SAFE HANDS & IIT-ian's PACE

BPT # 06 (NEET) SOLUTIONS

1. (b)

Sol. By using $A = \sqrt{a_1^2 + a_2^2 + 2a_1a_2\cos\phi}$

$\Rightarrow A = \sqrt{(4)^2 + (3)^2 + 2\times 4\times 3\cos\frac{\pi}{3}} = \sqrt{37} \approx 6$.

2. (d)

Sol. For destructive interference, path difference the waves meeting at P (i.e. $S_1P - S_2P$) must be odd multiple of $\lambda/2$. Hence option (d) is correct.]

3. (d)

Sol. Path difference $\Delta = \frac{\lambda}{2\pi}\times\phi$

$\Rightarrow \frac{2\pi}{\lambda}\times 11\lambda = 22\pi$ i.e. constructive interference obtained at the same point So, resultant intensity

$I_R = (\sqrt{I_1} + \sqrt{I_2})^2 = (\sqrt{9I} + \sqrt{4I})^2 = 25I$.

4. (b)

Sol. By using

$$\frac{a_1}{a_2} = \left(\frac{\sqrt{\frac{I_{max}}{I_{min}}}+1}{\sqrt{\frac{I_{max}}{I_{min}}}-1}\right) = \left(\frac{\sqrt{\frac{144}{81}}+1}{\sqrt{\frac{144}{81}}-1}\right) = \left(\frac{\frac{12}{9}+1}{\frac{12}{5}-1}\right) = \frac{7}{1}$$

5. (a)

Sol. By using shift $\Delta x = \frac{p}{\lambda}(\mu - 1)t$

$\Rightarrow \Delta x = \frac{\beta}{5000\times 10^{-10}}(1.5-1)\times 2\times 10^{-6} = 2\beta$

Since the sheet is placed in the path of the first wave, so shift will be 2 fringes upward.

6. (a)

Sol. By using $\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$; where $\frac{\Delta\lambda}{\lambda} = \frac{0.4}{100}$ and $c = 3\times 10^8$ m/s

$\Rightarrow \frac{0.4}{100} = \frac{v}{3\times 10^8}$ $\Rightarrow v = 1.2\times 10^6$ m/s

Since wavelength is increasing i.e. it is moving away.

7. (a)

Sol. $\beta = \frac{\lambda D}{d} = \frac{\lambda D}{2a(\mu-1)\alpha}$

$\therefore \beta \propto 1/a$ If a↓, β↑

8. (d)

Sol. Coherent sources produce light of same frequency and of constant phase difference

9. (a)

Sol. It is given $\frac{a_1}{a_2} = \sqrt{\frac{I_1}{I_2}} = \sqrt{\beta}$

$I_{max} = (a_1 + a_2)^2$

$I_{min} = (a_1 - a_2)^2$

$\frac{I_{max} - I_{min}}{I_{max} + I_{min}} = \frac{(a_1+a_2)^2 - (a_1-a_2)^2}{(a_1+a_2)^2 + (a_1-a_2)^2} = \frac{2a_1a_2}{a_1^2 + a_2^2} = \frac{2\left(\frac{a_1}{a_1}\right)}{\left(\frac{a_1}{a_1}\right)^2 + 1} = \frac{2\sqrt{\beta}}{\beta + 1}$

10. (b)

Sol. $y \propto n$ $\Rightarrow \frac{y_{30}}{y_8} \propto \frac{30}{20} \Rightarrow y_{30} = \frac{30}{20}\times 8 = 12$ mm

11. (b)

Sol. $I = \cos^2 30$

$\frac{I}{I_0} = \frac{3}{8} = .375$ $\Rightarrow 37.5\%$

12. (a)

Sol. $y_0 = \frac{D}{d}(\mu - 1)t$ & $\beta = \frac{D\lambda}{d}$

$\therefore y_0 = \frac{\beta}{\lambda}(\mu - 1)t$

13. (a)

Sol. Phase difference between two successive fringes is 2π, the phase difference between two points separated by distance equal to one quarter of the distance between two successive fringes is equal to

$\phi = 2\pi\left(\frac{1}{4}\right) = \frac{\pi}{2}$

$\therefore I = I_{max}\cos^2\frac{\pi/2}{2}$

$\therefore \frac{I}{I_{max}} = 2.$

14. (b)

Sol. $\frac{3D\times 5000Å}{d} = \frac{4D\lambda}{d}$

$\Rightarrow \lambda = 3750$ Å

15. (b)

Sol. $d = 3\lambda$

$\Delta x = d \sin\theta = 3\lambda \sin\theta = n\lambda$

$\therefore \sin\theta = \frac{n}{3}$; n = – 3, – 2, –1, 0, + 1, + 2, + 3

16. (a)

Sol. $\frac{10D\lambda}{\mu d} = \frac{11}{2}\frac{D\lambda}{d}$

$\therefore \mu = \frac{20}{11} = 1.8$

17. (b)

$\frac{I_{max}}{I_{min}} = \frac{4}{1} = \left[\frac{\sqrt{I_1}+\sqrt{I_2}}{\sqrt{I_1}-\sqrt{I_2}}\right]^2$

$\therefore 2 = \frac{\sqrt{I_1}+\sqrt{I_2}}{\sqrt{I_1}-\sqrt{I_2}}$

$\therefore \sqrt{\frac{I_1}{I_2}} = 3 = \frac{A_1}{A_2}$

18. (b)

Sol. Width of fringe = β

if frequency is doubled then, wavelength becomes halved, because velocity of light in air remain same

$\beta \propto \lambda \Rightarrow \frac{\beta'}{\beta} = \frac{\lambda'}{\lambda} = \frac{\lambda/2}{\lambda} = \frac{1}{2}$ $\boxed{\beta' = \frac{\beta}{2}}$

19. (b)

Sol. For Ist minima;

$\sin\theta = \frac{\lambda}{a} = \frac{1}{2} \Rightarrow \theta = 30^0$

∴ Angular width of central maxima = 2 × 30 = 60

20. (d)

Sol. $\mu = \tan\theta_p \Rightarrow \mu = \tan 60^o = \sqrt{3}$

$\Rightarrow \frac{1}{\sin c} = \sqrt{3}$; $c = \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

21. (c)

Sol. Intensity of polarized light from 1st polarizer

$= \frac{100}{2} = 50$

$I = 50\cos^2 60^0 = \frac{50}{4} = 12.5\%$

22. (c)

Sol. $\mu = \tan i_p$ $\therefore \frac{c}{v} = \tan i_p$

$\therefore v = \frac{3\times10^8}{\sqrt{3}} = \sqrt{3} \times 10^8$ m/s

23. (a)

Sol. The intensity decreases in proportion for the distance squared.

24. (a)

Sol. Wave front is the locus of all points, where the particles of the medium vibrate with the sake phase

25. (c)

Sol. Converging spherical

26. (b)

Sol. Huygens

27. (c)

Sol. They will remain spherical, with the same curvature but sing of curvature reversed

28. (d)

Sol. The Huygen's construction of wave front does not explain the phenomena of origin of spectra.

29. (a)

Sol. Here $\lambda = 600nm$

$\Delta\lambda = 600.1nm - 600nm = 0.1nm$

As $\frac{V_s}{c} = \frac{\Delta\lambda}{\lambda}$

$\therefore v_s = \frac{\Delta\lambda}{\lambda}c = \frac{0.1nm}{600\,nm}\times3\times10^8 s^{-1}$

$= 50\times10^3 ms^{-1} = 50\,kms^{-1}$

30. (d)

Sol. $\mu = \frac{c}{v} = \frac{v\lambda_v}{v\lambda_g}$

$\therefore \lambda_g = \frac{\lambda_v}{\mu} = \frac{6000}{1.5} = 4000\,Å$

31. (c)

Sol. Fringe width, $\beta = \frac{\lambda D}{d}$

Also, $\lambda = \frac{h}{mv}$

Here h is Planck's constant. This wavelength is inversely proportional to the velocity. Hence, the fringe width increases with decreases in electron speed

32. (b)

Sol. the colours of a thin oil film are due to interference

33. (c)

Sol. Farther from the centre than the first maxima for green light

34. (d)

Sol. When a bright fringe is formed opposite to one of the slits, $x = \frac{d}{2}$

Path difference $=\frac{xd}{D}=\frac{d}{2}\times\frac{d}{D}=\frac{d^2}{2D}$

If it is n^{th} order bright fringe

Path difference $n\lambda=\frac{d^2}{2D}$ or $n=\frac{d^2}{2D\lambda}$

35. (b)
Sol. here $a=2mm=2\times10^{-3}m$

$\lambda=500\ nm=500\times10^{-9}m=5\times10^{-7}\ m$

D = 1m

The distance between the first minima on either side on a screen is

$=\frac{2\lambda D}{a}=\frac{2\times5\times10^{-7}\times1}{2\times10^{-3}}$

$=5\times10^{-4}m=0.5\times10^{-3}m=0.5mm$

36. (c)
Sol. Conservation of energy holds good and energy is redistributed

37. (b)
Sol. For destructive interference the path difference should be an odd multiple of $\frac{\lambda}{2}$

38. (d)
Sol. When red light is replaced by blue light the diffraction bands become narrow and crowded.

39. (c)
Sol. Distance between objective and eye piece for normal adjustment is

$L=F_0+F_e=16m+2cm=16.02m$

Angular magnification or magnifying power,

$\frac{\beta}{\alpha}=M=\frac{F_O}{F_e}=\frac{16}{0.02}=800$

40. (d)

Sol. Using $d\theta=\frac{1.22\lambda}{D}=\frac{1.22\times5000\times10^{-10}}{0.10}$

$=6.1\times10^{-6}\text{rad}=10^{-6}\text{rad}$

41. (a)
Sol. In freshnel biprism experiment the actual distance of separation between the two slits,

$d=\sqrt{d_1d_2}=\sqrt{16\times9}=12cm$

42. (b)

Sol. Fresnel distance $z_F=\frac{a^2}{\lambda}=\frac{(4\times10^{-3})^2}{500\times10^{-9}}$

$=\frac{4\times4\times10^{-6}}{5\times10^{-7}}$

$\therefore z_F=32\ m$

43. (b)
Sol. Width of central maximum in diffraction patern due to single slit $=\frac{2\lambda D}{a}$ where λ is the wavelength D is the distance between screen and slit and a is the slit width.

As the slit width a increases width of central maximum decrease i.e. central maximum becomes sharper or narrower. As same energy is distributed over a smaller area therefore central maximum becomes brighter.

44. (d)
Sol. In the case of linearly polarized light the magnitude of the electric field vector varies periodically with time.

45. (d)
Sol. Phenomenon of polarization confirmed that light is a transverse waves.

46. (c)
Sol. To form complex compounds.

47. (b)
Sol. Ag^+ forms a complex ion with NH_3

$AgCl + 2NH_3 \rightarrow [Ag(NH_3)_2]Cl$

48. (b)
Sol. Four water molecules.
$CuSO_4.5H_2O$ is a crystalline salt. Four H_2O molecules attach to copper forming a square planar symmetry and two oxygen atoms from SO_4^{2-} ion complete the distorted octahedron. The fifth water molecule is attached through hydrogen bonding between one of the co-ordinated water molecule and one of the sulphate ion.

49. (b)
Sol. Since Ag is less reactive than Cu therefore it does not displace Cu from $CuSO_4$ while other metals are more reactive, they displace Cu from $CuSO_4$.

50. (d)
Sol. Its reduction to metallic silver.

$2AgNO_3 \rightarrow \underset{\text{black stain}}{2Ag} + N_2 + 3O_2$

51. (b)
Sol.

$$2KI + HgI_2 \rightarrow \underbrace{K_2HgI_4}_{\text{Nessler's reagent}} + KOH$$

52. (c)
Sol. $Cr_2O_7^{2-} + 8H^+ + 2SO_3^{2-} \rightarrow 2Cr^{+3} + 3SO_4^{2-} + 4H_2O$

53. (c)
Sol. Amalgams are alloys which contain mercury as one of the contents.

54. (c)
Sol. Silver ; $AgNO_3 + NaCl \rightarrow \underset{\text{White ppt.}}{AgCl} + NaNO_3$

55. (a)
Sol. $CuSO_4 + 4NH_3 \rightarrow [Cu(NH_3)_4]^{++}SO_4^{--}$

56. (a)
Sol. $\text{Equivalent wt.} = \dfrac{\text{molecular wt.}}{\text{total no. of } e^- \text{ gained or lost}} = \dfrac{M}{1} = M$

57. (d)
Sol. Iron; $Fe + H_2O/H^+ \rightarrow Fe_2O_3.xH_2O$

58. (c)
Sol. $ZnO + 2NaOH \rightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + H_2O$

59. (a)
Sol. $FeCl_3$ is a salt of strong acid and weak base. It gives $Fe(OH)_3$ and HCl on hydrolysis. $Fe(OH)_3$ is a weak base and HCl is strong acid.
So the aqueous solution of $FeCl_3$ will be acidic in nature

60. (a)
Sol. CrO_3 and Mn_2O_7 are acidic oxide since they react with water to form acid.

$CrO_3 + H_2O \rightarrow \underset{\text{Chromic acid}}{H_2CrO_4}$; $Mn_2O_7 + H_2O \rightarrow \underset{\text{Permagnic acid}}{2HMnO_4}$

61. (a)
Sol. ZnO is an amphoteric oxide,

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$

$ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$

62. (a)
Sol. Fe^{3+} ion has $[Ar]3d^5$ configuration hence number of unpaired electron is 5.

63. (a)
Sol. Platinum acts as catalyst in the oxidation of ammonia to form nitric oxide. This reaction is used in the Ostwald's method of nitric acid preparation

$4NH_3 + 5O_2 \xrightarrow[750°C]{Pt} 4NO + 6H_2O$

$2NO + O_2 \rightarrow 2NO_2$

$4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$

64. (a)
Sol. Cu, Ag, Au group of elements are called coinage metals as these are used in minting coins.

65. (b)
Sol. Across lanthanoide series basicity of lanthanoide hydroxide decreases.

66. (d)
Sol. (A) According to the definition of transition metals, they have partially filled (n – 1)d orbitals except copper and zinc thus mostly show paramagnetism.
(B) It is the property of heavier p-block elements.
(C) Transition metals form a large number of alloys. The transition metals are quite similar in size and, therefore, the atoms of one metal can substitute the atoms of other metal in its crystal lattice. Thus, on cooling a mixture solution of two or more transition metals, solid alloys are formed.
(D) Show variable oxidation states as (n – 1)d and ns orbitals have nearly the same energy and, thus ns as well as (n – 1)d orbital electrons can be lost giving variable oxidation state.

67. (b)

Sol. It is fact.

68. (c)

Sol. The atomic radii of the second and third transition series are almost the same. This phenomenon is associated with the intervention of the 4f orbitals which must be filled before the 5d series of elements begin. The filling of 4f before 5d orbital results in a regular decrease in atomic radii called **Lanthanoid contraction** which essentially compensates for the expected increase in atomic size with increasing atomic number. The net result of the lanthanoid contraction is that the second and the third d series exhibit similar radii (e.g., Zr 160 pm, Hf 159 pm).

69. (d)

Sol. Lutetium ($_{71}Lu$) = $[Xe]^{54}\,4f^{14}5d^{1}6s^{2}$

70. (b)

Sol. (A) $2MnO_4^- + 16H^+ + 10Cl^- \longrightarrow 2Mn^{2+} + 8H_2O + 5Cl_2$

(B) Chromyl chloride test ; $Cr_2O_7^{2-} + 4Cl^- + 6H^+ \longrightarrow 2CrO_2Cl_2$ - (deep red) + $3H_2O$.

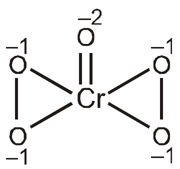
(C) $MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$

(D) $2Cl^- + F_2 \longrightarrow Cl_2 + 2F^-$

71. (a)

Sol. (I) $[Cr(H_2O)_6]Cl_3$, x + 6(0) = +3 ; so x = +3 (II)

CrO_5 ,



; so x = +6

(III) $K_3[CrO_8]^{3-}$ or $[Cr(O_2)_4]^{3-}$, here ligand is peroxo i.e. O_2^{2-} ; x + 4 (–2) = –3 ; so x = +5.

(IV) $(NH_3)_3CrO_4$ or $[Cr(O_2)_2]$, here ligand is peroxo i.e. O_2^{2-} ; x + 2 (–2) = 0 ; so x = +4.

72. (b)

Sol. $(NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + 4\,H_2O$.

Green coloured powder blown in air is Cr_2O_3

73. (b)

Sol. Hs (Z = 108) belongs to 6d series with electronic configuration - $[Rn]5f^{14}6d^{6}7s^{2}$

74. (d)

Sol. $_{24}Cr \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 \underbrace{4s^1 3d^5}_{\text{half-filled}}$

75. (d)

Sol. $Ce \rightarrow [Xe]4f^1 5d^1 6s^2$; $Ce^{4+} \rightarrow [Xe]$

$Yb \rightarrow [Xe]4f^{14}6s^2$; $Yb^{2+} \rightarrow [Xe]4f^{14}$

$Lu \rightarrow [Xe]4f^{14}5d^1 6s^2$; $Lu^{3+} \rightarrow [Xe]4f^{14}$

$Eu \rightarrow [Xe]4f^7 6s^2$; $Eu^{2+} \rightarrow [Xe]4f^7$

76. (b)

Sol. As we move down the lanthanoid series the shielding effect of electrons is very little due to poor shielding of f-orbitals and hence the nuclei charge increase at each step increasing the pull of the electron in wards which results in lanthnoid contraction.

77. (b)

Sol. The typical oxidation state of the lanthanides is +3 the other oxidation state +2 and +4 are also exhibited by few of lanthanides. (These are shown by those elements which acquire stable configuration by losing 2 and 4 electrons)

78. (a)

Sol. Lanthanum is a d-block element which resembles lanthanides.

79. (d)

Sol. Total number of inner transition elements in periodic table 28, 14 each in lanthanoid and actinoid series

80. (a)

Sol. $(n-1)d^{1-10}ns^2$

81. (d)

Sol. More the unpaired d-electrons, more is the magnetic moment.

$Cu^{2+} - 3d^9$ No. of unpaired electrons = 1

$Ni^{2+} - 3d^8$ No. of unpaired electrons = 2

$Co^{2+} - 3d^7$ No. of unpaired electrons = 3

$Fe^{2+} - 3d^6$ No. of unpaired electrons = 4

82. (b)

Sol. $Na_2[CuCl_4]$ Cu = +2 or $Cu^{2+} \rightarrow 3d^9$

$Na_2[CuCl_4]$ Cd = +2 or $Cd^{2+} \rightarrow 4d^{10}$

$K_4[Fe(CN)_6]$ Fe = +2 or $Fe^{2+} \rightarrow 3d^6$

$K_3[Fe(CN)_6]$ Fe = +3 or $Fe^{3+} \rightarrow 3d^5$

Since Cd^{2+} has completely filled d-subshell hence it is colourless.

83. (d)

Sol. In CrO_2Cl_2, O.S. of Cr $= +6$

MnO_4^-, O.S. of Mn = +7

$Cr(CN)_6^{3-}$, O.S. of Cr = +3

NiF_6^{2-}, O.S. of Ni = +4

84. (c)

Sol. $K_2Cr_2O_7$ contains $Cr^{6+}(3d^0)$ which is diamagnetic but coloured due to charge transfer spectra.

$(NH_4)_2[TiCl_6]$ contains $Ti^{4+}(3d^0)$, which is diamagnetic and colourless

$VOSO_4$ contains $V^{4+}(3d^1)$ which is paramagnetic and coloured.

$K_3[Cu(CN)_4]$ Contains $Cu^+(3d^{10})$ which is diamagnetic and colourless

85. (c)

Sol. During the reaction $K_2Cr_2O_7$ is converted to $Cr_2(SO_4)_3$

$$K_2Cr_2O_7 + 7H_2SO_4 + 6KI \rightarrow 4K_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3I_2$$

In $Cr_2(SO_4)_3$, O.S. of Cr is +3

86. (b)

Sol. Basic strength decreases from $La(OH)_3$ to $Lu(OH)_3$ hence, (1) is incorrect.

$Ce = [Xe]4f^1 5d^1 6s^2; Ce^{4+} = [Xe]$

$Yb = [Xe]4f^{14} 6s^2; Yb^{2+} = [Xe]4f^{14}$

$Lu = [Xe]4f^{14} 6s^2; Yb^{2+} = [Xe]4f^{14}$

The given ions contain no unpaired electrons and therefore are diamagnetic.

87. (a)

Sol. $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$

88. (b)

Sol. The electronic configuration of X^{3+} is $[Ar]3d^5$

$\therefore$ Atomic no. of X = 18 + 5 + 3 = 26

89. (d)

Sol. Mn^{2+} acts as autocatalyst.

90. (c)

Sol. Actinoid series has elements from atomic no. 90 to 103. Thulium (Tm) has atomic no. 69

Biology Answer key:

Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.
91	A	109	D	127	B	145	D	163	B
92	A	110	B	128	C	146	D	164	D
93	B	111	A	129	C	147	C	165	B
94	B	112	C	130	D	148	B	166	C
95	D	113	B	131	D	149	C	167	B
96	A	114	A	132	A	150	B	168	D
97	C	115	B	133	A	151	A	169	B
98	B	116	B	134	C	152	B	170	C
99	D	117	C	135	B	153	C	171	C
100	B	118	A	136	A	154	C	172	C
101	B	119	D	137	A	155	C	173	B
102	B	120	C	138	B	156	D	174	D
103	C	121	B	139	B	157	C	175	A
104	A	122	D	140	B	158	C	176	C
105	A	123	A	141	C	159	C	177	B
106	C	124	A	142	C	160	D	178	C
107	C	125	A	143	A	161	B	179	B
108	A	126	A	144	B	162	C	180	A