FIITJEE

ALL INDIA TEST SERIES

FULL TEST – I

JEE (Advanced)-2018-19

PAPER –2

ANSWERS, HINTS & SOLUTIONS

Physics

PART – I

SECTION – A

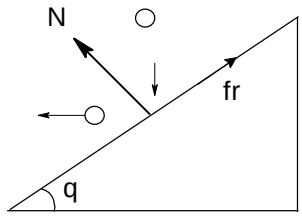
1. B

Sol. $\int Ndt = mv_0(1+e)Cos\theta$ (1)

$-\mu\int Ndt = m(V_x - V_0\sin\theta)$ (2)

$V_x = V_0\sin\theta - \mu V_0(1+e)Cos\theta$

$\tan\theta = \dfrac{eV_0\cos\theta}{V_x} \Rightarrow \mu = \dfrac{1-e}{1+e}$

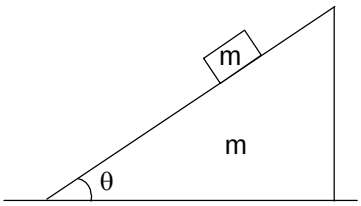


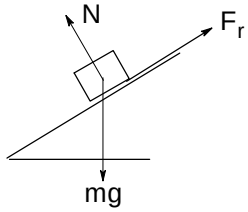
2. AB

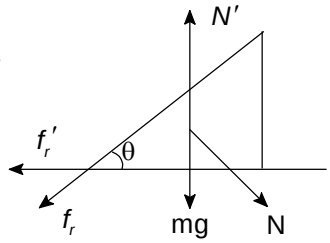
Sol. Graph must be hyperbolic.

3. BCD

Sol.







$N' = mg + N\cos\theta + \perp\sin\theta$

$N\sin\theta = \perp' + fr\cos\theta$

(for inclined plane to move over horizontal surface)

4. B

Sol. Heat taken from water to freeze

$m_\omega L_f - m_\omega S_i\left(0-\left(-10^\circ c\right)\right) =$ Heat taken by crushed ice $= m_i s_i\left(0-\left(-20^\circ c\right)\right)$

5. AD

Sol. $f \perp = n\left(\frac{hc}{\lambda_2}\cos 60^\circ - \frac{hc}{\lambda_1}\cos 45^\circ\right)$

$f_{11} = 0$

6. ABC

Sol.

$\mu_1 \quad (\mu_2) \quad \mu_3$

$\frac{\mu_3}{V} - \frac{\mu_1}{U} = \frac{\mu_3 - \mu_2}{R_2} + \frac{\mu_2 - \mu_1}{R_1}$

7. ABCD

Sol. $eVB = eE$

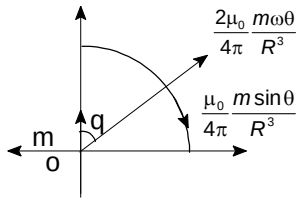
$ex\omega B = eE$

$E = \omega Bx$

$\Rightarrow E \propto x$

8. C

Sol. $E.m.f() = \int_0^{\pi/2} \frac{2\mu_0}{4\pi} m \frac{m\omega\theta}{R^3} \cdot Rd\theta$

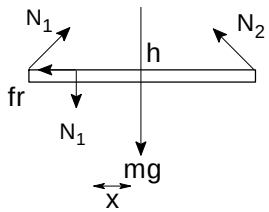


9. A

Sol. Motion of insect will be S.H.M as Plank is always horizontal

$f_r h = N'x$ (1)

$f_r = ma$ (2)

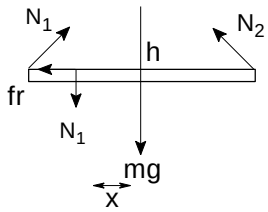


10. D

Sol. Motion of insect will be S.H.M as Plank is always horizontal

$f_r h = N'x$ (1)

$f_r = ma$ (2)



11. C

Sol. R.C circuit

12. A

Sol. R.C circuit

SECTION – C

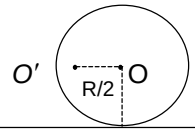
13. 9

Sol. $\left\{\frac{dx}{dt}\right\}_{in} = \frac{1}{T_1}\left\{\frac{dx}{dt}\right\}_{out} = -k\sqrt{x}$

$\left\{\frac{dx}{dt}\right\}_{net} = \left\{\frac{dx}{dt}\right\}_{in} + \left\{\frac{dx}{dt}\right\}_{out}$

14. 6

Sol.



For pure Rolling $\Rightarrow a = Rh$

Vertical line equation Lo sphere

$N - mg = ma_{cmy}\left\{a_{cmy} = \frac{Rh}{2} = \frac{a}{2}\right\}$

$N = mg + \frac{ma}{2}$

for not sliping

$m\omega^2\frac{R}{2} \le \mu\left(mg + m\frac{a}{2}\right)$

15. 5

Sol. Process will turn from endothermic to exothermic at point where slope of P-V graph satisfy the slope of adiabatic curve for same gas.

i.e. $\frac{YP}{V} = \frac{P_0}{V_0}$ *and* $P = -\frac{P_0}{V_0}\cdot V + P_0$

16. 3

Sol. $\omega_{Total} = \omega_g + \omega_{Electro} + \omega_{External} = \Delta K \cdot E$

{Final state is also in equilibrium}

17. 4

Sol. $f_{ab} = \left(\frac{v + v_{ob}}{v}\right)f_o$

$1 + \frac{v_{ob}}{v} = \frac{f_{ob}}{f_o}$

$v_{ob} = \left(\frac{f_{ob} - f_o}{f_o}\right)v$

$\Delta\tau = \tau_o - \tau_{ob} = \frac{L}{f_o} - \frac{L}{f_{ob}}$

$\Delta\tau = \frac{f_{ob} - f_o}{f_o \cdot f_{ob}}$

Difference in time interval of beep observed and produced is no. of oscillation multiplied by $\Delta\tau$.

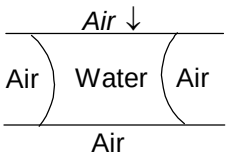
$$t' = \frac{\Delta t}{\tau_{ob}} \cdot \Delta\tau$$

Hence beep produced for interval

$\Delta t + t' = 4\,\text{sec}$

18. 2

Sol.



$$P_o - P_w = \frac{2T}{R}$$

$$P_w = \left(P_o - \frac{2T}{R}\right)$$

$$F_{net} = P_o A - \left(P_o - \frac{2T}{R}\right) A$$

19. 3

Sol. $BD = l_2$

$CD = l_1$

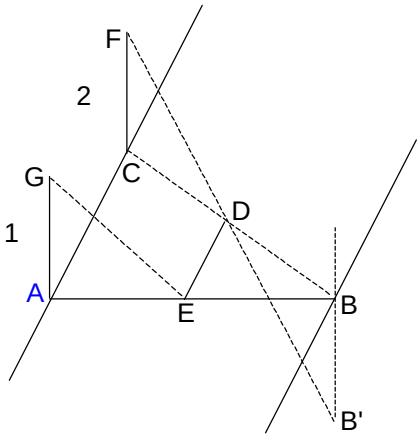
ΔCDF *and* $\Delta BB'D$ *are similar*

$$\frac{BB'}{CF} = \frac{BD}{CD}$$

$$\Rightarrow \frac{l_2}{l_1} = \frac{h_1}{h}$$

ΔACB *and* ΔBDE *are similar*

$$\frac{AC}{l_1 + l_2} = \frac{DE}{l_2}$$

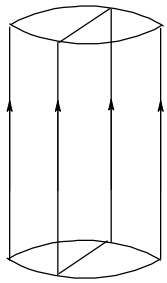


20. 4

Sol. $\frac{\mu_0 \lambda^2}{2} = \text{Magnetic Pressure}$

$$\text{Force} = \frac{\mu_0 \lambda^2}{2} \times \text{Pro sec tion area}$$

$$\lambda = \frac{I}{2\pi R}$$



Chemistry

PART – II

SECTION – A

21. BC

Sol. $Fe^{2+} + \left[Fe(CN)_6\right]^{3-} \longrightarrow Fe^{3+} + \left[Fe(CN)_6\right]^{4-} \longrightarrow$

$Fe_4\left[Fe(CN)_6\right]_3$ Blue precipitate

$Fe^{3+} + \left[Fe(CN)_6\right]^{4-} \longrightarrow Fe_4\left[Fe(CN)_6\right]_3$ Blue precipitate

$Fe^{2+} + \left[Fe(CN)_6\right]^{4-} \longrightarrow Fe_2\left[Fe(CN)_6\right]$ White precipitate

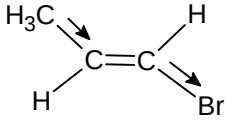
$Fe^{3+} + \left[Fe(CN)_6\right]^{3-} \longrightarrow Fe\left[Fe(CN)_6\right]$ Brown colour

$Cu^{2+} + \left[Fe(CN)_6\right]^{4-} \longrightarrow Cu_2\left[Fe(CN)_6\right]$ Brown colour

$Fe^{3+} + S_2O_3^{2-} \longrightarrow \underset{\text{violet colour}}{\left[Fe(S_2O_3)\right]^{-1}} \longrightarrow Fe^{2+} + S_4O_6^{2-}$

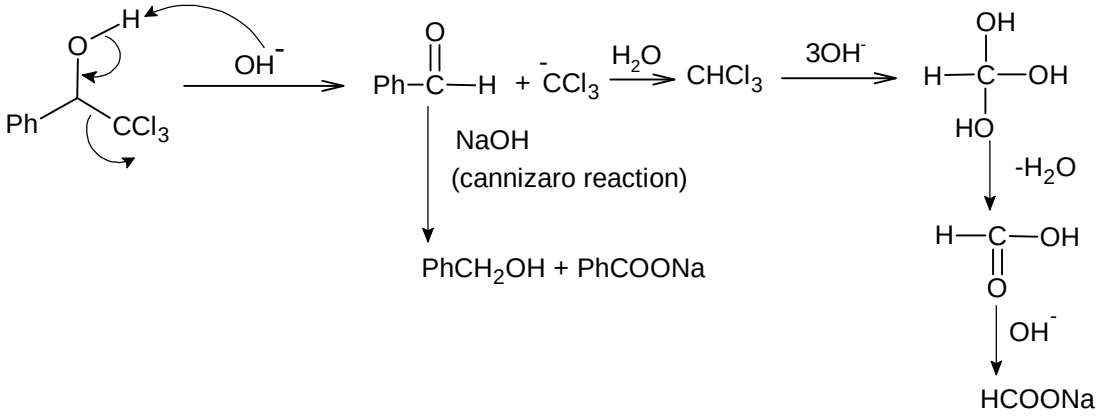
22. ABCD

Sol. (I) has higher dipole moment than (II).



23. ABC

Sol.



24. B

Sol. (B) is major due to 6-membered cyclic transition state.

25. C

Sol. $A \longrightarrow 3B$

a	0	initially
a – x	3x	time 't'

$v_0 \propto a$ and $v_t \propto a + 5x$

$$k = \frac{2.303}{t}\log\left(\frac{5v_0}{6v_0 - v_t}\right)$$

Putting $v_t = 2v_0$ and at $t = 970\,\text{sec}$

$$k = \frac{2.303}{970}\log\left(\frac{5}{4}\right) = \frac{2.303}{970} \times 0.0971 = 2.303 \times 10^{-4}$$

$$\therefore t_{\frac{1}{2}} = \frac{0.693}{2.303 \times 10^{-4}} = 3010\,\text{sec}$$

26. ACD

Sol. Fact

27. ACD

Sol. (A) $d_{x^2-y^2} + d_{x^2-y^2}$ can do σ or δ overlap

(B) s + p_x can do σ overlap

(C) $d_{xy} + d_{xy}$ can do π or δ overlap

(D) $p_z + p_z$ can do σ or π overlap

28. BD

Sol. Gas having higher critical temperature, shows higher extent of adsorption.

29. B

Sol. BF_3 forms addition product with water

$$BF_3 + H_2O \longrightarrow H^+\left[BF_3OH\right]^- \xrightarrow{H_2O} H_3O^+\left[BF_3OH\right]^-$$

30. A

Sol. H_3BO_3 is monobasic and $\left[B(OH_4)\right]^-$ is conjugate base of H_3BO_3. Also BF_3 (electron deficient) reacts with ether as:

$$R_2O + BF_3 \longrightarrow \left[R_2O \rightarrow BF_3\right]$$

31. D

Sol. In the nearest neighbour of Mn^{2+}(0), there are six oxides (x) at the adjacent six edge centre, hence CN of
Mn^{2+} = 6.
The nearest neighbour points to the body centre is the 12 edge centres where oxide ions (x) are present, hence CN of Ln^{4+} = 12.
In the nearest neighbour of O^{2-}(x) there are only two Mn^{2+} on the adjacent corners, hence CN of x = 2.

32. B

Sol. $$r\left(O^{2-}\right) + r\left(Mn^{2+}\right) = \frac{a}{2} \qquad (i)$$

$$r\left(O^{2-}\right) + r\left(Ln^{4+}\right) = \frac{a}{\sqrt{2}} \qquad (ii)$$

From (i) and (ii),

$$r\left(O^{2-}\right) + r\left(Ln^{4+}\right) > r\left(O^{2-}\right) + r\left(mn^{2+}\right)$$

$$r\left(Ln^{4+}\right) > r\left(Mn^{2+}\right)$$

SECTION – C

33. 7

Sol. $K_2Cr_2O_7, CuSO_4, H_2O_2, Cl_2, O_3, FeCl_3, HNO_3$

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

$2CuSO_4 + 4KI \longrightarrow Cu_2I_2 + I_2 + 2K_2SO_4$

$H_2O_2 + 2KI \longrightarrow I_2 + 2KOH$

$Cl_2 + 2KI \longrightarrow 2KCl + I_2$

$O_3 + 2KI + H_2O \longrightarrow 2KOH + I_2 + O_2$

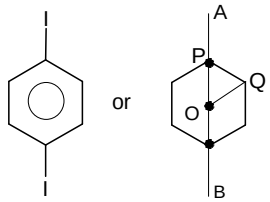
$2FeCl_3 + 2KI \longrightarrow 2FeCl_2 + I_2 + 2KCl$

$8HNO_3 + 6KI \longrightarrow 6KNO_3 + 2NO + 4H_2O + 3I_2$

$2KMnO_4 + KI + H_2O \longrightarrow KIO_3 + 2MnO_2 + 2KOH$

34. 7

Sol.



$AB = OA + OB = 2OA = 2(OP + PA)$

$= 2(PQ + PA)$ $(\because OP = PQ;\ \Delta OPQ \text{ is equilateral})$

$= 2(PQ + \text{covalent radius of C} + \text{covalet radius of I})$

$= 2(1.40 + 0.77 + 1.33) = 7.0\,\overset{0}{A}$

35. 9

Sol. x = 2, y = 0, z = 3, w = 8.

36. 7

Sol. $-w = 3320 = P_{ext}\Delta V = nR\Delta t$

$\Rightarrow \Delta T = \dfrac{3320}{2 \times 8.3} = 200$

$\Rightarrow Q = 14.94\,kJ = nC_p\Delta T$

$\Rightarrow C_p = \dfrac{14.94 \times 1000}{2 \times 200} = 37.35\ Jk^{-1}mol^{-1}$

Also, $C_p = \left(\dfrac{3}{2} + x\right)R$ where $x = \text{atomicity}$

$\Rightarrow x = \dfrac{C_p}{R} - \dfrac{3}{2} = \dfrac{37.35}{8.3} - 1.5 = 3$

37. 3

Sol. $AgCN + H^+ \rightleftharpoons Ag^+ + HCN;\ k_{eq} = \dfrac{k_{sp}}{k_a}$

$0.01 - x \qquad\qquad x \quad x$

$$k_{eq} = \frac{k_{sp}}{k_a} = 10^{-6} = \frac{x^2}{0.01 - x}$$

$\because$ k_{eq} is sufficiently small, $0.01 - x \approx 0.01$

$\Rightarrow x = 10^{-4} M$

38. 4

Sol. Hydrocarbon is C_4H_8

$$\frac{r_{HC}}{r_{N_2}} = \frac{1}{\sqrt{2}} = \sqrt{\frac{M_{N_2}}{M_{HC}}}$$

$$M_{HC} = 28 \times 2 = 56$$

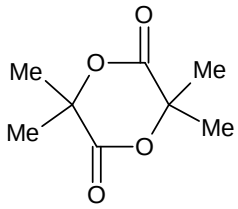
$$DBE / DU = \frac{2 \times 4 + 2 - 8}{2} = 1$$

39. 4

Sol.

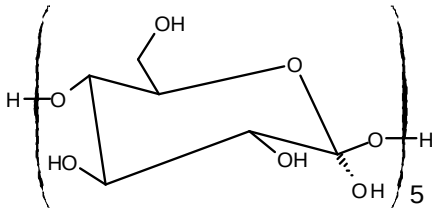
Final product E is

x = 4 and y = 0



40. 8

Sol.



pentasachharides derived from D - glucose

Each of the five monosachharides may be either α -D-glucose or β - D – glucose, thus total pentasachharides possible = $n = 2^5 = 32$

Answer is $\frac{32}{4} = 8$

Mathematics PART – III

SECTION – A

41. AC

Sol. Use formula of $2\tan^{-1}x$

42. ABCD

Sol. (A) $\frac{z^2}{z+1}=\frac{\bar{z}^2}{z+1}\Rightarrow z\bar{z}+z+\bar{z}=0$ or $z=\bar{z}$

(B) $|z|=4\sqrt{5}$ let $\omega=3+\sqrt{5}z$

$|\omega-3|=\sqrt{5}\times 4\sqrt{5}=20$

(C) $z=(2+a)+i\sqrt{3-a^2}=x+iy$

$x=2+a$ & $y=\sqrt{3-a^2}$

$\Rightarrow (x-2)^2+y^2=3$

(D) $z(1+a)=b+ic$ & $a^2+b^2+c^2=1$

$\Rightarrow \frac{1+iz}{1-iz}=\frac{a+ib}{1+c}$

43. ABC

Sol. $|\vec{a}+\vec{b}+\vec{c}|^2=|\vec{a}|^2+|\vec{b}|^2+|\vec{c}|^2+2\sum\vec{a}.\vec{b}\geq 0$

$9+9+9+2\sum\vec{a}.\vec{b}\geq 0\Rightarrow\sum\vec{a}.\vec{b}\geq -\frac{27}{2}$

$2\sum|\vec{a}|^2-2\sum(\vec{a}.\vec{b})=27$

$\sum(\vec{a}.\vec{b})=\frac{27}{2}$

44. ABCD

Sol. $f(x)=\frac{x^2+1}{x}=x+\frac{1}{x},\ x\neq 0$

45. ABD

Sol. $(\text{Four odd})+(\text{Four even})+(\text{Three even}+\text{Three odd})+(\text{Two even}+\text{Two odd})$

$={}^5C_4.4!+{}^4C_4.4!+{}^4C_3.{}^5C_1.4!+{}^4C_2.{}^5C_2\times 4\times 4$

$=1584$

46. CD

Sol. $3\cos A=\text{coa}(B-C)-\cos(B+C)=\cos(B-C)+\cos A$

$2\cos A=\cos(B-C)=-\cos(A+2C)$

$2=(\tan A.\sin 2C-\cos 2C)$

47. ABCD

Sol. $f(f(x)) = (1-x) \Rightarrow f(t) = 1 - f^{-1}(t)$

$f(t) + f^{-1}(t) = 1$

$\Rightarrow f(x) + f(1-x) = 1$

48. ABC
Sol. Facts

49. C
50. D
Sol. **(for Q. 49-50)**

$$L = \lim_{x\to\infty} \frac{xe^{2x}\left(1+3x^2\right)^{\frac{1}{2}}}{C\left(xe^x\right)^{C-1}\left(e^x + xe^x\right)}$$

51. B
52. D
Sol **(for Q. 51-52)**

$$b_{max} = 2,\ r = \frac{1}{\sqrt{1+b^2}}$$

SECTION – C

53. 8
Sol. 1st order linear DE

54. 5
Sol. $f(x) = x^2 - 2(a+1)x + (a-3)$

$f(0) \le 0$ & $f(2) \le 0$.

55. 8
Sol. $$\frac{r_1^{\frac{4}{3}} r_2^{\frac{4}{3}}}{\left(r_1^{\frac{2}{3}} + r_2^{\frac{2}{3}}\right)a^2} = 16$$

56. 7
Sol. $\left(3\hat{i} + 2\hat{j} + \hat{k}\right).\left(a\hat{i} + b\hat{j} + c\hat{k}\right) \le \sqrt{a^2+b^2+c^2}\sqrt{9+4+1}$

57. 7
Sol. $F'(x) = (2x+3)\int_x^2 f(x)\,dx$

58. 5
Sol. Newton Leibnitz's Rule

59. 4
Sol. Sum of AGP

60. 8
Sol. Facts