ANSWER KEY (MAINS-2011)

Ques.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	3	3	2	1	4	2	3	3	4	3	2	3	4	4	1	1	4	1	2	2
Ques.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Ans.	1	3	2	2	2	3	3	1	3	1	2	4	3	4	4	4	2	1	4	3
Ques.	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**
Ans.	1	3	2	4	4	2	4	4	1	2	3	3	2	2	2	1	1	4	1	4
Ques.	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
Ans.	2	1	3	4	3	4	1	1	2	3	3	2	3	1	4	1	1	4	3	2
Ques.	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**100**
Ans.	2	2	3	4	3	4	3	2	1	3	4	4	1	2	4	4	3	2	2	4
Ques.	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**	**118**	**119**	**120**
Ans.	3	1	3	2	1	2	4	2	2	2	2	1	4	3	3	4	2	2	2	4

HINTS & SOLUTIONS

1 **[3]**

Sol. $M = d.V \Rightarrow d = \dfrac{M}{L^3}$

$\Rightarrow d = \dfrac{4\,gm}{cm^3} = \dfrac{4(1/100)}{10^{-3}} = 40\dfrac{gm}{cm^3}$

2 **[3]**

Sol. Average velocity $= \dfrac{2v_1v_2}{v_1 + v_2}$

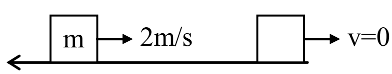
3 **[2]**

Sol. From the law of conservation of linear momentum

$mv\hat{i} + (3m)(2v)\hat{j} = 4\,mv'$

$v' = \dfrac{v}{4}\hat{i} + \dfrac{3}{2}v\hat{j}$

4. **[1]**



Sol. $F = \mu mg$

retardation of the block on the belt

$a = \dfrac{F}{m} = \mu g$

From $v^2 = u^2 + 2as$

$0 = 2^2 - 2(\mu g)\,s$

$s = \dfrac{4}{2 \times 0.5 \times 10} = 0.4$ m

5. **[4]**

Sol. From the law of conservation of angular momentum

$mvr = mv'\dfrac{r}{2}$

$v' = 2v$

so $\dfrac{KE}{KE_1} = \dfrac{\frac{1}{2}mv^2}{\frac{1}{2}mv'^2} = \dfrac{1}{4}$

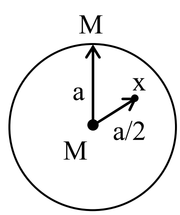
6. **[2]**

Sol. $v_{escape} = \sqrt{\dfrac{2GM}{R}}$

Escape velocity from earth surface.

7. **[3]**

Sol.

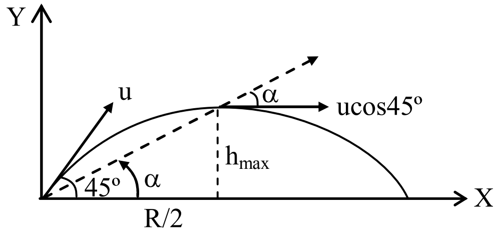


gravitational potential at x point

$V_x = \dfrac{GM}{a/2} + \dfrac{GM}{a} = \dfrac{3GM}{a}$

8. **[3]**

Sol.



$$\tan\alpha = \frac{h_{max}}{R/2} = \frac{\frac{u^2\sin^2 45^\circ}{2g}}{\frac{u^2\sin 90^\circ}{2g}}$$

$$\tan\alpha = \frac{1}{4}$$

$\alpha = \tan^{-1}(1/4)$

9 **[4]**

Sol. $P \propto T^{\gamma/\gamma-1}$

$$\frac{P_2}{P_1} = \left(\frac{T_2}{T_1}\right)^{\gamma/\gamma-1}$$

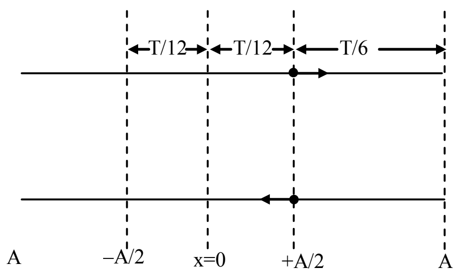
$$P_2 = P_1\left(\frac{T_2}{T_1}\right)^{\gamma/\gamma-1}$$

$$P_2 = 2\left(\frac{1200}{300}\right)^{\frac{1.4}{1.4-1}}$$

$P_2 = 256$ atm

10 **[3]**

Sol.



$$\text{Time interval} = \frac{T}{6} + \frac{T}{6} = \frac{2T}{6}$$

$$\text{Phase difference} \Rightarrow \frac{2T}{6} \equiv \frac{2\pi}{3}$$

11. **[2]**

Sol. $n \propto \sqrt{T}$

$$\frac{\Delta n}{n} = \frac{1}{2}\frac{\Delta T}{T}$$

$$\frac{\Delta T}{T} = 2\times\frac{\Delta n}{n} = 2\times\frac{6}{600} = 0.02$$

12. **[3]**

Sol. For without deviation

$$\frac{A}{A'} = -\frac{\mu'-1}{\mu-1}$$

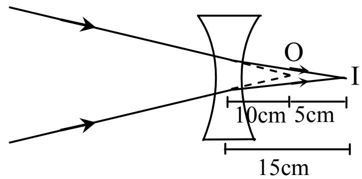
$$\frac{15^\circ}{A'} = -\frac{1.75-1}{1.50-1}$$

$$\frac{15^\circ}{A'} = -\frac{0.75}{0.50}$$

$A' = -10^\circ$

13. **[4]**

sol.



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

$$\frac{1}{15} - \frac{1}{10} = \frac{1}{f}$$

$f = -30$ cm

14. **[4]**

Sol. $W_{D\to E} = Q[V_E - V_D]$

$\because V_E = V_D \Rightarrow W_{D\to E} = 0$

15. **[1]**

Sol. $$\vec{E} = -\left[\hat{i}\frac{\partial V}{\partial x} + \hat{j}\frac{\partial V}{\partial y} + \hat{k}\frac{\partial V}{\partial z}\right]$$

$$\vec{E} = -[\hat{i}(8x)]$$

$$\vec{E}_{(1,0,2)} = -\,8\hat{i}$$

So electric field is 8 along negative x-axis.

16. **[1]**

Sol. By KVL along path ACDB

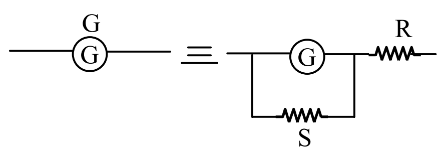
$V_A + 1 + (1)(2) - 2 = V_B$

$0 + 1 = V_B$

$\Rightarrow V_B = 1$ volt

17. **[4]**

Sol.



Current will be unchanged if resistance remains same so

$$G = \frac{GS}{G+S} + R$$

$$\Rightarrow R = G - \frac{GS}{G+S}$$

$$= \frac{G^2}{G+S}$$

18. **[1]**

Sol. For minimum deflection of 1 division

required current = 1 μA

$\Rightarrow$ Voltage required = IR = (1μA) (10) = 10 μV

$\therefore$ 40 μV ≡ 1ºC

$\Rightarrow 10\ \mu V \equiv \frac{1}{4}\ ^{\circ}C = 0.25^{\circ}C$

19. **[2]**

Sol. $B = \frac{\mu_0 I}{2R} = \frac{\mu_0 qf}{2R}$

$I = \frac{q}{T} = qf$

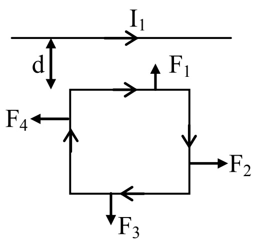
20. **[2]**

Sol. U = –MB cos θ

U = –MB cos 0 = –0.4 × 0.16 = –0.064

21. **[1]**

Sol.



$\vec{F_2} = -\vec{F_4}$

$\vec{F_1} = \frac{\mu_0 I_1 I_2 \ell}{2\pi d}$

$\vec{F_3} = \frac{\mu_0 I_1 I_2 \ell}{2\pi(d+\ell)}$

$\vec{F_1} > F_3$

So wire attract loop.

22. **[3]**

Sol. $V_{rms} = \left[\frac{1}{T}\int_0^{T/2} V_0^2\, dt\right]^{1/2} = \left[\frac{V_0^2}{T}[t]_0^{T/2}\right]^{1/2}$

$= \left[\frac{V_0^2}{T}(T/2)\right]^{1/2}$ or $V_{rms} = \left[\frac{V_0^2}{2}\right]^{1/2} = \frac{V_0}{\sqrt{2}}$

13 **[2]**

Sol. $X_L = 2\pi fL$

$X_L \propto f$

$\frac{X_{L_2}}{X_{L_1}} = \frac{f_2}{f_1} \Rightarrow X_{L_2} = 40\ \Omega$

R = 30 Ω

$Z = \sqrt{(30)^2 + (40)^2} = 50\ \Omega$

$I = \frac{V}{Z} = \frac{200}{50} = 4A$

24. **[2]**

Sol. $V_0 = \frac{E_{Ph} - W}{e} = \frac{h(\nu - \nu_0)}{e}$

$= \frac{6.62 \times 10^{-34}(8.2 \times 10^{14} - 3.3 \times 10^{14})}{1.6 \times 10^{-19}}$

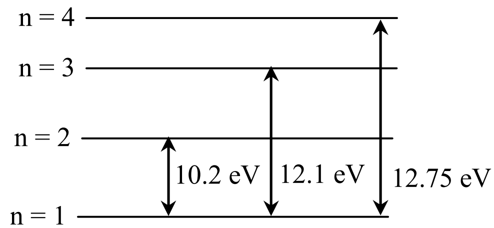
$= \frac{6.62 \times 10^{-34}}{1.6} \times 4.9 \times 10^{14+19}$

$= \frac{6.62 \times 4.9}{1.6} \times 10^{-1} = 2$ volt

25 **[2]**

Sol. $E_{Ph} = K.E_{max} + W$

$= eV_0 + W = 10 + 2.75 = 12.75$ eV



Differenced of 4 and 1 energy level is 12.75 eV

So higher energy level is 4 to ground and Excited state is n = 3.

26. **[3]**

Sol.

	P	Q
	$4N_0$	N_0
$T_{1/2}$	1 min	2 min

$N_P = N_Q$

$\frac{4N_0}{2^{t/1}} = \frac{N_0}{2^{t/2}}$

$4 = 2^{t/2}$

$2^2 = 2^{t/2}$

$\frac{t}{2} = 2 \Rightarrow t = 4$ min

Disactive nucleus or Nuclei of R

$= \left(4N_0 - \frac{4N_0}{2^4}\right) + \left(N_0 - \frac{N_0}{2^2}\right)$

$= 4\ N_0 - \frac{N_0}{4} + N_0 - \frac{N_0}{4} = 5\ N_0 - \frac{N_0}{2}$

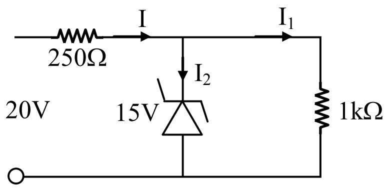
$= \frac{9}{2}\ N_0$

27. [3]

Sol. 11.1 eV is not possible

28. [1]

Sol.



$$I_1 = \frac{15}{1k\Omega} = 15 \text{ mA}$$

$$I = \frac{20-15}{250} = 20 \text{ mA}$$

$I_2 = I - I_1 = 20 \text{ mA} - 15 \text{ mA} = 5\text{mA}$

29. [3]

Sol. (a), (c) are forward bias.

30. [1]

Sol. $n_e\, n_h = n_i^2$

$n_e\, N_A = n_i^2$

$$n_e = \frac{n_i^2}{N_A} = \frac{(1.5\times10^{16})^2}{4.5\times10^{22}} = 5 \times 10^9/\text{m}^3$$

31. [2]

Sol. Unit of k = $\text{mol}^{1-n}\ \ell^{n-1}\ \text{s}^{-1}$

For zero order reaction

n = 0

unit of k = $\text{mol}\ \ell^{-1}\ \text{s}^{-1}$

32. [4]

Sol. $1.28 \longrightarrow 0.64 \longrightarrow 0.32 \longrightarrow 0.16 \longrightarrow 0.08 \longrightarrow 0.04$

No. of half lifes (n) = 5

$$5 = \frac{\text{Total time}}{138}$$

time required = 5 × 138

= 690 s

33. [3]

Sol. 2(i) – (iii) + (ii)

$\Delta H = 2(150) - 350 - 125$

$= -175$ kJ/mol

34. [4]

Sol. $O_2^+ = KK\sigma 2s^2\ \sigma^*2s^2\ \sigma 2p_z^2\ (\pi 2p_x^2 = \pi 2p_y^2)\ (\pi^*2p_x^1)$

$O_2 = KK\sigma 2s^2\ \sigma^*2s^2\ \sigma 2p_z^2\ (\pi 2p_x^2 = \pi 2p_y^2)\ (\pi^*2p_x^1 = \pi^*2p_y^1)$

O_2 and O_2^+ contain unpaired electron in π^* ABMO so paramagnetic.

35. [4]

Sol.
$$E = \frac{hC}{\lambda} = hC\, R_H\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

36. [4]

Sol. $[Ag^+]\,[Cl^-] = 1.8 \times 10^{-10}$

$$[Ag^+] = \frac{1.8\times10^{-10}}{0.1} = 1.8\times10^{-9}\,M$$

$[Pb^{+2}]\,[Cl^-]^2 = 1.7 \times 10^{-5}$

$$[Pb^{+2}] = \frac{1.7\times10^{-5}}{0.1\times0.1} = 1.7\times10^{-3}\,M$$

37. [2]

Sol.

$P_1 = 1.5$ bar	$P_2 = 1$
$T_1 = 288$ K	$T_2 = 298$ K
$V_1 = V$	$V_2 = ?$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$V_2 = 1.55$ V

38. [1]

Sol. $i = 1 - \alpha + n\alpha$

$i = 1 - 0.3 + 2(0.3)$

$i = 1.3$

$\Delta T_f = iK_f\, m$

$= 1.3 \times 1.86 \times 0.1$

$\Delta T_f = +\,0.24$ºC

Freezing point of solution = – 0.24ºC

39. [4]

Sol. $2Fe^{+3} + 2I^- \longrightarrow I_2 + 2Fe^{+2}$

40. [3]

Sol.
$$\text{Rate} = -\frac{1}{2}\frac{d[N_2O_5]}{dt} = +\frac{1}{4}\frac{d[NO_2]}{dt} = \frac{d[O_2]}{dt}$$

$$\frac{1}{2}K[N_2O_5] = \frac{1}{4}K'[N_2O_5]$$

$$K' = 2K \text{ and } K'' = \frac{K}{2}$$

41. **[1]**

Sol. $\pi v = \dfrac{w}{m}RT$

$2.57 \times 10^{-3} \times \dfrac{200}{1000} = \dfrac{1.26}{m} \times 0.083 \times 300$

$m = 61038 \text{ gm mol}^{-1}$

42. **[3]**

Sol. Plaster of paris = $CaSO_4.1/2\ H_2O$

Epsomite = $MgSO_4.7H_2O$

Kieserite = $MgSO_4.H_2O$

Gypsum = $CaSO_4.2H_2O$

43. **[2]**

Sol. SnO_2 react with acid as well base

So amphoteric

$SnO_2 + 4HCl \longrightarrow SnCl_4 + 2H_2O$

$SnO_2 + 2NaOH \longrightarrow Na_2\ SnO_3 + H_2O$

44. **[4]**

Sol. $SiO_2 \quad + \quad CaO \longrightarrow CaSiO_3$

Acidic   Basic   Slag

impunity   flux

45. **[4]**

Sol. Aluminium dissolve in excess NaOH to liberating hydrogen and forming metaaluminate

$2\ Al + 2NaOH + 6H_2O \longrightarrow 2Na\ [Al(OH)_4]$

or $(2NaAlO_2.2H_2O) + 3H_2$

46. **[2]**

Sol. $M \xrightarrow{M^+} M^+ + e^-$ $IE_1 = 5.1$ eV

$M^+ + e^- \longrightarrow M$ $\Delta H_{eg} = -5.1$ eV

47. **[4]**

Sol. Maximum number of molecules $= \dfrac{8}{2} N_A$

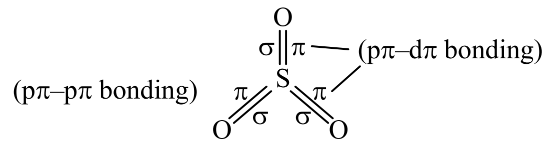
$= 4N_A$

48. **[4]**

Sol. $\dfrac{r_c}{r_a} = 0.414 \Rightarrow r_a = \dfrac{100}{0.414} = 241.5$ pm

49. **[1]**

Sol. Most preferred structure of SO_3 with lowest energy is as it contain maximum number of covalent bond.



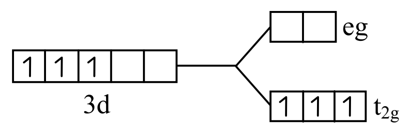
50. **[2]**

Sol. Due to positive oxidation state of Mn back donation in π* ABMO of CO is minimum therefore C–O bond is strongest.

51. **[3]**

Sol. $[Cr(NH_3)_6]^{+3}$ [Ar] $3d^3\ 4s^0$

three unpaired electron are present in t_{2g} orbited



52. **[3]**

Sol. Localized l.p. is more basic than delocalized l.p.

53. **[2]**

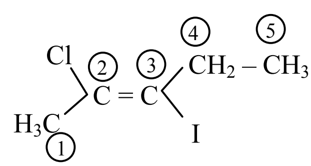
Sol. It is a fact

54. **[2]**

Sol. Intermediate carbanion is involve which is most stable with –M group.

55. **[2]**

Sol.



Configuration is (trans) OR (E)

Name ⇒ 2- chloro-3-iodo- 2-pentene

56. **[1]**

Sol.

$$CH_3-CH_2-COOH \xrightarrow{NH_3} CH_3-CH_2-COONH_4$$

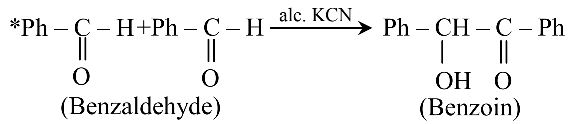
(A) (B)

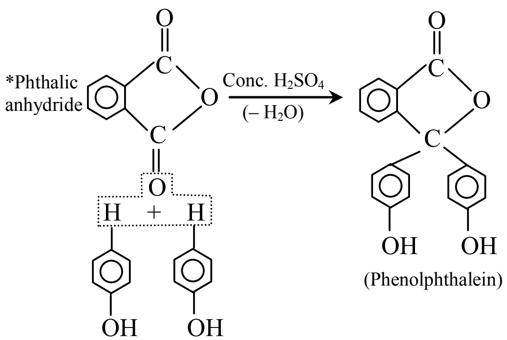
$$\xrightarrow[\Delta]{-H_2O} CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2 \text{ (C)}$$

$$CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-NH_2 \text{ (C)} \xrightarrow[\text{Hoffmann degradation}]{Br_2+KOH} CH_3-CH_2-NH_2$$

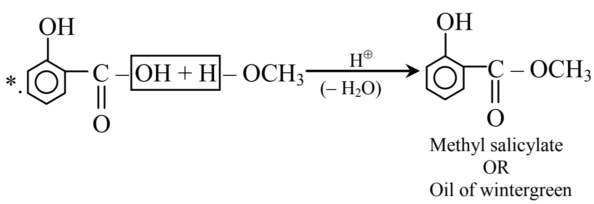
57. **[1]**

Sol.





* Methyl benzoate is involve in fries rearrangement.



58. **[4]**

Sol. Primary structure is unaffected by denaturation.

59. **[1]**

Sol. N.A. R $\propto \oplus$ Charge on Sp^2

carbon $\propto \dfrac{-M}{+M} \propto \dfrac{-I}{+I}$

60. **[4]**

Sol. 1° halide generally shows SN^2 reaction.

(No rearrangement)