

WB JEE

Engineering Entrance Exam

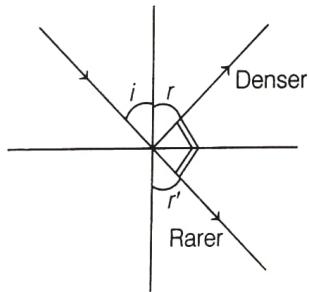
Practice Set 2

Physics

Category I (Q. Nos. 1 to 30)

Carry 1 marks each and only one option is correct.
In case of incorrect answer or any combination of more than one answer, 1/4 mark will be deducted.

1. A ray of light from a denser medium strikes a rarer medium at angle of incidence i . The reflected and refracted rays make an angle of reflection and refraction are r and r' , respectively. The critical angle is



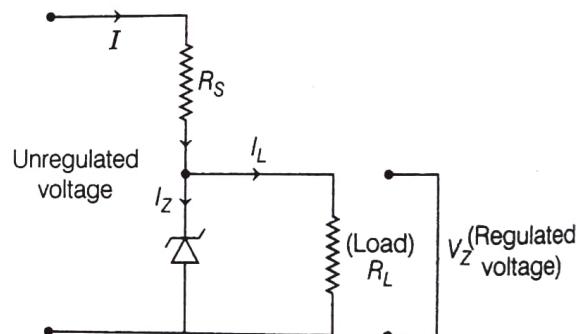
- (a) $\sin^{-1}(\tan r)$ (b) $\sin^{-1}(\cot i)$
 (c) $\tan^{-1}(\sin r)$ (d) $\tan^{-1}(\sin i)$

2. The half-life of ^{215}At is $100 \mu\text{s}$. The time taken for the radioactivity of a sample of ^{215}At to decay to $\frac{1}{16}$ th of its initial value is
 (a) $400 \mu\text{s}$ (b) $6.3 \mu\text{s}$ (c) $40 \mu\text{s}$ (d) $300 \mu\text{s}$
3. What is the de-Broglie wavelength of a nitrogen molecule in air at 300 K ? Assume that the molecule is moving with the root mean square speed of molecules at this temperature.

(Take, atomic mass of nitrogen = 14.0076 u)

- (a) 0.01 nm (b) 0.09 nm
 (c) 0.03 nm (d) 0.2 nm

4. Taking the Bohr radius as $a_0 = 53 \text{ pm}$, the radius of Li^{++} ion in its ground state, on the basis of Bohr's model, will be about
 (a) 53 pm (b) 27 pm
 (c) 18 pm (d) 13 pm
5. In a Zener regulated power supply, a Zener diode with $V_z = 6.0 \text{ V}$ is used for regulation. The load current is to be 4.0 mA and the unregulated input 10.0 V . The value of series resistor R_s must be



- (a) 167Ω (b) 120Ω
 (c) 250Ω (d) 20Ω

6. Each of the two inputs A and B can assume values either 0 or 1. Then, which of the following will be equal to $\bar{A} + \bar{B}$?
 (a) $\bar{A} \cdot \bar{B}$ (b) $\bar{A} + B$
 (c) $\bar{A} + B$ (d) $\bar{A} \cdot \bar{B}$

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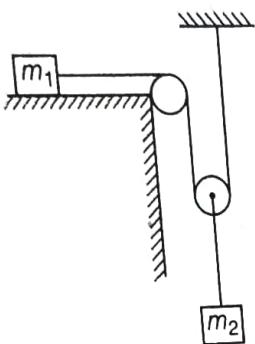
7. The correct dimensional formula for linear momentum is given by

- (a) ML^2T^{-2} (b) MLT^{-1}
 (c) ML^2T^{-1} (d) MLT^{-2}

8. A wire has a mass (0.3 ± 0.003) g, radius (0.5 ± 0.005) mm and length (6 ± 0.06) cm. The maximum percentage error in the measurement of its density is

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

9. If the surface is smooth, the acceleration of the block m_2 will be



- (a) $\frac{m_2g}{4m_1 + m_2}$ (b) $\frac{2m_2g}{4m_1 + m_2}$
 (c) $\frac{2m_1g}{m_1 + 4m_2}$ (d) $\frac{2m_1g}{m_1 + m_2}$

10. The work done in time t on a body of mass m which is accelerated from rest to a speed v in time t_1 as a function of time t is given by

- (a) $\frac{1}{2} \frac{mv}{t_1} t^2$ (b) $\frac{mv}{t_1} t^2$
 (c) $\frac{1}{2} \left(\frac{mv}{t_1} \right) t^2$ (d) $\frac{1}{2} \frac{mv^2}{t_1^2} t^2$

11. The speed of a projectile u reduces by 50% on reaching maximum height. What is the range on the horizontal plane?

- (a) $\frac{u^2}{g} \times \frac{\sqrt{3}}{2}$ (b) $\frac{u^2}{g}$ (c) $\frac{u^2}{2g} \times 3$ (d) $\frac{4u^2}{g}$

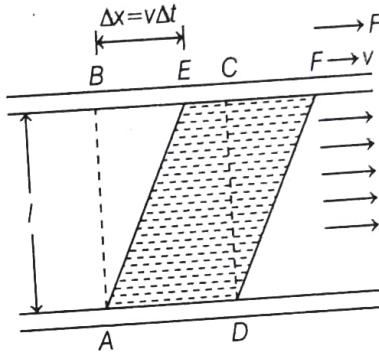
12. The time period of a satellite of the earth is 5h. If the separation between the earth and the satellite is increased to 4 times the previous value, then the new time period will become

- (a) 10 h (b) 80 h (c) 40 h (d) 20 h

13. A uniform rod of length (L) and area of cross-section (A) is subjected to tensile load (F) . If σ be the poisson's ratio and Y be the Young's modulus of the material of the rod, then find the volumetric strain produced in the rod.

- (a) $\frac{5}{AY} (1 + 2\sigma)$ (b) $\frac{F}{AY} (1 - 2\sigma)$
 (c) Zero (d) None of these

14. Suppose a fluid like oil enclosed between two glass plates as shown in figure. The bottom plate is fixed, while the top plate is moved with a constant velocity v relative to fixed plate.



If oil is replaced by honey, then which one has greater viscous force?

- (a) Honey > Oil (b) Honey < Oil
 (c) Honey = Oil (d) Honey \geq Oil

15. A black body radiate energy at rate of $X \text{ W/m}^2$ at a high temperature of T kelvin. When temperature is reduced to $\left(\frac{T}{2}\right)$ kelvin, the radiant energy is

- (a) $\frac{X}{16}$ (b) $\frac{X}{4}$ (c) $\frac{X}{2}$ (d) $2X$

16. Certain amount of heat is given to 100 g of copper to increase its temperature by 21°C . If the same amount of heat is given to 50 g water, then the rise in its temperature is (Take, specific heat capacity of copper = $400 \text{ Jkg}^{-1} \text{ K}^{-1}$ and that of water = $4200 \text{ Jkg}^{-1} \text{ K}^{-1}$)

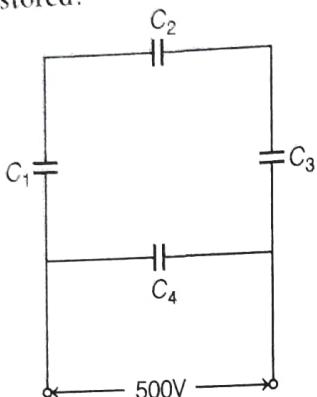
- (a) 4°C (b) 5.25°C
 (c) 8°C (d) 6°C

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17. The top surface of an incompressible liquid is open to the atmosphere. The pressure at a depth h_1 below the surface is p_1 . How does the pressure p_2 at depth $h_2 = 2h_1$ compare with p_1 ?

- (a) $p_2 > 2p_1$ (b) $p_2 = 2p_1$
 (c) $p_2 < 2p_1$ (d) $p_2 = p_1$

18. A network of four capacitors each of $12 \mu\text{F}$ capacitance, if connected to a 500 V supply as shown in figure. What is the total amount of charge stored?



- (a) $6000 \mu\text{C}$ (b) $5000 \mu\text{C}$ (c) $3000 \mu\text{C}$ (d) $8000 \mu\text{C}$

19. Four particles, each having a charge q are placed on the four corners A, B, C and D of a regular pentagon $ABCDE$. The distance of each corner from the centre is a . Find the electric field at the centre of the pentagon.

- (a) $\frac{q}{4\pi\epsilon_0 a^2}$ along OE (b) $\frac{q}{4\pi\epsilon_0 a^2}$ along OC
 (c) $\frac{q}{4\pi\epsilon_0 a^2}$ along OD (d) $\frac{q}{4\pi\epsilon_0 a^2}$ along OA

20. Two point charges placed at certain distance r in air exert a force F on each other. Then, the distance r at which, these charges will exert the same force in a medium of dielectric constant K is given by
 (a) r (b) r/K (c) r/\sqrt{K} (d) $r\sqrt{K}$

21. If magnetic field B is present at a place alongwith an electric field of intensity E , then force experienced by a moving charge q in that region is given by

- (a) $F = (qE + v \times B)$, where v is velocity of charge
 (b) $F = q(E + B) \times v$, where v is velocity of charge
 (c) $F = E + q(v \times B)$, where v is velocity of charge
 (d) $F = q(E + v \times B)$, where v is velocity of charge

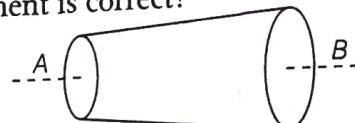
22. A long straight solid metal wire of radius R carries a current i uniformly distributed over its circular cross-section. Find the magnetic field inside the wire at a distance r from the axis of wire.

- (a) $B = \frac{\mu_0 \mu_r i r}{2\pi R^2}$
 (b) $B = \frac{\mu_0 \mu_r i r}{4\pi R^2}$
 (c) $B = \frac{\mu_0 \mu_r i r}{8\pi R^2}$
 (d) $B = \frac{\mu_0 \mu_r i r}{\pi R^2}$

23. A current i ampere flows along an infinitely long straight thin walled tube, then the magnetic induction at any point inside tube is

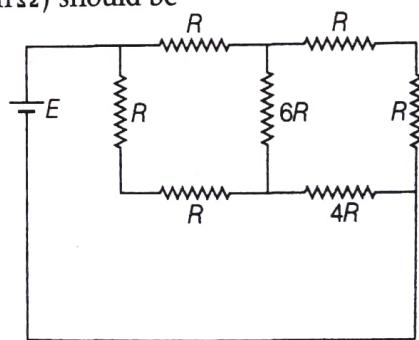
- (a) infinite
 (b) zero
 (c) $\frac{\mu_0}{4\pi} \cdot \frac{2i}{r}$ tesla
 (d) $\frac{2i}{r}$ tesla

24. A wire has a non-uniform cross-sectional area as shown in figure. A steady current i flows through it. Which one of the following statement is correct?



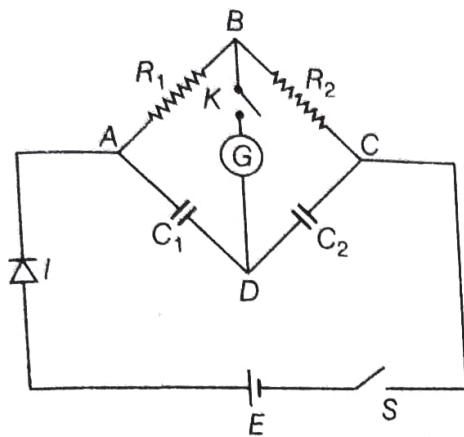
- (a) The drift speed of electron is constant
 (b) The drift speed increases on moving from A to B
 (c) The drift speed decreases on moving from A to B
 (d) The drift speed varies randomly

25. A battery of internal resistance 4Ω is connected to the network of resistance as shown in the figure. In order to give the maximum power to the network, the value of R (in Ω) should be



- (a) $4/9$ (b) $8/9$ (c) 2 (d) 18

26. In the circuit, if no current flows through the galvanometer when the key K is closed, the bridge is balanced. The balancing condition for bridge is



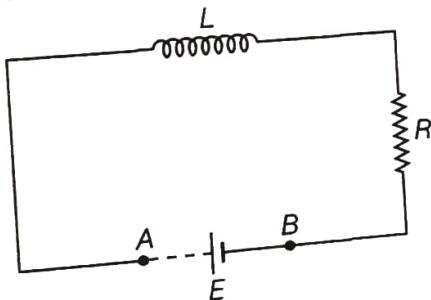
(a) $\frac{C_1}{C_2} = \frac{R_1}{R_2}$

(b) $\frac{C_1}{C_2} = \frac{R_2}{R_1}$

(c) $\frac{C_1^2}{C_2^2} = \frac{R_1^2}{R_2^2}$

(d) $\frac{C_1^2}{C_2^2} = \frac{R_2}{R_1}$

27. An inductor ($L = 100\text{ mH}$), a resistor ($R = 100\Omega$) and a battery ($E = 100\text{ V}$) are initially connected in series as shown in the figure. After a long time, the battery is disconnected after short circuiting the points A and B . The current in the circuit, 1 ms after the short circuit is



(a) $\frac{1}{e}\text{ A}$
 (c) 0.1 A

(b) $e\text{ A}$
 (d) 1 A

28. A car is fitted with a convex side-view mirror of focal length 20 cm. A second car 2.8 m behind the first car is overtaking the first car at relative speed 15 m/s. The speed of the image of the second car as seen in the mirror of the first one is

(a) $\frac{1}{15}\text{ m/s}$
 (c) 15 m/s

(b) 10 m/s
 (d) $\frac{1}{10}\text{ m/s}$

29. In a Young's double slit experiment, the fringe width obtained is 0.4 cm, when light of wavelength 5400 \AA is used. If the distance between the screen and the slit is reduced to half, then what should be the wavelength of light used to obtain fringes 0.0048 m wide?

(a) 12960 \AA
 (b) 1300 \AA
 (c) 1400 \AA
 (d) 1500 \AA

30. Find the angular spread between central maximum and first order maximum of the diffraction pattern due to a single slit of width 0.20 nm , when light of wavelength 5460 \AA is incident on it normally.
- (a) $9 \times 10^{-4}\text{ rad}$
 (b) $8.19 \times 10^{-3}\text{ rad}$
 (c) $6 \times 10^{-5}\text{ rad}$
 (d) $8.65 \times 10^{-4}\text{ rad}$

Category II (Q. Nos. 31 to 35)

Carry 2 marks each and only one option is correct.
 In case of incorrect answer or any combination of more than one answer, 1/2 mark will be deducted.

31. A gaseous mixture consists of 16 g of helium and 16 g of oxygen. The ratio $\frac{C_p}{C_v}$ of the mixture is
- (a) 1.59
 (b) 1.62
 (c) 1.4
 (d) 1.54

32. Air is filled in a motor car tube at 27°C temperature and 2 atmospheric pressure. If the tube suddenly bursts, then the final temperature will be $\left[\left(\frac{1}{2}\right)^{2/7} = 0.82\right]$
- (a) 246 K
 (b) 210 K
 (c) 320 K
 (d) 180 K

33. A block of copper having mass 2 kg is heated to a temperature of 500°C and then placed in a large block of ice at 0°C . What is the maximum amount of ice that can melt? The specific heat of copper is $400\text{ J kg}^{-1}\text{ C}^{-1}$ and latent heat of fusion of water is $3.5 \times 10^5\text{ J kg}^{-1}$.

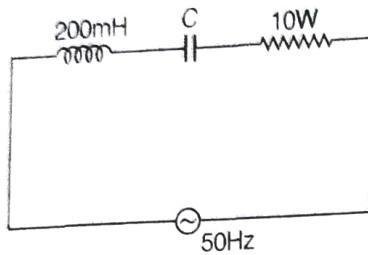
(a) $\frac{4}{3}\text{ kg}$
 (b) $\frac{6}{5}\text{ kg}$
 (c) $\frac{8}{7}\text{ kg}$
 (d) $\frac{10}{9}\text{ kg}$

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34. An iron rod of length L and magnetic moment m is bent in the form of a semi-circle. Now, its magnetic moment will be

- (a) m
- (b) $\frac{2m}{\pi}$
- (c) $\frac{m}{\pi}$
- (d) $m\pi$

35. In the given circuit, calculate the Q -factor of the circuit.



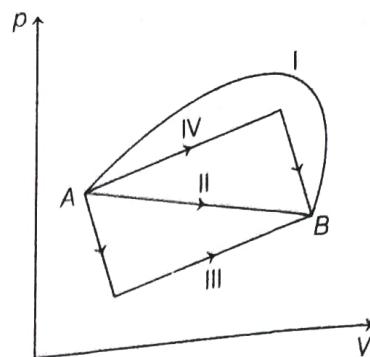
- (a) 6.32
- (b) 5.32
- (c) 4.00
- (d) 3.32

Category III (Q. Nos. 36 to 40)

Carry 2 marks each and one or more option(s) is/are correct. If all correct answers are not marked and also no incorrect answer is marked then score = $2 \times \text{number of correct answers marked} \div \text{actual number of correct answers}$. If any wrong option is marked or if any combination including a wrong option is marked, the answer will be considered wrong, but there is no negative marking for the same and zero marks will be awarded.

36. In a photoelectric experiment, the wavelength of the incident light is decreased from 6000 \AA to 4000 \AA , while the intensity of radiation remains the same.
- (a) the cut-off potential will increase
 - (b) the cut-off potential will decrease
 - (c) the kinetic energy of the emitted photoelectron will increase
 - (d) the photoelectric current will increase

37. Figure shows the p - V diagram of an ideal gas undergoing a change of state from A to B . Four different paths I, II, III and IV as shown in the figure may lead to the same changes of state.



- (a) Change in internal energy is same in IV and III cases, but not in I and II
- (b) Change in internal energy is same in all the four cases
- (c) Work done is maximum in case I
- (d) Work done is minimum in case II

38. A particle is hurled into air from a point on the horizontal ground at an angle with the vertical. If the air exerts a constant resistive force,

- (a) the path of projectile will be parabolic path
- (b) the time of ascent will be equal to time of descent
- (c) the total energy of the projectile is not conserved
- (d) at the highest point, the velocity of projectile is horizontal

39. Temperature dependence of resistivity $\rho(T)$ of semiconductors, insulators and metals is significantly based on the following factors:

- (a) Number of charge carriers can change with temperature T
- (b) Time interval between two successive collisions can depend on T
- (c) Length of material can be function of T
- (d) Mass of carriers is a function of T

40. Magnetic field due to a current carrying wire loop along its axis can be calculated by

- (a) finding electric field of coil and then by using $E/B = c$
- (b) finding electric field of a small element of current carrying coil and then by using $E/B = c$
- (c) summing up the magnetic field of small elements of the coil
- (d) finding magnetic field of a wire of length l and then by substituting $l = 2\pi r$, r being radius of loop

Category I (Q. Nos. 41-70)

Carry 1 mark each and only one option is correct.
In case of incorrect answer or any combination of more than one answer, 1/4 mark will be deducted.

- 41.** The angular momentum for an electron revolving in s-subshell will be

(a) $\frac{1}{2} \cdot \frac{\hbar}{2\pi}$ (b) zero (c) $\frac{\hbar}{2\pi}$ (d) $\sqrt{2} \cdot \frac{\hbar}{\pi}$

- 42.** Atomic number of vanadium (V), chromium (Cr), manganese (Mn) and Iron (Fe) are respectively 23, 24, 25 and 26. Which of these may be expected to have highest IInd ionisation enthalpy?

(a) V (b) Cr (c) Mn (d) Fe

- 43.** The first ionisation potential of Na is 5.1 eV, the value of electron gain enthalpy of Na⁺ will be

(a) -2.55 eV (b) -5.1 eV
(c) -10.2 eV (d) +2.55 eV

- 44.** Normality of '30 volume' H₂O₂ solution is

(a) 1.6 (b) 91.07 (c) 10.72 (d) 5.36

- 45.** Among the following complex ions, the species whose central atom does not have 'd' electrons is

(a) [MnO₄]⁻ (b) [Co(NH₃)₆]³⁺
(c) [Fe(CN)₆]³⁻ (d) [Cr(H₂O)₆]³⁺

- 46.** The molecular shape of SF₄, CF₄ and XeF₄ are:

(a) different with 1, 0 and 2 lone-pair of electrons on the central atom, respectively
(b) different with 0, 1 and 2 lone-pair of electrons on the central atom, respectively
(c) same with 1, 1 and 1 lone-pair of electrons on the central atom, respectively
(d) same with 2, 0 and 1 lone-pair of electrons on the central atom, respectively

- 47.** A gas is initially at 1 atm pressure, to compress it to $\frac{1}{4}$ th of its initial volume.

Pressure to be applied is
(a) 1 atm (b) 2 atm (c) 4 atm (d) $\frac{1}{4}$ atm

- 48.** The uncertainty in position of a particle of 25 g in space is 10^{-5} m. Hence, its uncertainty in velocity (in ms⁻¹) is

(Given : Planck's constant $h = 6.6 \times 10^{-34}$ J-s)

(a) 2.1×10^{-28} (b) 2.1×10^{-20}
(c) 2.1×10^{-34} (d) 2.1×10^{12}

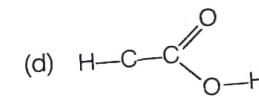
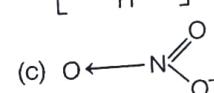
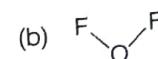
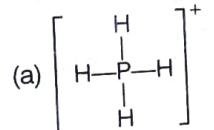
- 49.** 5 mL of N.HCl, 20 mL of $\frac{N}{2}$ H₂SO₄ and 30 mL

of $\frac{N}{3}$ HNO₃ are mixed and volume made to 1 L.

The normality of the resulting solution will be

(a) $\frac{N}{5}$ (b) $\frac{N}{10}$ (c) $\frac{N}{20}$ (d) $\frac{N}{40}$

- 50.** Which of the following formula does not correctly represent the bonding capacity of the atoms involved?



- 51.** Hydrogen can not be produced by the action of dil. H₂SO₄ on

(a) Cu (b) Zn (c) Fe (d) Al

- 52.** The oxidation state of Cr in [Cr(NH₃)₄Cl₂]⁺ is

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

- 53.** The pK_a of a weak acid [HA] is 4.5 the pOH of an aqueous buffered solution of HA in which 50% of it is ionised is?

(a) 4.5 (b) 2.5 (c) 9.5 (d) 7.0

- 54.** For a reaction

CO(g) + Cl₂(g) ⇌ COCl₂(g), the K_p / K_c is equal to

(a) $\frac{1}{RT}$ (b) RT (c) \sqrt{RT} (d) $(RT)^2$

- 55.** A spontaneous change is one, in which the system suffers

(a) an increase in internal energy
(b) lowering in entropy (c) lowering in free energy
(d) no change in energy

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56. When a mole of sodium chloride is dissolved in water at 298 K, the free energy change will be

(Given, lattice energy of NaCl = $-777.8 \text{ kJ mol}^{-1}$, Hydration energy of NaCl = $-774.1 \text{ kJ mol}^{-1}$ and ΔS at 298K = $0.043 \text{ kJ mol}^{-1}$)

- (a) -3.7 kJ (b) -12.814 kJ
 (c) -9114 kJ (d) -16.54 kJ

57. Graphite is a good conductor of electricity. because it contain

- (a) bonded electrons (b) mobile electrons
 (c) strong C—C bonds (d) strong C=C bonds

58. Which of the following does not form M^{3+} ion?

- (a) B (b) Al (c) Ga (d) In

59. Sodium is made by the electrolysis of molten mixture of about 40% NaCl and 60% CaCl₂, because

- (a) Ca²⁺ can reduce NaCl to Na
 (b) CaCl₂ helps in conduction of electricity
 (c) the mixture has lower melting point than NaCl
 (d) Ca²⁺ ion can displace Na from NaCl

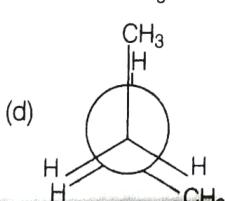
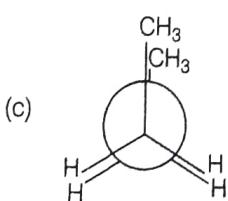
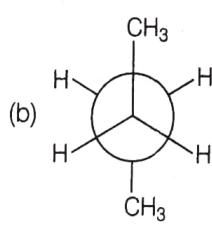
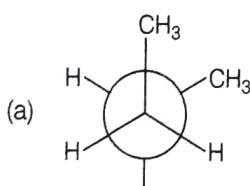
60. The compound which does not exhibit optical isomerism is

- (a) CH₃CHBrCOOH (b) CH₂ClCH₂COOH
 (c) CH₃CH.OH.COOC₂H₅ (d) CH₃CHOHCOOH

61. On ozonolysis of organic compound (A) we get acetone and propionaldehyde as equimolar mixture.

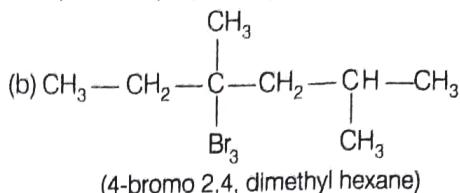
- Identify (A) from the following compounds.
 (a) 2-methyl pent 1-ene (b) pent 1-ene
 (c) pent -2-ene (d) 2-methyl pent-2-ene

62. The most stable conformation of *n*-butane is



63. Which of the following nomenclature is not according to IUPAC system?

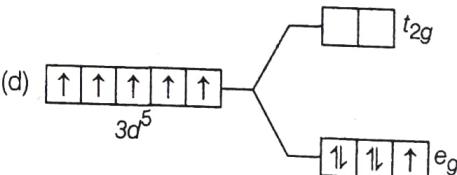
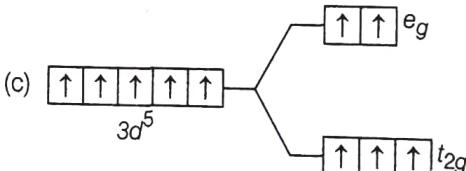
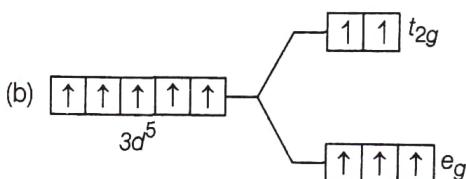
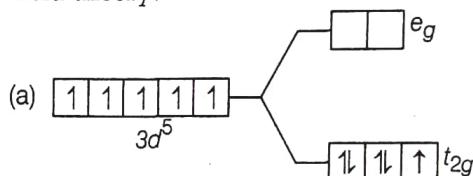
- (a) Br—CH₂—CH = CH₂
 (1-bromo prop 2-ene)



- (c) CH₃—CH—CH—CH₂—CH₃
 CH₃ Ph
 (2-methyl 3-phenyl pentane)

- (d) CH₃—C—CH₂—CH₂—CH₂—COOH
 O
 (5-oxohexanoic acid)

64. Which of the following energy level diagram for [FeF₆]³⁻ is correct on the basis of crystal field theory?



65. In XeF₂, XeF₄ and XeF₆, the number of lone-pairs on the Xe-atom are respectively.

- (a) 2, 3, 1 (b) 1, 2, 3
 (c) 3, 1, 2 (d) 3, 2, 1

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66. The salts of Cu in +1 oxidation are unstable because

- (a) Cu^+ and $3d^{10}$ configuration
- (b) Cu^+ disproportionates easily to $\text{Cu}(0)$ and Cu^{2+}
- (c) Cu^+ disproportionates easily to Cu^{2+} and Cu^{3+}
- (d) Cu^+ is easily reduced to Cu^{2+}

67. Number of P—O—P bonds present in cyclic metaphosphoric acid are

- (a) four
- (b) three
- (c) two
- (d) one

68. Which of the following changes take place during roasting?

- (i) Impurities are removed as their volatile oxides.
 - (ii) Ore is converted into oxide.
 - (iii) Changes like oxidation, chlorination, etc. can take place.
- (a) (i) and (ii) only
 - (b) (ii) and (iii) only
 - (c) (i) and (ii) only
 - (d) (i), (ii) and (iii)

69. The movement of dispersion medium under the influence of electric field is known as

- (a) electrodialysis
- (b) electrophoresis
- (c) electroosmosis
- (d) cataphoresis

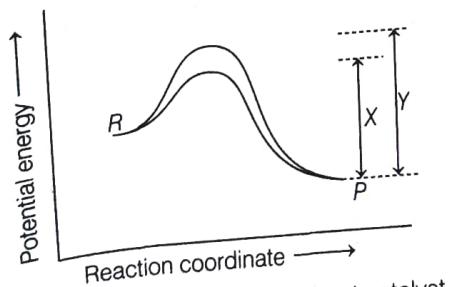
70. The half-life period of a first order reaction is 10 min, what percentage of the reaction will be completed in 100 min?

- (a) 25%
- (b) 50%
- (c) 75%
- (d) 99.9%

Category II (Q. Nos. 71-75)

Carry 2 marks each and only one option is correct. In case of incorrect answer or any combination of more than one answer, 1/2 mark will be deducted.

71. The graph of the effect of catalyst on activation energy is given below. Choose the blanks X and Y with appropriate statements.



- (a) X = energy of activation without catalyst,
Y = energy of activation with catalyst

- (b) X = path of reaction with catalyst,
Y = path of reaction without catalyst
- (c) X = energy of activation with catalyst,
Y = energy of activation without catalyst
- (d) X = energy of endothermic reaction,
Y = energy of exothermic reaction

72. The amount of metal deposited, when a current of 12 ampere with 75% efficiency is passed through the cell for 3 H. (Given, $Z = 4 \times 10^{-4}$).

- (a) 32.4 g
- (b) 38.8 g
- (c) 36.0 g
- (d) 22.4 g

73. Molar conductivity of NH_4OH can be calculated by the equation

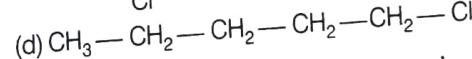
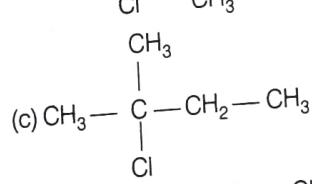
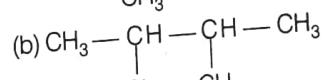
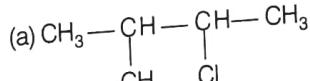
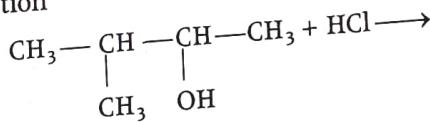
$$(a) \overset{\circ}{\Lambda}_{\text{NH}_4\text{OH}} = \overset{\circ}{\Lambda}_{\text{Ba}(\text{OH})_2} + \overset{\circ}{\Lambda}_{\text{NH}_4\text{Cl}} - \overset{\circ}{\Lambda}_{\text{BaCl}_2}$$

$$(b) \overset{\circ}{\Lambda}_{\text{NH}_4\text{OH}} = \overset{\circ}{\Lambda}_{\text{BaCl}_2} + \overset{\circ}{\Lambda}_{\text{NH}_4\text{Cl}} - \overset{\circ}{\Lambda}_{\text{Ba}(\text{OH})_2}$$

$$(c) \overset{\circ}{\Lambda}_{\text{NH}_4\text{OH}} = \frac{\overset{\circ}{\Lambda}_{\text{Ba}(\text{OH})_2} + 2\overset{\circ}{\Lambda}_{\text{NH}_4\text{Cl}} - \overset{\circ}{\Lambda}_{\text{BaCl}_2}}{2}$$

$$(d) \overset{\circ}{\Lambda}_{\text{NH}_4\text{Cl}} = \frac{\overset{\circ}{\Lambda}_{\text{NH}_4\text{Cl}} + \overset{\circ}{\Lambda}_{\text{Ba}(\text{OH})_2}}{2}$$

74. Halogen acids react with alcohols to form alkyl halides. The reaction follows a nucleophilic substitution mechanism. What will be the major product of the following reaction



75. 3 moles of P and 2 moles of Q are mixed. What will be the total vapour-pressure in the solution. If their partial vapour pressures are 80 and 60 torr respectively.

- (a) 80 torr
- (b) 140 torr
- (c) 72 torr
- (d) 70 torr

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Category III (Q. Nos. 76-80)

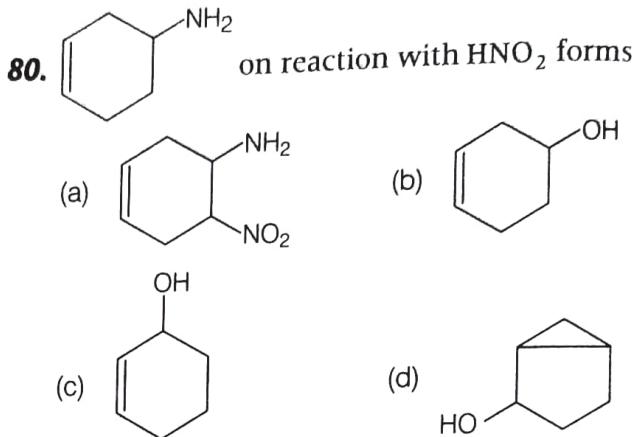
Carry 2 marks each and one or more option(s) is/are correct. If all correct answers are not marked and also no incorrect answer is marked then score = $2 \times$ number of correct answers marked + actual number of correct answers. If any wrong option is marked or if any combination including a wrong option is marked, the answer will be considered wrong, but there is no negative marking for the same and zero mark will be awarded.

76. Which of the following has same oxidation number for the central atom?
- (a) KMnO_4 (b) KClO_3
 (c) $\text{K}_2\text{Cr}_2\text{O}_7$ (d) CrO_5

77. Which of the following are used to convert $R\text{CHO}$ into $R\text{CH}_2\text{OH}$?
- (a) H_2/Pd
 (b) LiAlH_4
 (c) NaBH_4
 (d) Reaction with RMgX followed by hydrolysis

78. Which of the following has same hybridisation of the central atom?
- (a) H_2SO_4 (b) NH_3 (c) H_2O (d) PCl_5

79. Which of the following solution show same number of moles of solute in the given solution?
- (a) 100 mL solution of 0.1 M HCl
 (b) 50 mL solution of 0.2 M NaOH
 (c) 200 mL solution of 0.01 M HCl
 (d) 75 mL solution of 0.025 M NaOH



Mathematics

Category I (Q. Nos. 1 to 50)

Only one answer is correct. Correct answer will fetch full marks 1. Incorrect answer or any combination of more than one answer will fetch -1/4 marks.

1. $\lim_{x \rightarrow a^-} \left\{ \frac{|x|^3}{a} - \left[\frac{x}{a} \right]^3 \right\}$, $a > 0$ where $[x]$ denotes the greatest integer less than or equal to x , is
- (a) $a^2 - 3$ (b) $a^2 - 1$
 (c) a^2 (d) None of these

2. Let $f(x) = \int \frac{x^2}{(1+x^2)\{1+\sqrt{1+x^2}\}} dx$ and

- $f(0) = 0$. Then, $f(1)$ is equal to
- (a) $\log_e(1+\sqrt{2})$ (b) $\log_e(1+\sqrt{2}) - \frac{\pi}{4}$
 (c) $\log_e(1+\sqrt{2}) + \frac{\pi}{4}$ (d) None of these

3. If $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$, then x is

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

4. The value of $\int_0^{\pi/4} (\tan^n x + \tan^{n-2} x) dx$
- $$= \left[x - \frac{[x]}{1!} + \frac{[x]^2}{2!} - \frac{[x]^3}{3!} + \dots \right]$$

where $[x]$ is greatest integer function, is

- (a) $\frac{1}{n}$ (b) $\frac{1}{n+2}$ (c) $\frac{1}{n-1}$ (d) $\frac{1}{n-2}$

5. The function $f(x) = \int_0^x \log\left(\frac{1-x}{1+x}\right) dx$ is

- (a) an even function (b) an odd function
 (c) a periodic function (d) None of these

6. If $f(x)$ is an integrable function on $\left[\frac{\pi}{6}, \frac{\pi}{3}\right]$ and

$$I_1 = \int_{\pi/6}^{\pi/3} \sec^2 \theta f(2 \sin 2\theta) d\theta \text{ and}$$

$$I_2 = \int_{\pi/6}^{\pi/3} \operatorname{cosec}^2 \theta f(2 \sin 2\theta) d\theta, \text{ then}$$

(a) $I_1 = 2I_2$
(c) $2I_1 = I_2$

(b) $I_1 = 3I_2$
(d) None of these

7. The value of $\int_0^{2\pi} |\cos x - \sin x| dx$ is

(a) $\frac{1}{\sqrt{2}}$
(c) $\frac{2}{\sqrt{2}}$

(b) $2\sqrt{2}$
(d) $4\sqrt{2}$

8. The value

$$\int_{-2}^2 \left\{ p \ln \left(\frac{1+x}{1-x} \right) + q \ln \left(\frac{1-x}{1+x} \right)^{-2} + r \right\} dx \text{ depends}$$

on the value of

(a) p
(c) r
(b) q
(d) p and q

9. Solution of the differential equation

$$x \left(\frac{dy}{dx} \right)^2 + 2\sqrt{xy} \frac{dy}{dx} + y = 0 \text{ is}$$

(a) $x + y = a$
(c) $x^2 + y^2 = a^2$
(b) $\sqrt{x} - \sqrt{y} = a$
(d) $\sqrt{x} + \sqrt{y} = \sqrt{a}$

10. The general solution of

$$ydx - xdy - 3x^2 y^2 e^{x^3} dx = 0 \text{ is equal to}$$

(a) $\frac{x}{y} = e^{x^3} + c$
(c) $xy = e^x + c$
(b) $\frac{y}{x} = e^{x^3} + c$
(d) $xy = e^x + c$

11. If a hyperbola passing through the origin has $3x - 4y - 1 = 0$ and $4x - 3y - 6 = 0$ as its asymptotes then the equations of its transverse and conjugate axes are

(a) $x - y - 5 = 0$ and $x + y + 1 = 0$
(b) $x - y = 0$ and $x + y + 5 = 0$
(c) $x + y - 5 = 0$ and $x - y - 1 = 0$
(d) $x + y - 1 = 0$ and $x - y - 5 = 0$

12. If an error of 1° is made in measuring the angle of a sector of radius 30 cm, then the approximate error in its area is

(a) 450 cm^2
(c) $2.5\pi \text{ cm}^2$
(b) $25\pi \text{ cm}^2$
(d) None of these

13. If the sides of a triangle are in GP and its larger angle is twice the smallest, then the common ratio r satisfies the inequality

(a) $0 < r < \sqrt{2}$
(c) $1 < r < 2$
(b) $1 < r < \sqrt{2}$
(d) None of these

14. If $9^{\log_3(\log_2 x)} = \log_2 x - (\log_2 x)^2 + 1$, then x is equal to

(a) 1
(c) 3
(b) $\frac{1}{2}$
(d) None of these

15. Let Z_1 and Z_2 be n th roots of unity which subtend a right angle at the origin. Then, n must be of the form

(a) $4K + 1$
(c) $4K + 3$
(b) $4K + 2$
(d) $4K$

16. If z is a complex number satisfying $|z|^2 - |z| - 2 < 0$, then the value of $|z^2 + z \sin \theta|$, for all value of θ is

(a) equal to 4
(c) more than 6
(b) equal to 6
(d) less than 6

17. If the equation $ax^2 + bx + 6 = 0$ has real roots, where $a \in R$, $b \in R$, then the greatest value of $3a + b$, is

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

18. There are 3 sections in a question paper each containing 5 questions. A candidate has to solve only 5 questions, choosing at least one question from each section. In how many ways can he make his choice?

(a) ${}^{15}C_5$
(c) 2250
(b) ${}^3C_1 \times {}^{12}C_4$
(d) 2253

19. The number of ways in which 7 plus (+) signs and 5 minus (-) signs can be arranged in a row so that no two minus signs are together, is

(a) ${}^8C_5 \times 5!$
(c) 8C_5
(b) ${}^7C_5 \times 5!$
(d) 7!

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20. If $49^n + 16n + \lambda$ is divisible by 64 for all $n \in N$, then the least negative integral value of λ is
 (a) -2 (b) -1 (c) -3 (d) -4

21. The number of terms which are free from radical signs in the expansion of $(y^{1/5} + x^{1/10})^{55}$ is
 (a) 5 (b) 6 (c) 7 (d) None of these

22. The matrix $A = \begin{bmatrix} i & 1-2i \\ -1-2i & 0 \end{bmatrix}$ is which of the following?
 (a) Symmetric (b) Skew-symmetric
 (c) Hermitian (d) Skew-hermitian

23. If A and B are square matrices of size $n \times n$ such that $A^2 - B^2 = (A - B)(A + B)$, then which of the following is true?
 (a) $A = B$
 (b) $AB = BA$
 (c) Either A or B is a zero matrix
 (d) Either A or B is an identity matrix

24. Let $A = \begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$. The only correct statement about the matrix A is
 (a) A^{-1} does not exist
 (b) $A = (-1)I$ is a unit matrix
 (c) A is a zero matrix
 (d) $A^2 = I$

25. In a 4×4 matrix the sum of each row, column and both the main diagonal is α . Then the sum of the four corner elements
 (a) is also α (b) may not be α
 (c) is never equal to α (d) None of these

26. Let $P = \{\theta : \sin \theta - \cos \theta = \sqrt{2} \cos \theta\}$ and $Q = \{\theta : \sin \theta + \cos \theta = \sqrt{2} \sin \theta\}$ be two sets. Then,
 (a) $P \subset Q$ and $Q - P = \emptyset$ (b) $\theta \notin P$
 (c) $P \not\subset Q$ (d) $P = Q$

27. Let the function $f : R \rightarrow R$ be defined by $f(x) = 2x + \sin x$. Then, f is
 (a) one-to-one and onto
 (b) one-to-one but not onto

28. Let the relation R in the set N of natural numbers be defined as $(x, y) \in R$ if $x^2 - 4xy + 3y^2 = 0$ for all $x, y \in N$. The relation R is
 (a) reflexive and transitive
 (b) reflexive symmetric
 (c) symmetric and transitive
 (d) an equivalence relation

29. Two numbers are selected randomly from the set $S = \{1, 2, 3, 4, 5, 6\}$ without replacement one by one. The probability that the minimum of the two numbers is less than 4 is
 (a) $\frac{1}{15}$ (b) $\frac{14}{15}$ (c) $\frac{1}{5}$ (d) $\frac{4}{5}$

30. If x follows a binomial distribution with parameters $n = 8$ and $p = \frac{1}{2}$, then $P(|x - 4| \leq 2)$ equals
 (a) $\frac{118}{128}$ (b) $\frac{119}{128}$
 (c) $\frac{117}{128}$ (d) None of these

31. The number of real solutions of $1 + |e^x - 1| = e^x (e^x - 2)$, is
 (a) 0 (b) 1 (c) 2 (d) 4

32. The area of a triangle ABC is $\sqrt{3}$ sq units and $\angle B = 60^\circ$. If a^2, b^2, c^2 are in AP, the length of the side AC is
 (a) $2\sqrt{3}$ units (b) 2 units
 (c) 3 units (d) $3\sqrt{3}$ units

33. The lines $x + y = |a|$ and $ax - y = 1$ intersect each other in the first quadrant. Then the set of all possible values of a is the interval
 (a) $[1, \infty)$ (b) $(-1, \infty)$
 (c) $(-1, 1)$ (d) $(0, \infty)$

34. Let $A(2, -3)$ and $B(-2, 1)$ be vertices of a triangle ABC . If the centroid of this triangle moves on the line $2x + 3y = 1$, then the locus of the vertex C is the line
 (a) $3x - 2y = 3$ (b) $2x - 3y = 7$
 (c) $3x + 2y = 5$ (d) $2x + 3y = 9$

35. The Locus of the orthocentre of the triangle formed by the lines $(1+p)x - py + p(1+p) = 0$, $(1+q)x - qy + q(1+q) = 0$ and $y = 0$, where $p \neq q$, is

- (a) hyperbola (b) a parabola
(c) an ellipse (d) a straight line

36. If the angle between the pair of straight lines represented by the equation $x^2 - 3xy + \lambda y^2 + 3x - 5y + 2 = 0$, is $\tan^{-1} 3$, where ' λ ' is a non-negative real number. Then, $\lambda =$

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

37. If a variable line drawn through the point of intersection of straight lines $\frac{x}{\alpha} + \frac{y}{\beta} = 1$ and

$\frac{x}{\beta} + \frac{y}{\alpha} = 1$ meets the coordinate axes in A and B , then the locus of the mid-point of AB is

- (a) $\alpha\beta(x + y) = xy(\alpha + \beta)$
(b) $\alpha\beta(x + y) = 2xy(\alpha + \beta)$
(c) $(\alpha + \beta)(x + y) = 2\alpha\beta xy$
(d) None of the above

38. The limiting points of the coaxial system containing the two circles

$$x^2 + y^2 + 2x - 2y + 2 = 0 \text{ and}$$

$$25(x^2 + y^2) - 10x - 80y + 65 = 0 \text{ are}$$

- (a) $(1, -1), (-5, 40)$ (b) $(1, -1), \left(-\frac{1}{5}, -\frac{8}{5}\right)$
(c) $(-1, 1), \left(\frac{1}{5}, \frac{8}{5}\right)$ (d) $(-1, 1), \left(-\frac{1}{5}, -\frac{8}{5}\right)$

39. If $H(x, y) = 0$ represents the equation of a hyperbola and $A(x, y) = 0, C(x, y) = 0$ the joint equation of its asymptotes and the conjugate equation of its asymptotes and the conjugate hyperbola respectively, then for any point (α, β) in the plane, $H(\alpha, \beta)$, $A(\alpha, \beta)$ and $C(\alpha, \beta)$ are in

- (a) AP (b) GP
(c) HP (d) None of these

40. The equation of the normal to the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ at the positive end of the latusrectum is}$$

- (a) $x + ey + e^3 a = 0$ (b) $x - ey - e^3 a = 0$
(c) $x - ey - e^2 a = 0$ (d) None of these

41. The equations of the tangents to the hyperbola $3x^2 - y^2 = 3$ which are

- perpendicular to the line $x + 3y = 2$ are
- (a) $y = 3x \pm \sqrt{6}$ (b) $y = 3x \pm 2\sqrt{3}$
(c) $y = 3x \pm \sqrt{3}$ (d) None of these

42. Tangent at a point on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

is drawn which cuts the coordinate axes at A and B . The minimum area of the triangle OAB is (O being origin)

- (a) ab (b) $\frac{a^3 + b^3 + ab}{3}$
(c) $a^2 + b^2$ (d) $\frac{a^2 + b^2}{4}$

43. The acute angle between the lines whose direction ratios are given by $l + m - n = 0$ and $l^2 + m^2 - n^2 = 0$, is

- (a) 0 (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

44. Equation of the line passing through $(1, 1, 1)$ and parallel to the plane $2x + 3y + z + 5 = 0$, is

- (a) $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-1}{1}$ (b) $\frac{x-1}{-1} = \frac{y-1}{1} = \frac{z-1}{-1}$
(c) $\frac{x-1}{3} = \frac{y-1}{2} = \frac{z-1}{1}$ (d) $\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-1}{1}$

45. If $\lim_{x \rightarrow 0} \frac{(a-n)nx - \tan x}{x^2} = 0$, where n is

a non-zero real number, then a is equal to

- (a) 0 (b) $\frac{n+1}{n}$ (c) n (d) $n + \frac{1}{n}$

46. If $\lim_{t \rightarrow x} \frac{e^t f(x) - e^x f(t)}{(t-x)(f(x))^2} = 2$ and $f(0) = \frac{1}{2}$, then

- $f'(0) =$
(a) 4 (b) 2 (c) 0 (d) 1

47. Consider the function $f(x) = \sin x + \{x\}$, then

- (a) f is of period 2π
(b) f is of period π
(c) f is not periodic
(d) f is of period $\frac{\pi}{2}$

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48. $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x} \right)^{\left(\frac{\sin x}{x - \sin x} \right)}$ is equal to

- (a) e (b) $\frac{1}{e}$ (c) 1 (d) 0

49. If $f(x) = x + \tan x$ and f is the inverse of g , then $g'(x)$ equals

- (a) $\frac{1}{1 + [g(x) - x]^2}$ (b) $\frac{1}{2 - [g(x) - x]^2}$
 (c) $\frac{1}{2 + [g(x) - x]^2}$ (d) None of these

50. If $f(x)$ and $g(x)$ are differentiable function for $0 \leq x \leq 1$ such that $f(0) = 10$, $g(0) = 2$, $f(1) = 2$, $g(1) = 4$, then in the interval $(0, 1)$

- (a) $f'(x) = 0$ for all x
 (b) $f'(x) + 4g'(x) = 0$ for atleast one x
 (c) $f'(x) = 2g'(x)$ for atmost one x
 (d) None of the above

Category II (Q. Nos. 51 to 65)

Carry 2 marks each and only one option is correct.
In case of incorrect answer or any combination of more than one answer, 1/2 mark will be deducted.

51. The value of $\sum_{r=0}^n \sum_{p=0}^r {}^r C_r \cdot {}^r C_p$ is equal to

- (a) $3^n - 2^n$ (b) $3^n - 2^n - 2$
 (c) $3^n - 2^n + 2$ (d) None of these

52. The coefficient of x^{20} in the expansion of

$$(1 + x^2)^{40} \left(x^2 + 2 + \frac{1}{x^2} \right)^{-5}$$

- (a) ${}^{30} C_{10}$ (b) ${}^{30} C_{25}$
 (c) 1 (d) None of these

53. If $\mathbf{a} = \hat{\mathbf{i}} + \hat{\mathbf{j}} + \hat{\mathbf{k}}$, $\mathbf{a} \cdot \mathbf{b} = 1$ and $\mathbf{a} \times \mathbf{b} = \hat{\mathbf{j}} - \hat{\mathbf{k}}$, then \mathbf{b}

- (a) $\hat{\mathbf{i}} - \hat{\mathbf{j}} + \hat{\mathbf{k}}$ (b) $2\hat{\mathbf{j}} - \hat{\mathbf{k}}$
 (c) $\hat{\mathbf{i}}$ (d) $2\hat{\mathbf{i}}$

54. If θ is the angle between the line

$$\mathbf{r} = (\hat{\mathbf{i}} + 2\hat{\mathbf{j}} - \hat{\mathbf{k}}) + \lambda(\hat{\mathbf{i}} - \hat{\mathbf{j}} + \hat{\mathbf{k}})$$

and the plane $\mathbf{r} \cdot (2\hat{\mathbf{i}} - \hat{\mathbf{j}} + \hat{\mathbf{k}}) = 4$, then $\cos \theta =$

- (a) $\frac{1}{2\sqrt{2}}$ (b) $\frac{2\sqrt{2}}{3}$
 (c) $\frac{1}{3}$ (d) None of these

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55. If \mathbf{a} and \mathbf{b} are vectors in space given by $\mathbf{a} = \frac{\hat{\mathbf{i}} - 2\hat{\mathbf{j}}}{\sqrt{5}}$ and $\mathbf{b} = \frac{2\hat{\mathbf{i}} + \hat{\mathbf{j}} + 3\hat{\mathbf{k}}}{\sqrt{14}}$, then the value of $(2\mathbf{a} + \mathbf{b}) \cdot [(\mathbf{a} \times \mathbf{b}) \times (\mathbf{a} - 2\mathbf{b})]$ is

- (a) 4 (b) 5 (c) 6 (d) 7

56. The minimum value of $\left| \arg \left(\frac{1}{1-z} \right) \right|$ for $|z|=1$,

- $z \neq 1$ is
 (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{2}$ (d) π

57. Consider the system of linear equations

$$x_1 + 2x_2 + x_3 = 3; 2x_1 + 3x_2 + x_3 = 3 \\ 3x_1 + 5x_2 + 2x_3 = 1$$

The system has

- (a) a unique solution
 (b) no solution
 (c) infinite number of solutions
 (d) exactly three solutions

58. The value of parameter α , for which the function $f : R \rightarrow R$ given by $f(x) = 1 + \alpha x$, $\alpha \neq 0$ is the inverse of itself is

- (a) -2 (b) -1 (c) 1 (d) 2

59. The function $f : [0, 3] \rightarrow [1, 29]$, defined by

$$f(x) = 2x^3 - 15x^2 + 36x + 1, \text{ is}$$

- (a) one-one and onto
 (b) onto but not one-one
 (c) one-one but not onto
 (d) neither one-one nor onto

60. If the line passing through the points $(5, 1, a)$ and $(3, b, 1)$ crosses the yz -plane at the point

$$\left(0, \frac{17}{2}, -\frac{13}{2} \right)$$

- (a) $a = 6, b = 4$ (b) $a = 8, b = 2$
 (c) $a = 2, b = 8$ (d) $a = 4, b = 6$

61. The coordinates of the point of intersection of tangents drawn to the hyperbola

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$
 at the points where it is

intersected by the line $lx + my + n = 0$ are

- (a) $\left(\frac{a^2 l}{n}, -\frac{b^2 m}{n} \right)$ (b) $\left(-\frac{a^2 l}{n}, \frac{b^2 m}{n} \right)$
 (c) $\left(\frac{a^2 l}{n}, \frac{b^2 m}{n} \right)$ (d) $\left(-\frac{a^2 l}{n}, -\frac{b^2 m}{n} \right)$

62. The value of $\lim_{x \rightarrow 0} \frac{\frac{1}{2}(1 - \cos 2x)}{x}$ is
 (a) 1 (b) -1 (c) 0 (d) None of these

63. Let $f(x) = \sin x$, $g(x) = [x + 1]$ and $h(x) = g \circ f(x)$
 where $[\cdot]$ is the greatest integer function.
 Then, $h' \left(\frac{\pi}{2} \right)$ is
 (a) 1 (b) -1 (c) non-existent (d) None of these

64. The function $f(x) = \cos \frac{x}{2} + \{x\}$, where $\{x\}$ =
 the fractional part of x is a
 (a) periodic function with period 4π
 (b) periodic function with period 1
 (c) periodic function with interminate period
 (d) None of the above

65. A particle's velocity V at time t is given by
 $v = 2e^{2t} \cos \frac{\pi t}{3}$. The least value of t at which the
 acceleration becomes zero is
 (a) 0 (b) $\frac{3}{2}$
 (c) $\frac{3}{\pi} \tan^{-1} \left(\frac{6}{\pi} \right)$ (d) $\frac{3}{\pi} \cot^{-1} \left(\frac{6}{\pi} \right)$

Category III (Q. Nos. 66 to 75)

Carry 2 marks each and one or more option(s) is/are correct. If all correct answers are not marked and also no incorrect answer is marked then score = $2 \times$ number of correct answers marked \div actual number of correct answer. If any wrong option is marked or if, any combination including a wrong option is marked, the answer will be considered wrong, but there is no negative marking for the same and zero marks will be awarded.

66. For $a \in R$ (the set of all real numbers), $a \neq -1$,

$$\lim_{n \rightarrow \infty} \frac{(1^a + 2^a + \dots + n^a)}{(n+1)^{a-1} [(na+1) + (na+2) + \dots + (na+n)]} = \frac{1}{60}$$

- Then, a is equal to
 (a) 5 (b) 7 (c) $-\frac{15}{2}$ (d) $-\frac{17}{2}$

67. If S is the area of the region enclosed by
 $y = e^{-x^2}$, $y = 0$, $x = 0$ and $x = 1$. Then
 (a) $S \geq \frac{1}{e}$
 (b) $S \geq 1 - \frac{1}{e}$
 (c) $S \leq \frac{1}{4} \left(1 + \frac{1}{\sqrt{e}} \right)$
 (d) $S \leq \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{e}} \left(1 - \frac{1}{\sqrt{2}} \right)$

68. The vector(s) which is/are coplanar with vectors $\hat{i} + \hat{j} + 2\hat{k}$ and $\hat{i} + 2\hat{j} + \hat{k}$ are perpendicular to the vector $\hat{i} + \hat{j} + \hat{k}$ is/are
 (a) $\hat{j} - \hat{k}$ (b) $-\hat{i} + \hat{j}$
 (c) $\hat{i} - \hat{j}$ (d) $-\hat{j} + \hat{k}$

69. Let $h(x) = f(x) - \{f(x)\}^2 + \{f(x)\}^3$ for every real number x . Then,
 (a) h is increasing whenever f is increasing
 (b) h is increasing whenever f is decreasing
 (c) h is increasing whenever f is decreasing
 (d) nothing can be said in general

70. Let z_1 and z_2 be complex numbers such that $z_1 \neq z_2$ and $|z_1| = |z_2|$. If z_1 has positive real part and z_2 has negative imaginary part, then $\frac{z_1 + z_2}{z_1 - z_2}$ may be
 (a) zero
 (b) real and positive
 (c) real and negative
 (d) purely imaginary

71. In a ΔABC , if $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$, then
 $\sin^2 A + \sin^2 B + \sin^2 C$ is
 (a) $\frac{3\sqrt{3}}{2}$ (b) $\frac{9}{4}$ (c) $\frac{5}{4}$ (d) 2

72. The locus of the point of intersection of the lines $x \cos \alpha + y \sin \alpha = a$ and $x \sin \alpha - y \cos \alpha = b$, where α is a variable is
 (a) $x^2 + y^2 = a^2 - b^2$
 (b) $x^2 - y^2 = a^2 - b^2$
 (c) $x^2 + y^2 = a^2 + b^2$
 (d) None of the above

- 73.** The locus of a point $p(\alpha, \beta)$ having under the condition that the line $y = \alpha x + \beta$ is a tangent to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is

(a) a hyperbola (b) a parabola
 (c) a circle (d) an ellipse

74. Let f and g be differentiable functions satisfying $g'(a) = 2$, $g(a) = b$ and $f \circ g = I$ (Identity function). The $f'(b)$ is equal to

(a) 2 (b) 3
 (c) $\frac{1}{2}$ (d) None of these

75. The equation $\sin x + x \cos x = 0$ has at least one root in the interval

(a) $\left(-\frac{\pi}{2}, 0\right)$ (b) $(0, \pi)$
 (c) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (d) None of these

Answers

Physics

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|------------|------------|---------------|------------|---------|
| 1. (a) | 2. (a) | 3. (c) | 4. (c) | 5. (a) | 6. (a) | 7. (b) | 8. (d) | 9. (a) | 10. (d) |
| 11. (a) | 12. (c) | 13. (b) | 14. (a) | 15. (a) | 16. (a) | 17. (c) | 18. (d) | 19. (a) | 20. (c) |
| 21. (d) | 22. (a) | 23. (b) | 24. (c) | 25. (c) | 26. (b) | 27. (a) | 28. (a) | 29. (a) | 30. (b) |
| 31. (b) | 32. (a) | 33. (c) | 34. (b) | 35. (a) | 36. (a, c) | 37. (b, c) | 38. (a, c, d) | 39. (a, b) | 40. (c) |

Chemistry

- 41.** (b) **42.** (b) **43.** (b) **44.** (d) **45.** (a) **46.** (a) **47.** (c) **48.** (a) **49.** (d) **50.** (d)
51. (a) **52.** (d) **53.** (c) **54.** (a) **55.** (c) **56.** (c) **57.** (b) **58.** (a) **59.** (c) **60.** (b)
61. (d) **62.** (b) **63.** (a) **64.** (c) **65.** (d) **66.** (b) **67.** (b) **68.** (d) **69.** (c) **70.** (d)
71. (c) **72.** (b) **73.** (c) **74.** (c) **75.** (c) **76.** (c, d) **77.** (a, b, c) **78.** (a, b, c) **79.** (a, b) **80.** (b, c, d)

Mathematics

- | | | | | | | | | | |
|---------|---------|---------|---------|---------|------------|------------|------------|------------|------------|
| 1. (c) | 2. (b) | 3. (b) | 4. (c) | 5. (a) | 6. (d) | 7. (d) | 8. (c) | 9. (d) | 10. (a) |
| 11. (c) | 12. (c) | 13. (b) | 14. (d) | 15. (d) | 16. (d) | 17. (c) | 18. (c) | 19. (c) | 20. (b) |
| 21. (b) | 22. (d) | 23. (b) | 24. (d) | 25. (a) | 26. (d) | 27. (a) | 28. (a) | 29. (d) | 30. (b) |
| 31. (b) | 32. (b) | 33. (a) | 34. (d) | 35. (d) | 36. (b) | 37. (b) | 38. (c) | 39. (a) | 40. (b) |
| 41. (a) | 42. (a) | 43. (d) | 44. (b) | 45. (d) | 46. (c) | 47. (c) | 48. (b) | 49. (c) | 50. (b) |
| 51. (d) | 52. (b) | 53. (c) | 54. (c) | 55. (b) | 56. (c) | 57. (b) | 58. (b) | 59. (b) | 60. (a) |
| 61. (b) | 62. (d) | 63. (c) | 64. (d) | 65. (c) | 66. (b, d) | 67. (b, d) | 68. (a, d) | 69. (b, c) | 70. (a, d) |
| 71. (b) | 72. (c) | 73. (a) | 74. (c) | 75. (b) | | | | | |

* For detailed solutions visit <http://tinyurl.com/y5h46qkb> or scan

