
All The Best...!!

Part - A Physics

Section - I: Single Correct

*This section contains a total of 20 questions.
All questions in this section are mandatory.
For every correct response you shall be awarded 4 marks.
For every incorrect response -1 marks shall be deducted.
For more details refer the first page of this booklet.*

1. The respective speeds of five molecules are 1, 2, 3, 4 and 5 km/sec. The ratio of their rms speed and the average speed will be:
- (a) $\sqrt{11} : 3$
 - (b) $3 : \sqrt{11}$
 - (c) $1 : 2$
 - (d) $3 : 4$

2. An EM wave through vacuum is described by $E = E_0 \sin(kx - \omega t)$ and $B = B_0 \sin(kx - \omega t)$. Then which of the following statements is true?
- (a) $kE_0 = \omega B_0$
 - (b) $\omega E_0 = kB_0$
 - (c) $\omega E_0 = B_0$
 - (d) $E_0 = \omega B_0$

3. A bob is suspended from an ideal string of length l . Now it is pulled to a side through 60° to the vertical and rotates along a horizontal circle. Then its period of revolution is

(a) $\pi\sqrt{\frac{l}{g}}$

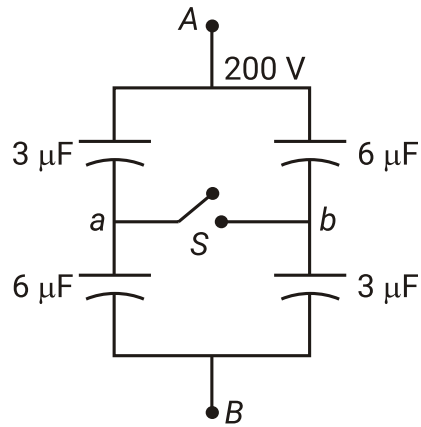
(b) $\pi\sqrt{\frac{l}{2g}}$

(c) $\pi\sqrt{\frac{2l}{g}}$

(d) $2\pi\sqrt{\frac{l}{g}}$

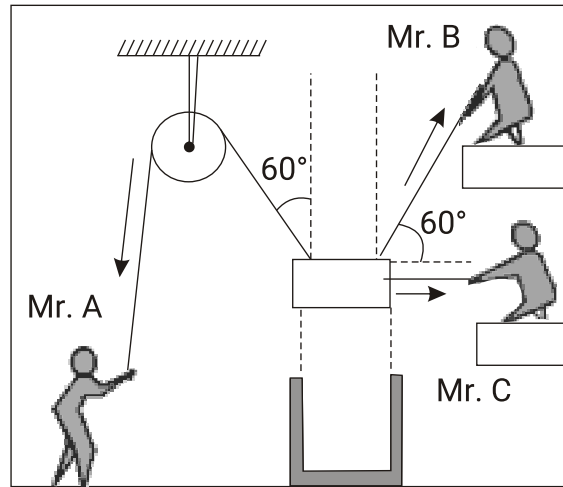
4. When two capillary tubes of the same material but different diameters are dipped vertically inside water, the rise of water is
- (a) the same in both the tubes
 - (b) more in the tube of larger diameter
 - (c) less in the tube of smaller diameter
 - (d) more in the tube of smaller diameter

5. In the circuit diagram, potential difference between points A and B is 200 volt. Find out the potential difference between points a and b ? (switch S remain opened)



- (a) 100 volt
 (b) $\frac{200}{3}$ volt
 (c) $\frac{100}{3}$ volt
 (d) 50 volt

6. Mr. A, B and C are trying to put a heavy piston into a cylinder at a mechanical workshop in a railway yard. If they apply forces F_1 , F_2 and F_3 respectively on the ropes then for which set of forces at that instant, they will be able to perform the said job?



- (a) $\sqrt{3}F_1 = F_2 + 2F_3$
 (b) $F_1 = F_2 + 2F_3$
 (c) $\sqrt{3}F_1 = F_2 - 2F_3$
 (d) $F_3 = 2F_1 - \sqrt{3}F_2$

7. An electron moving with speed v and a photon moving with speed c , have same de-Broglie wavelength. The ratio of kinetic energy of electron to that of photon is:

(a) $\frac{v}{3c}$

(b) $\frac{v}{2c}$

(c) $\frac{3c}{v}$

(d) $\frac{2c}{v}$

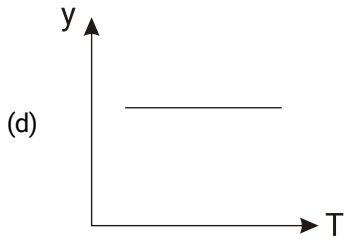
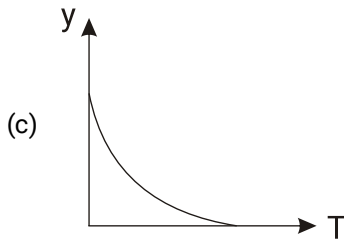
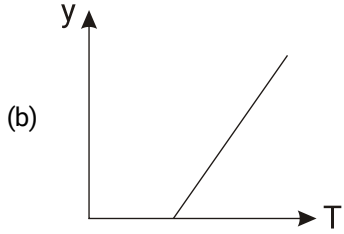
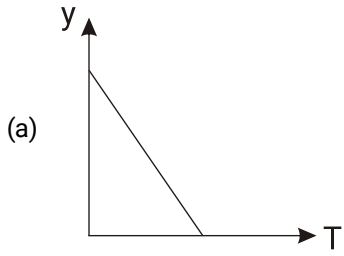
8. A body of mass M is kept on a rough horizontal surface (static friction coefficient μ). A person is trying to pull the body by applying a horizontal force but the body is not moving. The force by the surface on the body is F , then
- (a) $F = Mg$
 - (b) $F = \mu Mg$
 - (c) $Mg \leq F \leq Mg\sqrt{1 + \mu^2}$
 - (d) $Mg \geq F \geq Mg\sqrt{1 + \mu^2}$

9. A wall clock uses a simple pendulum. It is accurate at the Earth's surface. If it is taken to a high altitude:
- (a) it will run fast
 - (b) its length should be increased to keep it accurate
 - (c) its length should be decreased to keep it accurate
 - (d) even if the length is changed it cannot be accurate

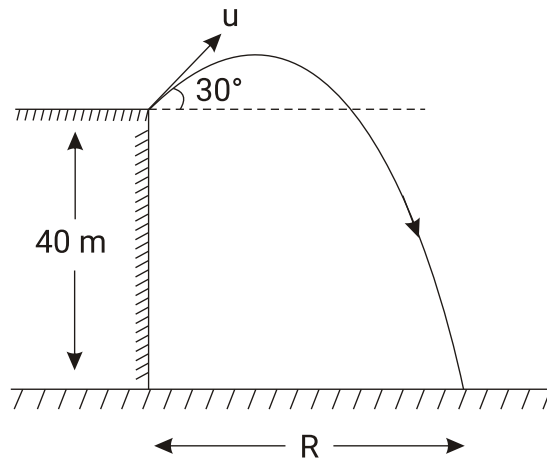
10. The potential energy of a 2 kg particle, free to move along the x -axis is given by, $V(x) = \left(\frac{x^3}{3} - \frac{x^2}{2}\right)$ J. The total mechanical energy of the particle is 4 J. The maximum speed (in ms^{-1}) is

- (a) $\frac{1}{\sqrt{2}}$
- (b) $\sqrt{2}$
- (c) $\frac{3}{\sqrt{2}}$
- (d) $\frac{5}{\sqrt{6}}$

11. A hot liquid is kept in a big room. According to Newton's Law of Cooling, the magnitude of its rate of cooling of the liquid (represented as y) is plotted against its absolute temperature T . Which of the following curves may represent the plot?

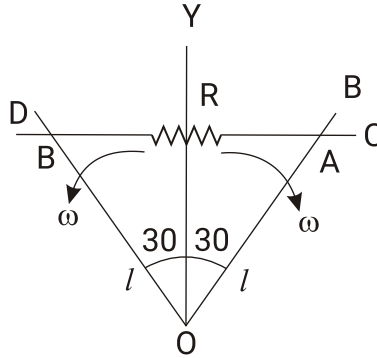


12. The figure shows a projectile thrown with a speed $u = 20$ m/s at an angle 30° with the horizontal from the top of a building 40 m high. Then the horizontal range (R) of the projectile is



- (a) $20\sqrt{3}$ m
- (b) $40\sqrt{3}$ m
- (c) 40 m
- (d) 20 m

13. In the shown figure uniform magnetic field B is pointing out of the plane in the region. Wire CD is fixed and has resistance R , while OA & OB are conducting wires rotating with angular velocity ω about O as shown. If at some instant $OA = OB = l$ and each wire makes angle $\theta = 30^\circ$ with Y -axis, find our the current through resistance R at this instant?

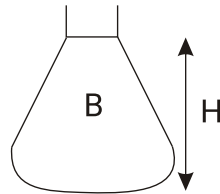
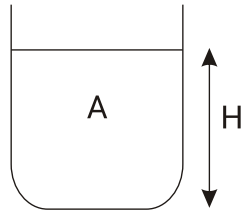


- (a) $\frac{B\omega l^2}{R}$
 (b) $\frac{\sqrt{3}B\omega l^2}{2R}$
 (c) $\frac{\sqrt{3}B\omega l^2}{4R}$
 (d) $\frac{B\omega l^2}{2R}$

14. The radius of the base of a cylinder is r cm. Water is poured into it at the rate of k^3 cc/s. When the height of the water level is x cm, then the water level is rising at the rate of

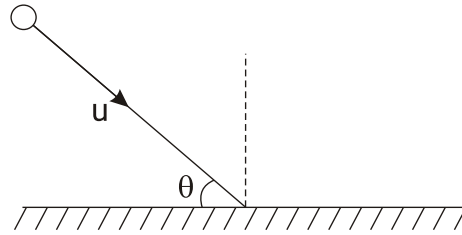
- (a) $\frac{k^2}{\pi h^2}$ cm/s
(b) $\frac{k^2}{\pi r^2}$ cm/s
(c) $\frac{k^3}{\pi r^2}$ cm/s
(d) $\frac{k}{\pi x^2}$ cm/s

15. Two vessels A and B have the same base area and contain water to the same height, but the mass of water in A is four times that in B. The ratio of the liquid thrust at the base of A to that at the base of B is:



- (a) 4 : 1
- (b) 2 : 1
- (c) 1 : 1
- (d) 16 : 1

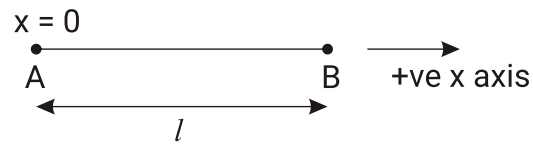
16. A ball of mass m moving with a speed u collides with a smooth horizontal surface at an angle θ with it as shown in the figure. The magnitude of impulse imparted to the surface by the ball is [the coefficient of restitution for the collision is e]



- (a) $\mu(1 + e) \cos \theta$
- (b) $\mu(1 - e) \sin \theta$
- (c) $\mu(1 - e) \cos \theta$
- (d) $\mu(1 + e) \sin \theta$

17. A Brass stopper snugly fits in the hole of a steel plate. To remove the stopper easily, the system
- (a) should be heated
 - (b) should be cooled
 - (c) may be heated or cooled
 - (d) can not be removed by heating or cooling

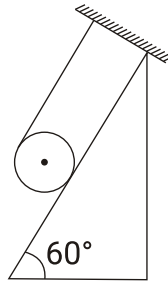
18. A second harmonic has to be generated in a string of length l stretched between two rigid supports A and B as shown in the figure. The x coordinates of the points where the string has to be plucked and held respectively maybe



- (a) $\frac{l}{4}, \frac{l}{2}$
 (b) $\frac{l}{4}, \frac{3l}{4}$
 (c) $\frac{l}{2}, \frac{l}{2}$
 (d) $\frac{l}{2}, \frac{3l}{4}$

19. A physical quantity $\rho = \frac{\sqrt{abc^2}}{d^3}$ is determined by measuring a, b, c and d separately with the percentage error of 2%, 3%, 2%, and 1% respectively. Minimum percentage of error is contributed by the measurement of
- (a) a
 - (b) b
 - (c) c
 - (d) d

20. A solid cylinder of mass m is wrapped with an inextensible light string and, is placed on a rough inclined plane as shown in the figure. The frictional force acting between the cylinder and the inclined plane is: [The coefficient of static friction is 0.4]



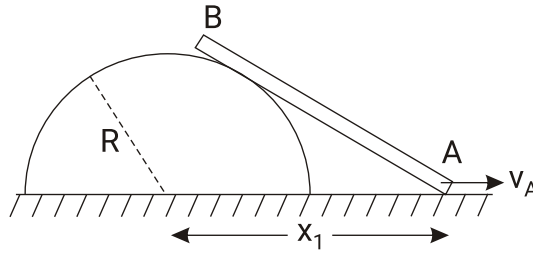
- (a) $\frac{7}{2}mg$
(b) $5mg$
(c) $\frac{mg}{5}$
(d) 0

Section - II: Numerical

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21. The radius of a sphere is measured to be (7.50 ± 0.85) cm. Suppose the percentage error in its volume is x . The value of x , to the nearest x , is_____.

22. There is a fixed smooth hemisphere of radius R . A rod AB is placed as shown in the figure. When the end A of the rod is at a distance x_1 from the centre of the hemisphere and has velocity v_A in the horizontal direction, the angular speed of the rod is found as $\frac{nv_A R}{x_1 \sqrt{x_1^2 - R^2}}$. Find n ? (Assume all the surfaces are smooth).



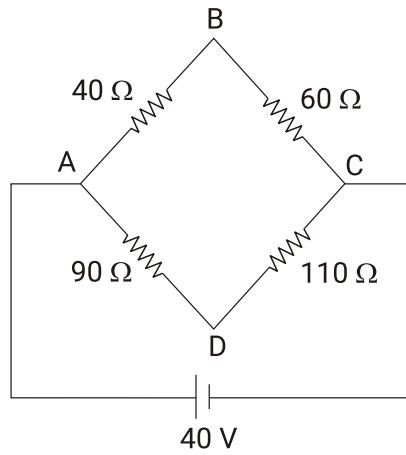
23. A series LCR circuit is designed to resonate at an angular frequency $\omega_0 = 10^5$ rad/s. The circuit draws 16 W power from 120 V source at resonance. The value of resistance 'R' in the circuit is $___\Omega$.

24. If $\vec{P} \times \vec{Q} = \vec{Q} \times \vec{P}$, the angle between \vec{P} and \vec{Q} is $\theta (0^\circ < \theta < 360^\circ)$. The value of θ will be ____°.

25. Emissivity e is the property of the surface. Suppose for a surface, emissivity e varies with Kelvin temperature T as $e = CT$ (C is a constant). If the energy emission rate at temperature 600 K from the surface is 160 W, what will be the energy emission rate (in Watt) at 300 K?

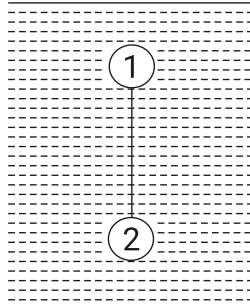
26. The width of one of the two slits in Young's double-slit experiment is three times the other slit. If the amplitude of the light coming from a slit is proportional to the slit width, the ratio of minimum to maximum intensity in the interference pattern is $x : 4$ where x is ____.

27. Four resistances $40\ \Omega$, $60\ \Omega$, $90\ \Omega$ and $110\ \Omega$ make the arms of a quadrilateral ABCD. Across AC a battery of emf 40 V and internal negligible resistance is connected. The potential difference across BD in V is:



28. For VHF signal broadcasting, ____ km^2 of maximum service area will be covered by an antenna tower of height 30 m, if the receiving antenna is placed at ground. Let radius of the earth be 6400 km. (Round off to the Nearest Integer) (Take π as 3.14)

29. Two spheres each of volume 250 cc but of relative densities 0.8 and 1.2 are connected by a string and the combination is immersed in a liquid in vertical position as shown in the figure. The tension in the string is $\frac{k}{18}$ N. Find the value of k. (Given, $g = 10 \text{ ms}^{-2}$)



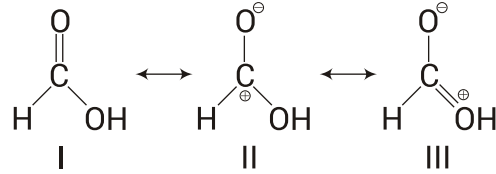
30. The susceptibility of Magnesium at 300 K is 1.2×10^{-5} . At what temperature (in Kelvin) will its susceptibility be equal to 1.44×10^{-5} ?

Part - B Chemistry

Section - I: Single Correct

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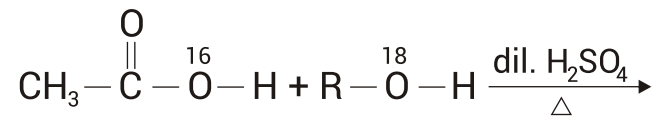
31.



Among these canonical structures, the correct order of stability is:

- (a) I > II > III
- (b) III > II > I
- (c) I > III > II
- (d) II > I > III

32.



The major product of the reaction is

- (a) $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\overset{18}{\text{O}}-\text{R}$
- (b) $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\overset{16}{\text{O}}-\text{R}$
- (c) $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\overset{18}{\text{O}}-\text{CH}_3$
- (d) $\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\overset{16}{\text{O}}-\text{R}$

33. The quantity of electricity required to reduce 12.3 g of nitrobenzene to aniline assuming 50% current efficiency is
- (a) 115800 C
 - (b) 57900 C
 - (c) 231600 C
 - (d) 28950 C

34. The final product formed, when alkaline KI solution reacts with ozone, is
- (a) I_2
 - (b) KIO_3
 - (c) HI
 - (d) Reaction will not occur

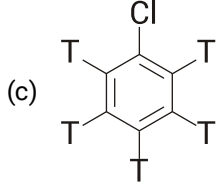
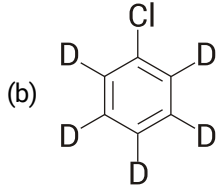
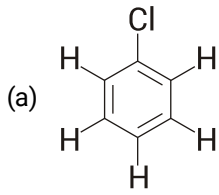
35. The reagent which forms crystalline osazone derivative when reacted with glucose is
- (a) Fehling solution
 - (b) Phenylhydrazine
 - (c) Benedicts solution
 - (d) Hydroxylamine

36. The substance which can be used as an adsorbent in column chromatography is
- (a) Na_2O
 - (b) NaCl
 - (c) Al_2O_3
 - (d) Alum

37. At the critical micelle concentration (CMC) the surfactant molecules
- (a) Associate
 - (b) Dissociate
 - (c) Decompose
 - (d) Become completely soluble

38. When an element of group 14 is doped with an element of group 15
- (a) p-type of semi-conductors are formed
 - (b) n-type of semi-conductors are formed
 - (c) Zeolites are formed
 - (d) Electrolytes are formed

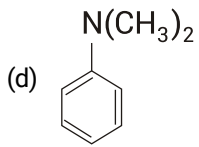
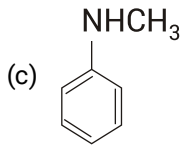
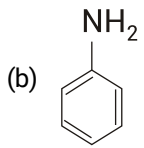
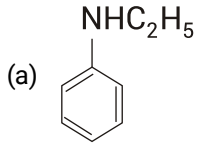
39. In Dow's process haloarene is converted to phenol with fused NaOH. The most reactive compound is



(d) All are equally reactive

40. For a first-order reaction, the time taken to reduce the initial concentration to a factor of $\frac{1}{4}$ is 10 minutes. If the reduction in concentration is carried out to a factor of $\frac{1}{16}$, then the time required will be
- (a) 10 minutes
 - (b) 20 minutes
 - (c) 40 minutes
 - (d) 60 minutes

41. Which of the following amine will give the carbylamine test?



42. The blue colour produced on adding H_2O_2 to acidified $\text{K}_2\text{Cr}_2\text{O}_7$ is due to the formation of
- (a) CrO_5
 - (b) Cr_2O_3
 - (c) CrO_4^{2-}
 - (d) CrO_3

43. The crystal Field stabilization Energy (CFSE) of $[\text{CoF}_3(\text{H}_2\text{O})_3](\Delta_0 < P)$ is :-
- (a) $-0.8\Delta_0$
 - (b) $-0.4\Delta_0 + P$
 - (c) $-0.8\Delta_0 + 2P$
 - (d) $-0.4\Delta_0$

44. Specific volume of cylindrical virus particle is 6.02×10^{-2} cc/gm whose radius and length are 7 \AA and 10 \AA respectively. If $N_A = 6.02 \times 10^{23}$, find molecular weight of virus.
- (a) 15.4 kg/mol
 - (b) 1.54×10^4 kg/mol
 - (c) 3.08×10^4 kg/mol
 - (d) 3.08×10^3 kg/mol

45. Match the species in Column I with their corresponding ground state electronic configuration in Column II.

| Column I | | Column II | |
|----------|-----------|-----------|---|
| (A) | Cu | (P) | $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$ |
| (B) | Cu^{2+} | (Q) | $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$ |
| (C) | Zn^{2+} | (R) | $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$ |
| (D) | Cr^{3+} | (S) | $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$ |
| | | (T) | $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$ |

- (a) $A \rightarrow R, B \rightarrow S, C \rightarrow P, D \rightarrow T$
 (b) $A \rightarrow S, B \rightarrow R, C \rightarrow P, D \rightarrow R$
 (c) $A \rightarrow P, B \rightarrow S, C \rightarrow P, D \rightarrow T$
 (d) $A \rightarrow R, B \rightarrow S, C \rightarrow P, D \rightarrow R$

46. A 0.2 molal aqueous solution of a weak acid (HX) is 20% ionized. The freezing point of the solution is (K_f of $H_2O = 1.86 \text{ K} \cdot \text{molal}^{-1}$)
- (a) -0.45°C
 - (b) -0.90°C
 - (c) -0.31°C
 - (d) -0.53°C

47. The composition of 'golden spangles' is
- (a) PbCrO_4
 - (b) PbI_2
 - (c) As_2S_3
 - (d) BaCrO_4

48. At temperature T, a compound $AB_2(g)$ dissociates according to the reaction, $2AB_2(g) \rightleftharpoons 2AB(g) + B_2(g)$ with a degree of dissociation 'x' which is small as compared to unity. The expression for K_p in terms of 'x' and total pressure P is

(a) $\frac{Px^3}{2}$

(b) $\frac{Px^2}{3}$

(c) $\frac{Px^3}{3}$

(d) $\frac{Px^2}{2}$

49. The number of moles of FeC_2O_4 required to react completely with 1 mole of $\text{K}_2\text{Cr}_2\text{O}_7$ in acidic medium is
- (a) 2
 - (b) 6
 - (c) 1
 - (d) 3

50. The IUPAC name of the given compound is:

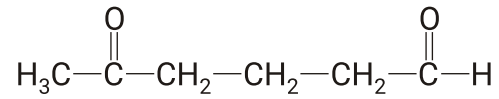


- (a) 2-Methyl spiro [4.5] dec-1-ene
- (b) 2-Methyl spiro [5.4] dec-1-ene
- (c) 2-Methyl spiro [4.5] dec-2-ene
- (d) 2-Methyl spiro [5.4] dec-2-ene

Section - II: Numerical

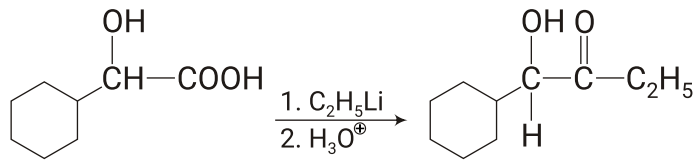
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51. Number of possible intramolecular aldol condensation products on heating with NaOH.



52. 4 g equimolar mixture of NaOH and Na_2CO_3 contains x g of NaOH and y g of Na_2CO_3 . The value of x is g.
(Nearest integer)

53. Consider



How many moles of ethyl lithium is required to transform 1 mole of reactant into product?

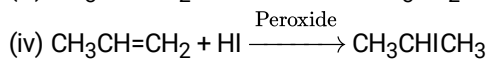
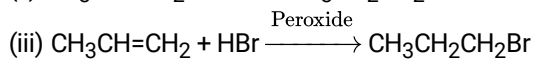
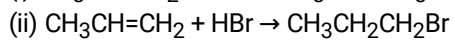
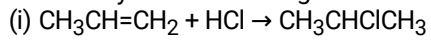
54. Two solutions are given as

S₁: 4.6 gm of C₂H₅OH dissolved in 1 kg of water under its normal freezing conditions.

S₂: 28.4 gm of Na₂SO₄ dissolved in 2 kg of water under its normal freezing conditions then $\frac{\Delta T_f(S_2)}{\Delta T_f(S_1)}$ will be:

(Assume: Solute is completely non-volatile)

55. How many of the following reactions are correct?



56. The average S—F bond energy in kJ mol^{-1} of SF_6 is _____. (Rounded off to the nearest integer)
[Given: The values of standard enthalpy of formation of $\text{SF}_6(\text{g})$, $\text{S}(\text{g})$, and $\text{F}(\text{g})$ are -1100 , 275 , and 80 kJ mol^{-1} respectively.]

57. Find the value of $\frac{n}{5}$ where n is the total number of compounds among the following which produce H_2S gas on treatment with water.
 P_4S_{10} , Al_2S_3 , MgS , Na_2S , BaS , Cr_2S_3

58. Find the total number of acidic radicals which produce volatile product with dil HCl
 SO_4^{2-} , I^- , NO_2^- , NO_3^- , SO_3^{2-} , HCO_3^-

59. 2.65 g of a diacidic base was dissolved in 500 ml of water. 20ml of this solution required 12 ml of N/6 HCl solution. What is the molecular mass of the compound?

60. How many no. of active Hydrogen atoms are present in a compound (mol. mass 90) 0.45 g of which when treated with Na metal liberates 112 ml of the H_2 gas at STP.

Part - C Mathematics

Section - I: Single Correct

*This section contains a total of 20 questions.
All questions in this section are mandatory.
For every correct response you shall be awarded 4 marks.
For every incorrect response -1 marks shall be deducted.
For more details refer the first page of this booklet.*

61. Area bounded by the curves $y = |x - 1|$, $y = 0$ and $|x| = 2$ is
- (a) 5
 - (b) 4
 - (c) $\frac{9}{2}$
 - (d) None

62. $\frac{x+4}{x-3} < 2$ is satisfied when x satisfies -
- (a) $(-\infty, 3) \cup (10, \infty)$
 - (b) $(3, 10)$
 - (c) $(-\infty, 4) \cup (8, \infty)$
 - (d) $(4, 8)$

63. If R is a relation from a finite set A having m elements to a finite set B having n elements, then the number of relations from A to B is -
- (a) 2^{mn}
 - (b) $2^{mn} - 1$
 - (c) $2mn$
 - (d) m^n

64. The equation of the ellipse (referred to its axes as the axes of x and y respectively) which passes through the point $(-3, 1)$ and has eccentricity $\sqrt{\frac{2}{5}}$, is -
- (a) $3x^2 + 6y^2 = 33$
 - (b) $5x^2 + 3y^2 = 48$
 - (c) $3x^2 + 5y^2 - 32 = 0$
 - (d) None of these

65. If $x = y\sqrt{1 - y^2}$, then $\frac{dy}{dx} =$

(a) 0

(b) x

(c) $\frac{\sqrt{1 - y^2}}{1 - 2y^2}$

(d) $\frac{\sqrt{1 - y^2}}{1 + 2y^2}$

66. $\sin^{-1}\left(\sin \frac{23\pi}{7}\right) + \cos^{-1}\left(\cos \frac{39\pi}{7}\right)$

- (a) $\frac{\pi}{7}$
- (b) $\frac{2\pi}{7}$
- (c) $\frac{3\pi}{7}$
- (d) $\frac{4\pi}{7}$

67. The equation of tangents to hyperbola $x^2 - 4y^2 = 36$ which are perpendicular to the line $x - y + 4 = 0$
- (a) $y = -x + 3\sqrt{3}$
 - (b) $y = x - 3\sqrt{3}$
 - (c) $y = -x \pm 2$
 - (d) None of these

68. The solution set of $(2 \cos x - 1)(3 + 2 \cos x) = 0$ in the interval $0 \leq x \leq 2\pi$ is -

(a) $\left\{ \frac{\pi}{3} \right\}$

(b) $\left\{ \frac{\pi}{3}, \frac{5\pi}{3} \right\}$

(c) $\left\{ \frac{\pi}{3}, \frac{5\pi}{3}, \cos^{-1}\left(\frac{-3}{2}\right) \right\}$

(d) None of these

69. If $\tan \theta = \frac{x \sin \phi}{1 - x \cos \phi}$ and $\tan \phi = \frac{y \sin \theta}{1 - y \cos \theta}$, then $\frac{x}{y} =$

(a) $\frac{\sin \phi}{\sin \theta}$

(b) $\frac{\sin \theta}{\sin \phi}$

(c) $\frac{\sin \phi}{1 - \cos \theta}$

(d) $\frac{\sin \theta}{1 - \cos \phi}$

70. If $I_n = \int (\log_e x)^n dx$, then $I_n + nI_{n-1} =$

- (a) $x(\log_e x)^n$
- (b) $(x \log_e x)^n$
- (c) $(\log_e x)^{n-1}$
- (d) $n(\log_e x)^n$

71. $\int_0^{\frac{\pi}{4}} \sec^7 \theta \sin^3 \theta d\theta =$

(a) $\frac{1}{12}$

(b) $\frac{3}{12}$

(c) $\frac{5}{12}$

(d) None of these

72. If $y = y(x)$ is the solution curve of the differential equation $x^2 dy + \left(y - \frac{1}{x}\right) dx = 0$; $x > 0$ and $y(1) = 1$, then

$y\left(\frac{1}{2}\right)$ is equal to:

- (a) $\frac{3}{2} - \frac{1}{\sqrt{e}}$
- (b) $3 + \frac{1}{\sqrt{e}}$
- (c) $3 + e$
- (d) $3 - e$

73. Mean deviation from the mean for the observations $-1, 0, 4$ is

(a) $\sqrt{\frac{14}{3}}$

(b) $\frac{2}{3}$

(c) 2

(d) None

74. If $N = \left(2^{\log_7 9800}\right) \left(5^{\log_7 140}\right) \left(7^{\log_7 2}\right)$, then N is equal to

- (a) 20
- (b) 60
- (c) 18
- (d) 40

75. If $p \Rightarrow (q \vee r)$ is false, then the truth values of p, q, r are respectively-
- (a) T, F, F
 - (b) F, F, F
 - (c) F, T, T
 - (d) T, T, F

76. Let $f : \left(-\frac{\pi}{4}, \frac{\pi}{4}\right) \rightarrow \mathbb{R}$ be defined as

$$f(x) = \begin{cases} (1 + |\sin x|)^{\frac{3a}{\sin x}} & , \quad -\frac{\pi}{4} < x < 0 \\ b & , \quad x = 0 \\ e^{\cot 4x / \cot 2x} & , \quad 0 < x < \frac{\pi}{4} \end{cases}$$

If f is continuous at $x = 0$, then the value of $6a + b^2$ is equal to

- (a) $1 + e$
- (b) $1 - e$
- (c) e
- (d) $e - 1$

77. The shadow of a tower is found to be 60 metre shorter when the sun's altitude changes from 30° to 60° . The height of the tower from the ground is approximately equal to
- (a) $62m$
 - (b) $301m$
 - (c) $101m$
 - (d) $52m$

78.
$$\begin{vmatrix} 1 & 1 & 1 \\ {}^m C_1 & {}^{m+1} C_1 & {}^{m+2} C_1 \\ {}^m C_2 & {}^{m+1} C_2 & {}^{m+2} C_2 \end{vmatrix} =$$

- (a) $m(m + 1)$
- (b) $m(m - 1)$
- (c) 1
- (d) 0

79. If A is any skew-symmetric matrix of odd orders, then $|A|$ equals:
- (a) -1
 - (b) 0
 - (c) 1
 - (d) None

80. If in a ΔABC , $a \sin A = b \sin B$ then the triangle is-
- (a) isosceles
 - (b) right angled
 - (c) equilateral
 - (d) none of these

Section - II: Numerical

*This section contains a total of 10 questions.
Out of the 10 questions, 5 questions are mandatory.
For every correct response you shall be awarded 4 marks.
For every incorrect response -1 marks shall be deducted.
For more details refer the first page of this booklet.*

81. If $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is the equation of the ellipse whose foci are $(4, 0)$ and whose eccentricity is $\frac{1}{3}$, then value of $|a| + \sqrt{b^2 + 16}$ is:

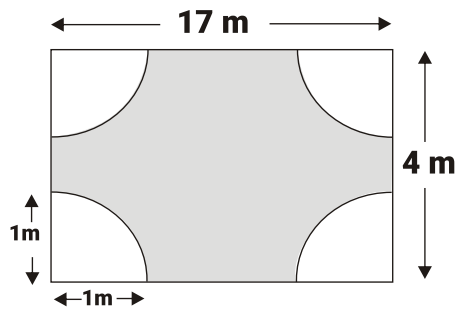
82. Consider an obtuse-angled triangle with sides 8 cm , 15 cm and $x\text{ cm}$ (Largest side being 15 cm). If x is an integer, then find the number of possible triangles.

83. If $\int \frac{e^{9x} + e^{11x}}{e^x + e^{-x}} dx = \frac{e^{k_1 x}}{k_2} + C$, where C denotes constant of integration, then value of $(k_1 + k_2)$ is

84. The eccentricity of the conjugate hyperbola of the hyperbola $x^2 - 3y^2 = 1$, is

85. The value of the expression $(\operatorname{cosec} 50^\circ + \sqrt{3} \sec 50^\circ)$ is equal to:

86. The perimeter of the shaded portion of the following figure is ____ m. (Use $\pi = 3.14$)



87. If m, n are positive real numbers such that $m^{\log_3 5} = 9$ and $n^{\log_5 7} = 25$ then

$$A = m^{(\log_3 5)^2} + n^{(\log_5 7)^2}$$

$$B = (2 + 49^{\log_7 5})^{\log_{27} 7}$$

$$C = \text{antilog}_{\sqrt{7}}(\log_7 2401)$$

find the value of $(A + C \div B)$?

88. If PSQ is a focal chord of the parabola $y^2 = 8x$ such that $SP = 6$, then the length SQ is equal to

89. If α, β and γ are the roots of the equation $5x^3 - qx - 1 = 0$, ($q \in R$) then find the value of
$$\frac{\alpha^2 - 3}{\beta\gamma} + \frac{\beta^2 - 3}{\gamma\alpha} + \frac{\gamma^2 - 3}{\alpha\beta}.$$

90. Let $h(x) = \tan\left(\frac{\cos^{-1}(\sin(\cos^{-1} x)) + \sin^{-1}(\cos(\sin^{-1} x))}{2}\right)$. Then find the value of $\sum_{x=1}^7 h\left(\frac{x}{8}\right)^2$.