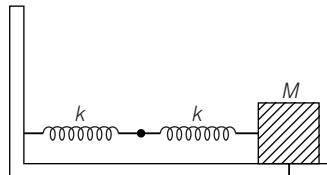


MET 2016 Memory Based Question Paper PDF

Physics

- Two particles of charges $+e$ and $+2e$ are at 16 cm away from each other. Where should another charge q be placed between them, so that the system remains in equilibrium?
(a) 24 cm from $+e$ (b) 12.23 cm from $+e$
(c) 80 cm from $+e$ (d) 6.63 cm from $+e$
- How does the energy difference between the consecutive energy level vary as the quantum number n increases?
(a) Increases
(b) Decreases
(c) Remains unchanged
(d) First increases and then decreases
- The ionisation potential of hydrogen atom is 13.6 eV. How much energy need to be supplied to ionise the hydrogen atom in the first excited state?
(a) 13.6 eV (b) 27.2 eV (c) 3.4 eV (d) 6.8 eV
- If 10% of the main current is to be passed through the moving coil galvanometer of resistance $99\ \Omega$, then the required shunt resistance will be
(a) $9.9\ \Omega$ (b) $10\ \Omega$
(c) $11\ \Omega$ (d) $9\ \Omega$
- A mixture of two gases is contained in a vessel. The gas 1 is monoatomic and gas 2 is diatomic and the ratio of their molecular masses $M_1/M_2 = 1/4$. What is the ratio of root mean square speeds of the molecules of two gases?
(a) 2 (b) 4
(c) 8 (d) 16
- A current carrying coil is bent sharply so as to convert it into a double loop both carrying current in the same direction. If B be the initial magnetic field at the centre, then what will be the final concentric magnetic field?
(a) $2B$ (b) $4B$
(c) $8B$ (d) Zero
- White light reflected at normal incidence from a soap film has minima at $6500\ \text{\AA}$ and maxima at $7500\ \text{\AA}$ in the visible region with not minimum in between. If μ is $\frac{5}{3}$ for the, then film, the thickness of film is
(a) $7.40 \times 10^{-7}\ \text{cm}$ (b) $9.75 \times 10^{-5}\ \text{mm}$
(c) $9.70 \times 10^{-7}\ \text{cm}$ (d) $9.75 \times 10^{-4}\ \text{mm}$
- A long wire carries a steady current. It is bent into a circle of one turn and the magnetic field at the centre of the coil is B . It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be
(a) nB (b) n^2B (c) $2nB$ (d) $2n^2B$
- Two springs are connected to a block of mass M placed on a frictionless surface as shown below. If both the springs have a spring constant k , then the frequency of oscillation of the block is



- (a) $\frac{1}{2\pi} \sqrt{\frac{k}{M}}$ (b) $\frac{1}{2\pi} \sqrt{\frac{k}{2M}}$
(c) $\frac{1}{2\pi} \sqrt{\frac{2k}{M}}$ (d) $\frac{1}{2\pi} \sqrt{\frac{M}{k}}$

10. Four identical balls, A, B, C and D are placed on a smooth horizontal plane such that B, C and D are in one line and are in contact and A is kept along the same line but a distance away. Now, A is set in motion with speed v along the line and it strikes the ball B . After this collision, which is elastic.

- (a) Balls A, B, C will be at rest and D will move with speed v
(b) A will be at rest, where B, C and D will move together with speed $v/3$
(c) A will rebound with speed $v/2$ while B, C and D will move together with speed $v/2$
(d) A, B, C and D will move together with speed $v/4$

11. Two coils X and Y are placed in a circuit such that a current changes by 3 A in coil X and magnetic flux changes of 1.2 Wb occurs in Y . The value of mutual inductance of the coils is

- (a) 0.2 H (b) 0.4 H
(c) 0.6 H (d) 3.6 H

12. A projectile has the maximum range 500 m. If the projectile is thrown up an inclined plane of 30° with the same (magnitude) velocity, the distance covered by it along the inclined plane will be

- (a) 250 m (b) 500 m
(c) 400 m (d) 1000 m

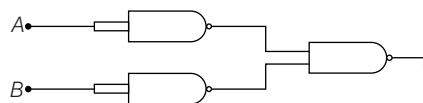
13. Nuclear reactor in which U-235 is used as fuel. Uses 2 kg of U-235 in 30 days. Then, power output of the reactor will be (given energy released per fission = 185 MeV)

- (a) 43.5 MW (b) 58.5 MW
(c) 69.6 MW (d) 73.1 MW

14. Two capacitors of capacitances $3\mu\text{F}$ and $6\mu\text{F}$ are charged to a potential of 12 V each. They are now connected to each other, with the positive plate of each joined to the negative plate of the other. The potential difference across each will be

- (a) 4 V (b) 12 V
(c) zero (d) 3 V

15. The combination of gates shown in the figure below produces



- (a) NOR gate (b) OR gate
(c) AND gate (d) XOR gate

16. A thin dielectric rod of length l lies along X -axis. One end of the rod is placed at the origin and the other end of the rod is placed at $(l, 0)$. A total charge Q is distributed uniformly along the length of the rod. What is the potential at a point $(x, 0)$ when $x > l$?

- (a) $\frac{Q}{4\pi\epsilon_0} \cdot \log_e \left(\frac{x}{x-1} \right)$ (b) $\frac{Q}{4\pi\epsilon_0 l} \cdot \log_e \left(\frac{x}{l} \right)$
(c) $\frac{Q}{4\pi\epsilon_0 l} \cdot \log_e \left(\frac{x-1}{x} \right)$ (d) $\frac{Q}{4\pi\epsilon_0 l}$

17. A ray of light is travelling through a medium of refractive index $\frac{1}{\sqrt{2}}$ with respect to air.

When it is incident on the surface making an angle 45° with the surface, which of the following will take place?

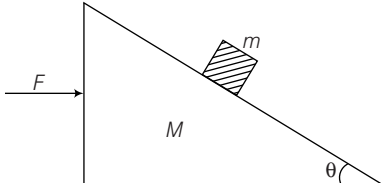
- (a) Angle of refraction will be 45°
(b) Angle of refraction will be 90°
(c) The ray will be internally reflected
(d) None of the above

18. If a wave travelling in positive x -direction with $A = 0.2$ m/s, velocity = 360 m/s and $\lambda = 60$ m, then correct expression for the wave is

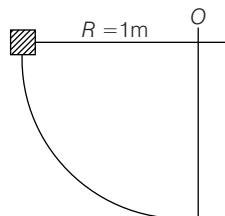
- (a) $y = 0.2 \sin \left[2\pi \left(6t + \frac{x}{60} \right) \right]$
(b) $y = 0.2 \sin \left[\pi \left(6t + \frac{x}{60} \right) \right]$
(c) $y = 0.2 \sin \left[2\pi \left(6t - \frac{x}{60} \right) \right]$
(d) $y = 0.2 \sin \left[\pi \left(6t - \frac{x}{60} \right) \right]$

19. In a potentiometer experiment for measuring the emf of a cell, the null point is at 240 cm when we have a 500Ω resistor in series with the cell and galvanometer. If the series resistance reduced to half, then the null point will be at

- (a) 480 cm (b) 240 cm (c) 120 cm (d) 60 cm

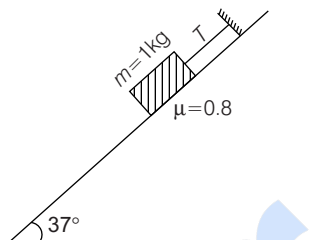
20. Two coils each of self-inductance L are connected in parallel. If they are separated by a large distance, then what will be the self-inductance of combination?
 (a) $\frac{L}{4}$ (b) $\frac{L}{2}$ (c) L (d) $2L$
21. Two bar magnets having same geometry with magnetic moments m and $2m$, are firstly placed in such a way that their similar poles one are on same side. Then, its time period of oscillation is T_1 . Now, the polarity of the one of the magnet is reversed. Then, time period of oscillation is T_2 , then
 (a) $T_1 < T_2$ (b) $T_1 = T_2$ (c) $T_1 > T_2$ (d) $T_2 = \infty$
22. A solenoid of 2.5 m length and 2.0 cm diameter possesses 10 turns per cm. A current of 0.5 A is flowing through it. The magnetic induction at axis inside the solenoid is
 (a) $2\pi \times 10^{-4}$ T (b) $2\pi \times 10^{-5}$ T
 (c) $2\pi \times 10^{-6}$ T (d) $2\pi \times 10^{-7}$ T
23. In an L - C - R circuit which one of the following statements is correct?
 (a) L and R oppose each other
 (b) R value increase with frequency
 (c) The inductive reactance increases with frequency
 (d) The capacitive reactance increases with frequency
24. What will be the kinetic energy of an electron having de-Broglie wavelength $2\text{\AA}$?
 (a) 37.5 eV (b) 75 eV
 (c) 150 eV (d) 300 eV
25. In an L - C - R series circuit, the values of R , X_L and X_C are $120\ \Omega$, $180\ \Omega$ and $130\ \Omega$, what is the impedance of the circuit?
 (a) $120\ \Omega$ (b) $130\ \Omega$ (c) $180\ \Omega$ (d) $330\ \Omega$
26. Particle which can be added to the nucleus of an atom without changing its chemical properties are
 (a) neutrons (b) electrons
 (c) protons (d) α -particle
27. Two sources give interference pattern which is observed on a screen, placed at a distance D from the sources. The fringe width is given as $2W$. If the distance of sources from the screen is doubled, then the fringe width will
 (a) become $W/2$ (b) remains the same
 (c) become W (d) become $4W$
28. A particle moves along X -axis from $x = 0$ to $x = 5$ cm under the influence of force given by $F = (7 - 2x + 3x^2)$ N. The work done in the process is
 (a) 70 J (b) 270 J (c) 35 J (d) 135 J
29. A sphere of mass m moving with a constant velocity u hits another stationary sphere of the same mass. If e is the coefficient of restitution, then the ratio of velocities of the two spheres after collision $\left(\frac{v_1}{v_2}\right)$ will be
 (a) $\frac{1-e}{1+e}$ (b) $\frac{1+e}{1-e}$
 (c) $\frac{e+1}{1-e}$ (d) $\frac{e-1}{e+1}$
30. The molar specific heat of oxygen at constant pressure $C_p = 7.03$ cal/mol $^\circ\text{C}$ and $R = 8.31$ J/mol $^\circ\text{C}$. The amount of heat taken by 5 moles of oxygen when heated at constant volume from 10°C to 20°C will be approximately.
 (a) 25 cal (b) 50 cal
 (c) 253 cal (d) 500 cal
31. The half-life of ^{215}At is $100\ \mu\text{s}$. The time taken for the radioactivity of a sample of this nucleus to decay to $\frac{1}{16}$ th of its initial value is
 (a) $6.3\ \mu\text{s}$ (b) $40\ \mu\text{s}$
 (c) $300\ \mu\text{s}$ (d) $400\ \mu\text{s}$
32. A mass m is placed on a wedge (triangular block) of mass M . The wedge moves on a smooth horizontal surface what should be the force F applied on the wedge to the right, so that m remains stationary with respect to wedge. (Ignore any friction)
- 
- (a) $g \tan\theta$ (b) $mg \cos\theta$
 (c) $(M + m) g \tan\theta$ (d) $(M + m)g \csc\theta$

33. A block of mass 1 kg slides down a curved track that is one quadrant of a circle of radius 1 m. Speed of the block at the bottom is 2 m/s. Work done by the frictional force on the block when it reaches at the bottom is



- (a) 8 J (b) -8 J (c) 4 J (d) 0 J

34. In the arrangement, the minimum value of tension in the string to prevent it from sliding down is

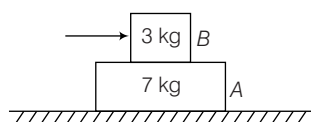


- (a) 6 N (b) 8 N (c) 10.8 N (d) zero

35. In a planetary motion, the areal velocity of position vector of a planet depends on angular velocity (ω) and distance (r) of the planet from the sun. The correct relation for areal velocity ($\frac{dA}{dt}$) is

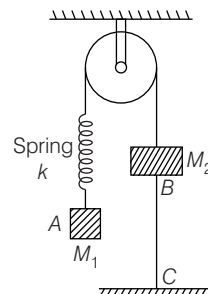
- (a) $\frac{dA}{dt} \propto \omega r$ (b) $\frac{dA}{dt} \propto \omega^2 r$
(c) $\frac{dA}{dt} \propto \omega r^2$ (d) $\frac{dA}{dt} \propto \sqrt{\omega r}$

36. Two blocks A and B are placed one over the other on a smooth horizontal surface. The maximum horizontal force that can be applied on the upper block B, so that A and B move without separation is 49N. The coefficient of friction between A and B is



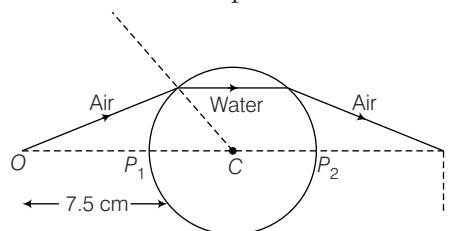
- (a) 0.2 (b) 0.3 (c) 0.5 (d) 0.8

37. In the system shown in figure $M_1 > M_2$ and pulley and threads are ideal. System is held at rest by thread BC. Just after thread BC is burnt.



- (a) Acceleration M_1 and M_2 will be upward
(b) Magnitude of acceleration of both masses will be $\frac{M_1 - M_2}{M_1 + M_2} g$
(c) Acceleration of M_1 and M_2 will be equal to zero
(d) Acceleration of M_1 will be equal to zero, which that of M_2 will be $\frac{M_1 - M_2}{M_2} g$ upward

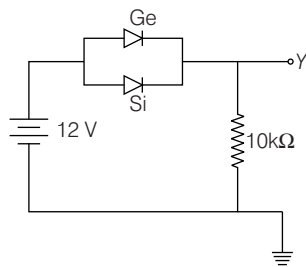
38. A thin walled glass sphere of radius 2.5 cm is filled with water. An object (O) is placed at 7.5 cm from the surface of the sphere. Neglecting the effect of glass wall, at what distance the image (I) of the object, measured from the centre of sphere is formed?



- (a) 20 cm (b) 15 cm (c) 10 cm (d) 7.5 cm

39. An artificial satellite moving in a circular orbit around the earth has a total (kinetic + potential) energy E_0 , its potential energy is
- (a) $-E_0$ (b) $1.5E_0$ (c) $2E_0$ (d) E_0

40. Two junction diodes one of germanium (Ge) and other of silicon (Si) are connected as shown in figure to a battery of emf 12 V and a load resistance 10 k Ω . The germanium diode conducts at 0.3 V and silicon diode at 0.7 V. When a current flows in the circuit, then the potential of terminal Y will be



- (a) 12 V (b) 11 V (c) 11.3 V (d) 11.7 V
41. Fifty six tuning forks are arranged in a series such that each fork gives 6 beats per second with the preceding one. Assuming the frequency of the last fork to be double of the first fork, the frequency of the last fork should be
(a) 220 Hz (b) 330 Hz (c) 440 Hz (d) 660 Hz
42. The wavelength of incident light falling on a photosensitive surface is changed from $2000 \text{ \AA}$ to $2100 \text{ \AA}$. The corresponding change in stopping potential is
(a) 0.03 V (b) 0.3 V (c) 3 V (d) 3.3 V
43. The path difference between two waves
 $y_1 = a_1 \sin \left(\omega t - \frac{2\pi x}{\lambda} \right)$ and
 $y_2 = a_2 \cos \left(\omega t - \frac{2\pi x}{\lambda} + \phi \right)$ is
 (a) $\frac{\lambda \phi}{2\pi}$ (b) $\frac{\lambda}{2\pi} \left(\phi + \frac{\pi}{2} \right)$
 (c) $\frac{2\pi}{\lambda} \left(\phi - \frac{\pi}{2} \right)$ (d) $\frac{2\pi \phi}{\lambda}$
44. In photoelectric effect, the photo current
 (a) increases with increase of frequency of incident photon
 (b) decreases with increase of frequency of incident photon
 (c) does not depend on the frequency of photon but depends only on intensity of incident light
 (d) depends both on intensity and frequency of incident beam
45. A copper ball of radius r is moving with a uniform velocity v in the mustard oil and the dragging force acting on the ball is F . The dragging force on the copper ball of radius $2r$ with uniform velocity $2v$ in the mustard oil is
 (a) F (b) $2F$ (c) $4F$ (d) $8F$
46. In a photoemissive cell with exciting wave length λ , the fastest electron has a speed v . If the exciting wavelength is changed to $3\lambda/4$, then the speed of the fastest emitted electron will be
 (a) $v \left(\frac{3}{4} \right)^{\frac{1}{2}}$ (b) $v \left(\frac{4}{3} \right)^{\frac{1}{2}}$
 (c) less than $v \left(\frac{4}{3} \right)^{\frac{1}{2}}$ (d) greater than $v \left(\frac{4}{3} \right)^{\frac{1}{2}}$
47. A block of wood of side 40 cm floats in water in such a way that its lower face is 5 cm below the free surface of water. What is the weight of the block?
-
- (a) 64 kg (b) 16 kg (c) 8 kg (d) cannot be determined as density of wood is not given
48. A stone is projected from the ground with velocity 50 m/s at an angle 30° with horizontal. It crosses a wall after 3 s. How far beyond the wall the stone will strike the ground? ($g = 10 \text{ m/s}^2$)
 (a) 90.2 m (b) 12.5 m (c) 86.5 m (d) $125\sqrt{3} \text{ m}$
49. An iron cube floats in a vessel containing mercury at 20°C . If the temperature is increased by 100°C , then the cube will float
 (a) lower (b) higher (c) at same level (d) lower or higher depending on mass of cube
50. In Young's double slit experiment, when wavelength used is $600 \text{ \AA}$ and the screen is 40 cm from the slits, then the fringes are 0.012 cm apart. What is the distance between the slits?
 (a) 0.024 cm (b) 2.4 cm (c) 0.24 cm (d) 0.2 cm

Chemistry

- A gaseous compounds having carbon, hydrogen and oxygen was burnt in the presence of oxygen. After combustion, 1 volume of the gaseous compound produces 2 volumes of CO_2 and 2 volumes of steam. Determines the molecular formula of the compound, if all the volumes were measured under the same conditions of pressure and temperature.
 - $\text{C}_2\text{H}_4\text{O}_2$
 - $\text{C}_3\text{H}_6\text{O}_3$
 - $\text{C}_4\text{H}_8\text{O}_2$
 - $\text{C}_5\text{H}_{10}\text{O}_3$
- A silicon chip used in an integrated circuit of computer has a mass of 5.68 mg. The number of Si atoms present in this chip are
 - 1.44×10^{20} atoms
 - 1.8×10^{20} atoms
 - 2.1×10^{20} atoms
 - None of these
- Cost of sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) is ₹ 50 per kg. Calculate its cost per mol.
 - ₹ 17.1 per mol
 - ₹ 27.1 per mol
 - ₹ 14.1 per mol
 - None of the above
- A man writes his biodata with carbon pencil on the plane paper having mass 150 mg. After writing his biodata, he weighs the written paper and find its mass is 152 mg. What is the number of carbon atoms present in the paper?
 - 1.0036×10^{20}
 - 5.02×10^{20}
 - 1.0036×10^{23}
 - 0.502×10^{20}
- The concentration of a solution can be expressed in molarity, normality, formality and molality. Among them, which mode of expression is the most accurate for the all conditions?
 - Molarity
 - Formality
 - Normality
 - Molality
- Calculate the energy of photons having wavelength, $5 \times 10^{-7} \text{ m}$ falls on a metal surface of work function, $3.4 \times 10^{-19} \text{ J}$.
 - $3.97 \times 10^{-19} \text{ J}$
 - $3.55 \times 10^{-19} \text{ J}$
 - $2.97 \times 10^{-19} \text{ J}$
 - $2.57 \times 10^{-19} \text{ J}$
- Select the correct options according to Hund's rule and Pauli exclusion principle.

I.

$\uparrow\downarrow$			
----------------------	--	--	--

II.

$\uparrow\downarrow$	$\uparrow\downarrow$		
----------------------	----------------------	--	--

III.

$\uparrow\downarrow$	$\uparrow$	$\uparrow$	$\uparrow$
----------------------	------------	------------	------------

IV.

$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow$	
----------------------	----------------------	------------	--

Codes

- Both I and II
- Both II and III
- Both I and III
- Both III and IV

- The electronic configurations of chromium (at. no. 24) and copper (at. no. 29) are

- $[\text{Ar}]4s^1 3d^5$ and $[\text{Ar}] 4s^1 3d^{10}$
- $[\text{Ar}] 4s^2 3d^4$ and $[\text{Ar}] 4s^1 3d^{10}$
- $[\text{Ar}] 4s^1 3d^5$ and $[\text{Ar}] 4s^2 3d^9$
- $[\text{Ar}] 4s^2 3d^4$ and $[\text{Ar}] 4s^2 3d^9$

- The Pauli exclusion principle applies to the following option.

- H
- H^+
- H^-
- He^+

- Metals are usually used as catalysts belong to

- s-block
- p-block
- d-block
- f-block

- Which of the following has the highest electron affinity?

- K
- O^-
- F^-
- O

- Which of the following compounds has lowest boiling point?

- KCl
- CuCl
- CuCl_2
- CsCl

- Which of the following compounds has zero dipole moment?

- CH_2Cl_2
- NH_3
- CH_4
- PH_3

- Which of the following compounds show hydrogen bonding?

- HCl
- C_2H_6
- RCH_2CHO
- $\text{RCH}_2\text{NHCH}_3$

15. In van der Waals' equation of gaseous state, the constant 'b' is a measure of
 (a) volume occupied by the molecules
 (b) intermolecular repulsions
 (c) intermolecular attraction
 (d) pressure correction
16. Which of the following is incorrect statement for liquid?
 (a) Surface tension of a liquid decreases with increase in temperature
 (b) Viscosity of a liquid decreases with decrease in temperature
 (c) Vapour pressure of a liquid increases with increase in temperature
 (d) Droplets of a liquid on flat surface are slightly flattened due to gravity
17. Thermodynamically, in which form of carbon is the most stable?
 (a) Coal (b) Fullerenes
 (c) Diamond (d) Graphite
18. Enthalpy of formation of HF and HCl are -161 kJ and -92 kJ, respectively. Select the incorrect statement on the basis of the above fact.
 (a) HF is more stable than HCl
 (b) HCl is more stable than HF
 (c) Affinity of fluorine to hydrogen is greater than affinity of chlorine to hydrogen
 (d) HF and HCl are exothermic compound
19. A reaction is spontaneous at low temperature, but non-spontaneous at high temperature. Which of the following condition is true for the chemical reaction?
 (a) $\Delta H < 0$, $\Delta S < 0$
 (b) $\Delta H > 0$, $\Delta S = 0$
 (c) $\Delta H < 0$, $\Delta S > 0$
 (d) $\Delta H > 0$, $\Delta S > 0$
20. The chemical reaction of a gas phase is given below.

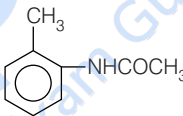
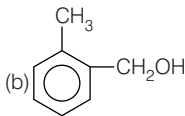
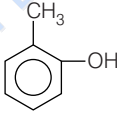
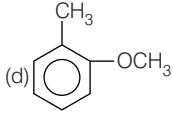
$$2A(g) + B(g) \rightleftharpoons C(g) + D(g)$$

 Which one of the following changes will affect the value of K_c ?
 (a) Addition of inert gas
 (b) Increasing in temperature
 (c) Addition of reactants
 (d) Addition of catalyst
21. For the chemical equilibrium,

$$2NO_2(g) \rightleftharpoons N_2O_4(g); + 14.6 \text{ kcal}$$

 increase in temperature
 (a) favours the formation of N_2O_4
 (b) favours the decomposition of N_2O_4
 (c) does not affect equilibrium
 (d) stop the reaction
22. The property of the alkaline earth metals which increases with their atomic number?
 (a) Ionisation energy
 (b) Electronegativity
 (c) Solubility of their hydroxides in water
 (d) Solubility of their sulphates in water
23. Which of the following element has maximum photoelectric effect?
 (a) Li (b) Na
 (c) K (d) Cs
24. Among boron halides, which is the strongest Lewis acid?
 (a) BF_3 (b) BI_3
 (c) BCl_3 (d) BBr_3
25. The compound gives blood red colouration when its Lassaigne's extract is treated with alkali and ferric chloride?
 (a) Benzamide (b) Phenyl hydrozine
 (c) Diphenyl sulphide (d) Thiourea
26. The IUPAC name for the hydrocarbon represented by

 (a) 3, 3-diethylpentane (b) 2-ethylpentane
 (c) tetraethyl carbon (d) neo-nonane
27. Keto-enol tautomerism is not observed in
 (a) $CH_3COCH_2COCH_3$
 (b) $C_6H_5COCH_2COCH_3$
 (c) $C_6H_5COCH=CH_2$
 (d) $C_6H_5COC_6H_5$
28. Which of the following statements are true with respect to electronic displacement in a covalent bond?
 I. Inductive effect operates through π -bond.
 II. Resonance effect operates through σ -bond.
 III. Inductive effect operates through σ -bond.
 IV. Resonance effect operates through π -bond.

- V. Resonance and inductive effects operate through σ -bond.
- (a) III and IV (b) I and II
(c) II and IV (d) I and V
29. The most susceptible to nucleophilic attack at the carbonyl group among the given compound is
(a) $\text{CH}_3\text{COOCH}_3$ (b) CH_3CONH_2
(c) $\text{CH}_3\text{COOCH}_3$ (d) CH_3COCl
30. Among the following species, the most stable carbonium ion is
(a) $\text{C}_6\text{H}_5\text{CH}_2^+$
(b) $\text{C}_6\text{H}_5\text{CH}_2^+$
(c) CH_3CH_2^+
(d) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2^+$
31. For the following,
(i) I^- (ii) Cl^- (iii) Br^-
the increasing order of nucleophilicity would be
(a) $\text{Br}^- < \text{Cl}^- < \text{I}^-$ (b) $\text{I}^- < \text{Cl}^- < \text{Br}^-$
(c) $\text{Cl}^- < \text{Br}^- < \text{I}^-$ (d) $\text{I}^- < \text{Br}^- < \text{Cl}^-$
32. Which will undergo fastest $\text{S}_\text{N}2$ substitution reaction when treated with NaOH ?
(a) $\text{H}-\text{C}(\text{H})(\text{Br})-\text{CH}_2-\text{CH}_2-\text{CH}_3$
(b) $\text{H}-\text{C}(\text{CH}_3)(\text{Br})-\text{C}_2\text{H}_5$
(c) $\text{CH}_3-\text{C}(\text{CH}_3)_2-\text{Br}$
(d) $\text{H}_3\text{C}_2-\text{C}(\text{CH}_3)(\text{Br})-\text{H}$
33. Which one of the following is aromatic?
(a) Cycloheptatrienyl cation
(b) Cycloheptatriene
(c) Cyclooctatetraene
(d) Cyclopentadienyl cation
34. The following compound which cannot be prepared by Wurtz reaction?
(a) Methane
(b) Ethane
(c) Butane
(d) Propane
35. Anti-Markownikoff's rule addition reaction is not observed in the following compound.
(a) propene
(b) 1-butene
(c) but-2-ene
(d) pent-2-ene
36. The most reactive towards electrophilic reagent is
(a) 
(b) 
(c) 
(d) 
37. The maximum heat of hydrogenation among the following is
(a) 
(b) 
(c) 
(d) 
38. The process of 'eutrophication' is due to
(a) increase in concentration of radioactive substances in water.
(b) the reduction in concentration of the dissolved oxygen in water due to phosphate pollution in water.
(c) increase in concentration of fluoride ion in water.
(d) increase in concentration of insecticide in water.

39. Match the Column I and Column II and pick the correct matching from the codes given below.

Column I	Column II
A. Peroxy acetyl nitrate	1. Waste incineration
B. Polycyclic aromatic	2. Global warming
C. Dioxins	3. Photochemical smog
D. Indigo	4. Carcinogens
E. IR active molecules	5. Vat dye

	A	B	C	D	E
(a)	3	4	1	5	2
(b)	1	2	3	4	5
(c)	3	5	1	2	4
(d)	5	3	1	2	4

40. The flame colours of metal ions are due to

- (a) metal excess defect
(b) metal deficiency defect
(c) Schottky defect
(d) Frenkel defect

41. The gas mixture which is used by the divers inside the sea is

- (a) $O_2 + N_2$
(b) $O_2 + Ar$
(c) $O_2 + Xe$
(d) $O_2 + He$

42. van't Hoff factor, when benzoic acid is dissolved in benzene, will be

- (a) 2
(b) 1
(c) 0.5
(d) 1.5

43. 1 C electricity deposits

- (a) half of electrochemical equivalent of Ag
(b) electrochemical equivalent of Ag
(c) 96500 g of Ag
(d) 10.8 g of Ag

44. Which of the following does not influence the rate of reaction?

- (a) Molecularity of the reaction
(b) Temperature of the reaction
(c) Concentration of the reactants
(d) Nature of the reactants

45. During the adsorption of krypton on activated charcoal at low temperature.

- (a) $\Delta H < 0$ and $\Delta S > 0$
(b) $\Delta H > 0$ and $\Delta S > 0$
(c) $\Delta H < 0$ and $\Delta S < 0$
(d) $\Delta H > 0$ and $\Delta S < 0$

46. In which of the following the pyrophosphate bond of ATP is broken down and linkage takes place between two molecules?

- (a) I some rases
(b) Lyases
(c) Transferases
(d) Ligases

47. Which of the following option best describes the 'hydrogen economy'?

- (a) Using dihydrogen in an efficient manner
(b) Dihydrogen is carried and stored in the form of liquid or gas
(c) Addition of dihydrogen to the reactant
(d) Both (a) and (b)

48. Electrolytic reduction of alumina to aluminium by Hall-Heroult process is carried out

- (a) in the presence of NaCl
(b) in the presence of Hnorite
(c) in the presence of cryolite which forms a melt with lower melting temperature
(d) in the presence of cryolite which forms a melt with higher melting temperature

49. Which of the following anions is present in the chain structure of silicates?

- (a) $(Si_2O_5^{2-})_n$
(b) $(Si_2O_3^{2-})_n$
(c) $Si_2O_4^{4-}$
(d) $Si_2O_7^{6-}$

50. Myosin(s) is/are

- (a) fibrous proteins
(b) globular proteins
(c) enzyme
(d) Both (a) and (b)

Mathematics

1. If $2a + 3b + 6c = 0$, then atleast one root of the equation $ax^2 + bx + c = 0$ lies in the interval
 - (a) (0, 1) (b) (1, 2)
 - (c) (2, 3) (d) None of these
2. If $\mathbf{a}$ and $\mathbf{b}$ be two perpendicular unit vectors such that $\mathbf{x} = \mathbf{b} - (\mathbf{a} \times \mathbf{x})$, then $|\mathbf{x}|$ is equal to
 - (a) 1 (b) $\sqrt{2}$
 - (c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{3}$
3. If $aN = \{an : n \in N\}$ and $bN \cap cN = dN$, where $a, b, c \in N$ and b, c are coprime, then
 - (a) $b = cd$ (b) $c = bd$
 - (c) $d = bc$ (d) None of these
4. If $f(x) = \int_0^1 e^{|t-x|} dt$ ($0 \leq x \leq 1$), then the maximum value of $f(x)$ is
 - (a) $\sqrt{e} - 1$ (b) $2(e - 1)$ (c) $(e - 1)$ (d) $2(\sqrt{e} - 1)$
5. The mean deviation from the mean for the set of observations $-1, 0, 4$ is
 - (a) less than 3 (b) less than 1
 - (c) greater than 2.5 (d) greater than 4.9
6. If $f(x)$ is a non-negative continuous function for all $x \geq 1$ such that $f'(x) \leq pf(x)$, where $p > 0$ and $f(1) = 0$, then $[f(\sqrt{e}) + f(\sqrt{\pi})]$ is equal to
 - (a) 0 (b) negative
 - (c) positive (d) None of these
7. If $t_n = \sum_{r=0}^n \frac{1}{({}^nC_r)^k}$ and $S_n = \sum_{r=0}^n \frac{r}{({}^nC_r)^k}$, where $k \in \mathbb{Z}^+$, then $\cos^{-1}\left(\frac{S_n}{nt_n}\right)$ is
 - (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$
8. If X follows a binomial distribution with parameters $n = 8$ and $p = \frac{1}{2}$, then $P(|x - 4| \leq 2)$ is equal to
 - (a) $\frac{119}{128}$ (b) $\frac{116}{128}$
 - (c) $\frac{29}{128}$ (d) None of these
9. Sum of the last 30 coefficients in the expansion of $(1+x)^{59}$, when expanded in ascending power of x is
 - (a) 2^{59} (b) 2^{58} (c) 2^{30} (d) 2^{29}
10. If $\theta = \sin^{-1} x + \cos^{-1} x - \tan^{-1} x$, $1 \leq x < \infty$, then the smallest interval in which θ lies is
 - (a) $\frac{\pi}{2} \leq \theta \leq \frac{3\pi}{4}$ (b) $0 \leq \theta \leq \frac{\pi}{4}$
 - (c) $-\frac{\pi}{4} \leq \theta \leq 0$ (d) $\frac{\pi}{4} \leq \theta \leq \frac{\pi}{2}$
11. If $2\tan^{-1}(\cos x) = \tan^{-1}(2\operatorname{cosec} x)$, then the value of x is
 - (a) $\frac{3\pi}{4}$ (b) $\frac{\pi}{4}$
 - (c) $\frac{\pi}{3}$ (d) None of these
12. If $\cos^{-1} p + \cos^{-1} q + \cos^{-1} r = 3\pi$, then $p^2 + q^2 + r^2 + 2pqr$ is equal to
 - (a) 3 (b) 1 (c) 2 (d) -1
13. The points on the curve $xy^2 = 1$ which are nearest to the origin, are
 - (a) $\left[\left(\frac{1}{2}\right)^{1/3}, \pm \left(\frac{1}{2}\right)^{-1/6}\right]$ (b) $\left[\left(\frac{1}{2}\right)^{1/3}, 2^{-1/6}\right]$
 - (c) $\left[2^{1/3}, \pm \left(\frac{1}{2}\right)^{-1/6}\right]$ (d) None of these
14. The statement $p \rightarrow (q \rightarrow p)$ is equivalent to
 - (a) $p \rightarrow (p \leftrightarrow q)$ (b) $p \rightarrow (p \rightarrow q)$
 - (c) $p \rightarrow (p \vee q)$ (d) $p \rightarrow (p \wedge q)$
15. Total number of polynomials of the form $x^3 + ax^2 + bx + c$ that are divisible by $x^2 + 1$, where $a, b, c \in \{1, 2, 3, \dots, 10\}$ is equal to
 - (a) 90 (b) 45 (c) 5 (d) 10
16. Total number of regions in which ' n ' coplanar lines can divide the plane, it is known that no two lines are parallel and no three of them are concurrent, is equal to
 - (a) $\frac{1}{2}(n^2 + n + 2)$ (b) $\frac{1}{2}(n + 3n^2)$
 - (c) $\frac{1}{2}(3n + n^2)$ (d) $(n^2 - n + 2)$

17. The value of $\lim_{n \rightarrow \infty} \left[\sqrt[3]{n^2 - n^3} + n \right]$ is

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

18. The coefficient of the term independent of x in the expansion of

$$\left(\frac{x+1}{x^{2/3} - x^{1/3} + 1} - \frac{x-1}{x - x^{1/2}} \right)^{10}$$

- (a) 210 (b) 105
(c) 70 (d) 112

19. If $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is to be the square root of two

rowed unit matrix, then α, β and γ should satisfy the relation

- (a) $1 + \alpha^2 + \beta\gamma = 0$ (b) $1 - \alpha^2 - \beta\gamma = 0$
(c) $1 - \alpha^2 + \beta\gamma = 0$ (d) $\alpha^2 + \beta\gamma - 1 = 0$

20. The differential equation of the family of curves $y = Ae^{3x} + Be^{5x}$, where A and B are arbitrary constants, is

- (a) $\frac{d^2y}{dx^2} + 8\frac{dy}{dx} + 15y = 0$
(b) $\frac{d^2y}{dx^2} - \frac{dy}{dx} + y = 0$
(c) $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 15y = 0$
(d) None of the above

21. The derivative of $\sin^{-1}(2x\sqrt{1-x^2})$ with respect to $\sin^{-1}(3x - 4x^3)$ is

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

22. $\int \frac{(2x^{12} + 5x^9)}{(1 + x^3 + x^5)^3} dx$ equals

- (a) $\frac{x^{10}}{2(x^5 + x^3 + 1)^2} + C$
(b) $\frac{x^2 + 2x}{(x^5 + x^3 + 1)} + C$
(c) $\log(x^5 + x^3 + 1 + \sqrt{(2x^{12} + 5x^9) + C})$
(d) None of the above

$$23. \begin{vmatrix} \sin \theta & \cos \theta & \sin 2\theta \\ \sin\left(\theta + \frac{2\pi}{3}\right) & \cos\left(\theta + \frac{2\pi}{3}\right) & \sin\left(2\theta + \frac{4\pi}{3}\right) \\ \sin\left(\theta - \frac{2\pi}{3}\right) & \cos\left(\theta - \frac{2\pi}{3}\right) & \sin\left(2\theta - \frac{4\pi}{3}\right) \end{vmatrix}$$

equals

- (a) $3\sin \theta$ (b) $\sin^3 \theta$
(c) 0 (d) None of these

24. Area bounded by the curves $y = x^2$ and $y = 2 - x^2$ is

- (a) $\frac{8}{3}$ sq units (b) $\frac{3}{8}$ sq unit
(c) $\frac{3}{2}$ sq units (d) None of these

25. $\lim_{n \rightarrow \infty} \left(\frac{1^2}{1-n^3} + \frac{2^2}{1-n^3} + \dots + \frac{n^2}{1-n^3} \right)$ is equal to

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

26. The value of $\int \frac{\sin x + \cos x}{3 + \sin 2x} dx$ is

- (a) $\frac{1}{4} \log \left(\frac{2 - \sin x + \cos x}{2 + \sin x - \cos x} \right) + C$
(b) $\frac{1}{2} \log \left(\frac{2 + \sin x}{2 - \sin x} \right) + C$
(c) $\frac{1}{4} \log \left(\frac{1 + \sin x}{1 - \sin x} \right) + C$
(d) None of the above

27. The equation of the circle passing through the point $(2a, 0)$ and whose radical axis is $x = \frac{a}{2}$ with respect to the circle $x^2 + y^2 = a^2$, will be

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

28. The coordinates of the point on the parabola $y = x^2 + 7x + 2$, which is nearest to the straight line $y = 3x - 3$, are

- (a) $(-2, -8)$ (b) $(1, 10)$
(c) $(2, 20)$ (d) $(-1, -4)$

29. The area bounded by the parabolas $y^2 = 4a(x + a)$ and $y^2 = -4a(x - a)$ is
- (a) $\frac{16}{3}a^2$ (b) $\frac{8}{3}a^2$
 (c) $\frac{4}{3}a^2$ (d) None of these
30. The solution of the differential equation $\frac{dy}{dx} = \sin(x + y) \tan(x + y) - 1$ is
- (a) $\operatorname{cosec}(x + y) + \tan(x + y) = x + C$
 (b) $x + \operatorname{cosec}(x + y) = C$
 (c) $x + \tan(x + y) = C$
 (d) $x + \sec(x + y) = C$
31. Fifteen coupons are numbered 1, 2, ..., 15, respectively. Seven coupons are selected at random one at a time with replacement. The probability that the largest number appearing on a selected coupon is 9, is
- (a) $\left(\frac{9}{10}\right)^6$ (b) $\left(\frac{8}{15}\right)^7$
 (c) $\left(\frac{3}{5}\right)^7$ (d) None of these
32. Let $h(x) = \min(x, x^2)$, for every real numbers x . Then,
- (a) h is not continuous for all x
 (b) h is differentiable for all x
 (c) $h'(x) \neq 1$, for all $x > 1$
 (d) h is not differentiable at two values of x
33. If the function $f(x) = \begin{cases} (\cos x)^{1/x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is
- (a) 8 (b) 1
 (c) -1 (d) None of these
34. If $f(x) = \frac{e^{1/x} - 1}{e^{1/x} + 1}$, $x \neq 0$ and $f(0) = 0$, then $f(x)$ is
- (a) left continuous at 0 (b) right continuous at 0
 (c) discontinuous at 0 (d) continuous at 0
35. The value of $\sum_{p=1}^6 2 \left(\sin \frac{2p\pi}{7} - i \cos \frac{2p\pi}{7} \right)$ is
- (a) $2i$ (b) $-2i$
 (c) 2 (d) 1
36. A letter lock contains 5 rings each marked with four different letters. The number of all possible unsuccessful attempts to open the lock is
- (a) 625 (b) 1024
 (c) 624 (d) 1023
37. The domain of definition of the function $f(x) = \frac{1}{\sqrt{||x|| - 1} - 5}$ is
- (a) $(-\infty, -7] \cup [7, \infty)$
 (b) $(-\infty, \infty)$
 (c) $(7, \infty)$
 (d) $(-7, \infty)$
38. If $y^{1/m} + y^{-1/m} = 2x$, then $(x^2 - 1)y_2 + xy_1$ is equal to
- (a) m^2y (b) $-m^2y$
 (c) $\pm m^2y$ (d) None of these
39. The condition that the straight line $cx - by + b^2 = 0$ may touch the circle $x^2 + y^2 = ax + by$ is
- (a) $abc = 1$ (b) $a = c$
 (c) $b = ac$ (d) None of these
40. If $0 < \alpha, \beta, \gamma < \frac{\pi}{2}$ such that $\alpha + \beta + \gamma = \frac{\pi}{2}$ and $\cot \alpha, \cot \beta, \cot \gamma$ are in AP, then the value of $\cot \alpha \cot \gamma$ is
- (a) 1 (b) 3
 (c) $\cot^2 \beta$ (d) None of these
41. In a ΔABC , if $b = 2$, $\angle B = 30^\circ$, then the area of the circumcircle of ΔABC (in sq units) is
- (a) π (b) 2π (c) 4π (d) 6π
42. The sum of the series $\frac{3}{4 \cdot 8} - \frac{3 \cdot 5}{4 \cdot 8 \cdot 12} + \frac{3 \cdot 5 \cdot 7}{4 \cdot 8 \cdot 12 \cdot 16} - \dots$ is
- (a) $\sqrt{\frac{3}{2}} - \frac{3}{4}$ (b) $\sqrt{\frac{2}{3}} - \frac{3}{4}$
 (c) $\sqrt{\frac{3}{2}} - \frac{1}{4}$ (d) $\sqrt{\frac{2}{3}} - \frac{1}{4}$
43. The value of $\int_0^\pi |\sin^3 \theta| d\theta$ is
- (a) 0 (b) π
 (c) $\frac{4}{3}$ (d) $\frac{3}{8}$

44. The value of $\int \frac{\cos x + x \sin x}{x^2 + x \cos x} dx$ is

- (a) $\log \left| \frac{\sin x}{1 + \cos x} \right| + C$
 (b) $\log \left| \frac{\sin x}{x + \cos x} \right| + C$
 (c) $\log \left| \frac{2 \sin x}{x + \cos x} \right| + C$
 (d) $\log \left| \frac{x}{x + \cos x} \right| + C$

45. Tangent to the ellipse $\frac{x^2}{32} + \frac{y^2}{18} = 1$ having

slope $-\frac{3}{4}$ meet the coordinate axis at A and

B. Then, the area of $\triangle AOB$, where O is the origin, is

- (a) 12 sq units (b) 8 sq units
 (c) 24 sq units (d) 32 sq units

46. The value of $\lim_{x \rightarrow \pi/6} \frac{2 \sin^2 x + \sin x - 1}{2 \sin^2 x - 3 \sin x + 1}$ is

- (a) 3 (b) -3 (c) 6 (d) 0

47. If $\sin A + \cos B = a$ and $\sin B + \cos A = b$, then $\sin(A + B)$ is equal to

- (a) $\frac{a^2 + b^2}{2}$ (b) $\frac{a^2 - b^2 + 2}{2}$
 (c) $\frac{a^2 + b^2 - 2}{2}$ (d) None of these

48. In a $\triangle ABC$, if $\sin A \sin B = \frac{ab}{c^2}$, then the triangle is

- (a) equilateral (b) isosceles
 (c) right angled (d) obtuse angled

49. The direction cosines l, m, n of two lines are connected by the relations $l + m + n = 0$ and $lm = 0$, then the angle between them is

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

50. The foci of the conic section

$$25x^2 + 16y^2 - 150x = 175 \text{ are}$$

- (a) $(0, \pm 3)$ (b) $(0, \pm 2)$
 (c) $(3, \pm 3)$ (d) $(0, \pm 1)$

51. If $x - 2y = 4$, then the minimum value of xy is

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

52. If **b** and **c** are any two non-collinear unit vectors and **a** is any vector, then

$$(\mathbf{a} \cdot \mathbf{b}) \mathbf{b} + (\mathbf{a} \cdot \mathbf{c}) \mathbf{c} + \frac{\mathbf{a} \cdot \mathbf{b} \times \mathbf{c}}{|\mathbf{b} \times \mathbf{c}|} \cdot (\mathbf{b} \times \mathbf{c}) \text{ is equal to}$$

- (a) 0 (b) a (c) b (d) c

53. If θ is the semi-vertical angle of a cone of maximum volume and given slant height, then $\tan \theta$ is given by

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

54. The period of the function

$$f(x) = \frac{\sin 8x \cos x - \sin 6x \cos 3x}{\cos 2x \cos x - \sin 3x \sin 4x} \text{ is}$$

- (a) π (b) 2π
 (c) $\frac{\pi}{2}$ (d) None of these

55. The equation of the plane through the points (2, 3, 1) and (4, -5, 3) parallel to X-axis is

- (a) $x + 4z = 7$ (b) $y - 4z = 7$
 (c) $y + 4z = -7$ (d) $y + 4z = 7$

56. If Q is the image of the point P(2, 3, 4) under the reflection in the plane $x - 2y + 5z = 6$, then the equation of the line PQ is

- (a) $\frac{x-2}{-1} = \frac{y-3}{2} = \frac{z-4}{5}$
 (b) $\frac{x-2}{1} = \frac{y-3}{-2} = \frac{z-4}{5}$
 (c) $\frac{x-2}{-1} = \frac{y-3}{-2} = \frac{z-4}{5}$
 (d) $\frac{x-2}{1} = \frac{y-3}{2} = \frac{z-4}{5}$

57. The equation of the plane passing through the line of intersection of the planes $x + y + z = 6$ and $2x + 3y + 4z + 5 = 0$ and perpendicular to the plane $4x + 5y - 3z = 8$ is

- (a) $x + 7y + 13z - 96 = 0$
 (b) $x + 7y + 13z + 96 = 0$
 (c) $x + 7y - 13z - 96 = 0$
 (d) $x - 7y + 13z + 96 = 0$

58. $1 + \frac{2^3}{2!} + \frac{3^3}{3!} + \frac{4^3}{4!} + \dots \infty$ equals

- (a) 5e (b) 4e (c) 3e (d) 2e

59. The number of values of x , where $f(x) = \cos x + \cos \sqrt{2}x$ attains its maximum is
 (a) 1 (b) 0
 (c) 2 (d) infinite
60. A vector perpendicular to the plane containing the points $A(1, -1, 2)$, $B(2, 0, -1)$, $C(0, 2, 1)$ is
 (a) $4\hat{i} + 8\hat{j} - 4\hat{k}$
 (b) $8\hat{i} + 4\hat{j} + 4\hat{k}$
 (c) $3\hat{i} + \hat{j} + 2\hat{k}$
 (d) $\hat{i} + \hat{j} - \hat{k}$
61. If $P = \begin{bmatrix} \sqrt{3}/2 & 1/2 \\ -1/2 & \sqrt{3}/2 \end{bmatrix}$, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP'$, then $P'Q^{2005}P$ is
 (a) $\begin{bmatrix} 1 & 1 \\ 2005 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$
 (c) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 2005 \\ 2005 & 1 \end{bmatrix}$
62. $\int \cos^{-3/7} x \sin^{-11/7} x dx$ is equal to
 (a) $\log |\sin^{4/7} x| + C$
 (b) $\frac{4}{7} \tan^{4/7} x + C$
 (c) $\frac{-7}{4} \tan^{-4/7} x + C$
 (d) $\log |\cos^{3/7} x| + C$
63. All the chords of the hyperbola $3x^2 - y^2 - 2x + 4y = 0$, subtending a right angle at the origin pass through the fixed point
 (a) $(1, -2)$
 (b) $(-1, 2)$
 (c) $(1, 2)$
 (d) None of the above
64. The vector equation of the plane through the point $\hat{i} + 2\hat{j} - \hat{k}$ and perpendicular to the line of intersection of the plane $\mathbf{r} \cdot (3\hat{i} - \hat{j} + \hat{k}) = 1$ and $\mathbf{r} \cdot (2\hat{i} - 4\hat{j} + 2\hat{k}) = 2$ is
 (a) $\mathbf{r} \cdot (2\hat{i} + 7\hat{j} - 13\hat{k}) = 1$
 (b) $\mathbf{r} \cdot (2\hat{i} - 7\hat{j} - 13\hat{k}) = 1$
 (c) $\mathbf{r} \cdot (2\hat{i} + 7\hat{j} + 13\hat{k}) = 0$
 (d) None of the above
65. The degree of the differential equation $x = 1 + \left(\frac{dy}{dx}\right) + \frac{1}{2!}\left(\frac{dy}{dx}\right)^2 + \frac{1}{3!}\left(\frac{dy}{dx}\right)^3 + \dots$
 (a) 3 (b) 2
 (c) 1 (d) Not defined
66. The locus of the mid-points of the chords of the circle $x^2 + y^2 = 16$ which are tangent to the hyperbola $9x^2 - 16y^2 = 144$, is
 (a) $(x^2 + y^2)^2 = 16x^2 + 9y^2$
 (b) $(x^2 - y^2)^2 = 16x^2 - 9y^2$
 (c) $(x^2 + y^2)^2 = 16x^2 - 9y^2$
 (d) None of the above
67. The number of positive integers satisfying the inequality ${}^{n+1}C_{n-2} - {}^{n+1}C_{n-1} \leq 50$ is
 (a) 9 (b) 8 (c) 7 (d) 6
68. The intercepts on the straight line $y = mx$ by the line $y = 2$ and $y = 6$ is less than 5, then m belongs to
 (a) $\left[-\frac{4}{3}, \frac{4}{3}\right]$
 (b) $\left[\frac{4}{3}, \frac{3}{8}\right]$
 (c) $\left[-\infty, -\frac{4}{3}\right] \cup \left[\frac{4}{3}, \infty\right]$
 (d) $\left[\frac{4}{3}, \infty\right]$
69. A line passing through origin and is perpendicular to two given lines $2x + y + 6 = 0$ and $4x + 2y - 9 = 0$. The ratio in which the origin divides this line, is
 (a) 1 : 2 (b) 2 : 1 (c) 4 : 2 (d) 4 : 3
70. Let A and B be two events such that $P(\overline{A \cup B}) = \frac{1}{6}$, $P(A \cap B) = \frac{1}{4}$ and $P(\overline{A}) = \frac{1}{4}$, where $\overline{A}$ stands for complement of event A . Then, the events A and B are
 (a) mutually exclusive and independent
 (b) independent but not equally likely
 (c) equally likely but not independent
 (d) equally likely and mutually exclusive

English & General Awareness

Directions (Q. Nos. 1-5) *Rearrange the following five sentences (A), (B), (C), (D) and (E) in proper sequence to form a meaningful paragraph and then answer the questions given below them.*

- (A) The history of mankind is full of such fightings between communities, nations and people.
- (B) From the primitive weapons of warfare, man has advanced to the modern nuclear weapons.
- (C) Ever since the dawn of civilisation, man has been fighting with man.
- (D) A modern war is scientific in character, but the effect is the same, wiping human existence out of this Earth.
- (E) The only difference now seems to be in the efficiency of the instruments used for killing each other.

1. Which of the following should be the FIRST sentence?

- (a) A (b) B
- (c) C (d) D
- (e) E

2. Which of the following should be the SECOND sentence?

- (a) A (b) B
- (c) C (d) D
- (e) E

3. Which of the following should be the THIRD sentence?

- (a) A (b) B
- (c) C (d) D
- (e) E

4. Which of the following should be the FOURTH sentence?

- (a) A (b) B
- (c) C (d) D
- (e) E

5. Which of the following should be the FIFTH (LAST) sentence?

- (a) A (b) B
- (c) C (d) D
- (e) E

Directions (Q. Nos. 6-10) *In these questions, look at the underlined part of the given sentence. Below the sentence are given three possible substitutions for the underlined part. If any of substitutions; (a), (b) or (c) is better than the underlined part, choose that substitution as your response. If none of the substitution improves the sentence, choose (d) as your response. Thus, a 'No improvement' response will be signified by the letter (d).*

6. It is no good to cry over spilt milk.

- (a) It is no good crying
- (b) It is of no good to cry
- (c) It is of no good crying
- (d) No improvement

7. He has been working off and on for several years to compile a dictionary.

- (a) on or off
- (b) on and off
- (c) regularly
- (d) No improvement

8. Rohit assured Sunita that he would look at her work while she was on leave.

- (a) would overlook
- (b) would look after
- (c) will look
- (d) No improvement

9. Newton wanted to know why did the apple fall to the ground.

- (a) know that why did the apple fall
- (b) know why the apple fell
- (c) know that why the apple fell
- (d) No improvement

10. He was extremely unhappy because of the inordinately delay.

- (a) the inordinate delaying
- (b) the inordinate delay
- (c) the inordinately delaying
- (d) No improvement

Directions (Q. Nos. 11-12) *Each of the following items consists of a sentence followed by four words or group of words. Select the opposite of the word occurring in the sentence as per the context.*

11. His family severed ties with him for marrying inter-caste.
 (a) joined (b) included
 (c) detached (d) disrupted
12. Domestic violence is a very inhuman act.
 (a) indifferent
 (b) compassionate
 (c) terrible
 (d) ferocious

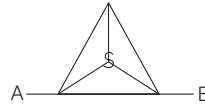
Fill in the blanks with correct prepositions.

Directions (Q. Nos. 13-14) *Four words are given in each question, out of which only one word is correctly spelt. find the correctly spelt word and mark your answer.*

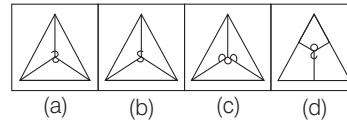
13. (a) arcitecture
 (b) architectere
 (c) architecetur
 (d) architecture
14. (a) epilogue
 (b) eppilogue
 (c) epiloge
 (d) epiloug
15. The poor have to work morning to evening.
 (a) in (b) to
 (c) from (d) before
16. John, in the morning, started walking towards North and then turn towards opposite side of the Sun. He then turn left again and stops. Which direction is he facing now?
 (a) North
 (b) West
 (c) South
 (d) East
17. If $64 + 7 = 460$ and $25 + 8 = 212$, then $43 + 8 = ?$
 (a) 360 (b) 376
 (c) 332 (d) 356

18. What is the mirror image of the following figure?

Question Figure



Answer Figures

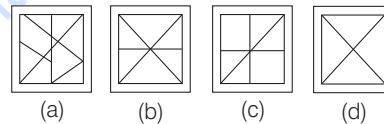


19. If '+' mean '×', '-' means '÷', '×' means '-' and '÷' means '+', then find the value of the following equation. $6 + 64 - 8 \div 45 \times 8$
 (a) 85 (b) 76
 (c) 87 (d) 75
20. Which of the following has the given figure embedded in it?

Question Figure



Answer Figures



21. 1, 4, 2, 3, 2, ?
 (a) 2 (b) 5
 (c) 3 (d) 4
- 22.
- | | | |
|--|--|--|
| $\begin{array}{c} 6 \\ \diagup \quad \diagdown \\ 25 \quad 17 \end{array}$ | $\begin{array}{c} 8 \\ \diagup \quad \diagdown \\ 38 \quad 18 \end{array}$ | $\begin{array}{c} ? \\ \diagup \quad \diagdown \\ 89 \quad 16 \end{array}$ |
| (a) 13 | (b) 15 | |
| (c) 17 | (d) 19 | |
23. Two persons ride towards each other from two places 55 km apart, one riding at 12 km/h and the other at 10 km/h. When will they be 11 km apart?
 (a) 2 h and 30 min (b) 1 h and 30 min
 (c) 2 h (d) 2 h and 45 min

24. If $x - \frac{1}{x} = 2$, then what is the value of $x^2 + \frac{1}{x^2}$?
(a) 4 (b) 5 (c) 3 (d) 6
25. The population of a state is 20000. It increases by 20% during the first year and 30% during the second year. The population after two years will be
(a) 32000 (b) 40000
(c) 31200 (d) 30000
26. A reduction of 20% in the price of rice enable a buyer to buy 5 kg more for ₹ 1200. The reduced price per kg of rice will be
(a) 36 (b) 45
(c) 48 (d) 60
27. A man spends 60% of his income on different expenditures. His income is increased by 20% and his expenditure also increased by 10%. Find the percentage decrease in his saving.
(a) 10% (b) 15%
(c) 20% (d) 25%
28. Find the amount which Shyam will get on ₹ 4096, if he gave it for 18 months at $12\frac{1}{2}\%$ per annum, interest being compounded half yearly.
(a) ₹ 5813 (b) ₹ 4515
(c) ₹ 4913 (d) ₹ 5713
29. A works twice as fast as B. If B can complete a piece of work independently in 12 days, then what will be the number of days taken by A and B together to finish the work?
(a) 4 (b) 6
(c) 8 (d) 18
30. A well of diameter 3 m is dug 14 m deep. The Earth taken out of it has been spread evenly all around it in the shape of a circular ring of width 4 m to form an embankment. Find the height of the embankment.
(a) 4.25 m
(b) 2.250 m
(c) 1.125 m
(d) 1.750 m