ALL INDIA OPEN TEST (AIOT)
(JEE MAIN PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 11-02-2018

COURSE : 00JA, 01JA, 01JB, 07JB, 01JP, 01EA, 01EB, 13EBH

HINTS & SOLUTIONS

PART-A : PHYSICS

1. A particle moves ....

Sol. As per the question

$$\frac{dy}{dx} = 8$$

$$\Rightarrow \frac{3x^2}{6} = 8 \quad \Rightarrow x = \pm\ 4$$

2. Graph of position ....

Sol. the equation of the straight line shown in the graph is

$$x = \frac{2}{\nu} - 1$$

But $\nu = \frac{dx}{dt}$

$$\therefore\ x = \frac{2dt}{dx} - 1$$

$$\Rightarrow x\,dx = 2\,dt - dx$$

$$\Rightarrow \int_3^{15} x dx = 2\int_0^1 dt - \int_3^{15} dx$$

$$\Rightarrow \frac{1}{2}[225 - 9] = 2t - [15 - 3]$$

$\Rightarrow 108 + 12 = 2t \qquad \Rightarrow t = 60$ s

3. Touching a ....

Sol. The ball must strike the sphere normally (i.e., along radius) so that is can rebound back along the same path.

$$\sin\theta = \frac{R/2}{R} = \frac{1}{2}$$

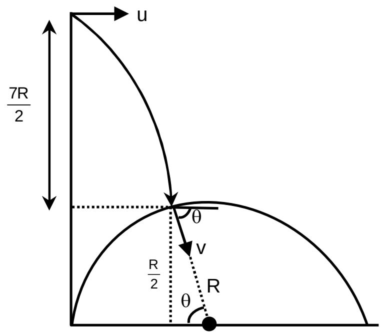
$\theta = 30°$

The velocity of the ball at the instant of hitting the sphere is inclined at θ to the horizontal.

$$\therefore\ \tan\theta = \frac{\nu_y}{\nu_x}$$

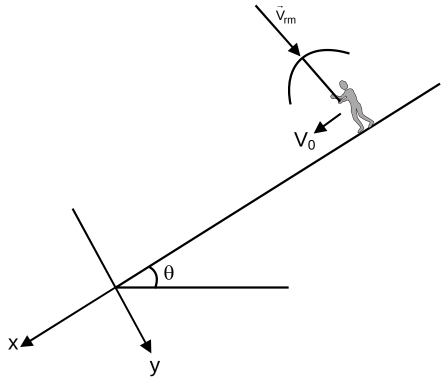
$$\frac{1}{\sqrt{3}} = \frac{\sqrt{2g\left(\frac{7R}{2}\right)}}{u}$$

$$\therefore\ u = \sqrt{21gR}$$



4. A man walking ....

Sol. Take x axis along the incline and y direction perpendicular to it.



Velocity of rain relative to the man is perpendicular to the incline in this case (i.e., along the umbrella stick. This keeps canopy perpendicular to the rainfall and provides maximum safety).

$$\vec{V}_{rm} = \vec{V}_r - \vec{V}_m$$

$$= (V_x\hat{i} + V_y\hat{j}) - V_0\hat{i} = (V_x - V_0)\hat{i} + V_y\hat{j}$$

Since $\vec{V}_{rm}$ has no x component

$\therefore\ V_x = V_0$

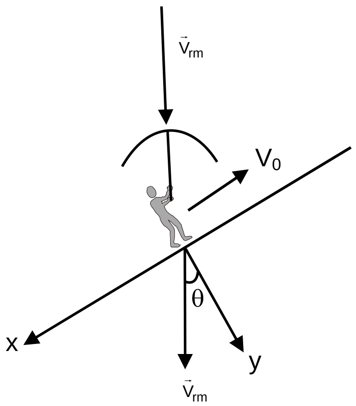
When the man is walking up. $\vec{V}_{rm}$ is directed vertically downward.

$$\vec{V}_{rm} = (V_x\hat{i} + V_y\hat{j}) - (V_0\hat{i})$$

$$= V_0\hat{i} + V_y\hat{j} + V_0\hat{i}$$

$$= 2V_0\hat{i} + V_y\hat{j}$$

From diagram



$\tan\theta = \dfrac{2V_0}{V_y}$

$\dfrac{3}{4} = \dfrac{2V_0}{V_y} \Rightarrow V_y = \dfrac{8V_0}{3}$

$\therefore\ V_r = \sqrt{V_x^2 + V_y^2} = \sqrt{\dfrac{73}{3}}V_0$

6. A solid block ....

Sol. Acceleration of the platform

$\vec{a}_p = \dfrac{d\vec{v}}{dt} = 2\hat{i} + \hat{j} + 3\hat{k}$

Horizontal and vertical acceleration

$a_H = \sqrt{4+1} = \sqrt{5}$ m/s^2

$a_v = 3$ m/s^2

Normal force on the block

$N = m(g + a_v) = 1 \times 13 = 13N$

Maximum acceleration that friction can provide

$a_{max} = \mu(g + a_v) = 0.2 \times 13 = 206$ m/s^2

$\therefore\ a_{max} > a_H$

$\therefore$ Block will not slide on the platform.

$\therefore$ Value of friction force on the block

$f = ma_H = \sqrt{5}$ N

$\therefore$ Force by the platform on the block is

$F = \sqrt{N^2 + f^2} = \sqrt{169 + 5} = \sqrt{174}$ N

7. Two hemispheres ....

Sol.

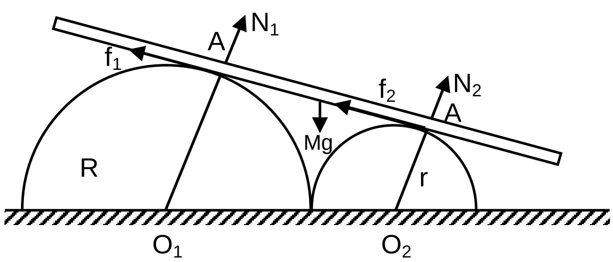


Figure (a)

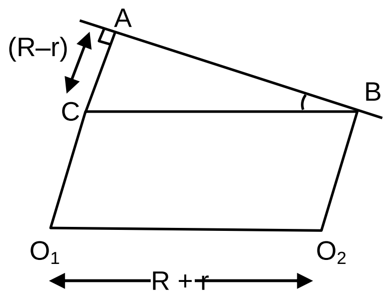


Figure (b)

In figure (b)

$\text{Sin}\theta = \dfrac{R-r}{R+r} = \dfrac{1-\eta}{1+\eta}\left[\text{where}\ \eta = \dfrac{r}{R}\right]$ ....(1)

The equilibrium of rod gives

$N_1 + N_2 = Mg\cos\theta$ ....(2)

and $\mu(N_1 + N_2) = mg\sin\theta$ ....(3)

Assuming the friction to be at its limiting value.

(3) / (2) gives

$\tan\theta = \mu$

$\therefore\ \sin\theta = \dfrac{\mu}{\sqrt{1+\mu^2}}$

Put in (1)

$\dfrac{1-\mu}{1+\mu} = \dfrac{\mu}{\sqrt{1+\mu^2}}$

$\sqrt{1+\mu^2} - \eta\sqrt{1+\mu^2} = \mu + \mu\eta$

$\therefore\ \dfrac{\sqrt{1+\mu^2} - \mu}{\sqrt{1+\mu^2} + -\mu} = \eta$

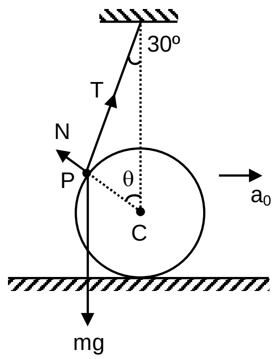
If the ratio η is decreased, θ will increase and the rod will begin to slide.

8. A sphere ....

Sol. Since the particle is small, the string will be tangential to the sphere. θ = 60º (see figure).

Let acceleration of the sphere be a_0 immediately after release

The particle will have its initial acceleration (a) along normal to the string towards PC. And, component of a_0 in the direction $\overline{PC}$ must be equal to a



$\therefore$ a = a_0 cos(90 – θ) = a_0 sinθ = $\frac{\sqrt{3}}{2}a_0$

Force on the particle has been shown in the figure. The equation of motion along PC will be

mg cosθ – N = ma $\Rightarrow \frac{1}{2}$ mg – N = $\frac{\sqrt{3}}{2}ma_0$

.... (i)

Sphere experiences a force N along PC. It has a horizontal component = N sin θ

$\therefore N\frac{\sqrt{3}}{2} = Ma_0 \Rightarrow N = \frac{2}{\sqrt{3}}Ma_0$

.... (ii)

Form (i) and (ii) $\frac{1}{2}mg = \left(\frac{\sqrt{3}m}{2}+\frac{2M}{\sqrt{3}}\right)a_0$

$a_0 = \frac{\sqrt{3}mg}{3m+4M}$

10. A particle of ....

Sol. Let velocity of particle at point P be ν.

Form conservation of mechanical energy

$\frac{1}{2}.m\nu^2 = K = mgh$

Let N be the normal reaction between the particle and the pipe at this instant.

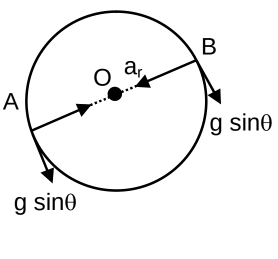
Then N – mg sinθ = $\frac{m\nu^2}{R}$

But, $\frac{m\nu^2}{R} = \frac{2K}{R}$ and sinθ = $\frac{h}{R}$

Hence, N = mg $\left(\frac{h}{R}\right)+\frac{2K}{R}=\frac{K}{R}+\frac{2K}{R}$

($\therefore$ K = mgh)

Hence, N = $\frac{3K}{R}$ = force on the pipe.

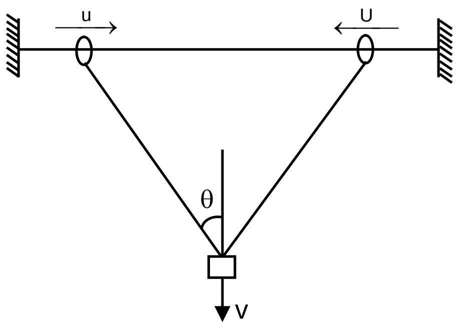


11. Two small ....

Sol. ν cos θ = u sin θ

$\nu = \sqrt{3}u$ .... (i)

mg ℓ cosθ = mu^2 + v .... (ii)



$u = \sqrt{\frac{g\ell}{5}}, \nu = \sqrt{\frac{3g\ell}{5}}$

12. Figure shows ....

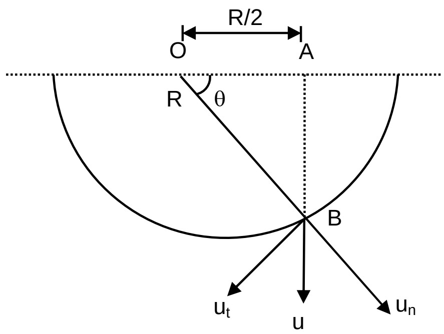
Sol. cos θ = $\frac{1}{2} \Rightarrow \theta = \frac{\pi}{3}$

(a) After collision the particle moves along the track. This means there is no normal component of velocity. Hence e = 0

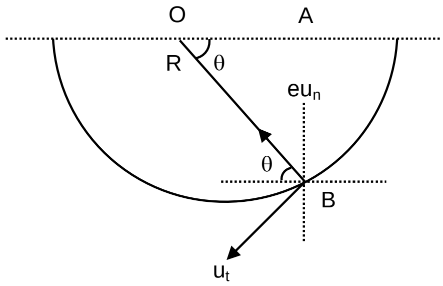
(b) Just before collision, the components of velocity along the normal and along the tangent are

u_n = u sin θ

u_t = u cos θ



During collision u_t does not change. The normal component of velocity becomes eu_n along $\vec{B}$O.



Just after collision

Question says that velocity of the particle is horizontal after collision, which means u_t cos θ = eu_n sinθ

u cos2 θ = eu sin2θ $\Rightarrow e = \cot^2\frac{\pi}{3} = \frac{1}{3}$

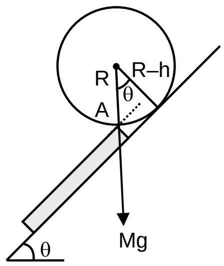
13. A disc is rolling ....

Sol. In reference frame attached to the centre of the disc, the velocity of point P is along the tangent. A point which is diametrically opposite to P has same velocity in opposite direction. This point has maximum speed relative to P. This maximum speed is equal to 2ν.

14. There is a ....

Sol. (a) The ball begin to climb the step if the line of action of its weight (Mg) passes to the left of point A. This will cause an unbalanced torque about A.

In critical case (see figure) $\cos\theta = \frac{R-h}{R}$



(b) In the position shown, the COM of the ball is vertically above point A at a distance R. As the ball climbs, its centre of mass will lover from this position. (Otherwise why will the ball come down?) In the position shown the centre of mass is at highest position.

15. A disc is ....

Sol. $\omega r = u$ = a constant

$$\ell n\,\omega + \ell nR = \ell nu \Rightarrow \frac{1}{\omega}\frac{d\omega}{dt} + \frac{1}{R}\frac{dR}{dt} = 0$$

$$\therefore \quad \frac{d\omega}{dt} = \frac{\omega}{R}\frac{dR}{dt}$$

Angular acceleration $\alpha = \frac{\omega}{R}\frac{dR}{dt}$

.................................(1)

If we consider an interval 'dt' in which radius decreases by dR; then $2\pi RdR = (udt)d$

$$\therefore \quad \frac{dR}{dt} = \frac{u.d}{2\pi R} = \frac{u^2 d}{2\pi R^3}$$

Put in (1) $\alpha = \frac{\omega}{R}.\frac{ud}{2\pi R} = \frac{u^2 d}{2\pi R^3}$

$$\Rightarrow F.R = I.\frac{u^2 d}{2\pi R^3} \Rightarrow F = \frac{Iu^2 d}{2\pi R^4}$$

16. A solid wooden ....

Sol. (a) Buoyancy force is $F_B = \nu\rho g$

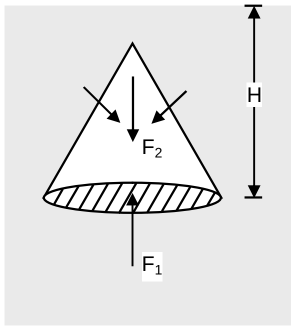
Weight of the cone $W = \nu dg$

$\therefore$ Tension $T = W - F_B = \nu g\,(d - \rho)$

(b) $F_B = \nu\rho g$

Buoyancy is resultant of vertically upward force (F_1) applied by water pressure on the base of the cone

and the vertically downward force (F_2) applied by water on the slant surface. [The horizontal component of this force sums up to zero due to symmetry



$\therefore F_1 - F_2 = F_B$

$\pi R^2.\,[\rho_0 + \rho gH] - F_2 = \nu\rho g$

$\therefore F_2 = \pi R^2\,[\rho_0 + \rho gH] - \nu\rho g$

17. A circular ring ....

Sol. When the ring is about to leave the water surface, surface tension force on it is

$F_{ST} = 2\pi RT + 2\pi rT = 2\pi\,(R + r)T$

Spring force $F_S = kx$

$\therefore kx = 2\pi(R + r)T + mg$

$$\therefore T = \frac{kx - mg}{2\pi(R + r)} = \frac{0.7x3.4x10^{-2} - 7x10^{-4}x9.8}{2x3.14x(30 + 10x10^{-3})} =$$

$0.076\ Nm^{-1}$

18. A liquid is ....

Sol. Shear stress is tangential force applied by the liquid on unit area of the floor:

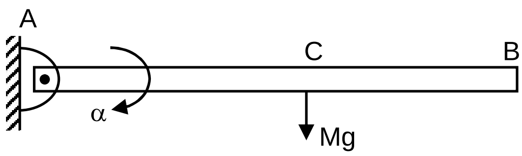
Velocity gradient $= \frac{dv}{dy} = \frac{2v_0}{h} - \frac{2v_0}{h^2}y$

At y = 0, $\frac{dv}{dy} = \frac{2v_0}{h}$

$\therefore$ Viscous force per unit area $= \eta\frac{dv}{dy} = \frac{2\eta v_0}{h}$

19. A thin uniform ....

Sol.



Immediately after release

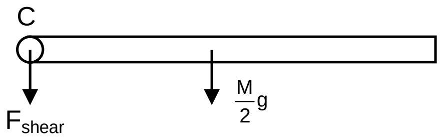
$$I\,\alpha = \tau \qquad \Rightarrow \frac{ML^2}{3}.\,\alpha = Mg\,\frac{L}{2} \Rightarrow \qquad \alpha = \frac{3}{2}\frac{g}{L}$$

Consider the half rod BC. Its COM has a downward acceleration

$$a_{BC} = \frac{3L}{3}.\alpha = \frac{9}{8}g$$

F_{Shear} = Shear force applied by part AC on the part BC.

$$\frac{Mg}{2} + F_{shear} = \frac{M}{2}a_{BC}$$



$\therefore$ Shear stress $= \frac{mg}{16A}$

21. A block of ....

Sol. Time to travel from A to B (t_1) is given by –

$x = ut + \frac{1}{2}at^2$ $\quad$ [$\therefore$ a = g sinθ = 5m/s^2]

$0.3 = \frac{1}{2} \times 5 \times t_1^2 \Rightarrow t_1 = 0.35s$

Speed of the block when it hits the spring is given by –

$V^2 = 0^2 + 2ax = 2 \times 5 \times 0.3$

$V = \sqrt{3}$ m/s

The motion of the block in contact with the spring can be regarded as a part of SHM. In equilibrium, compression in the spring is given by

$kx_0 = mg\sin\theta$

$x_0 = \dfrac{40 \times 10 \times \frac{1}{2}}{1000} = 0.2m$

Let the block compress the spring by a length x_1.

Energy conservation gives –

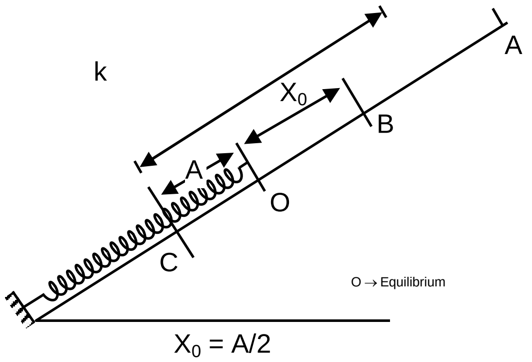
$\frac{1}{2}kx_1^2 = \frac{1}{2}MV^2 + Mgx_1\sin\theta$

$\frac{1}{2} \times 1000.\ x_1^2 = \frac{1}{2} \times 40 \times \left(\sqrt{3}\right)^2 \times \left(40 \times 10 \times \frac{1}{2}\right)x_1$

$5x_1^2 - 2x_1 - 0.6$ m

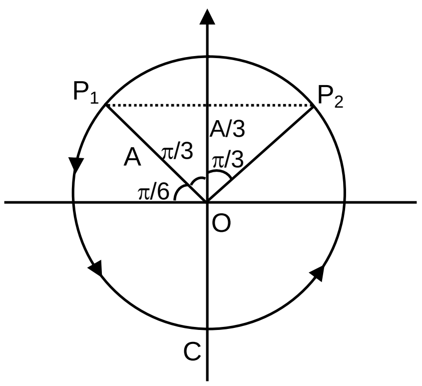
Solving x_1 = 0.5 m

Hence, amplitude of SHM is $A = x_1 - x_0 = 0.4m$



The motion from B to C and back to B can be regarded as motion of a particle performing SHM [from $x = +\frac{A}{2}$ to negative extreme and back to $x = +\frac{A}{2}$].

Time for this motion can be obtained from fig given below.



Particle on circle moves from P_1 to C to P_2. Time required for completing this two third circle = $\frac{2T}{3}$

Hence, desired time $t_2 = \frac{2T}{3} = \frac{2}{3}2\pi\sqrt{\frac{m}{k}}$

$= \frac{4\pi}{3}\sqrt{\frac{40}{1000}} = \frac{8\pi}{30}$ s = 0.84 s

$\therefore$ Time required for the block to come back to A is $t = 2t_1 + t_2$

= 2 x 0.35 + 0.84 = 1.54 s

22. Fundamental ....

Sol. $f_0 = \frac{1}{2L}\sqrt{\frac{T}{\mu}}$

$f = \frac{1}{2(L+\Delta L)}\sqrt{\frac{T+\Delta T}{\mu}} = \eta f_0$

$\therefore\ \eta = \frac{L}{L+\Delta L}\sqrt{\frac{T+\Delta T}{T}} = \dfrac{\sqrt{1+\frac{\Delta T}{T}}}{1+\frac{\Delta T}{T}}$

$\therefore\ \eta_1 = \frac{\sqrt{1-0.96}}{1-0.35} = \frac{1.4}{0.65}$ and $\eta_2 = \frac{\sqrt{1-0.36}}{1+0.3} = \frac{0.8}{1.3}$

$\therefore\ \frac{\eta_1}{\eta_2} = \frac{1.4}{0.65} \times \frac{1.3}{0.8} = 3.5$

23. Two tuning ....

Sol. The frequencies of two forks are assumed to be f and f + 4

When forks are moving towards the observer, the frequencies received by the observer are

$f_1 = f\left(\frac{\nu}{\nu-u}\right)$ and $f_2 = (f+4)\left(\frac{\nu}{\nu-u}\right)$

$\therefore\ \Delta f = f_2 - f_1 = 4\left(\frac{\nu}{\nu-u}\right)$

$\therefore\ 5 = 4\left(\frac{\nu}{\nu-u}\right)$

$\Rightarrow 5\nu - 5u = 4\nu \qquad \Rightarrow u = \frac{\nu}{5}$

When observer also begins to run, the frequencies received by him will be

$f_1' = f\left(\frac{\nu+u}{\nu-u}\right)$ and $f_2' = (f+4)\left(\frac{\nu+u}{\nu-u}\right)$

$\therefore\ \Delta f' = f_2' - f_1' = 4\left(\frac{\nu+u}{\nu-u}\right)$

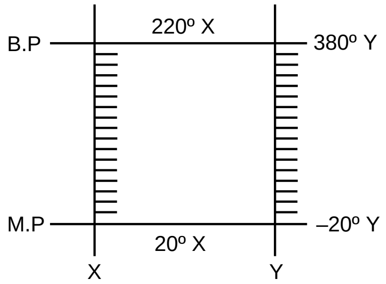
$= 4\left(\dfrac{\nu+\frac{\nu}{5}}{\nu-\frac{\nu}{5}}\right) = 4.\frac{6}{4} = 6$ Hz

24. In a temperature ....

Sol. Change of 1º X = change of 2º Y

At a particular temperature, if we are x divisions away from 20º X and y divisions away from –20º Y then–

$20 + x = -20 + 2x \Rightarrow x = 40$



25. A certain mass ....

Sol. $Q = \frac{4}{5}$ m. L ....(i)

2Q = mL + ms(50 – 20)

$\Rightarrow \frac{8}{5}mL$ = mL + 30 ms

$\Rightarrow \frac{3L}{5} = 30\text{ s} \Rightarrow \frac{L}{s} = 50$

26. A hypothetical ....

Sol. The equation of the straight line is

$$\frac{dN}{du} = -u + 4$$

$$u_{rms}^2 = \frac{\int u^2 dN}{\int dN} = \frac{\int_0^4 u^2 \frac{dN}{du} du}{\int_0^4 \frac{dN}{du} du}$$

$$= \frac{\int_0^4 u^2(-u+4)du}{\text{area under the graph}}$$

$$u_{rms}^2 = \frac{\int u^2 dN}{\int dN} = \frac{\int_0^4 u^2 \frac{dN}{du} du}{\int_0^4 \frac{dN}{du} du}$$

$$= \frac{\int_0^4 u^2(-u+4)du}{\text{ग्राफ से परिबद्ध क्षेत्राफल}}$$

$$= \frac{\int_0^4 (-u^3)du + 4\int_0^4 u^2 du}{\frac{1}{2}\times 4 \times 4} = \frac{\left[-\frac{u^4}{4} + 4.\frac{u^3}{3}\right]_0^4}{8}$$

$$u_{rms}^2 = \frac{8}{3} \Rightarrow u_{rms} = \sqrt{\frac{8}{3}}$$

27. The average ....

Sol. Law of equipartition of energy

$$< KE_R > = 2\,.\,\frac{1}{2}\,kT = E$$

$$\therefore \quad < KE_T > = 3.\,\frac{1}{2}\,kT$$

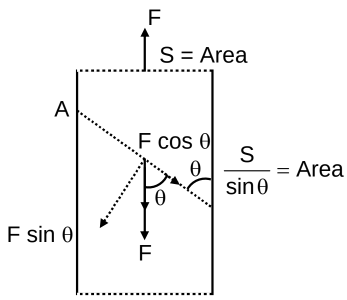
$$< KE_T > = \frac{3E}{2}$$

28. An ideal gas may ....

Sol. If a is isothermal and c is adiabatic processes then for b ΔU will be negative and Q will be positive so specific heat will be negative.

29. A rectangular ....

Sol. $\sigma' = \frac{F\sin\theta}{S\,\text{cosec}\,\theta} = \sigma \sin^2\theta$



30. A flywheel can ....

Sol. Dimensions of kinetic energy per unit mass = L^2T^{-2}

$$\left[\frac{\alpha\sigma}{\rho}\right] = \frac{ML^{-1}T^{-2}}{ML^{-3}} = L^2T^{-2}$$

PART-B : CHEMISTRY

31. The compressibility ....

Sol. Above Boyle's temperature (T_b) : Z > 1

32. Equal volume of the ....

Sol. For precipitation IP > K_{sp}

33. A gas $\left(C_{v,m} = \frac{5}{2}R\right)$ behaving ....

Sol. $\frac{T_2}{T_1} = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$

or T_2 = 150 K

$$\Delta H_m = nC_P\Delta T = \frac{7}{2}R(150-600) = -1575R$$

34. When 1 L of 0.1 M sulphuric ....

Sol. NaOH is LR.

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$$

$[Na_2SO_4] = \dfrac{0.05}{2} = 0.025$ M

35. 0.01 mol of a gaseous ....

Sol. vol. of CO_2 + vol. of remaining oxygen = 560 mL

or vol. of remaining oxygen = 112 mL

$$C_2H_2O_x(g) + \left(\frac{5-x}{2}\right)O_2(g) \xrightarrow{\Delta} 2\,CO_2(g) + H_2O(\ell)$$

224 mL	224 mL	0	–
0	112 mL	448 mL	–

For used moles of O_2 :

$$\left(\frac{5-x}{2}\right)\times 0.01 = \frac{0.01}{2}$$

or x = 4

36. Two moles of a monoatomic ....

Sol. Charles law :

$$V \propto T \qquad \frac{V_A}{T_A} = \frac{V_B}{T_B} = \frac{T_B}{T_A}$$

$T_B = 2 \times 300 = 600$ K

$W_{cyclic} = W_{AB} + W_{BC} + W_{CD} + W_{DA}$

W_{AB} (isobaric)= $-nR\Delta T$

$= -2 \times 2 \times (600 - 300)$

$= -1200$ cal

W_{BC} (isothermal) = $-2.303\, nRT \log \dfrac{V_2}{V_1}$

$= -2.303 \times 2 \times 2 \times 600 \times \log \dfrac{2}{1}$

$= -1658.16$ cal

W_{CD} (Isochoric) = 0

W_{DA} (isothermal) = $-2.303 \times 2 \times 2 \times 300 \times \log \dfrac{1}{4}$

$= +1658.16$ cal

For cyclic process $\Delta E = 0$

therefore from FLOT Q = $-W_{cyclic}$ = 1200 cal

37. M(OH)$_x$ has K_{sp} ....

Sol. $M(OH)_x \rightleftharpoons M^{+x} + x\,OH^-$

s xs

$K_{sp} = S.(XS)^x = X^x.S^{(X+1)} = 4 \times 10^{-12}$ given () $S = 10^{-4}$

y **x = 2**

38. The equilibrium constant ....

Sol. $K_P = \dfrac{4\alpha^2}{1-\alpha^2}P$

P = 2 atm $K_P = \dfrac{9}{2}$

α = degree of dissociation of N_2O_4 (g)

$25\alpha^2 = 9 \qquad \alpha = \dfrac{3}{5} = 0.6$

$$\alpha = \frac{M_t - M_{mix}}{(n-1)M_{mix}}$$

$M_{exp} = \dfrac{92}{1+0.6} = 57.5$ g/mol

39. In which of the following ....

Sol. (1) $5U(SO_4)_2 + 2KMnO_4 + 2H_2O \longrightarrow 2MnSO_4 + 5UO_2(SO_4) + 2H_2SO_4 + K_2SO_4$

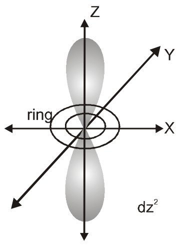
(2) $Bi_2O_3 + 2OCl^- + 2OH^- \longrightarrow 2BiO_3^- + 2Cl^- + H_2O$

(3) $3WO_3 + SnCl_2 + 4HCl \longrightarrow W_3O_8 + SnCl_6^{2-} + H_2O + 2H^+$

(4) $3CuO + 2NH_3 \longrightarrow 3Cu + N_2 + 3H_2O$

40. The electron present in ....

Sol.



Good finding probability at xy, xz & yz planes.

41. Titanium oxide (TiO_2) is ....

Sol. $TiO_2 + H_2 \longrightarrow H_2O + Ti_xO_y$

1.6 g 1.44 g

$\therefore$ 0.16 g Oxygen loose from 1.6 g oxide.

$\therefore$ 8 g Oxygen loose from = $\dfrac{1.6}{0.16} \times 8 = 80$ g

Molar mass of TiO_2 = 48 + 32 = 80

$TiO_2 \longrightarrow TiO_{2-\frac{1}{2}} \longrightarrow TiO_{3/2} \longrightarrow Ti_2O_3$

As 0.01 mole of O is lost in the reaction then H_2O formed will be 0.01 mole and moles of H_2 used will be also 0.01 mole.

42. The degree of dissociation ....

Sol. $K_W = 55.5 \times 3.6 \times 10^{-15} \times 0.1 = 2 \times 10^{-14}$

Hence temperature must be > 25°C.

43. A certain transition in ....

Sol. 10 lines are obtained as a result of electronic transition from 5th level to lower levels and lines corresponding to UV spectrum are as follows :
$5 \rightarrow 1$, $4 \rightarrow 1$, $3 \rightarrow 1$, $2 \rightarrow 1$

44. Calculate the temperature ....

Sol. $\Delta G = \Delta H - T\Delta S$
$0 = +131.3 - T(+0.1336)$
(for spontaneity)
$T > \dfrac{131.3}{0.1336} = 982.8$ K
$t^oC > 982.8 - 273 = 709.8^oC$

45. Which of the following ....

Sol. From PV = RT dV.P + V.dP = 0

or $\left(\dfrac{dV}{dP}\right) = -\dfrac{V}{P}$

or $\beta = \left(\dfrac{-dV}{dP}\right)_T \Big/ V = \dfrac{1}{P}$

Thus plot of β vs P gives (A).

46. According to molecular ....

Sol. (2) $O_2 : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_x^2 \begin{matrix} \pi 2p_y^2 & \pi^* 2p_y^1 \\ \pi 2p_z^2 & \pi^* 2p_z^1 \end{matrix}$

Bond order $= \dfrac{10-6}{2} = 2.0$

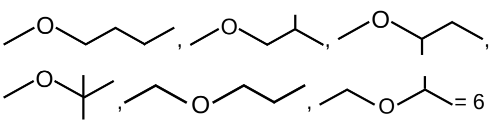
(Two unpaired electrons in antibonding molecular orbital)

$O_2^+ : \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \sigma 2p_x^2 \begin{cases} \pi 2py^2 \\ \pi 2pz^2 \end{cases} \begin{cases} \pi^* 2py^1 \\ \pi^* 2pz^0 \end{cases}$

Bond order $= \dfrac{10-5}{2} = 2.5$

(One unpaired electron in antibonding molecular orbital so it is paramagnetic)

47. How many structural ethers ....

Sol. 
= 6

48. What is the geometry of the ....

Sol. (3) Generally octahedral compound show sp^3d^2 – hybridization.

49. On dissolving moderate ....

Sol. Refer notes.

50. Which of the following ....

Sol. 'α' hydrogen atoms with respect to C=C bond take part in hyperconjugation.

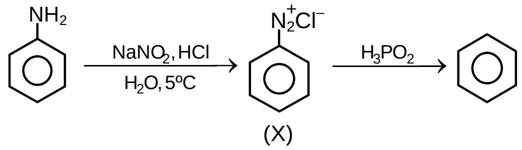
51. Which of the following ....

Sol. Refer notes.

52. The most stable ....

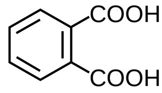
Sol. In (2) octet of all atoms is complete and positive charge present on less electronegative atom.

53. Identify the X and Y ....

Sol. 

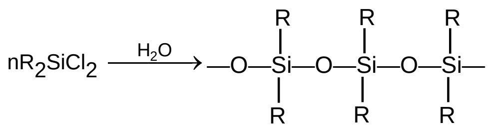
54. Select the incorrect matching ....

Sol. Correct name of



phthalic acid

55. Given type of silicones ....

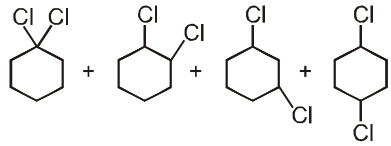
Sol. 

Linear silicone

56. Which of the following ....

Sol. **Refer notes.**

57. How many position ....

Sol. 

58. Which of the following is ....

Sol. Chlorous acid is $HClO_2$

59. An alkene on ozonolysis ....

Sol. $CH_3–CH=CH–CH_3 \xrightarrow[(2)\,Zn.H_2O]{(1)\,O_3} CH_3–CH=O$

$\xrightarrow{\text{Fehling Solution}}$ Red ppt of Cu_2O

Ph–CH=O does not give positive Fehling solution test.

60. Ethyl bromide reacts ....

Sol. (1) $C_2H_5Br + Ag-O-N=O \rightarrow \underset{\text{Nitro ethane}}{C_2H_5-N\overset{O}{\underset{O}{}}} + AgBr$

$Ag-O-N=O$ is a covalent compound. Therefore, attack of nucleophile occurs through Nitrogen atom. Hence, nitroethane is formed.

PART-C : MATHEMATICS

61. If bx + cy = a, ...

Sol. Given equation is bx + cy = a, where a, b, c are of the same sign. So the line intersects the axes at

A $\left(\frac{a}{b},0\right)$ and B $\left(0,\frac{a}{c}\right)$

$\Rightarrow$ Area enclosed between the axes and the line

$=\frac{1}{2}.\frac{a}{b}.\frac{a}{c}=\frac{a^2}{2bc}=\frac{1}{8}$

$\Rightarrow$ $4a^2$=bc, so b,±2a,c are in G.P.

62. In the expansion........................

Sol. $T_{r+1}={}^{6561}C_r(7)^{\frac{6561-r}{3}}(11)^{\frac{r}{9}}$

$\Rightarrow$ r is multiple of 9

$\therefore\ r=0,9,18,....,6561$

63. An AP consists ....

Sol. $t_{11}+t_{12}+t_{13}=141$

and $t_{21}+t_{22}+t_{23}=261$

$\therefore 3a+33d=141 \Rightarrow a+11d=47$

and $3a+63d=261 \Rightarrow a+21d=87$

On solving eqs. (i) and (ii) , we get

$a=3,\ d=4.$

64. In a ΔABC, ...

Sol. $\because b\cos^2\frac{A}{2}+a\cos^2\frac{B}{2}=\frac{3}{2}c$

$\Rightarrow b\ \frac{s(s-a)}{bc}+a\ \frac{s(s-b)}{ac}=\frac{3}{2}c$

$\Rightarrow \frac{s}{c}[s-a+s-b]=\frac{3}{2}c$

$\Rightarrow \frac{a+b+c}{2}=\frac{3}{2}c \Rightarrow a+b=2c$

65. The sum of ....

Sol. Sum of integers divided by 2

= 2 + 4 + 6 + 8 +…+1 00 = 50 x 51 = 2550

Sum of integers divided by 5

= 5 + 10 + 15 + ….+ 100 = 51 x 20 = 1050

Sum of integers divided by 10

= 10 + 20 + … + 100 = 550

$\therefore$ Required sum = 2550 + 1050 – 550 = 3050

66. If $\log_{\sin x}(\cos x)=\frac{1}{2}$ ....

Sol. $\log_{\sin x}\cos x=\frac{1}{2} \Rightarrow \cos x=(\sin x)^{\frac{1}{2}}$

$\Rightarrow \cos^2 x=\sin x \Rightarrow \sin^2 x+\sin x-1=0$

$\Rightarrow \sin x=\frac{\sqrt{5}-1}{2}$ as $x\in\left(0,\frac{®}{2}\right)$

67. For x ≥ 0 , the ....

Sol. f(x) = $\frac{4(x+1)^2+9}{6(1+x)}=\frac{2}{3}(x+1)+\frac{3}{2(x+1)}$

AM ≥ GM

$\geq 2\sqrt{\frac{2}{3}.\frac{3}{2}}$

≥ 2

68. The values of ....

Sol. For $x\geq 2$

$|2-|2x-4||=1 \Rightarrow |6-2x|=1$

$\Rightarrow 6-2x=\pm 1 \Rightarrow x=\frac{5}{2}$ or $x=\frac{7}{2}$

For $x<2$

$|2-(4-2x)|=1 \Rightarrow |2x-2|=1$

$\Rightarrow 2x-2=\pm 1 \Rightarrow x=\frac{1}{2}$ or $x=\frac{3}{2}$

$\therefore\ 0<a<b<c<d$

69. The scores of ....

Sol. Median

34, 38, 42, 44, 46, 48, 54, 55, 63, 70

$\therefore$ Median $\frac{46+48}{2}=47$

Hence $\sum|xi-M_d| = \sum|xi-47| = 86$

$\therefore\ M.D(M_2) = \frac{\sum|xi-M_d|}{N}$

$=\frac{86}{10}$

$= 8.6$

70. **Statement**-1 : The expansion........................

Sol. $n!(100-n)! = \frac{100!}{{}^{100}C_n}$

${}^{2n}C_r$ is max. when $r = n$

$\therefore\ n!(100-n)! = \frac{100!}{{}^{100}C_n}$

Hence $n!(100-n)!$ will be max. when $n = 50$.

71. Let P(x) be a ....

Sol. (x + 1) P(x) – 1 = a (x) (x - 1) (x - 2) … (x - 11) ......(1)

Put x = -1

0 – 1 = a (-1) (-2) ….. (-12)

a = $\frac{-1}{12}$

from eq (1) put a = $\frac{-1}{12}$, x = 12

13 P(12) – 1 = $\frac{-1}{12}$ (12) (11) ….. (1) = P (12) = 0

72. The distance ....

Sol. $y = -(x-1)(x-3)$

Highest point occurs at x = 2,

$y = -(2-1)(2-3) = 1$

Lowest point of $y = x(x-4)$ occurs at $x = 2$

So, $y = 2(-2) = -4$

Thus, difference =1-(-4)=5.

73. Number of integral ....

Sol. $\frac{x^2-6x-7}{|x+4|} < 0$ Here $x \neq -4$

$(x+7)(x-1) < 0 \Rightarrow -7 < x < 1$

$-6, -5, -3, -2, -1, 0$

74. If α and β be........................

Sol. $x^2 + 3x + 1 = 0$

Let roots be α & β.

$\sim + \quad = -3$

$\sim \quad = 1$

Also $\sim^2 = -3\sim -1$

$\quad^2 = -3 \quad -1$

Sum $= \frac{\sim^2}{(1+\quad)^2} + \frac{\quad^2}{(1+\sim)^2}$

$= \left(\frac{-3\sim -1}{-}\right) + \left(\frac{-3 \quad -1}{-\sim}\right)$

$= \frac{\sim(1+3\sim) + \quad (1+3\quad)}{\sim}$

$= 3(\sim^2 + \quad^2) + (\sim + \quad)$

$= 3[9-2] + (-3)$

$= 21 - 3$

$= 18$

75. Sum of all the........................

Sol. 2, 3, 3, 4, 4, 4.

□□□□□ 2 $= \frac{5!}{2!3!} = 10$

□□□□□ 3 $= \frac{5!}{3!} = 20$

□□□□□ 4 $= \frac{5!}{2!2!} = 30$

$\therefore$ sum $= (2\times10) + (3\times20) + (4\times30) = 200$

of unit place place

$\therefore$ Reqd. sum

$= 200\left(10^5 + 10^4 + 10^3 + 10^2 + 10^1 + 10^0\right)$

$= 200(111111) = 22\ 22\ 22\ 00$

76. The value of ....

Sol. tan65° - 2tan40°

= tan(45° +20°) - 2tan40°

= $\frac{1+\tan 20^o}{1-\tan 20^o} - \frac{4\tan 20^o}{1-\tan^2 20^o}$

= $\frac{(1+\tan 20^o)^2 - 4\tan 20^o}{1-\tan^2 20^o}$

= $\frac{(1-\tan 20^o)^2}{1-\tan^2 20^o}$ = $\frac{1-\tan 20^o}{1+\tan 20^o}$

= tan(45° - 20°) = tan25°

77. A variable chord ....

Sol. $(x^2 + y^2 - 2ax) + a\ (y - mx) = 0$

$x^2 + y^2 - (2a + m\,a)\,x + a\,y = 0$

let centre is (h,k)

and $h = \left(\frac{2a + m a}{2}\right), k = \frac{-a}{2}$

a $= \frac{-2am}{1+m^2}$

By eliminating m, we get

$x^2 + h^2 - ah = 0$

$x^2 + y^2 - ax = 0$

78. If x, y $\in [0, 2®]$ ....

Sol. sin x cos y = 1

sin x = 1 and cos y = 1 or sin x = –1 & cos y = -1

$x = \frac{®}{2}$, $x = \frac{3®}{2}$

$y = 0, 2®$, $y = ®$

$\left(\frac{®}{2}, 0\right)\left(\frac{®}{2}, 2®\right)\left(\frac{3®}{2}, ®\right)$ **Ans 3**

79. Which of the ....

Sol. All have different graphs.

80. The owner of ....

Sol. L = mp + b

p = 14, L = 980

980 = 14m + b .... (1)

p = 16, L = 1220

1220 = 16m + b ..... (2)

(1) & (2)

m = 120

b = -700

L = 120p – 700

Put $\Rightarrow$ p = 17

L = 120 (17) – 700 = 1340

81. Let $< a_n >$ be ....

Sol. Terms of AP are: $1, 1+d, 1+2d, 1+3d, ...$

Terms of GP are: $2, d, \frac{d^2}{2}, \frac{d^3}{4}, ...$

$\therefore\ a_4b_1 + a_3b_2 + 2a_1b_3$

$= (2+6d) + (1+2d)d + 2\left(1 \times \frac{d^2}{2}\right)$

$= 3d^2 + 7d + 2\ = 3\left(d + \frac{7}{6}\right) - \frac{25}{12}$

$\therefore$ Minimum value = -25/12

82. The value of ....

Sol. $\sum_{n=3}^{\sim} \frac{1}{(n-2)(n-1)n(n+1)(n+2)}$

$= \frac{1}{4}\sum_{n=3}^{\sim} \frac{(n+2)-(n-2)}{(n-2)(n-1)n(n+1)(n+2)}$

$= \frac{1}{4}\sum_{n=3}^{\sim}\left(\frac{1}{(n-2)(n-1)n(n+1)} - \frac{1}{(n-1)n(n+1)(n+2)}\right)$

$= \frac{1}{4}\left[\frac{1}{(3-2)(3-1)(3+1)3}\right] = \frac{1}{96}$

83. The vertex and ....

Sol. Coordinates of vertex is (a, 0) and directrix x + a′ – 2a = 0

Equation of parabola is $(x + a' - 2a)^2 = (x - a')^2 + (y - 0)^2$

i.e. $y^2 = -4(a - a')(x - a)$

84. If the value of........................

Sol. $\frac{{}^nC_r}{{}^nC_{r-1}} = \frac{n-r+1}{r}$

$\Rightarrow \frac{r\ {}^nC_r}{{}^nC_{r-1}}$ = n – r + 1 = 11 – r (n = 10)

$\therefore \left(\frac{C_1}{C_0} + 2\frac{C_2}{C_1} + 3\frac{C_3}{C_2} + ... + 10\frac{C_{10}}{C_9}\right)$

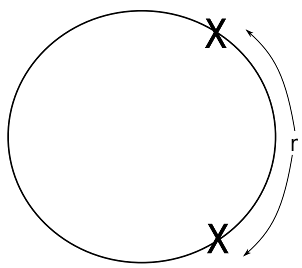
$= (10 + 9 + ... + 1) = \frac{10(11)}{2} = 55$

85. In the expansion........................

Sol. Number of distinct terms = 21.

86. Number of ways ....

Sol.



${}^{n-2}C_r \times r! \times (n-2-r)! \times 2!$

$= \frac{(n-2)!}{(n-2-r)!} \times (n-2-r)! \times 2! = 2 \cdot (n-2)!$

= Dependent on n but Independent of r .

87. If $x^2 + 9y^2 = 1$, ...

Sol. Let $x = \cos^{-}$, $y = \frac{1}{3}\sin^{-}$

$Z = 3\cos^{2-} - 27\frac{1}{9}\sin^{2-} + 8\sin^{-}\cos^{-}$

$= 3\cos 2^{-} + 4\sin 2^{-} \Rightarrow -5 \le Z \le 5$.

88. Consider a hyperbola.......................

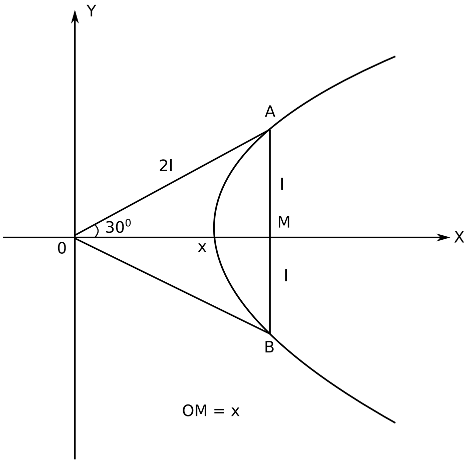
Sol. Equation of the common tangent is y = tx – t^2

$\therefore$ mid point of AB is $\left(\frac{t}{2}, -\frac{t^2}{2}\right)$

$\therefore$ the locus is y = – $2x^2$

89. AB is double ....

Sol.



$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

$$\Rightarrow x^2 = \left(b^2 + y^2\right)\frac{a^2}{b^2} \quad .....(i)$$

Also,

$$x^2 + \ell^2 = 4\ell^2$$

$$x^2 = 3\ell^2 \quad .....(ii)$$

(i) & (ii) $\Rightarrow \frac{a^2\left(b^2 + \ell^2\right)}{b^2} = 3\ell^2$

$$\Rightarrow a^2b^2 + a^2\ell^2 = 3b^2\ell^2$$

$$\Rightarrow \ell^2 = \frac{a^2b^2}{3b^2 - a^2} > 0$$

$$\Rightarrow 3b^2 - a^2 > 0 \ \Rightarrow \frac{b^2}{a^2} > \frac{1}{3}$$

$$\therefore 1 + \frac{b^2}{a^2} > 1 + \frac{1}{3}$$

$$e^2 > \frac{4}{3} \ \Rightarrow e > \frac{2}{\sqrt{3}}$$

90. If tangent at point.......................

Sol^n : $y = x^2 + 6x + 10$

$$\therefore \frac{dy}{dx} = 2x + 6$$

$$\left.\frac{dy}{dx}\right|_{(-2, 2)} = 2$$

$\therefore$ slope of Normal, m = – 1/2

$$\therefore y = ax^2 + bx + \frac{7}{2}$$

Passes through (1, 2) $\Rightarrow$ a + b = – 3/2 .... (1)

Also $\left.\frac{dy}{dx}\right|_{(1, 2)} = 2a + b$

$$\Rightarrow -\frac{1}{2} = 2a + b \quad .... (2)$$

[1] and [2] $\Rightarrow$ a = 1, b = –5/2

ALL INDIA OPEN TEST (AIOT)
(JEE MAIN PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2019
DATE : 11-02-2018
COURSE : 00JA, 01JA, 01JB, 07JB, 01JP, 01EA, 01EB, 13EBH

ANSWER KEY

CODE-0

PHYSICS

1.	(2)	**2.**	(3)	**3.**	(2)	**4.**	(3)	**5.**	(2)	**6.**	(2)	**7.**	(1)
8.	(4)	**9.**	(2)	**10.**	(3)	**11.**	(1)	**12.**	(4)	**13.**	(2)	**14.**	(2)
15.	(1)	**16.**	(1)	**17.**	(2)	**18.**	(1)	**19.**	(4)	**20.**	(1)	**21.**	(3)
22.	(2)	**23.**	(3)	**24.**	(2)	**25.**	(3)	**26.**	(2)	**27.**	(4)	**28.**	(2)
29.	(3)	**30.**	(4)										

CHEMISTRY

31.	(2)	**32.**	(3)	**33.**	(3)	**34.**	(3)	**35.**	(1)	**36.**	(1)	**37.**	(2)
38.	(2)	**39.**	(2)	**40.**	(4)	**41.**	(3)	**42.**	(3)	**43.**	(3)	**44.**	(2)
45.	(1)	**46.**	(2)	**47.**	(4)	**48.**	(3)	**49.**	(4)	**50.**	(3)	**51.**	(2)
52.	(2)	**53.**	(4)	**54.**	(4)	**55.**	(1)	**56.**	(2)	**57.**	(2)	**58.**	(4)
59.	(4)	**60.**	(1)										

MATHEMATICS

61.	(4)	**62.**	(1)	**63.**	(4)	**64.**	(1)	**65.**	(3)	**66.**	(2)	**67.**	(2)
68.	(1)	**69.**	(2)	**70.**	(4)	**71.**	(3)	**72.**	(4)	**73.**	(2)	**74.**	(2)
75.	(2)	**76.**	(3)	**77.**	(1)	**78.**	(1)	**79.**	(4)	**80.**	(1)	**81.**	(4)
82.	(2)	**83.**	(1)	**84.**	(4)	**85.**	(3)	**86.**	(3)	**87.**	(2)	**88.**	(2)
89.	(4)	**90.**	(1)										

ALL INDIA OPEN TEST (AIOT)
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ANSWER KEY

CODE-1

PHYSICS

1.	(1)	**2.**	(1)	**3.**	(3)	**4.**	(4)	**5.**	(4)	**6.**	(1)	**7.**	(2)
8.	(2)	**9.**	(3)	**10.**	(1)	**11.**	(3)	**12.**	(4)	**13.**	(3)	**14.**	(4)
15.	(2)	**16.**	(2)	**17.**	(1)	**18.**	(2)	**19.**	(2)	**20.**	(2)	**21.**	(1)
22.	(4)	**23.**	(1)	**24.**	(4)	**25.**	(2)	**26.**	(1)	**27.**	(3)	**28.**	(1)
29.	(1)	**30.**	(1)										

CHEMISTRY

31.	(1)	**32.**	(4)	**33.**	(2)	**34.**	(4)	**35.**	(2)	**36.**	(2)	**37.**	(3)
38.	(1)	**39.**	(2)	**40.**	(4)	**41.**	(2)	**42.**	(2)	**43.**	(3)	**44.**	(1)
45.	(1)	**46.**	(1)	**47.**	(4)	**48.**	(2)	**49.**	(4)	**50.**	(4)	**51.**	(3)
52.	(3)	**53.**	(3)	**54.**	(3)	**55.**	(2)	**56.**	(2)	**57.**	(1)	**58.**	(3)
59.	(3)	**60.**	(2)										

MATHEMATICS

61.	(3)	**62.**	(2)	**63.**	(3)	**64.**	(1)	**65.**	(4)	**66.**	(3)	**67.**	(3)
68.	(1)	**69.**	(3)	**70.**	(4)	**71.**	(4)	**72.**	(3)	**73.**	(3)	**74.**	(3)
75.	(3)	**76.**	(4)	**77.**	(2)	**78.**	(2)	**79.**	(4)	**80.**	(2)	**81.**	(4)
82.	(2)	**83.**	(2)	**84.**	(3)	**85.**	(4)	**86.**	(3)	**87.**	(3)	**88.**	(3)
89.	(3)	**90.**	(2)										

ALL INDIA OPEN TEST (AIOT)
(JEE MAIN PATTERN)
TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 11-02-2018

COURSE : 00JA, 01JA, 01JB, 07JB, 01JP, 01EA, 01EB, 13EBH

ANSWER KEY

CODE-2

PHYSICS

1.	(2)	**2.**	(3)	**3.**	(2)	**4.**	(3)	**5.**	(2)	**6.**	(2)	**7.**	(1)
8.	(4)	**9.**	(2)	**10.**	(3)	**11.**	(1)	**12.**	(4)	**13.**	(2)	**14.**	(2)
15.	(1)	**16.**	(1)	**17.**	(2)	**18.**	(1)	**19.**	(4)	**20.**	(1)	**21.**	(3)
22.	(2)	**23.**	(3)	**24.**	(2)	**25.**	(3)	**26.**	(2)	**27.**	(4)	**28.**	(2)
29.	(3)	**30.**	(4)										

CHEMISTRY

31.	(2)	**32.**	(3)	**33.**	(3)	**34.**	(3)	**35.**	(1)	**36.**	(1)	**37.**	(2)
38.	(2)	**39.**	(2)	**40.**	(4)	**41.**	(3)	**42.**	(3)	**43.**	(3)	**44.**	(2)
45.	(1)	**46.**	(2)	**47.**	(4)	**48.**	(3)	**49.**	(4)	**50.**	(3)	**51.**	(2)
52.	(2)	**53.**	(4)	**54.**	(4)	**55.**	(1)	**56.**	(2)	**57.**	(2)	**58.**	(4)
59.	(4)	**60.**	(1)										

MATHEMATICS

61.	(4)	**62.**	(1)	**63.**	(4)	**64.**	(1)	**65.**	(3)	**66.**	(2)	**67.**	(2)
68.	(1)	**69.**	(2)	**70.**	(4)	**71.**	(3)	**72.**	(4)	**73.**	(2)	**74.**	(2)
75.	(2)	**76.**	(3)	**77.**	(1)	**78.**	(1)	**79.**	(4)	**80.**	(1)	**81.**	(4)
82.	(2)	**83.**	(1)	**84.**	(4)	**85.**	(3)	**86.**	(3)	**87.**	(2)	**88.**	(2)
89.	(4)	**90.**	(1)										