PAPER CONTRIBUTOR : IINSIGHT

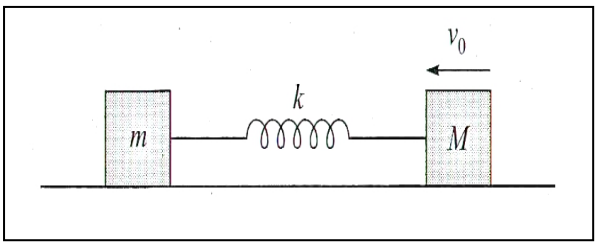
(PHYSICS)

1. A diatomic molecule moving at a speed u absorbs a photon of wavelength λ, and then dissociates into two identical atoms. One of the atoms is found to be moving with a speed v in a direction perpendicular to the initial direction of motion of the molecule. Take mass of the molecule to be M and find the binding energy of the molecule. Assume that momentum of absorbed photon is negligible compared to that of the molecule.

(a) $\frac{hc}{\lambda}+\frac{1}{2}Mu^2-\frac{1}{2}Mv^2$ (b) $\frac{1}{2}Mu^2-\frac{1}{2}Mv^2-\frac{hc}{\lambda}$

(c) $\frac{1}{2}Mu^2-\frac{hc}{\lambda}$ (d) $\frac{hc}{\lambda}-\frac{1}{2}Mu^2-\frac{1}{2}Mv^2$

2. Two blocks of masses m and M are joined with an ideal spring of spring constant k and kept on a rough surface as shown. The spring is initially upstretched and the coefficient of friction between the blocks and the horizontal surface is μ. What should be the maximum speed of the block of mass M such that the smaller block does not move?



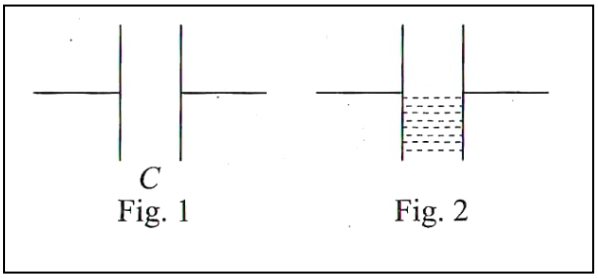
(a) $\mu g\sqrt{\frac{Mm}{(M+m)k}}$ (b) $\mu g\sqrt{\frac{(M+m)k}{Mm}}$ (c) $\mu g\sqrt{\frac{(2M+m)m}{kM}}$ (d) None of these

3. A thermally insulated piece of metal is heated under atmospheric pressure by the source providing constant power P, due to its absolute temperature depends on time as $T\ (t)\ = T_0[1+K(t-t_0)]^{1/4}$

Here K, T_0 and t_0 are constants. Then the heat capacity C_p(T) can be given by

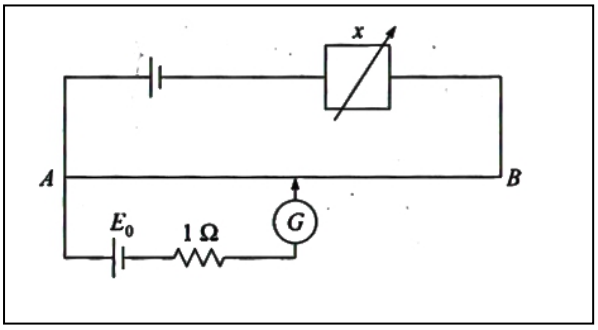
(a) $\frac{4P}{KT_0}$ (b) $\frac{4PT^3}{KT_0^4}$ (c) $\frac{2PT^3}{KT_0^4}$ (d) $\frac{2P}{KT_0}$

4. A parallel plate air capacitor has a capacitance C (Fig. 1). When it is half filled with a dielectric of dielectric constant 5 (Fig. 2), the percentage increase in the capacitance will be



(a) 400% (b) 33.3% (c) 66.6% (d) 200%

5. Figure shows a potentiometer arrangement with $R_{AB} = 10\Omega$ rheostat of variable resistance x. For x = 0, null deflection point is found at 20 cm from A. For unknown value of x null deflection point was at 30 cm from A, then the value of x is x



(a) 10Ω (b) 5Ω (c) 3Ω (d) 1Ω

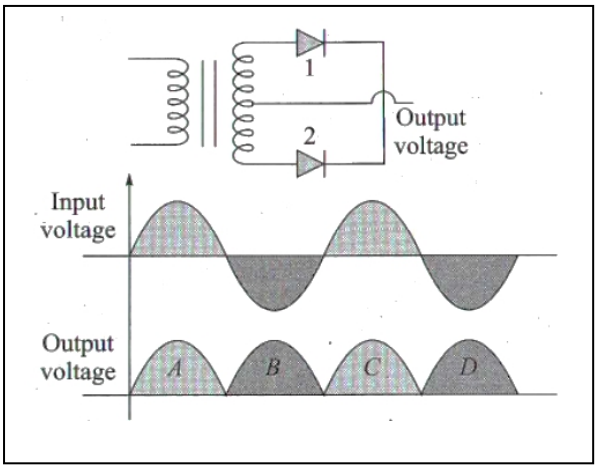
6. A conducting sphere of radius R carries a charge Q. It is enclosed by another concentric spherical shell of radius 2R. Charge from the inner sphere is transferred in infinitesimally small installments to the outer sphere. The work done in transferring the entire charge from the inner sphere to the outer one will be

(a) $-\frac{Q^2}{8\pi\epsilon_0 R}$ (b) $\frac{Q^2}{2\sqrt{2}\pi\epsilon_0 R}$ (c) $-\frac{Q^2}{16\pi\epsilon_0 R}$ (d) $-\frac{Q^2}{2\sqrt{2}\pi\epsilon_0 R}$

7. In Young's double slit experiment (with identical slits), the intensity of a maxima is I. P is a point on the screen where 10^{th} maxima is formed with light of wavelength $\lambda = 6000\ A^0$. Find the intensity at point P if the entire experimental set up is submerged in water of refractive index $\mu = \frac{4}{3}$. Assume that intensity due to individual slits remains unchanged after the system is dipped in water.

(a) $\frac{I}{8}$ (b) $\frac{I}{3}$ (c) $\frac{I}{2}$ (d) $\frac{I}{4}$

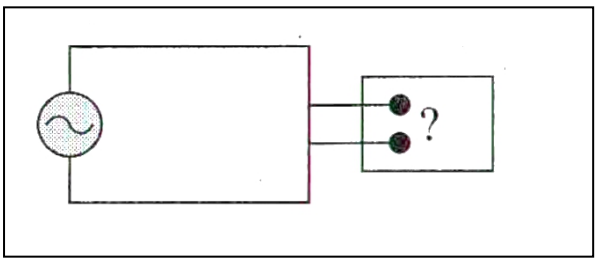
8. A full wave rectifier circuit along with the input and output voltages is shown in the figure.



The contribution to output voltage from diode 2 is

(a) A, C (b) B, D (c) B, C (d) A, D

9. Following figure shows an ac generator connected to a "black box" through a pair of terminals. The box contains possible R, L, C or their combination, whose elements and arrangements are not known to us. Measurements outside the box reveals that $e = 75\ sin\ (sin\ \omega t)\ volt, i = 1.5\ sin\ (\omega\ t + 45°)\ amp$, then the wrong statement is



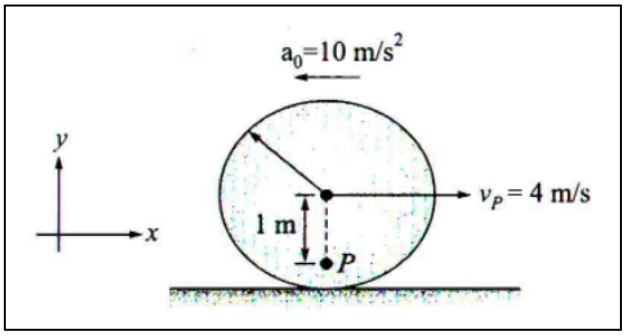
(a) There must be a capacitor in the box (b) There must be an inductor in the box

(c) There must be a resistance in the box (d) The power factor is 0.707

10. Two bodies of masses m_1 and m_2 are initially at rest at infinite distance apart. They are then allowed to move towards each other under mutual gravitational attraction. Their relative velocity of approach at a separation distance r between them is

(a) $\left[2G\ \frac{(m_1-m_2)}{r}\right]^{1/2}$ (b) $\left[\frac{2G}{r}\ (m_1+m_2)\right]^{1/2}$ (c) $\left[\frac{r}{2G(m_1m_2)}\right]^{1/2}$ (d) $\left[\frac{2G}{r}\ (m_1m_2)\right]^{1/2}$

11. A solid sphere of radius 2 m rolls without slipping on horizontal surface. Centre of mass has velocity V_o = 4 m/s and acceleration 10 m/s^2 as shown in figure, then acceleration at point P is



(a) $5\hat{i} - 4\hat{j}$ (b) $-5\hat{i} + 4\hat{j}$ (c) $10\hat{i} + 4\hat{j}$ (d) $10\hat{i} - 4\hat{j}$

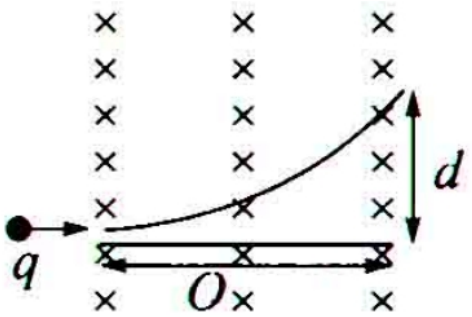
12. The angular frequency of damped oscillator is given by $\omega = \sqrt{\left(\frac{k}{m} - \frac{r^2}{4m^2}\right)}$

where k is the spring constant, m is the mass of the oscillator and r is the damping constant. If the ratio $\frac{r^2}{mk}$ is 8%, then the undamped oscillator is, approximately, as follows

(a) decreases by 1% (b) increases by 8%

(c) decreases by 8% (d) increases by 1%

13. In a certain region of space there exists a constant and uniform magnetic field of induction B. The width of the magnetic field is a. A charged particle having charge q, is projected perpendicular to $\overline{B}$ and along the width of the field. If deflection produced by the field perpendicular to the width is d, then the magnitude of the momentum of the particle is



(a) $\left(\frac{d^2+a^2}{2d}\right)qB$ (b) $\frac{a^2}{2d^2}qB$ (c) $\frac{4a^2}{(a+d)}qB$ (d) $\left(\frac{a^2-d^2}{2d}\right)qB$

14. Every iron-atom in a ferromagnetic domain in iron has a magnetic dipole moment equal to

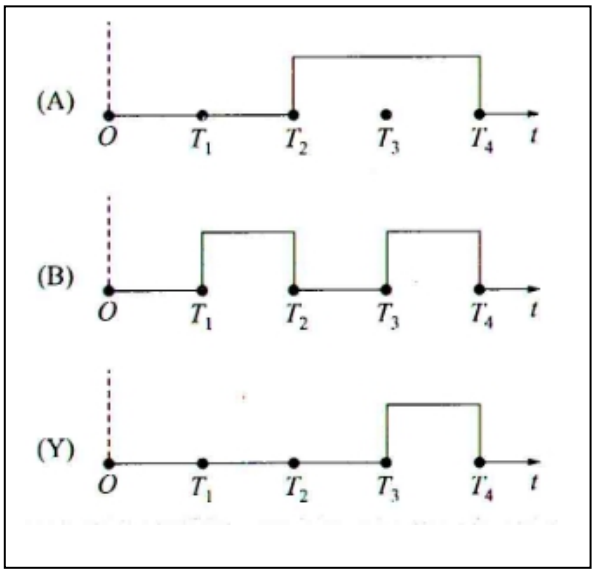
9.27×10^{-24} A/m^2. A ferromagnetic domain in iron has the shape of a cube of side 1 μm. The maximum dipole moment occurs when all the dipoles are aligned. The molar mass of iron is 56 g and its specific gravity is 8. The approximate magnetization of the domain is

(a) 8.0×10^5 A/m (b) 8.0×10^8 A/m (c) 8.0×10^{11} A/m (d) 8.0×10^{14} A/m

15. A radioactive material of half-life T was produced in a nuclear reactor at different instants. The quantity produced second time was twice of that produced first time, if now their present activities are A_1 and A_2, respectively, then their age difference equals

(a) $\frac{T}{ln2}\left|ln\frac{2A_1}{A_2}\right|$ (b) $T\left|ln\frac{A_1}{A_2}\right|$ (c) $\frac{T}{ln2}\left|ln\frac{A_1}{2A_2}\right|$ (d) $T\left|ln\frac{A_1}{2A_2}\right|$

16. The given figure shows the waveforms for two inputs A and B and that for the output Y of a logic circuit. The logic circuit is



(a) AND gate (b) OR gate (c) NAND gate (d) NOT gate

17. A particle having mass m and charge q moves along a line under the action of electric field

$E = \propto - \beta x$, where $\propto$and β are positive constants and x is the distance from a point where the particle initially is at rest. Therefore for an observer moving with an acceleration,

(i) The motion of particle is oscillatory (ii) The amplitude of particle is $\frac{\propto}{\beta}$

(iii) The mean position of particle is $x = \frac{\propto}{\beta}$ (iv) Maximum acceleration of particle is $\frac{q}{\beta} \propto$

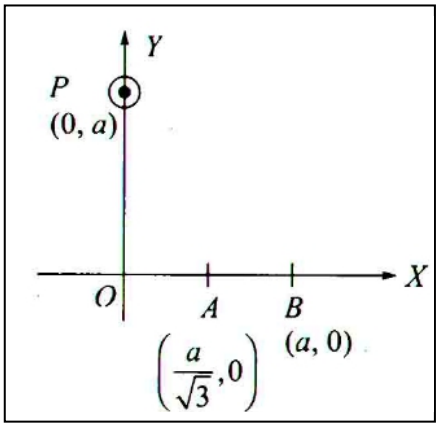
(a) Only (i) is correct (b) Only (i) and (iv) are correct

(c) Only (i), (ii) and (iii) are correct (d) (i), (ii), (iii) and (iv) are correct

18. A massive star is spinning about its diameter with an angular speed $\omega_0 = \frac{\pi}{1000} rad/day$. After its fuel is exhausted, the star collapses under its own gravity to form a neutron star. Assume that the volume of the star decreases to 10^{-12} times the original volume and its shape remains spherical. Assuming that the density of the star is uniform, find the angular speed of the neutron star

(a) 27 π x 10^5 rad/s (b) π x 10^5 rad/s (c) $\frac{5\pi}{3}$ x 10^5 rad/s (d) $\frac{5\pi}{2}$ x 10^5 rad/s

19. An infinite current carrying conductor carries current i and lies parallel to Z-axis and situated at point P as shown in figure. Find $\int_A^B \vec{B}.\vec{dl}$.



(a) $\frac{\mu_0 i}{24}$ (b) $\frac{\mu_0 i}{16}$ (c) $\frac{\mu_0 i}{12}$ (d) $\frac{\mu_0 i}{8}$

20. The position of a particle moving along a straight line is given by $x(t) = \frac{A}{B}(1 - e^{At})$, where B is constant and A > 0. The dimensions of $\frac{A^3}{B}$ is same as B

(a) linear momentum (b) moment of inertia

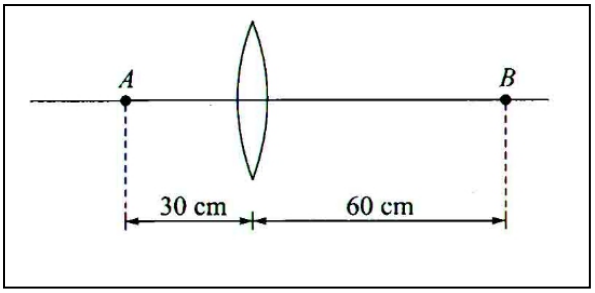
(c) relative velocity (d) acceleration

Numerical Value Type questions :

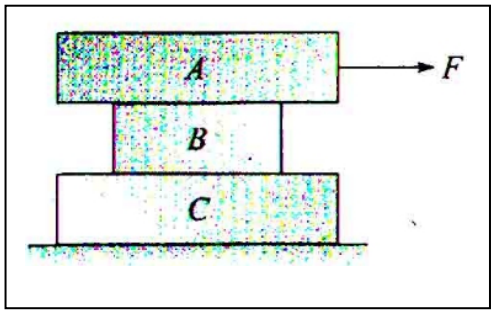
21. A siren placed at a railway platform is emitting sound of frequency 5 kHz. A passenger sitting in a moving train A records a frequency of 5.5 kHz, while the train approaches the siren. During his return journey in a different train, he records a frequency of 6.0 kHz while approaching the same siren. What is the ratio of the velocity of train B to that of train A?

22. Power transmitted on a string by means of transverse wave has dimension formula represented by $\frac{1}{2}\mu^1 V^1 \omega^x A^2$. Find the value of x, if μ is linear mass density (kg/m), V is speed (m/s), ω is angular frequency (rad/sec), A is amplitude (in metre).

23. Two point objects A and B are kept on the principal axis of a convex lens as shown. Image of both the objects is formed at same position. Find the focal length of the lens (in cm)?



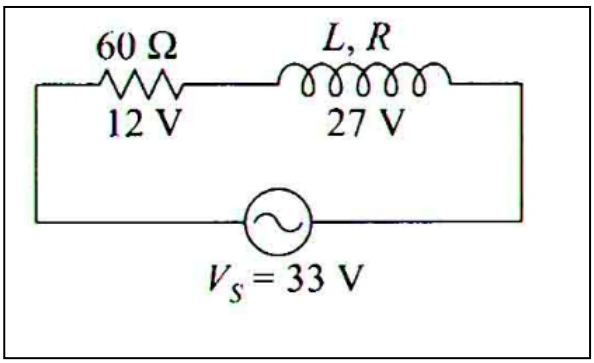
24. Given m_A = 30 kg, m_B = 10 kg, m_C = 20 kg. Between A and B μ_1 = 0.3, between B and C , μ_2 = 0.2, and between C and ground μ_3 = 0.1.



What is the least horizontal force F (in N) to start motion of any part of the system of three blocks resting upon one another as shown in figure (g = 10 m/s^2)

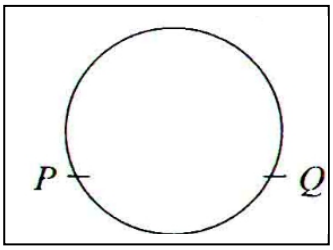
25. Two satellites A and B revolve around a planet in coplanar circular orbit in the same direction with period of revolutions 1 hour and 8 hours respectively: The radius of satellite A is 10^4 km, then the angular speed of B with respect to A in rad/hour is $\frac{\pi}{N}$. Find the value of N.

26. An inductor coil is connected to an AC source through a 60Ω resistance in series. The source voltage, voltage across the coil and voltage across the resistance are found to be 33 V, 27 V and 12 V respectively. What is the resistance of the coil in (Ω)?

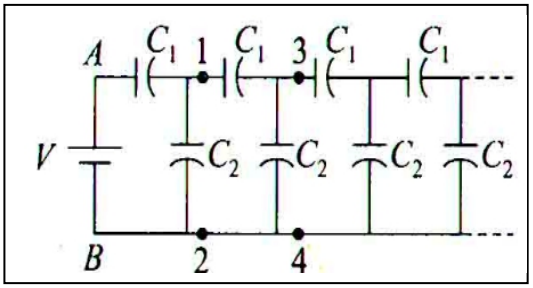


27. In a Young's double slit experiment, constructive interference is produced at a certain point P. The intensities of light at P due to the individual source are 4 and 9 units. What is the resultant intensity at point P?

28. A uniform wire of resistance 20 ohm having resistance 1 Ω/m is bent in the form of a circle as shown in figure. If the equivalent resistance between P and Q is 1.8 ohm, then the length of the shorter section is (in m)?



29. The circuit shown in the figure continues to infinity. The potential difference between points 1 and 2 is $\frac{V}{2}$, that between points, 3 and 4 is $\frac{V}{4}$, and so on, i.e., the potential difference becomes $\frac{1}{2}$ after every step of the ladder. Find the ratio $\frac{C_1}{C_2}$.

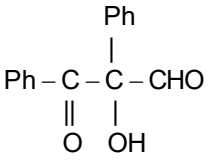


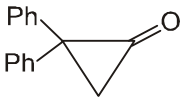
30. The oscillating magnetic field of a plane electromagnetic wave is given as:

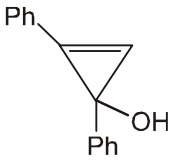
$B = 4 \times 10^{-6} \sin [200\pi x - 30 \times 10^{-9} \pi t]$ *tesla*. What is the amplitude of electric field (in v/m)?

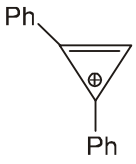
(CHEMISTRY)

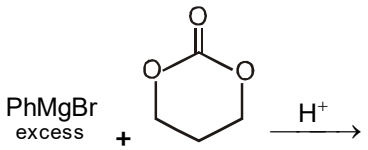
31. 2-Phenylcycloprop-2-en-1-one is allowed to react with phenylmagnesium bromide and the reaction mixture is hydrolysed with perchloric acid. The product formed is

(a) 

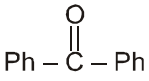
(b) 

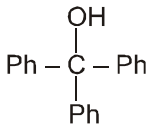
(c) 

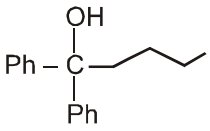
(d) 

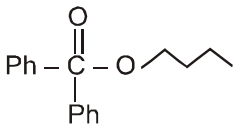
32. 

(A) . Product (A) is :

(a) 

(b) 

(c) 

(d) 

33. One mole of an ideal monoatomic gas at temperature T and volume 1L expands to 2L against a constant external pressure of one atm under adiabatic conditions, then final temperature of gas will be:

(a) $T + \frac{2}{3\times0.0821}$ (b) $T - \frac{2}{3\times0.0821}$ (c) $\frac{T}{2^{5/3-1}}$ (d) $\frac{T}{2^{5/3+1}}$

34. With t taken in seconds and I taken in Amp, the variation of I follows the equation

$$t^2 + I^2 = 25$$

what amount of Ag will be electrodeposited with this current flowing in the interval 0–5 second ? (Ag – 108)

(a) 22 mg (b) 66 mg (c) 77 mg (d) 88 mg

35. Consider the following statements

1. Steric number '7' gives 'sp^3d^3 hybridisation.
2. In C F_3 at least one bond angle is exactly 180°
3. Lone pair does not cause any distortion in the bond angle.

The above statements 1, 2, 3 respectively are (T = True, F = False)

(a) T F F (b) T T F (c) F T F (d) T T T

36. The gaseous HX molecule has a measured dipole moment of 4.0 D, which indicates that it is a very polar molecule. The separation between the nuclei in this molecule is 2.67×10^{-8} cm then the percentage ionic character in HX molecule:

(a) 78% (b) 31.25% (c) 50.25% (d) None of these

37. A coordination compound of cobalt has the molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three moles of ions in an aqueous solution. The aqeuous solution on treatment with an excess of $AgNO_3$ gives two moles of AgCl as a precipitate the formula of this complex would be

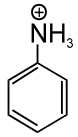
(a) $Co[NH_3)_4NO_2Cl][NH_3Cl]$ (b) $[Co(NH_3)Cl]\ [ClNO_2]$

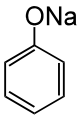
(c) $[Co(NH_3)_5NO_2]Cl_2$ (d) $[Co(NH_3)_5]\ [(NO_2)_2Cl_2]$

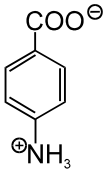
38. For a certain gas which deviates a little from ideal behaviour, the values of density, were measured at different values of pressure, P. The plot of P/ on the Y axis versus P on the X axis was nonlinear and had an intercept on the Y axis, which was equal to

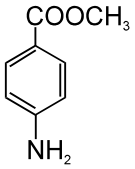
(a) $\frac{RT}{M}$ (b) $\frac{M}{RT}$ (c) RT (d) $\frac{RT}{V}$

39. Which of the following compound has highest dipole moment,

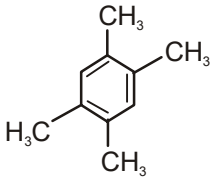
(a) 

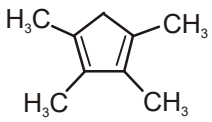
(b) 

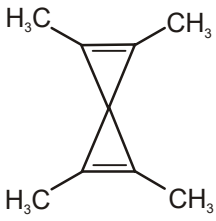
(c) 

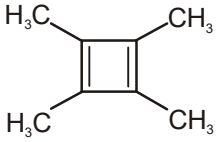
(d) 

40. Compound 'X' on ozonolysis followed by iodoform reaction produces 4 moles of CHI_3 and a tetrabasic acid. The structural formula of 'X' can be

(a) 

(b) 

(c) 

(d) 

41. 18 ml of mixture of acetic acid and sodium acetate required 6ml of 0.1 M NaOH for neutalization of the acid and 12 ml of 0.1 MHCl for reaction with salt, separately. If pK_a of the acid is 4.75, what is the pH of the mixture? [log2 = 0.3]

(a) 5.05 (b) 4.75 (c) 4.5 (d) 4.6

42. A metal salt solution forms a yellow precipitate with potassium chromate in acetic acid, a white precipitate with dilute sulphuric acid, but gives no precipitate with sodium chloride or iodide, it is

(a) Lead carbonate (b) Calcium carbonate
(c) Barium carbonate (d) Strontium carbonate

43. In a single isolated atom of hydrogen electrons make transition from 4^{th} excited state to ground state producing maximum possible number of wave lengths. If the 2^{nd} lowest energy of these lines is used to further excite an already excited sample of Li^{2+} ion then transition will be

(A) 1215 (b) 912 (c) 69 (d) 36

44. The following compounds have been arranged in order of their increasing thermal stabilities. Identify the correct order.

K_2CO_3 (I), $MgCO_3$ (II), $CaCO_3$ (III), $BeCO_3$(IV)

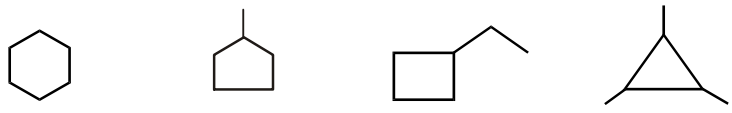
(a) I < II < III < IV *(b) IV < II < III < I* *(c) IV < II < I < III* *(d) II < IV < III < I.*

45. The correct boiling point order is

1 2 3 4

(a) 4 > 1 > 3 > 2 (b) 2 > 3 > 1 > 4 (c) 1 > 2 > 3 > 4 (d) 2 > 4 > 1 > 3

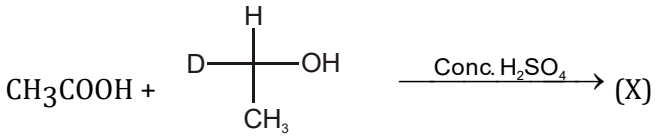
46. The correct order of heat of combustion of the following hydrocarbons is –

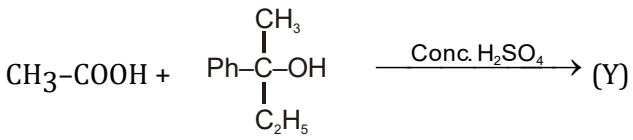


I , II , III , IV

(a) I < II < III < IV (b) I < II < IV < III (c) II < I < III < IV (d) IV < III < II < I

47.



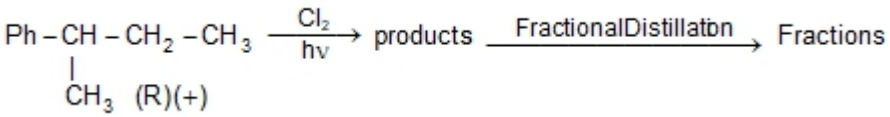


(a) (X) is optically active while (Y) is optically inactive (b) Both (X) and (Y) are optically active

(c) Both (X) and (Y) are optically inactive (d) (X) is optically inactive while (Y) isoptically

48. The half-lives of decomposition of gaseous CH_3CHO at constant temperature but at initial pressure of 364 mm and 170 mm Hg were 410 second and 880 second respectively. Hence order of reaction is

(a) 2 (b) 3 (c) 1.5 (d) 1

49. 

No. of products and No. of fractions are respectively

(a) 6, 5 (b) 6, 4 (c) 6, 6 (d) 6, 3

50. Minimum amount of Ag_2CO_3 (s) required to produce sufficient oxygen for the complete combustion of C_2H_2 which produces 11.2 ltr of CO_2 at S.T.P after combustion is: [Ag = 108]

$AgCO_3$ (s) 2Ag (s) + CO_2 (g) + O_2 (g)

$C_2H_2 + O_2$ $2CO_2 + H_2O$

(a) 276 gm (b) 345 gm (c) 690 gm (d) 1380 gm

NUMERICAL VALUE TYPE QUESTIONS

51. Hardness of water is 200 ppm. The normality of $CaCO_3$ in the water is_____

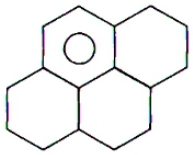
52. For 109% labelled oleum, if the number of moles of H_2SO_4 and free SO_3 be p and q respectively, then what will be the value of $\frac{p-q}{p+q}$?

53. Consider the electrode:
Ag I AgCl(s), Cl^- (0.1m), i.e., silver electrode in contact with 0.1 M KCl solution saturated with AgCl. If it is combined with the electrode Ag | Ag^+ (0.1 M) to form a complete cell, the EMF would be
(K_{sp} of $AgCl = 10^{-10}$ at 25°C)

54. In hydrogen atom an orbit has a diameter of about 16.92 A^0. The maximum number of electron that can accommodated is _____.

55. Two liquids A and B have vapour pressures in the ratio of $P_A^0 : P_B^0 = 1:2$ at a certain temperature. Suppose we have an ideal solution of A and B in the mole fraction ratio A : B = 1 : 2. The mole fraction of A in the vapour phase in equilibrium with the solution at a given temperature is_____.

56. The total number of contributing structure showing hyper conjugation (involving C-H bond) for the following compound is _____.



57. A sample of hard water contains 122 ppm of $HCO_3^{\ominus}$ ions. The minimum weight of CaO required to remove ions completely from 1 kg of such water sample is _____.

58. $\triangle_f H^{\ominus}$ of hypothetical MgCl is –125 kJ mol^{-1} and for $MgCl_2$ is –642 kJ mol^{-1}. The enthalpy of disproportionation of MgCl is $-49x$. Find the value of x.

59. The normality of a solution that result from mixing 4 g of NaOH, 500 mL of,1 M HCl and 10.0 mL of H_2SO_4 (specific gravity 1.1, 49% H_2SO_4 by weight) is_____.
(The total volume of solution was made to 1L with water)

60. 100 mL of 0.3 M Fe^{3+} (aq) ions were electrolysed by a charge of 0.072 F. In electrolysis, metal was deposited and O_2(g) was evolved. At the end of electrolysis, it is desired to oxidize the un-electrolyzed metal ion.

$$Fe^{3+} + e^{\ominus} \longrightarrow Fe^{2+}$$
$$Fe^{2+} + 2e^{\ominus} \longrightarrow Fe$$

The moles of Fe^{2+} ions left unelectrolysed in the solution is_____.

(MATHEMATICS)

61. If $|\vec{a}| = 1, |\vec{b}| = 2, |\vec{c}| = 3$, $\vec{a}, \vec{b}$ are perpendicular to $\vec{c}$ and $\vec{a} \cdot \vec{b} = 1$, then $\left[\frac{\vec{a}\times\vec{b}}{5}\ \vec{b}\times\vec{c}\ \frac{\vec{a}+\vec{b}+\vec{c}}{\sqrt{3}}\right]$ =

(a) $\sqrt{3}$ (b) 2 (c) 3 (d) $3\sqrt{3}$

62. If $\Delta(x) = \begin{vmatrix} \tan x & \tan(x+h) & \tan(x+2h) \\ \tan(x+2h) & \tan x & \tan(x+h) \\ \tan(x+h) & \tan(x+2h) & \tan x \end{vmatrix}$, then the value of $\lim_{h \to 0} \frac{\Delta(\pi/4)}{h^2}$ is :

(a) 36 (b) 81 (c) 144 (d) 256

63. Set of all real values of x satisfying the inequation $(x^2+3x)(2x+3)-16\left(\frac{2x+3}{x^2+3x}\right)\geq 0$ is :

(a) $x\in(-\infty,\ -4]\cup(-3,\ -3/2]\cup(0,\ 1]$ (b) $x\in\ [-4,\ -3)\cup[-3/2,\ 0)\cup\ [1,\infty)$

(b) $x\in[-4,\ -3]\cup[-3/2,\ 0]\cup[1,\ 2]$ (d) $x\in(-4,\ -3/2]\cup[1,\infty)$

64. If two distanct numbers m and n are chosen at random from the set {1, 2, 3, ….., 100}, then the probability that 2^m+2^n+1 is divisible by 3 is :

(a) $\frac{1}{2}$ (b) $\frac{49}{198}$ (c) $\frac{1}{4}$ (d) 1

65. In triangle ABC, if $b\ =\ 3, cos\ A\ =\frac{3}{5}$ and $\cos B=\frac{5}{13}$, then the value of c is :

(a) $\frac{14}{5}$ (b) $\frac{4}{5}$ (c) $\frac{7}{5}$ (d) $\frac{7}{2}$

66. Projection of line segment joining (2, 3, 4) and (5, 6, 7) on, plane $2x + y + z = 1$ is :

(a) 2 (b) $\sqrt{3}$ (c) 3 (d) $3\sqrt{3}$

67. If statements p and q take truth values as TT, TF, FT, FF in order, then the respective truth values of statement $(p\rightarrow q)\leftrightarrow(-p\rightarrow -q)$ will be

(a) T, F, F, T (c) T, F, F, F (c) F, F, F, F (d) T, T, T, T

68. Tangents are drawn to a circle of radius R from an external point P, to touch the circle at A and B. If C is centre of the circle and mid-point of AB is Q, then the value of $CP \bullet CQ$ is :

(a) $\frac{R^2}{2}$ (b) R^2 (c) $\frac{3R^2}{2}$ (d) $4R^2$

69. If A and B are two non-singular matrices of order 3 such that $AA^T = 2I$ and $A^{-1} = A^T - A \bullet$ adj $(2B^{-1})$, then det (B) equals

(a) 8 (b) $8\sqrt{2}$ (c) $16\sqrt{2}$ (d) 32

70. In α and β $(\alpha>\beta)$ are roots of $x^2+kx-1=0$, then :

(a) $tan^{-1}\alpha-tan^{-1}\beta=-\frac{\pi}{2}$ (b) $tan^{-1}\alpha+tan^{-1}\beta=-\frac{\pi}{2}$

(c) $tan^{-1}\alpha-tan^{-1}\beta=\frac{\pi}{2}$ (d) $tan^{-1}\alpha+tan^{-1}\beta=-\frac{\pi}{2}$

71. In any A. P., if the sum of first six terms is 5 times the sum of next six terms then which of its term is zero ?

(a) 10^{th} (b) 11^{th} (c) 12^{th} (d) 13^{th}

72. If $(4x^2+1)^n=\sum_{r=0}^{n}a_r\ (1+x^2)^{n-r}x^{2r}$, then the value of a_r is :

(a) ${}^nC_{r-1}\ 3^r$ (b) ${}^nC_{r-1}\ 4^r$ (c) ${}^nC_r\ 3^r$ (d) ${}^nC_r\ 4^r$

73. Number of ways in which 7 green bottles and 8 blue bottles can be arranged in a row, if exactly 1 pair of green bottles is side by side, is (assume all bottles to be alike except for the colour)

(a) 104 (b) 284 (c) 504 (d) 672

74. Let P be any point on ellipse $3x^2 + 4y^2 = 12$. If S and S' are foci of the ellipse, then locus of the centroid of triangle PSS' is a conic C whose eccentricity is :

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{3}}$

75. $\lim\limits_{x \to 0} \frac{1-cosx\sqrt{cos2x}}{x^2} =$

(a) 1/2 (b) 1 (c) 3/2 (d) 3

76. The function $f(x) = (x-1)|x-1| + sin(|x|)$ is :

(a) differentiable for all $x \in R - \{0, 1\}$ (b) continuous for all $x \in R - \{1\}$

(c) differentiable for all $x \in R - \{0\}$ (d) differentiable for all x

77. Let $f(x) = e^x$ for all $x \in R$, $g(x) = \begin{cases} x^2, & x < \frac{1}{2} \\ x - \frac{1}{4}, & x \geq \frac{1}{2} \end{cases}$ and $h(x) = f\big(g(x)\big)$. Then derivative of $h(x)$ at $x = \frac{1}{2}$ is :

(a) e (b) e^2 (c) e^4 (d) does not exist

78. Area of parallelogram formed by the lines $x + 2y = 5, x + 2y = 15, 3x + y = 10$ and $6x + 2y = c$ is greater than or equal to 1. The complete set of values of c is :

(a) $(-\infty, 21)$ (b) $(20, \infty)$ (c) $[19, \infty)$ (d) $(-\infty, 19] \cup [21, \infty)$

79. The quadratic function $f(x)$ is such that $f(x) - f(x+1) = 2x - 1, \forall\, x \in R$. If the greatest value of $f(x)$ in $(-\infty, 0]$ is 2, then the value of $f(1)$ is :

(a) 0 (b) 1 (c) 2 (d) 3

80. If four complex numbers z_1, z_2, z_3 and z_4 are such that $|z_1| < 1, |z_2| = 1$ and $|z_3| \leq 1$ and $z_3 = \frac{z_2(z_1 - z_4)}{\overline{z_1} z_4 - 1}$, then $|z_4|$ can be:

(a) 2 (b) 3 (c) 1/3 (d) 3/2

Numerical Value Type :

81. Let a be a positive real number and $\lim\limits_{n \to \infty} \frac{(n+1)^a + (n+2)^a + \ldots + (n+n)^a}{1^a + 2^a + \ldots + n^a} = 15$, then the value of a is :

82. Let f be a positive continuous function on the interval $[-2, 3]$. $A(t)$ is the area of the region bounded by the graph of $y = f(x)$ and the lines $y = 0, x = -2,$ *and* $x = t$ where $t \in (-2, 3)$. If $\lim\limits_{t\to 3^-} \frac{A(3)-A(t)}{3-t} = 3,$ then the value of $f(3)$ is :

83. The order of differential equation of family of circles passing through the point of intersection of $L \equiv x + 2y - 2 = 0$ *and* $S \equiv x^2 + y^2 - 2x - 2y - 1 = 0$ is .....

84. If the curves $x^2 = 9k(9 - y)$ *and* $x^2 = k(y + 1)$ intersect orthogonally, then the value of k is .....

85. Let $f(x) = \int \frac{1+2\cos x}{(\cos x+2)^2} dx$ and $g(0) = 0$. Then the value of $g(3\pi/2)$ is .....

86. If the system of equation $px + 2y - 3 = 0, x + 3y - 4 = 0$ *and*

$$px^2 + 3y^2 + 3xy + (q - 3)x - 3y - 1 = 0 \left(p \neq \frac{2}{3}\right)$$

Has a unique solution, then the value of $(p + q)$ is :

87. If $|z| = 1$ and $\arg(z) = \frac{\pi}{4}$, then principal argument of $\left(z^5 - iz\right)$ us _____. (take $\pi = 3.14$)

88. Let α *and* β $(\alpha > 3)$ be the roots of $2x^2 - ax + 4 = 0$ *and* $\sum_{n=1}^{\infty} \left(\frac{1}{\alpha} + \beta\right)^n = 3$. Then the value of α is :

89. The constant term in the expansion of $\left(log_{10}\left(x^{log_{10}x}\right) - log_{x^2}100\right)^{12}$ is _____.

90. If first row of a matrix A is [1 3 2]. If adj $A = \begin{bmatrix} -2 & 4 & \alpha \\ -1 & 2 & 1 \\ 3\alpha & -5 & -2 \end{bmatrix}$, then a possible value of det (A) is :

***

ANSWER KEY

PHYSICS

1.	d	2.	c	3.	b	4.	d	5.	b	6.	c	7.	d
8.	b	9.	b	10.	b	11.	b	12.	d	13.	a	14.	a
15.	c	16.	a	17.	d	18.	b	19.	a	20.	d		

Numerical Value Type

21.	2	22.	2	23.	40	24.	60	25.	3	26.	45	27.	5
28.	2	29.	2	30.	600								

CHEMISTRY

31.	d	32.	b	33.	b	34.	a	35.	a	36.	b	37.	c
38.	a	39.	c	40.	c	41.	a	42.	c	43.	b	44.	b
45.	b	46.	a	47.	a	48.	a	49.	a	50.	b		

Numerical Value Type

51.	4×10^{-3}	52.	1/9	53.	0.472	54.	32	55.	0.2	56.	6
57.	56	58.	8	59.	0.51	60.	0.009				

MATHS

61.	c	62.	a	63.	b	64.	b	65.	a	66.	b	67.	a
68.	b	69.	c	70.	c	71.	b	72.	c	73.	c	74.	c
75.	c	76.	c	77.	c	78.	d	79.	d	80.	c		

Numerical Value Type

81.	3	82.	3	83.	1	84.	4	85.	−0.5	86.	1	87.	-1.57
88.	9	89.	495	90.	1								