ $\quad$ $I_R = 4I = I_0$

$\therefore I_R = I_0\cos^2(\phi/2)$

When glass plate is introduced

$\Delta x = (\mu - 1)t = 7.5 \times 10^{-7}$ m

$\phi = \frac{2\pi}{\lambda}(7.5 \times 10^{-7}) = 3\pi$

$\therefore I_R = I_0\cos^2\left(\frac{3\pi}{2}\right) = 0$.

55. Ans. : 9

Sol. $\lambda = \frac{0.693}{3} = 0.231\ S^{-1}$

$N = N_0\ e^{-\lambda t}$ $1000 = 8000e^{-\lambda t}$

t = 9 s.

56. Ans. : 3

Sol. $\frac{1}{v} - \frac{3/2}{-4} = \frac{1-\frac{3}{2}}{-10}$ = v = – 3 cm.

57. Ans. : 4

Sol. $\frac{1}{f} = \left(\frac{3/2}{4/3} - 1\right)\left(\frac{1}{+10} - \frac{1}{+20}\right)$

$= \frac{1}{8} \times \frac{10}{200} = \frac{1}{160}$

f = 160 cm..