ADVANCED PATTERN
PART TEST-4 (APT-4)

TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 04-02-2018 **COURSE : VIKAAS (JA) & VIPUL (JB)**

HINTS & SOLUTIONS

MATHEMATICS

1. Let L_1 be a line....................

Sol. The chords are of equal length, then the distances of the centre from the lines are equal.

Let L_1 be y – mx = 0. Centre is $\left(\frac{1}{2}, -\frac{3}{2}\right)$

$$\frac{\left|-\frac{3}{2}-\frac{m}{2}\right|}{\sqrt{m^2+1}} = \frac{\left|\frac{1}{2}-\frac{3}{2}-1\right|}{\sqrt{2}} \Rightarrow 7m^2 - 6m - 1 = 0$$

$\Rightarrow m = 1, -\frac{1}{7}$

2. Consider the circles ....

Sol. $S_1 : x^2 + y^2 = 4$

and $S_2 = x^2 + y^2 - 2x - 4y + 4 = 0$

centre: (0, 0); radius = 2

centre : (1, 2); radius = 1

(A) d = distance between centres = $\sqrt{5}$

$r_1 + r_2 = 3 \Rightarrow | r_1 - r_2 | = 1$

$\therefore$ $| r_1 - r_2 | < d < r_1 + r_2$

$\therefore$ these 2 circles are intersecting.

$\therefore$ number of common tangents is 2.

(B) P(h, k) power of point P is same w.r.t. these two circles.

$\therefore$ $\sqrt{h^2+k^2-4} = \sqrt{h^2+k^2-2h-4k+4}$

$-4 = -2h - 4k + 4$

$2h + 4k - 8 = 0$

$x + 2y - 4 = 0$

(C) y intercept of S_1 is $2\sqrt{+4} = 4$

y intercept of S_2 is $2\sqrt{4-4} = 0$

$\therefore$ sum of y-intercept = 4

(D) $2(0 + 0) = -4 + 4$

$\therefore$ circle is orthogonal.

3. Locus of the ....

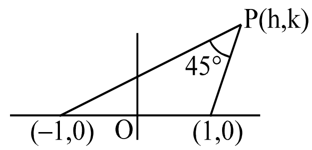
Sol. $m_1 = \frac{k}{h-1}$; $m_2 = \frac{k}{h+1}$;

$$\therefore \tan 45° = \left|\frac{\frac{k}{h-1}-\frac{k}{h+1}}{1+\frac{k^2}{h^2-1}}\right| = \left|\frac{k(h+1-h+1)}{h^2-1+k^2}\right|$$

$h^2 + k^2 - 1 = \pm 2k$

locus is $x^2 + y^2 \pm 2y - 1 = 0$

$x^2 + (y \pm 1)^2 = \left(\sqrt{2}\right)^2$



(0, 1) or (0, – 1) and radius = $\sqrt{2}$

4. The sum of the ....

Sol. The total number of numbers that can be fomed with the digits 3, 4, 5, 6 taken all at a time

= P(4, 4) = 4! = 24

Each of the digits 3, 4, 5, 6 occurs in 3!

= 3 × 2 = 6 times in the unit's place of all the numbers

= (3 + 4 + 5 + 6) × 6 = 18 × 6 = 108

5. If letters of word ....

Sol. (A) [A][ ][ ][ ][ ][ ] $\frac{5!}{2!} = 60$

[K][ ][ ][ ][ ][ ] $\frac{5!}{2!2!} = 30$

[P][A][A][ ][ ][ ] $\frac{3!}{2!} = 3$

[P][A][K][ ][ ][ ] $\frac{3!}{2!} = 3$

[P][A][R][A][ ][ ] 2! = 2

[P][A][R][K][A][R] 1 = 1

so rank is 99

(B) [A][A][ ][ ][ ][ ] $\frac{4!}{2!} = 12$

[A][K][ ][ ][ ][ ] $\frac{4!}{2!} = 12$

[A][P][ ][ ][ ][ ] $\frac{4!}{2!} = 12$

[A][R][A][ ][ ][ ] 3! = 6

[A][R][K][ ][ ][ ] 3! = 6

Sum = 48

49th word is [A][R][P][A][K][R]

50th word is [A][R][P][A][R][K]

(C) [P][ ][ ][ ][ ][ ] $\frac{5!}{2!2!} = 30$

Rank of RAAKPR is 60 + 30 + 30 + 1 = 121

6. You have n ....

Sol. The number of all possible pairs of objects that could be obtained from 'n' objects is $^nC_2 = \frac{n(n-1)}{2}$

Total weight of $\frac{n(n-1)}{2}$

pairs is $\frac{n(n-1)}{2}$ × 2 × w = 120 .....(1)

The number of all possible triplets are $^nC_3$

Total weight of $^nC_3$ triplets is

$\frac{n(n-1)(n-2)}{6} \times 3 \times w$ = 480 ...(2)

on solving n = 10 and w = $\frac{4}{3}$

11. Equation of circle ....

Sol. Let radius = r

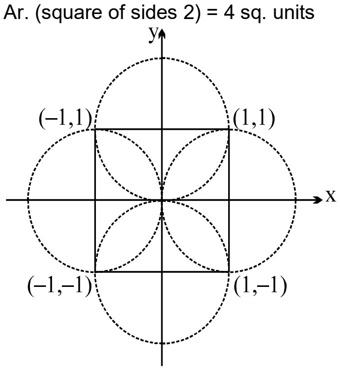
Then $C_1C_2 = r_1 \pm r_2$

$5 = r \pm 1$

r = 4 or 6

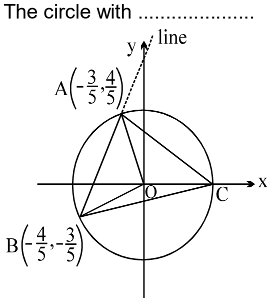
28. Four unit circles....................

Sol. Ar. (square of sides 2) = 4 sq. units



31. The circle with ....

Sol.



Solving y = 7x + 5 and the circle $x^2 + y^2 = 1$

$A\left(-\frac{3}{5}, \frac{4}{5}\right)$ and $B\left(-\frac{4}{5}, -\frac{3}{5}\right)$

$m_{OA} = -\frac{4}{3}$; $m_{OB} = \frac{3}{4}$

Hence ∠ AOB = 90°

$\Rightarrow \angle ACB = \frac{\pi}{4} = \tan^{-1}(1)$

32. A variable circle ....

Sol. Power : P = $a^2 + b^2 - 2(t^2 - 3t + 1)a - 2(t^2 + 2t)b + t$

$= -(2a + 2b)t^2 + (6a - 4b + 1)t + a^2 + b^2 - 2a$

This power is independent of the parameter t

if and only if 2a + 2b = 0 ⇒ a = – b

and 6a – 4b + 1 = 0

$\Rightarrow a = -\frac{1}{10}$ and $b = \frac{1}{10}$

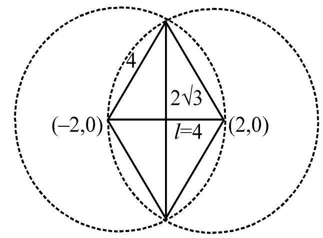
33. A rhombus is ....

Sol. circles with centre (2, 0) and (– 2, 0) each with radius 4

⇒ y – axis is their common chord.

The inscribed rhombus has its diagonals equal to 4 and $4\sqrt{3}$

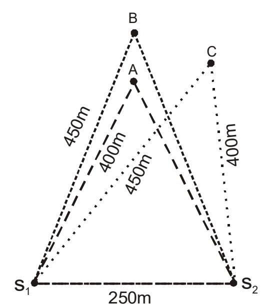
$\therefore$ A = $\frac{d_1d_2}{2} = 8\sqrt{3}$



PHYSICS

1. Two radio station ....

Sol.



At points A and B, path difference between the waves coming from two radio stations is zero. Hence there will be constructive interference at A and B,

For point C, path difference between the waves is 50 metre i.e. $\frac{\lambda}{2}$ so destructive interference takes places at point C.

3. At displacement ....

Sol. Self -explanatory

4. Two wave ....

Sol. Resultant Displacement

$y = y_1 + y_2$

for y to be zero

$(2x - 3t)^2 = (2x + 3t - 6)^2$

on solving $(x - \frac{3}{2})(t - 1) = 0$

Therefore,

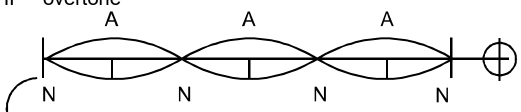
at x = $\frac{3}{2}$, resultant displacement is zero for all values of t.

5. A string of ....

Sol. Fundamental mode $\longrightarrow L = \frac{\lambda}{2} \Rightarrow \lambda = 2L$

$$f_0 = \frac{V}{\lambda} = \frac{V}{2L}$$

II[nd] overtone

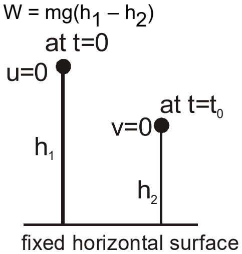


$$L = \frac{3\lambda'}{2} \Rightarrow \lambda' = \frac{2L}{3} = \frac{\lambda}{3} \text{ and } f' = \frac{V}{\lambda'} \Rightarrow f' = 3f_0$$

So it contain 4 node and –3 antinode frequency is 3 time at fundamental frequency wavelength is $\frac{1}{3}$ time at fundamental wavelength.

6. A small ball ....

Sol. From the figure-1 work done by gravity from t = 0 to t = t_0 is
$W = mg(h_1 - h_2)$



Since initial and final velocity of ball is zero its average acceleration will be zero.
Since net work done is zero from time interval t = 0 to t = t_0.
Hence work done by forces except gravity is $mg(h_2 - h_1)$.

7. A uniform ....

Sol. $T = 2\pi\sqrt{\frac{I}{mgy_{cm}}}$

$$I = \frac{MR^2}{2} - \left(\frac{1}{2}\frac{M}{4}\left(\frac{R}{2}\right)^2 + \frac{M}{4}\left(\frac{R}{2}\right)^2\right) = \frac{13MR^2}{32}$$

$$\Rightarrow y_{cm} = \frac{R}{6}$$

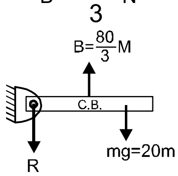
$$m = \frac{3M}{4} \text{ c}$$

$$T = 2\pi\sqrt{\frac{13}{4}\frac{R}{g}}$$

8. A rod of mass ....

Sol. $B = \rho_\ell V_{sub}\, g = 10^3 \times \left(\frac{8}{3} \times 10^{-3}\right) \times 1 \times 10$

$$B = \frac{80}{3} \text{ N}$$



Balancing torque about the hinge point,

$$\left(\frac{80}{3}\right) \times \frac{1}{2} = (20)\,(x)$$

(A,B) $x = \frac{2}{3}$ m

Applying force balance,

$$R + 20 = \frac{80}{3}$$

(C) $R = \frac{20}{3}$ M

(D) If we displace the rod, still torque will remain balanced.

9. A rod of length ....

Sol. Centre of mass = $\dfrac{\int_0^L \lambda_0 x^2 dx}{\int_0^L \lambda_0 x dx} = \dfrac{\lambda_0 \frac{L^3}{3}}{\lambda_0 \frac{L^2}{2}} = \dfrac{2L}{3}$

$$\text{Mass} = \int_0^L \lambda_0 x dx = \frac{\lambda_0 L^2}{2}$$

$$T_1 + T_2 = \frac{\lambda_0 L^2}{2} g$$

Balancing torque about A,

$$T_2 \times L = \frac{\lambda_0 L^2}{2} \times \frac{2L}{3} g$$

$T_2 = \dfrac{\lambda_0 L^2 g}{3}$ $\quad$ $T_1 = \dfrac{\lambda_0 L^2 g}{6}$

L = 0.3 m $\quad$ $\lambda_0 = 100$ kg/m^2

$T_2 = 30$ N, $\quad$ $T_1 = 15$ N

$V_1 = \sqrt{\dfrac{T_1}{\mu_1}}$ and $V_2 = \sqrt{\dfrac{T_2}{\mu_2}}$

$$\frac{V_1}{V_2} = \sqrt{\frac{T_1\mu_2}{T_2\mu_1}} = \frac{3}{2}$$

$\dfrac{n_1}{2\ell}\sqrt{\dfrac{15}{2}} = \dfrac{n_2}{2\ell}\sqrt{\dfrac{30}{9}}$ (ℓ is the length of the wire)

$$\frac{n_1}{n_2} = \frac{2}{3}$$

10. A particle is ....

Sol. The mean position of the particle will be at x = 2A and its displacement amplitude will be A.

11. A source emit ....

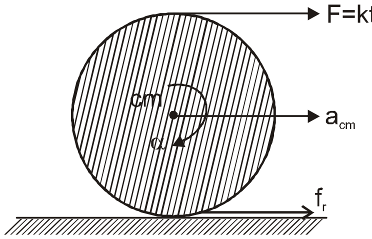
Sol. $\lambda' = \dfrac{V - V_s}{f} = \dfrac{332 - 32}{1000} = 0.3$ m

$$f' = f\frac{(V + V_0)}{V - V_s} = 1000 \times \frac{332 + 64}{332 - 32} = 1320 \text{ Hz}$$

$$\lambda'' = \frac{V - V_0}{f'} = 0.2 \text{ m.}$$

12. A uniform solid ....

Sol.



$F + f_r = (m)(a_{cm})$ ....(i)

$(\tau_{net})_{cm} = FR - f_rR = \left(\frac{MR^2}{2}\right)\alpha$ ....(ii)

$a_{cm} = \alpha R$ ....(iii)

Solving get, $a_{cm} = \frac{4F}{3m}$ and $f_r = \frac{F}{3} = \frac{kt}{3}$

So, graph between f_r and t will be straight line

(B) & (C) $a_{cm} = \frac{4}{3m}(kt) = \frac{dv_{cm}}{dt}$

$$\int_{v_{cm}=0}^{v_{cm}=v_{cm}} dv_{cm} = \frac{4k}{3m}\int_{t=t_0}^{t=t} t\,dt$$

$\Rightarrow$ $v_{cm} = \frac{2k}{3m}t^2$

So, velocity of the highest point is $2v_{cm} = \frac{4k}{3m}t^2$

(D) To prevent sliding,

$f_r < \mu_s M$

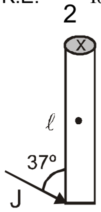
$\frac{kt}{3} < (\mu_s)(mg)$

$t < \frac{3\mu_s mg}{k}$.

13. A thin rod of ....

Sol. $J \sin 37^\circ \ell = \frac{m\ell^2}{3}\omega = L$

K.E. $= \frac{1}{2}I\omega^2$



$V = \frac{\ell}{2}\omega$.

14. Graph shows ....

Sol. Area under the curve is equal to number of molecules of the gas sample. Hence

$N = \frac{1}{2}.a.V_0 \Rightarrow$ $aV_0 = 2N$

$$V_{avg} = \int_0^\infty v\ N(V)\ dV = \frac{1}{N}\int_0^{V_0} C.\left(\frac{a}{v_0}.V\right)dV = \frac{2}{3}V_0 \Rightarrow$$

$\frac{V_{avg}}{V_0} = \frac{2}{3}$

$$v_{r\,ms}^2 = \frac{1}{N}\int_0^\infty V^2\ N(V)\ dV$$

$$= \frac{1}{N}\int_0^{v_0} V^2\left(\frac{a}{V_0}.V\right)dV = \frac{V_0^2}{2} \Rightarrow \frac{V_{rms}}{V_0} = \frac{1}{\sqrt{2}}$$

Area under the curve from 0.5 V_0 to V_0 is $\frac{3}{4}$ of total area.

15. The relation ....

Sol. As $\Delta Q = W$

$\Rightarrow \Delta U = 0 \therefore T_A = T_B$

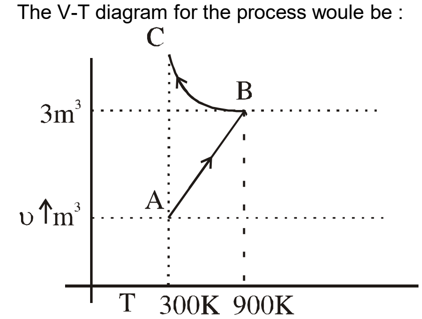
16. The ratio ....

Sol. Since $T_C = 2T_A$

$\therefore P_C = 2P_A$

18. Work done ....

Sol. The V-T diagram for the process woule be :



17) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ (for process AB)

$$\frac{1}{300} = \frac{3}{T_2} \Rightarrow T_2 = 900K$$

$$dU = nC_v dT = 2\left[\frac{5R}{2}\right][600] = 10^4 J$$

18) $$dW = W_{ab} + W_{bc} = Pdv + \frac{P_1V_1 - P_2V_2}{\gamma - 1}$$

$$= nRdT + \frac{nRdT}{\gamma - 1} = 35kJ$$

19. Choose the ....

Sol. Using equation of continuity $A_1v_1 = A_2v_2$

$(12\ cm^2)v_A = (6\ cm^2)(8.0\ m/s)$

$v_A = 4.0$ m/s

20. Choose the ....

Sol. Applying Bernoulli's principle between point A and C that are at same horizontal level

$$\frac{1}{2}\rho.V_A^{\ 2} + p_A = \frac{1}{2}\rho.V_C^{\ 2} + p_{atm}$$

$\Rightarrow$ $p_A = (1.01 \times 10^5\ N/m^2) + \frac{1}{2} \times 13,600\ (8^2 - 4^2)$

$= \ 4.27 \times 10^5\ N/m^2$

21. A sample of ....
Ans. **(A) – Q ; (B) – P ; (C) – Q ; (D) – S**
Sol. Number of moles = n (assume)

$C_V = \frac{3}{2}$ R and $C_P = \frac{5}{2}$ R (Monoatomic)

$T_A = 300$ K

$T_B / T_A = 2/1$

Hence $T_B = 600$ K

$Q_{BC} = W_{BC} = nRT_B \ln\left(\frac{V_C}{V_B}\right) = (n)\ (R)\ (600)\ \ln\left(\frac{4V_0}{2V_0}\right) =$ 600 n R ln 2

$\therefore$ $Q_{DA} = W_{DA} = nRT_D \ln\left(\frac{V_A}{V_D}\right) = (n)\ (R)\ (300)\ \ln\left(\frac{V_0}{4V_0}\right) = 300\ n\ R\ \ell n\left(\frac{1}{4}\right)$

$Q_{DA} = -600$ nR ln 2

$\therefore$ $\left|\frac{\Delta Q_{B\to C}}{\Delta Q_{D\to A}}\right| = 1$

Pressure is constant from A to B.
Pressure decreases from B to C and again from C to D.
Pressure increases from D to A.

So $\frac{P_{max}}{P_{min}} = \frac{P_A}{P_D} = \left(\frac{P_A\ V_A}{P_D\ \ V_D}\right)\ \left(\frac{V_D}{V_A}\right)$

$= \left(\frac{nRT_A}{nRT_D}\right)\ \left(\frac{4}{1}\right) = 4$

Ans : (s)

22. An ideal gas ....
Sol. Root mean square speed of molecules

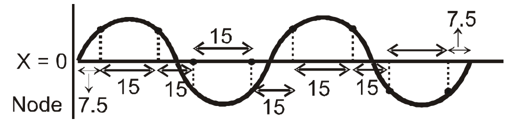
$= \sqrt{\frac{3RT}{M}} = 1.732\sqrt{\frac{RT}{M}}$

Most probable speed of molecues

$= \sqrt{\frac{2RT}{M}} = 1.44\ \sqrt{\frac{RT}{M}}$

Average velocity of a molecule is zero
Speed of any individual molecule may be anything.

23. A string 120 cm ....
Sol. 3[rd] overtone $\Rightarrow$ ωhich covers 120 cm length of the string



24. In the resonance ....
Sol. for first resonance

$\ell_1 + \varepsilon = \frac{v}{4f_0}$

for second resonance

$\ell_2 + \varepsilon = \frac{3v}{4f_0}$

for the third resonance

$\ell_3 + \varepsilon = \frac{5v}{4f_0}$

Solving get $\ell_3 = 2\ell_2 - \ell_1$

25. A sound ....

Sol. $I = \frac{p^2}{\rho v}$

$\frac{I_2}{I_1} = \frac{p_2^{\ 2}}{p_1^{\ 2}} \times \frac{\rho_1}{\rho_2}\frac{v_1}{v_2}$

$= \frac{9}{16}\times\frac{1.5}{3}\times\frac{400}{1200} = \frac{9}{16\times3\times2} = \frac{3}{32}$

26. A non–uniform ....

Sol. $\mu = Kx = \frac{dM}{dx}$

$\int_O^M dM = \int_O^{\ell} Kx\ \ dx$ and $K = \frac{2M}{\ell^2}$

$V = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{F}{Kx}} = \frac{dx}{dt}$

$\Rightarrow \int_O^{\ell}\sqrt{x}\ \ dx = \sqrt{\frac{F}{K}}\int_o^t dt$

$\therefore$ $t = \sqrt{\frac{4\ell^3}{9}.\frac{K}{f}} = \sqrt{\frac{4\ell^3}{9F}.\frac{2m}{\ell^2}}$

$= \sqrt{\frac{8M\ell}{9F}} = \sqrt{\frac{8\times45\times1.5}{9\times15}} = 2.$

27. A sonometer ....
Sol. $\ell_1 + \ell_2 + \ell_3 = 114$

$n_1 = \frac{1}{2\ell_1}\sqrt{\frac{T}{m}}$, $n_2 = \frac{1}{2\ell_2}\sqrt{\frac{T}{m}}$,

$n_3 = \frac{1}{2\ell_3}\sqrt{\frac{T}{m}}$

$n_2 = \frac{n_1}{3}$ & $n_3 = \frac{n_1}{4}$

$\ell_1 = 72$ cm, $\ell_2 = 24$ cm, $\ell_3 = 18$ cm,

$\ell_1 = 12 \times 6$ cm

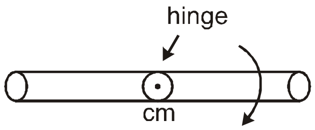
x = 6

28. A thin uniform ....

Sol. As L = $\frac{2}{3}$ $t^3 + 2t^2$

$\frac{dL}{dt} = 2t^2 + 4t = J$

J = 2 $\left(\frac{9}{4}\right) + 4\left(\frac{3}{2}\right)$



J = $\frac{21}{2}$ Nm

an $\tau = I\,\alpha$

$$\frac{21}{2} = \frac{(0.25)(1.2)^2}{12}\alpha$$

α = 350 rad/sec^2.
= 50 × 7

∴ x = 7

29. A uniform ....

Sol. From conservation of angular momentum.

$$mu\,\frac{L}{2} + mu\,\frac{L}{2} = \left[2m\frac{L^2}{12} + m\left(\left(\frac{L}{2}\right)^2 + \left(\frac{L}{2}\right)^2\right)\right]\omega$$

$$muL = \left[\frac{mL^2}{6} + \frac{mL^2}{4} + \frac{mL^2}{4}\right]\omega = \frac{2\;mL^2}{3}\omega$$

or $\omega = \frac{3u}{2\;L} = \frac{3\times6}{2\times1}$ = 9 rad/s

30. A rough track ....

Sol. Minimum velocity required at D $\frac{mv^2}{R-r}$ = mg

⇒ v = $\sqrt{g(R-r)}$

Energy conservation between A and D

$$mg(h - 2R + r) = \frac{1}{2}mv^2 + \frac{1}{2}\frac{mr^2}{2} \times \frac{v^2}{r^2}$$

$$g(h - 2R + r) = \frac{3}{4}g(R - r)$$

$$R = \frac{4h+7r}{11} = \frac{52+14}{11} = 6 \text{ cm.}$$

31. Find the moment ....

Sol. $I = \frac{ma^2}{12} + m\left(\frac{a}{\sqrt{2}}\right)^2 = \frac{7ma^2}{12}$ = 7.

32. How many ....

Sol. The velocity of sound propagation in gas is

$$V = \sqrt{\frac{\gamma P}{\rho}} \Rightarrow 330 = \sqrt{\frac{\gamma\times10^5}{1400/1089}}$$

⇒ γ = 1.4

The relation between γ and degrees of freedom ‘F’ is

$\gamma = 1 + \frac{2}{F}$ $\qquad$ $1.4 = 1 + \frac{2}{F}$

⇒ F = 5

[Ans: 5]

33. Figure shows ....

Sol. For rectangular hyperbola

XY = constant

Uρ = constant

n $C_V T\rho$= constant

$$n\frac{5}{2}R\;T\frac{M}{V} = \text{constant}$$

$$\frac{5}{2}P\frac{VM}{V} = \text{constant}$$

⇒ P = constant (isobaric process)

$\Delta U_{B\to A}$ = 37 – 2 = 35 J = $\frac{5}{2}nR\Delta T$

14 J = nRΔT ∴ W = 14 J

34. 2 moles of ....

Sol. $\Delta U = (1/2)f_1n_1R\Delta T + (1/2)f_2n_2R\Delta T = (1/2)(f_1n_1+f_2n_2)R\Delta T$ = (1/2) (5 x 2 +3 x 5) 2 ΔT= 25 ΔT

Since W = 0 , ΔU = Q = 25 Cal

35. A wheel of ....

Sol. Net external torque on the system is zero, Therefore, angular momentum will remain conserved. Thus,

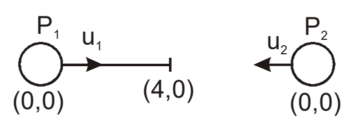
$$I_1\omega_1 = I_2\omega_2 \qquad \text{or} \qquad \omega_2 = \frac{I_1\omega_1}{I_2}$$

Here, $I_1 = I,\ \omega_1 = \omega_0,\ I_2 = I + mR^2$

$$\therefore \qquad \omega_2 = \frac{I\omega_0}{I + mR^2}$$

36. Two particles ....

Sol.



$u_1 = \frac{4}{t_0}$ and $u_2 = \frac{6}{t_0}$

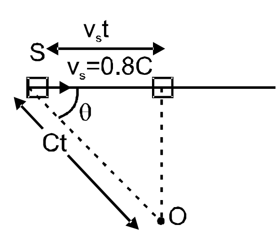
At t = t_0 , x-coordinate of c.m. is 4. Hence after further t_0 time

$X_{cm} = 4 + v_{cm}\cdot t_0$

$$= 4 + \frac{\left(\frac{4}{t_0} - \frac{6}{t_0}\right)\;.\;t_0}{2} = 3$$

37. A source of sound ....

Sol.



$\cos\theta = \frac{v_s t}{Ct} = 0.8$

$$f' = f\left[\frac{C}{C - v_s \cos\theta}\right]$$

$$= 1.8\left[\frac{C}{C - 0.8C\cos\theta}\right]$$

$$= 1.8\frac{1}{1-0.8^2} = 1.8\frac{1}{1-0.64} = \frac{1.8}{0.36}$$

$$= \frac{180}{36} = 5 \text{ kHz.}$$

38. A block of ....

Sol. For maximum speed,

$$\frac{dv}{dt} = 0 \Rightarrow \quad a = 0$$

If at maximum speed, elongation is x, then

$$F = kx \Rightarrow \quad x = \frac{F}{k}$$

Now, by WET,

$$-\frac{1}{2}kx^2 + Fx = \frac{1}{2}mv^2 \qquad \therefore$$

$$V = \frac{F}{\sqrt{mk}} = 6 \quad m/s$$

39. A uniform ....

Sol. Let ρ be the density of the material, ρ_0 be the density of water. When the sphere has just started sinking, the weight of the sphere = weight of water displaced

$$\Rightarrow \frac{4}{3}\pi(R^3 - r^3)\rho g = \frac{4}{3}\pi R^3 \rho_0 g$$

$$\Rightarrow (R^3 - r^3)\rho = R^3\rho_0 \Rightarrow \frac{R^3 - r^3}{R^3} = \frac{\rho_0}{\rho}$$

$$\Rightarrow \frac{r}{R} = \frac{(7)^{1/3}}{2}$$

40. Two sound ....

Sol. $f_1 = \frac{V}{\lambda}$

$$f_1 = \frac{330}{5} = 66$$

$$f_2 = \frac{330}{5.5} = 60$$

$\Delta f = f_1 - f_2 = 6$

CHEMISTRY

5. Which of the following ....

Sol. Boiling of egg leads to denaturation of proteins which has random coil structure.

6. For the given reaction............

Sol. $\frac{\Delta H_2 - \Delta H_1}{T_2 - T_1} = (\Delta C_P)_{reaction} = 2 \times 20 - 20 = 20 J/K$

$\because (\Delta C_P)_{reaction}$ is positive on T↑ ΔH↑

at 300K $\Delta G = \Delta H - T\Delta S$

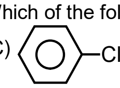
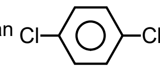
$= 30 - 300 \times 150 \times 10^{-3}$

$= -15$ KJ/mole

13. A piece of red litmus paper ....

Sol. BaO_2 and Na_2O_2 are peroxide. Aqueous solution of both give H_2O_2 which litmus paper turns white.

14. Which of the following ....

Sol. (C)  is more polar than  ($\mu = 0$)

(D) Bond angle in CF_4 & CCl_4 are identical.

16. The value of equilibrium ....

Sol.

$$\begin{array}{ccccc} H_2 & + & I_2 & \rightleftharpoons & 2HI \\ 0.5 & & 0.5 & & 0 \\ 0.5 - x & & 0.5 - x & & 2x \end{array}$$

$$K_c = \frac{\left(\frac{2x}{7}\right)^2}{\left(\frac{0.5-x}{7}\right)^2} = \frac{4x^2}{(0.5-x)^2} = 49$$

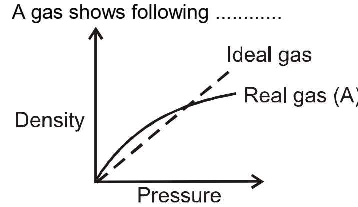
$$7 = \frac{2x}{0.5 - x} \Rightarrow x = \frac{3.5}{9}$$

total pressure = nRT/V = 8.21 atm

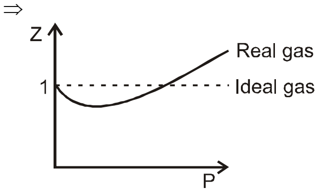
concentration of HI = 2x/V = $\frac{1}{9}$M

17. A gas shows following ....

Sol.



⇒



18. For a real gas ....

Sol. A real gas behaves ideally at Boyle's temperature.

$$Z = \frac{PV_M}{RT} = 1$$

$$P = \frac{RT}{V_M} = \frac{R\frac{a}{Rb}}{V_M} = \frac{a}{V_M.b}$$

20. Which compound will ....

Sol. $2O_2^- + 2H_2O \longrightarrow 2OH^- + H_2O_2 + O_2$

21. In Column-I there are ....

Sol. $Z = \frac{PV}{nRT}$ i ⇒ ideal, R ⇒ real

$$Z = \frac{P}{\left(\frac{nRT}{V}\right)} = \frac{P_R}{P_i} \text{ (at same n, T, V)}$$

$$Z = \frac{V}{\left(\frac{nRT}{P}\right)} = \frac{V_R}{V_i} \text{ (at same P, T, n)}$$

$$Z = \frac{\left(\frac{PV}{RT}\right)}{n} = \frac{n_i}{n_R} \text{ (at same P, V, T)}$$

$$Z = \frac{\left(\frac{PV}{nR}\right)}{T} = \frac{T_i}{T_R} \text{ (at same P, V, n)}$$

23. The outermost electronic ....

Sol. $M^{+3} : ns^2p^6d^4$

$M : ns^2p^6d^5(n+1)s^2$

24. A mixture of 32 gm of O_2 ....

Sol. $\left(\frac{r_{D_2}}{r_{O_2}}\right) = \frac{n_{D_2}}{n_{O_2}}\sqrt{\frac{M_{O_2}}{M_{D_2}}}$; $n_{O_2} = 1$; $n_{D_2} = 4$

$\Rightarrow 4\sqrt{\frac{32}{4}} = 8\sqrt{2}$

25. If heat of reaction for............

Sol. Heat of dissociation of HA = 13.7 – 6.7 = 7 Kcal.

26. 1 mole of an ideal gas ....

Sol. Process is isochoric.

27. 1 mole of an ideal gas ....

Sol. In isothermal reversible process

$\Delta S = \frac{q_{rev}}{T}$

$q = -w = 2.303\ RT \log \frac{V_2}{V_1}$

$= 2740.6$ J/mole

$\Delta S_{sys.} = \frac{q_{rev}}{T} = \frac{2740.6}{300} = 9.135$ J/K mole

$\Delta S_{surr.} = -\Delta S_{system} = -9.135\ JK^{-1}\ mole^{-1}$

$\Delta S_{universe} = 0$

28. Consider the following ....

Sol. (i), (ii), (iv), (v)

ΔS_{sys} is + ve

$\Delta S_{surr} = 0$, $\Delta H = 0$, $\Delta U = 0$

$\Delta G = \Delta H - \Delta(TS)$

$= 0 - T\Delta S$

$= -T\Delta S$

29. N_2O_3 dissociates into ....

Sol. $N_2O_3(g) \rightleftharpoons NO(g) + NO_2(g)$ $K_P = 1$

	$N_2O_3(g)$	$NO(g)$	$NO_2(g)$
Intial Pressure	3	3	3
at eq.	3 + P	3 – P	3 – P

$K_P = \frac{(3-P)^2}{(3+P)} = 1$

Solving this P = 1 atm

30. How many of the following ....

Sol. only (3) is correct

31. In how many of the ....

Sol. (i) $Z = \frac{PM}{dRT} = \frac{10 \times 32}{20 \times \frac{1}{12} \times 300} = \frac{16}{25}$

$\therefore$ O_2 shows negative deviation

(ii) $Z = \frac{6}{11.2} \Rightarrow Z < 1$ $\therefore$ N_2 shows negative deviation

(iii) A shows negative deviation at $T = T_C$ and $P < P_C$

(iv) Z > 1

(v) Z > 1

(vi) Z < 1

(vii) P = low, $T = T_B$

$\therefore$ Z = 1 or PV = nRT

32. How many species ....

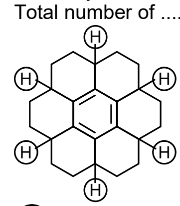
Sol. (i), (ii), (iv), (vii), (viii)

35. K_2CO_3, Rb_2CO_3, $CaCO_3$, ...

Sol. K_2CO_3, Na_2CO_3, Rb_2CO_3, $CaCO_3$, $SrCO_3$ & $BaCO_3$ are thermally stable than $MgCO_3$.

37. Total number of ....

Sol.



(H) → Hyperconjugative hydrogen.

38. How many of the ....

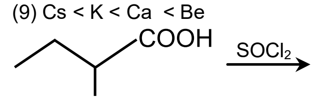
Sol. (a), (b), (c), (d) & (g) are correct.

39. How many of the ....

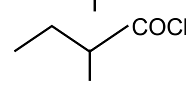
Sol. (1) CsH > KH > NaH > LiH → Reducing power

(7) Li > Na > K > Rb → Metallic bond strength

(9) Cs < K < Ca < Be → Ionisation enthalpy

40. 

....

Sol. 

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ADVANCED PATTERN
PART TEST-4 (APT-4)

TARGET : JEE (MAIN+ADVANCED) 2019

DATE : 04-02-2018 **COURSE : VIKAAS (JA) & VIPUL (JB)**

ANSWER KEY

CODE-0

MATHEMATICS

1.	(BC)	**2.**	(ABD)	**3.**	(CD)	**4.**	(ABC)	**5.**	(ABD)	**6.**	(BC)	**7.**	(A)
8.	(D)	**9.**	(A)	**10.**	(D)	**11.**	(AC)	**12.**	(A)	**13.**	(AC)	**14.**	(C)
15.	(D)	**16.**	(A)	**17.**	(A)	**18.**	(B)	**19.**	(A)	**20.**	(B)		

21. (A) $\to$ R; (B) $\to$ S; (C) $\to$ P; (D) $\to$ S **22.** (A) $\to$ S; (B) $\to$ P; (C) $\to$ S; (D) $\to$ Q **23.** (7)

24.	(8)	**25.**	(6)	**26.**	(2)	**27.**	(0)	**28.**	(4)	**29.**	(5)	**30.**	(2)
31.	(5)	**32.**	(0)	**33.**	(8)	**34.**	(7)	**35.**	(6)	**36.**	(2)	**37.**	(5)
38.	(4)	**39.**	(0)	**40.**	(0)								

PHYSICS

1.	(A)	**2.**	(AD)	**3.**	(ABCD)	**4.**	(D)	**5.**	(D)	**6.**	(ACD)	**7.**	(AC)
8.	(AC)	**9.**	(ACD)	**10.**	(BCD)	**11.**	(ABD)	**12.**	(ACD)	**13.**	(ABCD)	**14.**	(ABCD)
15.	(C)	**16.**	(B)	**17.**	(A)	**18.**	(C)	**19.**	(A)	**20.**	(AC)		

21. (A) – Q ; (B) – P ; (C) – Q ; (D) – S

22. (A) – P, Q ; (B) – Q, R, S ; (C) – P, Q, R, S ; (D) – P, Q, R, S **23.** (3) **24.** (3)

25.	(3)	**26.**	(2)	**27.**	(6)	**28.**	(7)	**29.**	(9)	**30.**	(6)	**31.**	(7)
32.	(5)	**33.**	(7)	**34.**	(1)	**35.**	(1)	**36.**	(4)	**37.**	(5)	**38.**	(6)
39.	(7)	**40.**	(6)										

CHEMISTRY

1.	(ABD)	**2.**	(AD)	**3.**	(ABCD)	**4.**	(D)	**5.**	(BD)	**6.**	(AC)	**7.**	(ABC)
8.	(ABD)	**9.**	(A)	**10.**	(BC)	**11.**	(D)	**12.**	(B)	**13.**	(BC)	14.	(CD)
15.	(ABCD)	**16.**	(AD)	**17.**	(ABC)	**18.**	(C)	**19.**	(AB)	**20.**	(B)		

21. (A) – Q, S; (B) – P, R; (C) – Q, S; (D) – P, R **22.** (A) - P, Q ;(B) - P, Q, R;(C) - P,Q, R;(D) - P,Q,S

23.	(5)	**24.**	(8)	**25.**	(7)	**26.**	(0)	**27.**	(0)	**28.**	(4)	**29.**	(2)
30.	(6)	**31.**	(4)	**32.**	(5)	**33.**	(4)	**34.**	(2)	**35.**	(6)	**36.**	(3)
37.	(6)	**38.**	(5)	**39.**	(6)	**40.**	(5)						