Towards Success

Turning Point

Turning Point

Institute for Pre-Medical/Engg. & Boards

3rd Floor Ram House, Jwala Heri, Paschim Vihar, Delhi - 63 Ph. : 47244724, 25278795

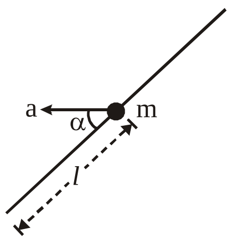
Important Instructions:

1. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
2. The test is of 3 hours duration.
3. The Test Booklet consists of 90 questions. The maximum marks are 360.
4. There are three parts in the question paper. The distribution of marks subjectwise in each part is as under for each correct response.
5. Candidates will be awarded marks as stated above in instructions No. 5 for correct response of each question. ¼ (one fourth) marks will be deducted for indicating incorrect response of each quest ion. No deduct ion from the total score will be made if no response is indicated for an item in the answer sheet .
6. Use Blue/Black Ball Point Pen only for writing particulars/ marking responses on Side-1 and Side-2 of the Answer Sheet. Use of pencil is strictly prohibi ted.
7. Rough work is to be done on the space provided for this purpose in the Test Booklet only. This space is given at the bottom of each page.
8. Do not fold or make any stray marks on the Answer Sheet.
9. **Cut off marks for each subject is 20% and you must score 40% in aggregate for qualifying.**

MOCK TEST

PHYSICS

1. A bead of mass m is fitted onto a rough rod of length $2l$ and can move along it only. At the initial moment the bead is in the middle of the rod. The rod moves translationally in space with the constant acceleration a in a direction forming an angle α with rod.

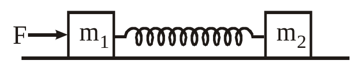


The time when the bead will leave the rod, if the coefficient of friction between bead and rod is μ, is (Neglect the weight of the bead).

(a) $\sqrt{\dfrac{2l}{a(\mu\cos\alpha-\sin\alpha)}}$ **(b)** $\sqrt{\dfrac{2l}{a(\cos\alpha-\mu\sin\alpha)}}$

(c) $\sqrt{\dfrac{2l}{a\cos\alpha}}$ **(d)** $\sqrt{\dfrac{2l}{\mu a(\cos\alpha+\sin\alpha)}}$

2. Two blocks of masses m_1 and m_2 connected by an ideal un-deformed spring rests on a horizontal plane. The coefficient of friction between the blocks and the surface is equal to μ. What minimum constant force has to be applied in the horizontal direction to the block of mass m_1 in order to shift the other block ? (given $m_2 > m_1$)



(a) $g\left(m_1+\dfrac{m_2}{2}\right)$ **(b)** $\mu g\left(m_1+\dfrac{m_2}{2}\right)$

(c) $\mu g\left(\dfrac{m_1}{2}+m_2\right)$ **(d)** $\mu g(m_1 + m_1)$

3. Two air bubbles in water

(a) attract each other **(b)** repel each other

(c) do not exert any force on each other

(d) may attract or repel depending upon the distance between them

4. A cannon fires successively two shells with velocity u, the first at an angle θ_1 and the second at an angle θ_2 to the horizontal, the azimuth being the same. Neglecting the air drag, the time interval between firings leading to the collision of the shells will be

(a) $\dfrac{2u}{g}\left[\dfrac{\sin(\theta_1-\theta_2)}{\cos\theta_1+\cos\theta_2}\right]$ **(b)** $\dfrac{2u}{g}\dfrac{\sin\theta_1+\sin\theta_2}{\cos\theta_1+\cos\theta_2}$

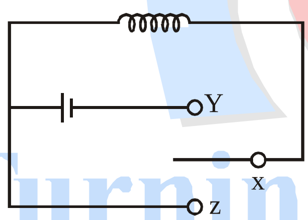
(c) $\frac{2u}{g}\left[\frac{\sin(\theta_1-\theta_2)}{\cos(\theta_1-\theta_2)}\right]$ **(d)** $\frac{2u}{g}\left[\frac{\sin(\theta_1+\theta_2)}{\cos(\theta_1+\theta_2)}\right]$

5. A hemispherical bowl of radius R is set rotating about its axis of symmetry which is kept vertical. A small block kept in the bowl rotates with the bowl without slipping on its surface. If the surface of the bowl is smooth and the angle made by the radius through the block with the vertical is θ, find the angular speed at which the bowl is rotating.

(a) $\sqrt{\frac{g}{R}\cos\theta}$ **(b)** $\sqrt{\frac{g\sec\theta}{R}}$

(c) $\sqrt{\frac{g}{R}\tan\theta}$ **(d)** $\sqrt{\frac{g}{R}\cot\theta}$

6. In the circuit shown, the coil has inductance and resistance. When X is joined to Y, the time constant is τ during growth of current. When the steady state is reached, heat is produced in the coil at a rate P. X is now joined to Z.



(a) The total heat produced in the coil is Pτ

(b) The total heat produced in the coil is $\frac{1}{2}P\tau$

(c) The total heat produced in the coil is 2Pτ

(d) The data given is not sufficient to reach the conclusion

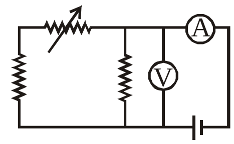
7. The density of an electric field depends only on the coordinates 'x' and 'y' as follows, $\vec{E}=\frac{a(x\hat{i}+y\hat{j})}{x^2+y^2}$

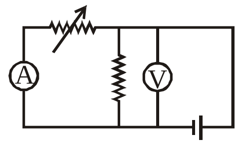
where, 'a' is a constant and $\hat{i}$ and $\hat{j}$ are the unit vectors of the 'x' and 'y' axes. The charge within a sphere of radius 'R' with the centre at the origin is

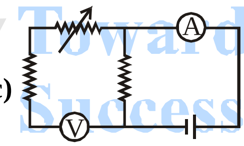
(a) $\varepsilon_0 aR$ **(b)** $\frac{aR}{4\pi\varepsilon_0}$

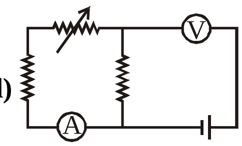
(c) $2\pi\varepsilon_0 aR$ **(d)** $4\pi\varepsilon_0 aR$

8. Express which of the following set ups can be used to verify Ohm's law ?

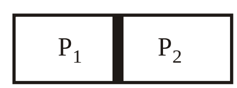
(a) 

(b) 

(c) 

(d) 

9. Figure below shows a cylindrical tube of volume V_0 divided in two parts by a frictionless separator. The walls of the tube are adiabatic but the separator is conducting. Ideal gases are filled in the two parts. When the separator is kept in the middle, the pressures are P_1 and P_2 in the left part and the right part respectively. The separator is slowly slide and is released at a position where it can stay in equilibrium. Find the volumes of the two parts.



(a) $\frac{P_1}{P_2}V_0, \frac{P_2}{P_1}V_0$ **(b)** $\frac{P_1V_0}{P_1+P_2}, \frac{P_2V_0}{P_1+P_2}$

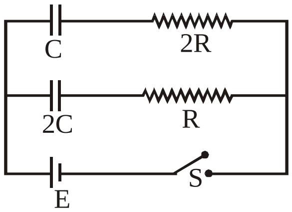
(c) $\left(1+\frac{P_1}{P_2}\right)V_0, \left(1+\frac{P_1}{P_2}\right)V_0$ **(d)** $\frac{(P_1+P_2)V_0}{P_1}, \frac{(P_1+P_2)V_0}{P_2}$

10. The wavelength of incident radiation is increased from 300 nm to 301 nm in a photoelectric effect experiment. The corresponding change in stopping potential is [Planck's constant h = 6.625 × 10^{-34} Js].

(a) 0.0138 V **(b)** – 0.0138 V

(c) 0.0153 V **(d)** 0.0152 V

11. In the circuit shown in the figure, switch S is closed at time t = 0. Select the incorrect statement(s).



(a) rate of increase of charge is same in both the capacitors

(b) ratio of charge stored in capacitors C and 2C at any time t would be 1 : 2

(c) time constants of both the capacitors are equal

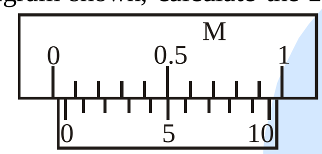
(d) steady state charge in capacitors C and 2C are in the ratio of 1 : 2

12. The density of steel is measured by measuring the mass and side length of a steel cube. If the maximum errors in the measurement of mass and length are 2% and 3% respectively, the maximum error in the measurement of the density is

(a) 11% **(b)** 7%

(c) 5% **(d)** 2%

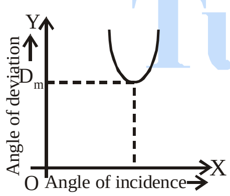
13. In the diagram shown, calculate the zero correction.

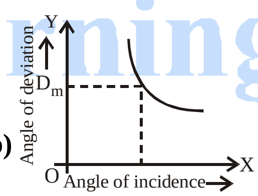


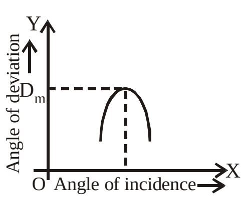
(a) + 0.05 cm **(b)** – 0.05 cm

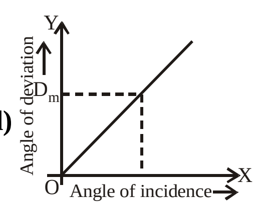
(c) 0 cm **(d)** ± 0.05 cm

14. Which is the correct form of the graph of angle of incidence vs angle of deviation for a triangular prism during the parallax method.

(a)


(b)


(c)


(d)


15. In Young's double-slit experiment, the separation between the slits is halved and the distance between the slits and the screen is doubled. The fringe width is

(a) unchanged **(b)** halved

(c) doubled **(d)** quadrupled

16. What happens when the applied load increases and upto breaking stress in the experiment to determine the Young's modulus of elasticity ?

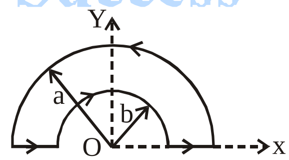
(a) The area of wire goes on decreasing and wire extends and breaks

(b) The area of wire goes on decreasing and wire breaks

(c) The wire extends and area remains constant

(d) The area remains same and wire length is also same

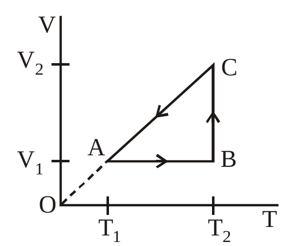
17. The magnetic moment of the loop as shown in figure by



(a) $\frac{\pi}{2}(a^2+b^2)I\hat{k}$ **(b)** $-\frac{\pi}{2}(a^2+b^2)I\hat{k}$

(c) $\frac{\pi}{2}(a^2-b^2)I\hat{k}$ **(d)** $-\frac{\pi}{2}(a^2-b^2)I\hat{k}$

18. The figure shows a process ABCA performed on an ideal gas. The net heat given to the system during the process is



(a) $nRT_1 \ln\left(\frac{V_2}{V_1}\right)$

(b) $nRT_2 \ln\left(\frac{V_2}{V_1}\right)$

(c) $nR\left[T_2 \ln\left(\frac{V_2}{V_1}\right)-(T_2-T_1)\right]$

(d) $nR\left[T_2 \ln\left(\frac{V_2}{V_1}\right) - T_2\right]$

19. For the determination of the focal length of a convex mirror, a convex lens is required because

(a) it is not possible to obtain the image produced by a convex mirror on the screen

(b) a convex lens has high resolving power so it helps to measure the focal length correctly

(c) a convex mirror always forms a real image which is diminished by the convex lens

(d) none of these

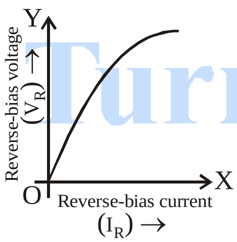
20. A binary star system consists of two stars A and B which have time period T_A and T_B and mass M_A and M_B. Then

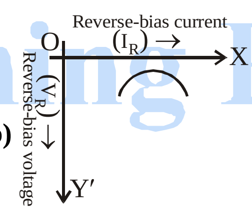
(a) if $T_A > T_B$ then $R_A > R_B$

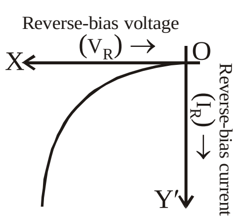
(b) if $T_A > T_B$ then $M_A > M_B$

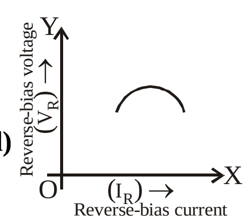
(c) $\left(\frac{T_A}{T_B}\right)^2 = \left(\frac{R_A}{R_B}\right)^3$ **(d)** $T_A = T_B$

21. Which of the following graph represents the plot of reverse bias voltage (V_R) vs reverse-bias current (I_R) of a junction diode in reverse-biased mode ?

(a)


(b)


(c)


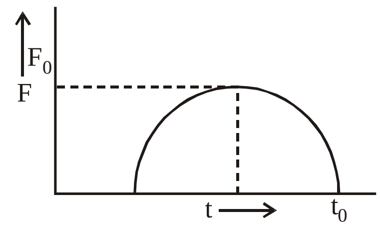
(d)


22. Two different coils have self-inductances L_1 = 8 mH, L_2 = 2 mH. The current in one coil is increased at a constant rate. The current in the second coil is also increased at the same rate. At a certain instant of time, the power given to the two coils is same. At the time the current, the induced voltage and the energy stored in the first coil are i_1, V_1 and W_1 respectively. Corresponding values for the second coil at the same instant are i_2, V_2 and W_2 respectively. Then

(a) $\frac{i_1}{i_2} = \frac{3}{4}$ **(b)** $\frac{i_1}{i_2} = 4$

(c) $\frac{W_1}{W_2} = 4$ **(d)** $\frac{V_2}{V_1} = \frac{1}{4}$

23. A variable force acts on a particle of mass ‘m’ (initially at rest) from ‘t’ = 0 to ‘t’ = t_0. The plot of F versus t is a semicircle as shown in figure. Which of the following is incorrect ?



(a) Impulse imparted to the particle is $\pi F_0^{\,2}$

(b) Impulse imparted to the particle is $\frac{1}{2}\pi F_0^2$

(c) The velocity acquired by the particle is $\frac{\pi F_0^2}{2m}$

(d) The momentum gain is $\frac{1}{2}\pi F_0^2$

Questions with Statement – 1 and Statement – 2

This section of Statement – 1 and Statement – 2. Of the four choices given here, choose the one that best describe the two Statements

(a) Statement – 1 is True, Statement – 2 is True ; Statement – 2 is a correct explanation for Statement – 1

(b) Statement – 1 is True, Statement – 2 is True ; Statement – 2 is not a correct explanation for Statement – 1

(c) Statement – 1 is True, Statement – 2 is False

(d) Statement – 1 is False, Statement – 2 is True,

24. Statement – 1

A cloth covers a table. Some dishes are kept on it. The cloth can be pulled out without dislodging the dishes form the table.

Statement – 2

For every action there is an equal and opposite reaction

25. Statement – 1

A block of mass m starts moving on a rough horizontal surface with a velocity v. It stops due to friction between the block and the surface after moving through a certain distance. The surface is now tilted to an angle of 30° with the horizontal and the same block is made to go up on the surface with the same initial velocity v. The decrease in the mechanical energy in the second situation is smaller than that in the first situation.

Statement – 2

The coefficient of friction between the block and the surface decreases with the increase in the angle of inclination.

Read the following Passages and Answer the Questions

PASSAGES : 1

A cylinder of radius R and height H = 3 m is filled with a liquid. Initial of filled water was $\frac{2}{3}H$ and R = 1 m. It is rotated at an unknown constant angular velocity 'ω'.

26. Section of the surface of the liquid by a vertical plane containing the axis is

(a) straight line **(b)** parabola

(c) hyperbola **(d)** any arbitrary curve

27. The speed of rotation when the water just starts spilling over the brim is

(a) $\sqrt{60}$ rad / sec **(b)** $\sqrt{80}$ rad / sec

(c) $\sqrt{40}$ rad / sec **(d)** $\sqrt{50}$ rad / sec

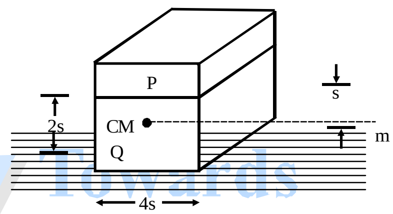
28. The speed of rotation when the point at the centre of the base is just exposed will be

(a) $\sqrt{60}$ rad / sec **(b)** $\sqrt{80}$ rad / sec

(c) $\sqrt{40}$ rad / sec **(d)** $\sqrt{50}$ rad / sec

PASSAGE 2

Consider a block P of mass 2M placed on another block Q of mass 4M lying on a fixed rough horizontal surface of coefficient of friction μ between this surface and the block Q. Surfaces of P and Q interacting with each other are smooth. A mass M is moving in the horizontal direction along a line passing through the centre of mass of block Q normal to the face. Speed of mass m is v_o when it solids elastically with the block Q at a height s from the rough surface. Both the blocks have same length 4s. Velocity v_o is enough to make the block P topple.



Now answer the following questions

29. Work done in moving the block Q through a distance 2s is

(a) 6μMgs (b) 12μMgs

(c) 18μMgs (d) 24μMgs

30. When mass M is colliding with velocity v_o the K.E> acquired by block Q is

(a) $\frac{8}{25}Mv_o^2$ (b) $\frac{25}{8}Mv_o^2$

(c) $\frac{1}{2}Mv_o^2$ (d) $\frac{3}{20}Mv_o^2$

CHEMISTRY

31. The gram equivalent volume of oxygen at STP is

(a) 5.6 L **(b)** 11.2 L

(c) 22.4 L **(d)** 16.8 L

32. The velocity of de-Broglie wave is given by

(a) $\frac{c^2}{v}$ **(b)** $\frac{h}{\lambda m}$

(c) $\frac{mc^2}{h}$ **(d)** $v\lambda$

33. The amount of urea to be dissolved in 500 cc of water (K_f = 1.86) to produce a depression of 0.186 °C in the freezing point is

(a) 6 g **(b)** 3 g
(c) 8 g **(d)** 1 g

34. For the reaction

$$A(s) \longrightarrow B(x) + C(s)$$

The entropy change at 298 K and 1 atm if absolute entropies of A, B and C are 112, 180 and 132 J K^{-1} mol^{-1} respectively is

(a) 86 J K^{-1} mol^{-1} **(b)** 100 J K^{-1} mol^{-1}
(c) 180 J K^{-1} mol^{-1} **(d)** 200 J K^{-1} mol^{-1}

35. Which of the following is acidic buffer solution ?

(a) NaCl + HCl **(b)** $NaNO_2$ + HNO_2
(c) NH_4NO_2 + HNO_2 **(d)** NH_4Cl + NH_4OH

36. Hybridisation of P in $POCl_3$ is

(a) sp **(b)** sp^3
(c) sp^2 **(d)** sp^3d

37. Which of the following is inorganic graphite ?

(a) BN **(b)** SiC
(c) $B_3N_3H_6$ **(d)** B_2H_6

38. Which of the following is correct for $(Ni(CN)_4]^{2-}$?

(a) It is tetrahedral and diamagnetic complex
(b) It is square-planar and diamagnetic complex
(c) It is square-planar and paramagnetic complex
(d) It is tetrahedral and paramagnetic complex

39. Which of the following contains two electrons and three centre bonds ?

(a) C_2H_6 **(b)** B_2H_6
(c) $B(OH)_3$ **(d)** Al_2Cl_6

40. Zinc on reaction with concentrated HNO_3 gives

(a) NH_4NO_3 **(b)** NO_2
(c) N_2O **(d)** N_2

41. Both geometrical and optical isomerisms are shown by

(a) $[Co(en)_2Cl_2]^+$ **(b)** $[Co(NH_3)_5Cl]^{2+}$
(c) $[Co(NH_3)_4Cl_2]^+$ **(d)** $[Cr(ox)_3]^{3-}$

42. H_2O_2 on reaction with titanium salt gives

(a) yellow colour **(b)** red colour
(c) white colour **(d)** black colour

43. Which of the following is not an acidic oxide ?

(a) CO_2 **(b)** N_2O
(c) NO_2 **(d)** SO_2

44. Which of the following is Saline hydride ?

(a) CaH_2 **(b)** CH_4
(c) AlH_3 **(d)** BH_3

45. Which of the following is formed when carbon dioxide is passed through a brine solution saturated with ammonia ?

(a) NH_4HCO_3 **(b)** $NaHCO_3$
(c) Na_2CO_3 **(d)** H_2CO_3

46. The oxidation states of chlorine in $CaOCl_2$ is

(a) – 1, – 1 **(b)** + 1, + 1
(c) + 1, – 1 **(d)** + 5, – 1

47. For decolourization of 1 mole of $KMnO_4$, the moles of H_2O_2 required is

(a) 1/2 **(b)** 3/2
(c) 5/2 **(d)** 7/2

48. Which of the following is correct order of stability of carbocations ?

(a) $CH_3-\overset{\oplus}{C}H_2 > CH_2=\overset{\oplus}{C}H > CH\equiv\overset{\oplus}{C}$

(b) $CH_2=\overset{\oplus}{C}H > CH\equiv\overset{\oplus}{C} > CH_3-\overset{\oplus}{C}H_2$

(c) $CH_3-\overset{\oplus}{C}H_2 > CH\equiv\overset{\oplus}{C} > CH_2=\overset{\oplus}{C}H$

(d) $CH_2=\overset{\oplus}{C}H > CH_3-\overset{\oplus}{C}H_2 > CH\equiv\overset{\oplus}{C}$

49. o-Nitrophenol and p-nitrophenol can be separated by

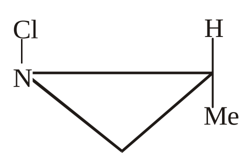
(a) vacuum distillation **(b)** fractional distillation
(c) steam distillation **(d)** simple distillation

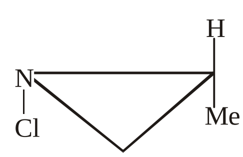
50. Which is produced on reduction of an aromatic nitro compound with Zn and HCl ?

(a) Oxime **(b)** Benzene
(c) Aniline **(d)** Amide

51. Which of the following having highest heat of hydrogenation ?

(a) 2, 3-Dimethylbut-2-ene **(b)** Propene
(c) Ethene **(d)** But-2-ene

52. 

and 

are

Rough Work

(a) d and *l* isomers **(b)** cis and trans isomers
(c) functional isomers **(d)** position isomers

53. Which of these is not stabilized by resonance ?
(a) CO_3^{2-} **(b)** BF_4^-
(c) NO_3^- **(d)** C_6H_6

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(d) Statement -1 is False, Statement -2 is True

54. Statement -1
In a hexagonal close packed structure of spheres the fraction of the volume occupied by the sphere is equal to the fraction of the volume occupied by the sphere in ccp.
Statement -2 :
Packing fraction increases with coordination number.

55. Staement - 1 :
The phenomenon of imbibition shows that gel is a three dimensional network with void space inside where the liquid
Statement – 2 : The extent of swelling varies with pH of the medium and is minimum and the isoelectric point

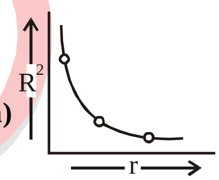
Read the following Passages and Answer the Questions :

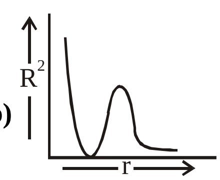
Passage :
The branch of science which deals with dual behaviour of matter is said to be quantum mechanics. The fundamental equation of quantum mechanics is Schrodinger wave equation. The important features of quantum mechanics are
(i) The energy of electron is quantized as a result of wave like properties of electrons.
(ii) The position and momentum of an electron cannot be determined simultaneously. The path of electron cannot be determined. We can only talk of probability of finding electron.
(iii) An atomic orbital is represented by wave function 'Ψ' for an electron. 'R' is radial wave function whose value varies with distance from the nucleus. Ψ^2 determines total probability (angular and radial) whereas R^2 is called radial probability.
All information about electron in an atom is stored in orbital wave function Y. 'R' is radial wave function.
(iv) R can be +ve or –ve but R^2 is always +ve. Similarly, Ψ can be +ve or –ve but Ψ^2 is always +ve. Ψ^2 can be equal to zero.

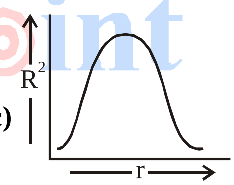
56. The region or space where $\Psi^2 = 0$ are called
(a) nodes **(b)** antinodes
(c) orbitals **(d)** energy levels

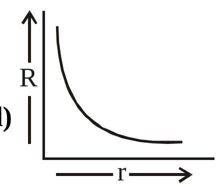
57. Hamiltonian operator represents
(a) kinetic energy **(b)** potential energy
(c) total energy
(d) probability of finding electron

58. Which of the following probability distribution curves represents 2s orbital for H-atom ?

(a)


(b)


(c)


(d)


PASSAGE - 2

Dicarboxylic acids contain two carboxylic acid groups. Acidity of carboxylic depends upon stability of intermediate formed. The α hydrogen present in carboxylic acid is labile. Dicarboxylic acids on decarboxylation form monocarboxylic acids, alkanes and cyclic ketones depending upon conditions. Greater the symmetry, higher will be the melting point.

59. Sodium adipate on electrolysis gives
(a) But-2-ene (b) But-1-ene
(c) Cyclobutane (d) Cyclobutene

60. Maleic acid on reaction with alkaline $KMnO_4$ gives
(a) d(+) tartaric acid (b) l(–) tartaric acid
(c) racemicmixture of tartaric acid
(d) Meso tartaric acid

MATHEMATICS

61. The equation of the common tangent to the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is
(a) $x + y + a = 0$ **(b)** $x + y = a$
(c) $x - y = a$ **(d)** none of these

62. If $\vec{a}, \vec{b}, \vec{c}$ are three noncoplanar vectors represented by concurrent edges of a parallelopiped of volume 4 then $(\vec{a}+\vec{b}).(\vec{b}\times\vec{c})+(\vec{b}+\vec{c}).(\vec{c}\times\vec{a})+(\vec{c}+\vec{a}).(\vec{a}\times\vec{b})$ is equal to
(a) 12 **(b)** 4
(c) 0 **(d)** ± 12

63. If $\phi(x) = \int \cot^4 x dx + \frac{1}{3}\cot^3 x - \cot x$ and $\phi\left(\frac{\pi}{2}\right) = \frac{\pi}{2}$ then $\phi(x)$ is
(a) $\pi - x$ **(b)** $x - \pi$
(c) $\frac{\pi}{2} - x$ **(d)** none of these

64. The number of all the possible selections which a student can make for answering one or more questions out of eight given questions in a paper, when each question has three alternative is
(a) 6561 **(b)** 256
(c) 6560 **(d)** none of these

65. If $x = a + b$, $y = a\omega + b\omega^2$, $z = a\omega^2 + b\omega$, then $x^3 + y^3 + z^3 =$
(a) $3(a^3 - b^3)$ **(b)** 0
(c) $3(a^3 + b^3)$ **(d)** $a^3 + b^3 + c^3 - 3abc$

66. The value of a for which the area of the region bounded by the curve $y = 8x^2 - x^5$, the straight line $x = 0$ and $x = a$ and the x-axis is equal to 16/3, is
(a) $\left(8+\sqrt{2}\right)^{1/3}$ **(b)** no such a exists
(c) $\left(8-4\sqrt{2}\right)^{1/3}$ **(d)** none of these

67. The greatest value of $f(x) = \int_1^x |t|\,dt$ on the interval $\left[-\frac{1}{2}, \frac{1}{2}\right]$ is
(a) $-\frac{3}{8}$ **(b)** $\frac{3}{8}$
(c) $\frac{1}{2}$ **(d)** $-\frac{1}{2}$

68. If α, β and γ are real numbers, then
$$\Delta \begin{vmatrix} 1 & \cos(\beta-\gamma) & \cos(\gamma-\alpha) \\ \cos(\alpha-\beta) & 1 & \cos(\gamma-\beta) \\ \cos(\alpha-\gamma) & \cos(\beta-\gamma) & 1 \end{vmatrix}$$ is equal to
(a) $\cos\alpha.\cos\beta.\cos\gamma$ **(b)** –1
(c) $\cos\alpha + \cos\beta + \cos\gamma$ **(d)** 0

69. If the system of equations $ax + y + z = 0$, $x + by + z = 0$ and $x + y + cz = 0$ $(a, b, c \neq 1)$ has a non-trival solution then the value of $\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}$ is
(a) –1 **(b)** 0
(c) 1 **(d)** none of these

70. The number of values of k for which the equation $x^2 - 3x + k = 0$ has two distinct roots lying in the interval (0, 1) are
(a) no values of k satisfies the requirement
(b) two
(c) three **(d)** infinitely many

71. If $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then the matrix A equals

(a) $\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}$ (b) $\begin{bmatrix}0 & 1\\ 1 & 1\end{bmatrix}$

(c) $\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$ (d) $\begin{bmatrix}1 & 1\\ 0 & 1\end{bmatrix}$

72. If the cube roots of unity are 1, ω, ω^2, then the roots of equation $(x-1)^3 + 8 = 0$ are

(a) $-1, 1-2\omega, 1-2\omega^2$ **(b)** $-1, -1, -1$

(c) $-1, 1+2\omega, 1+2\omega^2$ **(d)** none of these

73. The angles of elevation of the top of a tower at the top and the foot of a pole of height 10 meters are 30° and 60° respectively. The height of the tower is

(a) 10 metres **(b)** 15 metres

(c) 20 metres **(d)** none of these

74. The set of all x in $(-\pi, \pi)$ satisfying $|4\sin x - 1| < \sqrt{5}$ is given by

(a) $\left(\frac{-\pi}{10}, \frac{3\pi}{10}\right)$ **(b)** $\left(\frac{\pi}{10}, \frac{-3\pi}{10}\right)$

(c) $\left(\frac{\pi}{10}, \frac{3\pi}{10}\right)$ **(d)** none of these

75. If the fourth term in the expansion of $\left\{\sqrt{x^{\frac{1}{\log x+1}}} + x^{1/12}\right\}^6$ is equal 200 and x > 1, then x is equal to

(a) 10^4 **(b)** $10^{\sqrt{2}}$

(c) 10 **(d)** none of these

76. The number of terms common to two A.P.s. 3, 7, 11, ... 407 and 2, 9, 16, ... 709 is

(a) 21 **(b)** 28

(c) 14 **(d)** none of these

77. A bag contains 3 white, 3 black and 2 red balls one by one three balls are drawn without replacing them. The probability that the third ball is red, is

(a) $\frac{1}{4}$ **(b)** $\frac{2}{3}$

(c) $\frac{1}{3}$ **(d)** $\frac{1}{2}$

78. The amplitude of $\frac{1+i\sqrt{3}}{\sqrt{3}+1}$ is

(a) $\pi/4$ **(b)** $\pi/3$

(c) $\pi/6$ **(d)** none of these

79. A person predicts the outcome of 20 cricket matches of his home team. Each match can result either in a win, loss or tie for the home team. Total number of ways in which he can make the predictions so that exactly 10 predictions are correct, is equal to

(a) $^{20}C_{10}.2^{20}$ **(b)** $^{20}C_{10}.3^{20}$

(c) $^{20}C_{10}.3^{20}$ **(d)** $^{20}C_{10}.2^{10}$

80. A student is allowed to select at most n books from a collection of (2n + 1) books. If the total number of ways in which he can select one book is 63, then the value of n is

(a) 3 **(b)** 4

(c) 2 **(d)** none of these

81. The set of all values of a for which

$f(x) = \left(\frac{\sqrt{a+4}}{1-a} - 1\right)x^5 - 3x + \log 5$ decreases for all values of real x, is

(a) $\left[-3, \frac{1}{2}\left\{5-\sqrt{27}\right\}\right] \cup (2, \infty)$

(b) $(-\infty, \infty)$

(c) $(1, \infty)$

(d) $\left[-4, \frac{1}{2}\left\{3-\sqrt{21}\right\}\right] \cup (1, \infty)$

82. Let $f : R \to R : f(x) = \tan x$. Then $f^{-1}(1)$ is equal to

(a) $\frac{\pi}{4}$ **(b)** $\left\{n\pi + \frac{\pi}{4} : n \in Z\right\}$

(c) does not exist **(d)** none of these

83. Let A = {x, y, z}, B = (u, v, w} and $f : A \to B$ be defined by f(x) = u, f(y) = v, f(z) = w, then f is

(a) surjective but not injective

(b) bijective

(c) injective but not surjective

(d) none of these

Questions with Statement - 1 and Statement - 2

This section of Statement – 1 and Statement – 2. Of the four choices given here, choose the one that best describes the two Statements.

(a) Statement – 1 is True, Statement – 2 is True ; Statement – 2 is a correct explanation for Statement – 1

(b) Statement – 1 is True, Statement – 2 is True ; Statement – 2 is not a correct explanation for Statement – 1

(c) Statement – 1 is True, Statement – 2 is False

(d) Statement – 1 is False, Statement – 2 is True

84. Statement – 1 $\lim\limits_{x\to 0} \dfrac{2^{\frac{1}{x}}}{1+2^{\frac{1}{x}}} = 1$

Statement – 2 $\lim\limits_{x\to 0} \dfrac{\cos^{-1}(1-x)}{\sqrt{x}} = \sqrt{2}$

85. Statement – 1

The straight line 2x + 3y = 4 intersects the hyperbola $4x^2 - 9y^2 = 36$ in exactly one point.

Statement – 2

The line is parallel to an asymptote of the hyperbola.

Read the following Passage and Answer the Question

PASSAGE 1

Let L_1 is the line passes through A (1, 0) and make angle 135° with positive x-axis in anticlockwise direction. L intersect y-axis at point B.C and D are the points on the line AB such that C and D divides AB in the ratio 1 : 2 and 2 : 1. Another line L_2 which is parallel to L_1 and passes through origin. Another two lines L_3 and L_4 which passes through C and D respectively and perpendicular to L_2. L_2 intersects L_3 and L_4 at E and F respectively.

86. The distance between L_1 and L_2 is (in units)

(a) $\frac{1}{2}$ **(b)** $\frac{1}{\sqrt{2}}$

(c) $\sqrt{2}$ **(d)** 2

87. The distance between L_3 and L_4 is

(a) $\frac{1}{\sqrt{2}}$ **(b)** $\frac{\sqrt{2}}{3}$

(c) $\frac{1}{3}$ **(d)** 3

88. E and F points are mirror image with respect to

(a) x-axis **(b)** Origin

(c) y-axis **(d)** none of these

Passage - 2

From a point P on a radius OA of circle (radius r) produced beyond the circle, a tangent PT is drawn to the circle touching it at T. Draw TN $\perp$ OA.

89. As P tends to A, then $\dfrac{NA}{AP}$ tends to

(a) 1 (b) 1/2

(c) $1/\sqrt{2}$ (d) none of these

90. As P tends to A, then $\dfrac{AN}{(\text{arc}\,AT)^2}$ tends to

(a) 1/2r (b) 2/r

(c) 4/r (d) None of these

Rough Work