IIT-JEE-2011

CHEMISTRY PAPER I Solutions

PAPER CODE β 9

Paper - I :

Section-I (+3,-1)			
1. (B)	2.(B / D)	3. (A)	4. (D)
5. (C)	6. (A)	7.(A)	
Section-II (+4,0)	8.(A),(D)	9.(B),(C)	10.(A),(B),(D)
11.(A),(B),(C),(D)			
Section-III(+3,-1)	12.(B)	13.(A)	14.(C)
15.(D)	16.(B)		
Section-IV (+3,-0)	17.5	18.5	19.9
20.5	21.7	22.7	23.4

Paper - I :

1. **(B)** Cl is a weak field ligand so forms no pairing in the complex $[Ni(Cl)_4]^{+2}$ hence sp^3 hybridization Tetrahedral structure. CN- is a strong field ligand which gives pairing of complex hence dsp^2 hydridization - square planar structure.

2: **(D)** Ag^+ and k^+ ions both have nearly same mobility.

3: **(A)** Simple calculation.

4: **(D)** $3Ba(N_3)^2$-->$Ba_3N_2 + 8\ N_2$ (Pure form)

5: **(C) Due to ortho effect / hydrogen bonding the ortho isomer is having the highest acidic character.**

6: **(A)** Gabriel phalamide synthesis reaction

7: **(C)** Molarity = (2 / (1120/1.15)x1000 = 2.05M

8. **A,D** extraction of Sn from SnO_2

9. **B,C** due to allene type structure in (d) the two double bonds are lying perpendicular so other options are correct.

10. **A, B, D** By theoretical concepts.

11. **A,B, C, D** by kinetic theory postulates directly.

12. **B**

13. **A**

14. **C** Equations

1. $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2$

   Light Blue

2. $AgNO3^+ + NaCl \rightarrow AgCl + NaNo_3$

3. $Ag^+ + NH_3(aq) \rightarrow Ag(NH_3)_2^+$

4. $Cu^{+2} + NH_3(aq) \rightarrow Cu(NH_3)_2^{+2}$

   Dark Blue

15. **D** Reaction 1 - Hydration of alkynes to ketone Reaction 2 - Reduction ketone to Sec alcohol. Reaction 3- Rearrangement during dehydration

16. B

17. 5 Reaction $3Br_2 + 3Na_2CO_3 \rightarrow 5NaBr + NaBrO_3$

18. 5 As per the structure

19. 9 n^2 are the electrons in the orbit have the same spin quatum number.

20. 6 (796 + (9x18) x 0.47 = (n x 75) then find the value of n.

21. 7 By Dalton's law of partial pressure 0.68 = (0.1 / (n + 0.1) then apply PV=nRT and get the answer

22. 5 Two different alkenes showing (E, Z) isomers & the total structures are five.

23. 4 $hv \leq hv_0$ metals which show photoelectric effect must satisfy this condition.

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PHYSICS PAPER I Solutions

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24. A	**25.C**	**26. A**	**27. D**	**28. B**
29. D	**30. A**	**31. B, D**	**32. A, B, C, D**	**33. A, D**
34. A, C, D	**35. C**	**36. B**	**37. D**	**38. C**
39. B	**40. 5**	**41. 9**	**42. 6**	**43. 1**
44. 3	**45. 3**	**46. 4**		

24. A

Adiabatic Process : Workdone = $-\Delta U = -nx\frac{f}{2}Rx\Delta T$ Now, for data given,

$n = \frac{5.6}{22.4} = 0.25, f = 3$ (mono-atomic gas) and

$T_1 V_1^{(y-1)} = T_2 V_2^{(y-1)} \Rightarrow T_1(5.6ltr)^{(y-1)}, \gamma = (5/3) give \Delta T = -3T_1$, for the given

Process, therefore Workdone (by the gas) $-\Delta U = -\frac{9}{8}RT_1$

25. C

Since the Elec. Field given is uniform and the surface given is a ``lamina'' the Electric Flux can be calculated by $\phi_E = \vec{E}.\vec{A}. Now, \vec{E}. = E_0\hat{i} and A = \left(a\hat{j}\right)x\left(a\hat{i} + a\hat{k}\right) = \left(a^2\hat{i} - a^2\hat{k}\right)$ Hence by calaculation by the `dot' product of Field and area vector, the flux is equal to E_0a^2

26. A

Wavelength for first spectral line for the Balamer series for H-atom being λ_1 = 6561A^0 such that , $\frac{hc}{\lambda_1} = --(13.6eV)\left[\frac{1}{3^2} - \frac{1}{2^2}\right]$ whereas that for the second spectral line for the Balmer series of singly ionized He ion being λ_2 such $\frac{hc}{\lambda_2} = -(2^2)(13.6eV)\left[\frac{1}{4^2} - \frac{1}{2^2}\right]$ comparing the two

$$\frac{\lambda_2}{\lambda_1} = \frac{1}{4}x\frac{5}{36}x\frac{16}{3} \Rightarrow \lambda_2 = 1215A^\circ$$

27. D

Maximum possible value of angular speed for the ball will correspond to the equation,

$$m\omega_{\max}^2 r = T_{\max} \Rightarrow \omega_{\max} = \sqrt{\frac{324}{0.5x0.5}} = 36$$

$$x = \frac{10(52+1)}{(48+2)} = 10.6\Omega$$

29. D

When the switch is turned to position `2` from position `1` as show in the circuit, the inltial charge present on the plates of the 2 μ F capacitor Q = (2V) μ C gets redistributed between the two capacitors such that in steady state the charges on the plates of the 2 μ F and the $8\mu F are Q_1 = (0.4v)\mu C and Q_2 = (1.6V)\mu C$ respectively. Thus the final Electrostatic Potential Energy stored in the system $U_f = \frac{1}{2}\left[\frac{Q_1^2}{2\mu F} + \frac{Q_2^2}{8\mu F}\right] = (0.2V^2)\mu J$ whereas the initial potential Energy stored was $U_1 = \frac{1}{2}\left[\frac{Q^2}{2\mu F}\right] = (V^2)\mu J$ Thus there is an 80% ``dissipation`` of energy in the circuit.

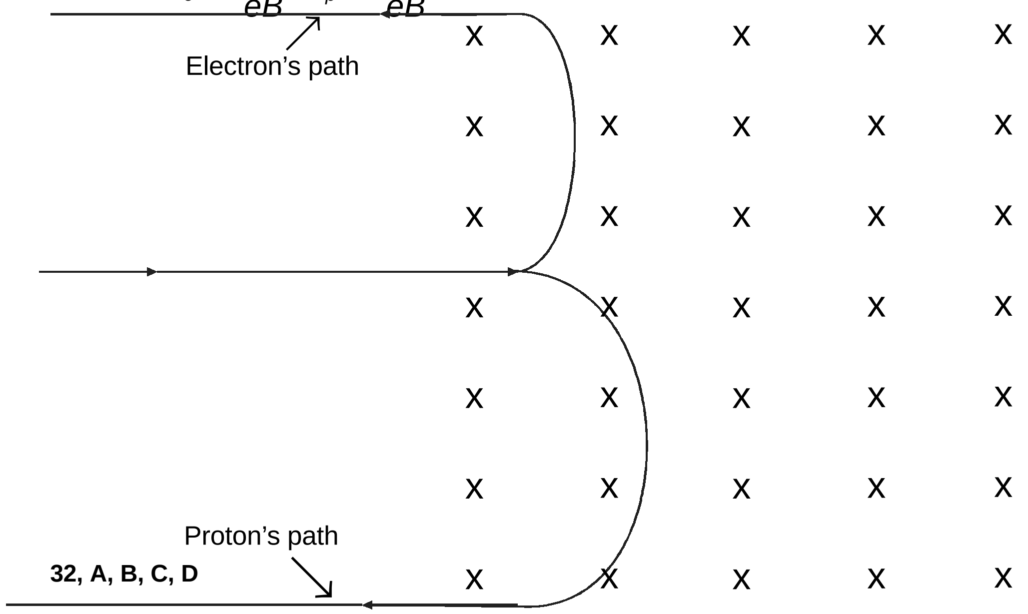
30. A

The frequency of the ``reflection'' of the siren as made by the tall building can be calculated by application of the Doppler effect formula $f = f\left[\frac{v}{v - v_s}\right] = 8kHz x \frac{320}{310}$ now, the frequency of this reflected siren as heard by the car driver can be calculated by re-applying the Doppler effect foumula,

$$f'' = f'\left[\frac{v + v_0}{v}\right] = \left[8kHz x \frac{320}{310}\right] x \frac{330}{320} = 8.5kHz$$

31. B

Since the proton and electron will traverse a `circular` trajectory and complete a semi-circle before they ``exit`` the region of the Uniform Magnetic Field, it is evident that they ``come-out in mutually parallel paths and that the time taken to complete the semi-circle would be different given by $T_e = \frac{\pi m_e}{eB}, T_p = \frac{\pi m_p}{eB}$



32, A, B, C, D

The Electric Field inside a conductor will always be zero in steady state through the appropriate redistribution of ``surface charges``. Also the net charge on the (A+B) system

Will be re-distributed on connecting them such that $V_A = V_B \Rightarrow \frac{Q_A}{R_A} = \frac{Q_B}{R_B} \Rightarrow \frac{\sigma_A R_A^2}{R_A} = \frac{\sigma_B R_B^2}{R_B}$

On a surface of a sphere $E \propto \sigma$

33. A,D

For both cases A and B, torque at angular postion θ = mgL sin θ

Angular Frequency, $\omega \propto \frac{1}{\sqrt{I}}$ where I is the moment of inertia about the point of supension. Here $I_A > I_B$

34. A,C,D

Net Heat flow rate $\frac{dQ}{dt} = \frac{kA\Delta T}{L}$

From the figure $\frac{dQ_A}{dt} = \frac{dQ_E}{dt} = \frac{dQ_B}{dt} + \frac{dQ_c}{dt} + \frac{dQ_D}{dt} =$ net heat rate flow

$\frac{dQ_B}{dt} = \frac{dQ_D}{dt} = \frac{1}{2}\frac{dQ_C}{dt}$ Also for slab E, L is minimum and K is maximum, hence ΔT is minimum

35. C

$[\omega] = [N]^a [e]^b [m]^c [e]^d$ and $[\omega] = T^{-1}$; $[N] = L^{-3}$; $[e] = IT$; $[m] = M$; $[\varepsilon_\circ] = M^{-1}L^{-3}I^{-2}T^4$

36. B

Solve for ω from Q. 35 and use $v = f\lambda$

37. D

As the ball goes up its position increases initially while the momentum decreases to zero, with both being positive. After reaching the highest point, momentum increases (sign is -ve) while position decreases (sign is +ve)

38. C In an SHM, total mechanical energy is proportional to square of amplitude

39. B

It's a damped oscillation, therefore decreasing amplitude. Also momentum is negative when position varies from positive extreme to negative extreme and vice-versa.

40. 5

μmg cos 450 + mg sin 45^0 = 3(mg sin 45^0 - μmg cos 45^0)

41. 9 $I = 2x\left[\frac{2}{5}mR^2\right] + 2x\left[\frac{2}{5}mR^2 + md^2\right]$

42. 6

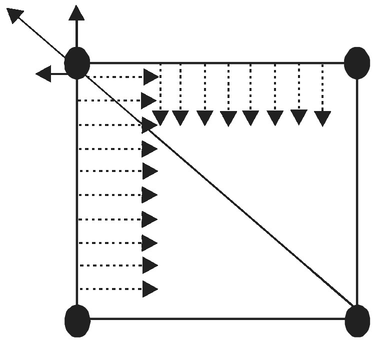
$B = \frac{\mu_\circ I}{\int}$; $\phi_B = B.\pi R^2 \Rightarrow i_{induced} = \frac{d\phi_B}{dt} \Big/ r$ where`r` is the resitance of the loop

$\mu = i_{induced} x \pi R^2$ $\left[Assume.\pi^2 \approx 10\right]$

43. 1

At t=0, $\frac{dN_\circ}{dt} = \lambda N_\circ$ also mean life $= \frac{1}{\lambda}$

44. 3 $\frac{\Delta \int}{\int} = \alpha \Delta T$ and $\frac{F/A}{\Delta \int / \int} = Y$ $F = mg; A = \pi R^2$



45. 3

$\propto y.a$

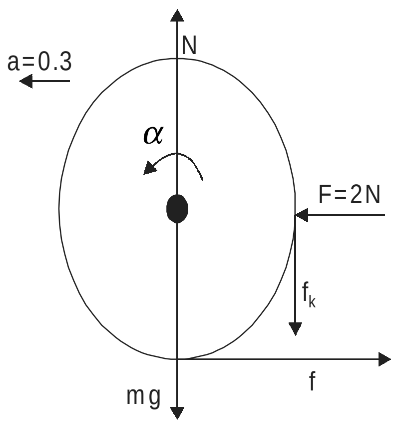
At equilibrium: net force on any charge is zero.
From the flgure, the dark lines represent the electrostatic force and the dashed lines represent the force due to the surface tension.
force due to the surface tension.

$\propto \frac{q^2}{a^2}$

Force due to electric field

$a = R\alpha$......(1)

46. 4



$F - f = ma$......(2)
From the f.b.d. of the ring :

$(f - f_X)R = I\alpha$.......(3)

$f_k = \mu F$ $I = mR^2$

and

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47. A	48. B	49. C	50. C	51. C
52. B	53. D	54. A, D	55. B, C	56. C
57. B, D	58. D	59. A	60. B	61. B
62. D	63. 9	64. 2	65. 7	66. 1
67. 5	68. 8	69. 8		

QN. 47. Put $x^2 = t$ then apply $\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$

QN. 48. $\int_o^b (x-1)^2 dx - \int_b^1 (x-1)^2 dx = \frac{1}{4}$

QN. 49. $\vec{v} = \vec{a} + \lambda\vec{b}, \frac{\vec{v},\vec{c}}{|\vec{c}|} = \frac{1}{\sqrt{3}}$

QN. 50. take log and simplify

QN. 51. $\frac{a_{10} - 2a_8}{2a_9} = \frac{\alpha^8(\alpha^2-2) - \beta^8(\beta^2-2)}{2(\alpha^9 - \beta^9)} = \frac{6(\alpha^9 - \beta^9)}{2(\alpha^9 - \beta^9)} = 3$

QN. 52. $y + 2 = m(x-3)$, use angle between two line $m_1 = m, m_2 = -\sqrt{3},$ and get $m_1 = \sqrt{3}$

QN. 53.
$P: \tan\theta = \sqrt{2} + 1$

$Q: \tan\theta = \frac{1}{\sqrt{2}-1} = \sqrt{2} + 1$

QN. 54. $\vec{v} = \vec{a} + \lambda\vec{b}, \vec{v}.\vec{c} = 0$

QN. 55. $f(x) = kx$

QN. 56. $M^T = -M, N^T = -N, (MN)^T = N^T M^T$

QN. 57. $e_{ellipse} = \frac{\sqrt{3}}{2}$, Focus of ellipse $= \left(\sqrt{3}, 0\right), \Rightarrow a^2 = 3, b^2 = 1$

QN. 58. Solving matrix

$$a + 8b + 7c = 0$$
$$9a + 2b + 3c = 0$$
$$a + b + c = 0$$

Also $2a + b + c = 1$, we get $a = 1, b + c = -1 \Rightarrow 7a + b + c = 6$

QN. 59. $a = 2, b = 12, c = -14$

QN. 60. $a = 1, b = 6, c = -7$

Putting these values make an infinite GP.

QN. 61. $\frac{1}{2}(\frac{3}{5}\frac{2}{2} + \frac{2}{5}\frac{1}{2}) + \frac{1}{2}(\frac{1}{10}\frac{1}{3} + \frac{3}{10}\frac{2}{2} + \frac{6}{10}\frac{2}{3}) = \frac{23}{30}$

QN. 62. $\dfrac{\frac{1}{2}(\frac{3}{5}\frac{2}{2} + \frac{2}{5}\frac{1}{2})}{\frac{1}{2}(\frac{3}{5}\frac{2}{2} + \frac{2}{5}\frac{1}{2}) + \frac{1}{2}(\frac{1}{10}\frac{1}{3} + \frac{3}{10}\frac{2}{2} + \frac{6}{10}\frac{2}{3})} = \frac{12}{23}$

QN. 63. $\frac{S_m}{S_n} = \dfrac{\frac{m}{2}(6 + (m-1)d)}{\frac{n}{2}(6 + (n-1)d)} = \dfrac{\frac{5n}{2}(6 + (5n-1)d)}{\frac{n}{2}(6 + (n-1)d)}$

As this is independent of n which is only possivel for d=6

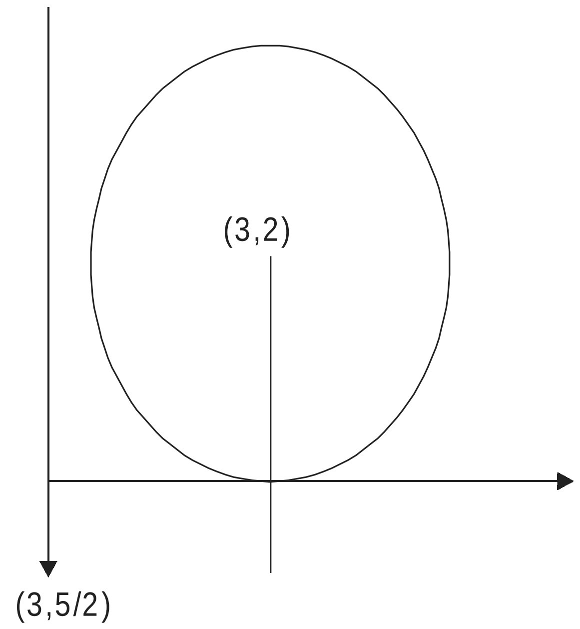
So AP has common diff=6

QN. 64. $\Delta_1 = \frac{1}{2}\begin{vmatrix} \frac{1}{2} & 2 & 1 \\ 2 & 4 & 1 \\ 2 & -4 & 1 \end{vmatrix} = 6$ $\qquad \Delta_2 = \frac{1}{2}\begin{vmatrix} -2 & 0 & 1 \\ 1 & 3 & 1 \\ -1 & -1 & 1 \end{vmatrix} = 3$

QN. 65. $Put \frac{\pi}{n} = \theta,$ use the formula of $\sin 2\theta$, $\sin 3\theta$, solving we get

QN. 66. $8\cos^3\theta - 4\cos^2\theta - 4\cos\theta + 1 = 0$ which is satisfied by $\frac{\pi}{7} = \theta$

QN. 67. $Solving, f(\theta) = |\tan\theta|, \frac{d}{d(\tan\theta)}(f(\theta)) = \pm 1$ but will take only positive value



QN. 68. Use AM>GM

QN. 69. Use Leibnitz