MATHS

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR MATHS

TEST PAPERS

Mathematics

1. The locus of the middle points of the facal chords of the parabola, $y^2 = 4x$ is ,

A. $y^2 = x - 1$

B. $y^2 = 2(x - 1)$

C. $y^2 = 2(1 - x)$

D. None

Answer: B

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2. The odds against a certain event is 5 : 2 and the odds in favour of another event is 6 : 5. If the both the events are independent, then the probability that at least one of the events will happen is

A. $\frac{50}{77}$

B. $\frac{52}{77}$

C. $\frac{25}{88}$

D. $\frac{63}{88}$

Answer: B

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3. In the Argand plane, the vector z = 4 - 3i is turned in the clockwise sense through 180° and stretched three times. The complex number represented by the new vector is

A. $12 + 9i$

B. $12 - 9i$

C. $-12 - 9i$

D. $-12 + 9i$

Answer: D

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4. An ellipse and a hyperbola are confocal (have the same focus) and the conjugate axis of the hyperbola is equal to the minor axis of the ellipse. If $e_1 and e_2$ are the eccentricities of the ellipse and the hyperbola, respectively, then prove that $\frac{1}{e12} + \frac{1}{e22} = 2$.

A. 1

B. 2

C. 3

D. 4

Answer: B

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5. A man walks a distance of 3 units from the origin towards the North-East $\left(N45^0E\right)$ direction.From there, he walks a distance of 4 units towards the North-West $\left(N45^0W\right)$ direction to reach a point P. Then, the position of P in the Argand plane is $3e^{\frac{i\pi}{4}} + 4i$ (b) $(3 - 4i)e^{\frac{i\pi}{4}}$ $(4 + 3i)e^{\frac{i\pi}{4}}$ (d) $(3 + 4i)e^{\frac{i\pi}{4}}$

A. $3e^{i\frac{\pi}{4}} + 4i$

B. $(3 - 4i)e^{i\frac{\pi}{4}}$

C. $(4 + 3i)e^{i\frac{\pi}{4}}$

D. $(3 + 4i)e^{i\frac{\pi}{4}}$

Answer: D

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6. The normal at a point P on the ellipse $x^2 + 4y^2 = 16$ meets the x-axis at $\dot{Q}$ If M is the midpoint of the line segment PQ, then the locus of M intersects the latus rectums of the given ellipse at points. $\left(\pm \frac{(3\sqrt{5})}{2} \pm \frac{2}{7} \right)$ (b) $\left(\pm \frac{(3\sqrt{5})}{2} \pm \frac{\sqrt{19}}{7} \right)$ $\left(\pm 2\sqrt{3}, \pm \frac{1}{7} \right)$ (d) $\left(\pm 2\sqrt{3} \pm \frac{4\sqrt{3}}{7} \right)$

A. $\left(\pm \frac{3\sqrt{4}}{2}, \pm \frac{2}{7} \right)$

B. $\left(\pm \frac{3\sqrt{4}}{2}, \pm \frac{\sqrt{19}}{4} \right)$

C. $\left(\pm 2\sqrt{3}, \pm \frac{\sqrt{1}}{7} \right)$

D. $\left(\pm 2\sqrt{3}, \pm \frac{4\sqrt{3}}{4} \right)$

Answer: C

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7. India plays two matches each with West Indies and Australia. In any match the probabilities of India getting points $0, 1$ and 2 are $0.45, 0.05$ and 0.50 respectively. Assuming that the outcomes are independent, the probability of India getting at least 7 points is (a) 0.8750 (b) 0.0875 (c) 0.0625 (d) 0.0250

A. 0.875

B. 0.0875

C. 0.0625

D. 0.025

Answer: B

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8. The coordinates of the focus of the parabola described parametrically by $x = 5t^2 + 2. y = 10t + 4$ are

A. (7,4)

B. (3,4)

C. (3,-4)

D. (-7,4)

Answer: A

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9. The ellipse $x^2 + 4y^2 = 4$ is inscribed in a rectangle aligned with the coordinate axes, which in turn is inscribed in another ellipse that passes through the point (4, 0). Then the equation of the ellipse is (1) $x^2 + 16y^2 = 16$ (2) $x^2 + 12y^2 = 16$ (3) $4x^2 + 48y^2 = 48$ (4) $4x^2 + 64y^2 = 48$

A. $x^2 + 16y^2 = 16$

B. $x^2 + 12y^2 = 16$

C. $4x^2 + 48y^2 = 48$

D. $4x^2 + 64y^2 = 48$

Answer: B

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10. If $|z - 1| + |z + 3| \leq 8$, then the maximum, value of $|z - 4| is =$

A. (0,7)

B. (1,8)

C. [1,9]

D. [2,5]

Answer: C

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11. AB is double ordinate of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ such that ΔAOB (where 'O' is the origin) is an equilateral triangle, then the eccentricity e of hyperbola satisfies:

A. $1 < e < \frac{2}{\sqrt{3}}$

B. $e = \frac{2}{\sqrt{3}}$

C. $e = \frac{\sqrt{3}}{2}$

D. $e > \frac{2}{\sqrt{3}}$

Answer: D

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12. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$.

If 'n' is not fixed and series ends when any one of the team completes its 4^{th} win then probability that India wins the series is

A. $\frac{4}{2^7}$

B. $\frac{47}{2^7}$

C. $\frac{47}{2^6}$

D. None

Answer: C

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13. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$.

If n = 7, them probability that India wins atleast three consercutive matches is

A. $\frac{17}{2^6}$

B. $\frac{47}{2^7}$

C. $\frac{47}{2^6}$

D. None

Answer: B

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14. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$.

For n = 7, probadility that India wins atleast three conseutive matches is

A. $\frac{4}{2^7}$

B. $\frac{17}{2^6}$

C. $\frac{47}{2^7}$

D. None

Answer: B

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15. Form, a cosmetic shop containing perfumes and does, a pair is selected at random. The probability that the selected pair will consist of one perfume and one deo is $\frac{16}{31}$. Find the maximum number of perfumes and does the shop can contain ?

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PHYSICS

1. The equation of the molar the heat capacity for an ideal gas in given by :

$$C = \frac{R}{\gamma - 1} + \frac{P}{n}\left(\frac{dV}{dT}\right)$$

When , R is universal gas constant, gamma is a dimesnion constant , P is opressure, V is volume 'n' is number of mole, T is temperature

Then find the SI units for the molar heat capacity .

A. $Jmol/K$

B. $molJ/K$

C. mol/K

D. $J/molK$

Answer: D

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2. A gas bubble from an explosion under water oscillates with a period T proportional to $P^a d^b E^c$, where P is the pressure, d is density of water and E is the total energy of the explosion. Find the value of a,b and c`.

A. $a = \frac{3}{2}, b = -\frac{1}{3}, c = \frac{1}{2}$

B. $s = -\frac{5}{6}, b = \frac{1}{3}, c = \frac{1}{2}$

C. $a = -\frac{5}{6}, b = \frac{1}{2}, c = \frac{1}{3}$

D. $a = \frac{3}{2}, b = -\frac{1}{3}, c = \frac{1}{2}$

Answer: C

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3. The van der Waals, equation for n moles of real gas is: $\left(P + \frac{n^2 a}{V^2}\right)(V - nb) = nRT$ where P is the pressure, V is the volume , T is the absolute temperature, R is the molar gas constant and a, b are van der

Waal's constant. Which of the following have the same dimension as those of PV ?

A. nRT

B. a/V

C. Pb

D. ab/V^2

Answer: A

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4. A vector has a magnitudes of 12. What its tail is at the origin it lies between the positive x axis and the negative y axis and makes an angles of 30° with x axis . Its y component is :

A. $6/\sqrt{3}$

B. $-6/\sqrt{3}$

C. 6

D. -6

Answer: D

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5. The momentum of a particle moving in straight line is given by

$$p = t + \frac{1}{t} (\text{in } m/s)$$

find the (time $t > 0$) at which the net force aciting on particle is 0 and it's momentum at that time.

A. $1kgm/\sec$

B. $2kgm/\sec$

C. $3kgm/\sec$

D. $4kgm/\sec$

Answer: B

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6. A normal human cye can see an object making an angle of 1.8° at the eye. What is the

approximate height of object which can be seen by an eye placed at a distance of 1 m from the object.

A. $\pi/4cm$

B. $\pi/2$ cm

C. πcm

D. $3\pi/2cm$

Answer: C

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7. A level flight olane flying at an altitude of 1024 ft with a speed of 240 ft/s is overtaking a motor boat travelling at 80 ft/s in the same direction as the plane. At what horizontal distance before the boat should a bag be dropped from the plane in order to hit the boat ? $\left[g = 32 \text{ ft/s}^2\right]$

A. 1200 ft

B. 1280 ft

C. 1300 ft

D. 1380 ft

Answer: B

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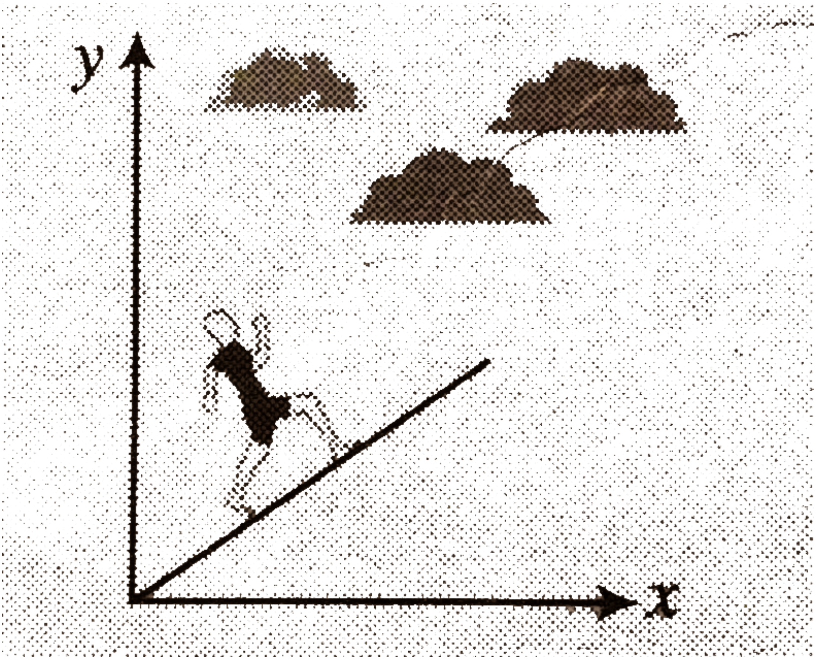
8. To a man running upwards on the hill, the rain appears to fall vertically downwards with $4ms^{-1}$. The velocity vector of the man w.r.t. earth is $\left(2\hat{i} + 3\hat{j}\right)ms^{-1}$. If the man starts running down the hill with the same speed, then determine the relative speed of the rain w.r.t. man.



A. $\sqrt{10}m/s$

B. $2\sqrt{10}m/s$

C. $\sqrt{20}m/s$

D. $2\sqrt{20}m/s$

Answer: C

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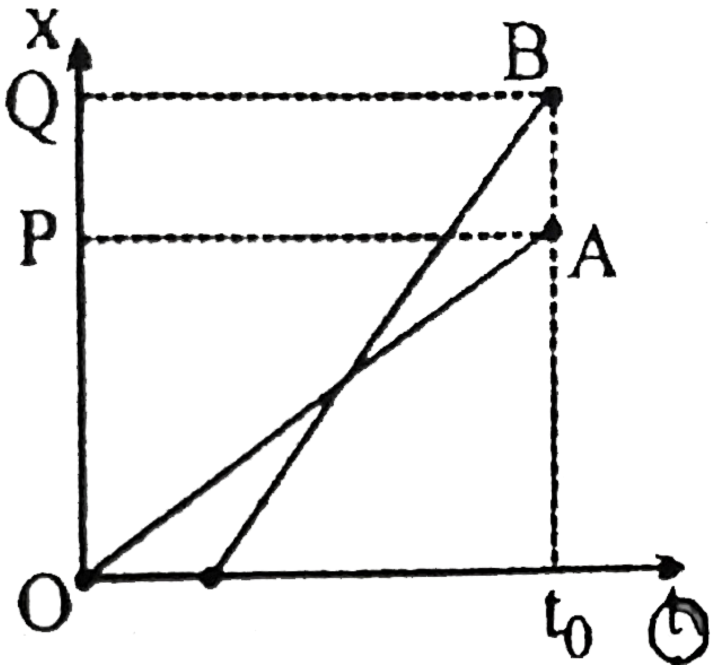
9. The position- time (x-t) graphs for two rabbits A and B moving from their carrot field O to their homes P and Q respectively along straight line path (taken as x axis) are shown in figure below. Choose the correct statement(s):



A. A lives closer to the carrot field than B

B. A starts form the carrot field earlier than B

C. A and B have equal average velocities form 0 tot_0

D. B overtakes A on the way

Answer: A::B::C

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10. The verical of point above the ground is twice that of Q. A particle is projected downward with a speed of $5ms^{-1}$ from P and at the same time another particle is projected upward with the same speed from W. Both particle reach the ground simultaneously, then

A. PQ= 30 m

B. PQ = 60 m

C. time of glight of the stone = 3s

D. time of flight of the stones = $1/3$s

Answer: A::C

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11. A boat is travelling due east at $12ms^{-1}$. A flag on the boat flaps at $53^{\circ} NofW$. Another flag on the shore flaps due north.

A. Speed of wind with respect to ground is $16m/s$

B. Speed ofwind with respect to ground is $20m/s$

C. Speed of wind with respect to boat is $20m/s$

D. Speed of wond with respect to boat is $16m/s$

Answer: A::C

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12. A capacitor of capacitance C carrying charge Q is connected to a source of emf E. Finally, the charge on capacitor would be

A. Q

B. Q + CE

C. C E

D. none

Answer: C

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13. In the circuit shown in the figure, the capacitor C is charged to a potential Vo. The heat generated in the circuit when the switch S is closed, is

A. CV_0^2

B. $2CV_0^2$

C. $4CV_0^2$

D. $8CV_0^2$

Answer: D

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14. A cell of emf E and internal resistance r is connected in series with an external resistance nr. Than what will be the ratio of the terminal potential difference to emf, if n=9.

A. 1/n

B. $\frac{1}{n+1}$

C. $\frac{n}{n+1}$

D. $\frac{n+1}{n}$

Answer: C

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15. A point charge q moves from A to B along a parabolic(x2 =2ay) path (AB is latus rectum). Electric field is along x-axis. The work done by the field is

A. $-qEa$

B. $+qEa$

C. $-2qEa$

D. $2qEa$

Answer: D

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16. Five point charges each of charge + q are placed on five vertices of a regular of side h as shown in the figure. Then

A. the forces on (-q) at O due to charges +q at A and D are balanced.

B. the forces on (-q) due to charges at D and E are balanced.

C. The resultant force on $-q$ at O is $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{h^2}$ along OE.

D. The resultant force on - q at O is $\frac{1}{4\pi\varepsilon_0}\frac{q^2}{h^2}$ along OC.

Answer: A::D

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17. A dielectric slab of thickness d is inserted in a parallel plate capacitor whose negative plate is at $x = 0$ and positive plate is at $x = 3d$. The slab is equidistant from the plates. The capacitor is given some charge. As one goes from 0 to $3d$:

A. the magnitude of the electric field remains the same

B. the direction of the electric field remains the same

C. the electric potential increases continuously

D. the electric potential increases at fist, then decreases and again increase.

Answer: C

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18. A long straight wire carries the current along +ve x-direction. Consider four points in space $A(0, 1, 0), B(0, 1, 1), C(1, 0, 1),$ and $D(1, 1, 1)$. Which of the pairs will have the same magnitude of magnetic field?

A. A and B

B. A and C

C. B and C

D. B and D

Answer: B::D

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19. A wire having a linear density $0.1 kg/m$ is kept under a tension of $490N$. It is observed that it resonates at a frequency of $400Hz$. The next higher frequency is $450Hz$. Find the length of the wire.

A. $0.4m$

B. $0.6m$

C. $0.49m$

D. $0.7m$

Answer: D

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20. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of he closed pipe is found to be higher by 100 Hx than the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is

A. $200Hz$

B. $300Hz$

C. $240Hz$

D. $480Hz$

Answer: A

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21. A mass M is attached to a spring oscillates with a period of 2 sec. If the mass is increased by 2 kg, the period increases by 1 sec. Assuming Hooker's law is obeyed the value of intital mass M is

A. $1.6kg$

B. $1.8kg$

C. $2.1kg$

D. $2kg$

Answer: A

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22. A source frequency f gives t beats when sounded with a frequency 200Hz. The second harmonic of same source gives 10 beats when sounded with a source of frequency 420Hz. The value of f is

A. $200Hz$

B. $210Hz$

C. $205Hz$

D. $195Hz$

Answer: C

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23. For a temperature difference $\Delta T = 20.0\,^{\circ}C$, one slab of material conducts $10.0W/m^2$, another of the same shape conduct $20.0W/m^2$. What is the rate of heat flow $perm^2$ of surface area whenthe slabs are placed side by side with $\Delta T_{\to t} = 20.0\,^{\circ}C$?

A. $10W/m^2$

B. $30W/m^2$

C. $\frac{20}{3}W/m^2$

D. none of these

Answer: C

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24. If a body (coated black) at $600K$ surrounded by atmosphere at $300K$ has cooling rate r_0, the same body at $900K$, surrounded by the same atmosphere will have to colloing rate close to :

A. $16r_0/3$

B. $81r_0/16$

C. $16r_0$

D. $4r_0$

Answer: A

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25. A body floats on water and also on an oil of density 1.25. Which of the following is/are true?

A. The body loses more weight in oil than in water

B. The volume of waer displaced is 1.25 times that of oil displaced.

C. The body experience equal upthurst from water and oil

D. to make the body just sink. One will need 1.25 times load in case of oil than in case

Answer: B::C

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26. A closed system receives 200kJ of heat at constant volume. It then rejects 100kJ of heat while it has 50kJ of work done on it at constant pressure. If an adiabatic process can be found which will restore the system to its initial state, the work done by the system during this process is

A. 100 kJ

B. 50 kJ

C. 150 kJ

D. 20 kJ

Answer: C

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27. A sufficiently long closed organ pipe has a small hole at its bottom. Initially the pipe is empty. What poured into the pipe at a constant rate. The fundamental frequency of the air column in the pite

A. continously increasing

B. first increases and them becomes

C. continuously decreases

D. first decreases and them becomes

Answer: B

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28. The sinusoidal wave

$y(x, t) = ym\sin(kx - \omega t)$

is incident on the fixed end of a string at $x = L$. The reflected wave is given by :-

A. $y_m\sin(kx + \omega t)$

B. $-y_m\sin(kx + \omega t)$

C. $y_m\sin(kx + \omega t - kL)$

D. $y_m\sin(kx + \omega t - 2kL)$

Answer: D

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29. Two progressive transverse waves are described by :

$y_1 = 3.0cm\sin[(4x - 700t)rad]$ and

$y_2 = 3.0cm\sin[(4x - 700t - \pi/3)rad]$.

A. Amplitude of a resultant wave is $3\sqrt{3}cm$

B. Resultantis a standing wave.

C. Resultant is a progressive wave

D. The particle will be oscillating in xy-plane.

Answer: A::C::D

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30. A particle performing S.H.M undergoes displacement of $A/2$ (where A = amplitude of S.H.M.) in one second. At $t = 0$ be the particle was located at either position or mean position. The time period of S.H.M. can be : (consider all possible cases)

A. 12s

B. 2.4

C. 6s

D. 1.2s

Answer: A::B::C::D

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31. Two particles of of a medium disturbed by the wave propagation are at $x_1 = 0$ and $x_2 = 1cm$. The wave is propagating in positive x-direction. The displacement of the particles is given by the equation :

$y_1 = (2\sin 3\pi t)cm$ and $y_2 = 2\sin(3\pi t - \pi/8)cm$ (t is in second

A. The frequency of wave is 1.5 Hz

B. wavelength of the wave can be 16 cm.

C. Velocity of the wave can be $24cm/s$

D. Wave equation can by $y = (2)\sin\left[\frac{2\pi}{16}(24t - x)\right]cm.$

Answer: A::B::C::D

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32. Water jet coming out of a stationary horizontal tube at speed v strikes horizontally a massive wall moving in opposite with same speed. Water come to rest relative to wall after striking. Treating A as cross-section of jet and density of water as ρ. Select the correct alternative(s)

A. force exerted on the wall is $2\rho A v^2$

B. force exerted on the wall is $4\rho A v^2$

C. rate of change of kinetic energy of water jet striking the wall is $8\rho A v^3$

D. rate of change of kinetic energy of water jet striking the wall is zero

Answer: B::D

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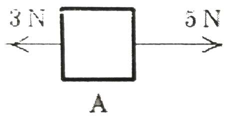
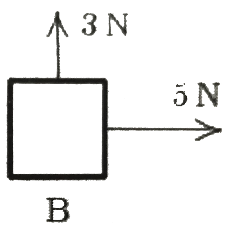
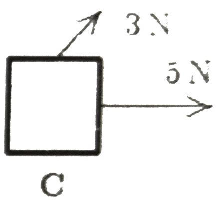
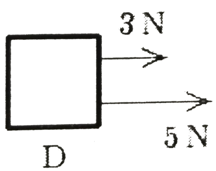
33. Two forces, one with a magnitude of 3N and the other with a magnitude of 5N ,are applied to an object. For which orientations of the forces shown in the diagrams is the magnitude of the acceleration of the object the least ?

A. 

B. 

C. 

D. 

Answer: A

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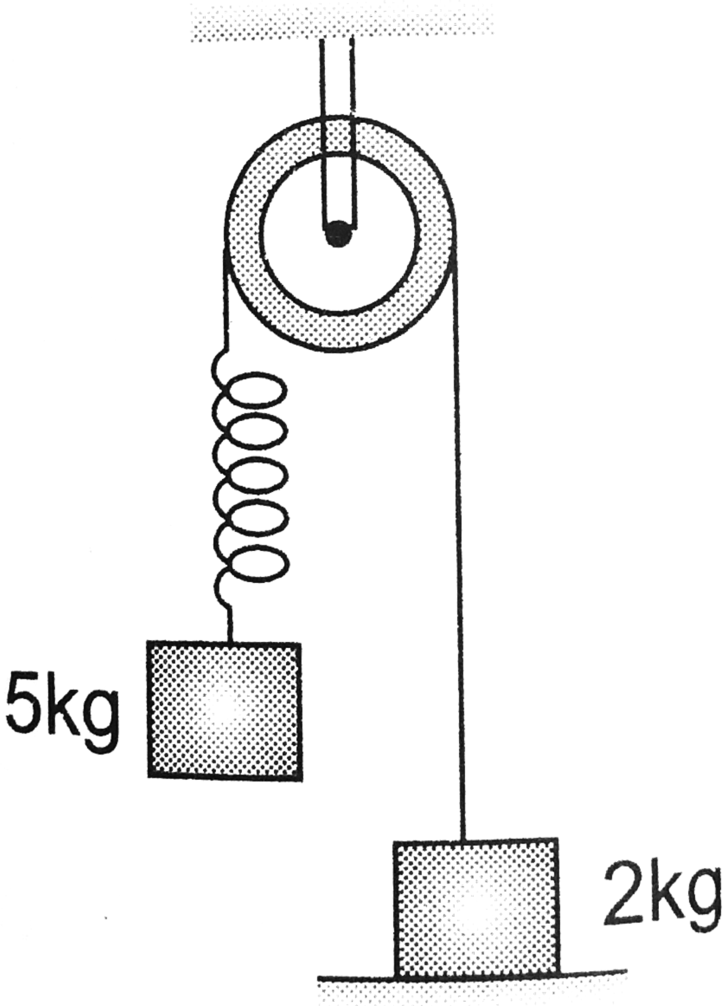
34. System shown in figure is released from rest . Pulley and spring is mass less and friction is absent everywhere. The speed of $5kg$ block when $2kg$ block leaves the constant of with ground is (force constant of spring

$k = 40N/m$ and $g = 10m/s^2)$



A. $\sqrt{2}$ m/s

B. $2\sqrt{2}$ m/s

C. 2 m/s

D. $4\sqrt{2}$ m/s

Answer: B

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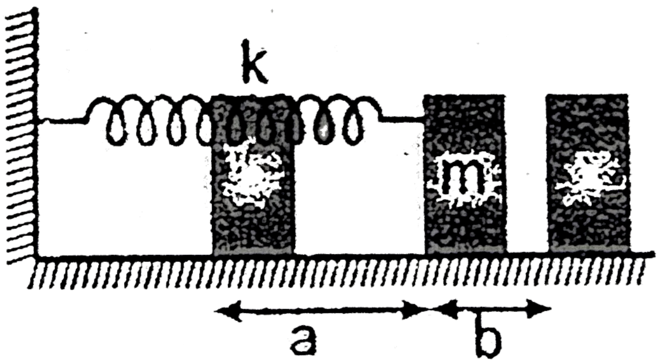
35. The spring is compressed by a distance a and released. The block again comes to rest when the spring is elongated by a distance b. During this



A. work done by the spring on the block $= \frac{1}{2}k(a - b)^2$

B. work done by the spring on the block $= \frac{1}{2}k\left(a^2 + b^2\right)$

C. coefficient of friction $= \dfrac{k(a - b)}{2mg}$

D. coefficient of friction $= \dfrac{k(a+b)}{2mg}$

Answer: C

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36. The potential energy of a body is given by $U = \dfrac{9}{x^2} - \dfrac{2}{x}$ The position at which its speed can be maximum is.

A. $x = +3m$

B. $x = -3m$

C. $x = 9m$

D. $x = -9m$

Answer: C

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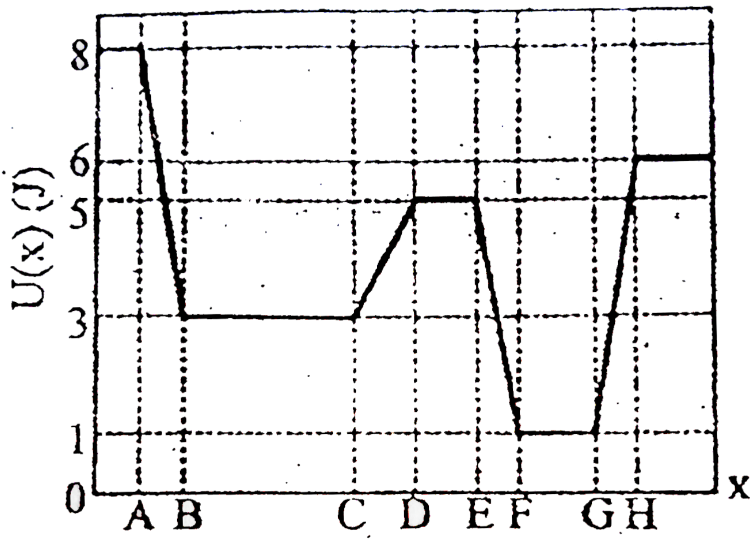
37. A potential energy curve $U(x)$ is shown in the figure. What value must the mechanical energy E_{mec} of the particle not exceed, if the particle is to be trapped within the region shown in graph?



A. 3 J

B. 5 J

C. 6 J

D. 8 J

Answer: C

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38. A cyclist moves uniformaly on a horizontal circular track of radius 100 m . If the cofficient of friction is 0.1. At which of the following speed (s) can he travel without slipping

A. 5 m/s

B. 9 m/s

C. 14 m/s

D. none of these

Answer: A::B

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39. One end of uniform wire of length Land of weight W is attached rigidly to a point in the roof and a weight W_1 is suspended from its lower end. If S is the area if cross-section of the wire, the stress in the wire at a height (3L/4) from its lower end is

A. W_1/S

B. $\left[W_1 + (W/4)\right]/S$

C. $\left[W_1 + (3W/4)\right]/S$

D. $\left(W_1 + W\right)/S$

Answer: c

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40. When the speed of a rear-drive car is increasing on a horizontal road the direction of the frictional force on the tires is:

A. forward for all tires

B. backward for all tires

C. forward for the front tires and backward for the rear tires

D. backward for the front tires and forward for the rear tires

Answer: d

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41. If a body (coated black) at 600K surrounded by atmosphere at 300K has cooling rate r_0, the same body at 900K, surrounded by the same atmosphere, will have the cooling rate close to:

A. $16r_0/3$

B. $81r_0/6$

C. $16r_0$

D. $4r_0$

Answer: a

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42. In an elastic collision between disks A and B of equal mass but unequal radii, A moves along the x-axis and B is stationary before impact. Which of the following is possible after impact?

A. A comes to rest

B. The velocity of B relative to A remains the same in magnitude but reverses in direction

C. A and B move with equal speeds, making an angle of 45° each with the x-axis

D. A and B move with unequal speeds, making angles of 30° and 60° with the x-axis respectively

Answer: abcd

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43. Which of the following statements is/are correct?

A. Areal gas approaches perfect gas behaviour at high temperature and low pressure

B. Molecules of ideal gas possess only translational kinetic energy at all temperatures

C. An ideal gas would never condense into the liquid state

D. The average translational kinetic energy per molecule at any given temperature is independent of the type of ideal gas

Answer: acd

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44. Given $\vec{A} = 3\hat{i} + \hat{j}$ and $\vec{B} = 6\hat{i} + 8\hat{j}$. Which of the following satements is incorrect ?

A. $\vec{A}.\vec{B} = 50$

B. $\dfrac{|\vec{A}|}{|\vec{B}|} = \dfrac{1}{2}$

C. $\left|\vec{A}\right| = 5$

D. $\vec{A}.\vec{B} = 48$

Answer: D

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45. At t = 2 sec., a particles is at $(1, 0, 0,)$. It moves towards $(4, 4, 12)$ with a constant speed of 65 m/s. The position of the paritcle is measured in metres and the time is sec. Assuming constant velocity, the position of the particle at t = 3 s is,

A. $\left(13\hat{i} - 120\hat{j} + 40\hat{k}\right)$

B. $\left(40\hat{i} + 31\hat{j} - 120\hat{k}\right)$

C. $\left(13\hat{i} - 40\hat{j} + 12\hat{k}\right)$

D. $\left(45\hat{i} + 60\hat{j} + 180\hat{k}\right)$

Answer: D

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46. A boat is moving in direction of vector $-4\hat{i}+3\hat{j}$ with a speed of 10 m/s. Velocity vector of boat can be expressed as :

A. $-8\hat{i}+6\hat{j}$

B. $-40\hat{i}+30\hat{j}$

C. $-\frac{4}{5}\hat{i}+\frac{3}{5}\hat{j}$

D. $-6\hat{i}+8\hat{j}$

Answer: A

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47. If the angle α between two forces of equal magnitude is reduced to $(\alpha-\pi/3)$, then the magnitude of their resultant becomes $(\alpha-\pi/3)$, times of the earlier one. The angle α is

A. $\pi/2$

B. $2\pi/2$

C. $\pi/4$

D. $4\pi/5$

Answer: B

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48. The greatest and the leat resultant of two forces acting at point are 12N and 8N respectively. Find out the forces.

A. $12N\&8N$

B. $4N\&8N$

C. $3N\&9N$

D. $10N\&2N$

Answer: D

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49. A loaded grocery cart is rolling across a parking lot in a strong wind. You apply a constant force $\vec{F} = (30N)\hat{i} - (40N)\hat{j}$ to the cart as it undergoes a displacement $\vec{s} = (9.0m)\hat{i} - (3.0m)\hat{j}$. How much work does the forces you apply do on the grocery cart ?

A. $150J$

B. $390J$

C. $-150J$

D. $270J$

Answer: B

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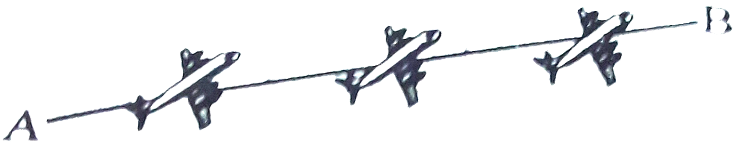
50. An aeroplane moves along horizontail line AB as shoen in figure. Choose correct option about wind velocity.



A. wind may not be moving at all

B. wind may be moving in east direction

C. wind may be moving in north direction

D. wind may be moving in west direction

Answer: B

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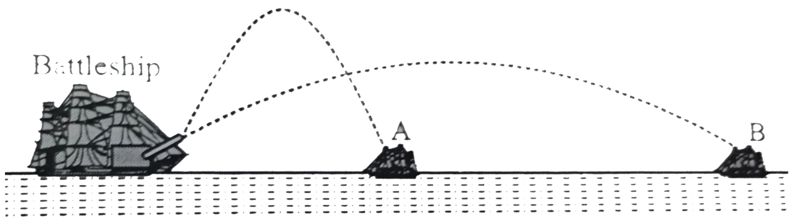
51. A gun is mounted in a stationary battleship which is used to hit two different boats A and B. The initial speed of both the shots is the same.

Choose the correct statement.



A. Both shots have same time of flight and same final speed

B. Both shots have same time of flignt but different final speeds

C. Both shots have different time of flight but same final speed

D. Both shots have different time of flight and different final speed

Answer: C

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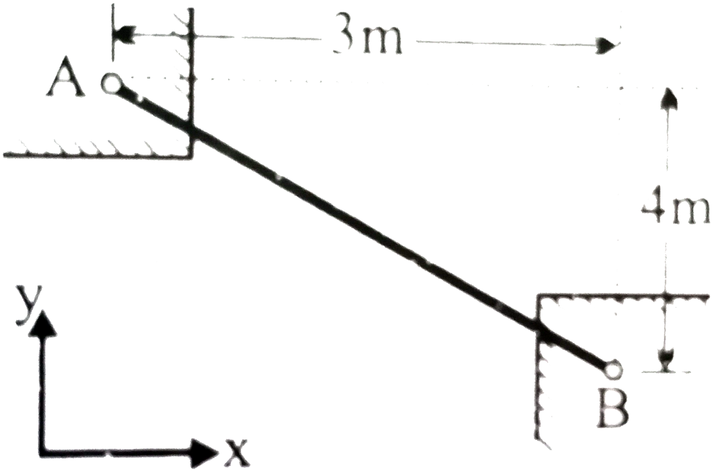
52. A light cable stretched between the fixed supports A and B is under a tension T of 1000 N. Express the tension as a vector using the unit vectors $\hat{i}$ and $\hat{j}$, first, as a force $\vec{T}_A$ acting on A and second, as a force $\vec{T}_B$

acting on B.



A. $\vec{T}_A = \left(600\hat{i} - 800\hat{j}\right)N$

B. $\vec{T}_B = \left(-600\hat{i} + 800\hat{j}\right)N$

C. $\vec{T}_A = \left(-800\hat{i} - 600\hat{j}\right)N$

D. $\vec{T}_B = \left(-800\hat{i} + 600\hat{j}\right)N$

Answer: A::B

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53. The magnitude of the vector $\hat{i} + x\hat{j} + 3\hat{k}$ is half of the magnitude of vector $\hat{i} + x\hat{j} + 3\hat{k}$ The values of x are

A. -2/3

B. 1/3

C. 2/3

D. 2

Answer: A

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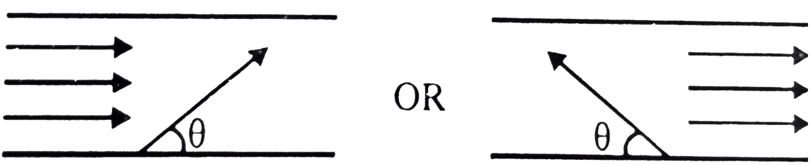
54. A man swims with same speed relative to river irrespective of whether water is flowing or not. He swims at an angle of θ to bank as shown in 2 figures. Velocity of river flow $>$ Velocity of man in still water.



A. In both situations, he crosses river in same time

B. In both situation, he crosses the rever with same drift,

C. To minimize the dirft, he has to swim $\perp$ to river flow,

D. To minimize the time, he has to swim $\perp$ to river flow.

Answer: A::D

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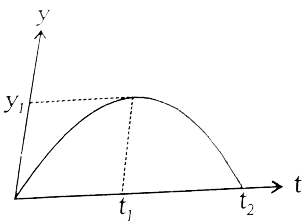
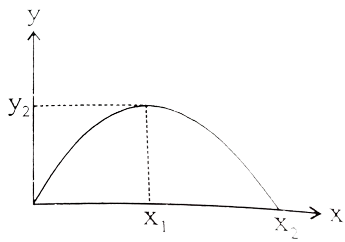
55. y-t graph of a projectile parabola is drawn in figure 1 and it's path is drawn in figure 2. (Y vertical up,x horizontal).





A. $y_1 = y_2$

B. $t_1 = 2t_2$

C. $x_1 = 2x_2$

D. $\dfrac{x_1}{x_2} = \dfrac{t_1}{t_1}$

Answer: A::C::D

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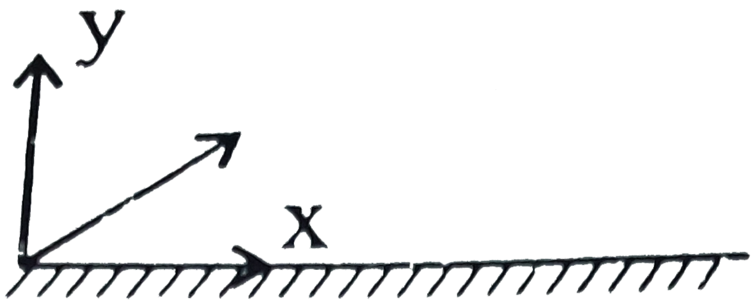
56. 4 projectiles are projected with velocities indicated in column II. Match the appropriate description in column I. The projectile is projected from level ground.



	Column I		Column II
(A)	Initial speed is maximum	(P)	$30\hat{i} + 40\hat{j}$
(B)	Range is maximum	(Q)	$40\hat{i} + 30\hat{j}$
(C)	Time of fight is maximum	(R)	$37\hat{i} + 35\hat{j}$
(D)	Velocity at the top most point is maximum	(S)	$37\hat{i} + 35\hat{j}$
		(T)	$10\hat{i} + 50\hat{j}$

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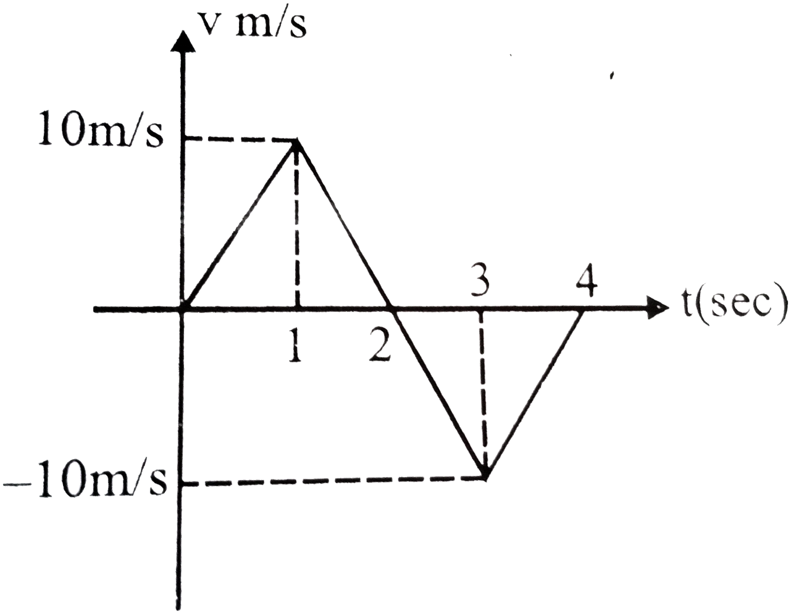
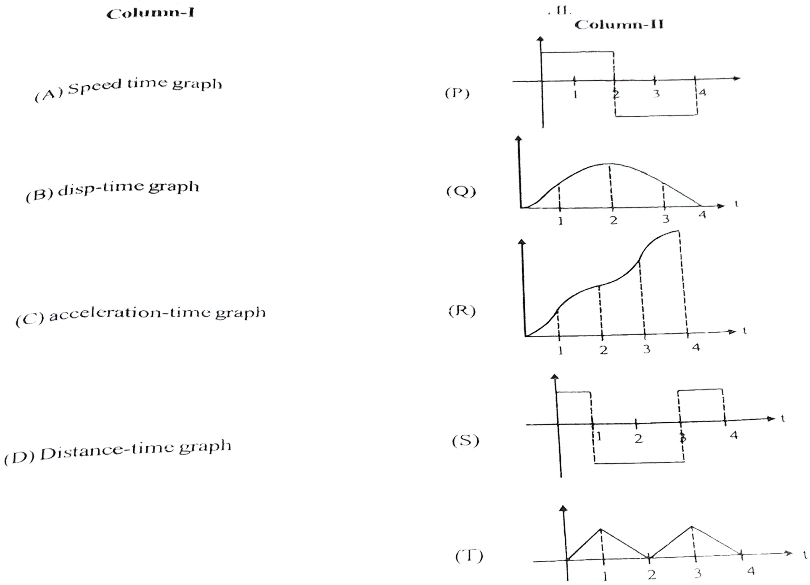
57. The velocity time graph of a particles of mass 1 kg is given as shown



Then match the physical quantity column I to graph in column II.



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58. The potential energy 'U' of a particle veries with distance 'x' from a fixed origin as $U = \frac{AX}{x^2 + B}$. Where A and B are dimensional constants. Find the dimension of length in AB.

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59. The drug coefficient C_v of an automobile is determined from the experssion $C_D = \dfrac{D}{\frac{1}{2}pv^2S}$

Where D is the drag force experimentally determined in a wind tunnel, p is the air density, v is the speed of the air in the wind tunnel, and S is the cross-sectional area of the car presented to the air flow. Determine the dimension of C_D in lenght.

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60. In a given system of unit standard measurement of mass is 100 gm standard measurement of length is 200 cm and standard measurement of time is 5 sec 10 J energy in the given system of unit has value N, then value of N is

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61. If 2 vectors $c\hat{i} - 5\hat{j} + 6\hat{k}$ and $c\hat{i} + c\hat{j} - 4\hat{k}$ are perpendicular to each other, and c is given to be a positive integer, find its value.

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62. A rock is shot vertically upward from the edge of the top of a tall building. The rock reaches its maximum height above the top of the building 1.75s after being shot. Then, after barely missing the edgr of the building as it falls downward, the rock stikes the ground 6.0 s after ut us kaybcged, In SI units, how tall is the builging ?

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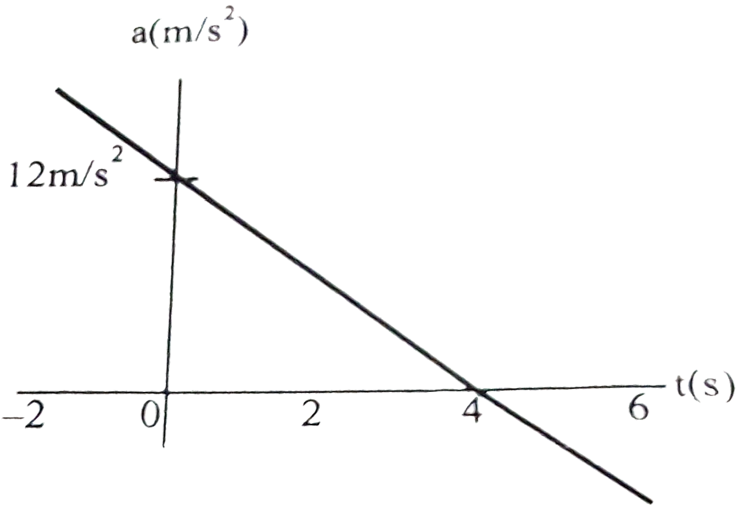
63. Figure gives the acceleration a versus time t for a particle moving along an x - axis. $A = -2.0s$, the particle's velocity is $7.0 m/s$. What is velocity (in m/s) at $t = 6.0s$?



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64. Find longest wavelength in Lyman series of hydrogen atom spectrum.

A. 1216Å

B. 216Å

C. 1016Å

D. 116Å

Answer: A

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65. The de-Broglie wavelength of an electron moving in the nth Bohr orbit of radius ris given by

A. $\frac{2\pi r}{n}$

B. $n\pi r$

C. $\frac{nr}{2\pi}$

D. $\frac{nr}{\pi}$

Answer: A

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66. The activity of a radioactive element reduces to $(1/16)th$ of its original value in 30 years. Find its half life?

A. 7.5 year

B. 75 trs

C. 7.5 day

D. 75 month

Answer: A

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67. The total energy of the electron in the hydrogen atom in the ground state is -13.6 eV. Which of the following is its kinetic energy in the first excited state?

A. 13.6eV

B. 6.8 eV

C. 3.4 eV

D. 1.825 eV

Answer: C

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68. A frheshly prepared radioactive source of half life 2 hrs emits radiation of intensity which is 32 times the permissible safe value of intensity. Which of the following is the minimum time after which it would be possible to work safely with this source?

A. 16 hrs

B. 5hrs

C. 10 hrs

D. 32 hrs

Answer: C

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69. The average current due to an electron orbiting the proton in the n^{th} Bohr orbit of the hydrogen atom is

A. $\propto n$

B. $\propto n^3$

C. $\propto b$

D. none of these

Answer: C

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70. The radius of the shortest orbit in a one-electron system is 18 pm. It may be

A. Hydrogen

B. Deuterium

C. He^+

D. Li^+

Answer: D

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71. If E_1, E_2 and E_3 represent respectively the kinetic energies of an electron, an a-particle and a proton each having same de-Broglie's wavelength then

A. $E_1 > E_2 > E_3$

B. $E_2 > E_3 > E_1$

C. $E_1 > E_2 > E_2$

D. $E_1 = E_2 = E_3$

Answer: C

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72. The wavelength of first member ofBalmer Series is 6563 Å. Calculate the wavelength of second member of Lyman series.

A. 1025.5Å

B. 2050Å

C. 6563Å

D. none of these

Answer: A

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73. The x-raybeam emerging iiom anX-ray tube

A. is monochmmatic.

B. contains all wavelengths smaller a certain maximum wavelength

C. contains all wavelengths larger then a certain minimum wavelength

D. contains all wavelengths lying between a minimum and a maximum wavelength.

Answer: C

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74. A beam of ultraviolet light of all wavelengths passes through hydrogen gas at room temperature, in the x. dimction. Assume thatall photons emitted due to electron transitions inside the gas emerge in the y-diiection. LetA and B denote the lights emerging from the gas in the x- and y-directions respectively. Then,

A. some of the incident wavelengths willbe absent in A

B. only those wavelengths will be present in B which are absent in A

C. B will contain some visible light

D. B will contain some visible light

Answer: ACD

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75. Photons are incident from vacuum on a transparent material with a refractive index n for a given wavelength. Determine the momentum of the incident photon, if its wavelength in the material is equal to λ.

A. nh/λ

B. h/λ

C. $\frac{h}{n\lambda}$

D. $h/\lambda(n+1)$

Answer: C

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76. An electron collides with a fixed hydrogen atom in its ground state. Hydrogen atom gets excited and the colliding electron loses all its kinetic energy. Consequently the hydrogen atom may emit a photon corresponding to the largest wavelength of the Balmer series. The K.E. of colliding electron will be

A. 10.2 eV

B. 1.9 eV

C. 12.1 eV

D. 13.6 eV

Answer: B

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77. Photo electric effect supports the quantum nature of light because:

A. there is a minimum frequency of light below which no photoelectrons are emitted.

B. the maximum K.E. of photoelectrons depends only on the frequency of light and not on its intensity.

C. even when the metal surface is faintly illuminated by light of the approximate wavelength, the photoelectrons leave the surface immediately.

D. electric charge of photoelectrons is quantized.

Answer: C

View Text Solution

78. Which of the following pails constitute very similar radiations

A. Hard ultraviolet rays and solft X-ray

B. Soil ultraviolet-rays and hard X-rays

C. Very hard X-ray and low-frequency y-rays

D. soft X-roys and y-rays

Answer: AC

View Text Solution

79. Polychromatic light described at a place by the equation

$$E = 100\left[\sin\left(0.5\pi \times 10^{15}t\right) + \cos\left(\pi \times 10^{15}t\right) + \sin\left(2\pi \times 10^{15}t\right)\right]$$

where E is in V/m and t in sec, falls on a metal surface having work function 2.0 eV. The maximum kinetic energy of the photoelectron is

[Take h = Planck's constant $= 6.4 \times 10^{-34} J - s$]

A. zero

B. 1 eV

C. 2 eV

D. 3 eV

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80. A beam of fast moving electrons having cross-sectional area A falls normally on a flat surface. The electrons are absorbed by the surface and the average pressure exerted by the electrons on this surface is found to be P. If the electrons are moving with a speed v, then the effective current through any cross-section of the electron beam is

A. Ape/(mv)

B. Ape/$\left(mv^2\right)$

C. Apv/(me)

D. Apm/(eV)

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81. The difference between the longest wavelength line of the Balmer series and shortest wavelength lion of the Lyman series for a hydrogenic atom (Atomic number Z) equal to $\Delta\lambda$. The value of the Rydberg constant for the given atom is

A. $\frac{5}{31}\frac{1}{\Delta\lambda . Z^2}$

B. $\frac{5}{36}\frac{z^2}{\Delta\lambda}$

C. $\frac{31}{5}\frac{1}{\Delta\lambda . Z^2}$

D. none

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82. In a hydrogen like atom, energy required to excite the electron from its first excited state to second excited state is 7.55 eV. The energy required to remove the electron from its ground state is

A. 72.6 eV

B. 67.9 eV

C. 58.6 eV

D. 54.4 eV

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83. Energy levels A, B and C of a certain atoms correspond to increasing values of energy, i.e. $E_A < E_B < E_c$. If $\lambda_1, \lambda_2, \lambda_3$ are the wavelengths of radiation corresponding to the transitions $C \to B$, $B \to A$ and $C \to A$ respectively, then :

A. $\lambda_1 = \lambda_2 = \lambda_3$

B. $\lambda_3 = \dfrac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$

C. $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

D. none of these

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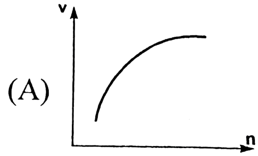
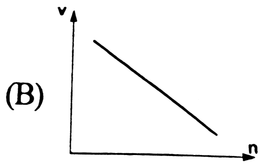
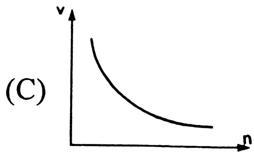
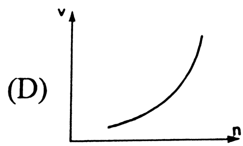
84. Which of the following curves may represent the speed of the electron in a hydrogen atom as a function of the principal quantum number n ?

A. 

B. 

C. 

D. 

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85. A beam of 5 ke V α-particles and a beam of 5 ke V electrons are absorbed by a target. The two beams deliver equal amounts of energy to the target per second.

If $\frac{\text{mass of } \alpha \text{ - particle}}{\text{mass of electron}} = 7.27 \times 10^3$, what is the value of $\frac{\text{pressure on target due to } \alpha \text{ - particle}}{\text{pressure on target due to electron}}$?

A. 1.38×10^{-4}

B. 1.17×10^{-2}

C. 1.45

D. 85.3

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86. Which of these unclear reactions is possible ?

A. $._{11}^{23}Na + ._1^1H \rightarrow ._{10}^{20}Ne + ._2^4He$

B. $._5^{10}B + ._2^4He \rightarrow ._7^{13}N + ._1^1H$

C. $._5^{10}B + ._0^1n \rightarrow ._5^{11}B + \beta^- + \bar{v}$

D. $._7^{14}N + ._1^1H \rightarrow ._6^{12}C + \beta^- + \bar{v}$

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87. A scientist claims to have perfected a technique in which he can spontaneously convert an electron completely into energy in the laboratory without any other material required. What is the conclusion about this claim from our current understanding of physics ?

A. This is possible because Einstein's equation says that mass and energy are equivalent....it is just very difficult to achieve with electrons

B. This is possible and it is done all the time in the high-energy physics labs.

C. The scientist is almost correct... Except that in converting the electron to energy, an electron's anti-particle is produced in the process as well

D. This is not possible because charge conservation would be violated.

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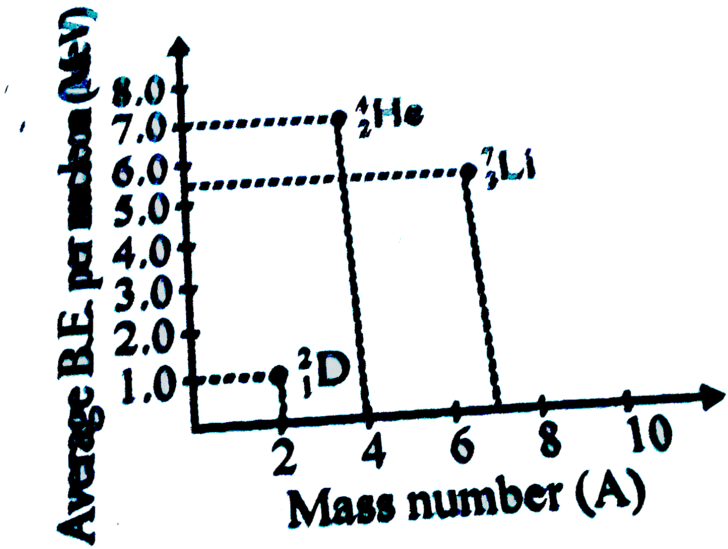
88. The positions of $._{1}^{2}D, ._{2}^{4}He$ and $._{3}^{7}Li$ are shown on the binding energy curve as shown in figure. The energy released in the fusion reaction $._{1}^{2}D + ._{3}^{7}Li \rightarrow 2._{2}^{4}He + ._{0}^{1}n$ will be closest to



A. 20 MeV

B. 16 MeV

C. 8 MeV

D. 4 MeV

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89. Which of the following experiment in Photoelectric effect will support particle nature of light ?

A. Photocurrent is set up almost instantaneously even with faint light of sufficiently small wavelength.

B. Existence of cutoff potential which depends upon wavelength of radiation incident on emitter.

C. Existence of thersold wavelength for incident radiation above which no photocurrent can be set up.

D. Existence of saturation current which increase with intensity of radiation incident on emitter.

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90. Negative charge is revolving around is fixed positive charge in a circular orbit If the classical idea of an accelerating charge rediating energy is valid, then the negative charge will:

A. spiral towards the positive charge, with increasing kinetic energy

B. spiral towards the positive charge with potential energy decreasing at a faster rate than increase in its kinetic energy .

C. spiral away from the positive charge and finally escape from the binding of the positive charge

D. revolve around the positive charge with increasing frequency of revolution.

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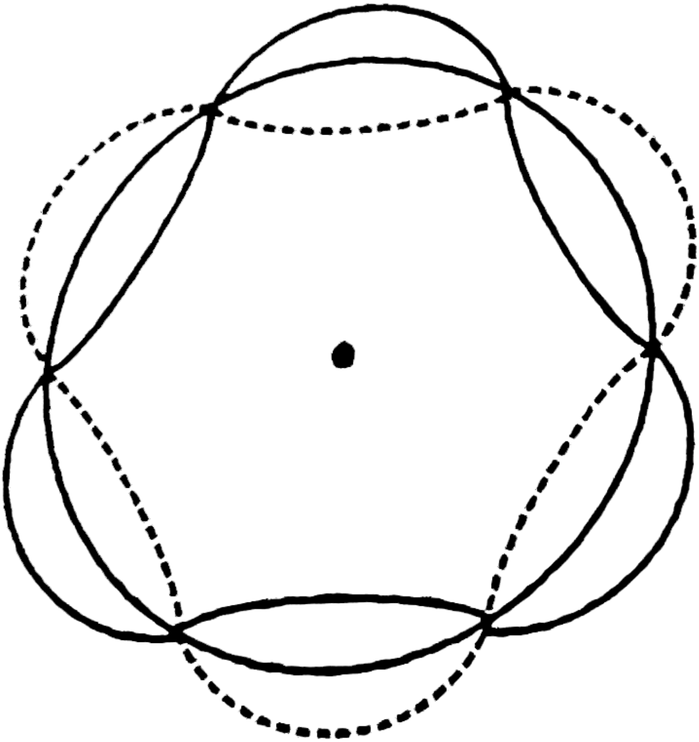
91. The figure shows electronic wave function for a hydrogen atom.



A. The quantum number of this state is 6

B. The wavelength of this electron is $6\pi r_0$(r_0 is radius of ground state)

C. It can go to ground state by emitting 3 different photons

D. On deexcitation it emits at least one line in infra red region of spectrum.

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92. If

c is the velocity of electromagnetic radiation

e is the charge of an electron

m is the mass of an electron and

h is the Planck's constant,

then the combination of these universal constants that is dimensionless, is

A. $me^2/(hc)$

B. $ch/(me)$

C. mc^2/h

D. none

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93. In the α-decay of a U-238 nucleus the energy released in the decay is Q. The U-238 nucleus was initially stationary. Which of the following is (are) true?

A. Ratio of K.E. of α-particle and Thorium nucleus is 117 : 2

B. Ratio of K.E. of Thorium nucleus and α-particle and 1 : 234

C. Momentum of a-particle is (234Q$m_{\alpha}/119]^{1/2}$

D. Recoil velocity of Thorium nucleus is (234Q/119 $\times$ $117m_{Th}]^{1/2}$

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94. Consider a silver target in coolidge tube to produce x-rays. The accelerating potential is 31 kV. $E_K = 25.51KeV, E_L = 3.51KeV$. If$\lambda_{K\alpha}$ - $\lambda_{\min}$ is approximately8N pm(in pm), where N is an integer find N. Round off to nearest integer.

(Take : hc = 1240 e V nm)

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95. The reaction $\_(3)^7Li +_1^1H \rightarrow _4^7Be +_0^1n$ is endothermic. Assuming that Li nuclei is free and at rest. What is the minimum kinetic energy (in keV) of incident proton so that this reaction occurs? Take Q value of this reaction as -1645 keV.

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96. A Bohr hydrogen atom undergoes a transition $n = 5 \rightarrow n = 4$ and emits a photon of frequency v. Frequency of circular motion of electron in n = 4 orbit is V_4. Find the ratio v/v_4. $\frac{54}{25N}$, where N is an integer find N

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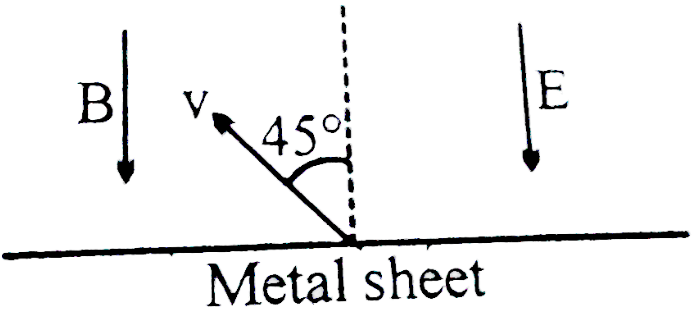
97. A stream of photons with energy 4.4eV strike a metal surface with work function 3.5 eV. The electrons are ejected at an angle 45° with the normal to the surface. Uniform magnetic and electric field exist in the space outside the surface of metal as shown. Determine the value of pitch (in m) of helix in the 3^{rd} revolution for electrons ejected maximum kinetic energy. Round off the answer to nearest integer. Intensity of electric field is $10^{-3}N/C$ and magnetic field is $\pi \times 10^{-6}$T. (Given : mass of electron $= 9 \times 10^{-31}$ kg, charge of electron $= 1.6 \times 10^{-19}C$).



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98. When the voltage applied to an X-ray tube increased from $V_1 15.5$ KV to V_2 = 31 KV, the wavelength interval between the K_α line and the short wavelength cut-off of the continuous X-ray spectrum increases by a factor of 1.3. If the atomic number of the element of the target is 13N, where N is an integer find N (Take : hc = 1240 eV and R=$1 \times 10^7/m$)

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99. When a certain metallic surface is irradiated with monochromatic light wavelength λ, the stopping potential for photoelectric current is $3V_0$. When the same surface is irradiated with light of wavelength 2λ, the stopping potential is V_0 The threshold wavelength for the given surface is

A. 4λ

B. 6λ

C. 8λ

D. $4\frac{\lambda}{3}$

Answer: A

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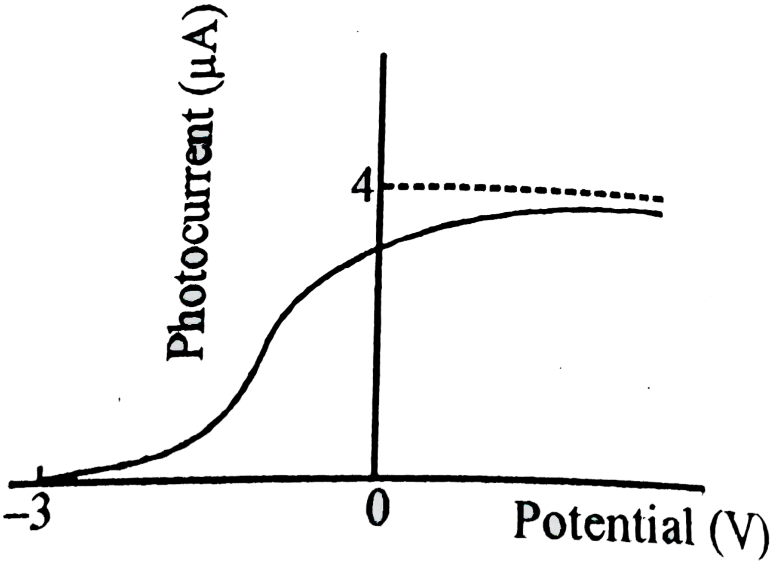
100. Figure shows the graph of photocurrent versus potential of the anode with respect to the cathode.The intensity of the incident radiation is halved and freqency doubled. The stopping potential and the saturation current will now be respectively.



A. $-6.0V$ and $2.0\mu A$-

B. $-6.0V$ and $4.0\mu A$

C. $-6.0V$ and $1.0\mu A$

D. None of these

Answer: D

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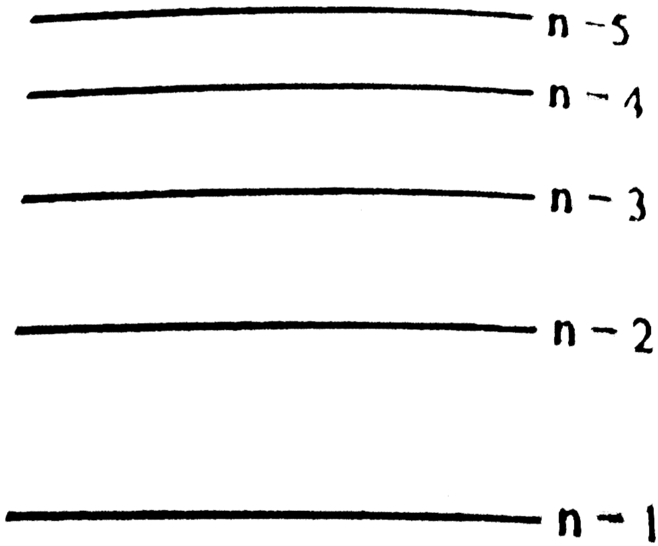
101. The energy level diagram of a hypothetical atom is shown in the figure. A transition from n = 3 to n = 2 produces visible radiation. The possible transition to obtain infrared radiation is



A. $4 \rightarrow 3$

B. $2 \rightarrow 1$

C. $4 \rightarrow 1$

D. none of these

Answer: A

View Text Solution

102. Suppose frequency of emitted photon is of when electron of a stationary hydrogen atom jumps from a higher state m to a lower state n. If the atom is moving with a velocity $v(< < c)$ and emits a photon of frequency f during the same transition, then which of the following statements are possible.

A. f may be equal to f_0

B. f may be greater than f_0

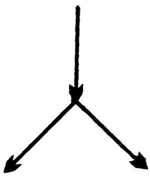
C. f may be less than f_0

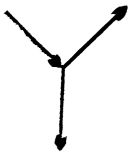
D. f cannot be equal to f_0

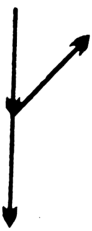
Answer: A::B::C

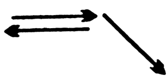
View Text Solution

103. A cloud chamber is a device, which makes the tracks of moving charged particles visible. A light charged particle collides with a nucleus and rebounds elastically. Which of the momentum vector diagrams shown below indicates the event to a good approximation.

A. (A)


B. (B)


C. (C)


D. (D)


Answer: B

View Text Solution

104. The nuclear binding energies of the elements P and Q are E_P and E_Q respectively. Three nuclei of elements Q fuse to form one nucleus of element P. In this process the energy released is 'e'. The correct relation between E_P, E_Q and e will be

A. $E_Q = 3E_P + e$

B. $E_Q = 3E_P - e$

C. $E_P = 3E_Q + e$

D. $E_P = 3E_Q - e$

Answer: C

View Text Solution

105. A radioactive substance with decay constant of $0.5 s^{-1}$ is being produced at a constant rate of 50 nuclei per second . If there are no nuclei present initially, the time (in second) after which 25 nuclei will be present is :

A. 1

B. ln 2

C. ln(4/3)

D. 2 ln (4/3)

Answer: D

View Text Solution

106. Rydberg atoms are nearly classical atoms in which electron is excited to states corresponding to n = 10 , 2 0 or even 100.

There are many difficulties in studying them.

1. The radius of their orbit will be very large. So at ordinary densities, their collisions will allow electrons to jump from one orbit to another without emitting radiation.

2. The energy levels at such value of n will be every close.

So experiment on rydberg atoms should be done at very low temperatures and very low pressures. Consider a very dilute gas of hydrogen atoms that are excited to n = 10. Assume for this situation that the average centre to centre distance should be equal to diameter of rydberg atom.

[Take wein constant $= 2.88 \times 10^{-3} mK$]

If this energy were to come from a photon corresponding to maximum spectral emissive power of a blackbody, what would be the temperature of that black body.

A. 5.3 K

B. 53 K

C. 530 K

D. 5300 K

Answer: B

View Text Solution

107. Rydberg atoms are nearly classical atoms in which electron is excited to states corresponding to n = 10 , 2 0 or even 100.

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[Take wein constant $= 2.88 \times 10^{-3} mK$]

Assuming the atoms to fill up space like footballs filling up a room, how many atoms would fill up in a $1m \times 1m \times 1m$ room. (approx.)

A. 10^{20}

B. 10^{28}

C. 10^{24}

D. 10^{32}

Answer: C

View Text Solution

108. The first nuclear reaction ever observed was by ernest Rutherford in 1919. It was triggered by α-particles incident on an isotope of nitrogen $._7^{14}N$. He observed a proton was emitted along with another element x. Let us assume that $._7^{14}N$ nucleus was initially stationary. For this reaction to occur, α-particle must touch the nitrogen nucleus. The distance between their centres at this moment is d. For this problem, we will neglect the effect of outer electrons in $._7^{14}N$. Symbols have their usual meanings.

X is an isotope of

A. Nitrogen

B. Oxygen

C. Fluorine

D. Carbon

Answer: B

View Text Solution

109. The first nuclear reaction ever observed was by ernest Rutherford in 1919. It was triggered by α-particles incident on an isotope of nitrogen $._{7}^{14}N$. He observed a proton was emitted along with another element x. Let us assume that $._{7}^{14}N$ nucleus was initially stationary. For this reaction to occur, α-particle must touch the nitrogen nucleus. The distance between their centres at this moment is d. For this problem, we will neglect the effect of outer electrons in $._{7}^{14}N$. Symbols have their usual meanings.

Value of d is

A. $R_0\left(2^{1/3}+7^{1/3}\right)$

B. $R_0\left(2^{2/3}+7^{2/3}\right)$

C. $R_0\left(2^{2/3}+14^{1/3}\right)$

D. $R_0\left(2^{1/3}+14^{1/3}\right)$

Answer: D

View Text Solution

110. In an electron transition inside a hydrogen atom, orbital angular momentum may change by (h=Planck constant)

A. h

B. $\frac{h}{\pi}$

C. $\frac{h}{2\pi}$

D. $\frac{h}{4\pi}$

Answer: B

View Text Solution

111. Which of the following are not dependent on the intensity of the incident radiation in a photoelectric experiment ?

A. Amount of photoelectric current

B. Stopping potential to reduce the photoelectric current to zero

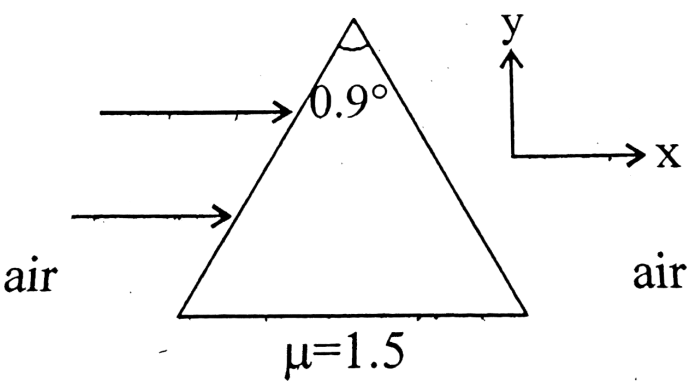
C. Work function of the

D. Maximum kinetic energy of photoelectrons

Answer: B::C::D

View Text Solution

112. Consider a beam of light of power 7.2 W incident on a prism of angle $0.9^{\circ}, \lambda = 221$ nm.



A. The angle of deviation is $\frac{\pi}{400}$ rad

B. The number of photons incident on the prism/time is 8×10^{18}/sec

C. The magnitude of component of force on prism in y direction is approx $6\pi \times 10^{-10} N$

D. There is a component of force on prism in-ve y-direction.

Answer: A::B

View Text Solution

113. An electron orbiting around the nucleus of an atom

A. has a magnetic dipole moment

B. exerts an electric force on the nucleus equal to that on it by the nucleus

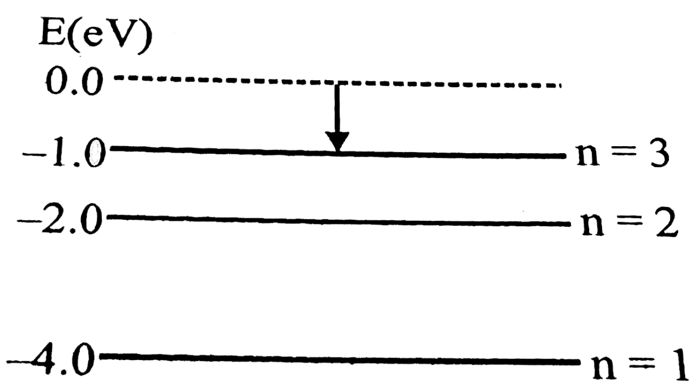
C. does produce a magnetic induction at the nucleus

D. has a net energy inversely proportional to its distance from the nucleus.

Answer: A::B::C::D

View Text Solution

114. Shows the energy-level diagram of hydrogen like imaginary element X. (hc=1242 eV-nm)



A. The ionization energy of Element X is 4eV

B. An atom in the ground state absorbs a photon, comes to an excited state then emits a photon with a wavelength of 1242 nm. The incident photon must have a wavelength of 414 nm.

C. An atom in the ground state has a collision with an electron, then emits a photon with a wavelength of 1242 nm. The incident electron must have an energy of 3eV.

D. An atom in the ground state absorbs a photon, comes to an excited state then emits a photon with a wavelength of 1242 nm. The incident photon must have a wavelength of 1242 nm.

Answer: A::B

View Text Solution

115. The $.^{238}U$ nucleus has a binding energy of about 7.6 MeV per nucleon. If the nucleus were to fission into two equal fragments, each would have a kinetic energy of just over 100 MeV. From this, it can be concluded that

A. nuclei near A = 119 has mass less than half that of $.^{238}U$.

B. nuclei near A = 119 have masses greater than half that of $.^{238}U$

C. nuclei near A = 119 must be bound by about 6.7 MeV / nucleon

D. nuclei near A = 119 must be bound by about 8.5 MeV / nucleon

Answer: A::D

View Text Solution

CHEMISTRY

1. Iron filing and water were placed in a 5 litre tank and sealed.The tank was heated to 1237 k. Upon anaiysis the tank was found to contain 1.10 gram of hydropen and 42.5 gm of water vapour. If the reaction in the tank is represented by

$3Fe(s) + 4H_2O(g) \Leftrightarrow Fe_3O(g) + 4H_2(g)$

the equilibrium constant will be -

A. 2.949×10^3

B. 6.490×10^3

C. 4.90×10^3

D. 3.200×10^3

Answer: A

View Text Solution

2. The correct IUPAC name of 1,3-dibromo butan -1- one is

A. 2,4-dibromo buton-4-one

B. 3-bromo butanoyl bromide

C. 3-bromo-3-methyl propanoyl bromide

D. β-bromo butyry bromide

Answer: B

View Text Solution

3. Which of the following set of molecules are having square pyramidal and pyramidal shape respectively.

A. ICl_4^- and SiF_4

B. NF_3 and IF_5

C. $KeOF_4$ and H_3O^+

D. BrF_5 and NF_4^+

Answer: C

View Text Solution

4. Calcualte the mass % of Na_2CO_3 in a mixture having mass 206 gm which produces 24 litre of CO_2 at 1 atm pressure and 300K with excess of HCL. [R = 0.08 atm lit/mol K]

A. 0.5

B. 0.485

C. 0.53

D. 0.4

Answer: B

Watch Video Solution

5. The reaction involved during the removal of temporary hardness of water is:

A. $2CaCl_2 + (NaPO_3)_6 \rightarrow Na_2(Ca_2(PO_3)_6) + 4NaCl$

B. $CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 \downarrow + 2NaCl$

C. $MgSO_4 + Na_2Al_2Si_2O_8xH_2O \rightarrow MgAl_2SiO_7xH_2O + Na_2SO_4$

D. $Ca(HCO_3)_2 \rightarrow CaCO_3 + H_2O + CO_2 \downarrow$

Answer: D

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6. A_3B_2 is a sparingly soluble salt with molar mass $M\left(gmol_{-}\right)$ and solubility x gm $litre_{-1}$, the ratio of the molar concentration of B^{3-} to the solubilty product of the salt is : -

A. $08\frac{x^5}{M^5}$

B. $\frac{1}{108}\frac{M^4}{x^4}$

C. $\frac{1}{54}\frac{M^4}{x^4}$

D. None

Answer: C

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7. Most stable form of ethylene glycol is :

A. anti

B. guache

C. fully eclipsed

D. partially eclipsed

Answer: B

Watch Video Solution

8. 1.5 ml of the gaseous hydrocarbon required 375 ml of air (containing 20% O_2 by volume) for complete combustion. The resultant gaseous mixture occupied 345 ml. The formula of the hyrocarbon is

A. C_4H_8

B. C_3H_8

C. C_3H_4

D. C_2H_4

Answer: B

View Text Solution

9. Which of the following statement is correct

A. N_2^+ is having bond of 2.5

B. To get N^+ from N_2^-, electron(s) are removed from antibonding orbitals

C. B_2 molecule is paramagetic with μ value of 1.73 Bm.

D. In the change of $O_2 \rightarrow O_2^+$ the bond length increase

Answer: A

View Text Solution

10. A 2.5 gm impure sample containing weak monoacidic base (Mol. Wt = 45) is dissolved in 100 ml water and titrated with 0.5 M HCL when $\left(\frac{1}{5}\right)^{th}$ of the base was neutralised the pH was found to be 9 and at equivalent point pH of solution is 4.5. Given : All data at $25^\circ C$ & log2 = 0.3.

Select correct statement(s).

A. k_b of base is less that 10^6

B. Concentration of salt (C) at equivalent points is 100 ml

C. Volume of HCl is used at equivalent point is 100 ml

D. Weight percentage of base in given sample is 80%.

Answer: B::C

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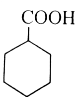
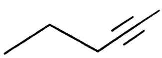
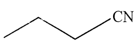
11. Select option with correct IUPAC names.

A. (A)  cyclohexanoic acid

B. (B)  2-hexyne

C. (C)  Propane nitrile

D.

Answer: B::D

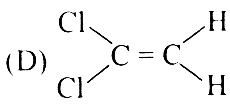
Watch Video Solution

12. Which of the following molecule has dipolemonet

A. $C_6H_4(OH)_2$ (para)

B. $C_6H_4Cl_2$ (para)

C. C_6H_5CIBr (para)

D. 

Answer: A::C::D

View Text Solution

13. To 100 gm oleum sapmle Labelled as "118% oleum", 9 gm of water is added. Select the correct option/ options for final solutions.

A. It contains only $H_2SO_4 \& SO_3$

B. It contains H_2SO_4, $SO \& H_2O$

C. New solutions will have labelling 100%

D. % w/w of SO_3 is neraly 36.7%

Answer: A::D

View Text Solution

14. Which of the following is/are redox reaction.

A. $KCl + K_2Cr_2O_7 \rightarrow con. H_2SO_4 \rightarrow CrO_2Cl_2 + K_2SO_4 + H_2O$

B. $K_2cr_2O_7 + H_2O_2 + dil. H_2SO_4 + Cr_2(SO_4)_3 + 7H_2O + 3O_2$

C. $K_2Cr_2O_7 + H_2O_2 + dil. H_2SO_4 \rightarrow K_2SO_4 + Cr(SO_4)_3 + 7H_2O + 3O_2$

D. $K_2Cr_2O_7 + 2KOH \rightarrow 2K_2CrO_4 + H_2O$

Answer: A::B::C

View Text Solution

15. What would be the reduction potential of an electrode at 298 K , which originally contained $1K_2Cr_2O_7$ solution in acidic buffer solution of $pH = 1.0$ and which was treated with 50% of the Sn necessary to reduce all $Cr_2O_7^{2-}$ to Cr^{3+}.Assume pH of solution remains constant.

Given : $E^0{\cdot}_{Cr_2O_7^{2-}/Cr^{3+},H^+} = 1.33V, \log 2 = 0.3, \dfrac{2.303RT}{F} = 0.06$

A. $1.285V$

B. $1.193V$

C. $1.187V$

D. None of these

Answer: C

View Text Solution

16. Which of the following reactions is not involved in extraction of Cu from copper pyrite ?

A. $Cu_2S \cdot Fe_2S_3 + 4O_2 \rightarrow Cu_2S + 2FeO + 3SO_2 \uparrow$

B. $Cu_2O + FeS \rightarrow Cu_2S + FeO$

C. $2CuO \rightarrow 2Cu + O_2$

D. $FeO + SiO_2 \rightarrow FeSiO_3$

Answer: C

View Text Solution

17. 1.0 molal aqueous solution of an electrolyte A_2B_3 is 60% ionised. The boiling point of the solution at 1 atm is $\left(K_b\left(H_2O\right) = 0.52K\ kg\ mol^{-1}\right)$

A. $274.76K$

B. 377 K

C. $376.\ 4K$

D. $374.\ 76K$

Answer: D

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18. The correct order of boiling point of noble gases is :

A. $Xe < Kr < Ar < Ne$

B. $Kr < Xe < Ar < Ne$

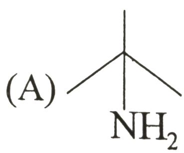
C. $Ar < Xe < Kr < Ne$

D. $Xe > Kr > Ar > Ne$

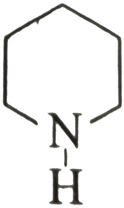
Answer: D

View Text Solution

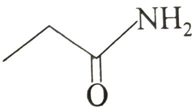
19. Which of the following compounds will give isocyanide on reaction with $CHCl_3 + KOH$?

A. 

(B)

B. 

(C)

C. 

D. none of these

Answer: A

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20. An aqueous solution containing $1MNiSO_4 \& 1MS_2O_8^{2-}$ is electrolysed using palladium electrode, at $25^\circ C$

$Ni^{+2} + 2e^- \rightarrow Ni$	$E^\circ = -0.25V$
$2H^+ + 2e^- \rightarrow H_2$	$E^\circ = 0.00V$
$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$	$E^\circ = 1.23V$
$Pd^{+2} + 2e^- \rightarrow Pd$	$E^\circ = 0.92V$
$S_2O_8^{2-} + 2e^- \rightarrow 2SO_4^{2-}$	$E^\circ = 2V$

pH of solution is 7.

Select the correct statement on the basis of above given information.

(Ignore over voltage & neglect variation of $E^{\circ}_{Pd^{+2}/Pd}$ with concentration)

A. Reaction at anode is $Pd \rightarrow Pd^{+2} + 2e^{-}$

B. Reaction at anode is $2H_2O \rightarrow O_2 + 4H^{+} + 4e^{-}$

C. Reaction at cathode is $Ni^{+2} + 2e^{-} \rightarrow Ni$

D. Reaction at cathode is $2H^{+} + 2e^{-} \rightarrow H_2$

Answer: B::C

View Text Solution

21. Which of the following plots represents an ideal binary mixture ?

A. Plot of $P_{\text{total}} \text{v/s} X_B$ is linear (X_B= mole fraction of 'B' in liquid phase).

B. Plot of $P_{\text{total}} \text{v/s} Y_A$ is linear (Y_B = mole fraction of 'A' in vapour phase)

C. Plot of $\dfrac{1}{P_{\text{total}}} \text{v/s } Y_A$ is linear

D. Plot of $\dfrac{1}{P_{\text{total}}} \text{v/s} Y_B$ is non linear

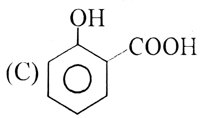
Answer: A::C

View Text Solution

22. Which will elimination CO_2 only on heating

A. $Me - C | | O - CH_2 - COOH$

B. $Ph - C | | O - CH_2 - SO_2H$

C. 

D. $CH_2 = CH - CH_2 - COOH$

Answer: A::C::D

View Text Solution

23. Choose the reactions which would liberate nitrogen gas?

A. $Ca(OCl)Cl + NH_3 \xrightarrow[\text{medium}]{\text{aqueous}} ?$

B. $NH_3 + PbO \xrightarrow{\Delta} ?$

C. $NH_3(excess) + Cl_2 \xrightarrow{\Delta} ?$

D. $NH_4Cl + NaNO_2 \xrightarrow{\Delta} ?$

Answer: A::B::C::D

View Text Solution

24. Select the option having all extensive terms.

A. pH, electrode potential, moles

B. Specific heat capacity, resistance, molar enthalpy

C. Heat capacity, resistance, enthalpy

D. Mass, molarity, resistivity

Answer: C

View Text Solution

25. A person takes $1/2$ kg of cheese sandwitches of energy equivalent to $813kJ$. Suppose that all the energy is lost only through perspiration, what mass of water would he need to perpire in order to maintain his original temperature.

Given : Enthalpy of vapurisation of water is $40.65kJmol^{-1}$.

A. 360g

B. 3.6 g

C. 180g

D. 190g

Answer: A

View Text Solution

26. Find the work done is calorie when $65.5g$ Zn reacts with excess H_2SO_4 (aq) to form $ZnSO_4$ & H_2 in a closed rigid vessel at $300K$.

A. -600

B. 0

C. -1200

D. -2494

Answer: B

View Text Solution

27. For the process :

$H_2O(l, 1atm, 373K) \Rightarrow H_2O(g, 1atm, 373K)$

[Given normal boiling point of water $= 373$ K at 1 atm pressure.]

The correct set of thermodynamic parameter is :

A. $\Delta G = 0, \Delta U < 0, \Delta H < 0$

B. $\Delta S_{\text{totale}} = 0, q > 0, \Delta S_{surr} < 0$

C. $\Delta G < 0, \Delta U > 0, \Delta H = 0$

D. none of these

Answer: B

View Text Solution

28. A definite amount of an ideal gas $(\gamma = 1.5)$ undergoes change of state in which heat exchange is equal to work done $(q = w)$. Molar heat capacity of the gas is :

A. 2R

B. 3R

C. R

D. $\frac{3}{2}R$

Answer: C

View Text Solution

29. Consider the following set of reactions :

$CHCl_2COOH + NaOH \rightarrow CHCl_2COONa + H_2O \quad \Delta H_1 =$ - 12830 Cal.

$HCl + NaOH \rightarrow NaCl + H_2O \quad \Delta H_2 =$ - 13680 Cal.

$NH_4OH + HCl \rightarrow NH_4Cl + H_2O \quad \Delta H_3 =$ - 12270 cal.

Select the correct option (s) :

A. Enthalphy of neutralization of $CHCl_2COOH$ by NH_4OH is 11420 Cal.

B. Enthalphy of dissociation of $CHCl_2COOH =$ - 850 Cal.

C. Enthalphy of dissociation of $NH_4OH = 1410$Cal.

D. Enthalphy change for the reaction $H_2O \rightarrow H^+ + OH^-$ is -13680Cal.

Answer: C

View Text Solution

30. What is the standard enthalpy change at 298 K for the following reaction?

$CO_2(g) + C(\text{diamond}) \rightarrow 2CO(g)$

Given : $\Delta H_f^\circ (CO, g) = -110.5 kJ/mol : \Delta H_f^\circ \left(CO_2, g\right) = --393.5 kJ/mol$

$\Delta H^\circ_{\text{transition}}[C(\text{graphite}) \rightarrow C(\text{diamond})] = 2.0 kJ/mol$

A. $-172.5 kJ/mol$

B. $-170.5 kJ/mol$

C. $+172.5 kJ/mol$

D. $170.5 kJ/mol$

Answer: D

View Text Solution

31. Structure of N_2O is $N = N = O$. Calculate bond enthalphy of $N = N$ bond in N_2O.

Given : $\Delta H^\circ_{f, N_2O} = 100 \text{kJmol}^{-1} \quad BE_{N=N} = 950 kJmol^{-1}$
$BE_{N=0} = 600 \text{kJmol}^{-1} \quad BE_{O=O} = 500 \text{kJmol}^{-}$

and resonance energy of $N_2O = -100 kJmol^{-1}$

A. $500 kJmol^{-1}$

B. $450 kJ mol^{-1}$

C. $400 kJ mol^{-1}$

D. $420 mol^{-1}$

Answer: C

View Text Solution

32. For the given reaction ,

$A(g) \rightarrow 2B(g), \Delta_r H = 30 kJ / \text{mole} \Delta_r S = 150 J / mol$ at $300K$

If $C_{P,A} = 20 J / K mol$ and $C_{P,B} = 20 J / K mol$. $(\ln 3/2 = 0.4)$

Which of the following statement is/are correct ?

A. ΔH will increase on increasing temperature

B. ΔHwill decrease on increasing temperature

C. At $300K$, ΔG is negative

D. At $T = 200$, ΔG is zero

Answer: A::C

View Text Solution

33. Select the incorrect statement(s) :

A. ΔH_f° of $CO_2(g)$ is same as the $\Delta H^{\circ}_{\text{Combustion}}$ of carbon graphite.

B. The larger and more complex a molecule, the greater is it's absolute entropy.

C. $H_2(g) + Cl_2(g) \rightarrow 2HCl(g) + 185kJ.$

On the basis of above information $\Delta H_f^{\circ}(HCl, g)$ is $92.5kJ/\text{mole}$

D. More volatile substance has high boiling point.

Answer: C::D

View Text Solution

34. For the decomposition of $NH_3(g)$ at standard state.

$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$

[Assume that ΔH° and ΔS° of reaction remain constant, 'T' represents temperature in Kelvin scale & K_P represents equilibrium constant.]

Choose the correct statement(s).

A. Graph between $\ln K_P$ vs $1/T$ is a straiht line with positive slope and positive intercept.

B. Graph between $\ln K_P$ vs $1/T$ is a straiht line with negative slope and positive intercept.

C. K_P increases with increases in temperature

D. At very low temperature reaction is non-spontaneus.

Answer: B::C::D

View Text Solution

35. 1 mole of a real gas changes it state from state-A(2bar, 3L, 100 K) to state -B (2bar, 5L, 200 K) at constant pressure and finally to state-C (3bar, 10 L, 300 K). If $\Delta U_{BC} = 110J$ and C_{Pm} of gas $= 3R = 3 \times 8.3JK^{-1}mol^{-1}$ then thoose the correct option(s) :

A. $W_{AB} = 830J$

B. $\Delta H_{AC} = 4600J$

C. $\Delta U_{AC} = 2200J$

D. $\Delta U_{AC} = 1770J$

Answer: B::C

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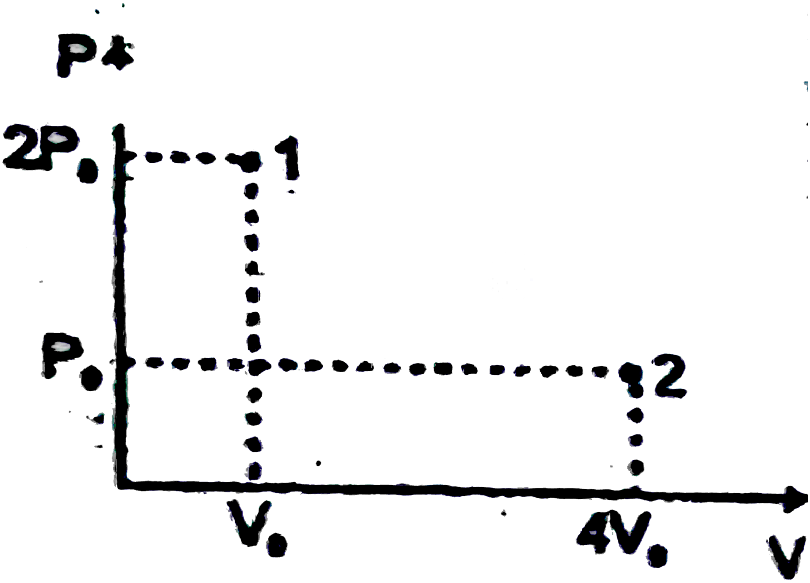
36. A liquid which is confined inside an adiabatic piston is suddently taken from state -1 to state -2 by a single stage irreversible process. If the piston comes to rest at point 2 as shown, then the enthalpy change for the process will be :



A. $\Delta H = \dfrac{2\gamma P_0 V_0}{\gamma - 1}$

B. $\Delta U = \dfrac{3P_0 V_0}{(\gamma - 1)}$

C. $\Delta H = -P_0 V_0$

D. $\Delta U = -3P_0 V_0$

Answer: C::D

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37. The volume (in ml) of 0.5 M NaOH required for the complete reaction with 150 ml of 1.5M H_3PO_3 solution is

A. 1350

B. 900

C. 1250

D. 1150

Answer: B

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38. Correct statement about inductive effect is :

A. It is a temporary effect

B. It decrease as the distance increases.

C. It doesn't depend upon the electronegativity

D. It operates through π-bond only.

Answer: B

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39. Select the correct atatement for Ne.

A. It is not isoelectronic with H_2O

B. Last electron enters in s-orbital

C. The value of 'm' must be zero for last electron

D. The value of 'l' must be '1' for last electron

Answer: D

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40. $-N = O$ group can show

A. $+M$ effect

B. -M effect

C. -I effect

D. All of these

Answer: D

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41. The ratio of the wavelength of a proton & α-particle will be 1:2 if their

A. Velocity of proton to velocity of α is in ratio 1:8

B. Velocity of proton of velocity of α particle is in the ratio 8:1

C. Kinetic energy of proton to Kinetic energy of α particle is in the ratio 64:1

D. Kinetic energy of proton to kinetic energy of α particle is in the ratio 26:1

Answer: B

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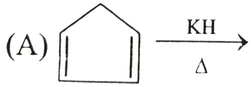
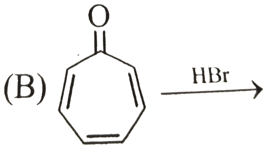
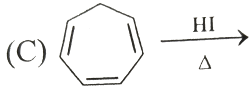
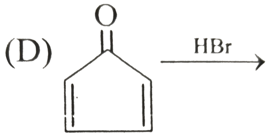
42. Select the one which does not results in the formation of aromatic species .

A. 

B. 

C. 

D. 

Answer: D

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43. Choose the correct option regarding energy of empty orbitals.

	n	l	m	s		n	l	m	s
(I)	4	0	0	$+\frac{1}{2}$	(II)	3	2	0	$-\frac{1}{2}$
(III)	3	1	1	$+\frac{1}{2}$	(IV)	3	0	0	$-\frac{1}{2}$

A. $I > IV$

B. $II < I$

C. $II < III$

D. $I = III$

Answer: A

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44. $CH_2 = CH - CH_2 - CH_2 - C \equiv CH \xrightarrow{HBr} (1eq)$ Product is

A. $BrCH_2 - CH_2 - CH_2 - CH_2 - C \equiv CH$

B. $CH_2 = CH - CH_2 - CH_2 - CH = CH - Br$

C. $CH_2 = CH - CH_2 - CH_2 - C | Br = CH_2$

D. $CH_3 - C | BrH - CH_2 - CH_2 - C \equiv CH$

Answer: D

View Text Solution

45. What are the value of p,q,r, and s for the following reaction

$pO_3 + qHI \rightarrow rI_2 + sH_2O$

A. 1,6,3,1

B. 1,6,3,3

C. 1,6,6,3

D. 1,6,3,6

Answer: B

View Text Solution

46. Which of the following is/are true

A. Multiplicity in Fe^{3+} is greater that that in Co^{3+}

B. Ti^{3+}, Cr^{+}, SC^{2+} ions are diamagnetic .

C. Value of $(n + l + m)$ for last electron of Mg is 3.

D. The value of Z_{eff} for 3s electron of Cl is 10.9

Answer: A::C::D

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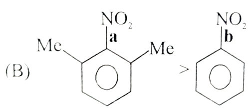
47. Correct order of indicated bond length is/are:

A. $CH_2 \overset{a}{=} CH - \text{OMe} < O_2N - CH_2 \overset{b}{=} CH - \text{OMe}$

B. 

C. $CH_3CH_2\underline{a}Cl < CH_2 = CH - CH_2\underline{b}Cl$

D. $CH_3 - C| | o\underline{a}OH < CH_3 - C| | o\underline{b}O^{\ominus}$

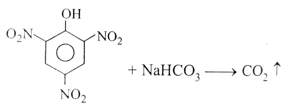
Answer: A::B::C

View Text Solution

48. Select reaction in which correct products are given :

A. $Ph - CH_2 - \overset{14}{C}OOH + NaHCO_3 \rightarrow CO_2 \uparrow$

B. $Ph - OH + NaH\overset{14}{C}O_3 \rightarrow \overset{14}{C}O_2 \uparrow$

C. 

D. $MeCONa + H_2O \rightarrow Me_3C - OH + NaOH$

Answer: A::C::D

View Text Solution

49. Three different solutions of oxidising agents $KMnO_4, K_2Cr_2O_7$ and I_2 is titrated separately with 0.158 gm of $Na_2S_2O_3$. If molarity of each oxidising agent is 0.1 M and reactions are :

I.$MnO_4^- + S_2O_3^{2-} \rightarrow MnO_2 + SO_4^{2-}$

II $CrO_7^{2-} + S_2O_3^{2-} \rightarrow Cr^{3+} + SO_4^{2-}$

III. $I_2 + S_2O_3^{2-} \rightarrow S_4O_6^{2-} + I^-$

A. Volume of $KMnO_4$ used in maximum

B. volume of iodine used is minimum

C. wt. of I_2 used in titration is maximum

D. all three oxidising agent can act as self indicator.

Answer: A::B::D

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50. Iron filling and water were placed in a 5 litre tank and sealed. The tank was heated to 1273 K. Upon analysis the tank was found to contain 1.10 gram of hydrogen and 42.5 gm of water vapour. If the reaction in the tank is represented by

$3Fe(s) + 4H_2O(g) \Leftrightarrow Fe_3O_4(s) + 4H_2(g)$

the equilibrium constant will be-

A. 2.949×10^{-3}

B. 6.490×10^{3}

C. 4.940×10^{3}

D. 3.200×10^{3}

Answer: a

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51. When H_2O_2 is reacted with $K_2Cr_2O_7$ in dilute H_2SO_4 and then ether is added. The ether layer gets -colour

A. Red

B. Yellow

C. Blue

D. Green

Answer: c

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52. The reaction involved during the removal of temporary hardness of water is:

A. $2CaCl_2 + (NaPO_3)_6 \rightarrow Na_2(Ca_2(PO_3)_6) + 4NaCl$

B. $CaCl_2 + Na_2CO_3 \rightarrow CaCO_3 \downarrow + 2NaCl$

C. $MgSO_4 + Na_2Al_2Si_2O_8xH_2O \rightarrow MgAl_2Si_2O_7xH_2O + Na_2SO_4$

D. $Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + H_2O + CO_2 \downarrow$

Answer: d

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53. What concentration of Ag^+ ions will be in equilibrium with a saturated solution containing a precipitate of Ag_2CrO_4 and CrO_4-ion concentration of 0.40 moles per litre. Given K_{SP} of $Ag_2CrO_4 = 1.1 \times 10^{-11}$

A. 5.24×10^{-6} moles per litre

B. 2.5×10^{-6} moles per litre

C. 7.5×10^{-6} moles per litre

D. 5.9×10^{-6} moles per litre

Answer: a

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54. All the following substances react with water. The pair that gives the same gaseous product is

A. Na and Na_2O_2

B. K and KO_2

C. Ba and BaO_2

D. Ca and CaH_2

Answer: d

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55. Which of the following alkali metal ions has the lowest ionic mobility in aqueous solutions?

A. Li^+

B. Na^+

C. Rb^+

D. Cs^+

Answer: a

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56. A_3B_2 is a sparingly soluble salt with molar mass $M\left(gmol_{-}\right)$ and solubility x gm $litre_{-1}$, the ratio of the molar concentration of B^{3-} to the solubilty product of the salt is : -

A. $108\dfrac{x^5}{M^5}$

B. $\dfrac{1}{108}\dfrac{M^4}{x^4}$

C. $\dfrac{1}{54}\dfrac{M^4}{x^4}$

D. None

Answer: c

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57. Which of the following metals does not form ionic hydride?

A. Berilium

B. calcium

C. magnesium

D. strontium

Answer: a

Watch Video Solution

58. Which of the following option is correct regarding the structure of borax?

A. No. of hydrated water malecule are equal to 10

B. S (B-O-B) linkages are present

C. B have sp^3 as well as sp^2 hybridisation

D. On thermal decomposition it gives transparent bead of $NaBO_2 \& B_2O_3$

Answer: a

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59. For the equilibrium:

$LiCl.3NH_{3(s)} \Leftrightarrow LiCl.NH_{3(s)} + 2NH_3, K_p = 9atm^2$

at $40^{\circ}C$. A $5litre$ vessel contains 0.1 mole of $LiCl.NH_3$. How many mole of NH_3 should be added to the flask at this temperture to derive the backward reaction for completion?

A. 5

B. 9

C. 3

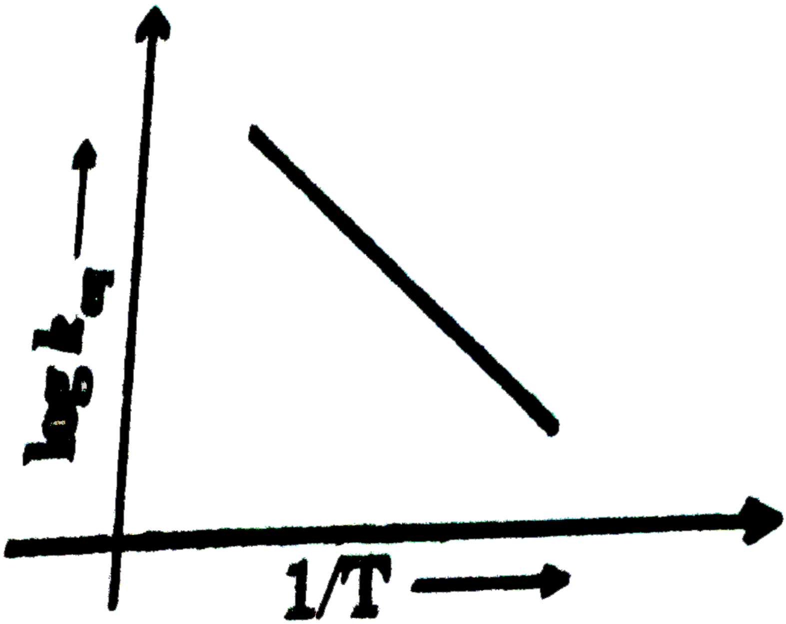
D. 1

Answer: a

Watch Video Solution

60. For the reaction

$2CIF_3(g) \leftrightarrow CI_2(g) + 3F_2(g) \log K_{eq} vs \frac{1}{T}$ (where temperature is in K) curve is obtained as given. Which of the following change will increase the concentration of CI_2 in an equilibrium mixture of CI_2, F_2 and CIF_3?



A. Addition of inert gas at constant pressure

B. Increase in temperature at constant volume

C. Addition of catalyst at equilibrium

D. Removal of $F_2(g)$ at equilibrium

Answer: ac

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61. Which of the following is/are redox reaction

A. $KCl + K_2Cr_2O_7 + con.\ H_2SO_4 \rightarrow CrO_2Cl_2 + K_2SO_4 + H_2O$

B. $K_2Cr_2O_7 + H_2O_2 + con.\ H_2SO_4 + \rightarrow K_2SO_4 + CrO_5 + H_2O$

C.

$$K_2Cr_2O_7 + H_2O_2 + dil.\ H_2SO_4 \rightarrow K_2SO_4 + Cr_2\left(SO_4\right)_3 + 7H_2O + 3O_2$$

D. $K_2Cr_2O_7 + 2KOH \rightarrow 2K_2CrO_4 + H_2O$

Answer: abc

View Text Solution

62. A 2.5 gm impure sample containing weak monoacidic base (Mol. wt. = 45) is dissolved in 100 ml water and titrated with 0.5 M HCl when of $\left(\frac{1}{5}\right)^{th}$ the base was neutralised the pH was found to be 9 and at equivalent point pH of solution is 4.5. Given: All data at $25^{\circ} C \& \log 2 = 0.3$. Select correct statement(s).

A. K_b of base is less than 10^{-6}

B. Concentration of salt (C) at equivalent point is 0.25 M

C. Volume of HCl is used at equivalent point is 100 ml

D. Weight percentage of base in given sample is 80%.

Answer: bc

View Text Solution

63. $CaOCl_2 \xrightarrow{\Delta} CoCl_2$product, The product are

A. $CaCl_2$

B. O_2

C. $Ca(ClO_3)_2$

D. All of these

Answer: ab

View Text Solution

64. Which of the following compounds are dimerised due to the formation of 3 centre four electron bond-

A. BH_3

B. AlF_3

C. $AlBr_3$

D. $AlCl_3$

Answer: cd

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65. A container has 'm' gram of a gas. After a white, a little amount of the gas escapes from the container. The presure of the gas left in the container becomes half, and the absolute temperature is reduced to two-third of the original value. The amount of gas, which escaped from the container is

A. $2/3m$

B. $1/2m$

C. $1/4m$

D. $1/6m$

Answer: C

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66. The compounds $C_2H_5OC_2H_5$ and $CH_3OCH_2CH_2CH_3$ are

A. chain isomers

B. geometrical isomers

C. metamers

D. conformational isomers

Answer: C

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67. The E.N. of H,X,O are $2.1, 0.8$ and 3.5 respectively comment on the nature of the compound $H - O - X$, that is :

A. Basic

B. Acidic

C. Amphoteric

D. Can't be predicted

Answer: A

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68. If 200 ml of 0.1 M Na_2SO_4 is mixed with 100 ml of 0.2 M NA_3PO_4 solution, molarity of Na^+ in the final solution, if final solution has density $1.2gm/ml$, will be :

A. $0.196M$

B. $0.33M$

C. $0.5M$

D. None of these

Answer: B

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69. Correct IUPAC name of following compound is:

$$\begin{array}{llll} O & & NH_2 & \\ || & & | & \\ H\,C & -CH|\,COOH & -CH & -COOH \end{array}$$

A. 2-amino-2-formylbutan-1,4-dioic acid

B. 2-formyl-3amino butan-1,2-dioic acid

C. 3-amino-2-form ylbuatan-1,4-dioic acid

D. 2-amino-3-carboxy4-oxobutanoic acid

Answer: A

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70. Which one of the following is incorrect ?

A. An element which has high electronegativity always has high electron gain enthalpy

B. Electron gain enthalpy is the property of an isolated atom

C. Electronegativity is the property of a boneded atom

D. Both electronegativity and electron gain enthalpy are generally related to nuclear charge and inversely releated to atomic size

Answer: A

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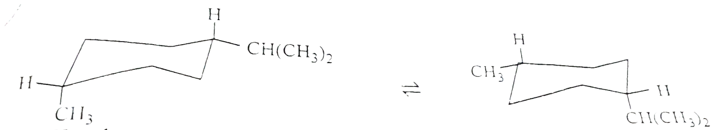
71. What can be side a about the magnitude of the equilibrium constant K for the following process ?



(A) K = 1
(B) K > 1
(C) K < 1
(D) No estimate of K can be made

A. $K = 1$

B. $K > 1$

C. $K < 1$

D. No estimate of K can be made

Answer: C

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72. The number of $p\pi$ - $d\pi$ linkages present in thiazyl fluoride, $S_4N_4F_4$, would be :

A. 4

B. 3

C. 2

D. 6

Answer: A

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73. For a gas select the correct potion / options.

A. The excluded volume fo a gas will be higher if $\frac{T_C}{P_C}$ is high

B. Higher the critical temperature of a gas higher will be extent of adsorption for the gas

C. Most probable speed of the gas increases with increase in T

D. At night temperature and low pressure a real gas behaves as an ideal gas

Answer: A::B::C::D

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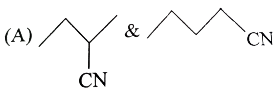
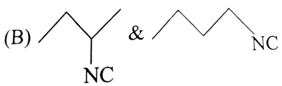
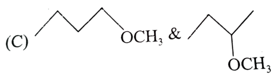
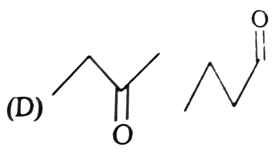
74. Identify the position isomer.

A. 

B. 

C. 

D. 

Answer: B::C

View Text Solution

75. Which of the following ionisation energy order is/are correct.

A. $Be^{+} > B^{2+}$

B. $C^{3+} > B^{2+}$

C. $N^{4+} < O^{5+}$

D. $F^{6+} < O^{3+}$

Answer: B::C

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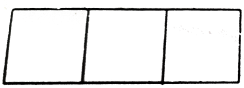
76.



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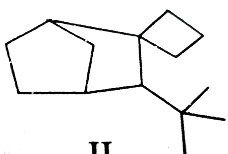
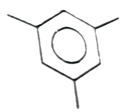


II



III

Select the correct statement about II, II & III compounds.

A. I is having four 2° &four3° carbons

B. II is having three 1°, six 2°, three 3° & two 4° carbons

C. III is having three 1°, three 2° & three 3° carbons

D. All are homocyclic compounds

Answer: A::B::C::D

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77.

	Column-I		Column-II
(A)	BCl_3	(P)	$3C - 4e^-$ bond is present in dimer
(B)	$BeCl_2$	(Q)	Planar
(C)	PCl_3	(R)	Change in hybridisation of the central atom during dimerisa
(D)	$AsCl_3$	(S)	Tautomerism is observed during final product formation in h
		(T)	Basicty of one of the hydrolysed product is three

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78. Two gases N_2 and H_2 are allowed to react from mixture of $N_2H_2(1)$ and $N_2H_4(g)$ leaving none of the reactants. Formation of N_2H_2 (1) does not create any energy change whereas formation of 1 ml $N_2H_4(g)$ absorbs 2 Joule energy. Ratio of volume contraction to energy change (in ml/Joule) during reaction when 30 ml N_2 and 40 ml H_2 react under similar conditions of temperature and pressure.

View Text Solution

79. 25 ml of a solution containing HCl and H_2SO_4 required 10 ml of 1 M NaOH solution for complete neutralization. 20 ml of the same acid mixture on being treated with excess of $AgNO_3$ gives Report your answer as $(x + y) \times 1000$.

View Text Solution

80. Analyse the following pairs of compounds.

Weite 1, if they are Chain isomers

Write 2, if they are Metamers

Write 3, if they are Position isomers

Write 4, if they are Homologues

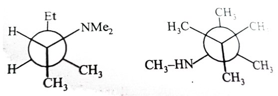
Write5, if they are Ring chain isomers

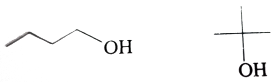
Write6, if they are Resonating structure

Write7, if they are Functional isomers

Write8, if they are Tautomers

A. 

B. 

C. 

D. $CH_3-CH=N-OH$ $CH_3-CH_2-N=O$

Answer: [5718]

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81. One moel of N_2 and 3.0 moles of PCl_5 were placed in a 100-lotre vessel and heated to $227\,^{\circ}C$. The equilibrium pressure was 2.05 atm. Assuming ideal behaviour, calculate X. Where $X = 1000 \times K_p$ of reaction at $227\,^{\circ}C$.

View Text Solution

82. How many number of species are diamagnetic and have the order greater than 2.5. $N_2, N_2^{\oplus}, NO^{\oplus}, NO^{\ominus}, CO, CN^{\ominus}, KO_2, Na_2O_2$

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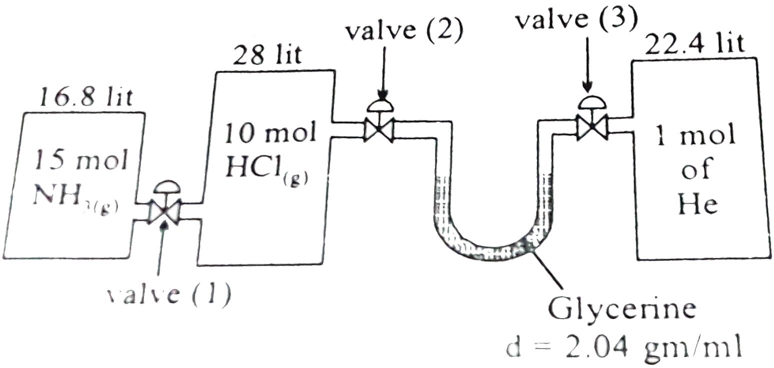
83. Observe the following figure carefully, which is showing the initial conditions of the systems when all valves are closed.



If at $0^\circ C$ all valves are opened and system is allowed to come at equilibrium, then calculate the height difference in the glycerine levels of the U tube monometer in (cm). [d of Hg=13.6 g gm/ml]

Assuming the complete reaction of $NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$.

Neglect any volume of solid produced and connecting tube. Assume that the manometer is sufficiently long and thin.

View Text Solution

84. Diamond structure can be considered as ZnS (Zinc blend) structure in which each Zn^{2+} in alternate tetrahedral void and S^{2-} in cubic close pack arrangement is replaced by one carbon atom.If C C covalent bond length in diamond is 1 .SÅ,what is the edge length of diamond unit cell (2 =8).

A. 3.46Å

B. 6.92 Å

C. 1.73 Å

D. 3 Å

Answer: A

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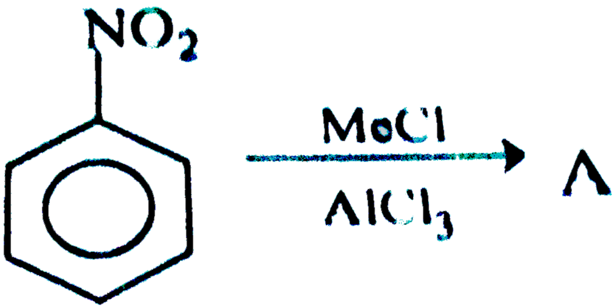
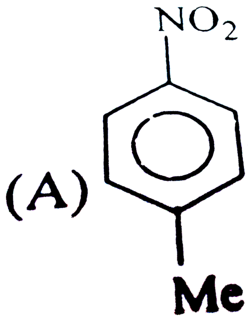
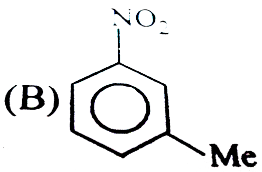
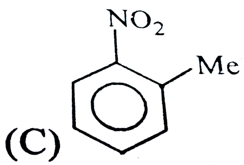
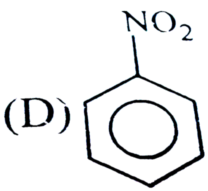


85. A is

A. 

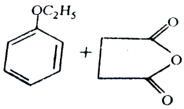
B. 

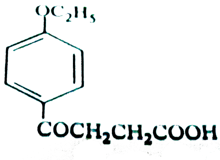
C. 

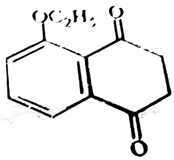
D. 

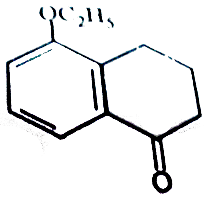
Answer: D

View Text Solution

86.  $\xrightarrow[H^+/H_2O]{AlCl_3}$ [X] $\xrightarrow{Zn/Hg/HCl}$ [Y] $\xrightarrow{HF}$ [Z]. The structure of [Z] is

A. (A) 

B. (B) 

C. (C) 

D. none

Answer: D

View Text Solution

87. Selecthe correct statement(s):

A. Physical chemistry

B. Physical Chemistry

C. Cation and anion are called basic and acidic radical respectively

D. $\left[NiCl_4\right]^{2-}$ is alow spin complex.

Answer: C

View Text Solution

88. Give the conect order of initials T(true) or F(false) for following statements [3]

I : Lyophobic sols are irreversible sols.

II : Micelles fonnation takes place only above krafc temperature

III : PO_4^{3-} ions have more coagulation value than SO_4^{2-} 2ions for coagulation ofpositive sols.

IV : The volues of the colligative properties observed exXperimcntall are ve small of colloied sols

A. F T T F

B. T F T F

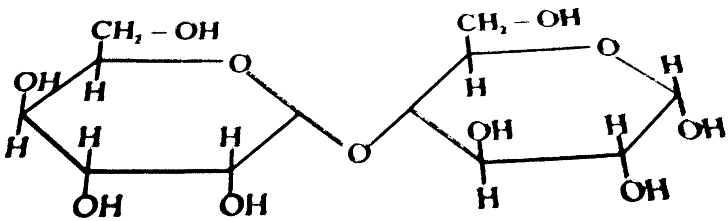
C. T T T T

D. T T F T

Answer: D

View Text Solution

89. In correct statement about given carbohydrate is



A. Above compound is a reducing sugar

B. Above compound undergo mutarotation

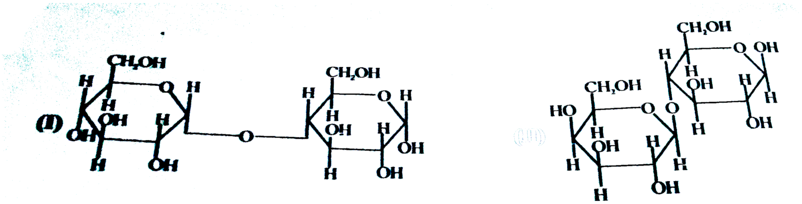
C. Above compound is a non-reducing sugar

D. Above compound has a glycosidic linkag

Answer: C

View Text Solution

90. Correct statement about I and II



A. I is reducing sugar

B. II is reducing sugar

C. I & II both are reducing sugar

D. None of the two is reducing sugar

Answer: C

View Text Solution

91. HgI_2 (yellow) will be turned into Hgl2 (med) variety on

A. Heating

B. Cooling

C. Application of mechanical stress

D. Subliming

Answer: C

View Text Solution

92. Which of the following is formed by condensation polymerisation.

A. Nylon-66

B. Terylene

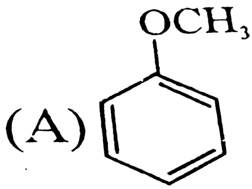
C. Bakelite

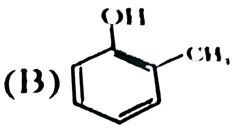
D. All of these

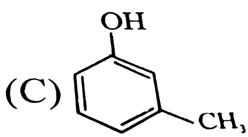
Answer: D

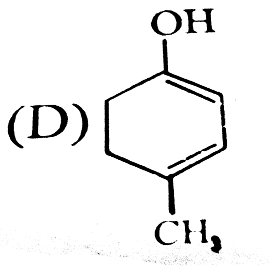
View Text Solution

93. Compound A(C_7H_8O)is insoluble in water, dilute HCl & aqueous $NaHCO_3$, it dissolves in dilute NaOH.When A is treatedwith Br_2 water it is converted into a compound $C_7H_5OBr_3$ rapidly. The structure ofA is

A. 

B. 

C. 

D. 

Answer: C

View Text Solution

94. The hcp and ccp structure of a given element. (Given radius of element id same in both structures)

A. have same density

B. have same distance between two consecutive layers (A&B)

C. have same co-ordination number

D. have same fraction of unoccupid space.

Answer: ABCD

View Text Solution

95. Which of the following reactions of benzene proves the presence of three carbon-carbon double bonds in it :

A. Formation of a triozonide with ozone

B. Hydrogenation of benzene to cyclohexane

C. Formation of $C_6H_6Cl_6$ by addition of chlorine

D. Formation of nitrobenzene on heating benzene with a mixture of concentrated nitric acid and sulphuric acid

Answer: ABC

View Text Solution

96. Which of the following metal (s) produce(s) N_2O gas on reaction with 20% HNO_3

A. Fe

B. Sn

C. Cu

D. Zn

Answer: AD

View Text Solution

97. Surfacetant molecules can cluster together as micelles, which are colloid sized cluster of molecules. Micelles from only above critical micelle concentration (CMC) and above centain temperature called K raft temperature. ΔH of micelle formation can be positive or negative. Which is correct statement(s) about micelle formation?

A. ΔS of micelle formation is positive

B. the hydrophobic part lie towards interior of micelle

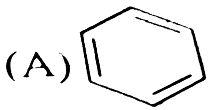
C. the hydrophilic part lie towards surface of micelle

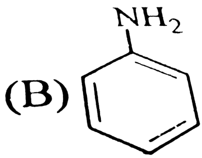
D. ΔS of micelle formation is negative

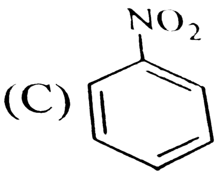
Answer: BCD

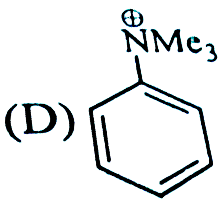
View Text Solution

98. Which of the following does not gives Friedel-Crafts reaction ?

A. 

B. 

C. 

D. 

Answer: BCD

View Text Solution

View Text Solution

99. When blood containing "Haemoglobin" as the colloidal partial is subjected to electro osmosis. The dispersion medium moves towards the anode. Hence, the incorrect statement will be

A. $Fe(OH)_3$ solution on mixing with haemoglobin in blood can cause coagulation

B. As_2S_3 solution can cause coagulation in blood on mixing.

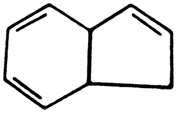
C. In electrophoresis of blood, movement of colloidal particle will be towards cathode.

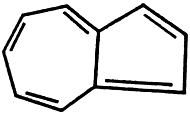
D. NaCl on mixing in blood can cause coagulation.

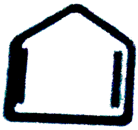
Answer: A

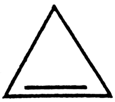
View Text Solution

100. Which one of the following is aromatic ?

A. (A) 

B. (B) 

C. (C) 

D. (D) 

Answer: B

View Text Solution

101. A compound (X) on decomposition gives a colourless gas. The residue is dissolved in water to obtain (Y). Excess CO_2 is bubbled through aqueous solution of (Y) and (Z) is formed. (Z) are gentle heating gives back (X) . The (X) is

A. $CaCO_3$

B. $Ca\left(HCO_3\right)_2$

C. $NaHCO_3$

D. Na_2CO_3

Answer: A

View Text Solution

102. Select the correct statement.

A. Milk is a homogeneous solution

B. When a solute is dispersed in alcohol it is known as Emulsion.

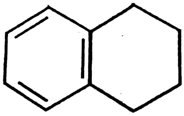
C. Greater the coagulation power higher is the coagulation value

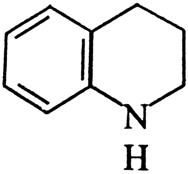
D. Tyndall effect is an optical property of colloidal solution.

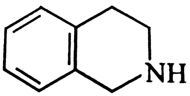
Answer: D

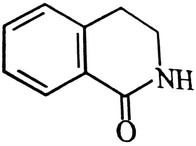
View Text Solution

103. Which one of the following compounds undergoes bromination of its aromatic ring (electrophilic aromatic substitution) at the fastest rate ?

A. (A) 

B. (B) 

C. (C) 

D. (D) 

Answer: B

Watch Video Solution

104. $BaCO_3(s) + AcOH \xrightarrow{Na_2C_2O_4 \text{Solution}} \Delta ?$

Comment on the product of this reaction.

A. $BaCO_3$ remains unaffected.

B. BaC_2O_4 will be precipitated as white precipitate

C. $BA(Oac)_2$ will be precipitated as white precipitate

D. Clear solution

Answer: D

View Text Solution

105. An ionic solid PQ crystallises in rock salt structure with density $4.0 gm/cm^3$.If the radius of cation and anion is 83 and 167 pm respectively, then the molar mass of solid is $\left[N_A = 6 \times 10^{23}\right]$

A. 75 gm/cm^3

B. $50 gm/cm^3$

C. $25 gm/cm^3$

D. $150 gm/cm^3$

Answer: A

View Text Solution

106. What is the correct order of nitration of the following compounds?

$C_6H_5CH_3$	C_6H_6	C_6D_6	C_6T_6	C_6H_5Br	$C_6H_5\overset{+}{N}R_3$	$C_6H_5NMe_2$
a	b	c	d	e	f	g

A. $g > a > b > c > d > e > f$

B. $g > b > c > d > e > a > f$

C. $g > a > b = c = d > e > f$

D. $g > a > b > c = d > e > f$

Answer: C

View Text Solution

107. A doctor by mistake administers a $Ba(NO_3)_2$ solution to a patient for radiography investigations. Which of the following should be given as the best to prevent to adsorption of soluble barium?

A. NaCl

B. Na_2SO_4

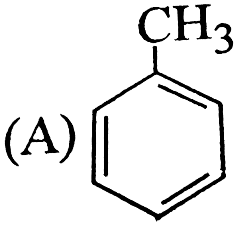
C. Na_2CO_3

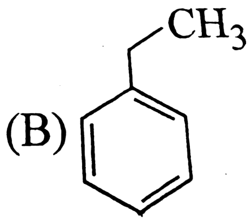
D. Na_2CO_3

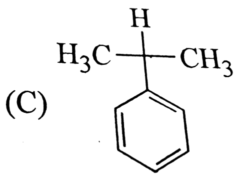
Answer: B

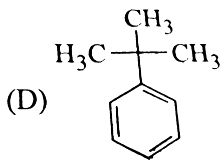
Watch Video Solution

108. In which one of the following compounds electron density on phenyl ring is maximum

A. 

B. 

C. 

D. 

Answer: A

View Text Solution

109. Which of the following statement are correct?

A. A gold solution when mixed with ferric hydroxide solution will cause coagulation.

B. For very large partial pressures, extent of adsorption of gases will be independent of pressure.

C. In case of electro-osmosis of As_2S_3 sol movement of one of the phase is towards cathode.

D. Higher the zeta potential of colloid, lower will be its stability.

Answer: A::B::C

View Text Solution

110. Select reagent (s) which is /are used in laboratory to differentiate $1^\circ, 2^\circ$ and 3° amines from each other:

A. $NaNO_2, HCl$

B. $PhSO_2Cl$

C. $CHCl_3, KOH$

D. $CS_2, HgCl_2$

Answer: A::B

View Text Solution

111. Al^{3+} and Cr^{3+} can be distinguished by which of following reagent.

A. NaOH

B. $NH_4OH + NH_4Cl$

C. ExcessNH_4OH

D. $(NH_4)_2S$

Answer: A::B::C::D

View Text Solution

112. Phenol and benzoic acid can not be separated by

A. $NaHCO_3$

B. $NaOH$

C. Na

D. $NaNH_2$

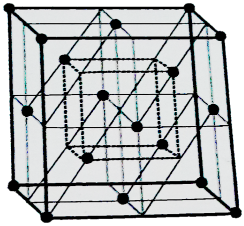
Answer: B::C::D

View Text Solution

113. The structure of diamond and silicon is same and can be described as atoms taking corners and faces of a cube and also taking positions of alternate tetrahedral voids. What is the value of

$$\left[\frac{\text{density (diamond)}}{\text{density(silicon)}}\right] \times 100.$$

$$\left[\frac{\text{density(diamond)}}{\text{density(silicon)}}\right] \times 100\cdot$$



At. mass (g / mol)	Covalent Bond Length (Å)
Carbon : 12	C – C = 1.50
Silicon : 28	Si – Si = 2.25

View Text Solution

114. A metal 'M' having atomic mass 31.25 crystallizes in cubic close packing and it shows "Schottky defects".

If the edge length of the cubic lattice is 500 pm and density of the metal is 1.6075 gm//ml then calculate number of moles of metal atom 'M' missing per litre of the crystal.

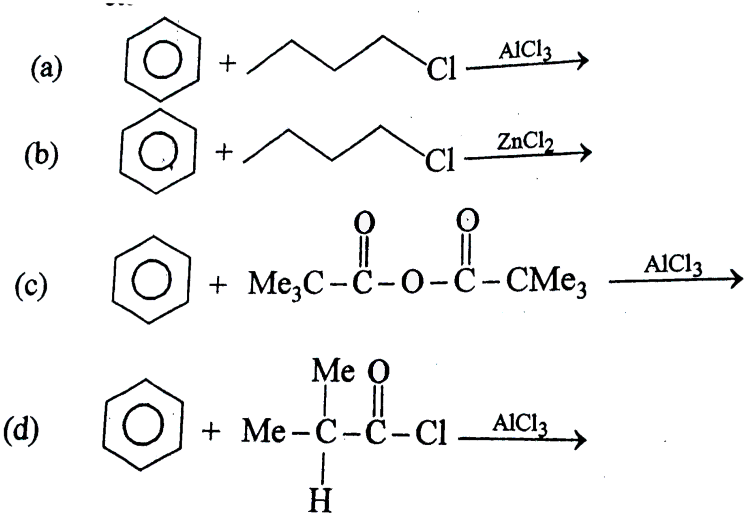
Given : 1 amu = 1.67×10^{-24}gm

View Text Solution

115. The oxidation state of Cr in K_3CrO_8.

View Text Solution

116. Four reaction are given below, write total number of hydrogen atoms on all the carbon atoms which are connected directly by a single bond to benzylic carbon (carbon connected to benzene ring) in the product.



Write answer of part (a), (b), (c) & (d) in the same order and present the four digit number as answer in OMR sheet.

Hint : If product is ltimg

src="https://d10lpgp6xz60nq.cloudfront.net/physics_images/BSL_PT_7_P1_E02_

width="80%"gt the answer will be 6.

View Text Solution

117. Which of the following statements is correct with respect to colloidal state and surface phenomenon.

A. Gold sol can be coagulated by SO $._4^{2-}$ ion.

B. Sb_2S_3 sol can be coagulated by adding $Fe(OH)_3$ sol.

C. Adsorption processes are entropy driven process always.

D. At very high pressures, adsorption increases with pressure.

Answer: B

View Text Solution

118. Cinnamic acid $(Ph - CH = CH - COOH)$ is nitrated preferably at ________ and it is ________ then nitration of benzene.

A. m-position, faster

B. o & p-positions, faster

C. m-position, slower

D. o & p-position, slower

Answer: D

View Text Solution

119. Catalyst used in conversion of n-hexane into benzene in:

A. $AlCl_3$

B. $SiO_2 - Al_2O_3$

C. $Cr_rO_3 - Al_2O_3$

D. MnO_2

Answer: C

View Text Solution

120. What is best reagent would you choose to convert MnO_4^{2-} to MnO_4^-.

A. Cl_2 water

B. O_3

C. A and B both

D. None of these

Answer: C

View Text Solution

121. If edge length of an unit cell $= 4 \times 10^{-8}$ cm and the unit cell is a face-centered cubic with atomic mass of metal is 40 then density of the unit cell will be $\left[N_2 = 6 \times 10^{23}\right]$

A. $\frac{100}{24}$ gm/ml

B. $\frac{25}{24}$ gm/ml

C. $\frac{50}{24}$gm/ml

D. $\frac{1}{4}$ gm/litre

Answer: A

View Text Solution

122. H_2S gas is not evolved when SO_3^{2-} ion reacts with following reagents.

A. An+dil.H_2SO_4

B. Al + conc. NaOH

C. Al + dil. HCl

D. None of these

Answer: B

View Text Solution

123. How many products are produced respectively when optically pure glucose and frutose are reduced one by $NaBH_4$?

A. 1 & 1

B. 2 & 2

C. 1 & 2

D. 2 & 1

Answer: C

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124. Metal (M) crystallizes in a cubic unit cell with density 3.2 g/cc. Edge-length of the unit cell is 4.37Å picometre (pm)

The nearest neighbour will be

A. On the corners

B. On the body diagonal

C. On the face diagonal

D. On opposite face

Answer: C

View Text Solution

125. Metal (M) crystallizes in a cubic unit cell with density 3.2 g/cc. Edge-length of the unit cell is 4.37Å picometre (pm)

The number of nearest neighbours of a Ca atom are

A. 4

B. 6

C. 8

D. 12

Answer: D

View Text Solution

126. When redox reaction occurs within the reactant , in which one component acts as oxidising agent and other component acts as reducing agent, then it is named as intra-molecular redox reaction, which usually occur in thermal decomposition of ionic compounds.

Which of the following compounds does not give nitrogen gas on heating ?

A. NH_4NO_2

B. $(NH_4)_2SO_4$

C. NH_4ClO_4

D. $(NH_4)_2Cr_2O_7$

Answer: B

View Text Solution

127. When redox reaction occurs within the reactant , in which one component acts as oxidising agent and other component acts as reducing agent, then it is named as intra-molecular redox reaction, which usually occur in thermal decomposition of ionic compounds.

Which of hte following salt does not give NO_2 gas on heating ?

A. $Pb\left(NO_3\right)_2$

B. $Hg\left(NO_3\right)_2$

C. KNO_2

D. $AgNO_3$

Answer: C

View Text Solution

128. Which of the following statements is/are correct with respect to surface phenomenon ?

A. Potassium ferrocyanide can cause greater coagulation in a basic dye as compared to Na_2HPO_3.

B. A starch aqua-sol can act as a protective colloid for $Fe(OH)_3$ sol.

C. The slope of the Freundlich Isotherm (log $\frac{x}{m}$ vs log p) keeps on changing for a long range of pressure and is constant over a limited range of pressure.

D. On mixing $AgNO_3$ with large amount of KI and subjecting the colloidal state to electrophoresis, coagulation is obtained at cathode.

Answer: A::B::C

View Text Solution

129. Identify incorrect statement.

A. D-Glucose, D-Mannose & D-Fructose all give same osazone on reaction on reaction with $Ph - NH - NH_2$

B. D-Glucose & D-Fructose on catalytic reduction give same products.

C. Glucose never react with $NaHSO_3$ Schiff's & $Ph - NH - NH_2$

D. Monomer of natural rubber is neoprene

Answer: B::C::D

View Text Solution

130. Which of the following compouds on direct heating can not produce anhydrous form of it.

A. $FeCl_3.6H_2O$

B. $CuSO_4.5H_2O$

C. $MgCl_2.6H_2O$

D. $ZnCl_2.2H_2O$

Answer: A::C::D

View Text Solution

131. Select the correct statement(s) about FCC (ABCAB...) structure.

A. Distance between nearest octahedral void and tetrahedral void is $\frac{\sqrt{3}a}{4}$

B. Distance between two nearest octahedral void is $\frac{a}{\sqrt{2}}$

C. Distance between two nearest tetrahedral void is $\frac{\sqrt{3}a}{2}$

D. Distance between layer A and B is 2r $\sqrt{\frac{2}{3}}$

Answer: A::B::D

View Text Solution

132. Which of the following is formed by condensation polymerisation.

A. Nylon-66

B. Terylena

C. Bakelite

D. None of these

Answer: A::B::C

View Text Solution

133. Which of the following properties of the metal gets changed due to changed due to formation of interstitial carbide.

A. Density

B. Hardness

C. Malleability

D. Electrical conductivity

Answer: A::B::C

View Text Solution

MATHEMATICS

1. The expression $q\left(\sqrt{6+\sqrt{6+\sqrt{6+\ldots.\infty}}}\right)^{\log_3 p\left[\frac{\log_q(\log_q r)}{\log_q p}\right]}$

A. q

B. p

C. r

D. 3

Answer: C

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2. If $\cos 17^\circ + \sin 17^\circ = \alpha$, then $\cos 34^\circ$ is equal to

A. $\alpha\sqrt{2-\alpha^2}$

B. $\sqrt{1 - \alpha^2}$

C. $\alpha\sqrt{1 - \alpha^2}$

D. $\sqrt{2 - \alpha^2}$

Answer: A

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3. Let $\alpha = \sqrt{19 - 8\sqrt{3}} + \sqrt{7 + 4\sqrt{3}}$ and $\beta = \sqrt{83 - 18\sqrt{2}} - \sqrt{6 - 4\sqrt{2}},$ then $\log_2\left(\frac{\alpha}{\beta}\right)$ lies in the interval

A. $(-2, -1)$

B. $\left(\frac{-1}{2}, 0\right)$

C. $(0, 1)$

D. $\left(-1, \frac{-1}{2}\right)$

Answer: B

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4. The set of angles between 0 and 2π satisfying the equation $4\cos^2\theta - 2\sqrt{2}\cos\theta - 1 = 0$ is

A. $\left\{\frac{\pi}{12}, \frac{5\pi}{12}, \frac{19\pi}{12}, \frac{23\pi}{12}\right\}$

B. $\left\{\frac{\pi}{12}, \frac{7\pi}{12}, \frac{17\pi}{12}, \frac{23\pi}{12}\right\}$

C. $\left\{\frac{5\pi}{12}, \frac{13\pi}{12}, \frac{19\pi}{12}\right\}$

D. $\left\{\frac{\pi}{12}, \frac{7\pi}{12}, \frac{17}{12}, \frac{23\pi}{12}\right\}$

Answer: B

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5. Statement -I: If $\alpha > \beta > 1$, then $\frac{\alpha\sqrt{\log_{\alpha}\beta}}{\beta\sqrt{\log_{\beta}\alpha}}$ is greater than 1.

Statement-2 : $\log_{c}b = \frac{\log_{a}b}{\log_{a}c}$, if $0 < a, b, c \neq 1$.

A. Statement -1 is ture, statement -2 is ture and statement-2 is correct explaination for statement -1

B. Statement-1 is ture, statement-2 is ture and statement -2 is NOT the correct explanation for statement -1.

C. Statement- 1 is ture,statement -2 is false.

D. Statement -1 is false, statement -2 is ture.

Answer: D

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6. Statement : If $N = \left(\frac{1}{20}\right)^{20}$ then N contains 7 digits before decimal.

A. Statement -1 is ture, statement -2 is ture and statement-2 is correct explaination for statement -1

B. Statement-1 is ture, statement-2 is ture and statement -2 is NOT the correct explanation for statement -1.

C. Statement- 1 is ture,statement -2 is false.

D. Statement -1 is false, statement -2 is ture.

Answer: D

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7. Which of the following do/does not reduce to unity ?

A. $\frac{\sin\left(180^\circ + A\right)}{\tan\left(180^\circ + A\right)} \cdot \frac{\cot\left(90^\circ + A\right)}{\tan\left(90^\circ + A\right)} \cdot \frac{\cos\left(360^\circ - A\right)\operatorname{cosec}A}{\sin(-A)}$

B. $\frac{\sin(-A)}{\sin\left(180^\circ + A\right)} - \frac{\tan\left(90^\circ + A\right)}{\cot A} + \frac{\cos A}{\sin\left(90^\circ + A\right)}$

C. $\frac{\sin 24^\circ \cos 6^\circ - \sin 6^\circ \sin 66^\circ}{\sin 21^\circ \cos 39^\circ - \cos 51^\circ \sin 69^\circ}$

D. $\frac{\left(\cos\left(90^\circ\right) + A\right)\sec(-A)\tan\left(180^\circ - A\right)}{\sec\left(360^\circ + A\right)\sin\left(180^\circ + A\right)\cot\left(90^\circ - A\right)}$

Answer: B::C::D

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8. Let $a, b, c > 0$ such that $a > b > c$ and $a + c > 2b$. If $In(a + c) + In(a - 2b + c) = 2In(a - c)$, then which of the following relation is(are) correct?

A. $\frac{1}{a} + \frac{1}{c} = \frac{2}{b}$

B. $b^2 = ac$

C. $\frac{c}{b} = \frac{b - c}{a - b}$

D. $b^2 = a^2 + c^2$

Answer: A::C

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9. If $\sin\theta + \sin^2\theta + \sin^3\theta = 1$,prove that $\cos^6\theta - 4\cos^4\theta + 8\cos^2 = 4$

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10. Let L denotes the value of a satisfying the equation $\log_{\sqrt{3}}(a) = \frac{10}{3}$ and M denotes the value of b satisfying the equation $4^{\log_9^3} + 9^{\log_2^4} = 10^{\log_b^{83}}$.

Find (L+M)

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11. The area bounded by the lines $y = 2, x = 1, x = a$ and the curve $y = f(x)$, which cuts the last two lines above first line for all $a \geq 1$, is equal to $\frac{2}{3}\left[(2a)^{3/2} - 3a + 3 - 2\sqrt{2}\right]$, then $f(x) =$

A. $2\sqrt{2x}, x \geq 1$

B. $\sqrt{2x}, x \geq 1$

C. $2\sqrt{x}, x \geq 1$

D. None

Answer: A

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12. Between any 2 real roots of a real valued differentiable function f(x), there lies atleast one critical point of f(x) is a conclusion of

A. Lagrange's mean value theorem

B. Fermats theorem

C. Rolle's theorem

D. Extreme value theorem

Answer: C

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13. A and B are two given matrices such that the order of A is 3×4 if A'Band BA' are both defined then

A. order of B' is 3×4

B. order of B' A is 4×4

C. order of B'A is 3×3

D. B'A is undefined

Answer: B

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14. If $\hat{a}, \hat{b}$ and $\hat{c}$ are unit vector inclined to each other at an angle of $\frac{\pi}{3}$ then the absolute value of $\left[\hat{a}+\hat{b}\hat{b}+\hat{c}\hat{c}+\hat{a}\right]$ equals

A. $\sqrt{2}$

B. $\sqrt{3}$

C. $3\sqrt{2}$

D. $2\sqrt{3}$

Answer: A

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15. The vectors $\vec{a} = (2 - x)\hat{i} + 2\hat{j} + 2\hat{k}, \quad \vec{b} = 2\hat{i} + (2 - y)\hat{j} + 2\hat{k}, \quad \vec{c} = 2\hat{i} + 2\hat{j} + (2 - z)\hat{k}$ and $\vec{d} = \hat{i}$

are coplanar, then

A. $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$

B. $\frac{1}{1 - x} + \frac{1}{1 - y} + \frac{1}{1 - z} = 1$

C. $x + y + z = 1$

D. $\frac{1}{x - 2} + \frac{1}{y - 2} + \frac{1}{z - 2} = 1$

Answer: A

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16. The system of equations $\alpha x + y + z = \alpha - 1, x + \alpha y + z = \alpha - 1, x + y + \alpha z = \alpha - 1$ has no solution if alpha is (A) 1 (B) not -2 (C) either -2 or 1 (D) -2

A. Not - 2

B. 1

C. -2

D. Either - 2 or 1

Answer: C

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17. The point at which the line joining the points $(2, -3, 1)$ and $(3, -4, -5)$ intersects the plane $2x + y + z = 7$ is

A. $(1, 2, 7)$

B. $(1, -2, 7)$

C. $(-1, 2, 7)$

D. $(1, -2, -7)$

Answer: B

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18. If $xdy = y(dx + ydy)$; $y(1) = 1$ and $y(x) > 0$, then what is $y(-3)$ equal to?

A. 1

B. 3

C. 5

D. -1

Answer: B

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19. The sine and cosine curves intersect infinitely many times , bounding regions of equal areas . Sketch one of these regions and find its area .

A. $\sqrt{2}$

B. $2\sqrt{2}$

C. $3\sqrt{2}$

D. $4\sqrt{2}$

Answer: B

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20. Let A be a 2×2 matrix with real entries. Let I be the 2×2 identity matrix. Denote by tr (A), the sum of diagonal entries of A. Assume that $A^2 = I$. Statement 1: If $A \neq I$ and $A \neq -I$, then det $A = -1$. Statement 2: If $A \neq I$ and $A \neq -I$, then $tr(A) \neq 0$. (1) Statement 1 is false, Statement $(2)(3) - 2(4)$ is true (6) Statement 1 is true, Statement $(7)(8) - 2(9)$ (10) is true, Statement $(11)(12) - 2(13)$ is a correct explanation for Statement 1 (15) Statement 1 is true, Statement $(16)(17) - 2(18)$ (19) is true; Statement $(20)(21) - 2(22)$ is not a correct explanation for Statement 1. (24) Statement 1 is true, Statement $(25)(26) - 2(27)$ is false.

A. Statement - 1 is true, statement - 2 is true and statement -2 is correct explanation for statement - 1.

B. Statement - 1 is true, statement - 2 is true and statement -2 is NOT the correct explanation for statement - 1.

C. Statement -1 is true, statement -2 is false.

D. Statement -1 is false, statement -2 is true.

Answer: C

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21. Statement 1: The product of two diagonal matrices of order 3 is also a diagonal matrix.

Statement -2 : In general, matrix multiplication is non-commutative.

A. Statement 1: is true , statement -2 is true and statement -2 is correct explanation for statement -1 .

B. Statement 1: is true, statement-2 is true and statement -2 is NOT the correct explanation for statement -1.

C. Statement 1: is true, statement -2is false.

D. Statement -1 is false, statement -2 is true.

Answer: B

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22. For the function $f(x) = \int_0^{x^2} \left(- \frac{t^2}{4} \right) (4 - t) dt$

A. local maximum occurs at x = 2

B. local maximum occurs at x = 0

C. local maximum occurs at x = -2

D. local minimum occurs at x = 0

Answer: A::C::D

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23. The tangent at any point P of a curve C meeta the x-axis at Q whose abscissa is positive and OP = OQ where O is origin, if C is a family of parabola having vertex (α, β) and latus- rectum = 4a, then find value of $\frac{4(\alpha + \beta)}{a}$?

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24. If the zeros of the polynomial $64x^3 - 144x^2 + 92x - 15$ are in AP, then the difference between the largest and the smallest zeroes of the polynomial is

A. 2

B. 1

C. $\frac{1}{2}$

D. $\frac{3}{8}$

Answer: B

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25. If α, β are the roots of the equation $x^2 + (\sin\phi - 1)x - \frac{1}{2}\cos^2\phi = 0(\phi \in R)$, then the maximum value of the sum of the squares of the roots is.

A. 4

B. 3

C. $9/4$

D. 2

Answer: A

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26. The quadratic equation $x^2 - 1088x + 295680 = 0$ has two positive integral roots whose greatest common divisor is 16. The least common multiple of the two roots is

A. 18240

B. 18480

C. 18960

D. 19240

Answer: B

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27. Let x,y,z be real numbers such that 3x, 4y and 5z from a geometric progression while x,y,z form an H.P. If the value of $\left(\frac{x}{z}+\frac{z}{x}\right)$ can be expressed as a lowest rational $\frac{p}{q}$, then (p+q) has the value equal to

A. 29

B. 39

C. 49

D. 59

Answer: C

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28. The value(s) of $'p'$ for which the equation $ax^2 - px + ab = 0$ and $x^2 - ax - bx + ab = 0$ may have a common root, given a, b are non zero real numbers, is -

A. $a + b^2$

B. $a^2 + b$

C. $a(1 + b)$

D. $b(1 + a)$

Answer: B

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29. x_1, x_2 are the $x^2 - 3x + A = 0; x_3, x_4$ are roots of the equation $x^2 - 12x + B = 0$ of the equation x_1, x_2, x_3, x_4 form in increasing $GP.$, then

A. A=2

B. B=32

C. $x_1 + x_3 = 5$

D. $x_2 + x_4 = 10$

Answer: B

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30. Let α,β , and γ be three distinct real roots of the equation $x(3x+2)^2 + 2 = (a + 12 + 9x)x^2 - bx + c$ where, a,b,c $\in R$. If every solution fo the inequality $(x-2)^2(4x+b)(x-c) < 0$ is also solution of the inequility $3x^2 + px + p^2 + 6p < 0$, then find number of integral values of 'p'

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31. If the relation between x and y in order that the 20^{th} arithmetic mean between x and 2y is same as the 20^{th} arithmetic mean between 2x and y , (99 means being inserted in each case)is y = Kx, find K.

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32. Find the sum of the value (s) of a so that the equation $(x^2 + 2ax + 2a + 3)(x^2 + 2ax + 4a + 5) = 0$ has only 3 real distinct roots.

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33. If $y = (\sin x + \operatorname{cosec} x)^2 + (\cos x + \sec x)^2$, then the minimum value of $y, \forall x \in R,$ 7 (b) 3 (c) 9 (d) 0

A. 7

B. 8

C. 9

D. 11

Answer: c

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34. 30. Radical centre of circles drawn on the sides as a diameter of triangle formed by the lines the $3x - 4y + 6 = 0$, $x - y + 2 = 0$ and $4x + 3y - 17 = 0$ is

A. (0,0)

B. (-2,3)

C. (-2,-3)

D. (2,3)

Answer: d

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35. If a given line is tangent to the circle then perpendicular distance from centre of the circle is equal to radius of the circle solve the following

:

If $16m^2 - 8l - 1 = 0$ the equation fo circle whose tangent is $lx + my + n = 0$ is

A. $x^2 + y^2 + 8x = 0$

B. $x^2 + y^2 - 8x = 0$

C. $x^2 + y^2 + 8y = 0$

D. $x^2 + y^2 - 8y = 0$

Answer: b

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36. If a given line is tangent to the circle then perpendicular distance from centre of the circle is equal to radius of the circle solve the following

:

If $4l^2 - 5m^2 + 6l + 1 = 0$ then the director circle of the circle whose tangent is $lx + my + 1 = 0$ is

A. $x^2 + y^2 + 6x - 1 = 0$

B. $x^2 + y^2 - 6x - 1 = 0$

C. $x^2 + y^2 - 6x - 10 = 0$

D. $x^2 + y^2 + 6x + 1 = 0$

Answer: b

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37. If $16l^2 + 9m^2 = 24lm + 6l + 8m + 1$ and the line $mx + ly = 1$ is tangent to circle $S_1 = 0$ then the equation of circle $S_2 = 0$ which touches $S_1 = 0$ at $(0, 0)$ and passing $(3, 1)$ is given by $x^2 + y^2 - ax - by + c = 0$, then find the value of $\sqrt{3a + 4b + 5c}$

A. $x^2 + y^2 - 8x + 14y = 0$

B. $x^2 + y^2 + 8x - 34y = 0$

C. $3x^2 + 3y^2 - 8x - 6y = 0$

D. none of theese

Answer: c

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38. The equation $2\sin^3\theta + (2\lambda - 3)\sin^2\theta - (3\lambda + 2)\sin\theta - 2\lambda = 0$ has exactly three roots in $(0, 2\pi)$, then λ can be equal to 0 (b) 2 (c) 1 (d) -1

A. -1

B. 0

C. $\frac{1}{2}$

D. 1

Answer: ad

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39. If $2\cos ec\theta - \cos\theta\cot\theta \geq k \forall \theta \in (0, \pi)$, then value of k is

A. 0

B. 1

C. 2

D. 3

Answer: abc

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40. The locus of points of intersection of the tangents to $x^2 + y^2 = a^2$ at the extremeties of a chord of circle $x^2 + y^2 = a^2$ which touches the circle $x^2 + y^2 - 2ax = 0$ is/are :

A. $\left(0, \frac{a}{2}\right)$

B. $(0, a)$

C. $(a, 0)$

D. $\left(\frac{a}{2}, 0\right)$

Answer: ac

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41. A line through the origin intersects the parabola $5y = 2x^2 - 9x + 10$ at two points whose x-coordinates add up to 17.

Then the slope of the line is ________ .

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42. Let S be the set of circles $x^2 + y^2 = r^2$ for $r = 1,$ 2 and 3 and T be the set of lines $y = x + k\sqrt{2}$ for $k = 0, \neq 1$ and ± 2. Find the number of distinct points of intersection of the graphs of set S and T.

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43. In a triangle, ABC, if $\cos A + \cos B + 4\cos C = 4$, then find the value of $\frac{a+b}{c}$.

[Note : All symbols used have their usual meaning in triangle ABC.]

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44. The locus of the middle points of the focal chords of the parabola, $y^2 = 4x$ is:

A. $y^2 = x - 1$

B. $y^2 = 2(x - 1)$

C. $y^2 = 2(1 - x)$

D. None

Answer: B

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45. The odds against a certain event is 5 : 2 and the odds in favour of another event is 6 : 5. If the both the events are independent, then the probability that at least one of the events will happen is

A. $\frac{50}{77}$

B. $\frac{52}{77}$

C. $\frac{25}{88}$

D. $\frac{63}{88}$

Answer: B

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46. In the Argand plane, the vector z = 4 - 3i is turned in the clockwise sense through 180^@` and stretched three times. The complex number represented ny the new vector is

A. $12 + 9i$

B. $12 - 9i$

C. - $12 - 9i$

D. $12 - 9i$

Answer: D

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47. An ellipse and a hyperbola have the same centre as origin, the same foci and the minor-axis of the one is the same as the conhugate axis of the other . If e_1, e_2 be their eccentricities respectively, then $e_1^{-2} + e_2^{-2}$ equals

A. 1

B. 2

C. 3

D. 4

Answer: B

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48. A man walks a distance of 3 units from the origin towards the North-East $\left(N45^0E\right)$ direction.From there, he walks a distance of 4 units towards the North-West $\left(N45^0W\right)$ direction to reach a point $P^{\cdot}$ Then, the position of P in the Argand plane is $3e^{\frac{i\pi}{4}} + 4i$ (b) $(3 - 4i)e^{\frac{i\pi}{4}}$ $(4 + 3i)e^{\frac{i\pi}{4}}$ (d) $(3 + 4i)e^{\frac{i\pi}{4}}$

A. $3e^{i\frac{\pi}{4}} + 4i$

B. $(3 - 4i)e^{i\frac{\pi}{4}}$

C. $(4 + 3i)e^{i\frac{\pi}{4}}$

D. $(3 + 4i)e^{i\frac{\pi}{4}}$

Answer: D

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49. The normal at a point P on the ellipse $x^2 + 4y^2 = 16$ meets the x-axis at Q. If M is the midpoint of the line segment PQ, then the locus of M intersects the latus rectums of the given ellipse at points.

$\left(\pm\frac{(3\sqrt{5})}{2}\pm\frac{2}{7}\right)$ (b) $\left(\pm\frac{(3\sqrt{5})}{2}\pm\frac{\sqrt{19}}{7}\right)$ $\left(\pm 2\sqrt{3}, \pm\frac{1}{7}\right)$ (d) $\left(\pm 2\sqrt{3}\pm\frac{4\sqrt{3}}{7}\right)$

A. $\left(\pm\frac{3\sqrt{4}}{2}, \pm\frac{2}{7}\right)$

B. $\left(\pm\frac{3\sqrt{4}}{2}, \pm\frac{\sqrt{19}}{4}\right)$

C. $\left(\pm 2\sqrt{3}, \pm\frac{\sqrt{1}}{7}\right)$

D. $\left(\pm 2\sqrt{3}, \pm\frac{4\sqrt{3}}{4}\right)$

Answer: C

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50. India plays two matches each with West Indies and Australia. In any match the probabilities of India getting points $0, 1$ and 2 are $0.45, 0.05$ and 0.50 respectively. Assuming that the outcomes are independent, the probability of India getting at least 7 points is (a) 0.8750 (b) 0.0875 (c) 0.0625 (d) 0.0250

A. 0.875

B. 0.0875

C. 0.0625

D. 0.025

Answer: B

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51. The coordinates of the focus of the parabola described parametrically by $x = 5t^2 + 2.\ y = 10t + 4$ are

A. (7,4)

B. (3,4)

C. (3,-4)

D. (-7,4)

Answer: A

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52. The ellipse $x^2 + 4y^2 = 4$ is inscribed in a rectangle aligned with the coordinate axes, which in turn is inscribed in another ellipse that passes through the point (4, 0). Then the equation of the ellipse is (1) $x^2 + 16y^2 = 16$ (2) $x^2 + 12y^2 = 16$ (3) $4x^2 + 48y^2 = 48$ (4) $4x^2 + 64y^2 = 48$

A. $x^2 + 16y^2 = 16$

B. $x^2 + 12y^2 = 16$

C. $4x^2 + 48y^2 = 48$

D. $4x^2 + 64y^2 = 48$

Answer: B

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53. If $|z - 1| + |z + 3| \leq 8$, then the range of values of $|z - 4|$ is

A. (0,7)

B. (1,8)

C. [1,9]

D. [2,5]

Answer: C

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54. AB is double ordinate of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ such that ΔAOB (where 'O' is the origin) is an equilateral triangle, then the eccentricity e of hyperbola satisfies:

A. $1 < e < \frac{2}{\sqrt{3}}$

B. $e = \frac{2}{\sqrt{3}}$

C. $e = \frac{\sqrt{3}}{2}$

D. $e > \frac{2}{\sqrt{3}}$

Answer: D

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55. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$.

If 'n' is not fixed and series ends when any one of the team completes its 4^{th} win then probability that India wins the series is

A. $\frac{4}{2^7}$

B. $\frac{47}{2^7}$

C. $\frac{47}{2^6}$

D. None

Answer: C

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56. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$.

If n = 7, them probability that India wins atleast three consercutive matches is

A. $\frac{17}{2^6}$

B. $\frac{47}{2^7}$

C. $\frac{47}{2^6}$

D. None

Answer: B

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57. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$.

For n = 7, probadility that India wins atleast three conseutive matches is

A. $\frac{4}{2^7}$

B. $\frac{17}{2^6}$

C. $\frac{47}{2^7}$

D. None

Answer: B

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58. Form, a cosmetic shop containing perfumes and does, a pair is selected at random. The probability that the selected pair will consist of one perfume and one deo is $\frac{16}{31}$. Find the maximum number of perfumes and does the shop can contain ?

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Math

1. The value of $\sec\left(2\cot^{-1}2 + \frac{\cos^{-1}3}{5}\right)$ is equal to

A. $\frac{25}{24}$

B. $-\frac{24}{7}$

C. $\frac{25}{7}$

D. $-\frac{25}{7}$

Answer: D

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2. Set A consists of 4 distinct and set-B consists of 3 distinct elements. Number of functions that can be defined from a set $A \rightarrow B$which are not onto is

A. 35

B. 45

C. 63

D. 9

Answer: B

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3. The value of $\sum_{r=2}^{\infty} \tan^{-1}\left(\frac{1}{r^2 - 5r + 7}\right)$, is

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{4}$

D. $\frac{5\pi}{4}$

Answer: C

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4. If the system of equations $x - ky - z = 0, kx - y - z = 0, x + y - z = 0$ has a nonzero solution, then the possible value of k are $-1, 2$ b. $1, 2$ c. $0, 1$ d. $-1, 1$

A. $-1, 2$

B. $1, 2$

C. $0, 1$

D. $-1, 1$

Answer: D

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5. If $f(x) = \pi\left(\dfrac{\sqrt{x+7} - 4}{x - 9}\right)$ then the range of function $y = \sin(2f(x))$ is :

A. $[0, 1]$

B. $\left(0, \frac{1}{\sqrt{2}}\right]$

C. $\left(0, \frac{1}{\sqrt{2}}\right) \cup \left(\frac{1}{\sqrt{2}}, 1\right]$

D. $(0, 1]$

Answer: C

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6. If $f(x) = \begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & (x+1)x \\ 3x(x-1) & x(x-1)(x-2) & (x+1)x(x-1) \end{vmatrix}$, then f(100) is equal to

- (i)0 (ii)1 (iii)100 (iv)-100

A. 0

B. 1

C. 100

D. -100

Answer: A

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7. Consider the matrix function

$$A(x) = \begin{bmatrix} \cos^{-1}x & \sin^{-1}x & cosec^{-1}x \\ \sin^{-1}x & \sec^{-1}x & \tan^{-1}x \\ cosec^{-1}x & \tan^{-1}x & \cot^{-1}x \end{bmatrix}$$

and $B = A^{-1}$. Also det.$(A(x))$ denotes the determinant of square matrix A(x).

Which of the following statement(s) is(are) correct ?

A. $A(-x) = A(x)$

B. $A(x) + A(-x) = \pi I_3$

C. $A(-x) = -A(x)$

D. $A(x) + A(-x) = -\pi I_3$

Answer: B

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8. Which of the following statements is (are) correct ?

A. A(x) is a symmetric matrix.

B. A(s) is a skew symmetric matrix.

C. Maximum value of det. $(A(x))$ equals $\frac{\pi^3}{8}$.

D. Maximum value of det. $(A(x))$ equals $\frac{\pi^3}{16}$.

Answer: A::C::D

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9. Which of the following statement(s) is (are) correct ?

A. det.(A(x)) is a continuous function in its domin but not differentiable in its domin.

B. det.(A(x)) is a continuous and differentiable function in its domain.

C. det.(A(x)) is a bounded function.

D. det.(A(x)) is one-one and odd function.

Answer: A::C

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10. Which is following statement(s) is (are) correct?

A. If a= det. (B) + det. $\left(B^2\right)$ + det. $\left(B^3\right)$ + ...∞, then minimum value of a equals $\frac{8}{\pi^3 - 8}$.

B. If $b =$ det. adj. (B) + det. adj. $\left(B^2\right)$ + det. adj. $\left(B^3\right)$ + ...∞. Then maximum value of b is $\frac{256}{\pi^6 - 256}$.

C. If a = det. (B) + det. $\left(B^2\right)$ + det. $\left(B^3\right)$ + ...∞, then maximum value of a equals $\frac{16}{\pi^3 - 16}$.

D. If b = det. adj. (B) + det. adj. $\left(B^2\right)$ + det. adj. $\left(B^3\right)$ + ...∞, then minimum value of b is $\frac{64}{\pi^6 - 64}$.

Answer: A::B::C::D

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11. Which of the following pair of functions have the same graph ?

A. $f(x)\ln[1+\{x\}]$ and $g(x)=\ln(1+[\{x\}])$,

B. $f(x)=\frac{1}{1+\tan^2 x}+(1)\left(1+\cot^2 x\right)$ and $g(x)=2\sin^2 x+\cos 2x$

C. $f(x)=2^{sgn}\left(x^2+3x+3\right)$ and $g(x)=2sgn\left(x^2+3x+3\right)$

D. $f(x)=\frac{sgnx}{sgnx}$ and $g(x)=\frac{|x|}{|x|}$

Answer: A::C::D

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12. Which of the following is/are correct ?

A. $\cos\left(\cos\left(\cos^{-1}1\right)\right)<\sin\left(\sin^{-1}(\sin\pi-1)\right)<\sin\left(\cos^{-1}(\cos(2\pi-2))\right.$

B.

$\cos\left(\cos\left(\cos^{-1}\right)\right) < \sin\left(\cos^{-1}(\cos(2\pi - 2))\right) < \sin\left(\sin^{-1}(\sin(\pi - 1))\right) < \tan($

C. $\sum^{5000} t = 1\cos^{-1}(\cos(2t\pi - 1)) = \sum^{2500} t = 1\cot^{-1}(\cot(t\pi + 2))$ where $t \in I$

D. $\cot^{-1}\cot\mathrm{cos}ec^{-1}\mathrm{cos}ec\sec^{-1}\sec\tan\tan^{-1}\cos\cos^{-1}\sin^{-1}\sin 4 = 4 - \pi$

Answer: A::C::D

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13. Let $f: R \rightarrow R$ defined by $f(x) = \min(|x|, 1 - |x|)$, then which of the following hold(s) good ?

A. Range of f is $(-\infty, 1]$

B. f is aperiodic.

C. f is neither even nor odd.

D. f is neither injective nor surjective.

Answer: B::D

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14. Let a function f defined from $R \rightarrow R$ as $f(x) = \left[x + p^2 f \text{ or } x \leq 2 \text{ and } px + 5, f \text{ or } x > 2\right.$, If the function is surjective, then find the sum of all possible integral values of p in $[-100, 100]$.

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15. If $f: R \rightarrow R$ be an injective mapping and p, q, r are non-zero distinct real quantities satisfying $f\left(\frac{p}{r}\right) = f\left(\frac{p-q}{q-r}\right)$ and $f\left(\frac{q}{r}\right) = f\left(\frac{r}{p}\right)$.

If the graph of $g(x) = px^2 + qx + r$ passes thorugh $M(1, 6)$ then find the value of q.

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1. If $\tan\theta \frac{P}{q}$ where $p, q > 0$ and if $\theta \in \left(0, \frac{\pi}{4}\right)$ then $\sqrt{\frac{q+p}{q-p}} + \sqrt{\frac{q-p}{q+p}}$ is equal to

A. $\frac{2\sin\theta}{\sqrt{\sin 2\theta}}$

B. $\frac{2\sin\theta}{\sqrt{\cos 2\theta}}$

C. $\frac{2\cos\theta}{\sqrt{\cos 2\theta}}$

D. $\frac{2\cos\theta}{\sqrt{\cos 2\theta}}$

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2. Let

$\alpha = \sqrt{19 - 8\sqrt{3}} + \sqrt{7 + 4\sqrt{3}}$ and $\beta = \sqrt{83 - 18\sqrt{2}} - \sqrt{6 - 4\sqrt{2}}$, then $\log_2\left(\frac{\alpha}{\beta}\right)$

lies in the interval

A. $(-2, -1)$

B. $\left(\frac{-1}{2}, 0\right)$

C. $(0, 1)$

D. $\left(-1, \frac{-1}{2}\right)$

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3. The value of the expression

$$\left(1+\cot 7^{\circ}\right)\left(1+\cot 9^{\circ}\right)\left(1+\cot 11^{\circ}\right)\ldots\ldots\left(1+\cot 45^{\circ}\right)\left(1-\cot 52^{\circ}\right)\left(1-\cot 54^{\circ}$$

is equal to

A. 2^{18}

B. 2^{19}

C. 2^{20}

D. 2^{21}

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4. The expression $\dfrac{\left(\log_{\frac{a}{b}} p\right)^2 + \left(\log_{\frac{b}{c}} p\right)^2 + \left(\log_{\frac{c}{a}} p\right)^2}{\left(\left(\log_{\frac{a}{b}} p + \log_{\frac{b}{c}} p + \log_{\frac{c}{a}} p\right)\right)^2}$, wherever defined, simplifies to

A. 1

B. 2

C. 3

D. 4

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5. Let $N = 10^{\log 2} - 2\log\left(\log 10^3\right) + \log\left(\left(\log 10^6\right)^2\right)$ where base of the logarithm is 10. The characteristic of the logarithm of N to the base 3, is equal to 2 (b) 3 (c) 4 (d) 5

A. 2

B. 3

C. 4

D. 5

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6. $\dfrac{\sqrt{2} - \sin 25^\circ - \cos 25^\circ}{\sin 25^\circ - \cos 25^\circ}$ is equal to

A. $\tan 25^\circ$

B. $\cos 20^\circ$

C. $-\tan 10^\circ$

D. $\sec 10^\circ$

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7. The value of

$$\left(1+\cos\frac{2\pi}{15}\right)\left(1+\cos\frac{8\pi}{15}\right)\left(1+\cos\frac{12\pi}{15}\right) is$$

A. $\frac{3-\sqrt{5}}{16}$

B. $\frac{3+\sqrt{5}}{16}$

C. $\frac{3+\sqrt{5}}{8}$

D. $\frac{3-\sqrt{5}}{8}$

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8. $10^{\log_p\left(\log_q\left(\log_r(x)\right)\right)}=1$ and $\log_q\left(\log_r\left(\log_p(x)\right)\right)=0$ then 'p' equals

A. $r^{q/r}$

B. rq

C. 1

D. $r^{r/q}$

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9. For $0 < \alpha < \beta < \frac{\pi}{2}$, if $\frac{\sin\alpha}{\sin\beta} = \frac{\sqrt{3}}{2}$ and $\frac{\cos\alpha}{\cos\beta} = \frac{\sqrt{5}}{2}$, *then*

A. $\tan\alpha = 1$

B. $\tan\beta = \frac{\sqrt{3}}{\sqrt{5}}$

C. $\tan\beta = 1$

D. $\tan\alpha = \frac{\sqrt{3}}{\sqrt{5}}$

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10. The equation $(\log)_{x^2} 16 + (\log)_{2x} 64 = 3$ *has* one irrational solution (b) no prime solution two real solutions (d) no integral solution

A. one irrational solution

B. no prime solution

C. two real solutions

D. no integral solution

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11. If

$$A = \sum_{r=7}^{2400} \log_7\left(\frac{r+1}{r}\right), \quad B = \prod_{r=2}^{1023} \log_r(t+1), \quad C = \sum_{r=2}^{2011} \frac{1}{\log_r 2 + \log_r 3 + \ldots . + \log$$

then which of the following statements is/are true ?

A. $3A + C = B$

B. $A + B + C = 0$

C. $A + C = B$

D. $B - 2A = 4C$

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12. If $y = \log_{7-a}\left(2x^2 + 2x + a3\right)$is defined $\forall x \in R$, then possible integral value (s) of a is/are

A. -3

B. -2

C. 4

D. 5

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13. Match the following Column I to Column II

Column-I		Column-II	
(A)	If $\log_3\left(5+8\log_{49}\left(5+\log_7 49\right)\right)=k$, then (k^2+1) is equal to	(P)	1
(B)	If $x=\sqrt{9+\sqrt{77}}$, then $\frac{1}{11}\left(x+\frac{2}{x}\right)^2$ is equal to	(Q)	2
(C)	If maximum and minimum value of $2\sin^2\theta+4\cos(\theta+\phi)\sin\theta\sin\phi+\cos 2(\theta+\phi)$ is a & b respectively then $(a+b)$ is less than	(R)	5
(D)	The value of b satisfying the equation, $\log_e 2\cdot\log_b 625=\log_{10}16\cdot\log_e 10$ is	(S)	8
		(T)	10

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14. Match the following Column I to Column II

Column-I		Column-II	
(A)	Number of real solutions of the equation $\lvert x-1\rvert+\lvert x-3\rvert=\frac{3}{2}$ is	(P)	0
(B)	If $\cot 40^\circ-\cot 50^\circ=k\cot 80^\circ$, then the value of k is	(Q)	1
(C)	The value of the expression $\tan 13^\circ\tan 27^\circ+\tan 27^\circ\tan 50^\circ+\tan 50^\circ\tan 13^\circ$ is equal to	(R)	2
(D)	The value of the expression $\frac{\cot 13^\circ+\cot 26^\circ+\cot 51^\circ}{\cot 13^\circ\cot 26^\circ\cot 51^\circ}$ is less than	(S)	3
		(T)	4

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15. If $(n,\theta)=\prod_{n=1}^{n}\left(\frac{1+\tan^2\left(2^n\theta\right)}{\left(1-\tan^2\left(2^n\theta\right)\right)^2}\right)$ then find the value of $8f\left(3,\frac{\pi}{8}\right)$?

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16. Find the number of integral solution of the equation $(\log)_{\sqrt{x}}(x + |x - 2|) = (\log)_x(5x - 6 + 5|x - 2|)$.

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17. Find the number of integral ordered pairs (x, y) satisfying the equation $\log(3x + 2y) = \log x + \log y$.

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18. If $\sin\beta = \sin(2\alpha + \beta)$ then find the value of $(\cot\alpha + \cot(\alpha + \beta))(\cot\beta - 5\cot(2\alpha + \beta))$?

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19. If $a = \log_{245} 175$ and $b = \log_{1715} 875$, then the value of $\frac{1 - ab}{a - b}$ is

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20. If $P = x + \frac{1}{x}$ and $P(\tan\alpha) = 2, P(\tan\beta) = 2\sqrt{2}, P(\cot\gamma) = 4$ where α, β, γ are acute angles and sum of all possible distinct values of α, β and $\gamma$is given by $\frac{m\pi}{n}$ where m and n are coprime, then find the value of $(m + n)$

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21. A die is rolled thrice, find the probability of getting a larger number each time than the previous number.

A. $\frac{5}{216}$

B. $\frac{5}{54}$

C. $\frac{1}{6}$

D. $\frac{5}{36}$

Answer: B

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22. The value of $\Sigma_{i=1}^{6}\left(\sin.\frac{2\pi k}{7}-i\cos.\frac{2\pi k}{7}\right)$

A. -1

B. 0

C. $-i$

D. i

Answer: D

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23. Find the eccentricity of an ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ whose latus rectum is half of its major axis.

A. $\frac{1}{\sqrt{2}}$

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

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

D. None of these

Answer: A

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24. AB is double ordinate of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ such that ΔAOB (where 'O' is the origin) is an equilateral triangle, then the eccentricity e of hyperbola satisfies:

A. $1 < e < \frac{2}{\sqrt{3}}$

B. $e = \frac{2}{\sqrt{3}}$

C. $e = \frac{\sqrt{3}}{2}$

D. $e < \frac{2}{\sqrt{3}}$

Answer: D

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25. The curve described parametrically by $x = t^2 + t + 1$, y = $t^2 - t + 1$ represents :

A. A pair of straight lines

B. An ellipse

C. A parabola

D. A hyperbola

Answer: C

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26. If A and B are two independent events such that $P(A) = \frac{1}{2}$ and $P(B) = \frac{1}{5}$, then which of the following is not true ?

A. $P(A \cup B) = \frac{3}{5}$

B. $P\left(\frac{A}{B}\right) = \frac{1}{4}$

C. $P\left(\frac{A}{A \cup B}\right) = \frac{5}{6}$

D. $P\left(\frac{A \cap B}{\bar{A} \cup \bar{B}}\right) = 0$

Answer: B

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27. If $\log \sqrt{3}\left(\frac{|z|^2 - |z| + 1}{2 + |z|}\right) > 2$, then the locus of z is

A. $|z| > 1$

B. $|z| < 5$

C. $|z| > 5$

D. $|z| < 1$

Answer: C

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28. Statement 1 : For the ellipse $\frac{x^2}{5} + \frac{y^2}{3} = 1$, the product of the perpendiculars drawn from the foci on any tangent is 3. Statement 2 : For the ellipse $\frac{x^2}{5} + \frac{y^2}{3} = 1$, the foot of the perpendiculars drawn from the foci on any tangent lies on the circle $x^2 + y^2 = 5$ which is an auxiliary circle of the ellipse.

A. 2

B. 3

C. 4

D. 5

Answer: B

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29. If $x = 9$ is the chord of contact of the hyperbola $x^2 - y^2 = 9$ then the equation of the corresponding pair of tangents is (A) $9x^2 - 8y^2 + 18x - 9 = 0$ (B) $9x^2 - 8y^2 - 18x + 9 = 0$ (C) $9x^2 - 8y^2 - 18x - 9 = 0$ (D) 9x^2-8y^2+18x+9=0`

A. $9x^2 - 8y^2 + 18x - 9 = 0$

B. $9x^2 - 8y^2 - 18x + 9 = 0$

C. $9x^2 - 8y^2 - 18x - 9 = 0$

D. $9x^2 - 8y^2 - 18x - 9 = 0$

Answer: B

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30. A fair coin is tossed repeatedly. If tail appears on first four tosses, them the probability of head appearing that 2 white and 1 black balls will be drawn, is

A. $\frac{1}{2}$

B. $\frac{1}{32}$

C. $\frac{31}{32}$

D. $\frac{1}{5}$

Answer: A

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31. Which of the following statement(s) is(are) correct ?

A. If the imaginary part of $\frac{2z+1}{iz+1}$ is -2, then the locus of the point representing z in the complex plane is a straight line.

B. Two circles are given such that one is completely lying inside the other without touching. Then the locus of the centre of a variable circle which touches the smaller circle from outside and the bigger circle from inside in an ellipse.

C. If the imaginary part of $\dfrac{2z+1}{iz+1}$ is -2, then the locus of the point representing z in the complex plane is a circle.

D. Two circles are given such that one is completely lying inside the other without touching. Then the locus of the centre of a variable circle which touches the smaller circle from outside and the bigger circle from inside is a hyperbola.

Answer: A::B

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32. Let 'L' be the point $(t, 2)$ and $'M'$ be a point on the y axis such that $'LM'$ has slope -$'t'$. Then the locus of the mid point of $'LM'$, $as' t'$ varies over all real values, is a parabola, whose

A. vertex is (0, 2)

B. lengths of latus-rectum is 2

C. focus is $\left(0, \frac{17}{8}\right)$

D. equation of directrix is 8y-15=0

Answer: A::C::D

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33. If from a variable point P representing the complex number z_1 on the curve $|z| = 4$, two tangents are drawn to the curve $|z| = 2$, meeting it at points $Q(z_2)$ and $R(z_3)$, then which of the following statement(s) is(are) correct?

A. Triangle , PQR is isosceles.

B. The locus of centroid of triangle PQR is |z|=1.

C. The circumradium of triangle PQR is 2.

D. The radius of circle inscribed in triangle PQR is 1.

Answer: C::D

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34. Let from the point $P(\alpha, \beta)$, tangents are drawn to the parabola $y^2 = 4x$, including the angle 45° to each other. Then locus of $P(\alpha, \beta)$ is(are)

A. a circle with centre (-3,0)

B. an ellipse with centre(-3,0)

C. a rectangular hyperbola with centre(3,0)

D. a rectangular hyperbola with centre (-3,0)

Answer: D

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35. The ellipse $4x^2 + 9y^2 = 36$ and the hyperbola $a^2x^2 - y^2 = 4$ intersect at right angles. Then the equation of the circle through the points of intersection of two conics is $x^2 + y^2 = 5$ $\sqrt{5}\left(x^2 + y^2\right) - 3x - 4y = 0$ $\sqrt{5}\left(x^2 + y^2\right) + 3x + 4y = 0$ $x^2 + y^2 = 25$

A. 1

B. 2

C. 3

D. 4

Answer: B::C::D

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36. Each of the n urns contains 4 white and 6 black balls. The $(n+1)$ th urn contains 5 white and 5 black balls. One of the $n+1$ urns is chosen at random and two balls are drawn from it without replacement. Both the balls turn out to be black. If the probability that the $(n+1)$ th urn was chosen to draw the balls is 1/16, then find the value of n .

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37. For all complex numbers z_1, z_2 satisfying $\left|z_1\right| = 12$ and $\left|z_2 - 3 - 4i\right| = 5$, find the minimum value of $\left|z_1 - z_2\right|$

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38. Find the minimum distance between the curves $y^2 = 4x and x^2 + y^2 - 12x + 31 = 0$

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39. If the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{125}$ coincide, the find the value of b^2.

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40. A bag 'A' contains 2 white and 3 red balls and bag 'B' contains 4 while and 5 red balls. One ball is drawn at random from a randomly chosen bag and is found to be red. If the proability that it was drawn from bag 'B' can be expressed as rational $\frac{p}{q}$ (where p and q are in their lowest form), then find (p+q).

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41. If the area of the triangle formed by the points z, z +iz and iz on the complex plane is 18, then the value of |z| is

A. 6

B. 9

C. $3\sqrt{2}$

D. $2\sqrt{3}$

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42. In the parabola $y^2 = 4ax$, then tangent at P whose abscissa is equal to the latus rectum meets its axis at T, and normal P cuts the curve again at $\dot{Q}$ Show that $PT:PQ = 4:5$.

A. $5:4$

B. $2:1$

C. $3:4$

D. $4:5$

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43. Three of the six vertices of a regular hexagon are chosen the random. What is the probability that the triangle with these vertices is equilateral.

A. $\frac{1}{2}$

B. $\frac{1}{5}$

C. $\frac{1}{10}$

D. $\frac{1}{20}$

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44. Out of 3n consecutive natural numbers, 3 natural numbers are chosen at random without replacement. The probability that the sum of the chosen numbers is divisible by 3, is

A. $\frac{n\left(3n^2 - 3n + 2\right)}{2}$

B. $\frac{\left(3n^2 - 3n + 2\right)}{2(3n - 1)(3n - 2)}$

C. $\frac{\left(3n^2 - 3n + 2\right)}{(3n - 1)(3n - 2)}$

D. $\frac{n(3n - 1)(3n - 2)}{3(n - 1)}$

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45. If $w = \alpha + i\beta$ where $B\eta 0$ and $z \neq 1$ satisfies the condition that $\left(\frac{w - \bar{w}z}{1 - z}\right)$ is purely real then the set of values of z is

A. $\{z : |z| = 1\}$

B. $\{z : z = \bar{z}\}$

C. $\{z : z \neq 1\}$

D. $\{z|z| = 1, z \neq 1|$

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46. The equation of the normal to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at the positive end of the latus rectum is

A. $x + ey + e^3a = 0$

B. $x - ey - e^3a = 0$

C. $x \quad ey - e^2 a = 0$

D. None of these

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47. If z_1 and z_2 are two non zero*comp* $\leq$ *xvmbersucht* $\wedge$ |z_1+z_2|=|z_1|+|z_2|

*then*arg z_1-argz_2*isequal* $\rightarrow$ (A)- pi/2(B)0(C)-pi(D)pi/2`

A. $-\pi$

B. $-\frac{\pi}{2}$

C. $\frac{\pi}{2}$

D. 0

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48. Find the equation of the hyperbola which has $3x - 4y + 7 = 0$ and $4x + 3y + 1 = 0$ as its asymptotes and which passes through the origin.

A. $12x^2 - 7xy - 12y^2 + 31x + 17y = 0$

B. $12x^2 - 7xy + 12y^2 + 31x + 17y = 0$

C. $12x^2 + 7xy - 12y^2 - 31x + 17y = 0$

D. $12x^2 - 7xy - 12y^2 + 31x - 17y = 0$

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49. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$

If 'n' is not fixed and series ends when any one of the team completes its 4^{th} win then probability that India wins the series is

A. $\frac{4}{2^7}$

B. $\frac{1}{2^7}$

C. $\frac{1}{2}$

D. None

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50. India and Pakistan play a series of 'n' one day matches and probability than India wins a match against Pakistan is $\frac{1}{2}$

IF $n = 7$, then probability that India wins atleast three consecutive matches is

A. $\frac{17}{2^6}$

B. $\frac{47}{2^7}$

C. $\frac{47}{2^6}$

D. None

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51. Let a hyperbola passes through the focus of the ellipse $16x^2 + 25y^2 = 400.$

The transverse and conjugate axes of this hyperbola coincide with the major and minor axes of the given ellipse. The eccentricity of the hyperbola is reciprocal of that the ellipse.

Which one of the following statement is correct ?

A. Vertices of hyperbola are $(\pm 3, 0)$.

B. Distance between foci of hyperbola is 6

C. Equation of directrices of hyperbola are $x = \pm \frac{5}{9}$.

D. None

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52. Let a hyperbola passes through the focus of the ellipse $\frac{x^2}{25} - \frac{y^2}{16} = 1.$

The transverse and conjugate axes of this hyperbola coincide with the major and minor axes of the given ellipse, also the product of eccentricities of given ellipse and hyperbola is 1, then

A. $\left(\frac{x^2}{9} - \frac{y^2}{16}\right)^2 = \frac{x^2 + y^2}{25}$

B. $\left(\frac{x^2}{9} - \frac{y^2}{16}\right) = \left(\frac{x^2 + y^2}{25}\right)^2$

C. $\left(\frac{x^2}{9} - \frac{y^2}{16}\right) = \frac{x^2 + y^2}{25}$

D. $\left(\frac{x^2}{9} - \frac{y^2}{16}\right)^2 = \left(\frac{x^2 + y^2}{25}\right)^2$

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53. Consider the chords of the parabola $y^2 = 4x$ which touches the hyperbola $x^2 - y^2 = 1$, the locus of the point of intersection of tangents drawn to the parabola at the extremitites of such chords is a conic section having latursrectum λ, the value of λ, is

A. The eccentricity of ellipse E equals $\cos 60^\circ$.

B. The foci of ellipse E are $\left(0, \pm\sqrt{3}\right)$.

C. The length of latus-rectum of ellipse E equals 1.

D. The distance between vertices of ellipse E equals 4.

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54. Consider the chords of the parabola $y^2 = 4x$ which touches the hyperbola $x^2 - y^2 = 1$, the locus of the point of intersection of tangents drawn to the parabola at the extremitites of such chords is a conic section having latursrectum λ, the value of λ, is

A. ± 1

B. ± 2

C. ± 3

D. ± 4

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55. A number is chosen at random from the set $\{1, 2, 3, 4, \ldots., n\}$. Let E_1 be the event that the number drawn is divisible by 2 and E_2 be the event that the number drawn is divisible by 3, then

A. E_1 and E_2 are always independent

B. E_1 and E_2 are independent if $n = 6k(k \in N)$

C. E_1 and E_2 are independent if $n = 6k + 2(k \in N)$

D. E_1 and E_2 are dependent if n = 10

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56. A $(-1, 0)$ and $B(2, 0)$ are two given points. A point M is moving in such a way thatthe angle B in the triangle AMB remains twice as large as the angle A. Show that the locus of the pointM is a hyperbola. Find the eccentricity of the hyperbola.

A. eccentricity equals 2

B. vertices $(\pm 3, 0)$

C. length of latus-rectum equals 6

D. equation of directrices are $x = \pm \frac{1}{2}$

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57. If $\left|Z - \frac{4}{Z}\right| = 2$ then maximum value of $|Z|$ is equal to

A. 2

B. 3

C. 4

D. 5

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58. Which of the following statement(s) is (are) correct ?

A. IF $|z| \leq 4$, then maximum value of $|iz + 3 - 4i|$ is equal to 9

B. If $|z| \leq 4$, then maximum value of $|iz + 3 - 4i|$ is equal to 8

C. z_1, z_2, z_3, z_4 are distinct complex numbers representing the vertices of a quadrilateral ABCD taken in order. If $z_1 - z_4 = z_2 - z_3$ and arg $\frac{z_4 - z_1}{z_2 - z_1} = \frac{\pi}{2}$, then the quadrilateral is rectangle.

D. z_1, z_2, z_3, z_4 are distinct complex numbers representing the vertices of a quadrilateral ABCD taken in order. If $z_1 - z_4 = z_2 - z_3$ and arg $\frac{z_4 - z_1}{z_2 - z_1} = \frac{\pi}{2}$, then the quadrilateral is rhombus .

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59. $\left|\frac{Z_1 - 1}{Z_1 - 4}\right| = 2 \& \left|\frac{Z_2 - 4}{Z_2 - 1}\right| = 2$ the $\left|Z_1 - Z_2\right|_{\max} - \left|Z_1 + Z_1\right|_{\min} = ?$

A. 2

B. 3

C. 5

D. 10

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60. The equation of a parabola having its focus at S(2,0) and one extremity of its latus rectum as (2,2) is

A. $y^2 = 4(3 - x)$

B. $y^2 = 4(1 - x)$

C. $y^2 = 4(1 - x)$

D. $y^2 = 8(3 - x)$

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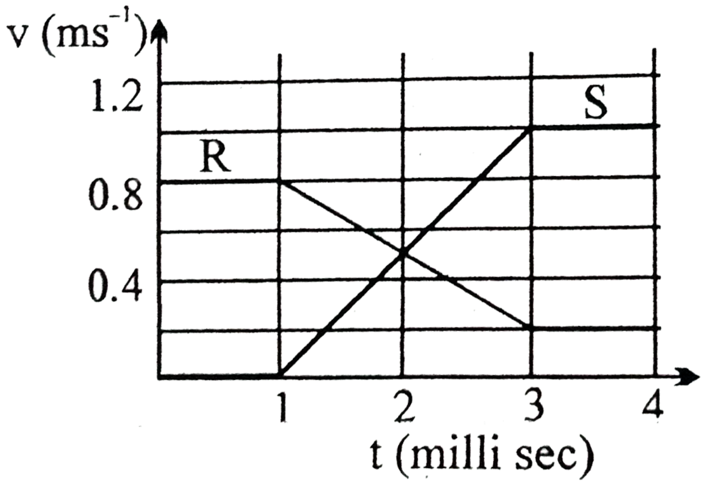
Physics, SECTION-1 (PART-A)

1. The diagram shows the velocity-time graph for two masses R an S that collided. The coefficient of restitution is



A. 1

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. 0

Answer: A

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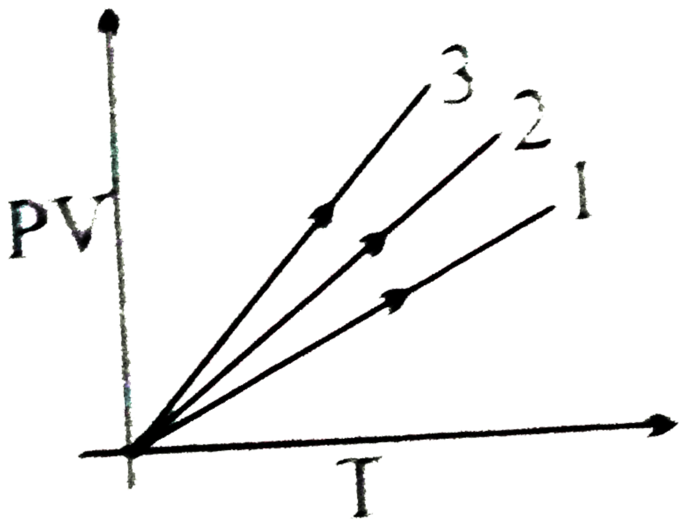
2. PV versus T graph of equal masses of H_2, He and CO_2 is shown in figure.

Choose the correct alternative



A. 3 corresponds to H_2, 2 to He and 1 to CO_2

B. 1 corresponds to He, 2 to H_2 and 3 to CO_2

C. 1 corresponds to He, 3 to H_2 and 2 to CO_2

D. 1 corresponds to CO_2, 2 to H_2 and 3 to He

Answer: A

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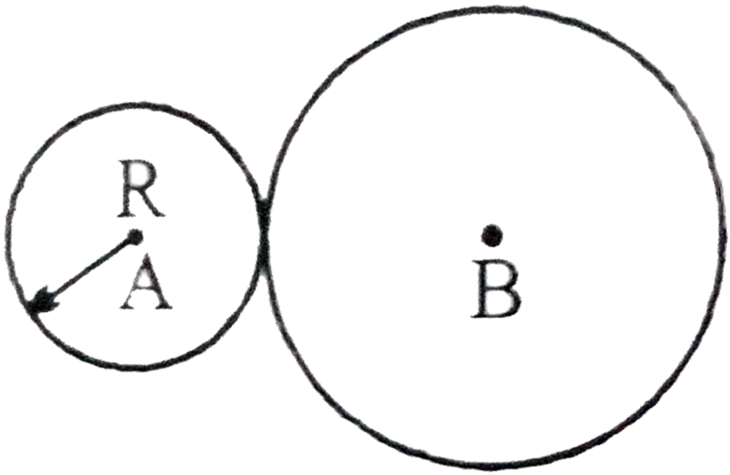
3. Two discs A and B of radii 'R' and '2R' respectively are placed on a horizontal surface as shown. Keeping the disc A motionless, disc B is rotated around it without slippage. When the disc B returns to its startin position, the angle that it has turned is equal to :



A. 3π radians

B. 2π radians

C. 6π radians

D. π radians

Answer: A

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4. Two rods of different materials having coefficient of thermal expansion α_1 and α_2 and Young's moduli Y_1 AND Y_2 respectively are fixed between two rigid massive walls. The rods are heated such that they undergo the same increase in temperature. There is no bending of the rods. If α_1 and α_2 are in the ratio2:3, the thermal stresses i the rods would be same for ratio $Y_1/Y_2 =$

A. $2:3$

B. $1:1$

C. $3:2$

D. $4:9$

Answer: C

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5. Two light wires of the same material (Young's modulus Y) and same length L but different radii R and 2R, as shown in the figure, are joined end to end supported from a fixed support. A weight W is suspended from the combination. The elastic potential energy in the ststem is ltbtgt ltimg src="https://d10lpgp6xz60nq.cloudfront.net/physics_images/BSL_PT_3_P1_E01_(width="80%"gt

A. $\dfrac{3W^2L}{4\pi R^2Y}$

B. $\dfrac{3W^2L}{8\pi R^2Y}$

C. $\dfrac{5W^2L}{8\pi R^2Y}$

D. $\dfrac{W^2L}{\pi R^2Y}$

Answer: A

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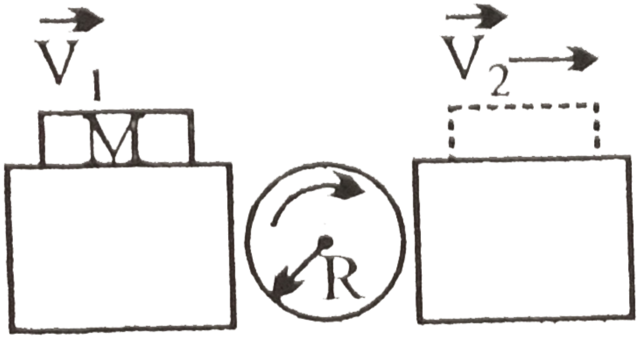
Physics, SECTION-1 (PART-A) [COMPREHENSION TYPE]

1. The axis of the uniform cylinder in figure is fixed. The cylinder is initially at rest. The block of mass M is initially moving to the right without friction and with speed v_1. It passes over the cylinder to the dashed position. Whe it first makes contact with the cylinder, it slips on the cylinder, but the friction is large enough so that slipping ceases before M loses contact with the cylinder. The cylinder has a radius R and a rotational inertia I.



If w is final angular velocity of the cylinder, then

A. $v_1 = \omega R$

B. $v_2 = \omega R$

C. $v_1 < \omega R$

D. none

Answer: A

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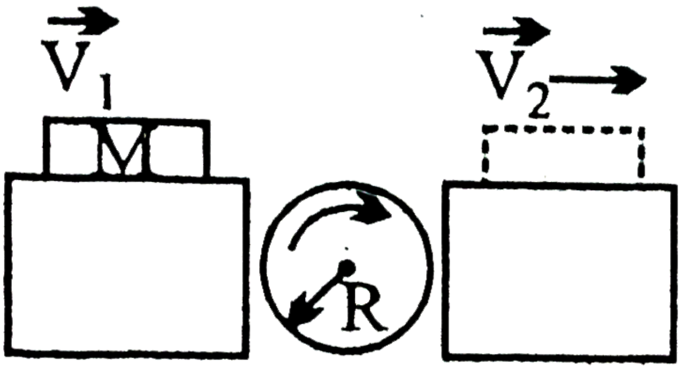
2. The axis of the uniform cylinder in figure is fixed. The cylinder is initially at rest. The block of mass M is initially moving to the right without friction and with speed v_1. It passes over the cylinder to the dashed position. Whe it first makes contact with the cylinder, it slips on the cylinder, but the friction is large enough so that slipping ceases before M loses contact with the cylinder. The cylinder has a radius R and a rotational inertia I.



Ouestion given below consists of two statements each printed as (I) and (II), while answering the question you are required to choose any one of the following four responses on the basis of above situation

I. Momentum of the block-cylinder system is conserved.

II. Force of friction between blockk and cylinder is internal force of block-cylinder system.

A. if both (I) and (II) are true and (II) is the correct explanation of (I)

B. if both (I) and (II) are true but (II) is not correct explanation of (I)

C. if (I) is true but (II) is false

D. if (I) is false and (II) is true

Answer: A

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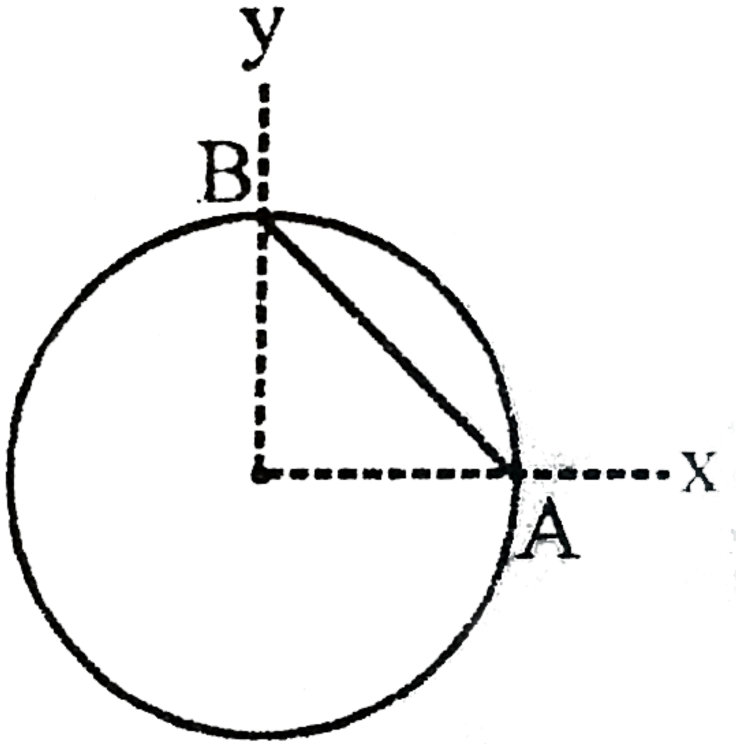
Physics, SECTION-1 (PART-A) [MULTIPLE CORRECT CHOICE TYPE]

1. An object comprises of a uniform ring of radius R and its uniform chord AB (not necessarily made of the same material) as shown. Which of the following can not be the centre of mass of object



A. $(R/3, R/3)$

B. $(R/3, R/2)$

C. $(R/4, R/4)$

D. $\left(R/\sqrt{2}, R/\sqrt{2}\right)$

Answer: A

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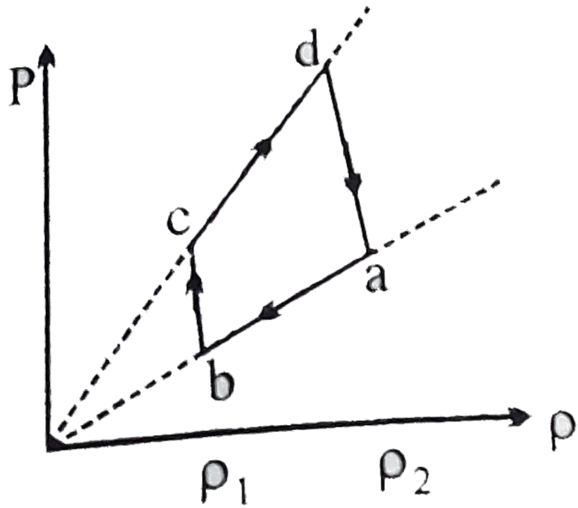
2. An ideal gas undergoes a cyclic process abcda which is shown by pressure-density curve



A. work done by the gas in the process "bc' is zero.

B. work done by the gas in the process 'cd' is negative.

C. internal energy of the gas at point 'a' is greater than at state 'c'

D. Net work done by the gas in the cycle is negative.

Answer: A

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3. Let V denote the root mean square speed of the molecules in an ideal diatomic gas at absolute temperature T. The mass of a molecule is m. Neglecting vibrational energy terms, which is True?

A. a molecule can have a speed greater than $\sqrt{2}v$

B. v is proportional to $\sqrt{T}$

C. the average rotational kinetic energy of a molecule is $\frac{mv^2}{4}$

D. the average kinetic energy of a molecule is $\frac{5mv^2}{6}$

Answer: A

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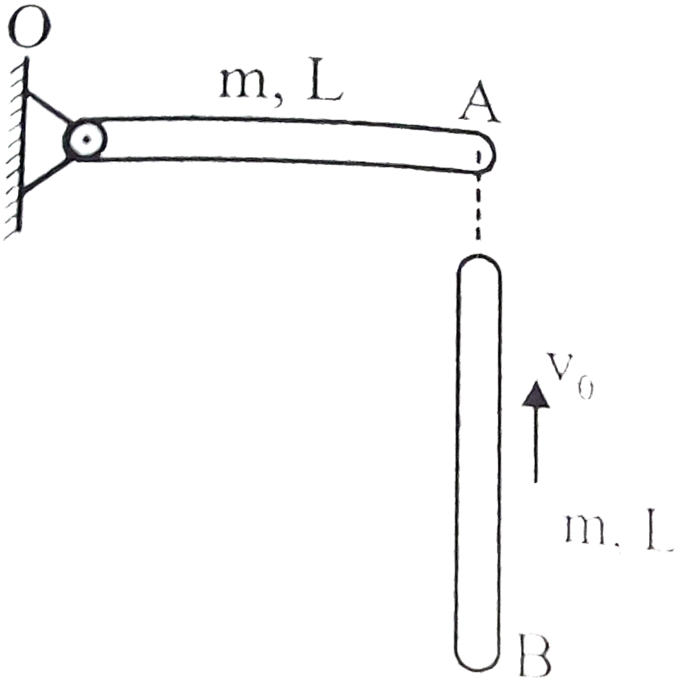
4. Rod B sticks to rod A on collision. Collision takes place on horizontal place on horizontal plane. Rod-A is hinged at O. Friction is absent every where.



A. Angular velocity of system just after collision is $\frac{2v_0}{5L}$

B. Velocity of centre of mass of system just after collision is $\sqrt{\frac{9}{40}}v_0$

C. Centre of mass of system is at a distance of $\frac{\sqrt{10}L}{4}$ from O

D. Kinetic energy of system just after collision is $\frac{9}{40}mv^2$.

Answer: A

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5. Two wires of same radii and length are jointed together and pulled by horizontal force applied at the two ends. The first wire has young's modulus double that of the second wire and poisson's ratio half that of the second wire. Choose the correct the correct statements.

A. Both the wire have the same tension

B. The tension in wire 1 is 2F

C. The elongation of first wire is double that of the second wire

D. The change in radii of both the wire are equal.

Answer: A

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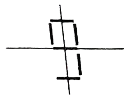
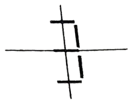
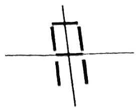
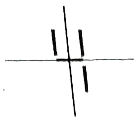
Physics, SECTION-1 (PART-B) [MATRIX TYPE]

1. On the left are statements about the locating of the center of mass of the objects depicted on the right. The objects on the right are symbols constructed out of sticks of equal length and mass. The location of the center of mass is described using the cooredinate system depicted in the sample.

Column I		Column II	
(A)	The center of mass is at $x > 0$ and $y = 0$	(P)	
(B)	The center of mass is at $x = 0$ and $y > 0$	(Q)	
(C)	The center of mass is at $x > 0$ and $y > 0$	(R)	
		(S)	

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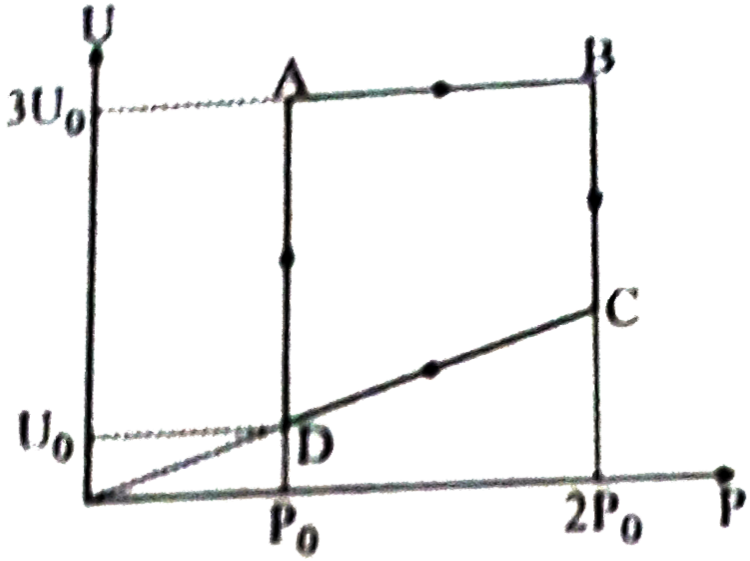
2. Consider the U (Internal energy) versus P (Pressure) graph shown. Find out the work by one mole of monoatonic ideal gas in each step. Take

$ln2 = 0.3010$



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Chemistry, SECTION-2 (PART-A) [SINGLE CORRECT CHOICE TYPE]

1. The value of K_p for the reaction $NH_2COONH_4(s) \Leftrightarrow 2NH_3(g) + CO_2(g)$ is $2.9 \times 10^{-5} atm^3$. The total pressure of gases at equilibrium when $NH_2COONH_4(s)$ is taken to start the reaction at the initial concentration of 1.0 mole is

A. 0.0620 atm.

B. 0.0310 atm.

C. 0.0582 atm.

D. 0.2610 atm.

Answer: C

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2. Correct rectivity order of molecular hydrogen, Nascent hydrogen and atomic hydrogen is :

H_2	$\rightarrow$	Molecular hydrogen
H	$\rightarrow$	Atomic hydrogen
$[H]$	$\rightarrow$	Nascent hydrogen

A. $[H] > H > H_2$

B. $H > [H] > H_2$

C. $[H] = H > H_2$

D. $[H] > H_2 > H$

Answer: B

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3. In the equilibrium, $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ the partial pressure of SO_2, O_2 and SO_3 are 0.662, 0.10 and 0.331 atm respectively. What should be the partial pressure of oxygen so that the equilibrium concentration of SO_2 and SO_3 are equal.

A. 0.4 atm

B. 1.0 atm

C. 0.8 atm

D. 0.25 atm

Answer: A

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4. Which of the following has least tendency to form nitride with nitrogen gas?

A. Mg

B. Ca

C. Ba

D. Al

Answer: C

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5. Which of the following will not give any colout to flame?

A. Be

B. Ca

C. Na

D. Li

Answer: B

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Chemistry SECTION-2 (PART-A) [PARAGRAPH TYPE]

1. The equilibrium equations and K_a values for three acids are given at $25^{\circ}C$:

$HA(aq) + H_2O \Leftrightarrow H_3O^+(aq) + A^-(aq), K_a = 2 \times 10^{-5}$

$HB(aq) + H_2O \Leftrightarrow H_3O^+(aq) + B^-(aq), K_a = 4 \times 10^{-6}$

$HC(aq) + H_2O \Leftrightarrow H_3O^+(aq) + C^-(aq), K_a = 1 \times 10^{-4}$

Which conjugate pair would be best for preparing a buffer with a $pH = 5.4$? $(\log 2 = 0.3)$

A. $HA + A^-$

B. $HB + B^-$

C. $HC + C^-$

D. $H_2O + H_3O^+$

Answer: B

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2. The equilibrium equations and K_a values for three acids are given at $25\,^\circ C$:

$$HA(aq) + H_2O \Leftrightarrow H_3O^+(aq) + A^-(aq), K_a = 2 \times 10^{-5}$$

$$HB(aq) + H_2O \Leftrightarrow H_3O^+(aq) + B^-(aq), K_a = 4 \times 10^{-6}$$

$$HC(aq) + H_2O \Leftrightarrow H_3O^+(aq) + C^-(aq), K_a = 1 \times 10^{-4}$$

The pH of 0.2 M aqueous HA solution is

A. 3.70

B. 2.70

C. 1.70

D. 2.35

Answer: B

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3. The equilibrium equations and K_a values for three acids are given at $25\,^\circ C$:

$HA(aq) \quad + \quad H_2O \Leftrightarrow H_3O^+(aq) \quad + \quad A^-(aq), K_a = 2 \times 10^{-5}$

$HB(aq) \quad + \quad H_2O \Leftrightarrow H_3O^+(aq) \quad + \quad B^-(aq), K_a = 4 \times 10^{-6}$

$HC(aq) \quad + \quad H_2O \Leftrightarrow H_3O^+(aq) \quad + \quad C^-(aq), K_a = 1 \times 10^{-4}$

The pH of 0.1 M aqueous NaC solution is (NaC is sodium salt of acid HC)

A. 2.5

B. 11.5

C. 9.5

D. 8.5

Answer: D

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Chemistry, SECTION-2 (PART-A) [REASONING TYPE]

1. Statement-1: pH of buffer solution always increases on increasing dilution.

Statement-2: pH of any acidic solution always increases on increasing dilution.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1 .

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement-1 is false, statement-2 is true.

Answer: D

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2. Statement-1: The hydrogen carbonates of the alkali metals are soluble in water, but are less soluble than the corresponding normal carbonates.

Statement-2: The hydrogen carbonates of the alkali metals have H-bonding.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1 .

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement-1 is false, statement-2 is true.

Answer: A

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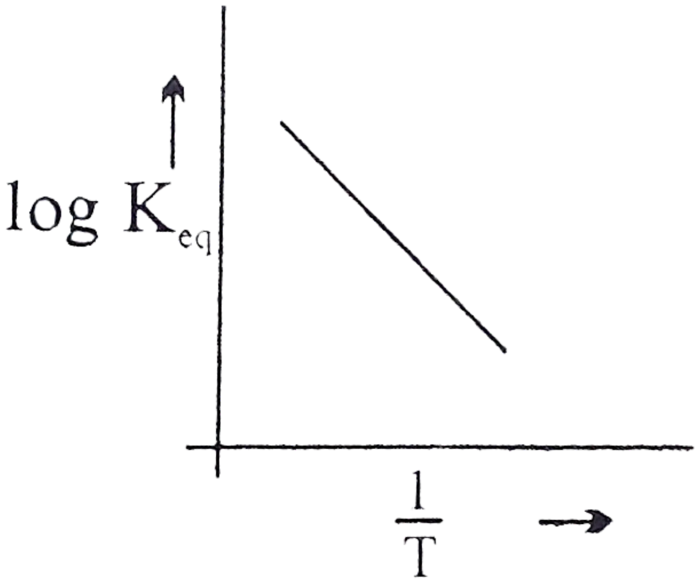
Chemistry, SECTION-2 (PART-A) [MULTIPLE CORRECT CHOICE TYPE]

1. For the reaction

$2ClF_3(g) \Leftrightarrow Cl_2(g) + 3F_2(g)$

$\log K_{eq} v/s \frac{l}{T}$ (where temperature is in K) curve is obtained as following

Which of the following change will increase the concentration of Cl_2 in an equilibrium mixture of $Cl_2, F_2 \& ClF_3$:



A. Addition of inert gas at constant pressure

B. Increase in temperature at constant volume

C. Addition of catalyst at equilibrium

D. Removal of $F_2(g)$ at equilibrim

Answer: B::D

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2. Which of the following statement/s is/are true:

A. In ortho hydrogen, both electrons spin in same direction whereas in para hydrogen, both electrons spin in opposite direction.

B. Solubility of NaCl in D_2O is less than in H_2O.

C. Although H_2O_2 is slightly acidic in nature, yet its aqueous solution is neutral towards litmus.

D. Ionisation energy of $H(g)$ is higher than ionisation energy of $Cl(g)$.

Answer: B::C::D

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3. The equilibrium constant for the ionization of $R - NH_2(g)$ in water as

$R - NH_2(g) + H_2O(l) \Leftrightarrow R - NH_3^+(aq) + OH^-(aq)$

is 10^{-6} at $25^\circ C$. Select write statement(s).

A. ph of solution 11 at $P_{RNH_2(g)} = 1$

B. forward reaction is favoured by addition of $HCl(aq)$

C. forward reaction is favoured by addition of $H_2O(l)$

D. forward reaction is favoured by addition of $RNH_2(g)$

Answer: A::B::C::D

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4. Which of the following undergoes partial hydrolysis?

A. B_2H_6

B. BCl_3

C. SiF_4

D. BF_3

Answer: C::D

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5. Which of the following is/are correct for group 14 elements?

A. The stability of dihalides are in the order $CX_2 < SiX_2 < GeX_2 < SnX_2 < PbX_2$

B. The ability to form $p\pi - p\pi$ multiple bonds among themselves increases down the group

C. The tendency for catenation decreases down the group

D. They all form oxides with the formula MO_2.

Answer: A::C::D

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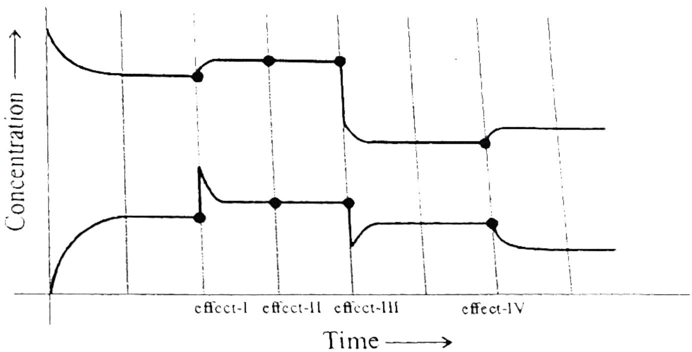
Chemistry, SECTION-2 (PART-B) [MATRIX TYPE]

1. For the given endothermic reaction

$A(g) \Leftrightarrow 2B(g)$

The variation in concentration due to different changes is plotted. In column II various changes are given and you are supposed to match the entries in column-I with possible changes the system have undergone.

Neglect the slope of change in concentration when system approaches equilibrium. Assume that changes are carried out very fast.



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Mathematics SECTION-3 (PART-A) [SINGLE CORRECT CHOICE TYPE]

1. If $\theta \in (0, 2\pi)$ then number of solution of equation

$$\frac{\sin^2 2\theta + 4\sin^4\theta - 4\sin^2\theta\cos^2\theta}{4 - \sin^2 2\theta - 4\sin^2\theta} = \frac{1}{9}, \text{ is//are}$$

A. 2

B. 3

C. 4

D. 0

Answer: A

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2. If Δ denotes area of triangle and P denotes the sum of the 3 sides of triangle then

A. $\Delta = \frac{P^2}{4}$

B. $\Delta \leq \frac{P^2}{12\sqrt{3}}$

C. $\Delta > \frac{P^2}{6\sqrt{3}}$

D. None of these

Answer: A

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3. If the lines $lx + y + 1 = 0, x + \text{my} + 1 = 0$ and $x + y + n = 0$ intersect at one point then the value of

$\frac{1}{1 - l} + \frac{1}{1 - m} + \frac{1}{1 - n}$ is (l,m, n are unequal).

A. 0

B. 1

C. 2

D. 3

Answer: A

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4. If $|\sin x| < 1$, then most general solution of the equation $3^{1+|\sin x|+|\sin x|+|\sin x|^3+\ldots\ldots\infty} = 9$ is given by

A. $n\pi + \frac{\pi}{6}, n \in I$

B. $n\pi + (-1)^n \frac{\pi}{6}, n \in I$

C. $n\pi + (-1)^{n+1} \frac{\pi}{6}, n \in I$

D. $n\pi \pm (\pi)(6), n \in I$

Answer: A

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5. The sum of all possible solution of trigonometric equation $2\sqrt{\cos^6\theta - \sin^6\theta} = \cos 2\theta + 1$ in interval $[\pi, 7\pi]$ is equal to

A. 7π

B. 14π

C. 28π

D. 42π

Answer: A

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Mathematics SECTION-3 (PART-A) [COMPREHENSION TYPE]

1. Consider a variable line L which passes through the point of intersection P of the lines $3x + 4y = 12$ and $x + 2y - 5 = 0$ meeting the coordinate axes at points A and B. Then

A. $3x + 4y = 4xy$

B. $3x + 4y = 3xy$

C. $4x + 3y = 4xy$

D. $4x + 3y = 3xy$

Answer: A

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2. Consider a variable line L which passes through the point of intersection P of the lines $3x + 4y = 12$ and $x + 2y - 5 = 0$ meeting the coordinate axes at points A and B. Then

A. $2\left(x^2 + y^2\right) - 3x - 4y = 0$

B. $2\left(x^2 + y^2\right) - 4x - 3y = 0$

C. $x^2 + y^2 - 2x - y = 0$

D. $x^2 + y^2 - x - 2y = 0$

Answer: A

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3. Consider a variable line L which passes through the point of intersection P of the lines $3x + 4y = 12$ and $x + 2y - 5 = 0$ meeting the coordinate axes at points A and B. Then

A. $3x + 4y + 6xy = 0$

B. $4x + 3y - 6xy = 0$

C. $3x + 4y - 6xy = 0$

D. $4x + 3y + 6xy = 0$

Answer: A

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Mathematics SECTION-3 (PART-A) [RESONING TYPE]

1. Statement-1: Each point on the line $7x - y = 0$ is equidistant from the lines

$4x + 3y - 1 = 0$ and $3x - 4y + 1 = 0$

Statement-2: The locus of point which is equidistant from 2 given lines $L_1 \equiv a_1x + b_1y + c_1 = 0$ and $L_2 \equiv a_2x + b_2y + c_2 = 0$ need not always be the angle bisector of 2 given lines.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1 .

B. Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement-1 is false, statement-2 is true.

Answer: A

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2. Consider the lines

$L : (k + 7)x - (k - 1)y - (k - 5) = 0$ where k is a parameter and the circle

$C : x^2 + y^2 + 4x12y - 60 = 0$

Statement-1: Every member of L inttersects the circle 'C" at an angle of 90°

Statement-2: Every member of L is tangent to the circle C.

A. Statement-1 is true, statement-2 is true, and statement-2 is correct explanation for statement-1 .

B. Statement-1 is true, statement-2 is true, and statement-2 is NOT the correct explanation for statement-1.

C. Statement-1 is true, statement-2 is false.

D. Statement-1 is false, statement-2 is true.

Answer: A

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Mathematics, SECTION-3 (PART-A) [MULTIPLE CORRECT CHOICE TYPE]

1. If $\theta \in (0, 2\pi)$ then number of solution of the equation $\cos^4 2\theta + 2\sin^2 2\theta = 17(\sin\theta + \cos\theta)^8$ is greater than of equal to

A. 2

B. 3

C. 4

D. 5

Answer: A

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2. Consider the circles

$S_1 : x^2 + y^2 - 4x - 6y - 12 = 0$

and $S_2 : x^2 + y^2 + 6x + 18y + 26 = 0$

then which of the following is (are) correct?

A. The circles S_1 and S_2 touches each other.

B. Number of common tangent(s) to S_1 and S_2 is 1.

C. The equation of radical axis of S_1 and S_2 is $5x + 12y + 19 = 0$.

D. Circle S_2 neither touches nor cuts the coordinate axes.

Answer: A

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3. Which of the following holds for a right angle triangle ABC?

A. Diameter of one of the ex-circles equals to the perimeter of the triangle.

B. Diameter of the circle circumscribing ΔABC equals to one of the sides of triangle.

C. $r : b + c : a = 2 : 17 : 13$

D. Diameter of incircle equals to length of the shortest tangent drawn from the vertices to the incircle

Answer: A

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4. A circle S_1 passes through the point $P(4, -3)$ and touches the circle $S_2 \equiv x^2 + y^2 - 10 = 0$ at the point

Q(3,1) on it. If (a,b) is the centre of the director circle of S_1, then the value of $\frac{a}{b}$ is less than

A. 2

B. 3

C. 4

D. 5

Answer: A

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5. In ΔABC, if m_a, m_b, m_c denote the lengths of the medians drawn to the sides a, b, c respectively and Δ is the area of the ΔABC with $a = 10, c = 6$ and $m_b = 7$then

A. $b = \sqrt{76}$

B. $\Delta = 15\sqrt{3}$

C. $m_a = \sqrt{76}$

D. $m_c = \sqrt{31}$

Answer: A

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Mathematics, SECTION-3 (PART-B) [MATRIX TYPE]

1. Match the following Column I to Column II

Column-I		Column-II	
(A)	If the straight line $ax + cy = 2b$ where $a, b, c > 0$ makes a triangle of area 2 square units with the co-ordinate axes, then the value of $\frac{b^2}{ac}$, is	(P)	0
		(Q)	1
(B)	If the acute angle bisector betweeen the lines $2x - y + 1 = 0$ and $x - 2y - 2 = 0$ is $a_1x + b_1y + 3 = 0$, then $(a_1 + b_1)$ is equal to	(R)	2
(C)	Given $A \equiv (1, 1)$ and AB is any line through it cutting the x-axis in B. If AC is perpendicular to AB and meets the y-axis in C, then the equation of locus of mid- point P of BC is $x + y = \lambda$, then the value of λ, is	(S)	3
		(T)	4

View Text Solution

2. Match the following Column I to Column II

Column-I		Column-II	
(A)	If the lines $2x - y + 4 = 0$ and $x + y + 5 = 0$ are along the longest chord of the same circle, and the circle passes through $(1, -2)$ then radius of circle equals	(P)	2
		(Q)	3
(B)	Square of the length of intercept made by the circle $2x^2 + 2y^2 - 4x + 1 = 0$ on x-axis equals	(R)	4
(C)	If the constant term of the binomial expansion $\left(2x - \frac{1}{x}\right)^n$ is -160, then n is equal to	(S)	6
(D)	The equation $ax^2 + 3xy - 3y^2 = 0$ represents a pair of perpendicular lines through origin then a equals	(T)	7

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Physics, SECTION-1 (PART-C)

1. A 30cm long metal rod expands by 0.0650cm when its temperature is raised from $0\,^{\circ}C$ to $100\,^{\circ}C$. A second rod of different metal and of the same length expands by 0.0350cm for the same rise in temperature. A third composite rod, also 30cm long, is made-up of pieses of each of the above metals placed end to end and expands by 0.0580cm when temperature is increased from $0\,^{\circ}C$ to $100\,^{\circ}C$. Find the length of the longer portion of the composite bar in cm at $0\,^{\circ}C$.

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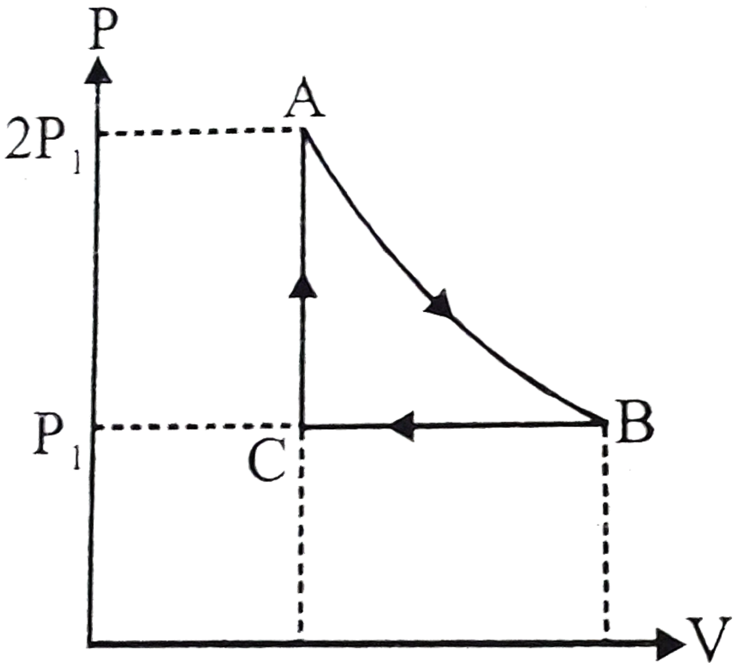
2. A steel rod at $25\,^{\circ}C$ is bolted at both ends and then cooled. By how many ^ ($\circ$)C should the rod be cooled so that it will rupture? Assume that till rupture, Hooke's law is obeyed.

$\left(\alpha_{\text{steel}} = 10 \times 10^{-6}/\,^{\circ}C, Y = 2 \times 10^{11} N/m^2 \text{ and } \sigma_b(\text{breaking stress of steel rod}) =\right.$

View Text Solution

3. One mole of an ideal gas undergoes a cyclic change as shown in figure. The process AB is isothermal. The pressure and volume at point C is 1 atmosphere and 22.4 litres respectively, the temperature at point B is (in K)



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4. A 20 kg car moving at a speed of $0.5 m/s$ to the right collides head on with a 35 kg car at rest. After cllision, the 35kg car is observed to move to the right with a speed of $0.2 m/s$. Find coefficient of restitution 'e' and fill 100e in the OMR sheet.

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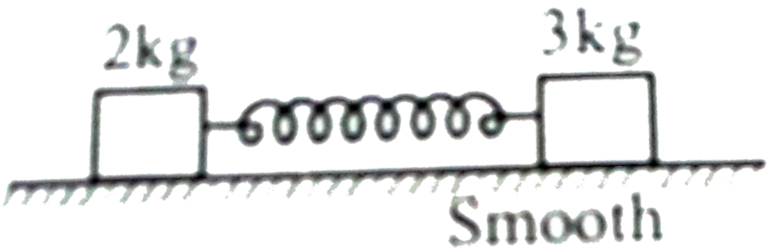
5. A 2kg mass and 3 kg mass are used to compress appoite ends of a spring $(k = 750 N/m)$ by a distance of 40 cm from natural length and released from rest. If the speeds of the two masses as they leave the spring v_2 and v_3, find $v_2 + v_3$(in m/s).



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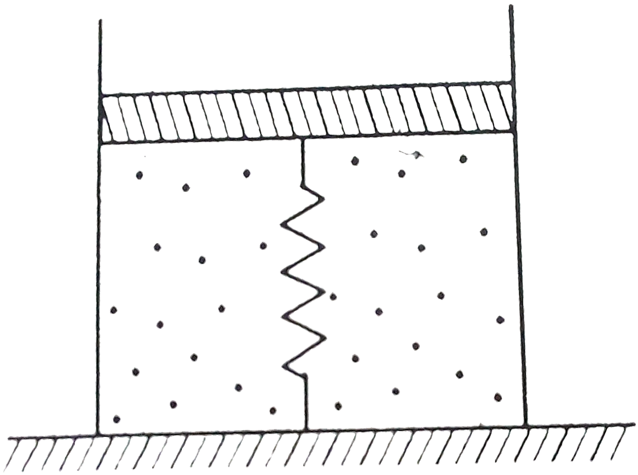
6. A gas is confined in the cylinder under a light piston which is connected to the bottom of the cylinder with a weightless spring as shown in figure, under pressure $p = 0.1$ MP a and temperature $T = 27^\circ C$. The initial pressure of the gas is equal to the external atmospheric pressure. To what temperature (in $^\circ C$) should we heat the gas to increase its volume to $n = 1.2$ times? If the gas under the piston is fully pumped out, the piston will reach the bottom of the vessel compressing the spring completely without touching the bottom.



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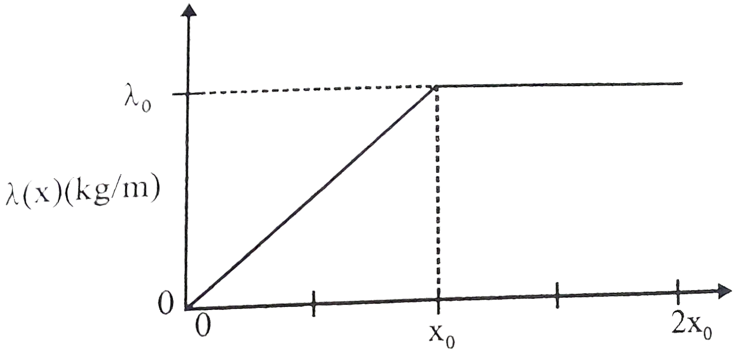
7. The linear mass density, $\lambda(x)$, for a one-dimensional object of length $2x_0$ is plotted in the graph. The location of the center of mass for this object is r_c from origin then $\frac{9r_c}{x_0}$ is ------------



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8. A tangential force 'F' is applied at the topmost point of a spherical shell of mass 'm' kept on a rough horizontal surface. If it rolls without slipping, it's acceleration is $\frac{6F}{xm}$ then $'x'$

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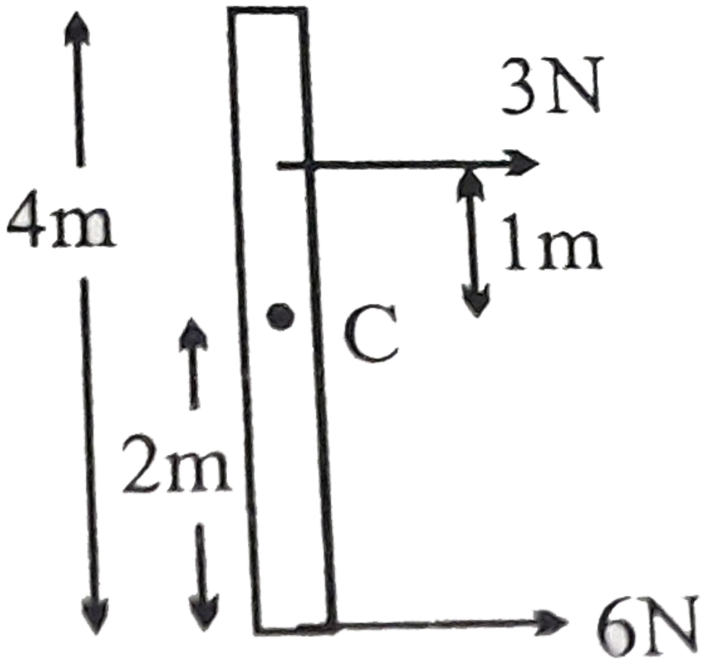
9. A rod of mass 1 kg is kept of frictionless table and is acted upon by 2 forces as shown. We want to replace these 2 forces by a single force so that the effect on the rod is the same. How far (in m) from the centre C of the rod should we apply the force ?



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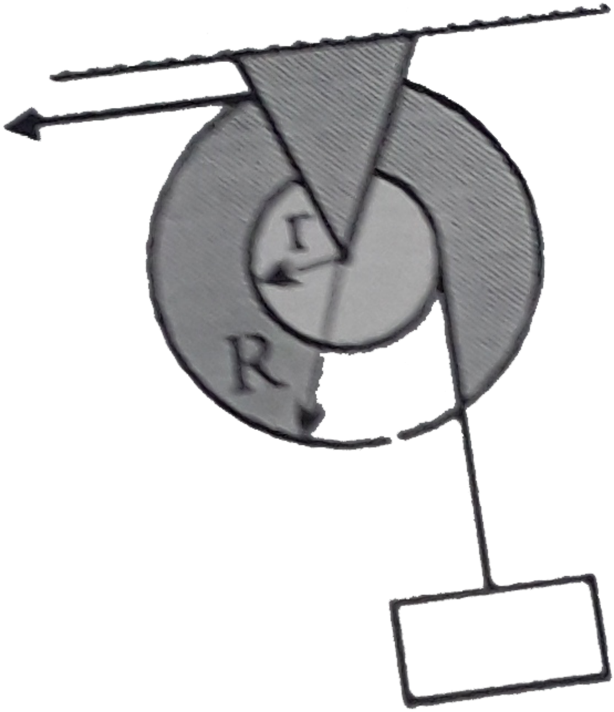
10. A yo-yo-shaped device mounted on a horizontal frictionless axis is used to lift a 30kg box as shown in figure. The outer radius R of the device is $0.50m$, an the radius r of the hub is $0.20m$. When a constant horizontal force of magnitude 152 N is applied in the left direction to a rope wrapped around the outside of the device, the box, which is suspended from a rope wrapped around the hub, has an upward acceleration of magnitude $0.80 m/s^2$. What is the rotational inertia I ("in" kg - m^2) of the device about its axis of rotation? Fill 10I in the OMR sheet.



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Chemistry, SECTION-2 (PART-C)

1. One mole of N_2 and 3.0 moles of PCl_5 were placedin a 100-liter vessel and heated to $227\,^{\circ}C$. The equilibrium pressure was $2.05\ \text{atm.}$ Assuming ideal behaviour, calculate X.

Where $X = 1000 \times K_P$ of the reaction at $227\,^{\circ}C$.

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2. $B(OH)_3(aq) + \text{ glycol } \top roductX.$

How many chelate rings are present in product X.

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3. What will be the pH of $4 \times 10^{-5}MA_2B$ solution which is assumed to be dissociated 75% in water.

[Given : $K_b(AHO) = 5 \times 10^{-9}$, H_2B is strng acid.]

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4. How many R_2SiCl_2 unit are required to the formation of single chain silicone having 10-Si-O-Si linkages.

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5. pH of a saturated solution of silver salt of monobasic acid HA is found to be 9.

Find the K_{sp} of sparingly soluble salt Ag A(s).

Given : $K_a(HA) = 10^{-10}$

Express your answer as a, b, c, d where $K_{sp} = a.b \times 10^{cd}$

[Written in scientific notation]

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6. Find out the total number of elements which produce hydrogen gas with $\text{dil/conc.}HNO_3$.

`Zn, Mg, Al, Cu, Zn, Sn, Mn,

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7. For the reaction $C_2H_6(g) \Leftrightarrow C_2H_4(g) + H_2(g), \Delta G^\circ = 22.38 KJmol^{-1}$ at $900K$. If pure C_2H_6 is passed over a suitable catalyst at a temperature of 900 K and a pressure of 1.0 atmosphere, then calculate X. Where $X = 100 \times$ mole percent of hydrogen present at equilibrium.

[Antilog`(1.299=0.05)]

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8. $Cl_2 + NaOH(\text{hot and conc.}) \rightarrow A + B$

Find the sum of oxidation state of Cl in A and B.

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9. A weak acid HA $(50.0 ml)$ was titrated against 0.1 M NaOH. The pH values when 20 ml & 40 ml base have been added are found to be 4.898 & 5.324 respectively. Calculate the pH of the solution at equivalence point. (Given :

$\log 8/3 = 0.426, \log 2 = 0.301, \log 15 = 1.176)$

Mark your answer in single digit to the nearest integral digit, say your answer is 7.213 then mark 0007 or if your answer is 12.567 then mark as 0013.

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10. (i) $PbO_2, H_2TiO_4, BaO_2, CrO_5, H_2S_2O_8, K_3CrO_8$

Total number of compounds having $\geq$ two peroxy linkages

If both H_2O and D_2O are electrolysed then D_2 Will be liberated at faster rate than, $H_2(b)$ is (If statement is true, write $b = 1$, If statement is false, write $b = 2$)

(iii) $Cr_2O_7^{-2} + H^+ + H_2O_2 \rightarrow CrO_5 + H_2O$

In this reaction, the magnitude of change in oxidation number of chromium is (c) Answer is ________

[Express your answer as abc i.e. if $a = 1, b = 2$ and $c = 3$ is then answer is 0123]

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Mathematics, SECTION-3 (PART-C)

1. If slope of one of the lines represented by $2x^2 + 2hxy + 3y^2 = 0$ is six times the slope of the other then find the value of $2|h|$.

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2. In triangle ABC, if $BC = 8$, $\angle B = 30^\circ$, $\angle C = 45^\circ$ and AD is altitude to to side BC. Assuming AD as diameter, a circle is drawn which cuts side AB and AC at P and Q respectively then find the value of $(PQ)^2$.

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3. The line $(a - 1)x + ay = 1$ intersects the curve $3x^2 + 4xy + 2y^2 = 1$ at points A and B. The circle on AB as diameter passes through the origin, then find the sum of all possible value of 'a'.

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4. Find the number of solution of the equation

$$\frac{2\sin\theta - \sin 3\theta}{1 + \cos\theta} + \frac{3\cos\theta + \cos 3\theta}{1 - \sin\theta} = 4\sqrt{2}\cos\left(\theta + \frac{\pi}{4}\right)$$

in the interval $(-10\pi, 8\pi]$.

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5. Let triangle ABC be an isosceles triangle with $AB = AC$. Suppose that the angle bisector of its angle B meets the side AC at a point D and that $BC = BD + AD$. Find angle A (in degrees).

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6. Right triangle ABC with right angle A has an area equal to its perimeter. If the incentre of the triangle ABC is I and IB is of length $\sqrt{13}$, find its area (in sq. units).

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7. If the equation of the circle throught the points of intersection of the circles $x^2 + y^2 - 4x - 6y - 12 = 0$ and $x^2 + y^2 + \text{Ax} + \text{By} + C = 0$ and intersecting the circle $x^2 + y^2 - 2x - 4 = 0$ orthogonally is $x^2 + y^2 + \text{Ax} + \text{By} + C = 0$, then find teh value of $(A + B + C)$.

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8. Suppose the line, L_1 has equation $10x - 12y = -17$. The line L_2intersect L_1 at $\left(\frac{1}{2}, \frac{11}{6}\right)$ and is perpendicular to L_1. Find the abscissa of the point on L_2 whose ordinate is `(1)/(30).

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9. A circle is inscribed in a right triangle ABC, right angled at C. The circle is tangent to the segment AB at D and length of segments AD and DB are 7 and 13 respectively. Find the area of triangle ABC.

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10. A variable line $lx + my = 1$ (where l and m are parameters) intersect a circle $x^2 + y^2 - 4x + 3 = 0$ at the points P and Q. The chord PQ subtends a right angle at the origin. If the locus of foot of perpendicular drawn from origin on the given variable lines is $\lambda x^2 + \mu y^2 - 4x + 3 = 0$, then find the value of $(\lambda + \mu)$.

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PHYSICS SECTION-1 Part-A (Single Correct choice Type)

1. The quantity that is the same for all six strings on a guitar is

A. the fundamental frequency

B. the fundametal wavelength

C. the speed of a wave on the string

D. all of the above

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2. Two wire of equal length, one of copper and the other of steel, are strecthed side by side by the same tension. So that they produce the same note, their diameters should bear a ratio.(ρ_{Cu}=8.9 gm/cc and ρ_{steel} =7.7 gm/cc)

A. $1.5:1$

B. $1.07:1$

C. $1:1.2$

D. $1.2:1$

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View Text Solution

3. Springs of spring constant K,3K,9K,27K,....243K are connected in series. A mass M is attached to the last spring and the system is allowed to make oscillation. The time period will be

A. $2\pi\sqrt{\frac{M}{K}}$

B. $2\pi\sqrt{\frac{3M}{2K}}$

C. $\frac{4\pi}{9}\sqrt{\frac{91M}{3K}}$

D. $2\pi\sqrt{\frac{4M}{3K}}$

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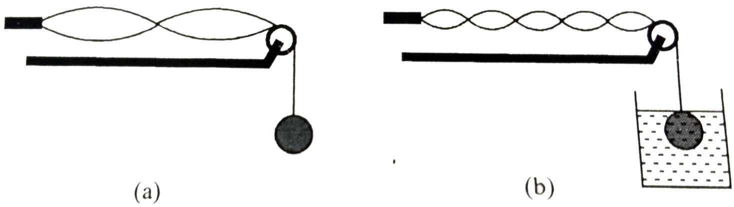
4. In example, by immersing the hanging sphere in water, the buoyand force changes the tension the in the string so that the string vibrates in its fifth harmonic. Suppose you would like to make the string vibrate in its first harmonic. Instead of immersing the sphere in water, you should .

(Assuming vibrator frequency remains the same)



(a) (b)

A. double the mass of the hanging sphere

B. triple the mass of the hanging sphere

C. quadruple the mass of the hanging sphere

D. increase the mass of the hanging sphere by a factor of eight

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5. A tennis ball receives a top spin when struck by a racket and describes a curved trajectory. The top spin implies that the rotatory motion of the top surface of tha ball is in the direction of the translatory motion of the ball. Which one of the following statement is the best description of the trajectory ?

A. Pressure on the top surface is lower, trajectory rises

B. Pressure on the top surface is lower, trajectory dips

C. Pressure on the top surface is higher, trajectory rises

D. Pressure on the top surface is higher, trajectory dips

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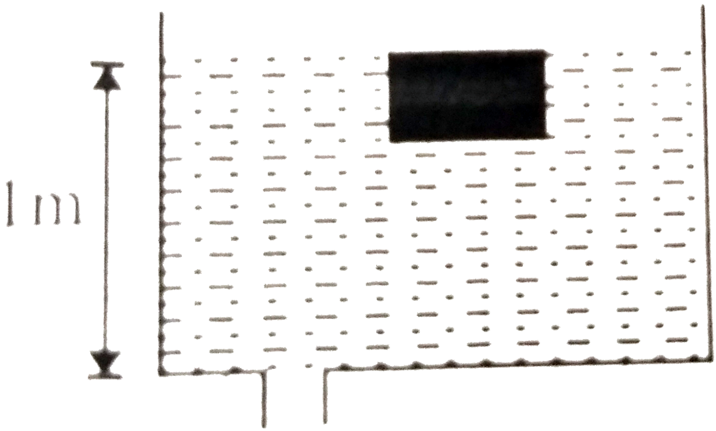
PHYSICS SECTION-1 Part-A (Comprehension type)

1. A contianer of crosss-sectional area A is filled with water upto the height 1.0 m. The container is fixed and the free surface of water is open to the atmosphere. A block of density double the density of water is released from the surface of water as shown in the figure. A small orifice of area a $= \frac{A}{10}$ is made at the bottom of the container.

The time t_1 taken by the block to reach the bottom of the container is



A. $\sqrt{0.16}$sec

B. $\sqrt{0.2}$sec

C. $\sqrt{0.4}$sec

D. $\sqrt{0.8}$sec

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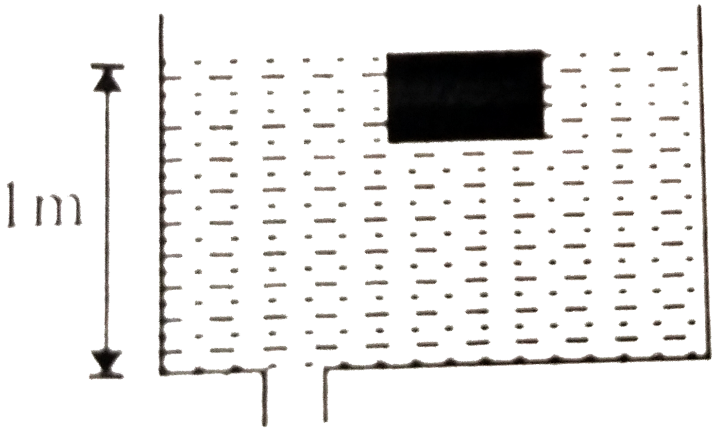
2. A contianer of crosss-sectional area A is filled with water upto the height 1.0 m. The container is fixed and the free surface of water is open to the atmosphere. A block of density double the density of water is released from the surface of water as shown in the figure. A small orifice of area a $= \frac{A}{10}$ is made at the bottom of the container.

The time taken by water level to decreases its height to 0.5 m approximately is



A. $0.1\sqrt{5}$sec

B. $0.2\sqrt{5}$sec

C. $0.6\sqrt{5}$sec

D. $0.8\sqrt{5}$

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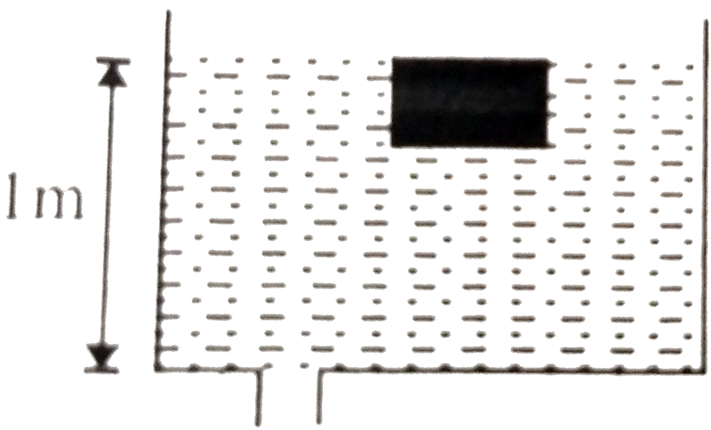
3. A contianer of crosss-sectional area A is filled with water upto the height 1.0 m. The container is fixed and the free surface of water is open to the atmosphere. A block of density double the density of water is released from the surface of water as shown in the figure. A small orifice of area a $= \frac{A}{10}$ is made at the bottom of the container.

The acceleration of block in the water is [Take g=$10ms^{-2}$]



A. $5ms^{-1}$

B. $10ms^{-1}$

C. $\frac{5}{4}ms^{-2}$

D. $\frac{5}{2}ms^{-2}$

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PHYSICS SECTION-1 Part-A (Reasoning type)

1. Statement-1 :When we dip our hands in a beaker filled partially with water, the force on bottom of beaker increases.

Statement-2: The liquid level increases.

A. Statement-1 is true, statement-2 is true and statement-2 is corretct explanation for statement-1

B. Statement-1 is true, statement-2 is true and statement-2 is NOT correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

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PHYSICS SECTION-1 Part-A (Multiple Correct Choice type)

1. Which of the following , taken by itself, would be decreasing the rate at which energy is transferred by a way travelling along a straight ?

A. reducing the linear mass density of the string by one half

B. double the wavelength of the wave

C. doubling the tension in the string.

D. doubling the amplitude of the wave.

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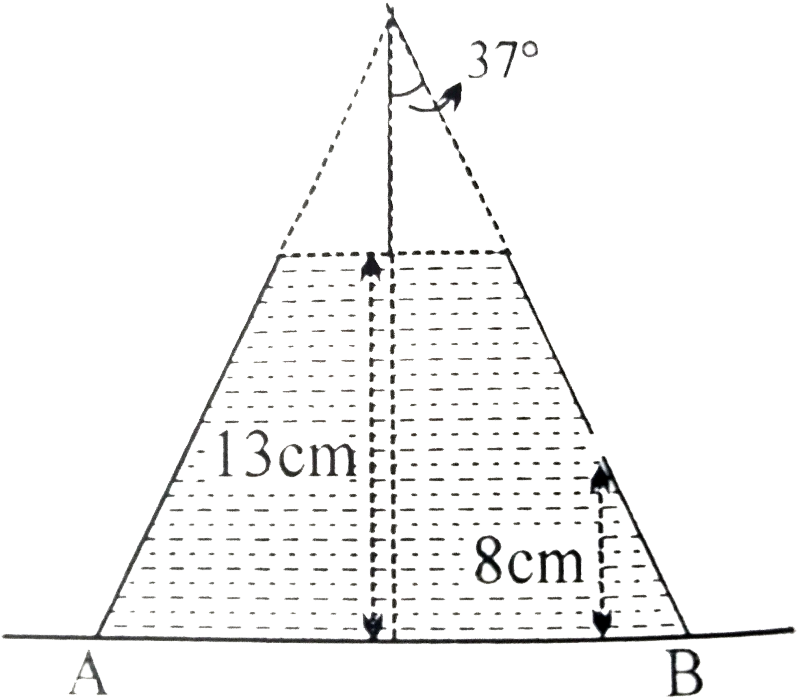
2. Curved surface of a vessel has shape of a truncated cone having semi vertex angle 37°. Vessel is full of water (density $\rho = 1000 kg/m^3$)upto a height of 13 cm and is placed on a smooth horizontal plane. Upper surface is opened to atmosphere. A hole of $1.5 cm^2$ is made on curved wall at a height of 8 cm from bottom as shown in figure. Area of water surface in the vessel is large as compared to the area of hole.



A. Initial velocity of efflux is 1m/sec

B. Initial horizontal range of water jet from point B is 6.65 cm

C. Horizontal force required to keep the vessel in static equilibrium is

0.15 N.

D. Horizontal force required to keep the vessel in static equilibrium is

0.12 N.

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3. A closed organ pipe of length 28 cm closed at one end is found to be at resonance when a tuning fork of frequency 850Hz is sounded near the open end. If velocity of sound in air is 340 m/s, then the

A. air in the pipe is vibrating in fundamental mode

B. air in the pipe is vibrating in first overtone

C. end correction of the pipe is 1cm

D. end correction of the pipe is 2cm.

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4. A particle performing S.H.M . Undergoes displacement A/2 (where A= amplitude of S.H.M.) in one second. At t=0 the particle was located at either extreme position or mean position. The time period of S.H.M. can be :(consider all possible cases)

A. 12s

B. 2.4 s

C. 6 s

D. 1.2s

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5. Three objects A, B and C all individually float on top of waater. A and B have identical masses and densities but different shapes while B and C have identical sizes and shapes but C has less mass and density than B. If three identical weights are then tied to the objects and all three are pulled completely beneath the surface of the water, which object will displace the greatest volume of water. ?

A. object A and C only

B. object B and C only

C. object A and B only

D. All three displace equal volumes of water.

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PHYSICS SECTION-1 Part-B [Matrix Types]

1. A particle having nonzero initial velocity is subjected to different kinds of resultant forces as mentioned in each situation of column-I. The resulting motion is mentioned in column-II. Match the condition on particle in each situation of column-I with the corresponding resulats that may be possible as given in column-II

	Column-I		Column-II
(A)	Under action of constant force	(P)	The particle may reach its initial position again after some time
		(Q)	The particle may not reach its initial position again
(B)	Under action of force of constant magnitude such that speed of particle remains constant	(R)	The particle may undergo simple harmonic motion
(C)	Under action of force which is always directed towards a fixed point in space	(S)	The particle may undergo periodic motion which is not SHM (simple harmonic motion)

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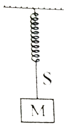
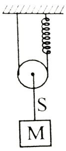
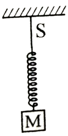
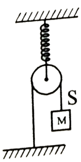
2. In the following four solution, mass M of 1kg is kept in equilibrium , K=100 N/m is all cases. What speed can be given to mass M vertically so that inextensible string S does not becomes slack in subsequent motion. Consider that pulley is ideal and string is massless. :

Column-I	Column-II
(A)  (the block is attached to spring by an inextensible thread)	(P) $1\ ms^{-1}$
(B) 	(Q) $0.5\ ms^{-1}$
(C)  (1 kg block is attached to the spring)	(R) $0.25\ ms^{-1}$
(D) 	(S) $2\ ms^{-1}$

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CHEMISTRY SECTION-2 Part-A (single correct choice type)

1. Combustion of sucrose is used by aerobic organisms for providing energy for the life sustaining process. If all the capturing of energy from the reaction is done through electrical process (non P-V work), then calculate, maximum available energy which can be captured by combustion of 34.2 g of sucrose :

(Given : $\Delta H_{\text{combustion}}(\text{sucrose}) = -6000 kJmol^{-1}$

$\Delta S_{\text{combustion}} = 180 j/K - mol$ and bodyntemperature is 300 K)

A. 60 kJ

B. 59.46 kJ

C. 0.54 kJ

D. 60.54kJ

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2. Lattice energy of Na_2CO_3 is -205 kJ/mole and hydration energy of Na^+ ion & CO_3^{2-} ion are -80kJ/mole and -40kJ/mole respectively. What can be predicted about solubility of Na_2CO_3 in water from the above data.

A. The solubility of Na_2CO_3 will increase will increase in temperature

B. The solubility of Na_2CO_3 will decrease with increase in temperature

C. The solubility of Na_2CO_3 will remain constant.

D.

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3. The enthalpy of solution, of sodium and sodium oxide in large volume of water , are -184 and -238 kJ/mol, respectively . If the enthalpy of formation of water is -286 kJ/ mol, then what is the enthalpy of formation of sodium oxide ? All the enthalpies are at 298 K and 1 bar pressure. [Given: REaction involved are

$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

$Na_2O(s) + H_2O\Big)(l) \rightarrow 2NaOH(aq)]$

A. $+54kJ/mol$

B. $-130kJ/mol$

C. $-416kJ/mol$

D. $+156kJ/mol$

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4. Calculate enthalpy change for the reaction

$C(\text{ dim } ond) + O_2(g) \rightarrow CO_2(g)$

Given: Energy required to break C-C bond in diamond is 350 kJ mol^{-1}

$\Delta H^{\circ}_{f,O(g)} = 250kJmol^{-1}$

$\Delta H^{\circ}_{\text{atomisation,CO\_(2)(g)}} = 1500kJmol^{-1}$

A. $-300kJmol^{-1}$

B. $-390 kJmol^{-1}$

C. $-400 kJmol^{-1}$

D. $-350 kJmol^{-1}$

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5. A certain mass of an ideal gas is expanded from (1L, 10 bar) to (4L,5bar) against a constant external pressure of 1 bar. If initial temperature of gas is 300 K and the heat capacity of process is $50J/\,^{\circ}C$. Then the enthalpy change during the process is :

A. $\Delta H = 14.7KJ$

B. $\Delta H = 15.7KJ$

C. $\Delta H = 14KJ$

D. $\Delta H = 0$

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CHEMISTRY SECTION-2 Part-A (paragraph type)

1. Entropy change for reversible phase transition at contant pressur 'P' and temperature 'T' is calculated by the formula$\Delta S = \frac{\Delta H}{T}$, where ΔH is the enthalpy change for phase transition. For irreversible phase transition$\Delta S > \frac{\Delta H}{T}$.

Cosider a phase transition

$\text{Sn(white, s)} \Leftrightarrow Sn(\text{gray, s})$

ΔH° at $1 atm \& 300K = -2kJmol^{-1}$.

The equilibrium temperature at 1 atm is 400 K.

Assume $C_{p,m}$ of Sn (white, s) and Sn (gray, s) are equal.

ΔG° for above phase transition at 1 atm and 300 K is

A. $-500Jmol^{-1}$

B. $-500kJmol^{-1}$

C. 0

D. $-100 Jmol^{-1}$

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CHEMISTRY SECTION-2 Part-A (Reasoning type)

1. Statement-1:It is impossible for a system to undergo a cyclic process whose sole effects are flow of heat into the system from a hot reservior and perform and equivalent amount of work by the system on the surroundin.

Statement-2 : First law of thermodynamics is invalid for a cyclic process.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement -1

B. Statement-1 is true, statement-2 is true and statement-2 is correct NOT explanation for statement -1

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

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2. Statement-1 : $\Delta_f H^{\circ}_{400K}$ is zero for $O_2(g)$

Statement-2 : $\Delta_f H^{\circ}_{298K}$ is zero for $O(g)$.

A. Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement -2

B. Statement-1 is true, statement-2 is true and statement-2 is correct NOT explanation for statement -2

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

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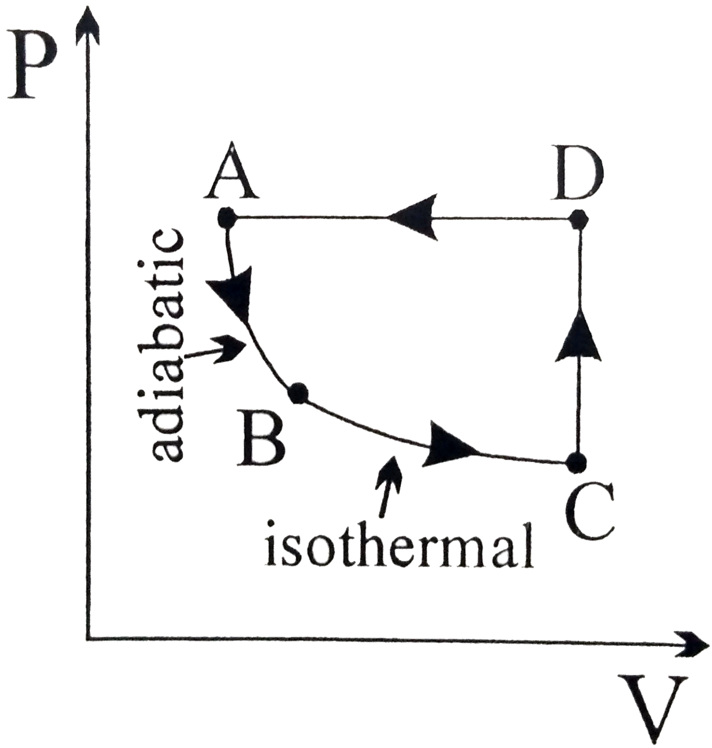
CHEMISTRY SECTION-2 Part-A (Multiple correct choice type)

1. 1 mole of an ideal gas , [$\gamma = 1.5$], are taken through a series of process.



Information-I	The tempearature at state'A' is 300K
Information-II	The reversible isothermal expansion form B to C doubles the volu
Information-III	The entropy change of the system from C to D is 4 ln 16 Cal/K.

Select the correct option(s) using above information.

A. The entropy change of the system from D to A is =3R ln 8

B. The temperature at point D is 2400 K

C. The work done from A to B is -600 Cal.

D. The work done from B to C is -300 ln 2 Cal.

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2. Which of the following represent(s) $\Delta H^{\circ}_{\text{atomization}, H_2O(s)}$?

A. $\Delta H^{\circ}_{\text{sublimation}, H_2O(s)} + 2\Delta H^{\circ}_{BE, O-H}$

B. $\Delta H^{\circ}_{\text{fusion}, H_2O(s)} + \Delta H^{\circ}_{\text{vapourisation} H_2O(l)}$

C. $-\Delta H^{\circ}_{\text{formation}, H_2O(s)} + \Delta^{\circ}_{BE, H-H} + \dfrac{\Delta H^{\circ}_{BE, O=O}}{2}$

D. $\Delta H^{\circ}_{\text{fusion}, H_2O(s)} + \Delta H^{\circ}_{\text{atomisation} H_2O(l)}$

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3. Consider the following set of reactions:

$CHCl_2COOH + NaOH \rightarrow CHCl_2COONa + H_2O \quad \Delta H_1 = -12830 Cal$

$HCl + NaOH \rightarrow NaCl \rightarrow NaCl + H_2O \quad \Delta H_2 = -13680 Cal.$

$NH_4OH + HCl \rightarrow NH_4Cl + H_2O \quad \Delta H_3 = -12270 Cal.$

Select the correct option(s) :

A. Enthalpy of neutralization of $CHCl_2COOH$ by NH_4OH is $-11420 Cal.$

B. Enthalpy of dissociation of $NH_4OH = 1410 Cal$

C. Enthalpy of dissociatiion of $NH_4OH = 1410 Cal.$

D. Enthalpy change for the reaction $H_2O \rightarrow H^+ + OH^- is - 13680 Cal$

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4. Which of the following statement(s) is / are correct

A. The internal energy of an ideal gas may be increased by adding more molecules to it, at constant temperature.

B. The molar enthalpy of any substance decrease on cooling , at constant pressure.

C. A diabatic free expansion & isothermal free expansion are similar processs for an ideal gas .

D. It is possible to have a process in which the entropy of an isolated system is decreased. .

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5. For adiabatic free expansion of a real gas, the correct relation are :

A. W=0

B. q=0

C. $\Delta U = 0$

D. $\Delta T = 0$

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CHEMISTRY SECTION-2 Part-B (Matrix type)

1. Match the following Column I to Column II

	Column I		Column II (ΔH_r is also known as)
(A)	C (graphite) + O_2 (g) $\longrightarrow$ CO_2 (g)	(P)	$\Delta H^o_{formation}$
(B)	C (graphite) $\longrightarrow$ C (gas)	(Q)	$\Delta H^o_{Combustion}$
(C)	$CH_3COOH(aq) + OH^-(aq) \rightarrow CH_3COO^-(aq) + H_2O(l)$	(R)	$\Delta H^o_{Atomization}$
		(S)	$\Delta H^o_{Neutralization}$

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2. Match the following Column I to Column II

	Column-I		Column-II
(A)	Cyclic process involving atleast two different path.	(P)	$\Delta H = 0$ and $\Delta U = 0$
(B)	Reversible isothermal process	(Q)	$q = -W$
(C)	Reversible adiabatic process	(R)	$\Delta U = q$
(D)	Isochoric process	(S)	$dH = VdP$
		(T)	$q = 0$

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MATHS SECTION-3 Part-A [single correct choice type]

1. If $f: R \rightarrow R$ satisfies f(x+y)=f(x)+f(y), for all x, y $\in$ R and f(1)=7, then $\sum_{r=1}^{n} f(r)$ is

A. $\frac{7n}{2}$

B. $\frac{7(n+1)}{2}$

C. $7n(n+1)$

D. $\frac{7n(n+1)}{2}$

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2. In the expansion of $\left(7^{\frac{1}{3}} + 11^{\frac{1}{9}}\right)^{6561}$, the number of terms free from radicals is:

A. 725

B. 730

C. 731

D. none

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3. Number of ways in which 5 alike red bottles and 6 alike blue bottles can be arranged so that exactly two pairs of blue togther, is

A. $6! \times 5! \times 2!$

B. ${}^{6}C_{4} \times 2!$

C. $\dfrac{6!}{2!2!}$

D. $\dfrac{6!}{2!2!2!}$

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4. Evaluate $\sum_{i=0}^{n} \sum_{j=0}^{n} {}^{n}C_{j} \cdot {}^{j}C_{i}, i \leq j$.

A. 4

B. 3

C. 2

D. None

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5. Fifteen sudents $S_1, S_2, S_3, \ldots . S_{15}$

participate in quiz competition. The number of ways in which they can be grouped into 5 teams of 3 each such that S_1 and S_2 are in different teams is equal to

A. $\frac{13!}{(3!)^4 4!}$

B. $\frac{14!}{(3!)^4 4!}$

C. $\frac{6(13!)}{(3!)^4 4!}$

D. none

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MATHS SECTION-3 Part-A [comprehension type]

1. Let $f(x) = x^2 - 2x - 1 \forall x \in R, Let f, (-\infty, a] \rightarrow [b, \infty)$, where 'a' is the largest real number for which f(x) is bijective.

The value of (a+b) is equal to

A. -2

B. -1

C. 0

D. 1

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2. Let $f(x) = x^2 - 2x - 1 \forall \xi n R$ Let $f: (-\infty, a] \to [b, \infty)$, where a is the largest real number for which f(x) is bijective. If $f: R \to R$, $g(x) = f(x) + 3x - 1$, then the least value of function $y = g(|x|)$ is

A. $-9/4$

B. $-5/4$

C. -2

D. -1

3. Let $f(x) = x^2 - 2x - 1 \forall x \in R, Let f, (-\infty, a] \to [b, \infty)$, where 'a' is the largest real number for which f(x) is bijective.

The value of (a+b) is equal to

A. $1 + \sqrt{x + 2}$

B. $1 - \sqrt{x + 3}$

C. $1 - \sqrt{x + 2}$

D. $1 + \sqrt{x + 3}$

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MATHS SECTION-3 Part-A [Reasoning type]

1. Statement-1: $11^{25} + 12^{25}$ when divided by 23 leaves the remainder zero.Statement-2: $(a + b)^n$ is divisible by $(a + b)$ for all values of $n \varepsilon$N

A. Statement-1 is true, statement -2 is true and statement -2 is correct explantion for statement-1.

B. Statement-1 is true, statement -2 is true and statement -2 is NOT correct explantion for statement-1.

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

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2. Let f: defined from

$(1/4, \infty) \rightarrow R^+ as, f(x) = \log_{1/4}\left(x - \frac{1}{4}\right) + \frac{1}{2}\log_4\left(16x^2 - 8x + 1\right)$

Statement-1: f(x) is neither injective nor surjective .

Statement-1: f(x) is a constant function.

A. Statement-1 is true, statement -2 is true and statement -2 is correct explantion for statement-1.

B. Statement-1 is true, statement -2 is true and statement -2 is NOT correct explantion for statement-1.

C. Statement-1 is true, statement-2 is false

D. Statement-1 is false, statement-2 is true

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MATHS SECTION-3 Part-A [Multiple correct choice type]

1. Which of the following functions have the same period ?

A. $f(x) = \sin^2(x) + \cos^4 x + 2$

B. $g(x) = \dfrac{1}{f(\sin x)} + \dfrac{1}{f(\cos x)}$ where $f(x) = \dfrac{1}{\sqrt{1 - x^2}}$

C. $h(x) = \dfrac{|\sin x| + |\cos x|}{|\sin x - \cos x|}$

D. $k(x) = \cos(\cos x) + \cos(\sin x)$

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2. Let $g(x) = ax + b$, where $a < 0$ and g is defined from [1,3] onto [0,2] then the value of $\cot\left(\cos^{-1}(|\sin x| + |\cos x|) + \sin^{-1}(-|\cos x| - |\sin x|)\right)$ is equal to :

A. $g(1)$

B. $g(2)$

C. $g(3)$

D. $g(1) + g(3)$

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3. Let $N = (1!)^3 + (2!)^3 + (4!)^3 + (8!)^3 + \ldots.$ upto 20 terms, then

A. digit at unit's place is 3

B. digit at thousand's place is 5.

C. digit at ten's place is 3

D. digit at thousand's place is 6

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4. If the middel term of $\left(x + \frac{1}{x}\sin x\right)^{12}$ is $\frac{6237}{16}$ then the value of $\sin^{-1}(\sin x)$ is (are)

A. $\frac{-\pi}{4}$

B. $\frac{-\pi}{3}$

C. $\frac{\pi}{4}$

D. $\frac{\pi}{3}$

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5. Suppose that f is an even function, g is an odd function and both f and g are defined on the entire real line R. Which of the following wherever defined are odd function ?

A. fof

B. gog

C. $\frac{f}{g}$

D. gof

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MATHS SECTION-3 Part-B[Matrix type]

1. Match the following Column I to Column II

	Column I		Column II
(A)	The sum of the coefficients in the expansion of $\left(\frac{1}{3} - 15x - 15x^3\right)^{2011}(17x - 17x^5 + 3)^{2012}$ is	(P)	2
(B)	If the value of the rational function $f(x) = \frac{x^2 - 3x + 4}{x - 3}$ can not lie in the interval (a_1, a_2), x being real, then the value of $(a_1 - a_2)$ is divisible by	(Q)	3
(C)	If the constant term of the binomial expansion $\left(2x - \frac{1}{x}\right)^n$ is -160, then n is equal to	(R)	4
		(S)	6

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2. Match the following Column I to Column II

	Column-I		Column-II
(A)	$f(x)=\sin(\sin^{-1}2x)+\operatorname{cosec}(\operatorname{cosec}^{-1}2x)+\tan(\tan^{-1}2x)$	(P)	odd function
(B)	$g(x)=\sin^{-1}\{x\}$, where $\{x\}$ denotes fractional part function	(Q)	injective mapping
(C)	$h(x)=\frac{2}{\pi}\operatorname{cosec}^{-1}(\operatorname{sgn} x)$	(R)	*range contains two integer only*
(D)	$k(x)=\cos^{-1}(\lvert \sin x+\cos x\rvert)$	(S)	aperiodic

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PHYSICS SECTION-1 Part-C (Integer Type)

1. A steel wire is rigidly fixed at both ends its length mass and cross sectional area are 1m, 0.1 kg and $10^6 m^2$ respectively then the temperature of the wire is lowered by $20\,^\circ C$ if the transverse waves are setup by plucking the wire at 0.25m from one end and assuming that wire vibrates with minimum number of loops possible for such a case. Find the frequency of vibration (in Hz). [coefficient of linear expansion of steel $=1.21\times 10^{-6}/.\,^\circ C$ and young's modulus $=2\times 10^{11}/N/m^2$]

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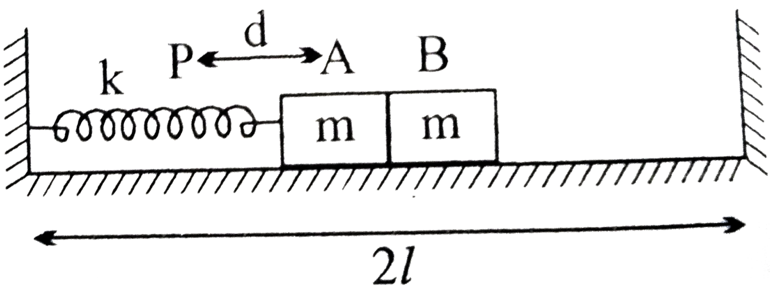
2. Two small blocks A and B of sam mass m are placed at the mid point of a smooth horizontal track of length 2l as shown. A massless spring of force constant k and free length l is touching the block A but is not attached to it. The block A is displaced towards left by a small distance d=AP thereby causing a compression in the spring. The block is then let free to move. The minimum time after colliding with B the block A again reaches its starting position is "πT" milli second. Find 'T' (Assume elastic collision)

Take m=1k and K=100N/m, l=πcm, d=1 cm.



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3. A string of length 75 cm is stretched between two fixed supports. It is found that standing waves may be excited at frequencies of 315 Hz and 420Hz, but at no frequencies in between. What is the lowest frequency at which a standing wave may be excited in this string ?

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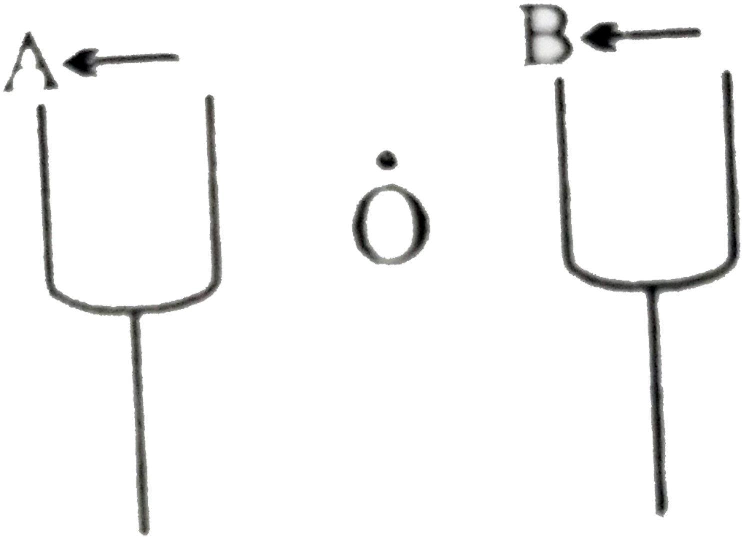
4. Two tuning fork A and B each of natural frequency 85 Hz move with velocity 10m/s relative to stationary observer 'O'. Fork A moves away from the observer while the fork B moves towards him as shown in the figure. A wind with a speed 10 m/s is blowing in the direction of motion of fork A. Find the heat frequency measured by teh observer in Hz. [Take speed of sound in air as 340 m/s]



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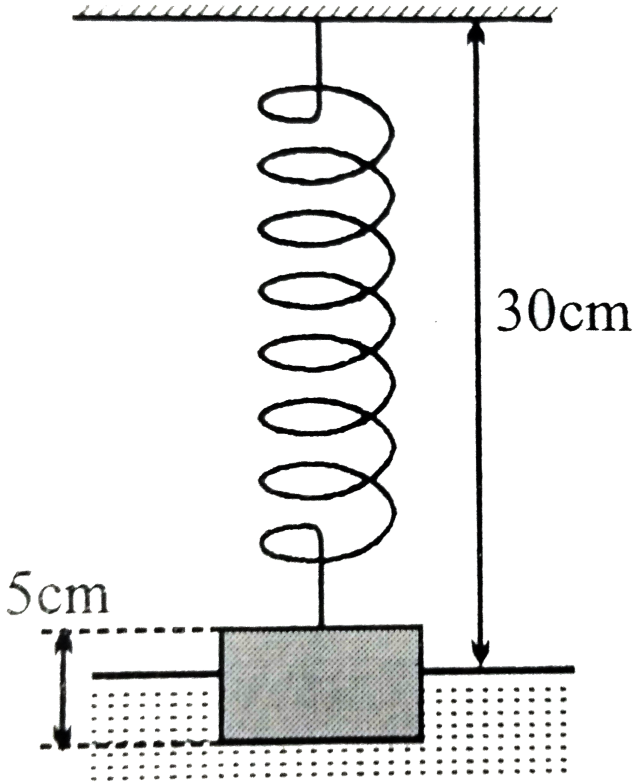
5. The original length of a spring is 25 cm. It elongates 2 cm if a force of 0.96 N is exerted on it. A container is filled with water and one end of the spring is fixed 30 cm above the surface of the water in the container. A wooden block of mass 32 g and of density $0.4 g/cm^3$ is hanged onto the other hand end of the spring. The height of the block is 5 cm. To what depth (in mm) does the block sink into the water ?



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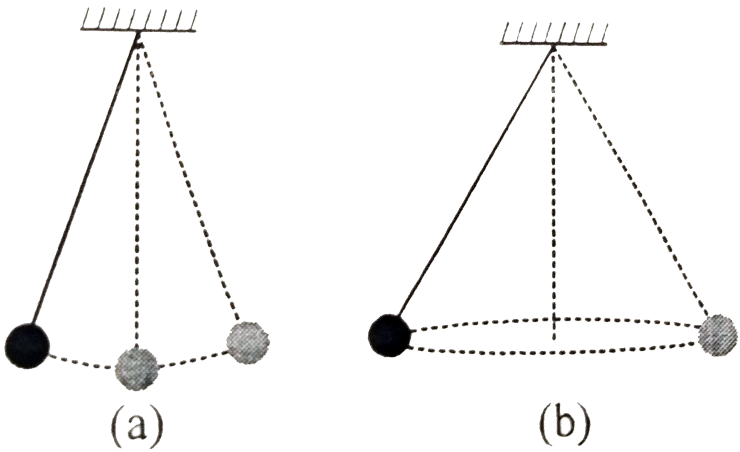
6. A small bead with mass M is attached to a very light string hung from a ceiling. The bead on the string may ocsillalte harmonically (with small angular amplitude) with a period 2 sec [Fig.(a)]. A student decide to perform another experiment . He takes the attached bead aside from its

equilibrium and pushes it horizontally in such a way that the bead revolves in a horizontal plane [fig. (b)]. The string breaks if tension in it exceeds teh value of 4Mg where g is acceleration due to gravity. What is the minimum time (in sec) of one revolution of the bead now ?



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7. Two particles P_1 and P_2 are performing SHM along the same line about the same meabn position , initial they are at their position exterm position. If the time period of each particle is 12 sec and the difference of their amplitude is $12cm$ then find the minimum time after which the seopration between the particle becomes $6cm$

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8. A block of wood is floating in water such that $1/2$ of it is submerged in water when the same block is floated in alcohol, $1/3^{rd}$ of it's volume is submerged Now a mixture of water and alcohol is made taking equal volume of both and block is floated in it. What is the % of it's volume that is now submerged?

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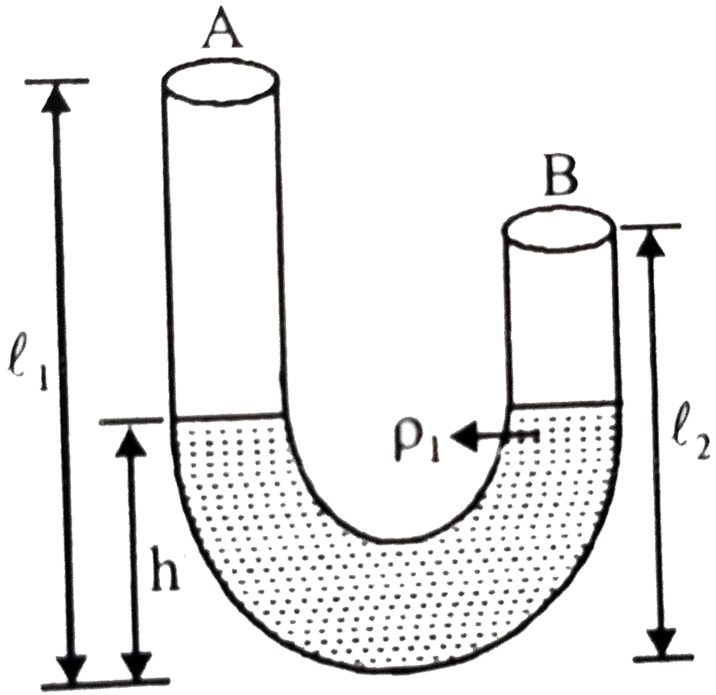
9. A U-tube having uniform cross-section but unequal arm length $l_1 = 100cm$ and $l_2 = 50cm$ has same liquid of density ρ_1 filled in it upto a height h=30 cm as shown in figure. Another liquid of density $\rho_2 = \rho_1/2$ is poured in arm A. BOth liquids are immiscible. What length of the second liquid (in cm) should be poured in A so that second overtone of A is in

unison with fundamental tone of B. (Neglect end correction)



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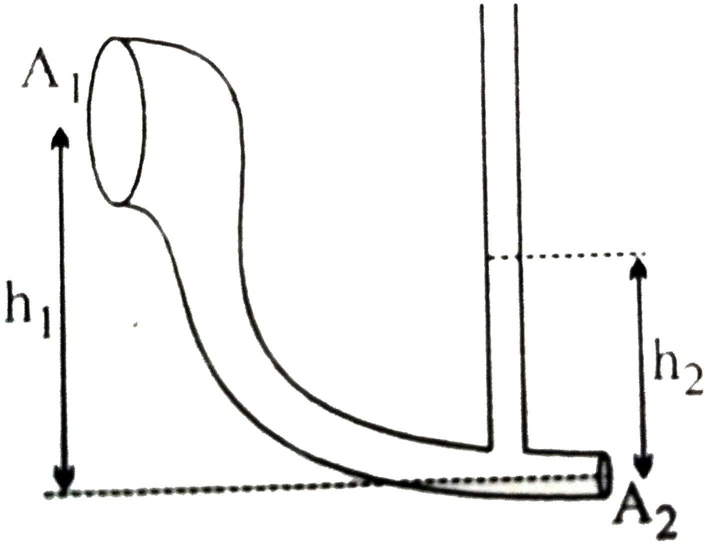
10. A horizontal pipe of cross-sectional area A_1 is joined to a lower pipe of cross-sectional area A_2. The entire pipe is full of liquid with density ρ , and the left end is at atmospheric pressure P_0. A small open tube extends upwards from the lower pipe is closed , $h_1 = kh_2$. Find k



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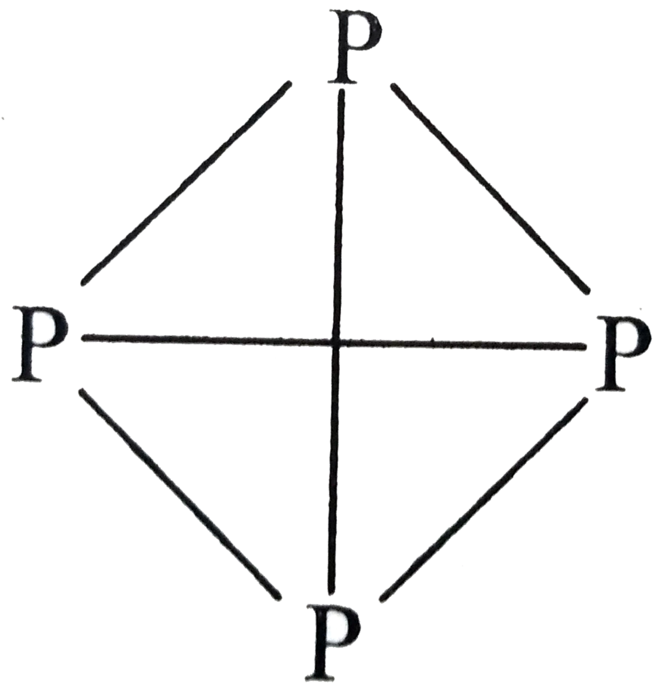
CHEMISTRY SECTION-2 Part-C (Integer type)

1. White phosphorous is a tetra - atomic solid $P_4(s)$ at room temperature .



Find average (P-P) bond enthalpy in kJ/mol.

Given : $\Delta H_{\text{sublimation}}$ of $P_4(s) = 59k\frac{J}{m}ol$

$\Delta H_{\text{atomisation}}$ of $P_4(s) = 1265k\frac{J}{m}ol$

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2. How much heat (in kcal) will be required at constant pressure to form

1.28 kg of CaC_2 from CaO(s) & C(s) ?

Given: $\Delta_f H^\circ(CaO, s) = -152kca\frac{l}{m}ol.$

$\Delta H_f\left(CaC_2, s\right) = -14kca\frac{l}{m}ol$

$\Delta H_f(CO, g) = -26kca\frac{l}{m}ol$

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3. What amount of heat (in kJ) is released in forming 31.2 g AsH_3 by the following reaction ?

(Given : At. Wt. As=75, H=1)

Given :$2As(s) + 3H_2(g) \rightarrow 2AsH_3(g) \quad \Delta H = -780k\frac{J}{m}ol$

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4. Calculate magnitude of ΔH in calorie for 1 mol of an ideal gas undergoing adiabatic reversible process from 8 atm, 300 K to 2 atm. (Given : $\gamma = 2, R = 2Cal/K/mol$)

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5. 2 mole of an ideal gas is expanded from (2 bar, 1L) to 1 bar isothermally. Calculate magnitude of minimum possible work in the change (in Joules).

(1 bar =100 J)

[Given: 1 bar L=100 J]

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6. A thermodynamic study of $AlCl_{3(s)}$ is done to determine its standard enthalpy of formation $\left(\Delta_f H^{\circ}_{AlCl_3(s)}\right)$ from the following information.

(i) $AlCl_3(s)s \rightarrow AlCl_3$[aq. In 4.0 M-HCl(aq)],$\Delta H^{\circ} = -180kJ$

(ii) $Al(s) + 3HCl(aq., 4.0M) \rightarrow AlCl_3$ [aq. in 4.0 M-HCl(aq.)] $+\frac{3}{2}H_2(g), \Delta H^{\circ} = -700kJ$

(iii) $\frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g) \rightarrow HCl$(aq., 4.0 M), $\Delta H^{\circ} = -158kJ$

Determine $\left|\Delta_f H^{\circ}_{AlCl_3(s)}\right|$ in kJ from these data:

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7. At 500 kbar pressure density of diamond and graphite are $3\text{g}/\text{cc}$ and $2\text{g}/\text{cc}$ respectively, at certain temperature T. Find the value of |DeltaH-DeltaU|$(\text{in kJ}/\text{mole})$for the conversion of 1 mole of graphite 1 mole of diamond at 500 kbar pressure.

(Given : $1\text{bar} = 10^5\text{N}/\text{m}^2\big)$

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8. For the reaction : $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g), \Delta H = -24KCal$ at $427^\circ C$ and 200 atm. Calculate magnitude of internal energy change (in Kcal ΔU), if 168 gm N_2 gas and 30 gm H_2 gas are allowed to react completely (100% reaction yield) to form $NH_3 gasat$427^(@)C\` and 200 atm.

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9. Calculate the magnitude of ring strain energy in (kJ/mol) of cyclopropane from the following data

$\Delta_f H\left[C_3H_6(g)\right] = 55, \Delta_f H[C(g)] = 715, \Delta_f H[H(g)] = 220,$

$BE(C - C) = 355, BE(C - H) = 410$ (all in kJ/mol) :

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10. Calculate the entropy change in system if 2 mole of methane undergoes complete combustion at 300 K from the following data.

Given data

$: \Delta H^{\circ}_{\text{cumbustion}} CH_4(g) = -900kJ, \Delta G_f^{\circ} CH_4(g) = -40, \Delta G_f^{\circ}\left(H_2O\right)(l) = -120, \Delta$

Instruction:- If your answer is -ve, then wire double the magnitude as your final answer

For example : If $\Delta S_{\text{surr}} = +20\frac{J}{K}$ then write your answer as 20 but if $\Delta S_{\text{surr}} = -20$ then write your answer as 40

Express your answer in J/K.

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MATHS SECTION-3 Part-C[Integer type]

1. Find the number of six digit number between 700000 and 800000 such that the first digit is equal to the sum of the other five digits.

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2. A shopkeeper sells three varieties of perfumes and he has a large number of bottles of the same size of each variety in his stock. There are 5 places in a row in his showcase. The number of different ways of displaying the three varieties of perfumes in the show case, is

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3. Find the value of a so that the term independent of x in $\left(\sqrt{x}+\frac{a}{x^2}\right)^{10}$ is 405 .

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4. There are 4 straight lines, 3 circles and 2 ellipse in xy plane. Find the maximum number of their intersection points.

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5. Find the number of different terms in the sum $(1+x)^{2009}+\left(1+x^2\right)^{2008}+\left(1+x^3\right)^{2007}$.

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6. Consider the number N=2012. Find the number of cyphers at the end of ${}^{N}C_{N/2}$.

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7. Let a,b,c,d $\in$ N and $a<b<c<d$ such that the equation $|x-a|+|x-b|+|x-c|+|x-d|=20-2(a+b)$ has infinite solutions then

find the number of possible quadruplets (a,b,c,d).

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8. Find the coefficient of t^8 in the expansion of $\left(1 + 2t^2 - t^3\right)^9$.

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9. Total number of ways of selecting two numbers from the set $\{1, 2, 3, ..., 90\}$ so that their sum is divisible by 3, is

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10. Find the sum of all possible values of x satisfying arc $\cos\left(\frac{2}{\pi}arc\cos x\right) = arc\sin\left(\frac{2}{\pi}arc\sin x\right)$.

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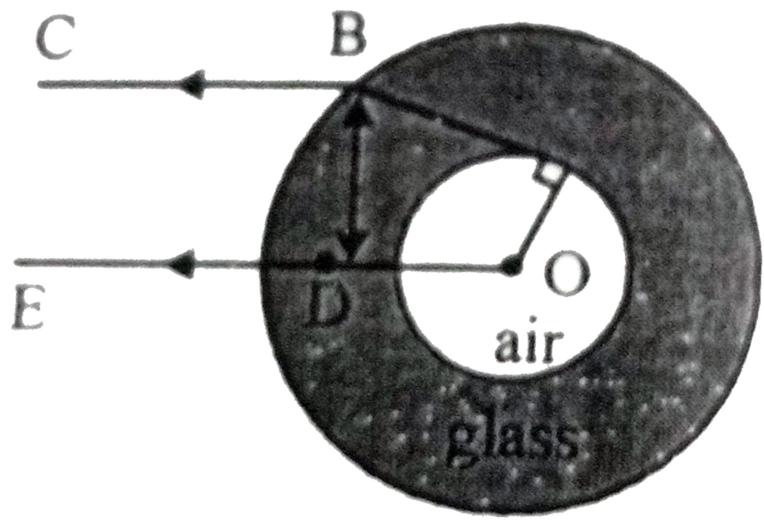
PHYSICS SECTION - 1 PART-A [SINGLE CORRECT CHOICE TYPE]

1. The adjacent figure shows cross section of a hollow glass tube of internal radius r, external radius R and index of refraction n. For two rays DE and ABC (in which De lies ODE and DE is parallel to BC), the separtion r_1 will be



A. $r_1 = (n - 1)R$

B. $r_1 n^2 R$

C. $r_1 = nr$

D. $r_1 n^2 r$

Answer: C

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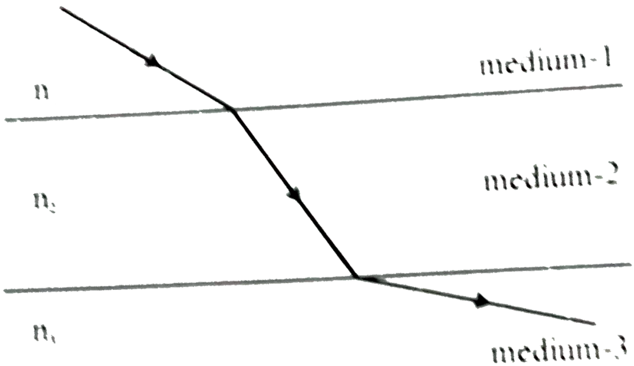
2. A beam of light from medium 1 to medium 2 to medium 3 as shown in the diagram. What may be concluded aboul the three indices of refraction n_1, n_2 and n_3 ?



A. $n_3 > n_1 > n_2$

B. $n_1 > n_3 > n_2$

C. $n_2 > n_3 > n_3$

D. $n_2 > n_1 > n_3$

Answer: D

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3. A ray of light passes through a prism whose refracting angle is 5° and dispersive power is 0.03. The refractive index for the mean ray in a spectrum is 1.62. The mean deviation and angle of dispersion respectively are

A. $3.1^{\circ}, 0.077^{\circ}$

B. $3.1^{\circ}, 0.093^{\circ}$

C. $6.2^{\circ}, 0.093^{\circ}$

D. $6.2^{\circ}, 0.077^{\circ}$

Answer: B

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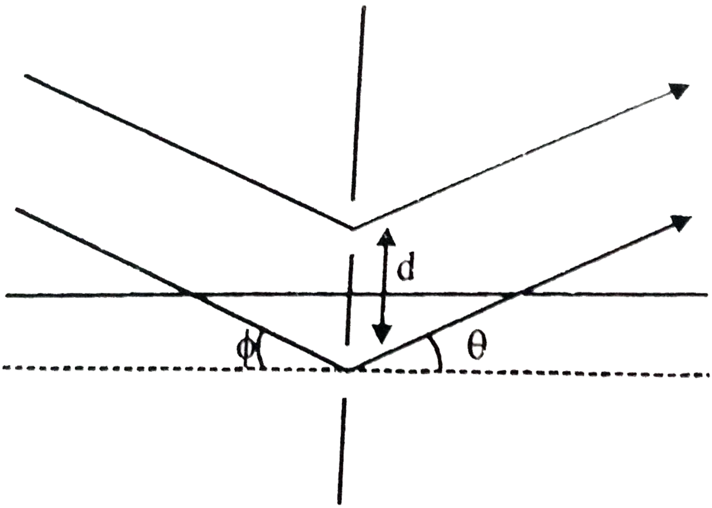
4. Light is incident at an angle ϕ with the normal to a plane containing two slits of separation d. Select the expression the correctly describes the positions of the interference maximum in terms of the incoming angle ϕ and outgoing angle θ.



A. $\sin\phi + \sin\theta = \left(m + \frac{1}{2}\right)\frac{\lambda}{d}$

B. $d\sin\theta = m\lambda$

C. $\sin\phi - \sin\theta = (m + 1)\frac{\lambda}{d}$

D. $\sin\phi + \sin\theta = m\frac{\lambda}{d}$

Answer: D

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5. In a Young's Double slit experiment, the slits are illuminted by monochromatic light. The entire set up is immersed in pure water. Which one of the following act CAN NOT restore the original fringe width.

A. bringing the slit close together

B. moving the screen away from the slit plane

C. replacing the incident light by that of a longer wavelength

D. introducing a thin transparent slab in front of the slits

Answer: D

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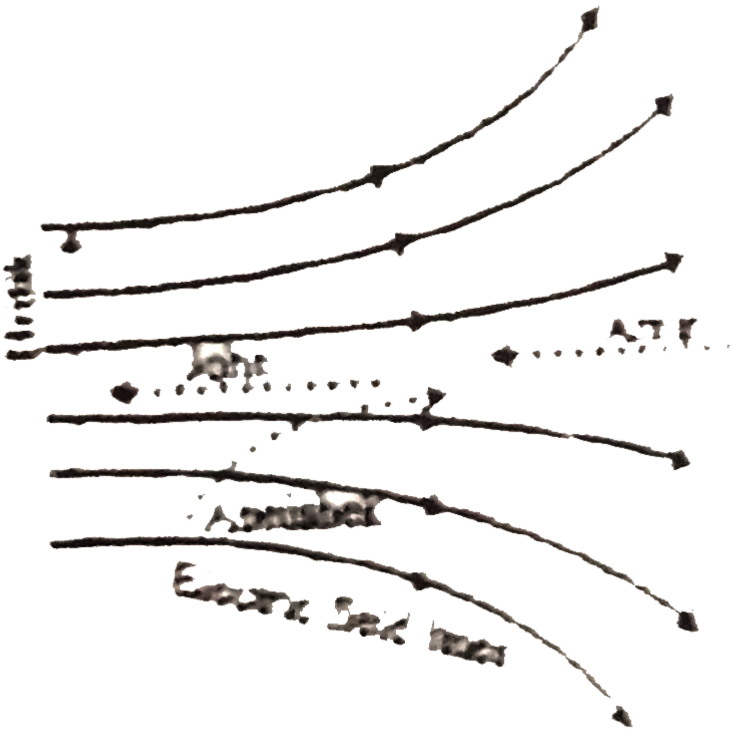
6. Abhishek, Hritik, John, and Amir are assigned the tasks of moving equal positive charges slowly through an electric field, along assigned path (shown as dotted line). In each case the charge is rest at the beginning. They all have paths of exactly equal lengths. Who must do the most positive work ?



A. Abhishek

B. Hritik

C. Amir

D. John

Answer: D

View Text Solution

7. Charge Q is given a displacement $\vec{r} = a\hat{i} + b\hat{j}$ in an electric field $\vec{E} = E_1 + E_2\hat{j}$. The work done

A. $Q\left(E_1 a + E_2 b\right)$

B. $Q\sqrt{\left(E_1 a\right)^2 + \left(E_2 b\right)^2}$

C. $Q\left(E_1 + E_2\right)\sqrt{a^2 + b^2}$

D. $Q\left(\sqrt{E_1^2 + E_2^2}\right)\sqrt{a^2 + b^2}$

Answer: A

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8. The phenomenon of interference demonstrates the fact that :

A. light possesses transvers wave nature

B. light possesses longitudinal wave nature

C. light possesses particle nature

D. light possesses wave nature

Answer: D

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9. A total charge Q is distributed over two concentric hallow uniform sphere of radii a and b, $(b > a)$ such a way that their surface charge densities are qual. The potential at the common centre is given by :

A. $\frac{Q}{4\pi\varepsilon_0}\frac{(a+b)}{\left(a^2+b^2\right)}$

B. $\frac{Q}{4\pi\varepsilon_0}\frac{(a - b)}{\left(a^2 + b^2\right)}$

C. $\frac{Q}{4\pi\varepsilon_0}\frac{(a - b)}{(a + b)^2}$

D. $\frac{Q}{4\pi\varepsilon_0}\frac{(b - a)}{(a + b)^2}$

Answer: A

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10. A double convex lens made of glass ($\mu = 1.5$) is immersed in water ($\mu = 4/3$). If its focal length in air is 'F', then the focal length in water will be :

A. F

B. $F/2$

C. 2F

D. 4F

Answer: D

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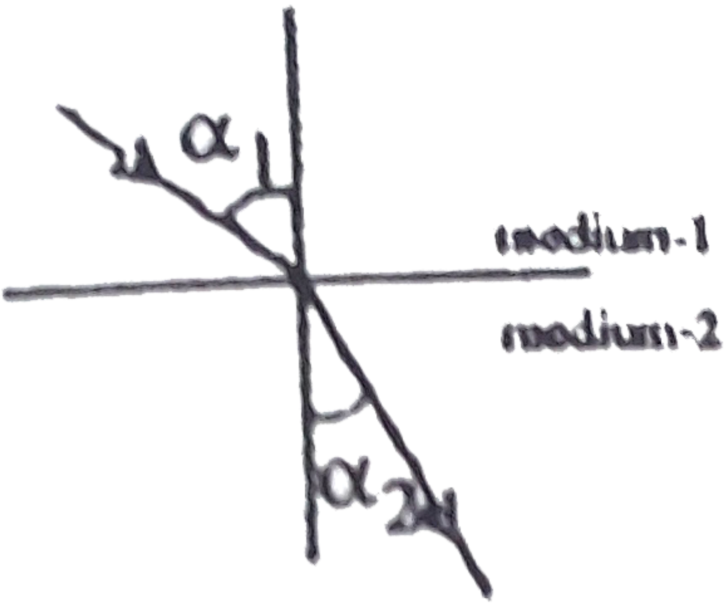
11. A beam of light propagates through a medium-1 and falls onto another medium-2 at an angle α_1 as shown. After that it propagates in medium-2 at angle α_2 as shown. The light's wavelength in medium-1 is λ_1. What is the wavelength of light in medium-2 ?



A. $\frac{\sin\alpha_1}{\sin\alpha_2}$

B. $\frac{\sin\alpha_2}{\sin\alpha_1}\lambda_1$

C. $\frac{\cos\alpha_1}{\cos\alpha_2}\lambda_1$

D. $\frac{\cos\alpha_2}{\cos\alpha_1}\lambda_1$

Answer: B

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12. In a Young's double slit experiment, the separation between the slits is d, distance between the slit and screen is $D(D > > d)$. In the interference pattern, there is a maximum exactly in front for each slit. Then the possible wavelength (s) used in the experiment are

A. $d^2/D, d^2 2D, d^2/3D$

B. $d^2/D, d^2 3D, d^2/5D$

C. $d^2/2D, d^2 4D, d^2/6D$

D. none of these

Answer: C

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13. In a double slit experiment, two parallel slits are illuminated first by light of wavelength 400 nm and then by light of unknown wavelength. The fourth order dark fringe resulting the known wavelength of light falls in the same place on the screen as the second order bright fringe from the unknown wavelength. The value of unknown wavelength of light is

A. 900nm

B. 700nm

C. 300nm

D. none of these

Answer: B

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14. The maximum electric field at a point on the axis a uniformly charged ring is E_0. At how many points on the axis will be magnitude of electric field be $E_0/2$

A. 1

B. 2

C. 3

D. 4

Answer: D

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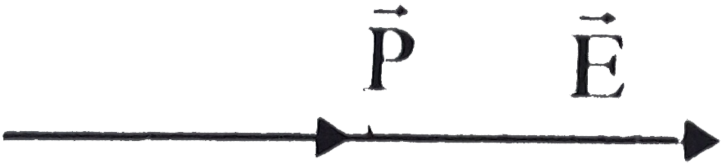
15. An electric depole moment $\vec{p}$ is oriented parallel to a uniform electric field $\vec{E}$, as shown.



It is rotated to one the four orientations shown below. Rank the final orientations according to the change in the potential energy of the dipole-field system, most negative to most positive.

A. (i),(ii),(iv),(iii)

B. (iv),(iii),(i),(ii)

C. (i),(ii),(iii),(iv)

D. (iii),(ii) and (iv) tie, then (i)

Answer: C

16. If g is the acceleration due to gravity on the earth's surface the change in the potential energy of an object of mass m raised from the surface of the eacrth to height to the radius R of the earth is

A. $mgR/2$

B. 2mgR

C. mgR

D. #REF!

Answer: A

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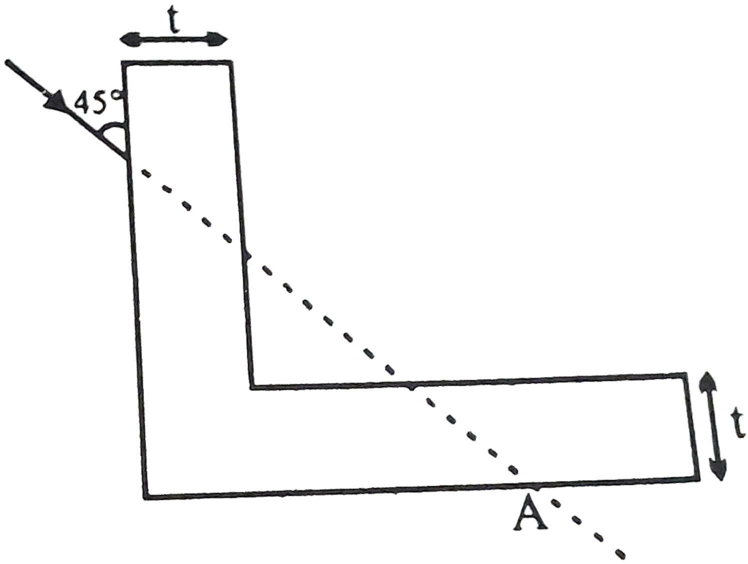
17. Two glass slabs of same thickness are joined to form an L as shown. A ray is incident on the combination as shown (in the plane of paper). The final emergent ray will



A. come out at point A in the same direction as that of original ray.

B. come out at point A but not in the same direction as that of the orginal ray.

C. does not come out at point A but is in the same direction as that of the original ray.

D. does not come out at point A and is not in the same direction as that of the original ray.

Answer: A

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18. When an object is kept at a distance of 30cm from a concave mirror, the image is formed at a distance of 10 cm. If the object is moved with a speed of $9cms^{-1}$ the speed with which the image moves is

A. 10 cm/s

B. 1 m/s

C. 9 m/s

D. 0.9 m/s

Answer: B

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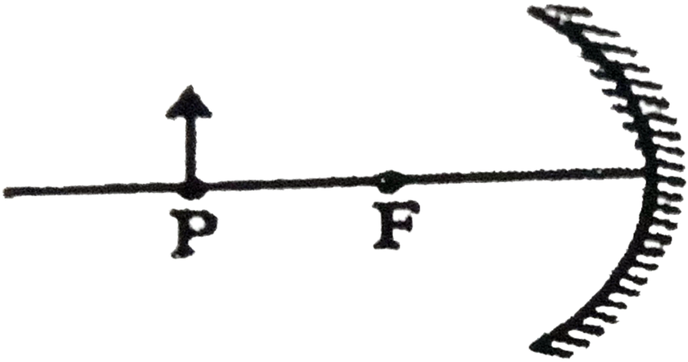
PHYSICS SECTION - 1 PART-B [MULTIPLE CORRECT CHOICE TYPE]

1. The diagram below shows an object located at P, 0.25 meter from a concave spherical mirror with principal focus F. The focal length of the mirror is 0.10 meter.



How does the image change as the object is moved from point P towards point F ?

A. Its distance from the mirror decreases

B. The size of image decreases

C. Its distance from the mirror increase

D. The size of image increases

Answer: C::D

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2. In displacement method, the distance between object and screen is 96 cm. The ratio of length of two images formed by a converging lens placed between them is 4.

A. Ratio of the length of object of the length of short image is 2

B. Distance between the position of the lens is 32 cm

C. Focal length of the lens is $\frac{64}{3}$ cm

D. When the short image is formed on screen, distance of the from the screen is 32 cm

Answer: A::B::C::D

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3. Particle A having positive charges is moving directly head -on to wards initially stationary positively charged particle B. At the instant when A and B are closest together .

A. the momenta of A and B must equal

B. the velocities of A and B must qual

C. B would have gained less kinetic energy that A would have lost

D. B would have gained the same momentum of A would have lost.

Answer: B::C::D

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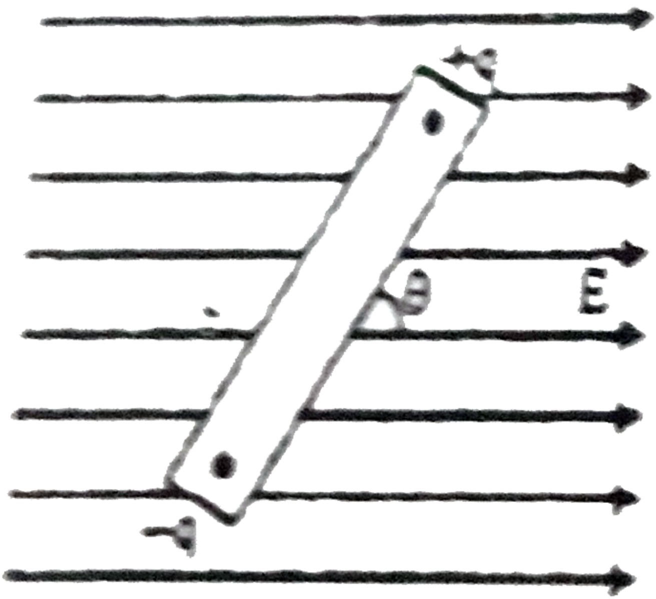
4. A small slectric dipole is placed in a uniform electric field as shown in the diagram.



Considering the situation above, chose the correct statement (s) :

A. The torque on the dipole point into the of the paper

B. If allowed to rotate freely about its center, the would initially swing counter-clockwise.

C. Work done by the electric field on the dipole, in rotating it from $\theta = 90^\circ$ to $\theta = 30^\circ$ is positive.

D. The potential energy of the dipole is maimum when the electric field is perpendicular to the dipole moment.

Answer: A::C

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5. A double-slit apparatus is set up and green light is used to form the interference pattern. The green light is then replaced by red light. Which of the following changes may allow the spacing of the bright bands on the screen to between to remain unaffected by the of light color ? (Given that the distance between the slits is d and that between the plane of the slite and the screen is D.)

A. Decrease D

B. Increase d

C. Increase d and decrease D

D. Increase the brightness of the lightness of the light source

Answer: A::B::C::D

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PHYSICS SECTION - 1 PART-C [INTEGER TYPE]

1. A vessel having perfectly reflecting plane botton is filled with water ($\mu = 4/3$) to depth d. A point source of light is placed at a height h above the surface of water. Find the distance of final image from water surface.

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2. A tunnel is dug along a chord of Earth having length $\sqrt{3}R$ where R is radius of Earth. A small block is released in the tunnel from the surface of Earth. The particle comes to rest centre of tunnel. If the coefficient of friction between the block and the surface of tunnel is $\mu = \frac{2\sqrt{3}}{n}$, then find n. Ignore the effect of rotation of Earth.

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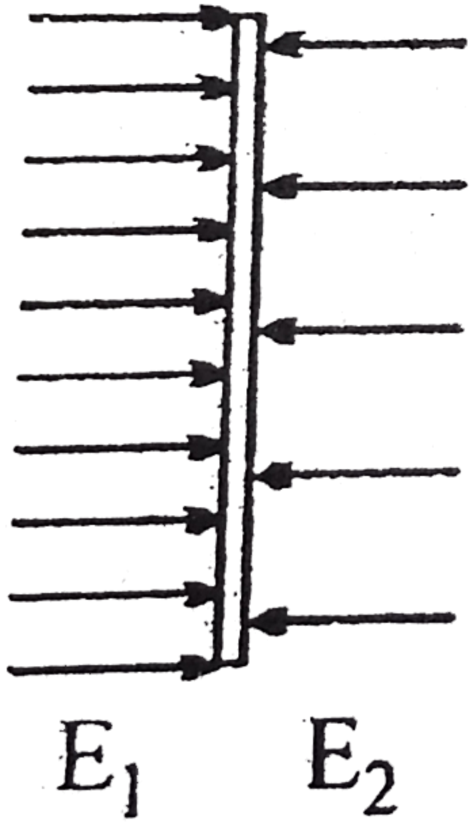
3. A charged large metal sheet is placed into uniform electric field, perpendicularly to the electric field lines. After placing the sheet into the field, the electric field on the left side of the sheet is $E_1 = 5 \times 10^5 V/m$ and on the right it is $E_2 = 3 \times 10^5 V/m$. The sheet experiences a net electric force of 0.08N. Find the area of one face of the sheet. Assume external field to remain constant after introducing the large sheet.

$Use\left(\frac{1}{4\pi\varepsilon_0}\right) = 9 \times 10^9 Nm^2/C^2$



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4. Visible light of variable wavelength is incident normally on a thin sheet of plastic in air. The reflected light has a minima only for $lamba = 512$ nm and $\lambda = 640$ nm in the visible spectrem. What is the minimum thickness (in mum) of the film $(\mu = 1.28)$?

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5. An electric field given by $\vec{E} = 4\hat{i} + 3\left(y^2 + 2\right)\hat{j}$ pierces a gaussian cube of side 1m placed at origin such that one of its corners is at origin and rest of sides are along positive side of coordinate axis. Find the magnitude of net charge enclosed within the cube

$\left[3 \in_0\right]$

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CHEMISTRY SECTION-2 PART-A [SINGLE CORRECT CHOICE TYPE]

1. The decomposition of N_2O_5 in chloroform was followed by measuring the volume of O_2 gas evolved :

$2N_2O_5\left(CC_4\right) \rightarrow 2N_2O_4\left(CCl_4\right) + O_2(g)$. The maximum volume of O_2 gas obtained was $100 cm^3$. In 500 minutes, $90 cm^3$ of O_2 were evolved. The first order rate constant (in $\min^{-1}$) for the rate of disappearance of N_2O_5 is

A. $\frac{2.303}{500}$

B. $\frac{2.303}{500}\log\frac{100}{90}$

C. $\frac{2.303}{500}\log\frac{90}{100}$

D. $\frac{100}{10 \times 500}$

Answer: A

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2. Correct order of rate of hydrolysis fo following compounds is

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width="80%"gt

A. $III > II > IV > I$

B. $I > II > III > IV$

C. $III > I > II > IV$

D. $III > II > I > IV$

Answer: A

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3. Consider the following complexes

(I) $\left[Cr(CO)_x\right]$, (II) $\left[Cr(CO)_{(x-1)}PF_3\right]$

If PF_3 is better π accepter than CO, what be the order of bond length of CO in complexes

(I) and (II) :

A. $I > II$

B. $II > I$

C. I=II

D. can not be compared

Answer: A

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4. To determine the age of stone it was analysed for the nuclei of 'B' & 'D' and were found to 10^{18} and 3×10^{18} respectively. Assuming that all the 'D' was produced by the disintegration of 'A' only, the age of the stone is [(Given : $\ln 2 = 0.3, \ln 3 = 0.45$]

A. 6930 days

B. 10395 days

C. 13860 days

D. 3465 days

Answer: C

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5. Arrange the stability of gem diol in decreasing order

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A. $I > II > III$

B. $III > II > I$

C. $I > III > II$

D. $III > I > II$

Answer: A

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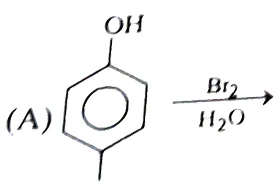
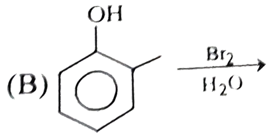
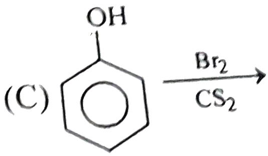
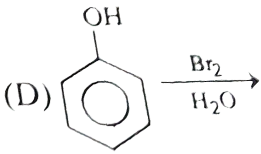
6. Which of following will form tri-bromo derivative of phenol ?



A.

B. 

C. 

D. 

Answer: D

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7. Which of the following is not square planar ?

A. $\left[PtCl_4\right]^{-2}$

B. $\left[Pt(CN)_4\right]^{-2}$

C. $\left[NiCl_4\right]^{-2}$

D. $\left[PdCl_4\right]^{-2}$

Answer: C

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8. An optically active compound 'X' has molecular formula $C_4H_8O_3$. It evolves CO_2 with aq. $NaHCO_3$. 'X' reacts with $LiAlH_4$ to give achiral compound. 'X' is :

A. $CH_3CH_2C \mid OHHCOOH$

B. $CH_3C \mid MeHCOOH$

C. $CH_3CHC \mid \quad CH_2OHOOH$

D. $CH_3C \mid OHHCH_2COOH$

Answer: C

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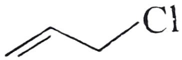
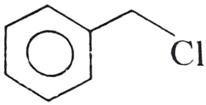
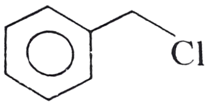
9. In which of the following replacement of Cl^- is most difficult ?

(A) 

A.

B. (B) 

C. (C) 

D. (C) 

Answer: D

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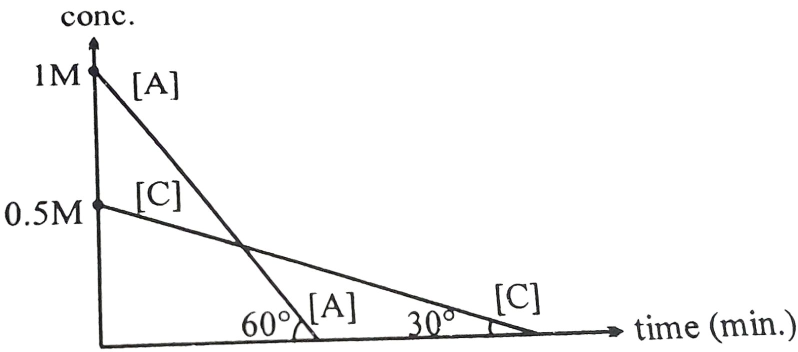
CHEMISTRY SECTION-2 PART-A [MULTIPLE CORRECT CHOICE TYPE]

1. For the two reactions

Reaction I : $A \rightarrow B$, Reaction II : $C \rightarrow D$

following curves are plotted



which of the following is/are true-

A. $\left(t_{100\%}\right)_{\text{reaction I}} = \frac{2}{3}\left(t_{100\%}\right)_{\text{reaction II}}$

B. $[A] = [C]$ at t $= \frac{\sqrt{3}}{4}$ minutes

C. Whan [B] = [A] at that time [C] = [D]

D. If both $[A]_0 \& [C]_0$ are 1 M then $\left(t_{50\%}\right)_I = \frac{1}{3} = \left(t_{50\%}\right)_{II}$

Answer: A::B::C

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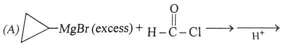
2. In which of the following reactions 3° alcohol will be obtained as a product.

A. 

B. $PhMgBr(excess) + CH_3 - \overset{O}{\overset{||}{C}} - Cl \rightarrow \quad \rightarrow H^+$

C. $CH_3MgBr(excess) + CH_3 - \overset{O}{\overset{||}{C}} - O - \overset{O}{\overset{||}{C}} - CH_3 \rightarrow \quad \rightarrow H^+$

D. $CH_3MgBr(excess) + Cl - \overset{O}{\overset{||}{C}} - O - Et \rightarrow \quad \rightarrow H^+$

Answer: B::C::D

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3. Which statement is/are incorrect for given conplex ?

$Co\left(C_2O_4\right)(en)Cl_2]^{-1}$

A. Oxidation state of central atom is + 3.

B. Coordination number of central atom is 4.

C. Bidentate ligand and Monodentate ligand both are present in this complex.

D. Ambidentate ligand and positive ligand are present in it.

Answer: B::D

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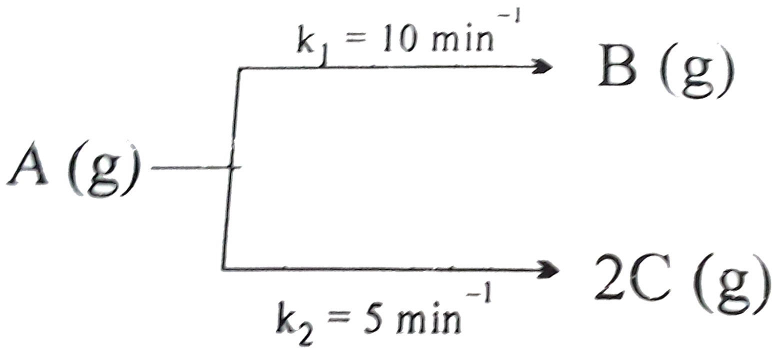
4. For the parallel reaction,



Given : Specific optical rotation of A = 100 °, B = 60 °, C = - 90 °

log2 = 0.3, log3 = 0.47]

If initially 1 mole of A is taken in a 1 litre container, then which statement (s) is/are correct :

A. Mole of B and C are equal at any time

B. On increasing the temperature $\frac{[B]t}{[C]t}$ increases if Arrhenius constant

(A) are equal for both reactions

C. At 2.777 sec racemic mixture is formed

D. $[C]_{\infty} = 0.667M$

Answer: A::D

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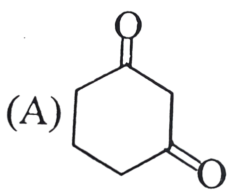
5. which of the following compound(s) give smlling product having anesthetic use in presence of $Cl_2, NaOH, \Delta$.

A. 

B. $CH_3 - C | IH - CH_3$

C. $CH_3 - \overset{O}{\overset{||}{C}} - OH$

D. $Ph - \overset{\overset{O}{||}}{C} - CH_3$

Answer: A::B::D

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CHEMISTRY SECTION-2 PART-C [INTEGER TYPE]

1. For the reaction

$$CH_3COCH_3 + Br_2 \xrightarrow{H^+} CH_3COCH_2Br + H^+ + Br^-$$

the following data was collected

[Acctone]	$[Br_2]$	$[H^+]$	Rate of reaction (Ms^{-1})
0.15	0.025	0.025	6×10^{-4}
0.15	0.050	0.025	6×10^{-4}
0.15	0.025	0.050	12×10^{-4}
0.20	0.025	0.025	8.0×10^{-4}

Calculate order of the reaction w.r.t. CH_3COCH_3 and Br_2

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2. How many grams of benzene would be produced when 135.5 gms of phenyl magnesium chloride is trated with 224 ml of ethyne at STP ?

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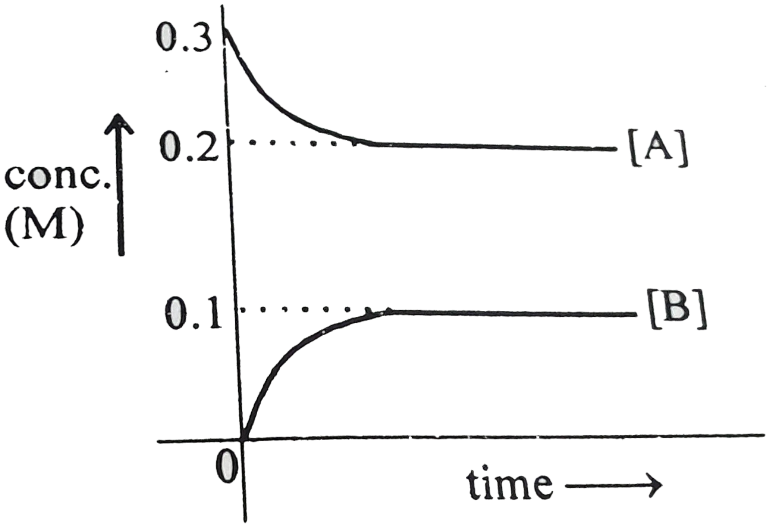
3. Consider a reversible reaction :

$$\underset{k_2}{\overset{k_1}{A \Leftrightarrow B}}$$

Which is a first order in both the directions $\left(k_1 = \frac{1.38}{3} \times 10^{-2}\text{min}^{-1}\right)$. The variation in concentration is plotted with time shown below.



Calculate the time (in minute) at which 25% of A would be exhausted.

$[\ln 2 = 0.69]$

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4. How many geometrical isomers are possible for the given complex ?

$Pt(gly)Cl_2BrI]^-$

[If your answer is 2 then write the answer as 0002.]

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5. For the elementary reaction :

$A + 2B \rightarrow C + D$

the following data is obtained, in which some information is missing.

Exp. No.	$[A]_0$ (M)	$[B]_0$ (M)	$t_{1/2}$ of reaction (min)
1	2 M	0.001 M	40
2	2 M	0.002 M	xy
3	0.01 M	10 M	20
4	0.005 M	5 M	vz

[Find the value of xy and vz. Fill the OMR sheet as xyvz. If xy=15 and vz=54

then fill the same in OMR sheet as 1505]

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MATHS SECTION-3 PART-A [SINGLE CORRECT CHOICE TYPE]

1. The value of $\text{Lim}_{x \to 0}\left(\frac{e}{4x} - \frac{e}{2x\left(e^{ex}+1\right)}\right)$ equals

A. $\frac{e^2}{2}$

B. $\frac{e^2}{4}$

C. $\frac{e^2}{8}$

D. $\frac{e}{2}$

Answer: A

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2. Let g(x) be differentiable function on R such $f(x) = g(x)\ln\left(4x^3 - x\right)$ and $g'\left(\frac{1}{3}\right) = -5$ then the value of f' $\left(\frac{1}{3}\right)$ is equal to

A. 3

B. 9

C. 27

D. non existent

Answer: A

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3. If $f(x) = \begin{cases} x^2 \left\{ e^{\frac{1}{x}} \right\}, x \neq 0 \\ k, x = 0 \end{cases}$ is continuous at $x = 0$, where {*} represents fractional part function, then

A. f(x) is differentiable at x=0.

B. k=1

C. f(x) is continuous but not differentiable at x=0

D. f(x) is continuous every where in its domain.

Answer: A

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4. If $e^{x} = \frac{\sqrt{1+z} - \sqrt{1-z}}{\sqrt{1+z} + \sqrt{1-z}}$ and $\tan\left(\frac{y}{2}\right) = \sqrt{\frac{1-z}{1+z}}$ then the value of $\frac{dy}{dx}$ at $z = 1$ is equal to to

A. -2

B. -1

C. 0

D. 1

Answer: A

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5. Let

$f(x) = \operatorname{cosec}2x + \operatorname{cosec}2^2x + \operatorname{cosec}2^3x + \ldots\ldots. + \operatorname{cosec}2^n, x \in \left(0, \frac{\pi}{2}\right)$ and $g(x) =$

. If

$H(x) = \begin{cases} (\cos x)^{g(x)} + (\sec)^{cisecx} & \text{if } x < 0 \text{ and } p \text{ if } x = 0 \text{ and } \frac{e^x + e^{-x} - 2\cos x}{x\sin x} \end{cases}$

.Find the value of p, if possible to make the functielf $H(x)$ continuous at $x = 0$.

A. $\frac{1}{2}$

B. 1

C. 2

D. 0

Answer: A

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6. If $\int_0^{\infty} \frac{dx}{\left(x+\sqrt{1+x^2}\right)^5} = \frac{m}{n}$ where m and relatively prime prime, then the value of (m+n) is

A. 31

B. 30

C. 29

D. 28

Answer: A

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7. The value of $\operatorname{Lim}_{x \to 0}\left(5x^2+\left[x^2+1\right]\right)^{\left(\frac{1}{x^2+\sin^2 x}\right)}$ is,

[Note : [y] denotes greatest interger less than or equal to y.]

A. $\frac{5}{2}$

B. $e^{\frac{5}{2}}$

C. $\frac{25}{2}$

D. $e^{\frac{25}{2}}$

Answer: A

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8. If $f(x) = \sin x + |\sin x|$ and $g(x) = f(x - \pi) + f(x + 2\pi)$, then value of $\int_{-2\pi}^{5\pi} g(x)dx$ is

A. 15

B. 7

C. 12

D. 28

Answer: A

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9. If $S_n = \frac{3}{1^2+2^2} + \frac{7}{1^2+2^2+3^2} + \ldots\ldots\ldots\ldots\ldots$ upto n terms, then value of $\text{Lim}\ n \to \infty S_n$ is equal to

A. $\frac{1}{2}$

B. 1

C. 5

D. 6

Answer: A

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10. Suppose $f: R \to R$ be a continuous function such that $f(3x) = f(x)\, \forall x \in R$. IF f(2) = 5, then $\int_2^5 sgn(f(x))dx$ equals

[Note : sign k denotes signum function of k.]

A. 2

B. 9

C. 6

D. 3

Answer: A

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MATHS SECTION-3 PART-B [MULTIPLE CORRECT CHOICE TYPE]

1. The value of $\text{Lim}_{n \to \infty}\left(\frac{2x}{\pi}\cot^{-1}(nx) - x\right)$ is/are

A. $1, x > 0$

B. $x, x < 0$

C. $-x, x > 0$

D. $-1, x < 0$

Answer: A

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2. Let $g(x) = \left(2x - x^2\right)^{\frac{1}{\log_{10}\left(2x - x^2\right)}}$. The value of x for which f' vanishes may be

A. 1

B. $\frac{1}{2}$

C. $\frac{3}{2}$

D. 3

Answer: A

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3. Consider $f(x) = \frac{\cos^{-1}(\cos(\sin x)) - |x - \pi|}{\sin^3 x}$, then

A. $\text{Lim}\ x \to 0 f(x)$ =does not exist

B. f(x) has removable discontinuity at $x = \pi$.

C. jump of discontinuity at $x = \pi$ is $\frac{1}{3}$

D. f(x) is discontinuous at $x = n\pi, n \in I$

Answer: A

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4. If $\int_0^{\frac{\pi}{2}} \frac{dx}{1 + \tan x + \cot x} = a$ and $\int_0^{\frac{\pi}{2}} \frac{\tan x}{1 + \tan x + \cot x} = b$ then which of the following is/are correct

A. $a = \frac{\pi}{8}$

B. $\frac{\pi}{6} \leq b < \frac{\pi}{4}$

C. $0 < a \leq \frac{\pi}{6}$

D. $b = \frac{\pi}{3}$

Answer: A

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5. Let $f(x) = \begin{cases} \dfrac{x^n \cos\left(\frac{1}{x}\right)}{0^{\tan^m x}} & x \neq 0 \\ 0 & x = 0 \end{cases}$

A. $n \leq m$

B. $m < n \leq m + 1$

C. $n < 2m$

D. $n < 2m + 1$

Answer: A

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MATHS SECTION-3 PART-C [INTEGER TYPE]

1. Let a function is defined as $f: R \to R$ such that $f(x) = \dfrac{6}{1 + 3le^x}$. Find the number of different integral values which function f(x) can take ?

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2. Find the sum of an infinite geometric series whose first term is $\sum_{x \to 0}^{2011} \frac{\left\{\frac{x}{\tan x} + 2k\right\}}{2011}$ and whose common ratio is the value of $\lim_{x \to 0} \frac{e^{\tan^3 x} - e^{x^3}}{2\ln\left(1 + x^3\sin^2 x\right)}$.

[Note : where {y} denotes fractional part of y.]

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3. If the value definite integral $\int_{-4}^{4} \frac{x^3 - 2x^2 - \operatorname{cosec}^3 x + \tan x}{5 - |x|} dx = a + b\ln 5$, where $a, b \in I$, find the value of $\left(\frac{a + b}{2}\right)$.

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4. Suppose the function $f(x) - f(2x)$ has the derivative 5 at $x = 1$ and derivative $7atx = 2$. The derivative of the function $f(x) - f(4x)atx = 1$ has the value equal to 19 (b) 9 (c) 17 (d) 14

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5. Consider $f(x) = \sin^{-1}\left(\frac{x+3}{2x+5}\right), g(x) = \sin^{-1}\left(\frac{ax^2+b}{x^2+5}\right)$.

If $\text{Lim}_{x \to \infty}(f(x) - g(x)) = 0$ and $\text{Lim}_{x \to \infty}(f(x) + g(x)) = \frac{\pi}{4}$, then find the value of $\left(a + b^2\right)$.

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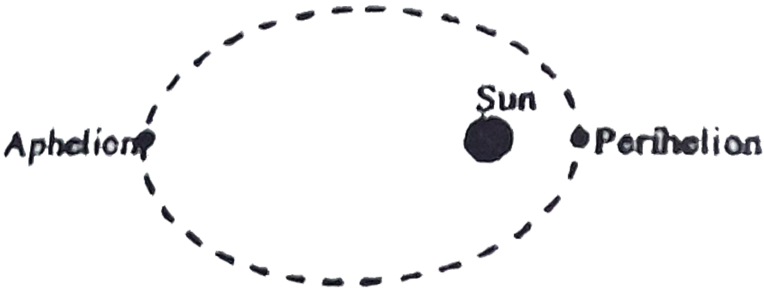
PHYSICS SECTION - 1 [PARAGRAPH TYPE]

1. The orbit of Plus is much more eccentric than the orbits of the other planets. That is, instead of being nearly circular, the orbit is noticeably elliptical. The point in the orbit nearest the Sun is called the aphelion.



At perihelion, the gravitational potential energy of Plus is orbit has

A. its maximum

B. its minimum value

C. the same value as every other point in the orbit

D. value which depend on sense of rotation

Answer: A

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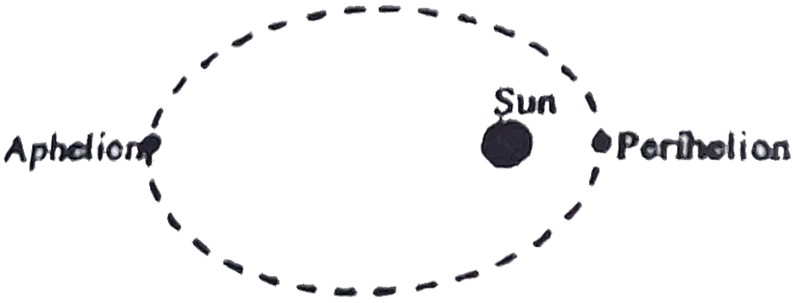
2. The orbit of Plus is much more eccentric than the orbits of the other planets. That is, instead of being nearly circular, the orbit is noticeably elliptical. The point in the orbit nearest the Sun is called the aphelion.



At perihelion, the mechanical energy of Pluto's orbit has.

A. its maximum

B. its minimum value

C. the same value as very other point in the orbit

D. value which depend on sense of rotation

Answer: C

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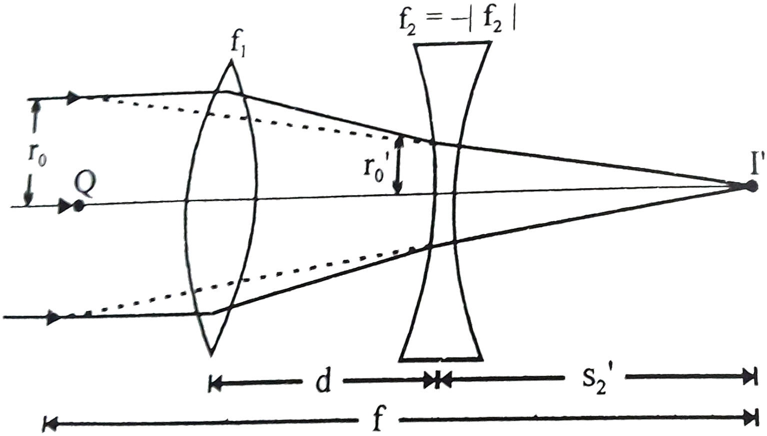
3. Focal Length of Zoom Lens : Figure shows a simple version of a zoom lens. The conerging lens has focal length f_1, and the diverging lens has focal length $f_2 = -|f_2|$. The two lenses are separated by a variable distance d that is always than f_1. Also, the magnitude of the focal length of the diverging lens satisfies the inequality $|f_2| > \left(f_1 - d\right)$. To determine the effective focal length of the combination lens, consider a bundle of parallel rays of radius r_0 entering the converging lens. It can be shown that the radius of the ray bundle decreases to $r_0' = \dfrac{r_0\left(f_1 - d\right)}{f_1}$ at the point it enters the diverging lens. Final image I' is formed a distance $s_2' = \dfrac{|f_2|\left(f_1 - d\right)}{\left(|f_2| - f_1 + d\right)}$ to the rifgt of the diverging lens.

It the rays that emerge from the diverging lens and reach the final image point are extended backward to the left of the diverging lens, they will eventually expand to the original radius r_0 at some point Q. The distance from the final image I' to the point Q is the effective focal length f the lens combination , if the combination were replaced by a single lens of focal length f placed at Q, parallel rays would still be brought to a focus at I'. The effective focal length is given by $f = \dfrac{f_1|f_2|}{\left(|f_2| - f_1 + d\right)}$

Assume that $f_1 = 12.0cm, f_2 = -18.0cm$, and the separation d is adjustable between 0 and 3.0 cm.



Which of the following can be a value of the effective focal length of the zoom lens ?

A. 18 cm

B. 12 cm

C. 28 cm

D. 38 cm

Answer: C

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4. Focal Length of Zoom Lens : Figure shows a simple version of a zoom lens. The conerging lens has focal length f_1, and the diverging lens has focal length $f_2 = - | f_2|$. The two lenses are separated by a variable distance d that is always than f_1. Also, the magnitude of the focal length of the diverging lens satisfies the inequality $|f_2| > \left(f_1 - d\right)$. To determine the effective focal length of the combination lens, consider a bundle of parallel rays of radius r_0 entering the converging lens. It can be shown that the radius of the ray bundle decreases to $r_0' = \frac{r_0\left(f_1 - d\right)}{f_1}$ at the point it enters the diverging lens. Final image I' is formed a distance $s_2' = \frac{|f_2|\left(f_1 - d\right)}{\left(|f_2| - f_1 + d\right)}$ to the rifgt of the diverging lens.

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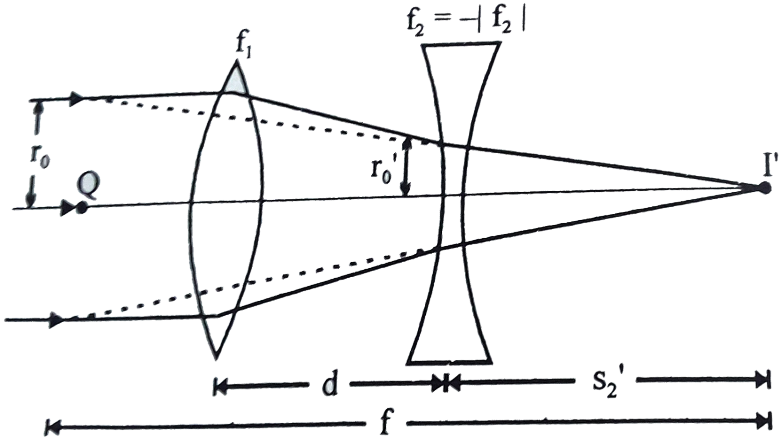
Assume that $f_1 = 12.0cm, f_2 = -18.0cm,$ and the separation d is adjustable between 0 and 3.0 cm.



The final image distance $s_2^{'}$ will be such that

A. $0 \le s_2^{'} \le |f_2|$

B. $|f_2| \le s_2^{'} \le 2|f_2|$

C. $2|f_2| \le s_2^{'} \le \infty$

D. any of the above three options

Answer: B

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PHYSICS SECTION - 1 [MULTIPLE CORRECT CHOICE TYPE]

1. The magnitudes of the gravitational field at distance r_1 and r_2 from the centre of a uniform sphere of radius R and mass M are F_1 and F_2 respectively. Then :

A. $\frac{F_1}{F_2} = \frac{r_1}{r_2}$ if $r_1 < R$ and $r_2 < R$

B. $\frac{F_1}{F_2} = \frac{r_2^2}{r_1^2}$ if $r_1 > R$ and $r_2 > R$

C. $\frac{F_1}{F_2} = \frac{r_1}{r_2}$ if $r_1 > R$ and $r_2 > R$

D. $\frac{F_1}{F_2} = \frac{r_1^2}{r_2^2}$ if $r_1 < R$ and $r_2 < R$

Answer: A::B

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2. Which of the following options are incorrect.

A. Gravitational potential inside a uniform solid is constant

B. Gravitational field intensity inside a uniform solid sphere is zero

C. Gravitational field intensity inside a uniform spherical shell is zero

D. Gravitational potential inside a uniform spherical shell is constant

Answer: A::B

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3. Two in-phase sources of waves are separated by a distance of 4.00 m These sources produce identical waves that have a wave length of 5.00 m. On the line between line them, there are two places at which the same type of interference (constructive or destructive) occurs .

A. This interference refers to construtive interference

B. This refers to destructive interference.

C. One of points is at 0.75 m from one the sources.

D. One of the points is at 0.5 m from one the sources.

Answer: B::C::D

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4. One microscope slide is placed on top of another with their left edges in contact and a human hair under the right edge of the upper slide. As a result, a wedge of air exists between the slides. An interference pattern results when monochromatic light is incident on the wedge.

A. a dark fringe is seen at the left edges of slides

B. a bright fringe is seen at the edges of slides.

C. The fringes are straight of equal thickness.

D. fringes are localized.

Answer: A::C::D

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5. Two point charge (Q each) are placed at (0,y) and (0,-y). A point charge q of the same polarity can move along X-axis. Then :

A. The force on q is maximum at $x \pm y/\sqrt{2}$

B. the charge on q in equilibrium at the origin

C. the charge q performs an oscillatory motion about the origin

D.

Answer: A::B::D

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6. A trihedral prism with refracting angle 60° deviates a light ray by 30°. The refractive index of the material of prism

A. may be equal to $\sqrt{2}$

B. can not be greater than $\sqrt{2}$

C. can not be less than $\sqrt{2}$

D. none of these

Answer: A::B

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CHEMISTRY SECTION - 2 PART A [SINGLE CORRECT CHOICE TYPE]

1. For reaction $A \rightarrow B$, the rate constant $k_1 = A_1 e^{-Ea}/RT$ and for the reaction $P \rightarrow Q$, the rate constant $k_2 = A_2 e^{-Ea_2}/RT$. If $A_1 = 10^8$, and $Ea_1 = 600\text{cal/mol}, Ea_2 = 1200\text{cal/mol}$, then the temperature at which $k_1 = k_2$ is (R=2cal/K-mol)

A. 600 K

B. 300×4.606 K

C. $\dfrac{300}{4.606}K$

D. $\dfrac{4.606}{600}K$

Answer: C

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2. The reaction of 4 - bromobenzylchloride with sodium cyanide in ethanol leads to

A. 4-bromobenzylcyanide

B. 4-cyanobenzlychloride

C. 4-cyanbenzyl cyanide

D. 4-bromo-2-cyanobenzyl chloride

Answer: A

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3. Select incorrect match for the following complexes.

A. $[IrF_6]^{3-}$ $(\Delta > P)$

B. $[Co(H_2O)_6]^{3+}$ $(\Delta < P)$

C. $Fe(CO)_5 \quad (\Delta > P)$

D. $\left[PdCl_2(SCN)_2\right]^{2-} \quad (\Delta > P)$

Answer: B

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4. A radioactive isotope $._{Z}X^{A}$ is converting into $._{Z-8}Y^{A-16}$ by α-decay. If g-atoms $._{Z}X^{A}$ produced 3 mole of He atoms in 20 hours, then calculate the half life of $._{Z}X^{A}$ (in hours).

A. 10

B. 5

C. 2

D. 1

Answer: A

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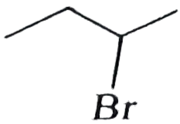
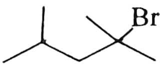
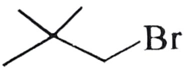
5. Which of the following alkyl halides would be most likely to give a rearranged product under S_N1 conditions ?

A. (A) 

B. (B) 

C. (C) 

D. (D) 

Answer: C

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6. What is the hybridisation of Fe in sodium thionitroprusside.

A. sp^3d^2

B. d^2sp^3

C. sp^3d

D. no hybridisation.

Answer: B

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7. For a two step reaction.

$$A \Leftrightarrow R + B \quad R + C \xrightarrow{k_2} P$$

(where, R is a reactive intermediate whose concentration is maintained at some low steady state throughout the reaction). If the concentration of C is very high then the order of reaction for formation of "P" is

A. 2

B. 0

C. 1

D. $1/2$

Answer: C

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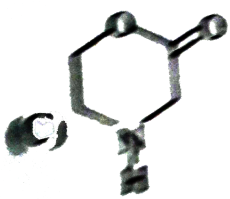
8. $Me - \overset{O}{\overset{||}{C}} - O - CH_2 - CH_2 - \overset{\oplus}{N}H_2 \xrightarrow{NaOH} Q$

A. $Me - \overset{O}{\overset{||}{C}} - O - CH_2 - CH_2 - NH_3$

B. $Me - \overset{O}{\overset{||}{C}} - NH - CH_2 - CH_2 - OH$



C.

D. $MeCOONa + HOCH_2CH_2NH_2$

Answer: B

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CHEMISTRY SECTION - 2 [PARAGRAPH TYPE]

1. A radioactive substance 'A' converts to stable nuclei D by following series of reaction :

$A \rightarrow B \rightarrow C \rightarrow D$

Given : $t_{1/2} \text{for}' A' = 0.0693$ days

$t_{1/2} \text{for}' B' = 6930$ days

$t_{1/2} \text{for}' C' = 6.93$ days

Number of nuclei of 'C' formed in the 10 days are, if initially 10^{20} nuclei of A is taken

A. 10^{18}

B. 10^{16}

C. 10^{17}

D. 10^{19}

Answer: C

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2. A radioactive substance 'A' converts to stable nuclei D by following series of reaction :

$A \rightarrow B \rightarrow C \rightarrow D$

Given : $t_{1/2}$for' A' = 0.0693 days

$t_{1/2}$for' B' = 6930 days

$t_{1/2}$for' C' = 6.93 days

Number of nuclei of 'D' present after 6930 days are, if initially 10^{20} nuclei of A is taken

A. 10^{10}

B. $\frac{1}{2} \times 10^{20}$

C. $\frac{1}{2} \times 10^{17}$

D. 10^{9}

Answer: B

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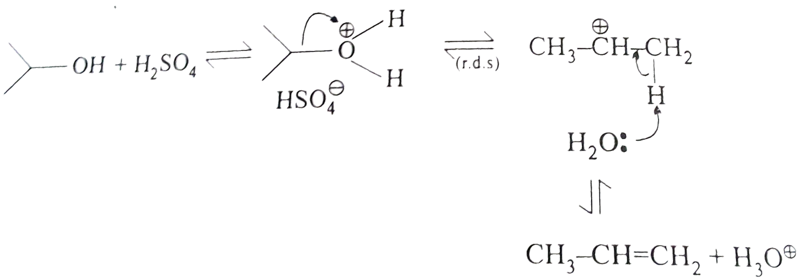
3. Dehydration require an acid catalyst to protonate the hydroxy group of the alcohol and convert it into good leaving group. Loss of water followed by a loss of proton, given the alkene an equilibrium is established between reactants and products.



To Improve the yield of above reaction which of following is correct.

A. High temperature

B. Distillation (removal of alkene)

C. Addition of H_2O

D. Both (A) and (B)

Answer: D

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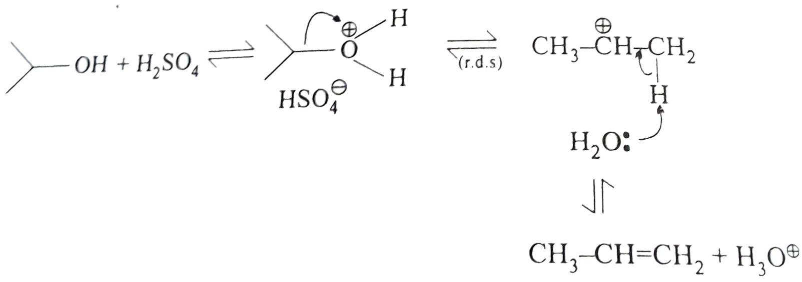
4. Dehydration require an acid catalyst to protonate the hydroxy group of the alcohol and convert it into good leaving group. Loss of water followed by a loss of proton, given the alkene an equilibrium is established between reactants and products.



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total number of α - hydrogen in A+B is

A. 13

B. 15

C. 17

D. 19

Answer: D

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5. Complex salt has two parts-one is ionisation sphere and another is coordination sphere. According to IUPAC nomenclature of complex, first we name positive ion then negative ion. According to VBT, metal ion should have vacent orbital equal to its coordination number. If ligand is strong field, pairing of electrons takes place. In the case of weak field ligand, pairing of electrons does not take place, generally. Crystal field splitting of d-orbitals of tetrahedral complex is just opposite to that octahedral complex.

If $\Delta_0 = 45000$ unit, find out the value of $\Delta(t)$

A. 2000 unit

B. 20000 unit

C. 45000 unit

D. 11250 unit

Answer: B

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6. Complex salt has two parts-one is ionisation sphere and another is coordination sphere. According to IUPAC nomenclature of complex, first we name positive ion then negative ion. According to VBT, metal ion should have vacent orbital equal to its coordination number. If ligand is strong field, pairing of electrons takes place. In the case of weak field ligand, pairing of electrons does not take place, generally. Crystal field splitting of d-orbitals of tetrahedral complex is just opposite to that octahedral complex.

A. $\left[Ni(CO)_4\right]$

B. $\left[Pd\left(NH_3\right)_4\right]Cl_2$

C. $\left[Fe(CO)_5\right]$

D. $K_2\left[ZnCl_4\right]$

Answer: B

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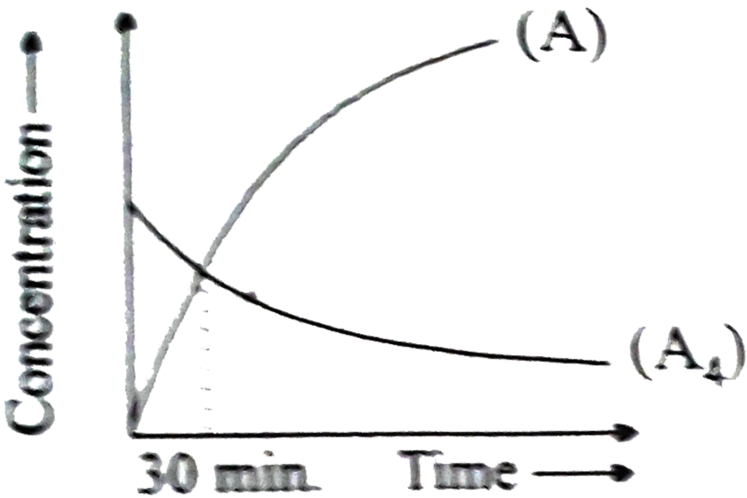
CHEMISTRY SECTION - 2 [MULTIPLE CORRECT CHOICE TYPE]

1. Consider the following first order decomposition reaction

$A_4(g) \rightarrow 4A(g)$

Which of the following statements regarding the reaction are correct ?

[Given : log 2 = 0.30]



A. At 30 min., only 20% reaction is complete

B. Rate of reaction is approximately 90 min.

C. Rate of reaction decreases lineraly with time.

D. The time for intersection of two curves is independent of initial concentration of A_4

Answer: A::B::D

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2. End-product of which of following reaction give positive Iodoform test.

A. $H-\overset{\overset{O}{||}}{C}-Cl \xrightarrow[(ii)H^{\oplus}]{(i)CH_3MgBr(\text{excess})}$

B. $Ph-\overset{\overset{O}{||}}{C}-O-Et \xrightarrow[(ii)H^{\oplus}]{(i)CH_3MgBr(\text{excess})}$

C. $H-\overset{\overset{O}{||}}{C}-O-Et \xrightarrow[(ii)H^{\oplus}]{(i)CH_3MgBr(\text{excess})}$

D. $H-\overset{\overset{O}{||}}{C}-H \xrightarrow[(ii)H^{\oplus}]{(i)CH_3MgBr(\text{excess})}$

Answer: A::B::C::D

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3. Which of the following statement is/are correct ?

A. In $Fe_2(CO)_9$ all CO bond length are not equal

B. In $Fe_2(CO)_9$, 3 CO bond length are larger rest of six are smaller than these three.

C. Suppose bond length of CO is 1.128Å and In $Fe_2(CO)_9$ all CO bond length are larger than 1.128Å.

D. $Fe_2(CO)_9$ is an organo metallic compound.

Answer: A::B::C::D

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4. All the metal ions contains $t_{2g}.^{6}eg^{0}$ configuration which of the following complex will not be paramagnetic :

A. $\left[FeCl(CN)_4\left(O_2\right)\right]^{4-}$

B. $\left[Co(CN)_5\left(O_2\right)\right]^{-4}$

C. $K_4\left[Fe(CN)_6\right]$

D. $\left[Fe(CN)_5\left(O_2\right)\right]^{5-}$

Answer: B::C::D

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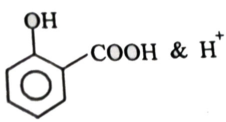
5. Which of the following reagents or process are suitable to distinguish MeOH & EtOH ?

A. $NAOI$

B. (B) 

C. anhydrous $ZnCl_2 + conc.\ HCl$

D. Victor Mayor's process

Answer: A::B

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6. $\left[PtCl\left(NH_3\right)_3\right]\left[Cu\left(NH_3\right)Cl_3\right]$ correct name of complex.

A. Triammine chloride platinum (II) ammine trichlorido cuprate (II)

B. Triammine chloride platinate (+2) ammine trichlorido copper (-2)

C. Triammine chloride platinate (II) ammine trichlorido copper (II)

D. Triammine chloride platinum (+1) ammine trichlorido cuprate (-1)

Answer: A::D

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MATHS SECTION - 2 PART A [SINGLE CORRECT CHOICE TYPE]

1. Let $\lim x \to \left(1 + \frac{P(x)}{x^5}\right)^{\frac{1}{x^3 - \tan^3 x}}$ exists and is equal to $e^{9/7}$, where P(x) is a polynormial function. The degree of polynomial is

A. 8

B. 9

C. 10

D. 11

Answer: A

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2. Let $f: R \to R$ be a continuous onto function satisfying $f(x) + f(-x) = 0 \,\forall x \in R$,. If $f(-3) = 2$ and $f(5) = 4$ in $[-5, 5]$, then the equation $f(x) = 0$ has

A. exactly 2 real roots.

B. exactly 3 real roots.

C. atleast 3 real roots.

D. atleast 5 real roots.

Answer: A

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3. If {x} represents the fractional part of then $\int_0^9 \left\{\sqrt{x}\right\} dx$ is equal to

A. 5

B. $\frac{69}{3}$

C. $\frac{79}{3}$

D. $\frac{89}{3}$

Answer: A

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4. Suppose g is the inverse fiunction of a diffdifferentiable finction fand

$G(x) = \frac{-4}{g^2(x)}$. If $f(5) = 3$ and $f'(5) = \frac{1}{125}$ then $g;(3)$ is equal to

A. 1

B. 2

C. 4

D. 8

Answer: A

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5. Let$f(x) = \text{Lim}_{n \to \infty} \frac{\left(x^2 + 4x + 5 + e^x + sgn\left(e^{-x}\right)\right)^n - 5}{2\left(x^2 + 4x + 5 + e^x + sgn\left(e^{-x}\right)\right)^n + 9}$ then

A. f(x) is discontinuous at x=0.

B. f(x) is discontinuous at infinite number of points.

C. f(x) is continuous but non-derivable for all $x \in R$.

D. f(x) is continuous and derivable for $x \in R$.

Answer: A

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6. The derivative of $y = \sin^{-1}\left(\frac{3x + \sqrt{16 - 16x^2}}{5}\right)$ with respect to x at $x = \frac{\sqrt{3}}{2}$, is

A. -2

B. 2

C. -4

D. does not exist

Answer: A

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7. If $\sqrt{y - x} + \sqrt{y + x} = 1$ then $\frac{d^3y}{dx^3}$ at x=1 is equal to

A. 2

B. 1

C. 0

D. Does bot exist

Answer: A

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8. Let $f(x) = \frac{\operatorname{cosec} x + \cot x - 1}{1 + \cot x - \operatorname{cosec} x}$. The Primitive of f(x) with respect to x is equal to

A. $\ln\left(\sin\frac{x}{2}\right) + C$

B. $2\ln\left(\cos\frac{x}{2}\right) + C$

C. $\ln(1 - \sin x) + C$

D. $In(1 - \cos x) + C$

Answer: A

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MATHS SECTION - 2 PART A [PARAGRAPH TYPE]

1. Consider

$$f(x) = \text{Lim}_{n \to \infty}\left(\left(a^n + b^n\right)^{\frac{1}{n}}\sin x + \left\{e^x\right\}^n\right)\left(\left[\frac{1}{n\cot^{-1}n}\right] + 1\right), \forall x \in R$$

where $a > b > 0$.

[Note : {k} and [k] denotes fractinal part of k and greatest interger less than or equal to k respectively.]

If H(x)=sgn (f(x)-3) has exactly one point of discontinuity $\forall x \in [0, 2\pi]$, then number of integral value of a, is

A. 1

B. 2

C. 0

D. infinite

Answer: A

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2. Consider

$$f(x) = \text{Lim}_{n \to \infty} \left(\left(a^n + b^n\right)^{\frac{1}{n}} \sin x + \left\{e^x\right\}^n \right) \left(\left[\frac{1}{n\cot^{-1} n} \right] + 1 \right), \forall x \in R$$

where $a > b > 0$.

[Note : sgn α denote signum function of α.]

Number of points where $G(x) = |f(x)| + f(|x|)$ is non-differentiable in $(-3\pi, 3\pi)$, is

A. 6

B. 5

C. 4

D. 7

Answer: A

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3. Consider $f(x)\begin{cases} |[x]|, & 0 \le \{x\} < \frac{1}{2} \\ |x|, & \frac{1}{2} \le \{x\} < 1 \end{cases}, \forall x \in \left[\frac{-7}{2}, \frac{7}{2}\right]$

Number of solution of the equation $f(x) = \frac{5}{2}$ is equal to

A. 2

B. 3

C. 4

D. infinite

Answer: A

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4. Consider $f(x)\begin{cases} |[x]|, & 0 \leq \{x\} < \frac{1}{2} \\ |x|, & \frac{1}{2} \leq \{x\} < 1 \end{cases}, \forall x \in \left[\frac{-7}{2}, \frac{7}{2}\right]$

If L is number of point of discontinuity any M is the number of point on non-differentiability of the function f(x), then (L+M) is equal to

A. 18

B. 20

C. 21

D. 16

Answer: A

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5. Let $f(x) = ax^2 + x + 3$ and $f(x) \geq 0 \, \forall x \in R, \, \forall a \in A$ where $A \subset R$.

Also $L = \lim_{x \to \infty} \left(x + 1 - \sqrt{ax^2 + x + 3}\right)$.

Range of a is equal to

A. (0,1)

B. $[1, \infty)$

C. $\left[\frac{1}{12}, \infty\right)$

D. $\left(-\infty, \frac{1}{12}\right]$

Answer: A

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6. Let $f(x) = ax^2 + x + 3$ and $f(x) \geq 0 \, \forall x \in R, \, \forall a \in A$ where $A \subset R$.

Also $L = \lim_{x \to \infty} \left(x + 1 - \sqrt{ax^2 + x + 3}\right)$.

Which one of the following statement is incorrect ?

A. If L exist then a=1.

B. If L does not exist then range of a is $\left[\frac{1}{12}, 1\right) \cup (1, \infty)$.

C. $|f(x)|$ is continuous and differentiable $\forall x \in R, \, \forall a \in A$

D. $f(|x|)$ is non-derivable at exact,y two points.

Answer: A

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MATHS SECTION - 2 [MULTIPLE CORRECT CHOICE TYPE]

1. If $\lim_{x \to \infty} \dfrac{p\cos x + xe^{\frac{1}{x}}}{1 + \sin x + q\cos x \cdot e^{\frac{1}{x}}} = 0$, then which of the following is are incorrect about p,q ?

A. $p = 0, q \in R$

B. $p = 4, q = 2$

C. $p = 2, q \in R$

D. $p = 0, q = 2$

Answer: A

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2. Cosider $f(x)ax^3 + bx^2 + cx + d$, where $a, b, c, d \in R$ and $a \neq 0$. If the equation f(x)=0 has three real roots α, β, γ such that $\alpha < \beta < \gamma$ and $L = \text{Lim} \dfrac{\left|ax^3 + bx^2 + cx + d\right|}{ax^3 + bx^2 + cx + d}$, where $m \in R$, then which of the following may be correct ?

A. $L = 1 \quad \text{if} \quad \beta < m < \gamma$

B. $L = -1 \quad \text{if} \quad \alpha < m < \beta$

C. $L = -1 \quad \text{if} \quad \beta < m < \gamma$

D. L=does not exist, if $m = \beta$

Answer: A

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3. If $f(x) = \sin^{-1}\left[e^{x}\right] + \sin^{-1}\left[e^{-x}\right]$ then which of the following hold(s) good ?

[Note: where [k] denotes the larest integer than or equal to k.]

A. f(x) has isolated point remonable discontinuity at x=0

B. domain of f(x) is (-In 2, In 2)

C. Range of f(x) contains exactly 2 elements.

D. Rang of $f(x) = \left\{\frac{\pi}{2}\right\}$

Answer: A

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4. If f(x) is integrable over [1,2] then $\int_1^2 f(x)dx$ is equal to

A. $\lim_{n \to \infty} \frac{1}{n} \sum_{r=1}^{n} f\left(\frac{r}{n}\right)$

B. $\lim_{n \to \infty} \frac{1}{2n} \sum_{r=n+1}^{n} f\left(\frac{r}{n}\right)$

C. $\lim_{n \to \infty} \frac{1}{n} \sum_{r=1}^{n} f\left(\frac{r+n}{n}\right)$

D. $\lim_{n \to \infty} \frac{1}{n} \sum_{r=1}^{2n} f\left(\frac{r}{n}\right)$

Answer: A

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5. If $\lim_{x \to \infty} \sin\left(\frac{\pi\left(1 - \cos^m x\right)}{x^n}\right)$ exists and non-zero where $m, n \in N$

then

A. m=1 , n=1

B. m=1 , n=2

C. m=2 , n=2

D. m=3 , n=2

Answer: A

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6. Which of the following function are continuous at x=0 ?

[Note : sgn x denotes signum dunction od x.]

A. $\cos\left(\frac{\pi}{2}sgn|x|\right) + sgn|x|$

B. $\cos\left(\frac{\pi}{2}sgn|x|\right)$ - $sgn|x|$

C. $\sin\left(\frac{\pi}{2}sgn|x|\right) + sgn|x|$

D. $\sin\left(\frac{\pi}{2}sgn|x|\right)$ - $sgn|x|$

Answer: A

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