Time : 3 Hrs.

# MOCK TEST PAPER

MM : 360

for

JEE (Main)-2017

GENERAL INSTRUCTIONS :

(i) Duration of Test is 3 hrs.

(ii) The Test booklet consists of 90 questions. The maximum marks are 360.

(iii) There are **three** parts in the question paper consisting of **Physics**, **Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted 4 **(four)** marks for each correct response.

(iv) One fourth (¼) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for any question in the answer sheet.

[PHYSICS]

Choose the correct answer :

1. A ball hits a rough horizontal floor, then during collision, momentum of ball is conserved
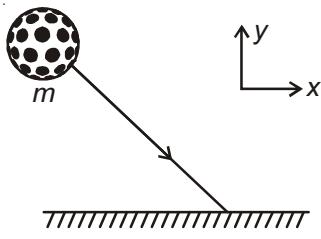
(1) Along only horizontal direction

(2) Along only vertical direction

(3) Along both horizontal and vertical direction

(4) Neither along horizontal nor along vertical direction

2. A bullet of mass m, travelling at speed u, hits a block of same mass m, suspended by a string of length l and gets embedded in it. The acceleration of the combined mass immediately after collision is
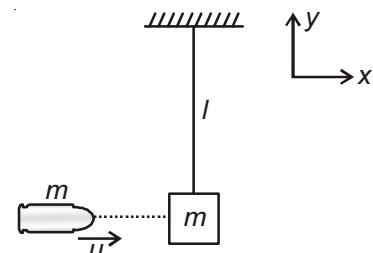

(1) $\dfrac{u^2}{4l}\hat{i}$

(2) $\dfrac{-u^2}{4l}\hat{i}$

(3) $\dfrac{u^2}{4l}\hat{j}$

(4) $\dfrac{-u^2}{4l}\hat{j}$

3. A rod of mass m and length l is fitted with two identical particles, each of mass m at the ends is in motion over smooth horizontal surface. At the instance, shown in figure, kinetic energy of the system is
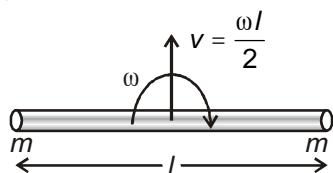

(1) $\dfrac{4}{33}mv^2$

(2) $\dfrac{5}{3}mv^2$

(3) $\dfrac{7}{3}mv^2$

(4) $\dfrac{8}{3}mv^2$

4. Two identical particles are projected horizontally from a height of 20 m and each with speed $v = 10$ m/s as shown in figures (Initial velocity vectors are in xz-plane and y- is vertical). The distance between the points at which they strike the ground, is
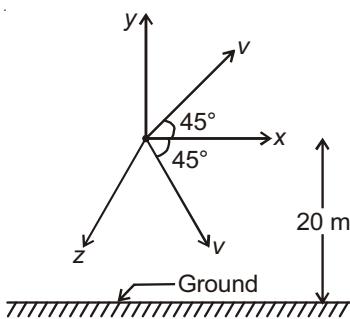

(1) $10\sqrt{2}$ m

(2) $20\sqrt{2}$ m

(3) $30\sqrt{2}$ m

(4) $40\sqrt{2}$ m

5. A heavy string of uniform linear mass density, is hanging vertically. Time taken, by a pulse generated at point B, to reach the topmost point, is
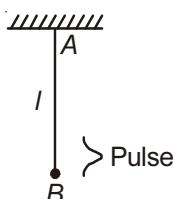

(1) $2\sqrt{\dfrac{l}{g}}$

(2) $\sqrt{\dfrac{l}{g}}$

(3) $\sqrt{\dfrac{2l}{g}}$

(4) $\dfrac{1}{2}\sqrt{\dfrac{l}{g}}$

6. 2 moles of an ideal monatomic gas undergoes a process as shown in P-V diagram. Then during process
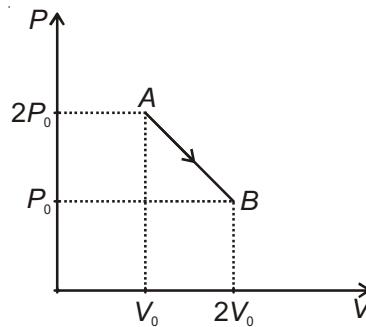
(1) Internal energy is minimum when $V = \dfrac{3}{2}V_0$

(2) Internal energy first decreases then increases

(3) The maximum temperature is $T_{max} = \dfrac{9}{8}\dfrac{P_0 V_0}{R}$ K

(4) Internal energy decreases continuously

7. An unpolarised light, of intensity I_0, is passing through four polaroids with transmission axis as shown in figure. Then intensity of finally transmitted light is
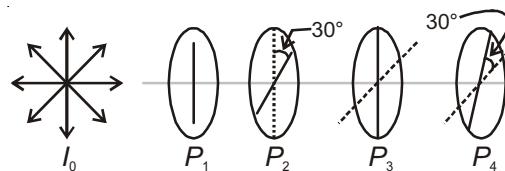
(1) $\dfrac{3I_0}{74}$

(2) $\dfrac{3I_0}{64}$

(3) $\dfrac{9I_0}{128}$

(4) $\dfrac{3I_0}{32}$

8. A semicircular ring of radius R, is suspended from rigid support as shown in figure. Then distance of the centre of mass of ring, from point of suspension, is


(1) $\sqrt{R^2 + \dfrac{3R^2}{\pi^2}}$

(2) $\sqrt{2}R$

(3) $\sqrt{R^2 + \dfrac{2R^2}{\pi^2}}$

(4) $\sqrt{R^2 + \dfrac{4R^2}{\pi^2}}$
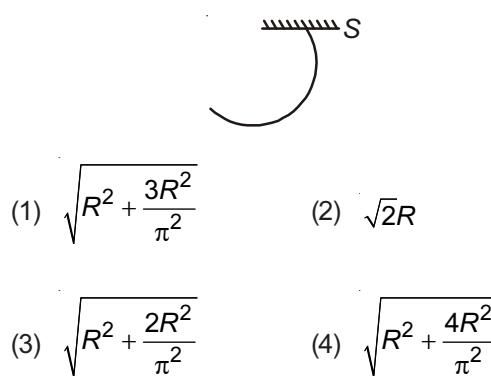
9. Potential due to an electric field at point (x, y, z) is given by $v = xy + x^2 + xz$. The electric field at $(1, 2, 3)$ is given by (All are in SI units)

   (1) $-7\hat{i} - \hat{j} - \hat{k}$

   (2) $-3\hat{i} - \hat{j} - \hat{k}$

   (3) $-\hat{i} - \hat{j} - 7\hat{k}$

   (4) $-\hat{i} - \hat{j} - 3\hat{k}$

10. For the given LC oscillator, the maximum value of charge on capacitors is

   (at $t = 0$, $I = I_0$ and capacitor are uncharged)
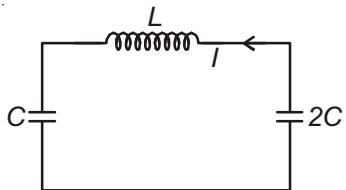
   (1) $\sqrt{3LC}I_0$

   (2) $\sqrt{\dfrac{2LC}{3}}I_0$

   (3) $\sqrt{\dfrac{LC}{3}}I_0$

   (4) $\sqrt{\dfrac{LC}{2}}I_0$

11. In the figure shown each segment is of length a and carries a current I. Magnetic field at the centre O is given by
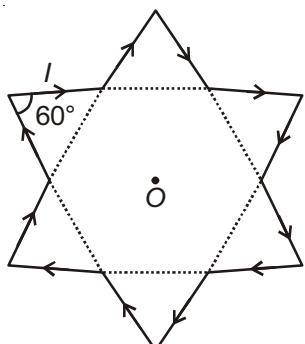
   (1) $\dfrac{\sqrt{3}\mu_0 I}{\pi a}\left[\sqrt{3} - 1\right]$

   (2) $\dfrac{\mu_0 I}{2\pi a}(\sqrt{3} - 1)$

   (3) $\dfrac{\sqrt{3}\mu_0 I}{2\pi a}\left[\sqrt{3} - 1\right]$

   (4) $\dfrac{\mu_0 I}{4\pi a}\left[\sqrt{3} - 1\right]$

12. For the given circuit, charge on the capacitor C and potential difference across capacitor $2C$ are respectively in the steady state are
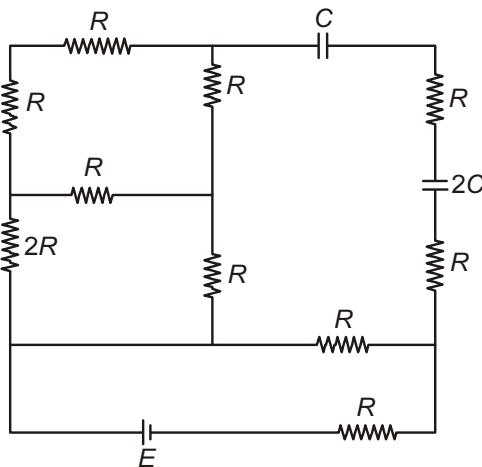

   (1) $\dfrac{CE}{3}, \dfrac{2E}{3}$

   (2) $\dfrac{CE}{3}, \dfrac{E}{6}$

   (3) $\dfrac{CE}{2}, \dfrac{E}{2}$

   (4) $\dfrac{2CE}{3}, \dfrac{E}{3}$

13. A source of frequency 'f_0' is moving with speed 25 m/s as shown in figure. What will be the maximum and minimum frequencies, detected by a detector, oscillating with amplitude $A = 5$ m and angular frequency $\omega = 5$ rad/s? (Take speed of sound equal to 325 m/s)
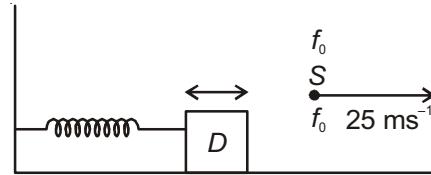
   (1) $\dfrac{6f_0}{5}, \dfrac{6f_0}{7}$

   (2) $\dfrac{7f_0}{6}, f_0$

   (3) $f_0, \dfrac{6f_0}{7}$

   (4) $f_0, \dfrac{5f_0}{6}$

14. An equiconvex lens $\left(\mu = \dfrac{3}{2}\right)$ and a plane mirror, are fitted at the ends of a tube, filled with water $\left(\mu_w = \dfrac{4}{3}\right)$. At what distance from the lens, an object should be placed so that its image coincides with itself? (The radius of curvature of lens surfaces is 20 cm)
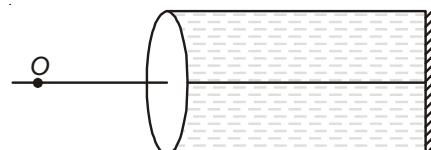
   (1) 30 cm

   (2) 20 cm

   (3) 40 cm

   (4) 25 cm

15. The minimum height of the obstacle so that sphere remains in equilibrium
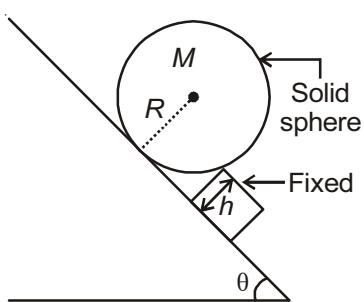
(1) $R(1-\sin\theta)$

(2) $R(1-\cos\theta)$

(3) $\dfrac{R}{1+\sin\theta}$

(4) $\dfrac{R}{1+\cos\theta}$

16. A telescope objective, of focal length 60 cm, is made of two thin lenses, one of crown glass and other of flint glass of refractive index 1.66. One surface of flint glass is plane. The radii of curvature of both lenses which forms achromatic doublet if dispersive powers of crown and flint glass are 0.0151 and 0.0302 respectively is
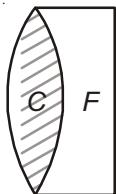
(1) 19.8 cm

(2) 39.6 cm

(3) 79.2 cm

(4) 46.4 cm

17. The displacement of a particle executing simple harmonic motion is given by $x = a\sin\omega t + a\cos\omega t + a\sin\left(\omega t + \dfrac{\pi}{4}\right)$. Total energy of the particle is

(1) $\dfrac{3}{4}m\omega^2 a^2$

(2) $\dfrac{1}{2}m\omega^2 a^2(1+\sqrt{2})$

(3) $\dfrac{1}{2}m\omega^2 a^2(3+2\sqrt{2})$

(4) $m\omega^2 a^2(2+\sqrt{2})$

18. Diameter of a plano-convex lens is 6 cm and its thickness at the centre is 3 mm. The speed of light in the material of lens is 2×10^8 m/s, the focal length of lens, is

(1) 10 cm

(2) 15 cm

(3) 30 cm

(4) 45 cm

19. For doubly ionized lithium atom, wavelength of radiation required to shift electron, from first to third orbit, is

(1) 114.25 Å

(2) 228.5 Å

(3) 57.12 Å

(4) 457 Å

20. A capacitor has square plates each of side a making an angle θ between them as shown in figure. If θ is small, capacitance of system is given by
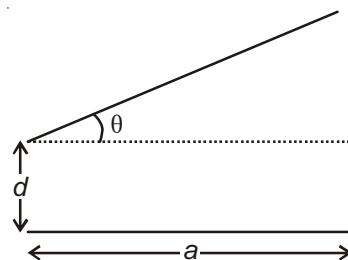
(1) $\dfrac{\varepsilon_0 a^2}{2d}\left[1-\dfrac{\theta a}{2d}\right]$

(2) $\dfrac{\varepsilon_0 a^2}{d}\left[1-\dfrac{\theta a}{2d}\right]$

(3) $\dfrac{\varepsilon_0 a^2}{2d}\left[1-\dfrac{\theta a}{d}\right]$

(4) $\dfrac{\varepsilon_0 a^2}{d}\left[1-\dfrac{\theta a}{d}\right]$

21. A solid sphere, of radius $\dfrac{R}{2}$, is removed from a large solid sphere, of mass M and radius R. Moment of inertia of remaining part about YY' axis is
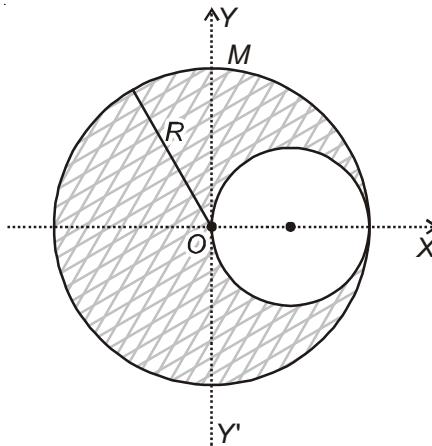

(1) $\dfrac{57}{80}MR^2$

(2) $\dfrac{31}{80}MR^2$

(3) $\dfrac{57}{160}MR^2$

(4) $\dfrac{31}{160}MR^2$

22. Diagram represents an infinite linear charge of charge density 'λ' lying along y-axis. The minimum work required to be done in moving a point charge q from point C to A along the circular arc CA, is
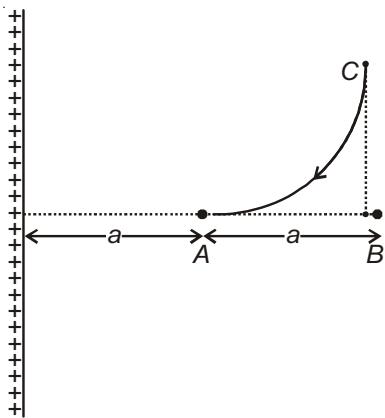
(1) $\dfrac{q\lambda}{2\pi\varepsilon_0}\log_e 2$

(2) $\dfrac{q\lambda}{2\pi\varepsilon_0}\log_e \sqrt{2}$

(3) $\dfrac{q\lambda}{4\pi\varepsilon_0}\log_e 2$

(4) $\dfrac{q\lambda}{2\pi\varepsilon_0}\log_e \dfrac{1}{2}$

23. Diagram shows a system of logic gates. From the study of truth table, it can be observed that to produce a high output [1] at R, we must have
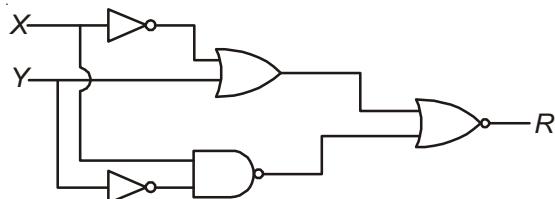
(1) $X = 0$, $Y = 1$

(2) $X = 1$, $Y = 1$

(3) $X = 1$, $Y = 0$

(4) $X = 0$, $Y = 0$

24. A projectile, projected with speed 'u' making an angle θ, with horizontal, collides with a vertical wall elastically such that it falls just below the maximum height point. If h is the vertical height of collision point of projectile with wall, value of $(h_{max} - h)$, is


(1) $\dfrac{h_{max}}{8}$

(2) $\dfrac{h_{max}}{4}$

(3) $\dfrac{h_{max}}{2}$
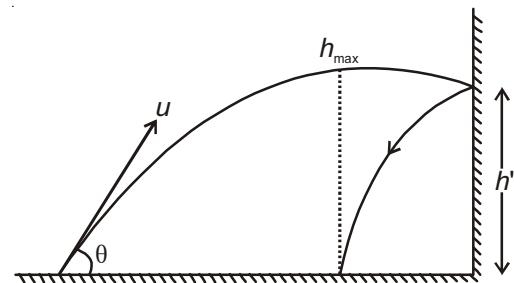
(4) $\dfrac{3h_{max}}{4}$

25. Density of air, in earth's atmosphere, decreases with height as $d = d_0 e^{-\alpha h}$, where d_0 = density of air at sea level and α is a positive constant. Then the atmospheric pressure, at sea level, is

(1) $\dfrac{d_0 g}{2\alpha}$

(2) $\dfrac{d_0 g}{\sqrt{2}\alpha}$

(3) $\dfrac{d_0 g}{\alpha}$

(4) $\dfrac{2d_0 g}{\alpha}$

26. A ray of light of intensity I is incident on a parallel glass slab at a point A as shown in figure. It undergoes partial reflection and refraction. At each reflection 25% of incident energy is reflected. The rays AB and $A'B'$ undergo interference. The ratio $\dfrac{I_{max}}{I_{min}}$ is
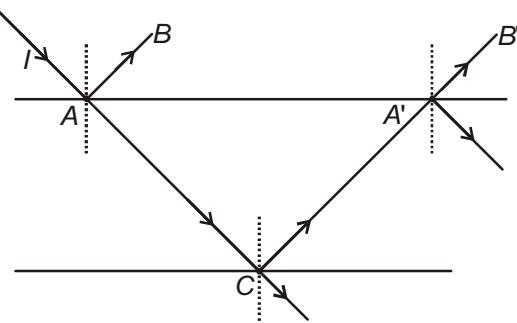
(1) 4 : 1

(2) 8 : 1

(3) 49 : 1

(4) 7 : 1

27. A rocket is going towards moon with a speed v. The astronaut in the rocket sends signals of frequency ν towards the moon and receives them back on reflection from the moon. What will be the frequency or the signal received by the astronaut?

[Take, $v << c$]

(1) $\dfrac{c}{c-v}\nu$

(2) $\left[\dfrac{c}{c-2v}\right]\nu$

(3) $\dfrac{2v}{c}\nu$

(4) $\dfrac{2c}{v}\nu$

28. A silver ball of radius 4.8 cm is suspended by a thread in the vacuum chamber. UV light of wavelength 200 nm is incident on the ball for some times during which a total energy of 1×10^{-7} J falls on the surface. Assuming on an average one out of 10^3 photons incident is able to eject electron. The potential on sphere will be

(1) 1 V

(2) 2 V

(3) 3 V

(4) Zero

29. A parent radioactive nucleus A (decay constant λ_a) converts into a radioactive nucleus B of decay constant λ_b, initially, number of atoms of B is zero. Let at any time, N_a and N_b are number of atoms of nuclei A and B respectively then maximum value of N_b is

   (1) $\dfrac{\lambda_a N_a}{\lambda_b}$

   (2) $\dfrac{\lambda_b N_a}{\lambda_a}$

   (3) $\dfrac{(\lambda_a + \lambda_b) N_a}{\lambda_b}$

   (4) $\dfrac{\lambda_b}{(\lambda_a + \lambda_b)} N_a$

30. A radioactive isotope X with a half-life of 1.37×10^9 years decays to Y which is stable. A sample of rock from the moon was found to contain both the elements X and Y which were in the ratio of $1:7$. The age of the rock is

   (1) 1.96×10^8 years

   (2) 3.85×10^9 years

   (3) 4.11×10^9 years

   (4) 9.59×10^9 years

[CHEMISTRY]

31. The solubility product of $Mg(OH)_2$ is 10^{-14}. The solubility of $Mg(OH)_2$ in a buffer solution of pH = 8 is

   (1) 10^{-8}

   (2) 10^{-6}

   (3) 10^{-2}

   (4) 10^{-4}

32. The values of critical pressure and critical temperature for gas A are 34 atm and 126 K whereas, for gas B they are 48 atm and 305 K respectively. Identify the correct statement.

   (1) Gas B has the smaller van der Waal's constant, b

   (2) Gas A has the smaller van der Waal's constant, a

   (3) Gas B exhibits the most nearly ideal behaviour at 25°C and 10 atm pressure

   (4) Gas B has lower value for critical volume

33. 0.25 L each of 4 samples of H_2O_2 labelled 10, 15, 20 and 30 volume strengths are mixed, then they are diluted with equal volumes of water. Calculate volume strength of the resultant solution.

   (1) 25.6 V

   (2) 4.625 V

   (3) 1.82 V

   (4) 9.375 V

34.
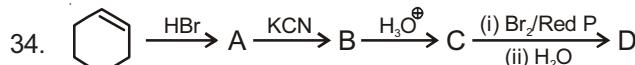
   Identify the compound D in the above reaction.

   (1)

   (2)

   (3)

   (4)
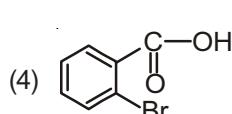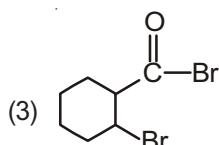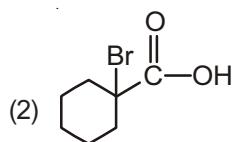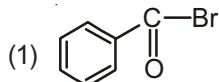
35. (i) If Hund's rule is not followed, the magnetic moment of Fe^{2+} is more than that of Cr.

   (ii) As the frequency of incident light is doubled, the maximum kinetic energy of photoelectrons also gets doubled in photoelectric emission of a metal.

   (iii) The electron gain enthalpy of nitrogen is more negative than that of carbon.

   For above stated statements which of the following is correct?

   (1) All are correct

   (2) All are wrong

   (3) Only (i) and (ii) are correct

   (4) Only (ii) and (iii) are correct

36. An octahedral complex is formed when

   (1) Excess KCN is added to aqueous $CdCl_2$ solution

   (2) Excess KCN is added to aqueous $ZnCl_2$ solution

   (3) Excess KCN is added to aqueous $Fe(CN)_2$ solution

   (4) All of the above cases yield octahedral complexess

37. Borax is converted into boron by the following steps,

   $$\text{Borax} \xrightarrow{\;1\;} H_3BO_3 \xrightarrow{\;\Delta\;} B_2O_3 \xrightarrow{\;2\;} B$$
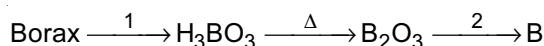
   The reagents 1 and 2 are

   (1) Acid, Al

   (2) Acid, C

   (3) Acid, Fe

   (4) Acid, Mg

38. Choose the incorrect statement.

    (1) $BeCO_3$ is preserved in an atmosphere of CO_2 as it is thermally least stable

    (2) BeF_2 forms a complex compounds with excess NaF, in which the complex entity containing Be is a cation

    (3) Beryllium dissolves in an alkali to form $[Be(OH)_4]^{2-}$ ion

    (4) Beryllium exhibits no diagonal relationship with sodium

39. In Lassaigne's test, a blue colour is obtained if the organic compound contains nitrogen. The blue colour is due to

    (1) $K_4[Fe(CN)_6]$
    (2) $Fe_4[Fe(CN)_6]_3$
    (3) $Na_3[Fe(CN)_6]$
    (4) $Cu_2[Fe(CN)_6]$

40. Rank the following in order of the increasing value of the equilibrium constant for hydration.
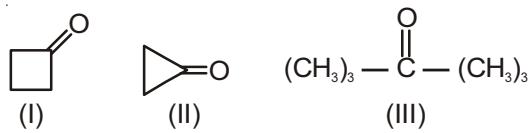
(I)   (II)   (III)

    (1) I < II < III
    (2) III < I < II
    (3) II < I < III
    (4) II < III < I

41. The correct order of stability for the following species is
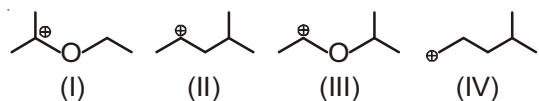
(I)   (II)   (III)   (IV)

    (1) II > IV > I > III
    (2) I > III > II > IV
    (3) I > II > III > IV
    (4) II > I > IV > III

42. Consider the following species

    I. $CH_3\overset{\ominus}{C}H_2$
    II. $CH_2=\overset{\ominus}{C}H$
    III. $CH\equiv\overset{\ominus}{C}$
    IV.

    The correct increasing order of stability of the given species is

    (1) I > II > III > IV
    (2) IV > III > I > II
    (3) IV > III > II > I
    (4) I > II > IV > III

43. The weakest B — N bond belongs to
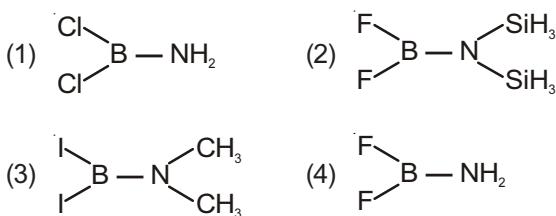
44. The following compound can exhibit
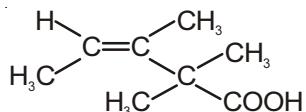

    (1) Geometrical isomerism only
    (2) Both geometrical and optical isomerism
    (3) Optical isomerism only
    (4) Neither geometrical nor optical isomerism

45. Which of the following is correct order of acidity?

    (1) $HCOOH < CH_3COOH < C_2H_5COOH < C_6H_5COOH$
    (2) $C_2H_5COOH < CH_3COOH < C_6H_5COOH < HCOOH$
    (3) $CH_3COOH < HCOOH < C_2H_5COOH < C_6H_5COOH$
    (4) $C_2H_5COOH > CH_3COOH > HCOOH > C_6H_5COOH$

46. What are the constituent amines formed when the mixture (I) and (II) undergo Hoffmann bromamide degradation)?

(I)   (II)
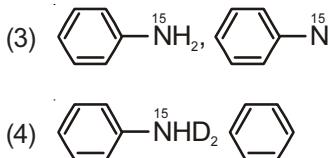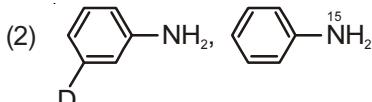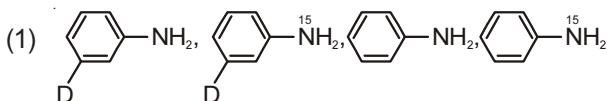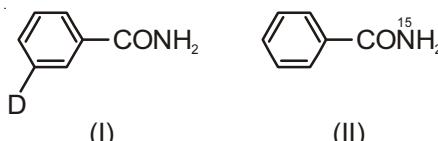
47. Identify 'D' in the following reaction.

(1)

(2)

(3)

(4)

48. The density of a salt solution is 1.025 g/ml. If x ml of water is added to 1.0 L of this solution its density becomes 1.02 gml^{-1}, what is the nearest integer value of x in ml approximately (density of water is 1 g/ml)?

(1) 150   (2) 100

(3) 250   (4) 350

49. What is the entropy change in surroundings, when 1.0 mole of water is formed at 298 K?
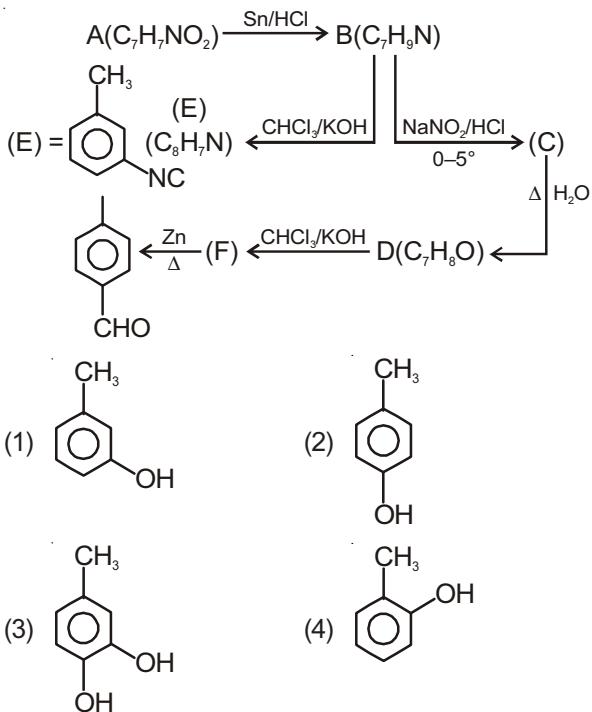
$(\Delta H_f^0)_{298K} = -256$ kJ

(1) 959 JK^{-1} mole^{-1} (2) 859 JK^{-1} mole^{-1}

(3) 830 JK^{-1} mole^{-1} (4) 720 JK^{-1} mole^{-1}

50. X^{2-} ions are arranged in ccp. A^{2+} ions are present in $\frac{1}{8}$th of T-voids and B^{3+} are present in $\frac{1}{2}$ of O-voids. The ratio of number of B^{3+} ions to A^{2+} ion is

(1) $\frac{1}{2}$ (2) 2

(3) $\frac{1}{3}$ (4) 3

51. SO_2 with excess of Na_2CO_3 (aq.) gives the compound B which with sulphur gives the compound (Y) used in photography. The compound Y is

(1) $Na_2S_2O_3$ (2) Na_2SO_4

(3) Na_2S (4) $Na_2S_2O_7$

52. Which represents the correct order of the property indicated?

(1) $Cr^{3+} > Cr^{2+}$ (Magnetic moment)

(2) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$ (Unpaired electrons)

(3) $Ni^{2+} > Fe^{2+} > Mn^{2+}$ (Size)

(4) $Mn < Ti < Cr < Sc$ (Size)

53. Carbon reduction method is not applicable to which of the following metal oxides in commercial extraction to their respective metals?

(i) ZnO   (ii) Fe_2O_3

(iii) Al_2O_3 (iv) SnO_2

(1) (i), (ii) & (iii)   (2) Only (ii)

(3) Only (iii)   (4) Both (iii) & (iv)

54. Number of optically active isomers exhibited by $[Cr(en)_2Cl_2]^+$ is

(1) 6   (2) 3

(3) 4   (4) 2

55. Increasing order of E° reduction of the following quinones is

(1) I < II < III   (2) II < I < III

(3) III < I < II   (4) III < II < I
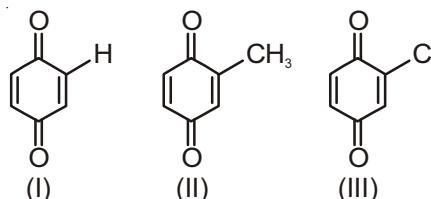
56. What is the major product (X) in the following reaction?

(1)

(2)

(3)

(4)
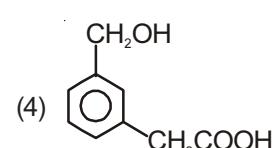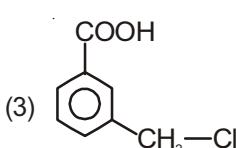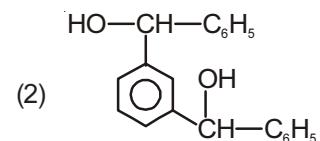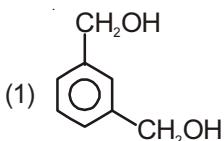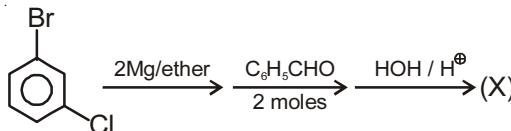
57. Major product of the reaction

$$H_3C - \overset{\overset{\displaystyle O}{||}}{C} - CH_2 - CH_2 - CH_2 - \overset{\overset{\displaystyle O}{||}}{C} - OH$$

$$\xrightarrow[\text{(ii) conc. } H_2SO_4 \atop \Delta]{\text{(i) } NaBH_4/H_2O} \text{ is}$$

(1)

(2) $H_3C - \underset{\underset{\displaystyle OH}{|}}{CH} - CH_2 - CH_2 - CH_2 - COOH$

(3) $H_3C - \overset{\overset{\displaystyle O}{||}}{C} - CH_2CH_2CH_2CH_2OH$
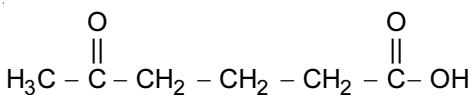
(4)
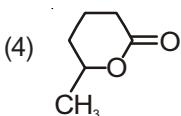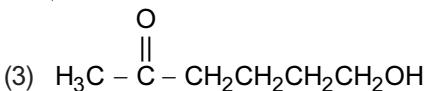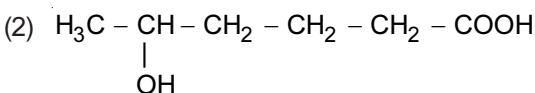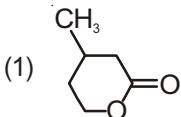
58. The product formed on heating of 1,1,2-cyclohexane-tricarboxylic acid is

(1)

(2)

(3)

(4)
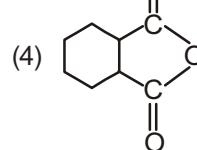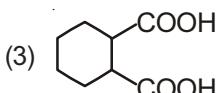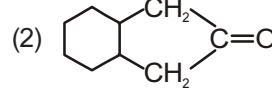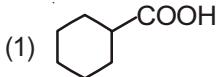
59. The compound containing most acidic α – H atom is

(1) CH_3COOH

(2) $CH_3 - NO_2$

(3) $CH_3 - SO_3H$

(4) CH_3CHO

60. The reaction

$2C_6H_5CHO + \text{conc. NaOH}$

$\longrightarrow C_6H_5COONa + C_6H_5CH_2 - OH$
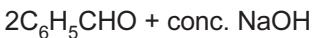
is known as

(1) Kolbe's reaction

(2) Cannizzaro's reaction

(3) Sandmeyer's reaction

(4) Wolff-Kishner reaction

[MATHEMATICS]

61. If $\log_{x^2-1}(x+1) < 1$, then

(1) $x \in (-\infty, -1) \cup (2, \infty)$

(2) $x \in (2, \infty)$

(3) $x \in (1, \sqrt{2}) \cup (2, \infty)$

(4) $x \in (-1, 2)$

62. If $\sin^3 x - 2\sin^2 x - (k+1)\sin x + 2 - k = 0$ possess a solution for finite integral values of k only, then the number of positive integral values of k are equal to

(1) 4

(2) 5

(3) 6

(4) 7

63. The number of solutions of locus of z satisfying $\arg\left(\dfrac{z-2-i}{z+3-2i}\right) = \dfrac{\pi}{4}$ and $\arg(z-2-i) = \dfrac{-\pi}{3}$ is/are

(1) 0

(2) 1

(3) 2

(4) 3

64. If both the roots of the equation $\sin^2 x - a \sin x + 2 = 0$ are positive, where $x \in \left(\dfrac{-\pi}{2}, \dfrac{\pi}{2}\right)$, then

(1) $a \in (2\sqrt{2}, 3)$

(2) $a \in (-\infty, 3)$

(3) $a \in (-\infty, -2\sqrt{2}) \cup (2\sqrt{2}, \infty)$

(4) $a \in \phi$

65. The sum of the infinite series $\dfrac{5}{3!} + \dfrac{19}{5!} + \dfrac{41}{7!} + \dfrac{71}{9!} + ..\infty$ is

(1) $\dfrac{3}{2}$

(2) 2

(3) 1

(4) $\dfrac{9}{2}$

66. $\lim\limits_{x \to \infty} \left(\dfrac{2x^2 + 3x - 5}{3x^2 - 4x + 1}\right)^{x+1} =$

(1) $\dfrac{2}{3}$

(2) 1

(3) $e^{2/3}$

(4) 0

67. If the solution of $\dfrac{dx}{dy} - \dfrac{2}{3}xy = x^4 y^3$ is $x^m = n(1 - y^2) + ce^{-y^2}$, then $m + 2n$ is equal to

(1) 0

(2) 3

(3) 6

(4) 9

68. The number of points of extrema of

$f(x) = \dfrac{x^2 - |x| - 4 + |x^2 + |x| - 4|}{2}$ is/are

(1) 0   (2) 1

(3) 2   (4) 3

69. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are three unit vectors such that

$\vec{a} \times (\vec{b} \times \vec{c}) = \dfrac{1}{2}\vec{b}$ and $\vec{b}, \vec{c}$ being non-parallel then

angle between $\vec{a}$ and $\vec{b}$ is

(1) $\dfrac{\pi}{6}$ (2) $\dfrac{\pi}{4}$

(3) $\dfrac{\pi}{3}$ (4) $\dfrac{\pi}{2}$

70. The odds against an event is 4 : 5 and the odds in favour of another event is 3 : 7. If both the events are independent, then the probability that at least one of the event will happen, is

(1) $\dfrac{31}{45}$ (2) $\dfrac{77}{90}$

(3) $\dfrac{1}{6}$ (4) $\dfrac{5}{6}$

71. If $y^3 + (a + 2)\lambda y^2 x + (a - 3)yx^2 + ax^3 = 0$ represents 3 non-horizontal distinct real lines, of which two lines are perpendicular to each other and a unique value exists for a, then $\lambda =$

(1) 0   (2) –2

(3) $\dfrac{-3}{2}$ (4) $\dfrac{1}{2}$

72. In an equilateral triangle the inradius, circumradius and exradius are in the ratio of

(1) 2 : 3 : 5

(2) 1 : 2 : 3

(3) 1 : 3 : 7

(4) 3 : 7 : 9

73. If $f : \{1, 2, 3, 4\} \longrightarrow \{1, 2, 3, 4\}$, $y = f(x)$ be a function such that $|f(\alpha) - \alpha| \leq 1$, where $\alpha \in \{1, 2, 3, 4\}$, then total function

(1) 81   (2) 36

(3) 54   (4) 74

74. If three angles A, B, C are such that $\cos A + \cos B + \cos C = 0$ and if $\cos A.\cos B.\cos C = \lambda[\cos 3A + \cos 3B + \cos 3C]$, then λ is equal to

(1) $\dfrac{1}{12}$ (2) $\dfrac{1}{8}$

(3) $\dfrac{1}{4}$ (4) $\dfrac{1}{2}$

75. Let R_1 be a relation defined by

$R_1 = \{(a, b) \mid a \geq b \ ; \ a, b \in R\}$, then R_1 is

(1) Only reflexive

(2) Both reflexive and transitive

(3) Symmetric, transitive but not reflexive

(4) Neither transitive nor reflexive but symmetric

76. If p, q, r be three statement, then

$(p \rightarrow (q \rightarrow r)) \leftrightarrow ((p \wedge q) \rightarrow r)$ is a

(1) Tautology

(2) Fallacy

(3) Neither tautology nor fallacy

(4) None of these

77. If the equation of all the circles which are orthogonal to the circles $|z| = 1$ and $|z - 1| = 4$ is

$|z + 7 - ib| = \sqrt{(\lambda + b^2)}$, $i = \sqrt{-1}$ and $b \in R$, then the value of λ must be equal to

(1) 48   (2) 47

(3) 37   (4) 36

78. The solution set of the equation

$\log_{x^3 + 6}(x^2 - 1) = \log_{2x^2 + 5x}(x^2 - 1)$ is

(1) $\{1\}$

(2) $\left\{\sqrt{2}, 3\right\}$

(3) $\{3\}$

(4) $\{-2, 1, 3\}$

79. Let A be a matrix of order 3×3 and matrices B, C, D are related such that $B = \text{adj}(A)$, $C = \text{adj}(\text{adj } A)$, $D = \text{adj}(\text{adj}(\text{adj}A))$. If $|\text{adj}(\text{adj}(\text{adj}(\text{adj } ABCD)))|$ is A^K, then K

   (1) Is less than 256

   (2) Has 21 divisors

   (3) Cannot say

   (4) Is an odd number

80. For integer $n > 1$, the digit at units place in the number

$$\sum_{r=0}^{100} r! + 2^{2^n} \text{ is}$$

   (1) 0

   (2) 1

   (3) 2

   (4) 4

81. $\lim\limits_{x \to 0} \left(\dfrac{x - \sin x}{x} \right) \sin\left(\dfrac{1}{x} \right)$ is

   (1) Non-existent

   (2) 1

   (3) –1

   (4) 0

82. Let $f''(x) > 0 \ \forall \ x \in R$ and $g(x) = f(2 - x) + f(4 + x)$. Then $g(x)$ is increasing in

   (1) $(-\infty, -1)$

   (2) $(-\infty, 0)$

   (3) $(-1, \infty)$

   (4) $(1, \infty)$

83. The solution of differential equation

   $ydx + (2\sqrt{xy} - x)dy = 0$ is

   (1) $cy = e^{\sqrt{x/y}}$

   (2) $cy = e^{-\sqrt{x/y}}$

   (3) $cy = e^{x/y}$

   (4) $cy = e^{\sqrt{2x/y}}$

84. If $f(x) = \displaystyle\int_0^{\cot x} \tan^{-1}t\,dt + \int_0^{\tan x} \cot^{-1}t\,dt$, if $0 < x < \dfrac{\pi}{2}$,

   then $f\left(\dfrac{\pi}{4} \right)$ is equal to

   (1) $\dfrac{\pi}{2}$

   (2) $-\dfrac{\pi}{2}$

   (3) $\dfrac{\pi}{4}$

   (4) $-\dfrac{\pi}{4}$

85. If $\cos^{-1}\sqrt{p} + \cos^{-1}\sqrt{1-p} + \cos^{-1}\sqrt{1-q} = \dfrac{3\pi}{4}$, then the value of q is

   (1) 1

   (2) $\dfrac{1}{\sqrt{2}}$

   (3) $\dfrac{1}{3}$

   (4) $\dfrac{1}{2}$

86. Solution of the differentiable equation

   $\dfrac{dy}{dx} = \dfrac{3x^2y^4 + 2xy}{x^2 - 2x^3y^3}$ is

   (1) $x^3y^2 + \dfrac{y^2}{x} = C$

   (2) $x^3y^2 + \dfrac{x^2}{y} = C$

   (3) $x^2y^3 + \dfrac{x^2}{y} = C$

   (4) $x^2y^2 + \dfrac{x^2}{y} = C$

87. If A and B are two independent event such that $P(A) = \dfrac{1}{3}$ and $P(B) = \dfrac{1}{4}$. Then the value of

$$P(A \cup B) + P\left(\dfrac{A}{A \cup B}\right) + P\left(\dfrac{B}{A' \cap B'}\right) + \dfrac{1}{2}P\left(\dfrac{A'}{B}\right) \text{ is}$$

(1) $\dfrac{1}{2}$

(2) 1

(3) $\dfrac{3}{2}$

(4) 2

88. The solution of $\dfrac{dy}{dx} = \dfrac{ax + h}{by + k}$, $(h, k \neq 0)$ represents a parabola if

(1) $a = 0$, $b = 0$

(2) $a = 4$, $b = 1$

(3) $a = 0$, $b = 2$

(4) $a = 2$, $b = -2$

89. The image of a point $(2, 2, -1)$ in the line passing through the points with position vectors $A(\hat{i} - \hat{j} + 2\hat{k})$ and $B(3\hat{i} + \hat{j} - 2\hat{k})$ is

(1) $\left(\dfrac{10}{3}, -\dfrac{2}{3}, -\dfrac{5}{3}\right)$

(2) $(2, 3, 4)$

(3) $\left(\dfrac{5}{3}, \dfrac{7}{3}, \dfrac{11}{3}\right)$

(4) $(3, 2, 6)$

90. If $f(x)$ is a non-negative continuous function for all $x \geq 1$, such that $f'(x) \leq pf(x)$, where $p > 0$ and $f(1) = 0$, then $\left[f(\sqrt{e}) + f(x)\right]$ is

(1) Positive

(2) Negative

(3) Zero

(4) Greater than 1

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