

MET 2014 Memory Based Question Paper PDF

Physics

1. The equation $\left(p + \frac{a}{V^2}\right)(V - b) = \text{constant}$. The

unit of a is

- (a) Dyne $\times$ cm⁵ (b) Dyne $\times$ cm⁴
(c) Dyne/cm³ (d) Dyne/cm²

2. If L , C and R denote the inductance, capacitance and resistance respectively, the dimensional formula for C^2LR is

- (a) $[ML^{-2}T^{-1}Q^0]$ (b) $[M^0L^0T^3Q^0]$
(c) $[M^{-1}L^{-2}T^6Q^0]$ (d) $[M^0L^0T^2Q^0]$

3. Number of particles is given by $n = -D \frac{n_2 - n_1}{x_2 - x_1}$

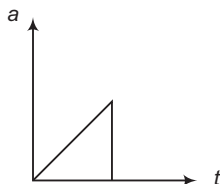
crossing a unit area perpendicular to X -axis is unit time, where n_1 and n_2 are number of particles per unit volume for the value of x meant to x_2 and x_1 . Find dimensions of D called as diffusion constant.

- (a) $[M^0L^2T^2]$ (b) $[M^0L^2T^{-4}]$ (c) $[M^0LT^{-3}]$ (d) $[M^0L^2T^{-1}]$

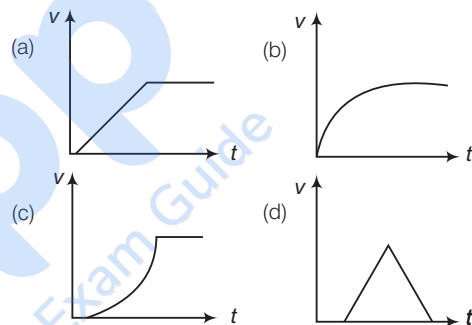
4. A body starts from the origin and moves along the x -axis such that velocity at any instant is given by $(4t^3 - 2t)$, where t is in second and velocity is in m/s. What is the acceleration of the particle, when it is $2m$ from the origin?

- (a) 28 m/s² (b) 22 m/s²
(c) 12 m/s² (d) 10 m/s²

5. The acceleration-time graph of a body is shown below



The most probable velocity-time graph of the body is



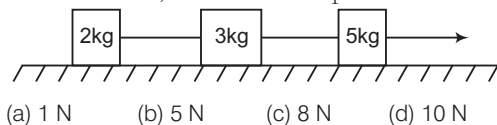
6. Two seconds after projection, a projectile is travelling in a direction inclined at 30° to the horizontal. After one more sec, it is travelling horizontally, the magnitude and direction of its velocity are

- (a) $2\sqrt{20}$ m/s, 60° (b) $20\sqrt{3}$ m/s, 60°
(c) $6\sqrt{40}$ m/s, 30° (d) $40\sqrt{6}$ m/s, 30°

7. The kinetic energy k of a particle moving along a circle of radius R depends on the distance covered. It is given as $KE = as^2$, where a is a constant. The force acting on the particle is

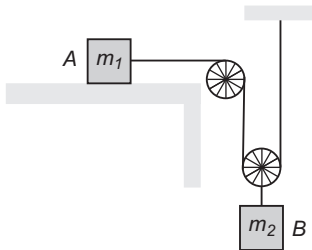
- (a) $2a \frac{s^2}{R}$ (b) $2as \left(1 + \frac{s^2}{R^2}\right)^{1/2}$ (c) $2as$ (d) $2a \frac{R^2}{s}$

8. Three blocks of masses 2 kg, 3 kg and 5 kg are connected to each other with light string and are then placed on a frictionless surface as shown in the figure. The system is pulled by a force $F = 10$ N, then tension $T_1 =$



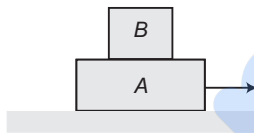
- (a) 1 N (b) 5 N (c) 8 N (d) 10 N

9. The acceleration of block B in the figure will be



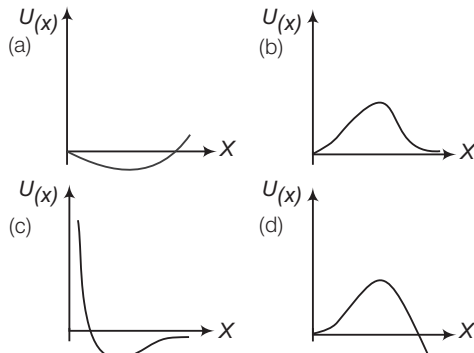
- (a) $\frac{m_2 g}{(4m_1 + m_2)}$ (b) $\frac{2m_2 g}{(4m_1 + m_2)}$
(c) $\frac{2m_1 g}{(m_1 + 4m_2)}$ (d) $\frac{2m_1 g}{(m_1 + m_2)}$

10. A body A of mass 1 kg rests on a smooth surface. Another body B of mass 0.2 kg is placed over A as shown. The coefficient of static friction between A and B is 0.15. B will begin to slide on A , if A is pulled with a force greater than

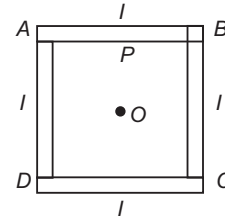


- (a) 1.764 N (b) 0.1764 N
(c) 0.3 N (d) It will not slide for any F

11. A particle which is constrained to move along the x -axis, is subjected to a force in the same direction which varies with the distance x of the particle from the origin is $F(x) = -kx + ax^3$. Here, k and a are positive constants. For $x \geq 0$, the functional form of the potential energy $U(x)$ of the particle is



12. Four thin rods of same mass M and same length l , form a square as shown in figure. Moment of inertia of this system about an axis through centre O and perpendicular to its plane is

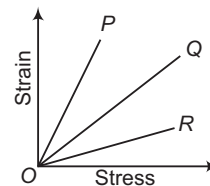


- (a) $\frac{4}{3} Ml^2$ (b) $\frac{Ml^2}{3}$ (c) $\frac{Ml^2}{6}$ (d) $\frac{2}{3} Ml^2$

13. A wheel is rotating with an angular speed of 20 rad/s. It is stopped to rest by applying a constant torque in 4s. If the moment of inertia of the wheel about its axis is 0.20 kg/m², then the work done by the torque in two seconds will be

- (a) 10 J (b) 20 J
(c) 30 J (d) 40 J

14. The strain stress curves of three wires of different materials are shown in the figure. P , Q and R are the elastic limits of the wires. The figure shows that



- (a) elasticity of wire P is maximum
(b) elasticity of wire Q is maximum
(c) tensile strength of R is maximum
(d) None of the above is true

15. Several spherical drops of a liquid of radius r coalesce to form a single drop of radius R . If T is surface tension and V is volume under consideration, then the release of energy is

- (a) $3VT \left(\frac{1}{r} + \frac{1}{R} \right)$ (b) $3VT \left(\frac{1}{r} - \frac{1}{R} \right)$
(c) $VT \left(\frac{1}{r} - \frac{1}{R} \right)$ (d) $VT \left(\frac{1}{r^2} + \frac{1}{R^2} \right)$

16. Two substances of densities ρ_1 and ρ_2 are mixed in equal volume and the relative density of mixture is 4. When they are mixed in equal masses, the relative density of the mixture is 3. The values of ρ_1 and ρ_2 are

(a) $\rho_1 = 6$ and $\rho_2 = 2$ (b) $\rho_1 = 3$ and $\rho_2 = 5$
 (c) $\rho_1 = 12$ and $\rho_2 = 4$ (d) None of these

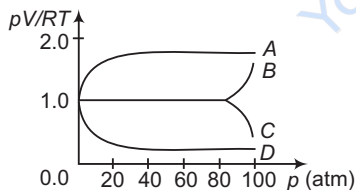
17. The pressure p , volume V and temperature T of a gas in the jar A and the other gas in the jar B at pressure $2p$, volume $V/4$ and temperature $2T$, then the ratio of the number of molecules in the jar A and B will be

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

18. Two identical containers each of volume V_0 are joined by a small pipe. The containers contain identical gases at temperature T_0 and pressure P_0 . One container is heated to temperature $2T_0$ while maintaining the other at the same temperature. The common pressure of the gas is P and n is the number of moles of gas in container at temperature $2T_0$

(a) $p = 2p_0$ (b) $p = \frac{4}{3}p_0$
 (c) $n = \frac{2}{3} \frac{p_0 V_0}{RT_0}$ (d) $n = \frac{3}{2} \frac{p_0 V_0}{RT_0}$

19. An experiment is carried on a fixed amount of gas at different temperature and at high pressure such that it deviates from the ideal gas behaviour. The variation of $\frac{pV}{RT}$ with p is shown in the diagram. The correct variation will correspond to

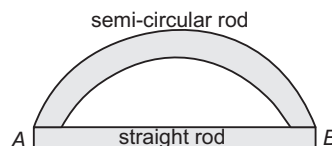


(a) Curve A (b) Curve B
 (c) Curve C (d) Curve D

20. Liquid is filled in a flask upto a certain point. When, the flask is heated, the level of the liquid

(a) immediately starts increasing
 (b) initially falls and then rises
 (c) rises abruptly
 (d) falls abruptly

21. Two rods (one semi-circular and other straight) of same material and of same cross-sectional area are joined as shown in the figure. The points A and B are maintained at different temperature. The ratio of the heat transferred through a cross-section of a semi-circular rod to the heat transferred through a cross-section of the straight rod in a given time is

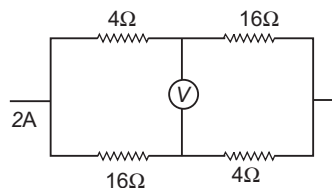


(a) 2 : π (b) 1 : 2
 (c) π : 2 (d) 3 : 2

22. Two particles executes SHM of same amplitude and frequency along the same straight line. They pass one another when going in opposite directions. Each time their displacement is half of their amplitude. The phase difference between them is

(a) 30° (b) 60°
 (c) 90° (d) 120°

23. In the following circuit reading of voltmeter V is



(a) 12 V (b) 8 V
 (c) 20 V (d) 16 V

24. The amount of work done in increasing the voltage across the plates of a capacitor from 5V to 10V is W . The work done in increasing it from 10 V to 5 V will be

(a) 0.6 W
 (b) 1 W
 (c) 1.25 W
 (d) 1.67 W

25. The de-Broglie wavelength of a neutron at 27°C is λ . What will be its wavelength at 927°C ?

(a) $\lambda/2$ (b) $\lambda/3$
 (c) $\lambda/4$ (d) $\lambda/9$

26. The minimum intensity of light to be detected by human eye is 10^{-10} W/m^2 . The number of photons of wavelength $5.6 \times 10^{-7} \text{ m}$ entering the eye, with pupil area 10^{-6} m^2 , per second for vision will be nearly

(a) 100 (b) 200
(c) 300 (d) 400

27. In a photoemissive cell with exciting wavelength λ , the fastest electron has speed v . If the exciting wavelength is changed by $3\lambda/4$, the speed of the fastest emitted electron will be
(a) $v(3/4)^{1/2}$
(b) $v(4/3)^{1/2}$
(c) less than $v(4/3)^{1/2}$
(d) greater than $v(4/3)^{1/2}$

28. The ratio of the wavelength for $2 \rightarrow 1$ transition in Li^+ , He^+ and H is

(a) 1 : 2 : 3 (b) 1 : 4 : 9
(c) 4 : 9 : 36 (d) 3 : 2 : 1

29. The fraction of atoms of radioactive element that decays in 6 days is $7/8$. The fraction that decays in 10 days will be

(a) $77/80$ (b) $71/80$ (c) $31/32$ (d) $15/16$

30. Nucleus of mass number A , originally at rest, emits the α -particle with speed v . The daughter nucleus recoils with a speed of

(a) $2v/(A+4)$ (b) $4v/(A+4)$
(c) $4v/(A-4)$ (d) $2v/(A-4)$

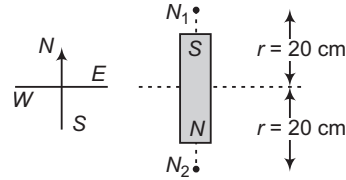
31. When ${}_{90}\text{Th}^{228}$ transforms to ${}_{83}\text{Bi}^{212}$, then the number to the emitted α and β -particles is, respectively

(a) $8\alpha, 7\beta$ (b) $4\alpha, 7\beta$
(c) $4\alpha, 4\beta$ (d) $4\alpha, 1\beta$

32. Two Cu^{64} nuclei touch each other. The electrostatics repulsive energy of the system will be

(a) 0.788 MeV (b) 7.88 MeV
(c) 126.15 MeV (d) 788 MeV

33. A short bar magnet is placed with its south pole towards geographical north. The neutral points are situated at a distance of 20 cm from the centre of the magnet. If $B_H = 0.3 \times 10^{-4} \text{ Wb/m}^2$ then the magnetic moment of the magnet is



(a) $9000ab - \text{amp} \times \text{cm}^2$ (b) $900ab - \text{amp} \times \text{cm}^2$
(c) $1200ab - \text{amp} \times \text{cm}^2$ (d) $225ab - \text{amp} \times \text{cm}^2$

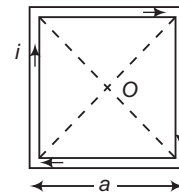
34. A magnet makes 40 oscillations per minute at a place having magnetic field intensity $B_H = 0.1 \times 10^{-5}$. At another place, it takes 2.5 s to complete one vibration. The value of the earth's horizontal field at the place

(a) $0.25 \times 10^{-6} \text{ T}$ (b) $0.36 \times 10^{-6} \text{ T}$
(c) $0.66 \times 10^{-8} \text{ T}$ (d) $1.2 \times 10^{-6} \text{ T}$

35. The coercivity of a small bar magnet is $4 \times 10^3 \text{ A/m}$. It is inserted inside a solenoid of 500 turns and length 1 m to demagnetise it. The amount of current to be passed through the solenoid will be

(a) 2.5 A (b) 5 A (c) 8 A (d) 10 A

36. A wire in the form of a square of side a carries a current i . Then, the magnetic induction at the centre of the square wire is (magnetic permeability of free space $= \mu_0$).

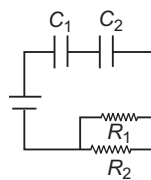


(a) $\frac{\mu_0 i}{2\pi a}$ (b) $\frac{\mu_0 i \sqrt{2}}{\pi a}$ (c) $\frac{2\sqrt{2}\mu_0 i}{\pi a}$ (d) $\frac{\mu_0 i}{\sqrt{2}\pi a}$

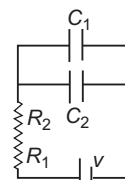
37. Given,

$R_1 = 1\Omega$
 $R_2 = 2\Omega$

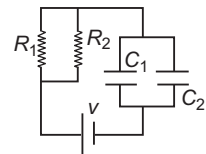
$C_1 = 2\mu\text{F}$
 $C_2 = 4\mu\text{F}$



(I)



(II)

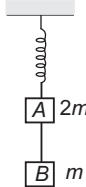


(III)

The time constant (in μs) for the circuits I, II, III are respectively

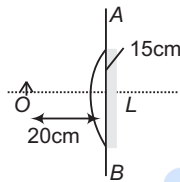
- (a) 18, 8/9, 4 (b) 18, 4, 8/9
(c) 4, 8/9, 18 (d) 8/9, 18, 4

- 38.** Two blocks *A* and *B* of masses $2m$ and m , respectively, are connected by a massless and inextensible string. The whole system is suspended by a massless spring as shown in the figure. The magnitudes of acceleration of *A* and *B*, immediately after the string is cut, are respectively



- (a) $g, g/2$ (b) $g/2, g$
(c) g, g (d) $g/2, g/2$

- 39.** A point object is placed at a distance of 20 cm from a thin plano-convex lens of focal length 15 cm, if the plane surface is silvered. The image will form at



- (a) 60 cm left of AB
(b) 30 cm left of AB
(c) 12 cm left of AB
(d) 60 cm right of AB

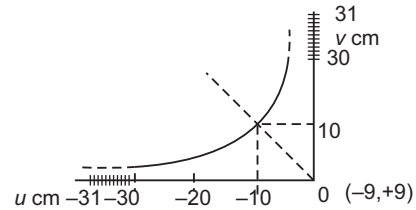
- 40.** A biconvex lens of focal length f forms a circular image of sun of radius r in focal plane. Then,

- (a) $\pi r^2 \propto f$
(b) $\pi r^2 \propto f^2$
(c) if lower half part is covered by black sheet, then area of the image is equal to $\pi r^2/2$
(d) if f is doubled, intensity will increase

- 41.** Given a sample of radium-226 having half-life of 4 days. Find, the probability, a nucleus disintegrates after 2 half lives.

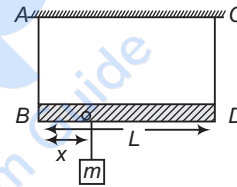
- (a) 1 (b) 1/2
(c) 1.5 (d) 3/4

- 42.** Graph of position of image *versus* position of point object from a convex lens is shown. Then, focal length of the lens is



- (a) 0.50 ± 0.05 cm (b) 0.50 ± 0.10 cm
(c) 5.00 ± 0.05 cm (d) 5.00 ± 0.10 cm

- 43.** A massless rod is suspended by two identical strings *AB* and *CD* of equal length. A block of mass m is suspended from point *O* such that *BO* is equal to x . Further, it is observed that the frequency of 1st harmonic (fundamental frequency) in *AB* is equal to 2nd harmonic frequency in *CD*. Then, length of *BO* is



- (a) $L/5$ (b) $4L/5$
(c) $3L/4$ (d) $L/4$

- 44.** A system of binary stars of masses m_A and m_B are moving in circular orbits of radii r_A and r_B respectively. If T_A and T_B are the time periods of masses m_A and m_B respectively, then

- (a) $\frac{T_A}{T_B} = \left(\frac{r_A}{r_B}\right)^{3/2}$
(b) $T_A > T_B$ (if $r_A > r_B$)
(c) $T_A > T_B$ (if $m_A > m_B$)
(d) $T_A = T_B$

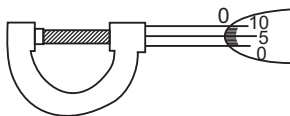
- 45.** A solid sphere of mass M , radius R and having moment of inertia about an axis passing through the centre of mass as I , is recast into a disc of thickness t , whose moment of inertia about an axis passing through its edge and perpendicular to its plane remains I . Then, radius of the disc will be

- (a) $\frac{2R}{\sqrt{15}}$ (b) $R\sqrt{\frac{2}{15}}$
(c) $\frac{4R}{\sqrt{15}}$ (d) $\frac{R}{4}$

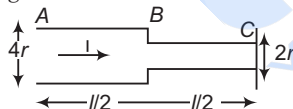
46. A student performs an experiment for determination of $g \left(= \frac{4\pi^2 l}{T^2} \right)$, $l \approx 1$ m, and he commits an error of Δl . For T he takes the time of n oscillations with the stop watch of least count ΔT and he commits a human error of 0.1 s. For which of the following data, the measurement of g will be most accurate?

	Δl	ΔT	n	Amplitude of oscillation
(a)	5 mm	0.2 s	10	5 mm
(b)	5 mm	0.2 s	20	5 mm
(c)	5 mm	0.1 s	20	1 mm
(d)	1 mm	0.1 s	50	1 mm

47. The circular divisions of shown screw gauge are 50. It moves 0.5 mm on main scale in one rotation. The diameter of the ball is



- (a) 2.25 mm (b) 2.20 mm
(c) 1.20 mm (d) 1.25 mm
48. Consider the cylindrical element as shown in the figure. Current flowing through the element is I and resistivity of material of the cylinder is ρ . Choose the correct option out of the following.



- (a) Power loss in first half is four times the power loss in second half
(b) Voltage drop in first half is twice of voltage drop in second half
(c) Current density in both halves are equal
(d) Electric field in both halves is equal
49. Ideal gas is contained in a thermally insulated and rigid container and it is heated through a resistance 100Ω by passing a current of 1 A for five minutes, then change in internal energy of the gas is
- (a) 0 kJ (b) 30 kJ
(c) 10 kJ (d) 20 kJ

50. Two litre of water at initial temperature of 27°C is heated by a heater of power 1 kW. If the lid of kettle is opened, then heat is lost at the constant rate of 160 J/s. Find, the time required to raise the temperature of water to 77°C with the lid open (specific heat of water 4.2 kJ/kg)

- (a) 5 min 40 s
(b) 14 min 20 s
(c) 8 min 20 s
(d) 16 min 10 s

51. An open organ pipe resonated with frequency f_1 and 2nd harmonic. Now, one end is closed and the frequency is slowly increased, then it resonates with frequency f_2 and n th harmonic then,

- (a) $n = 3, f_2 = \frac{3}{4}f_1$ (b) $n = 5, f_2 = \frac{3}{4}f_1$
(c) $n = 3, f_2 = \frac{5}{4}f_1$ (d) $n = 5, f_2 = \frac{5}{4}f_1$

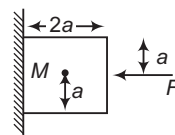
52. Which of the following process does not occur through convection

- (a) boiling of water
(b) land breeze and sea breeze
(c) circulation of air around furnace
(d) heating of glass bulb through filament

53. T_1 is the time period of simple pendulum. The point of suspension moves vertically upwards according to $y = kt^2$, where $k = 1 \text{ m/s}^2$. New time period is T_2 , then $\frac{T_1^2}{T_2^2} = ?$ ($g = 10 \text{ m/s}^2$)

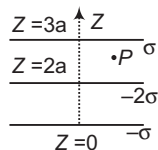
- (a) 4/5 (b) 6/5
(c) 5/6 (d) 1

54. In the figure shown, a cubical block is held stationary against a rough wall by applying force ' F ', then incorrect statement among the following is

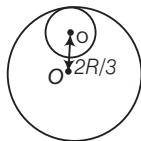


- (a) frictional force $f = mg$
(b) $F = N$, N is normal reaction
(c) F does not apply any torque
(d) N does not apply any torque

55. Three infinitely charged sheets are kept parallel to x - y plane having charge densities as shown. Then, the value of electric field at ' P ' is



- (a) $\frac{-4\sigma}{\epsilon_0} \hat{k}$ (b) $\frac{4\sigma}{\epsilon_0} \hat{k}$
(c) $\frac{-2\sigma}{\epsilon_0} \hat{k}$ (d) $\frac{2\sigma}{\epsilon_0} \hat{k}$
56. A circular disc of radius $\frac{R}{3}$ is cut from a circular disc of radius R and mass $9M$ as shown. Then, moment of inertia of remaining disc about ' O ' perpendicular to the plane of the disc is



- (a) $4MR^2$ (b) $9MR^2$
(c) $\frac{37}{9}MR^2$ (d) $\frac{40}{9}MR^2$

57. A cylindrical conducting rod is kept with its axis along positive z -axis, where a uniform magnetic field exists parallel to z -axis. The current induced in the cylinder is

- (a) zero
(b) clockwise as seen from $+z$ -axis
(c) anti-clockwise as seen from $+z$ -axis
(d) opposite to the direction of magnetic field

58. Ratio of area of hole to beaker is 0.1. Height of liquid in beaker is 3m, and hole is at the height of 52.5 cm from the bottom of beaker, find the square of the velocity of liquid coming out from the hole

- (a) 50 (m/s)^2 (b) 50.5 (m/s)^2
(c) 51 (m/s)^2 (d) 42 (m/s)^2

59. Temperature of a gas is 20°C and pressure is changed from $1.01 \times 10^5 \text{ Pa}$ to $1.165 \times 10^5 \text{ Pa}$. If volume is decreased isothermally by 10%. Bulk modulus of gas is

- (a) 1.55×10^5 (b) 0.155×10^5
(c) 1.4×10^5 (d) 1.01×10^5

60. The atomic number (Z) of an element whose k_α wavelength is λ is 11. The atomic number of an element whose k_α wavelength is 4λ is equal to

- (a) 6 (b) 11 (c) 44 (d) 4

Chemistry

1. Which of the following compounds will not react with Mg metal in the presence of ether to give a Grignard reagent?

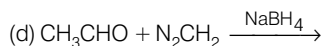
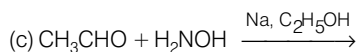
- (a) $\text{CH}_2=\text{CHBr}$
(b) $\text{CH}_3\text{CH}_2\text{I}$
(c) $\text{CH}_2\text{OHCH}_2\text{Br}$
(d) $\text{CH}_3\text{OCH}_2\text{CH}_3$

2. How many enols (including stereo isomers) exist for 3-hexanone?

- (a) Two (b) Three
(c) Four (d) Six

3. Which of the following processes does not yield a primary amine?

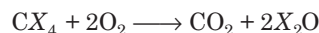
- (a) $\text{CH}_3\text{COCH}_3 + \text{NH}_3 + \text{H}_2 \xrightarrow{\text{Ni}}$
(b) $\text{CH}_3\text{CH}_2\text{CN} + \text{H}_2 \xrightarrow[140^\circ\text{C}]{\text{Ni}}$



4. An aqueous solution of phosphoric acid, H_3PO_4 being titrated has molarity equal to 0.25 M. Which of the following could be normality of this solution?

- (a) 0.25 N (b) 0.50 N
(c) 0.75 N (d) All of these

5. For the reaction represented by the equation,

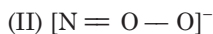
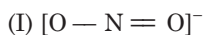


9.0 g of CX_4 completely reacts with 1.74 g of oxygen. The approximate molar mass of X will be

- (a) 20 (b) 40
(c) 60 (d) 80

6. Which of the following species contain an element in an oxidation state that is not a whole number?
(a) VO_4^{3-} (b) Mn_2O_3 (c) $\text{S}_4\text{O}_6^{2-}$ (d) Cl_2O_7
7. Gold is extracted by hydrometallurgical process, based on its property
(a) of being electropositive
(b) of being less reactive
(c) to form complexes which are water soluble
(d) to form salts which are water soluble
8. Due to lanthanide contraction
(a) Fe, Co, Ni have equal size
(b) Zr and Hf have equal size
(c) all *f*-block ions have equal size
(d) all isoelectronic ions have equal size
9. The element which forms ions in dimeric state is
(a) mercury (b) nickel (c) iron (d) cadmium
10. The high oxidising power of fluorine is due to its
(a) high electron affinity
(b) high heat of dissociation and low heat of hydration
(c) low heat of dissociation and high heat of hydration
(d) high heat of dissociation and high heat of hydration
11. Which one of the following is the weakest acid?
(a) HF (b) HCl (c) HBr (d) HI
12. Find the pressure of a sample of CCl_4 if 1.0 mole occupies 35L at 77°C . Assume CCl_4 obeys the van der Waals equation of state. ($a = 20 \text{ L}^2 \text{ mol}^{-2} \text{ atm}$ and $b = 0.14 \text{ L mol}^{-1}$)
(a) 0.56 atm (b) 0.572 atm
(c) 0.82 atm (d) 0.807 atm
13. KBr crystallises in NaCl type of crystal lattice and its density is 2.75 g/cm^3 . Number of unit cells of KBr present in a 1.00 mm^3 grain of KBr are
(a) $3 \cdot 6 \times 10^{18}$ (b) $3 \cdot 6 \times 10^{16}$
(c) $2 \cdot 34 \times 10^{23}$ (d) $6 \cdot 02 \times 10^{24}$
14. A body centre cubic lattice is made up of two different types of atoms A and B. Atom A occupies the body centre and B occupying the corner positions. One of the corners is left unoccupied per unit cell. Empirical formula of such a solid is
(a) AB (b) A_2B_3 (c) A_5B_7 (d) A_8B_7
15. A substance is carried out through the following transformations
-
- The equation $\Delta S_1 + \Delta S_2 = \Delta S_3 + \Delta S_4 + \Delta S_5$
(a) is true only if the steps are carried out reversibly
(b) is always true because entropy is a state function
(c) may be true but need more informations on the processes
(d) is incorrect
16. At 298 K the entropy of rhombic sulphur is 32.04 J/mol K and that of monoclinic sulphur is 32.68 J/mol K . The heat of their combustion are respectively -298246 and $-297948 \text{ J mol}^{-1}$. ΔG for the reaction; $S_{\text{rhombic}} \longrightarrow S_{\text{monoclinic}}$ will be
(a) 107.28 J (b) 10.728 J
(c) 107.28 kJ (d) 10728 J
17. An atomic orbital has two angular nodes and one radial node. It is a
(a) 2p orbital (b) 3p orbital
(c) 3d orbital (d) 4d orbital
18. Which of the following sets of quantum numbers could represent the last electron added to complete the electron configuration for a ground state atom of Br ($Z = 35$) according to the Aufbau principle, $n ; l ; m_l ; m_s$
(a) $4 ; 0 ; 0 ; -\frac{1}{2}$ (b) $4 ; 1 ; 1 ; -\frac{1}{2}$
(c) $3 ; 1 ; 1 ; -\frac{1}{2}$ (d) $4 ; 1 ; 2 ; +\frac{1}{2}$
19. Order the species CF^+ , CF and CF^- according to increasing C—F bond length
(a) $\text{CF}^+ < \text{CF} < \text{CF}^-$ (b) $\text{CF}^+ < \text{CF}^- < \text{CF}$
(c) $\text{CF}^- < \text{CF} < \text{CF}^+$ (d) $\text{CF} < \text{CF}^- < \text{CF}^+$
20. When the substances CCl_4 , CH_4 and CF_4 are arranged in order of increasing boiling point, what is the correct order?
(a) CCl_4 , CF_4 , CH_4
(b) CH_4 , CF_4 , CCl_4
(c) CF_4 , CCl_4 , CH_4
(d) CF_4 , CH_4 , CCl_4

21. The nitrite ion is represented by



Which of the structures represents possible resonance forms of this ion?

- (a) Only I (b) Only II
(c) Both I and II (d) Neither I and II

22. Equal moles of $NO_2(g)$ and $NO(g)$ are to be placed in a container to produce N_2O according to the reaction,



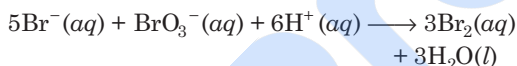
How many moles of NO_2 and NO be placed in the 5.0 L container to have an equilibrium concentration of N_2O to be 0.05 M?

- (a) 0.5115 (b) 0.1023 (c) 0.0526 (d) 0.2046

23. The rate of a chemical reaction involving liquids only will not be influenced by the

- (a) temperature of the system
(b) number of reacting particles per mL
(c) stability of the bonds
(d) pressure of the system

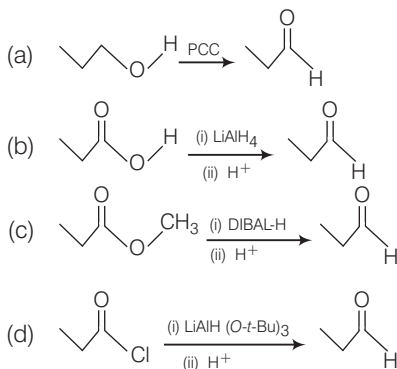
24. Consider the following reaction in aqueous solution.



If the rate of appearance of Br_2 at a particular moment during the reaction is 0.025 Ms^{-1} , what is the rate of disappearance (in Ms^{-1}) of Br^- at that moment?

- (a) 0.025 ms^{-1} (b) 0.042 ms^{-1}
(c) 0.075 ms^{-1} (d) 0.125 ms^{-1}

25. Shown below are four possible synthesis of propionaldehyde. Which one would not work?



26. The compound $C_6H_5CH = N - N = CHC_6H_5$ is produced by the reaction of an excess of benzaldehyde with which compound?

- (a) NH_3 (b) NH_2NH_2
(c) Hydroxyl amine (d) Phenyl hydrazine

27. Which of the following statements is not true for acetaldehyde?

- (a) It will undergo an aldol condensation reaction.
(b) It will undergo a Cannizzaro reaction.
(c) It will undergo a haloform reaction
(d) Enolisation is catalysed by acid or base

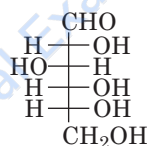
28. Which of the following compounds does not undergo mutarotation?

- (a) Glucose (b) Sucrose
(c) Ribose (d) Fructose

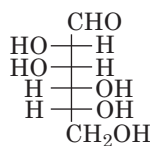
29. If two isomers have been classified correctly as anomers, they may be also called

- (a) conformers (b) enantiomers
(c) tautomers (d) diastereomers

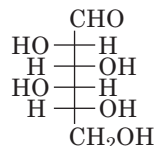
30. Which two of the following aldohexoses give the same osazone derivative?



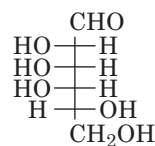
I.



III.



II.



IV.

- (a) I and IV (b) I and III
(c) II and III (d) III and IV

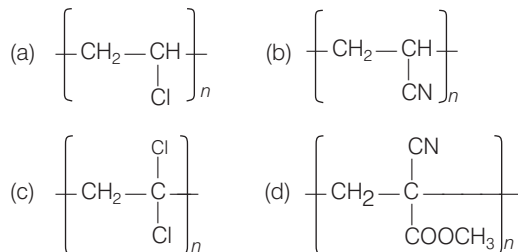
31. Which of the following describes the overall three dimensional folding of a polypeptide?

- (a) Primary structure (b) Secondary structure
(c) Tertiary structure (d) Quaternary structure

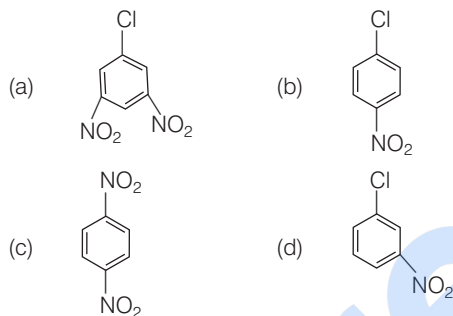
32. What is incorrect regarding natural rubber?

- (a) It is *cis*-polyisoprene
(b) It is amorphous in nature
(c) It has syndiotactic stereochemistry
(d) Molecules of rubber have coiled conformation

33. Which one of the following is the structure of polyacrylonitrile?



34. Which of the aromatic compounds react fastest with methoxide ion?



35. Which reagents would you use to carry out the reaction

Ethyl benzene $\longrightarrow$ 2 and 4-chloro-1-ethyl benzene?

- (a) Cl_2 , light and heat
(b) Cl_2 , FeCl_3
(c) SOCl_2
(d) $\text{C}_2\text{H}_5\text{Cl}$, AlCl_3

36. What represents the best method for producing salicylic acid?

- (a) Benzoic acid, strong base, high temperature
(b) Toluene, strong base, water, high temperature
(c) Phenol, base, carbon dioxide then acid
(d) Bromobenzene, carbonic acid, high temperature

37. Which pair is usually required for a nucleophilic aromatic substitution reaction?

- (a) An $-\text{NO}_2$ substitution and a strong electrophile
(b) A ring bearing a strong activating group and a strong acid
(c) An aryl halide with an $-\text{NO}_2$ and a strong nucleophile
(d) An unsubstituted benzene ring and a strong electrophile

38. What reaction does hydroquinone undergo most readily?

- (a) $\text{S}_{\text{N}}2$ substitution (b) Hydrolysis
(c) Oxidation (d) Reduction

39. In physical adsorption, the adsorbent and adsorbate are held together by the

- (a) ionic forces (b) covalent forces
(c) van der Waals' forces (d) H-bonding

40. Potassium stearate is obtained by the saponification of an oil or fat. It has formula $\text{CH}_3 - (\text{CH}_2)_{16} - \text{COOK}$. The molecule has a lyophobic terminal CH_3 and a lyophilic terminal $-\text{COOK}$. Potassium stearate is an example of

- (a) lyophilic colloid
(b) lyophobic colloid
(c) macromolecular colloid
(d) micelle

41. Suppose that gold is being plated on to another metal in an electrolytic cell. The half-cell reaction producing the Au(s) is $\text{AuCl}_4^- \rightarrow \text{Au(s)} + 4\text{Cl}^- - 3e^-$

If a 0.30 A current runs for 15.00 min, what mass of Au(s) will be plated, assuming all the electrons are used in the reduction of AuCl_4^- ? The Faraday constant is 96485 C/mol and molar mass of Au is 197.

- (a) 0.184 g Au (b) 0.551 g Au
(c) 1.84 g Au (d) 0.613 g Au

42. What is the cell potential (standard emf, E^0) for the reaction below?

$[E^0(\text{Fe}^{2+}(\text{aq})/\text{Fe}) = 0.44\text{V}]$ and

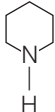
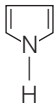
$E^0(\text{O}_2(\text{g})/\text{H}_2\text{O}/\text{OH}^-) = +0.4\text{V}]$

$2\text{Fe(s)} + \text{O}_2(\text{g}) + 2\text{H}_2\text{O(l)} \rightleftharpoons 2\text{Fe}^{2+}(\text{aq}) + 4\text{OH}^-(\text{aq})$

- (a) $E^0_{\text{cell}} = -0.48\text{V}$ (b) $E^0_{\text{cell}} = -0.04\text{V}$
(c) $E^0_{\text{cell}} = +0.84\text{V}$ (d) $E^0_{\text{cell}} = +1.28\text{V}$

43. If in a solvent, n simple molecules of solute combine to form an associated molecule, α is the degree of association, the van't Hoff's factor is equal to

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

44. If the osmotic pressure of a 0.010 M aqueous solution of sucrose at 27°C is 0.25 atm, then the osmotic pressure of a 0.010 M aqueous solution of NaCl at 27°C is
(a) 0.062 atm (b) 0.12 atm
(c) 0.25 atm (d) 0.50 atm
45. A certain radioactive isotope A_ZX (half-life = 10 days) decays to give ${}^{A-4}_{Z-2}X$. If 1.0 g of X is kept in a sealed vessel find the volume of He accumulated at STP in 20 days. Molar mass of ${}^A_ZX = 253$ u
(a) 22.40 mL (b) 33.40 mL
(c) 55.40 mL (d) 66.40 mL
46. Raw milk sours in about 4 h at 27°C, but in about 48 h in a refrigerator at 17°C. What is the activation energy for souring of milk?
(a) 78.3 kJ mol⁻¹
(b) 46.21 kJ mol⁻¹
(c) 23.5 kJ mol⁻¹
(d) 80.8 kJ mol⁻¹
47. If 200 mL of a 0.031 molar solution of H₂SO₄ are added to 84 mL of a 0.150 M KOH solution, what is the pH of the resulting solution?
(a) 12.4 (b) 1.7
(c) 2.2 (d) 10.9
48. (SiH₃)₃N is
(a) planar (b) pyramidal
(c) octahedral (d) tetrahedral
49. Solid N₂O₅ is
(a) ionic (b) covalent
(c) coordinate covalent (d) metallic
50. Which of the following phosphorus is the most reactive?
(a) Red phosphorus
(b) White phosphorus
(c) Scarlet phosphorus
(d) Violet phosphorus
51. The activity of alkaline earth metals as reducing agent
(a) decreases from Be to Ba
(b) increases from Be to Ba
(c) increases from Be to Ca and decreases from Ca to Ba
(d) decreases from Be to Ca and increases from Ca to Ba
52. Baking powder is more commonly used to make cakes or bread "rise". Filler in baking powder is
(a) NaHCO₃ (b) Ca(H₂PO₄)₂
(c) starch (d) NaAl(SO₄)₂
53. Strongest conjugate base is
(a) ClO⁻ (b) ClO₂⁻ (c) ClO₃⁻ (d) ClO₄⁻
54. Out of the following redox reactions
I. $\text{NH}_4\text{NO}_3 \xrightarrow{\Delta} \text{N}_2\text{O} + 2\text{H}_2\text{O}$
II. $\text{NH}_4\text{NO}_2 \xrightarrow{\Delta} \text{N}_2 + 2\text{H}_2\text{O}$
III. $\text{PCl}_5 \xrightarrow{\Delta} \text{PCl}_3 + \text{Cl}_2$
disproportionation is not shown in
(a) I and II (b) II and III
(c) I and III (d) I, II and III
55. The complex $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$ is formed in the ring test for nitrate ion when freshly prepared FeSO₄ solution is added to aqueous solution of NO₃⁻ followed by addition of Conc. H₂SO₄. This complex is formed by charge transfer in which
(a) Fe²⁺ changes to Fe³⁺ and NO⁺ changes to NO
(b) Fe²⁺ changes to Fe³⁺ and NO changes to NO⁺
(c) Fe²⁺ changes to Fe⁺ and NO changes to NO⁺
(d) No charge transfer takes place
56. Which pair is different from the others?
(a) Li — Mg (b) B — Al
(c) Na — K (d) Ca — Mg
57. The dominant factor in determining the IE of the elements on moving down the groups is its
(a) atomic radius (b) effective nuclear charge
(c) Both (a) and (b) (d) None of the above
58. Valence electrons in the element A are 3 and that in element B are 6. Most probable compound formed from A and B is
(a) A₂B (b) AB₂
(c) A₆B₃ (d) A₂B₃
59. Which of the following is the strongest base?
- (a) 
- (b) 
- (c) 
- (d) 

60. Which of the following best define the term hyperconjugation?

- (a) Transfer of H from a σ_{C-H} bond to the π system
 (b) Participation of an H-atom on terminal carbon in the electron sharing

- (c) Delocalisation of electron density from a properly oriented σ -bond into π -system
 (d) Interaction between a properly aligned lone electron pair with the empty π -system

Mathematics

1. If $\alpha = \cos \frac{2\pi}{7} + i \sin \frac{2\pi}{7}$, then the quadratic equation whose roots are $\alpha = a + a^2 + a^4$ and $\beta = a^3 + a^5 + a^6$, is

- (a) $x^2 - x + 2 = 0$ (b) $x^2 + 2x + 2 = 0$
 (c) $x^2 + x + 2 = 0$ (d) $x^2 + x - 2 = 0$

2. If $1, \omega, \omega^2, \dots, \omega^{n-1}$ are n, n^{th} roots of unity, then the value of $(9 - \omega) \cdot (9 - \omega^2) \cdot (9 - \omega^3) \dots (9 - \omega^{n-1})$ will be

- (a) $\frac{9^n + 1}{8}$ (b) $9^n - 1$
 (c) $\frac{9^n - 1}{8}$ (d) $9^n + 1$

3. Middle term in the expansion of $\left(x^2 + \frac{1}{x^2} + 2\right)^n$ is

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

4. The common tangent of the parabolas $y^2 = 4x$ and $x^2 = -8y$ is

- (a) $y = x + 2$ (b) $y = x - 2$
 (c) $y = 2x + 3$ (d) None of these

5. 10 different toys are to be distributed among 10 children. Total number of ways of distributing these toys, so that exactly two children do not get any toy, is

- (a) $\frac{10!}{2! \cdot 3! \cdot 7!}$
 (b) $\frac{10!}{(2!)^4 \times 6!}$
 (c) $(10!)^2 \left[\frac{1}{(2!)^4 \times 6!} + \frac{1}{2! \times 3!} \right]$
 (d) $\frac{10! \times 10!}{(2!)^2 \times 6!} \left[\frac{25}{84} \right]$

6. The variance of first n natural numbers is

- (a) $\frac{n(n+1)}{12}$ (b) $\frac{(n+1)(n+5)}{12}$
 (c) $\frac{(n+1)(n-5)}{12}$ (d) $\frac{n(n-5)}{12}$

7. A circle of radius 2 is touching both the axes and a circle with centre (6, 5). The distance between their centres is

- (a) 8 units (b) 5 units
 (c) 7 units (d) None of these

8. $S = \{1, 2, 3, \dots, 20\}$ is to be partitioned into four sets A, B, C and D of equal size. The number of ways it can be done, is

- (a) $\frac{20!}{4! \times 5!}$ (b) $\frac{20!}{4^5}$
 (c) $\frac{20!}{(5!)^4}$ (d) $\frac{20!}{(4!)^5}$

9. Out of 50 tickets numbered 00, 01, 02, ..., 49, one ticket is drawn randomly, the probability of the ticket having the product of its digits 7, given that the sum of the digits is 8, is

- (a) $\frac{1}{14}$ (b) $\frac{3}{14}$
 (c) $\frac{1}{5}$ (d) None of these

10. If the term free from x in the expansion of $\left(\sqrt{x} - \frac{k}{x^2}\right)^{10}$ is 405, then the value of k is

- (a) ± 1 (b) ± 3
 (c) ± 4 (d) ± 2

11. If $\tan \frac{\alpha}{2}$, and $\tan \frac{\beta}{2}$ are the roots of $8x^2 - 26x + 15 = 0$, then $\cos(\alpha + \beta)$ is equal to

- (a) $\frac{627}{725}$ (b) $-\frac{627}{725}$
 (c) -1 (d) None of these

12. If $a \cos^3 \alpha + 3a \cos \alpha \sin^2 \alpha = m$
and $a \sin^3 \alpha + 3a \cos^2 \alpha \sin \alpha = n$,
then $(m + n)^{2/3} + (m - n)^{2/3}$ is equal to
(a) $2a^3$ (b) $2a^{1/3}$
(c) $2a^{2/3}$ (d) $2a^3$
13. In a triangle, the lengths of two larger sides are 10 cm and 9 cm. If the angles of the triangle are in AP, then the length of the third side is
(a) $\sqrt{5} - \sqrt{6}$ (b) $\sqrt{5} + \sqrt{6}$
(c) $\sqrt{5} \pm \sqrt{6}$ (d) $5 \pm \sqrt{6}$
14. The distance of the point (3, 5) from $2x + 3y - 14 = 0$ measured parallel to $x - 2y = 1$ is
(a) $\frac{7}{\sqrt{5}}$ (b) $\frac{7}{\sqrt{13}}$
(c) $\sqrt{5}$ (d) $\sqrt{13}$
15. If the line $\frac{x}{a} + \frac{y}{b} = 1$ moves such that $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$, then the locus of the foot of the perpendicular from the origin to the line is
(a) straight line (b) circle
(c) parabola (d) ellipse
16. A rhombus is inscribed in the region common to the two circles $x^2 + y^2 - 4x - 12 = 0$ and $x^2 + y^2 + 4x - 12 = 0$ with two of its vertices on the line joining the centres of the circles. The area of rhombus is
(a) $8\sqrt{3}$ (b) $4\sqrt{2}$
(c) $16\sqrt{3}$ (d) $16\sqrt{2}$
17. If the line $y - \sqrt{3}x + 3 = 0$ cuts the parabola $y^2 = x + 2$ at A and B, then $PA \cdot PB$ is equal to where $P = (\sqrt{3}, 0)$.
(a) $\frac{4(2 - \sqrt{3})}{3}$ (b) $\frac{4(\sqrt{3} + 2)}{3}$
(c) $\frac{4\sqrt{3}}{3}$ (d) $\frac{2(\sqrt{3} + 2)}{3}$
18. AB is a chord of the parabola $y^2 = 4ax$ with vertex A, BC is drawn perpendicular to AB meeting the axis at C. The projection of BC on the axis of the parabola is
(a) a (b) 2a
(c) 4a (d) 8a
19. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{4} + \frac{4y^2}{7} = 1$ and having its centre at $(\frac{1}{2}, 2)$ is
(a) $\sqrt{5}$ (b) 3
(c) $\sqrt{12}$ (d) $\frac{7}{2}$
20. The area of the quadrilateral formed by the tangents at the end point of latusrectum to the ellipse $\frac{x^2}{9} + \frac{y^2}{5} = 1$ is
(a) $\frac{27}{4}$ (b) 9 (c) $\frac{27}{2}$ (d) 27
21. If the chords of the hyperbola $x^2 - y^2 = a^2$ touch the parabola $y^2 = 4ax$. Then, the locus of the middle points of these chords is
(a) $y^2 = (x - a)x^3$ (b) $y^2(x - a) = x^3$
(c) $x^2(x - a) = x^3$ (d) None of these
22. $\lim_{x \rightarrow 0} \frac{e^{\sin x} - 1}{x}$ is equal to
(a) 0 (b) e
(c) 1 (d) Does not exist
23. If p and q are two statements, then $(p \wedge q) \vee (q \Leftrightarrow p)$ is
(a) tautology
(b) contradiction
(c) neither tautology nor contradiction
(d) either tautology or contradiction
24. The value of the determinant $\begin{vmatrix} (a^x + a^{-x})^2 & (a^x - a^{-x})^2 & 1 \\ (b^x + b^{-x})^2 & (b^x - b^{-x})^2 & 1 \\ (c^x + c^{-x})^2 & (c^x - c^{-x})^2 & 1 \end{vmatrix}$ is
(a) 0 (b) 2abc
(c) $a^2b^2c^2$ (d) None of these
25. If $\Delta_r = \begin{vmatrix} 1 & n & n \\ 2r & n^2 + n + 1 & n^2 + n \\ 2r - 1 & n^2 & n^2 + n + 1 \end{vmatrix}$ and $\sum_{r=1}^n \Delta_r = 56$, then n is equal to
(a) 4 (b) 6 (c) 7 (d) 8

26. If a, b, c are cube roots of unity, then

$$\begin{vmatrix} e^a & e^{2a} & e^{3a} - 1 \\ e^b & e^{2b} & e^{3b} - 1 \\ e^c & e^{2c} & e^{3c} - 1 \end{vmatrix} \text{ is equal to}$$

- (a) 0 (b) e (c) e^2 (d) e^3

27. If $f \circ g = |\sin x|$ and $g \circ f = \sin^2 \sqrt{x}$, then $f(x)$ and $g(x)$ are

- (a) $f(x) = \sqrt{\sin x}$, $g(x) = x^2$
 (b) $f(x) = |x|$, $g(x) = \sin x$
 (c) $f(x) = \sqrt{x}$, $g(x) = \sin^2 x$
 (d) $f(x) = \sin \sqrt{x}$, $g(x) = x^2$

28. Let $f: R \rightarrow R$ be defined by $f(x) = \frac{x}{\sqrt{1+x^2}}$, then

$$(f \circ f \circ f)(x) \text{ is}$$

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

29. If $f(x) = \frac{a^x + a^{-x}}{2}$ and $f(x+y) + f(x-y) = k f(x) f(y)$, then k is equal to

- (a) 2 (b) 4
 (c) -2 (d) None of these

30. If $\tan^{-1}\left(\frac{a}{x}\right) + \tan^{-1}\left(\frac{b}{x}\right) = \frac{\pi}{2}$, then x is equal to

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

31. $\cos^{-1}\{\cos 2 \cot^{-1}(\sqrt{2}-1)\}$ is equal to

- (a) $\sqrt{2}-1$ (b) $\frac{\pi}{4}$ (c) $\frac{3\pi}{4}$ (d) 0

32. $\sum_{m=1}^n \tan^{-1}\left(\frac{2m}{m^4+m^2+2}\right)$ is equal to

- (a) $\tan^{-1}\left(\frac{n^2+n}{n^2+n+2}\right)$ (b) $\tan^{-1}\left(\frac{n^2-n}{n^2-n+2}\right)$
 (c) $\tan^{-1}\left(\frac{n^2+n+2}{n^2+n}\right)$ (d) None of these

33. $\lim_{x \rightarrow \frac{\pi}{2}} \frac{\left(1 - \tan \frac{x}{2}\right)(1 - \sin x)}{\left(1 + \tan \frac{x}{2}\right)(\pi - 2x)^3}$ is equal to

- (a) $\frac{1}{8}$ (b) 0 (c) $\frac{1}{32}$ (d) ∞

34. $f(x) = \begin{cases} \frac{\sin^3(\sqrt{3}) \cdot \log(1+3x)}{(\tan^{-1} \sqrt{x})^2 (e^{5\sqrt{x}} - 1)x}, & x \neq 0 \\ a, & x = 0 \end{cases}$ is

continuous in $[0, 1]$, if 'a' equals to

- (a) 0 (b) $\frac{3}{5}$
 (c) 2 (d) $\frac{5}{3}$

35. If $y = |\sin x|^{|\sin x|}$, then the value of $\frac{dy}{dx}$ at $x = \frac{-\pi}{6}$ is

- (a) $2 \frac{\pi}{6} [6 \log 2 - \sqrt{3}\pi]$
 (b) $2 \frac{\pi}{6} [6 \log 2 + \sqrt{3}\pi]$
 (c) $2 \frac{\pi}{6} [6 \log 2 + \sqrt{3}\pi]$
 (d) None of the above

36. The function x^x is increasing, when

- (a) $x > \frac{1}{e}$ (b) $x < \frac{1}{e}$
 (c) $x < 0$ (d) for all x

37. The length of the longest interval, in which $f(x) = 3 \sin x - 4 \sin^3 x$ is increasing, is

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

38. The triangle formed by the tangent to the curve $f(x) = x^2 + bx - b$ at the point (1, 1) and the coordinate axes lies in the first quadrant. If its area is 2, then the value of b is

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

39. The equation of the tangent to the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at (a, b) is

- (a) $\frac{x}{a} + \frac{y}{b} = 2$ (b) $\frac{x}{a} + \frac{y}{b} = \frac{1}{2}$
 (c) $\frac{x}{b} - \frac{y}{a} = 2$ (d) $ax + by = 2$

40. The minimum radius vector of the curve $\frac{a^2}{x^2} + \frac{b^2}{y^2} = 1$ is of length

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

41. The largest term in the sequence $a_n = \frac{n^2}{n^3 + 200}$

is given by

- (a) $\frac{529}{49}$ (b) $\frac{8}{89}$
(c) $\frac{49}{543}$ (d) None of these

42. $f(x) = \begin{cases} x^3 + x^2 + 3x + \sin x \cdot \left(3 + \sin \frac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$

The number of points, where $f(x)$ attains its minimum value, is

- (a) 1 (b) 2
(c) 3 (d) infinitely many

43. $\int \frac{x^2 - 1}{(x^4 + 3x^2 + 1) \tan^{-1}\left(x + \frac{1}{x}\right)} dx$ is equal to

- (a) $\tan^{-1}\left(x + \frac{1}{x}\right) + C$
(b) $\cot^{-1}\left(x + \frac{1}{x}\right) + C$
(c) $\log\left(x + \frac{1}{x}\right) + C$
(d) $\log\left[\tan^{-1}\left(x + \frac{1}{x}\right)\right] + C$

44. $\int \frac{\cos x}{\sin^2 x \cdot (\sin x + \cos x)} dx$ is equal to

- (a) $\log\left|\frac{1 + \tan x}{\tan x}\right| - \cot x + C$
(b) $\log\left|\frac{\tan x}{1 + \tan x}\right| + C$
(c) $\log\left|\frac{\tan x}{1 + \tan x}\right| - \tan x + C$
(d) $\log\left|\frac{\tan x}{1 + \tan x}\right| + \cot x + C$

45. $\int \frac{dx}{\sin x - \cos x + \sqrt{2}}$ is equal to

- (a) $-\frac{1}{\sqrt{2}} \tan\left(\frac{x}{2} + \frac{\pi}{8}\right) + C$
(b) $\frac{1}{\sqrt{2}} \tan\left(\frac{x}{2} + \frac{\pi}{8}\right) + C$
(c) $\frac{1}{\sqrt{2}} \cot\left(\frac{x}{2} + \frac{\pi}{8}\right) + C$
(d) $-\frac{1}{\sqrt{2}} \cot\left(\frac{x}{2} + \frac{\pi}{8}\right) + C$

46. $\int_0^{\frac{3\pi}{2}} \sin\left[\frac{2x}{\pi}\right] \cdot dx$, where $[\cdot]$ denotes the greatest integer function, is equal to

- (a) $\frac{\pi}{2}(\sin 1 + \cos 1)$ (b) $\frac{\pi}{2}(\sin 1 + \sin 2)$
(c) $\frac{\pi}{2}(\sin 1 - \cos 1)$ (d) $\frac{\pi}{2}(\sin \pi + \sin 2)$

47. The value of $\int_{1/n}^{(an-1)/n} \frac{\sqrt{x}}{\sqrt{a-x} + \sqrt{x}} dx$ is equal to

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

48. The area bounded by $y = x|\sin x|$ and X-axis between $x = 0$ and $x = 2\pi$ is

- (a) 2π sq units (b) 3π sq units
(c) π sq units (d) 4π sq units

49. The area enclosed by the curves $|y + x| \leq 1$, $|y - x| \leq 1$ and $2x^2 + 2y^2 = 1$ is

- (a) $\left(2 + \frac{\pi}{2}\right)$ sq units (b) $\left(2 - \frac{\pi}{2}\right)$ sq units
(c) $\left(3 + \frac{\pi}{2}\right)$ sq units (d) $\left(3 - \frac{\pi}{4}\right)$ sq units

50. The real value of m for which the substitution $y = u^m$ will transform the differential equation $2x^4 \cdot y \frac{dy}{dx} + y^4 = 4x^6$ into a homogeneous equation, is

- (a) $m = 0$ (b) $m = 1$ (c) $m = \frac{3}{2}$ (d) $m = \frac{2}{3}$

51. The equation of the curve for which the square of the ordinate is twice the rectangle contained by the abscissa and the intercept of the normal on the X-axis and passing through $(2, 1)$, is

- (a) $x^2 + y^2 - x = 0$
(b) $4x^2 + 2y^2 - 9y = 0$
(c) $2x^2 + 4y^2 - 9x = 0$
(d) $4x^2 + 2y^2 - 9x = 0$

52. If $|a| = 1$, $|b| = 4$, $a \cdot b = 2$ and $c = 2a \times b - 3b$, then the angle between b and c is

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

53. If a, b, c are p^{th} and q^{th} and r^{th} terms of a GP, then the vectors $\log a \hat{i} + \log b \hat{j} + \log c \hat{k}$ and $(q-r)\hat{i} + (r-p)\hat{j} + (p-q)\hat{k}$ are
 (a) equal (b) parallel
 (c) perpendicular (d) None of these
54. The line joining the points $(1, 1, 2)$ and $(3, -2, 1)$ meets the plane $3x + 2y + z = 6$ at the point
 (a) $(1, 1, 2)$ (b) $(3, -2, 1)$
 (c) $(2, -3, 1)$ (d) $(3, 2, 1)$
55. The distance of the point $(1, -5, 9)$, from the plane $\mathbf{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 5$ measured along the line $\mathbf{r} = \hat{i} + \hat{j} + \hat{k}$ is
 (a) $3\sqrt{5}$ (b) $10\sqrt{3}$ (c) $5\sqrt{3}$ (d) $3\sqrt{10}$
56. The image of the point with position vector $\hat{i} + 3\hat{k}$ in the plane $\mathbf{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 1$ is
 (a) $\hat{i} + 2\hat{j} + \hat{k}$ (b) $\hat{i} - 2\hat{j} + \hat{k}$
 (c) $-\hat{i} - 2\hat{j} + \hat{k}$ (d) $\hat{i} + 2\hat{j} - \hat{k}$
57. In a trial, the probability of success is twice the probability of failure. In six trial, the probability of atleast four successes will be
 (a) $\frac{496}{729}$ (b) $\frac{400}{729}$ (c) $\frac{500}{729}$ (d) $\frac{600}{729}$
58. If the integers m and n are chosen at random between 1 and 100, then the probability that a number of the form $7^m + 7^n$ is divisible by 5, equals
 (a) $\frac{1}{4}$ (b) $\frac{1}{7}$ (c) $\frac{1}{8}$ (d) $\frac{1}{49}$
59. If $\sin^{-1} a + \sin^{-1} b + \sin^{-1} c = \pi$, then the value of $a \cdot \sqrt{1-a^2} + b \cdot \sqrt{1-b^2} + c \cdot \sqrt{1-c^2}$ will be
 (a) $2abc$ (b) abc (c) $\frac{1}{2}abc$ (d) $\frac{1}{3}abc$
60. The value of λ and μ for which the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$ and $x + 2y + \lambda z = \mu$ have no solution, are
 (a) $\lambda = 3, \mu \neq 10$ (b) $\lambda \neq 3, \mu = 10$
 (c) $\lambda \neq 3, \mu \neq 10$ (d) None of these
61. The range of $f(x) = \sec\left(\frac{\pi}{4} \cos^2 x\right)$, $-\infty < x < \infty$ is
 (a) $[1, \sqrt{2}]$ (b) $[1, \infty]$
 (c) $[-\sqrt{2}, -1] \cup [1, \sqrt{2}]$ (d) $[-\infty, -1] \cup [1, \infty]$
62. The value of the $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x + c^x}{3} \right)^{2/x}$, $(a, b, c > 0)$ is
 (a) $(abc)^3$ (b) abc
 (c) $(abc)^{1/3}$ (d) None of these
63. The function $f(x) = [x] \cos\left[\frac{2x-1}{2}\right]\pi$, where $[\cdot]$ denotes the greatest integer function, is discontinuous at
 (a) all x
 (b) no x
 (c) all integral points
 (d) x which is not an integer
64. The function $f(x) = (x^2 - 1)|x^2 - 3x + 2| + \cos|x|$ is non-differentiable at
 (a) -1 (b) 0
 (c) 1 (d) 2
65. If $f(x+y) = f(x) \cdot f(y)$ for all x and y and $f(15) = 2$, $f'(0) = 3$, then $f'(5)$ will be
 (a) 2 (b) 4
 (c) 6 (d) 8
66. If $x \sin(a+y) + \sin a \cos(a+y) = 0$, then $\frac{dy}{dx}$ is equal to
 (a) $\frac{\sin^2(a+y)}{\sin a}$ (b) $\frac{\cos^2(a+y)}{\cos a}$
 (c) $\frac{\sin^2(a+y)}{\cos a}$ (d) $\frac{\cos^2(a+y)}{\sin a}$
67. The approximate value of $f(5.001)$, where $f(x) = x^3 - 7x^2 + 15$, is
 (a) -34.995 (b) -33.995
 (c) -33.335 (d) -35.993
68. What are the values of c for which Rolle's theorem for the function $f(x) = x^3 - 3x^2 + 2x$ in the interval $[0, 2]$ is verified?
 (a) $c = \pm 1$ (b) $c = 1 \pm \frac{1}{\sqrt{3}}$
 (c) $c = \pm 2$ (d) None of these
69. The equation of the plane through the intersection of the planes $3x - y + 2z - 4 = 0$ and $x + y + z - 2 = 0$ and the point $(2, 2, 1)$ is
 (a) $7x + 5y + 4z + 8 = 0$ (b) $7x + 5y + 4z - 8 = 0$
 (c) $7x - 5y + 4z - 8 = 0$ (d) None of these

70. $\lim_{x \rightarrow 0} (1^{\csc^2 x} + 2^{\csc^2 x} + \dots + n^{\csc^2 x})^{\sin^2 x}$ is equal to

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

71. $\int_0^{\pi/2} \frac{\sin x - \cos x}{1 + \sin x \cdot \cos x} dx$ is equal to

- (a) 0 (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{2}$ (d) π

72. The area of the region bounded by $1 - y^2 = |x|$ and $|x| + |y| = 1$ is

- (a) $1/3$ sq unit
(b) $2/3$ sq unit
(c) $4/3$ sq units
(d) 1 sq unit

73. The equations of the lines passing through the point $(1, 0)$ and at a distance $\frac{\sqrt{3}}{2}$ from the origin are

- (a) $\sqrt{3}x + y - \sqrt{3} = 0, \sqrt{3}x - y - \sqrt{3} = 0$
(b) $\sqrt{3}x + y + \sqrt{3} = 0, \sqrt{3}x - y + \sqrt{3} = 0$
(c) $x + \sqrt{3}y - \sqrt{3} = 0, x - \sqrt{3}y - \sqrt{3} = 0$
(d) None of the above

74. The equation of circle which passes through the origin and cuts off intercepts 5 and 6 from the positive parts of the axes respectively, is $\left(x - \frac{5}{2}\right)^2 + (y - 3)^2 = \lambda$, where λ is

- (a) $\frac{61}{4}$ (b) $\frac{6}{4}$
(c) $\frac{1}{4}$ (d) 0

75. A perpendicular is drawn from the point $P(2, 4, -1)$ to the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$. The equation of the perpendicular from P to the given line is

- (a) $\frac{x-2}{6} = \frac{y-4}{3} = \frac{z+1}{2}$ (b) $\frac{x+2}{6} = \frac{y-4}{3} = \frac{z+1}{2}$
(c) $\frac{x+2}{-6} = \frac{y-4}{3} = \frac{z+1}{2}$ (d) $\frac{x+2}{6} = \frac{y+4}{3} = \frac{z+1}{2}$

76. If $\cos^2 A + \cos^2 C = \sin^2 B$, then $\triangle ABC$ is

- (a) equilateral
(b) right angled
(c) isosceles
(d) None of the above

77. If $\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & z+x+2y \end{vmatrix}$

$= k(x+y+z)^3$, then the value of k is

- (a) 1 (b) 2
(c) 4 (d) 8

78. The minimum value of $\frac{x}{\log x}$ is

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

79. One mapping (function) is selected at random from all the mappings of the set $A = \{1, 2, 3, \dots, n\}$ into itself. The probability that the mapping selected is one-one, is

- (a) $\frac{n!}{n^{n-1}}$
(b) $\frac{n!}{n^n}$
(c) $\frac{n!}{2n^n}$
(d) None of the above

80. In how many ways, can a student choose a program of 5 courses, if 9 courses are available and 2 specific courses are compulsory for every student?

- (a) 34 (b) 36 (c) 35 (d) 37

English

Directions (Q.Nos. 1-5) *Out of the four alternatives, choose the one which best expresses the meaning of the given word.*

1. Remorse

- | | |
|----------------|------------------|
| (a) Warmth | (b) Delight |
| (c) Repentance | (d) Satisfaction |

2. Stigma

- | | |
|-----------|-------------|
| (a) Gedit | (b) Pride |
| (c) Shame | (d) Clarity |

3. Blemish

- | | |
|-------------------|-----------|
| (a) Adornment | (b) Blank |
| (c) Embellishment | (d) Flaw |

4. Deteriorate

- | | | | |
|-----------|-------------|-----------|-------------|
| (a) Boost | (b) Improve | (c) Build | (d) Descend |
|-----------|-------------|-----------|-------------|

5. Knave

- | | |
|-----------|-------------|
| (a) Fraud | (b) Angel |
| (c) Ugly | (d) Perfect |

Directions (Q.Nos. 6-10) *Choose the word opposite in meaning to the given word and mark it in the answer sheet.*

6. Enormous

- | | |
|----------|-------------|
| (a) Soft | (b) Average |
| (c) Tiny | (d) Weak |

7. Commissioned

- | | |
|--------------|----------------|
| (a) Started | (b) Closed |
| (c) Finished | (d) Terminated |

8. Artificial

- | | |
|--------------|-------------|
| (a) Red | (b) Natural |
| (c) Truthful | (d) Solid |

9. Exodus

- | | |
|------------|-----------------|
| (a) Influx | (b) Home-coming |
| (c) Return | (d) Restoration |

10. Mortal

- | | |
|---------------|--------------|
| (a) Divine | (b) Immortal |
| (c) Spiritual | (d) Eternal |

Directions (Q.Nos. 11-15) *Four alternatives are given in each group, one word is correctly spelt. Find the correctly spelt word.*

- 11.** (a) Advertise (b) Surrender
(c) Admiror (d) Pitiable

- 12.** (a) Humilliation (b) Veterinary
(c) Appology (d) Resturant

- 13.** (a) Accute (b) Forstry
(c) Personel (d) Omnious

- 14.** (a) Diference (b) Homogenous
(c) Greatful (d) Possession

- 15.** (a) Committee (b) Commentery
(c) Involuntry (d) Anxiety

Directions (Q.Nos. 16-20) *Out of the four alternatives, choose the one which can be substituted for the given words/sentences.*

16. To examine ones to own thoughts and feelings

- | | |
|-------------------|--------------------|
| (a) Introspection | (b) Retrospection |
| (c) Euthanasia | (d) Circumspection |

17. The custom of having more than one husband at a time

- | | |
|----------------|---------------|
| (a) Polygamy | (b) Polyandry |
| (c) Debauchery | (d) Bigamy |

18. Murder of a brother

- | | |
|---------------|----------------|
| (a) Patricide | (b) Regicide |
| (c) Homicide | (d) Fratricide |

19. Study of mankind

- | | |
|---------------|------------------|
| (a) Pathology | (b) Physiology |
| (c) Philology | (d) Anthropology |

20. Through which life cannot pass

- | | |
|-------------|------------|
| (a) Dull | (b) Dark |
| (c) Obscure | (d) Opaque |

Directions (Q.Nos. 21-30) *Some of the words have been left out. First read the passage over and try to understand what it is about. Then, fill in the blanks with the help of the alternatives given.*

Something has happened in the last twenty years that surely must **(21)** anything that has happened before. Some historians are already saying that thrust **(22)** space represents a vital turning point in history. Moon flights are considered **(23)** less than steps in human evolution **(24)** to the time when life on earth emerged from the sea and established itself on land. Of course, not everyone **(25)** enraptured by space. Critics have often said that space flight has been an **(26)** use of resources that should have **(27)** to feeding, clothing and housing people. There is, however, no proof that if

we had (28) been working on space, we would have done anything of great human value. In fact, research and exploration have a (29) spin-offs, quite apart from the fact that they demonstrate that (30) is alive and insatiably curious.

- | | |
|--------------------|------------------|
| 21. (a) terminate | (b) transcend |
| (c) precede | (d) recede |
| 22. (a) on | (b) upon |
| (c) in | (d) into |
| 23. (a) nothing | (b) certainly |
| (c) sufficiently | (d) probably |
| 24. (a) exceeding | (b) contrasting |
| (c) comparable | (d) matching |
| 25. (a) was | (b) has been |
| (c) had been | (d) being |
| 26. (a) economical | (b) extravagant |
| (c) appropriate | (d) benevolent |
| 27. (a) devoted | (b) allotted |
| (c) reserved | (d) gone |
| 28. (a) not | (b) occasionally |
| (c) seldom | (d) possibly |
| 29. (a) renowned | (b) renounced |
| (c) remarkable | (d) relevant |
| 30. (a) one | (b) man |
| (c) human | (d) individual |

Directions (Q.Nos. 31-35) *Some of the sentences have errors and some are correct. Find out which part of a sentence has a error and corresponding to the appropriate letter (a), (b) and (c) If the sentence free from error, then mark (d).*

31. You will not(a)/get well until(b)/you take medicine regularly.(c)/No error(d)
32. You must either(a)/ inform the police else be(b)/ prepared to suffer any loss.(c)/ No error(d)
33. Both the rich along with the poor(a)/ are responsible for a great many vices(b)/with which our society as well as country is in flicted.(c)/ No error(d)
34. Have you ever(a)/ met such a boy(b)/ who has not travelled by train?(c)/ No error(d)
35. The robber had hardly(a)/ put the ornaments in his bag(b)/ than the house wife woke up.(c)/ No error(d)
- Directions** (Q.Nos. 36-40) *Sentences are given with blanks to be filled with an appropriate word. Four alternatives are suggested for each question. Choose the correct alternative.*
36. I wish my bus so late, then I could have reached home before breakfast
 (a) had not arrived (b) does not arrive
 (c) has not arrived (d) arrived
37. you examine it carefully you will notice some flaws.
 (a) Despots (b) If
 (c) Unless (d) Until
38. The contractor did not keep his promise that the work be finished before the end of the week.
 (a) shall (b) could (c) would (d) may
39. If you come across my umbrella anywhere bring it to me,?
 (a) is not it (b) do not you
 (c) will you (d) let you
40. Miss Pillai teaches very well?
 (a) did not she
 (b) does not she
 (c) was not it
 (d) would not she