

G.G.S. INDRAPRASTHA UNIVERSITY ENGINEERING ENTRANCE

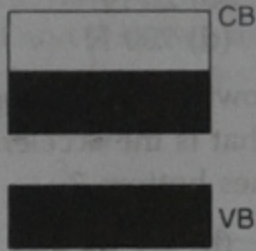
SOLVED PAPER-2005

PHYSICS

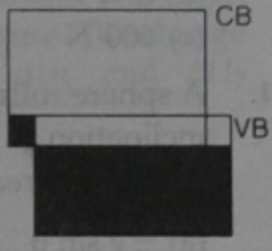
1. A setting sun appears to be at an altitude higher than it really is. This is because of :
 - (a) absorption of light
 - (b) reflection of light
 - (c) refraction of light
 - (d) dispersion of light

2. In a Young's double slit experiment, the slit separation is 1 mm and the screen is 1 m from the slit. For a monochromatic light of wavelength 500 nm, the distance of 3rd minima from the central maxima is :
 - (a) 0.50 mm
 - (b) 1.25 mm
 - (c) 1.50 mm
 - (d) 1.75 mm

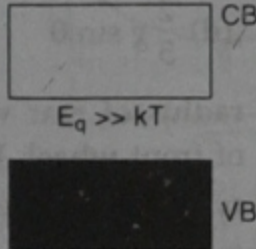
3. Which of the energy band diagrams shown in the figure corresponds to that of a semiconductor ?



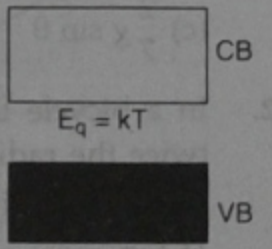
(a)



(b)



(c)



(d)

4. The saturation current in a diode valve is governed by :
 - (a) Child's law
 - (b) Len's law
 - (c) Richardson's law
 - (d) Ampere's law

5. Let i_e , i_c and i_b represent emitter current, collector current and the base current of a transistor, then :
 - (a) $i_c > i_e$
 - (b) $i_b > i_c$
 - (c) $i_b > i_e$
 - (d) $i_e > i_c$

6. A radioactive substance has an average life of 5 hours. In a time of 5 hours :
 - (a) half of the active nuclei decay
 - (b) less than half of the active nuclei decay
 - (c) more than half of the active nuclei decay
 - (d) all active nuclei decay

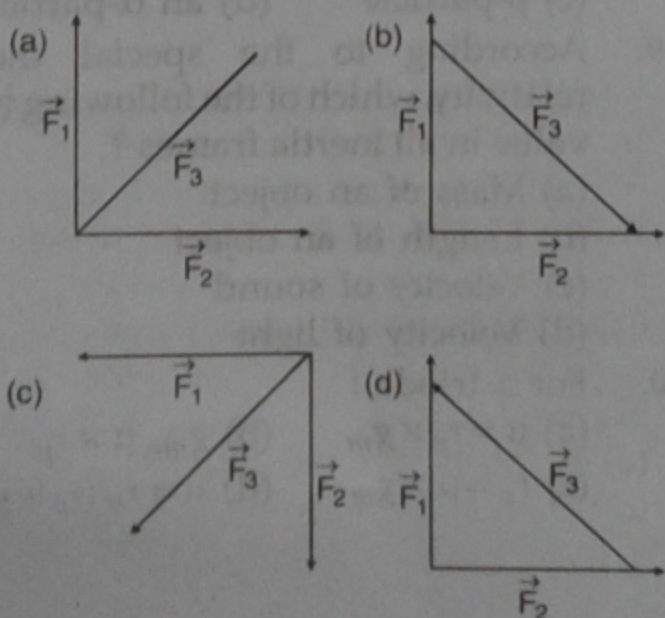
7. Light energy emitted by stars is due to :
 - (a) breaking of nuclei
 - (b) joining of nuclei
 - (c) burning of nuclei
 - (d) reflection of solar light

8. The atomic number and the mass number of an atom remains unchanged when it emits :
 - (a) a photon
 - (b) a neutron
 - (c) β -particle
 - (d) an α -particle

9. According to the special theory of relativity, which of the following has same value in all inertia frames ?
 - (a) Mass of an object
 - (b) Length of an object
 - (c) Velocity of sound
 - (d) Velocity of light

10. For a triode :
 - (a) $\mu = r_p \times g_m$
 - (b) $g_m = \mu \times r_p$
 - (c) $r_p = \mu \times g_m$
 - (d) $\mu = r_p / (r_p + g_m)$

11. A small object placed on a rotating horizontal turn table just slips when it is placed at a distance of 4 cm from the axis of rotation, if the angular velocity of the turn-table is doubled the object slips when its distance from the axis of rotation is :
 (a) 1 cm (b) 2 cm (c) 4 m (d) 8 cm
12. When two parallel wires carry currents in the same direction :
 (a) they attract each other
 (b) they repel each other
 (c) magnetic forces on two wire are perpendicular to each other
 (d) they do not experience any magnetic force
13. The efficiency of Carnot engine is 0.6. It rejects 20 J of heat to sink. The work done by the engine is :
 (a) 20 J (b) 30 J (c) 33.3 J (d) 50 J
14. The dimension of K in the equation $W = \frac{1}{2} Kx^2$ is :
 (a) $[M^1L^0T^{-2}]$ (b) $[M^0L^1T^{-1}]$
 (c) $[M^1L^1T^{-2}]$ (d) $[M^1L^0T^{-1}]$
15. When $\vec{A} \cdot \vec{B} = -|A| \cdot |B|$, then :
 (a) \vec{A} and \vec{B} are perpendicular to each other
 (b) \vec{A} and \vec{B} act in the same direction
 (c) \vec{A} and \vec{B} act in the opposite direction
 (d) \vec{A} and \vec{B} can act in any direction
16. Which of the four arrangements in the figure correctly shows the vector addition of two forces F_1 and F_2 to yield the third force F_3 ?



17. Two bullets are fired simultaneously, horizontally and with different speeds from the same place. Which bullet will hit the ground first ?
 (a) The faster one
 (b) Depends on their mass
 (c) The slower one
 (d) Both will reach simultaneously
18. Heat current is maximum in which of the following (rods are of identical dimension) ?
 (a)

Cu

 (b)

Steel	Cu
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 (c)

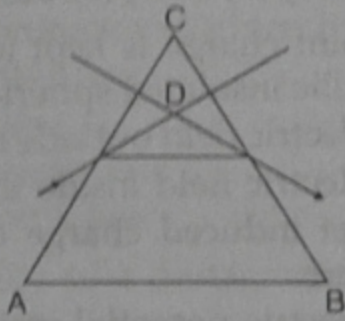
Cu	Steel
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 (d)

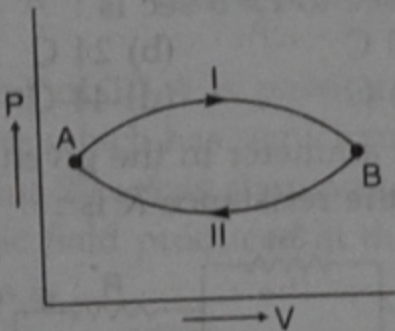
Steel

19. A plumb line is suspended from a ceiling of a car moving with horizontal acceleration of a . What will be the angle of inclination with vertical ?
 (a) $\tan^{-1}\left(\frac{a}{g}\right)$ (b) $\tan^{-1}\left(\frac{g}{a}\right)$
 (c) $\cos^{-1}\left(\frac{a}{g}\right)$ (d) $\cos^{-1}\left(\frac{g}{a}\right)$
20. A body of mass 2 kg is kept by pressing to a vertical wall by a force of 100 N. The friction between wall and body is 0.3. Then the frictional force is equal to :
 (a) 6 N (b) 20 N
 (c) 600 N (d) 700 N
21. A sphere rolls down an inclined plane of inclination θ . What is the acceleration as the sphere reaches bottom ?
 (a) $\frac{5}{7}g \sin \theta$ (b) $\frac{3}{5}g \sin \theta$
 (c) $\frac{2}{7}g \sin \theta$ (d) $\frac{2}{5}g \sin \theta$
22. In a bicycle the radius of rear wheel is twice the radius of front wheel. If r_f and r_r are the radius, v_f and v_r are the speeds of top most points of wheel, then :
 (a) $v_r = 2v_f$ (b) $v_f = 2v_r$
 (c) $v_f = v_r$ (d) $v_f > v_r$

23. In the given figure, what is the angle of prism ?



- (a) A (b) B (c) C (d) D
24. Moment of inertia of an object does not depend upon :
- (a) mass of object (b) mass distribution
(c) angular velocity (d) axis of rotation
25. A particle falls towards earth from infinity. Its velocity on reaching the earth would be :
- (a) infinity (b) $\sqrt{2gR}$
(c) $2\sqrt{gR}$ (d) zero
26. Universal gas constant is :
- (a) C_p/C_v (b) $C_p - C_v$
(c) $C_p + C_v$ (d) C_v/C_p
27. Two bodies of mass m and $4m$ have equal kinetic energy. What is the ratio of their momentum ?
- (a) 1 : 4 (b) 1 : 2
(c) 1 : 1 (d) 2 : 1
28. A gas at state A changes to state B through path I and II shown in figure. The change in internal energy is ΔU_1 and ΔU_2 respectively. Then :



- (a) $\Delta U_1 > \Delta U_2$ (b) $\Delta U_1 < \Delta U_2$
(c) $\Delta U_1 = \Delta U_2$ (d) $\Delta U_1 = \Delta U_2 = 0$
29. According to Kepler's law the time period of a satellite varies with its radius are as :

- (a) $T^2 \propto R^3$ (b) $T^3 \propto R^2$
(c) $R^2 \propto (1/R^3)$ (d) $T^3 \propto (1/R^2)$

30. A particle is moving in a circle with uniform speed v . In moving from a point to another diametrically opposite point :
- (a) the momentum changes by mv
(b) the momentum changes by $2mv$
(c) the kinetic energy changes by $(1/2)mv^2$
(d) the kinetic energy changes by mv^2
31. n small metal drops of same size are charged to V volt each. If they coalesce to form a single large drop, then its potential will be :
- (a) V/n (b) Vn (c) $Vn^{1/3}$ (d) $Vn^{2/3}$
32. In an adiabatic process, the state of a gas is changed from P_1, V_1, T_1 to P_2, V_2, T_2 . Which of the following relation is correct ?
- (a) $T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}$
(b) $P_1 V_1^{\gamma-1} = P_2 V_2^{\gamma-1}$
(c) $T_1 P_1^{\gamma} = T_2 P_2^{\gamma}$
(d) $T_1 V_1^{\gamma} = T_2 V_2^{\gamma}$
33. Minimum and maximum values of Possion's ratio for a metal lies between :
- (a) $-\infty$ to $+\infty$ (b) 0 to 1
(c) $-\infty$ to 1 (d) 0 to 0.5
34. A wire of diameter 1 mm breaks under a tension of 1000 N. Another wire, of same material as that of the first one, but of diameter 2 mm breaks under a tension of :
- (a) 500 N (b) 100 N
(c) 1000 N (d) 4000 N
35. In a capillary tube experiment, a vertical, 30 cm long capillary tube is dipped in water. The water rises upto a height of 10 cm due to capillary action. If this experiment is conducted in a freely falling elevator, the length of the water column becomes :
- (a) 10 cm (b) 20 cm
(c) 30 cm (d) zero

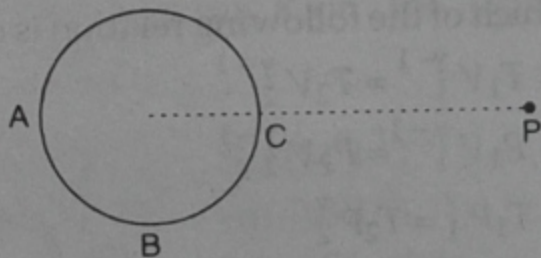
36. An aeroplane gets its upward lift due to a phenomenon described by the :

- (a) Archimedes principle
- (b) Bernoulli's principle
- (c) buoyancy principle
- (d) Pascal law

37. A wooden block is taken to the bottom of a deep, calm lake of water and then released. It rises up with a :

- (a) constant acceleration
- (b) decreasing acceleration
- (c) constant velocity
- (d) decreasing velocity

38. A hollow conducting sphere is placed in an electric field produced by a point charge placed at P as shown in figure. Let V_A, V_B, V_C be the potentials at points A, B and C respectively. Then :



- (a) $V_C > V_B$
- (b) $V_B > V_C$
- (c) $V_A > V_B$
- (d) $V_A = V_C$

39. A parallel plate air capacitor is charged and then isolated. When a dielectric material is inserted between the plates of the capacitor, then which of the following does not change ?

- (a) Electric field between the plates
- (b) Potential difference across the plates
- (c) Charge on the plates
- (d) Energy stored in the capacitor

40. A spherical drop of mercury having a potential of 2.5 V is obtained as a result of merging 125 droplets. The potential of a constituent droplets would be :

- (a) 1.0 V
- (b) 0.5 V
- (c) 0.2 V
- (d) 0.1 V

41. A 10 micro farad capacitor is charged to 500 V and then its plates are joined together through a resistance of 10 ohm.

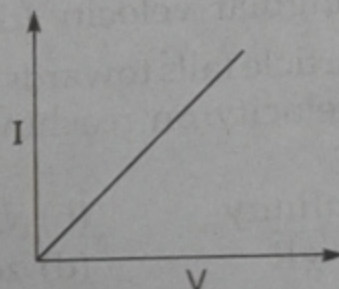
The heat produced in the resistance is :

- (a) 500 J
- (b) 250 J
- (c) 125 J
- (d) 1.25 J

42. A point charge is kept at the centre of a metallic insulated spherical shell. Then :

- (a) electric field outside the sphere is zero
- (b) electric field inside the sphere is zero
- (c) net induced charge on the sphere is zero
- (d) electric potential inside the sphere is zero

43. I - V characteristic of a copper wire of length L and area of cross-section A is shown in figure. The slope of the curve becomes :

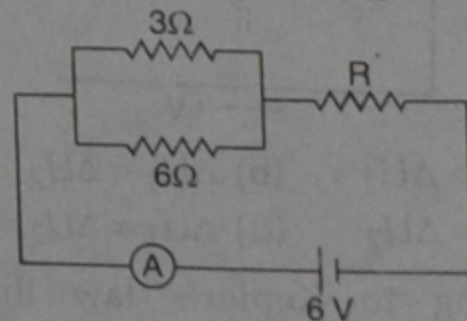


- (a) more if the experiment is performed at higher temperature
- (b) more if a wire of steel of same dimension is used
- (c) more if the length of the wire is increased
- (d) less if the length of the wire increased

44. The current in a conductor varies with time t as $I = 2t + 3t^2$, where I is in ampere and t in seconds. Electric charge flowing through a section of the conductor during $t = 2$ sec to $t = 3$ sec is :

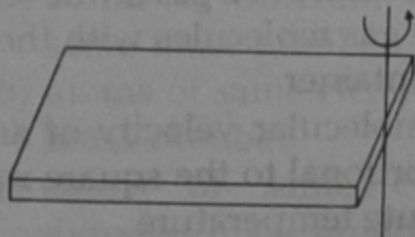
- (a) 10 C
- (b) 24 C
- (c) 33 C
- (d) 44 C

45. If the ammeter in the given circuit reads 2 A, the resistance R is :

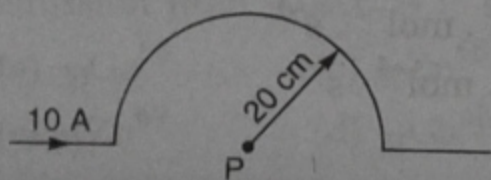


- (a) 1 Ω
- (b) 2 Ω
- (c) 3 Ω
- (d) 4 Ω

46. The magnetic field near a current carrying conductor is given by :
 (a) Coulomb's law
 (b) Lenz's law
 (c) Biot-Savart's law
 (d) Kirchoff's law
47. Susceptibility of a diamagnetic substance is :
 (a) zero (b) negative
 (c) less than 1 (d) greater than 1
48. A 50 ohm galvanometer gets full scale deflection when a current of 0.01 A pass through the coil. When it is converted to a 10 A ammeter, the shunt resistance is :
 (a) 0.01Ω (b) 0.05Ω
 (c) 2000Ω (d) 5000Ω
49. A horizontal rod of length L rotates about a vertical axis with a uniform angular velocity ω . A uniform magnetic field B exists parallel to the axis of rotation. Then potential difference between the to ends of the rod is :



- (a) $\omega L^2 B$ (b) $\omega^2 L B$
 (c) $\frac{1}{2} \omega L^2 B$ (d) $\frac{1}{2} \omega^2 L B$
50. A current of 10 A is passing through a long wire which has semicircular loop of the radius 20 cm as shown in the figure. Magnetic field produced at the centre of the loop is :



- (a) $10\pi \mu T$ (b) $5\pi \mu T$
 (c) $4\pi \mu T$ (d) $2\pi \mu T$

51. An a.c. source is rated at 220 V, 50 Hz. The time taken for voltage to change from its peak value to zero is :
 (a) 50 sec (b) 0.02 sec
 (c) 5 sec (d) 5×10^{-3} sec
52. An ideal transformer has 500 and 5000 turn in primary and secondary windings respectively. If the primary voltage is connected to a 6 V battery then the secondary voltage is :
 (a) zero (b) 60 V
 (c) 0.6 V (d) 6.0 V
53. Resistance in the two gaps of a meter bridge are 10 ohm and 30 ohm respectively. If the resistances are interchanged the balance point shifts by :
 (a) 33.3 cm (b) 66.67 cm
 (c) 25 cm (d) 50 cm
54. When a plane electromagnetic wave enters a glass slab, then which of the following will not change ?
 (a) Wavelength (b) Frequency
 (c) Speed (d) Amplitude
55. A source emits a sound of frequency of 400 Hz, but the listener hears its to be 390 Hz. Then :
 (a) the listener is moving towards the source
 (b) the source is moving towards the listener
 (c) the listener is moving away from the source
 (d) the listener has a defective ear
56. A particle executing simple harmonic motion along y -axis has its motion described by the equation $y = A \sin(\omega t) + B$. The amplitude of the simple harmonic motion is :
 (a) A (b) B
 (c) $A + B$ (d) $\sqrt{A + B}$
57. An open pipe resonates with a tuning fork of frequency 500 Hz. It is observed that two successive nodes are formed at distances 16 and 46 cm from the open

6

end. The speed of sound in air in the pipe is :

- (a) 230 m/s (b) 300 m/s
(c) 320 m/s (d) 360 m/s

58. It takes 2.0 seconds for a sound wave to travel between two fixed points when the day temperature is 10°C . If the temperature rises to 30°C the sound wave travels between the same fixed parts in :

- (a) 1.9 sec (b) 2.0 sec
(c) 2.1 sec (d) 2.2 sec

59. Two plane mirrors are inclined to each other at an angle of 60° . A point object is placed in between them. The total number of images produced by both the mirrors is :

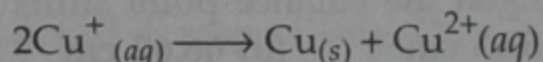
- (a) 2 (b) 4 (c) 5 (d) 6

60. For a real object, which of the following can produced a real image ?

- (a) Plane mirror
(b) Concave lens
(c) Convex mirror
(d) Concave mirror

CHEMISTRY

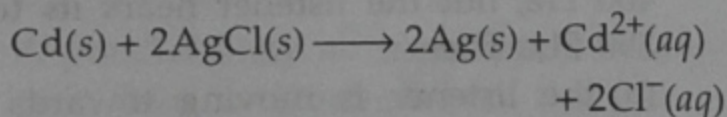
1. The standard e.m.f. for the cell reaction,



is $+0.36\text{ V}$ at 298 K . The equilibrium constant of the reaction is :

- (a) 5×10^6 (b) 1.4×10^{12}
(c) 7.4×10^{12} (d) 1.2×10^6

2. The standard e.m.f. of the cell, $\text{Cd}(s) | \text{CdCl}_2(aq) (0.1\text{ M}) || \text{AgCl}(s) | \text{Ag}(s)$ in which the cell reaction is :



is 0.6915 V at 0°C and 0.6753 V at 25°C . The enthalpy change of the reaction at 25°C is :

- (a) -176 kJ (b) -234.7 kJ
(c) $+123.5\text{ kJ}$ (d) -167.26 kJ

3. Which of the following statement is true ?

- (a) The relative lowering of vapour pressure of a solution is equal to the mole fraction of the solute present in the solution
(b) Passage of solute molecules towards solution side through semipermeable membrane is osmosis.
(c) The boiling point of a solution is always lower than the solvent
(d) The boiling point of a liquid is the temperature at which its vapour pressure becomes equal to 260 mm

4. The deviation from the ideal gas behaviour of a gas can be expressed as :

- (a) $Z = \frac{P}{VRT}$ (b) $Z = \frac{PV}{nRT}$
(c) $Z = \frac{nRT}{PV}$ (d) $Z = \frac{VR}{PT}$

5. Which of the following statement is not true ?

- (a) The pressure of a gas is due to collision of the gas molecules with the walls of the container
(b) The molecular velocity of any gas is proportional to the square root of the absolute temperature
(c) The rate of diffusion of a gas is directly proportional to the density of the gas at constant pressure
(d) Kinetic energy of an ideal gas is directly proportional to the absolute temperature

6. The unit of second order reaction rate constant is :

- (a) $\text{L}^{-1} \cdot \text{mol} \cdot \text{s}^{-1}$
(b) $\text{L}^2 \cdot \text{mol}^{-2} \cdot \text{s}^{-1}$
(c) $\text{L} \cdot \text{mol}^{-1} \cdot \text{s}^{-1}$
(d) s^{-1}

7. Hess' law states that :

- (a) the standard enthalpy of an overall reaction is the sum of the enthalpy changes in individual reactions

- (b) enthalpy of formation of a compound is same as the enthalpy of decomposition of the compound into constituent elements, but with opposite sign
- (c) at constant temperature the pressure of a gas is inversely proportional to its volume
- (d) the mass of a gas dissolved per litre of a solvent is proportional to the pressure of the gas in equilibrium with the solution
8. The half-life of a reaction is halved as the initial concentration of the reactant is doubled. The order of the reaction is
 (a) 0.5 (b) 1
 (c) 2 (d) 0
9. One gram of (A) decays by β -emission to 0.125 g in 200 years. The half-life period of the reaction is :
 (a) 0.014 years (b) 6.66 years
 (c) 66.6 years (d) 666 years
10. Isotopes are :
 (a) atoms of different elements having same mass number
 (b) atoms of same elements having same mass number
 (c) atoms of same elements having different mass number
 (d) atoms of different elements having same number of neutrons
11. Acid hydrolysis of sucrose is a :
 (a) pseudo first order reaction
 (b) zero order reaction
 (c) second order reaction
 (d) unimolecular reaction
12. The product obtained after positron emission from ${}_{31}\text{Ga}^{68}$ is :
 (a) ${}_{30}\text{Ga}^{68}$ (b) ${}_{30}\text{Zn}^{68}$
 (c) ${}_{31}\text{Zn}^{69}$ (d) ${}_{31}\text{Ga}^{69}$
13. The relationship between coefficient of viscosity of a liquid and temperature can be expressed as :
 (a) $\eta = Ae^{ERT}$ (b) $\eta = Ae^{E/RT}$
 (c) $\eta = ET/R$ (d) $\eta = Ae^{RT/E}$
14. An aqueous solution in which the H^+ ion concentration is greater than 10^{-7} M is said to be
 (a) acidic (b) alkaline
 (c) neutral (d) none of these
15. In the hydrolysis of a salt of weak acid and weak base, the hydrolysis constant K_h is equal to :
 (a) $\frac{K_w}{K_b}$ (b) $\frac{K_w}{K_a}$
 (c) $\frac{K_w}{K_a \cdot K_b}$ (d) $K_a \cdot K_b$
16. In the following reaction,
 $\text{AgCl} + \text{KI} \rightleftharpoons \text{KCl} + \text{AgI}$
 as KI is added, the equilibrium is shifted towards right giving more AgI precipitate, because :
 (a) both AgCl and AgI are sparingly soluble
 (b) the K_{sp} of AgI is lower than K_{sp} of AgCl
 (c) the K_{sp} of AgI is higher than K_{sp} of AgCl
 (d) both AgCl and AgI have same solubility product
17. In the nuclear reaction;
 ${}_{13}\text{Al}^{27} + {}_2\text{He}^4 \longrightarrow {}_{14}\text{X}^{30} + {}_1\text{H}^1$, X is :
 (a) Si (b) Al (c) Mg (d) P
18. What kind of a molecule AlCl_3 is ?
 (a) Bronsted acid (b) Lewis acid
 (c) Lewis base (d) Bronsted base
19. How much $\text{K}_2\text{Cr}_2\text{O}_7$ (Molecular weight = 294.19) is required to prepare one litre of 0.1 N solution ?
 (a) 9.8063 g (b) 7.3548 g
 (c) 3.6774 g (d) 4.903 g
20. The ionic strength of a solution containing 0.1 mol/kg of KCl and 0.2 mol/kg of CuSO_4 is :
 (a) 0.3 (b) 0.6 (c) 0.9 (d) 0.2

21. A gas can expand from 100 mL to 250 mL under a constant pressure of 2 atm. The work done by gas is :
(a) 30.38 joule (b) 25 joule
(c) 5 k joule (d) 16 joule
22. If the r.m.s. speed of a gaseous molecule is x m/sec at a pressure P atm, then what will be the r.m.s. speed at a pressure $2P$ atm and constant temperature ?
(a) x (b) $2x$ (c) $4x$ (d) $x/4$
23. Ionic mobility of Ag^+ is ($\lambda_{\text{Ag}^+} = 5 \times 10^{-1} \text{ ohm}^{-1} \text{ cm}^2 \text{ eq}^{-1}$) :
(a) 5.2×10^{-9} (b) 2.4×10^{-9}
(c) 1.52×10^{-9} (d) 8.25×10^{-9}
24. Which among the following is the strongest acid ?
(a) HF (b) HCl (c) HBr (d) HI
25. What is the general outer electronic configuration of the coinage metals ?
(a) $ns^2 np^6$ (b) $(n-1)d^{10} ns^1$
(c) $(n-1)d^{10} ns^2$ (d) $(n-1)d^9 ns^2$
26. How does the ionisation energy of 1st group elements vary ?
(a) Increases down the group
(b) Decreases down the group
(c) Remains unchanged
(d) Variation is not regular
27. What is the oxidation number of chlorine in ClO_3^- ?
(a) +5 (b) +3 (c) +4 (d) +2
28. What type of hybridisation takes place in the N atom of NH_3 ?
(a) sp^2 (b) sp^3 (c) dsp^2 (d) sp
29. What is the co-ordination number of Cl^- in NaCl crystal ?
(a) 8 (b) 6 (c) 4 (d) 3
30. How many electrons are involved in oxidation of KMnO_4 in basic medium ?
(a) 1 (b) 2 (c) 5 (d) 3
31. The magnetic moment of $\text{K}_3[\text{Fe}(\text{CN})_6]$ is found to be 1.7 BM. How many unpaired electron (s) is/are present per molecule ?
(a) 1 (b) 2
(c) 3 (d) 4
32. Which among the following is an electron deficient compound ?
(a) NF_3 (b) PF_3
(c) BF_3 (d) AsF_3
33. Arrange the hydra-acids of halogens in increasing order of acidity.
(a) $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$
(b) $\text{HI} < \text{HBr} < \text{HCl} < \text{HF}$
(c) $\text{HF} < \text{HBr} < \text{HI} < \text{HCl}$
(d) $\text{HF} < \text{HI} < \text{HBr} < \text{HCl}$
34. What is the product of the reaction of H_2O_2 with Cl_2 ?
(a) $\text{O}_2 + \text{HOCl}$ (b) $\text{HCl} + \text{O}_2$
(c) $\text{H}_2\text{O} + \text{HCl}$ (d) $\text{HCl} + \text{H}_2$
35. Which of the following organo-silicon compound on hydrolysis will give a three dimensional silicone ?
(a) R_3SiCl (b) RSiCl_3
(c) SiCl_4 (d) R_2SiCl_2
36. NaOCl is used as a bleaching agent and sterilising agent. It can be synthesized by the action of
(a) NaCl with H_2O
(b) NH_4Cl with NaOH
(c) Cl_2 with cold and dilute NaOH
(d) Cl_2 with hot and concentrated NaOH
37. How can you synthesize nitric oxide in the laboratory ?
(a) Zinc with cold and dilute HNO_3
(b) Zinc with concentrated HNO_3
(c) Copper with cold and dilute HNO_3
(d) Heating NH_4NO_3
38. Which of the following does not have a lone pair on the central atom ?
(a) NH_3 (b) PH_3 (c) BF_3 (d) PCl_3
39. Which colourless gas evolves when NH_4Cl reacts with zinc in a dry cell battery ?
(a) NH_3 (b) N_2 (c) H_2 (d) Cl_2

40. What is the nature of the bond between B and O in $(C_2H_5)_2OBH_3$?
 (a) Covalent
 (b) Co-ordinate covalent
 (c) Ionic bond
 (d) Banana shaped bond
41. An alkene gives two moles of HCHO, one mole of CO_2 and one mole of CH_3COCHO on ozonolysis. What is its structure ?
 (a) $CH_2=C(CH_3)-CH_2-CH_3$
 (b) $CH_2=CH-CH(CH_3)-CH=CH_2$
 (c) $CH_2=C(CH_3)-C(CH_3)=CH_2$
 (d) $CH_2=C=C-CH=CH_2$
42. IUPAC name of the compound,

$$\begin{array}{c}
 CH_3 \\
 | \\
 CH_3-CH_2-CH-CH_2-CH-CH_2-CH_2-CH_3 \\
 | \\
 CH \\
 / \quad \backslash \\
 CH_3 \quad CH_3
 \end{array}$$
 (a) 4-isopropyl, 6-methyl octane
 (b) 3-methyl, 5-(1-methyl ethyl) octane
 (c) 3-methyl, 5-isopropyl octane
 (d) 6-methyl, 4-(1-methylethyl) octane
43. The order of melting point of *ortho*, *para*, *meta*-nitrophenol is
 (a) $o > m > p$ (b) $p > m > o$
 (c) $m > p > o$ (d) $p > o > m$
44. When $CHCl_3$ is boiled with NaOH, it gives :
 (a) formic acid (b) trihydroxy methane
 (c) acetylene (d) sodium formate
45. Which of the following is an example of ketohexose ?
 (a) Mannose (b) Galactose
 (c) Maltose (d) Fructose
46. When aniline is treated with sodium nitrite and hydrochloric acid at $0^\circ C$, it gives
 (a) phenol and N_2
 (b) diazonium salt
 (c) hydrazo compound
 (d) no reaction takes place
47. When benzoic acid is treated with PCl_5 at $100^\circ C$, it gives :
 (a) benzoyl chloride
 (b) *o*-chlorobenzoic acid
 (c) *p*-chlorobenzoic acid
 (d) benzyl chloride
48. The key step in Cannizaro's reaction is the intermolecular shift of :
 (a) proton (b) hydride ion
 (c) hydronium ion (d) hydrogen bond
49. Aldehydes and ketones can be reduced to hydrocarbon by using :
 (a) $LiAlH_4$
 (b) $H_2/Pd-BaSO_4$
 (c) Na-Hg/HCl
 (d) NH_2-NH_2/C_2H_5ONa
50. Cinnamic acid is formed when C_6H_5-CHO condenses with $(CH_3CO)_2O$ in presence of :
 (a) concentrated H_2SO_4
 (b) sodium acetate
 (c) sodium metal
 (d) anhydrous $ZnCl_2$
51. What is the product of the reaction of phenol with $CHCl_3$ in aqueous NaOH and subsequent acid hydrolysis ?
 (a) Salicylic acid (b) Salicylaldehyde
 (c) Benzoic acid (d) Benzaldehyde
52. On treatment with chlorine in presence of sunlight, toluene gives the product :
 (a) *o*-chloro toluene
 (b) 2, 5-dichloro toluene
 (c) *p*-chloro toluene
 (d) benzyl chloride

53. Which of the following cycloalkane gives open chain compound, when reacts with bromine ?
 (a) Cyclopropane (b) Cyclopentane
 (c) Cyclohexane (d) Cyclooctane
54. Which of the following intermediate have the complete octet around the carbon atom ?
 (a) Carbonium ion (b) Carbanion
 (c) Free radical (d) Carbene
55. If the dipole moment of toluene and nitro-benzene are 0.43 D and 3.93 D, then what is the expected dipole moment of *p*-nitro toluene ?
 (a) 3.50 D (b) 2.18 D
 (c) 4.36 D (d) 5.30 D
56. What is the product when 2-butyne is treated with liquid NH_3 in presence of lithium ?
 (a) *n*-butane (b) *cis*-2-butene
 (c) *trans*-2-butene (d) 1-butene
57. In the dichlorination reaction of propane, mixture of products are obtained. How many isomers the mixture contains ?
 (a) 2 (b) 3
 (c) 4 (d) 5
58. Cyclopentadienyl anion is :
 (a) aromatic (b) non-aromatic
 (c) non-planar (d) aliphatic
59. What is the product of the reaction of 1, 3-butadiene with Br_2 ?
 (a) 1, 4-dibromo butene
 (b) 1, 2-dibromo butene
 (c) 3, 4-dibromo butene
 (d) 2, 3-dibromo-2-butene
60. The most common type of reaction in aromatic compounds is :
 (a) elimination reaction
 (b) addition reaction
 (c) electrophilic substitution reaction
 (d) rearrangement reaction

MATHEMATICS

1. The equation of the plane through the intersection of the planes $x + y + z = 1$ and $2x + 3y - z + 4 = 0$ and parallel to *x*-axis is :
 (a) $y - 3z + 6 = 0$ (b) $3y - z + 6 = 0$
 (c) $y + 3z + 6 = 0$ (d) $3y - 2z + 6 = 0$
2. The distance of the point (3, 8, 2) from the line $\frac{x-1}{2} = \frac{y-3}{4} = \frac{z-2}{3}$ measured parallel to the plane $3x + 2y - 2z + 15 = 0$ is :
 (a) 2 (b) 3
 (c) 6 (d) $\frac{19}{2}$
3. Let (3, 4, -1) and (-1, 2, 3) are the end points of a diameter of sphere. Then the radius of the sphere is equal to :
 (a) 1 (b) 2
 (c) 3 (d) 9
4. If A, B, C, D are the points (2, 3, -1), (3, 5, -3), (1, 2, 3), (3, 5, 7) respectively, then the angle between AB and CD is :
 (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$
 (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$
5. If $u = \log \left(\frac{x^2 + y^2}{x + y} \right)$, then the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is :
 (a) -1 (b) 0
 (c) 1 (d) 2
6. A five digits number is formed by writing the digits 1, 2, 3, 4, 5 in a random order without repetitions. Then the probability that the number is divisible by 4, is :
 (a) $\frac{3}{5}$ (b) $\frac{18}{5}$
 (c) $\frac{1}{5}$ (d) $\frac{6}{5}$

7. Two persons A and B takes turns in throwing a pair of dice. The first person to throw 9 from both dice will be awarded the price. If A throws first, then the probability that B wins the game, is :
- (a) $9/17$ (b) $8/17$
(c) $8/9$ (d) $1/9$
8. The probability that in a year of the 22nd century chosen at random, then there will be 53 Sundays, is :
- (a) $3/28$ (b) $2/28$
(c) $7/28$ (d) $5/28$
9. The standard deviation of a variable x is 10. Then the standard deviation of $50 + 5x$ is :
- (a) 50 (b) 550
(c) 10 (d) 500
10. The octal equivalent of the decimal number 0.3125 is :
- (a) 0.24 (b) 0.42
(c) 0.39 (d) 0.98
11. The hexadecimal equivalent of the binary number 11110001010001 is
- (a) 15C3 (b) C351
(c) 3C51 (d) C315
12. A real value of x will satisfy the equation $\left(\frac{3-4ix}{3+4ix}\right) = \alpha - i\beta$ (α, β are real), if :
- (a) $\alpha^2 - \beta^2 = -1$ (b) $\alpha^2 - \beta^2 = 1$
(c) $\alpha^2 + \beta^2 = 1$ (d) $\alpha^2 - \beta^2 = 2$
13. If ω is a complex cube root of unity, then the value of
- $$\frac{p+q\omega+r\omega^2}{r+p\omega+q\omega^2} + \frac{p+q\omega+r\omega^2}{q+r\omega+p\omega^2}$$
- ($p, q, r \in R$) is equal to :
- (a) 0 (b) 1
(c) -1 (d) 2
14. If P, Q, R, S are represented by the complex numbers $4+i, 1+6i, -4+3i, -1-2i$ respectively, then $PQRS$ is a :
- (a) rectangle (b) square
(c) rhombus (d) parallelogram
15. If n is a positive integer, then $(1+i)^n + (1-i)^n$ is equal to :
- (a) $(\sqrt{2})^{n-2} \cos\left(\frac{n\pi}{4}\right)$
(b) $(\sqrt{2})^{n-2} \sin\left(\frac{n\pi}{4}\right)$
(c) $(\sqrt{2})^{n+2} \cos\left(\frac{n\pi}{4}\right)$
(d) $(\sqrt{2})^{n+2} \sin\left(\frac{n\pi}{4}\right)$
16. The number of ways in which 9 persons can be divided into three equal groups is :
- (a) 1680 (b) 840
(c) 560 (d) 280
17. A dictionary is printed consisting of 7 letters words only that can be made with a letters of the word CRICKET. If the words are printed at the alphabetical order as in an ordinary dictionary, then the number of words before the word CRICKET is :
- (a) 530 (b) 480
(c) 531 (d) 481
18. If the sum of the coefficient in the expansion of $(x+y)^n$ is 1024, then the value of the greatest coefficient in the expansion is :
- (a) 356 (b) 252
(c) 210 (d) 120
19. The value of the determinant
- $$\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$$
- is :
- (a) $2(10!11!)$
(b) $2(10!13!)$
(c) $2(10!11!12!)$
(d) $2(11!12!13!)$

20. If A and B are 3×3 matrices such that $AB = B$ and $BA = A$, then :
- (a) $A^2 = A$ and $B^2 \neq B$
 (b) $A^2 \neq A$ and $B^2 = B$
 (c) $A^2 = A$ and $B^2 = B$
 (d) $A^2 \neq A$ and $B^2 \neq B$
21. If the points (x_1, y_1) , (x_2, y_2) and (x_3, y_3) are collinear, then the rank of the matrix $\begin{bmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{bmatrix}$ will always be less than :
- (a) 2 (b) 3
 (c) 1 (d) none of these
22. The system of equations; $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ has no solution for :
- (a) $\lambda \neq 3, \mu = 10$ (b) $\lambda = 3, \mu \neq 10$
 (c) $\lambda \neq 3, \mu \neq 10$ (d) none of these
23. If $A = \begin{vmatrix} \sin(\theta + \alpha) & \cos(\theta + \alpha) & 1 \\ \sin(\theta + \beta) & \cos(\theta + \beta) & 1 \\ \sin(\theta + \gamma) & \cos(\theta + \gamma) & 1 \end{vmatrix}$ then :
- (a) $A = 0$ for all θ
 (b) A is an odd function of θ
 (c) $A = 0$ for $\theta = \alpha + \beta + \gamma$
 (d) A is independent of θ
24. An investigator interviewed 100 students to determine the performance of three drinks milk, coffee and tea. The investigator reported that 10 students take all three drinks milk, coffee and tea; 20 students take milk and coffee, 30 students take coffee and tea, 25 students take milk and tea, 12 students take milk only, 5 students take coffee only and 8 students take tea only. Then the number of students who did not take any of the three drinks, is :
- (a) 10 (b) 20 (c) 25 (d) 30
25. Let $Y = \{1, 2, 3, 4, 5\}$, $A = \{1, 2\}$, $B = \{3, 4, 5\}$ and ϕ denotes null set. If $(A \times B)$ denotes cartesian product of the sets A and B , then $(Y \times A) \cap (Y \times B)$ is :
- (a) Y (b) A
 (c) B (d) ϕ
26. Let $A = \{2, 3, 4, 5, \dots, 16, 17, 18\}$. Let \approx be the equivalence relation on $A \times A$ cartesian product of A and A , defined by $(a, b) \approx (c, d)$ if $ad = bc$, then the number of ordered pairs of the equivalence class of $(3, 2)$ is :
- (a) 4 (b) 5
 (c) 6 (d) 7
27. A question "who have studied Physics?" was asked to three students A, B and C . The question was answered correctly as it is true that if A studied Physics, then B also studied Physics, but it is a false statement that if C studied Physics, then B also studied Physics. Then Physics was studied by :
- (a) both A and B (b) only A
 (c) only B (d) only C
28. If a, b be two fixed positive integers such that $f(a+x) = b + [b^3 + 1 - 3b^2 f(x) + 3b \{f(x) - \{f(x)\}^3\}^{1/3}]^{1/3}$ for all real x , then $f(x)$ is a periodic function with period :
- (a) a (b) $2a$
 (c) b (d) $2b$
29. The domain of the function $f(x) = \log_{3+x}(x^2 - 1)$ is :
- (a) $(-3, -1) \cup (1, \infty)$
 (b) $[-3, -1] \cup [1, \infty)$
 (c) $(-3, -2) \cup (-2, -1) \cup (1, \infty)$
 (d) $[-3, -2) \cup (-2, -1) \cup (1, \infty)$
30. The value of $\cot 70^\circ + 4 \cos 70^\circ$ is :
- (a) $1/\sqrt{3}$ (b) $\sqrt{3}$
 (c) $2\sqrt{3}$ (d) $1/2$
31. The equation $\sin x + \sin y + \sin z = -3$ for $0 \leq x \leq 2\pi, 0 \leq y \leq 2\pi, 0 \leq z \leq 2\pi$ has :
- (a) one solution
 (b) two sets of solution
 (c) four sets of solution
 (d) no solution

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32. If $\theta = \sin^{-1} x + \cos^{-1} x - \tan^{-1} x$, $x \geq 0$ 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) $\frac{\pi}{4} \leq \theta \leq \frac{\pi}{2}$

33. Let A, B and C are the angles of a plain triangle and $\tan\left(\frac{A}{2}\right) = \frac{1}{3}$, $\tan\left(\frac{B}{2}\right) = \frac{2}{3}$.

Then $\tan\left(\frac{C}{2}\right)$ is equal to :

(a) $7/9$ (b) $2/9$ (c) $1/3$ (d) $2/3$

34. If α, β ($\alpha \neq \beta$) satisfies the equation $a \cos \theta + b \sin \theta = c$, then the value of

$\tan\left(\frac{\alpha + \beta}{2}\right)$ is :

(a) b/a (b) c/a (c) a/b (d) c/b

35. A ray of light passing through the point $(1, 2)$ is reflected on the x -axis at a point P and passes through the point $(5, 3)$, then the abscissa of a point P is :

(a) 3 (b) $13/3$

(c) $13/5$ (d) $13/4$

36. The equation $4x^2 - 24xy + 11y^2 = 0$ represents :

(a) two parallel lines

(b) two perpendicular lines

(c) two lines through the origin

(d) a circle

37. The length of the chord joining the points in which the straight line $\frac{x}{3} + \frac{y}{4} = 1$ cuts

the circle $x^2 + y^2 = \frac{169}{25}$ is :

(a) 1 (b) 2

(c) 4 (d) 8

38. The normal to the parabola $y^2 = 8x$ at the point $(2, 4)$ meets the parabola again at the point :

(a) $(-18, -12)$ (b) $(-18, 12)$

(c) $(18, 12)$ (d) $(18, -12)$

39. If a bar of given length moves with its extremities on two fixed straight lines at right angles, then the locus of any point on bar marked on the bar describes a/an:

(a) circle (b) parabola

(c) ellipse (d) hyperbola

40. The straight line $x + y = \sqrt{2} p$ will touch the hyperbola $4x^2 - 9y^2 = 36$ if :

(a) $p^2 = 2$ (b) $p^2 = 5$

(c) $5p^2 = 2$ (d) $2p^2 = 5$

41. The function $f(x) = \frac{1 - \sin x + \cos x}{1 + \sin x + \cos x}$ is not defined at $x = \pi$. The value of $f(\pi)$, so that $f(x)$ is continuous at $x = \pi$, is :

(a) $-1/2$ (b) $1/2$

(c) -1 (d) 1

42. If $f(x) = \sin^2 x$ and the composite function $g(f(x)) = |\sin x|$, then the function $g(x)$ is equal to :

(a) $\sqrt{x-1}$ (b) \sqrt{x}

(c) $\sqrt{x+1}$ (d) $-\sqrt{x}$

43. Area of the figure bounded by the curves $y = |x-1|$ and $y = 3 - |x|$ is :

(a) 1 sq. units (b) 2 sq. units

(c) 3 sq. units (d) 4 sq. units

44. Let $x = \left[\frac{a+2b}{a+b} \right]$ and $y = \frac{a}{b}$, where a and

b are positive integers. If $y^2 > 2$, then :

(a) $x^2 \leq 2$ (b) $x^2 < 2$

(c) $x^2 > 2$ (d) $x^2 \geq 2$

45. $\int_0^1 \tan^{-1} \left(\frac{1}{x^2 - x + 1} \right) dx$ is :

(a) $\log 2$ (b) $-\log 2$

(c) $\frac{\pi}{2} + \log 2$ (d) $\frac{\pi}{2} - \log 2$

46. The curves $x = \log(y+e)$ and $y = \log\left(\frac{1}{x}\right)$:

(a) do not meet

(b) meet at one point

(c) meet at two points

(d) meet at more than two points

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47. $\lim_{x \rightarrow 0} \frac{\cos(\sin x) - 1}{x^2}$ equals :

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

48. Let $\vec{a}, \vec{b}, \vec{c}$ be three vectors form
 $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \times \vec{c}$, if :

- (a) $\vec{b} \times (\vec{a} \times \vec{c}) = 0$ (b) $\vec{a} (\vec{b} \times \vec{c}) = 0$
(c) $\vec{c} \times \vec{a} = \vec{a} \times \vec{b}$ (d) $\vec{c} \times \vec{b} = \vec{b} \times \vec{a}$

49. If $\hat{i}, \hat{j}, \hat{k}$ are unit vectors and $|\vec{a}| = a$, then the value of

$$|\hat{i} \times \vec{a}|^2 + |\hat{j} \times \vec{a}|^2 + |\hat{k} \times \vec{a}|^2 \text{ is :}$$

- (a) a^2 (b) $3a^2$ (c) $2a^2$ (d) $4a^2$

50. If the area above the x-axis bounded by the curves $y = 2^{kx}$ and $x = 0$ and $x = 2$ is

$$\frac{3}{\log 2}, \text{ then the value of } k \text{ is :}$$

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

51. The value of $\int_a^b \frac{x}{|x|} dx, a < b < 0$ is :

- (a) $-(|a| + |b|)$ (b) $|b| - |a|$
(c) $|a| - |b|$ (d) $|a| + |b|$

52. The value of

$$\int_{-2}^2 \left[p \log \left(\frac{1+x}{1-x} \right) + q \log \left(\frac{1-x}{1+x} \right)^{-2} + r \right] dx$$

depends on :

- (a) the value of p
(b) the value of q
(c) the value of r
(d) the value of p and q

53. A curve having the condition that the slope of tangent at some point is two times the slope of the straight line joining the same point to the origin of co-ordinates, is a/an :

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

54. If a is an arbitrary constant, then solution of the differential equation

$$\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0 \text{ is :}$$

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

55. A particle is moving along the curve $x = at^2 + bt + c$. If $ac = b^2$, then the particle would be moving with uniform:

- (a) rotation (b) velocity
(c) acceleration (d) retardation

56. The solution of the equation

$$x^2 \frac{d^2 y}{dx^2} = \log x \text{ when } x=1, y=0 \text{ and}$$

$$\frac{dy}{dx} = -1 \text{ is :}$$

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

57. Let the unit vectors \vec{a} and \vec{b} be perpendicular to each other and the unit vector \vec{c} be inclined at an angle θ to both \vec{a} and \vec{b} . If $\vec{c} = \alpha \vec{a} + \beta \vec{b} + \gamma (\vec{a} \cdot \vec{b})$, where α, β, γ are scalars, then :

- (a) $\alpha = \cot \theta, \beta = \sin \theta, \gamma^2 = \cos 2\theta$
(b) $\alpha = \cos \theta, \beta = \cos \theta, \gamma^2 = \cos 2\theta$
(c) $\alpha = \cos \theta, \beta = \sin \theta, \gamma^2 = \cos 2\theta$
(d) $\alpha = \sin \theta, \beta = \cos \theta, \gamma^2 = -\cos 2\theta$

58. If $y = \frac{1}{\sqrt{a^2 - b^2}} \cos^{-1} \left[\frac{a \cos(x - \alpha) + b}{\theta} \right]$

where $\theta = a + b \cos(x - \alpha)$, then $\frac{dy}{dx}$ is equal to :

- (a) $1/\theta$ (b) $2/\theta$
(c) $1/\theta^2$ (d) $2/\theta^2$

59. Let K be a set of real number and $f: K \rightarrow R$ such that for all x and y $|f(x) - f(y)| \leq |x - y|^5$. If $f(3) = 7$, then the value of $f(9)$ is equal to :
- (a) 5 (b) 7
(c) 9 (d) 11
60. If $f(x) = \frac{1}{1-x}$ then the derivative of the composite function $f[f(f(x))]$ is equal to :
- (a) 0 (b) $1/2$
(c) 1 (d) 2

Answers

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PHYSICS

1. (c) 2. (b) 3. (d) 4. (c) 5. (d) 6. (c) 7. (b) 8. (a) 9. (d) 10. (a)
11. (a) 12. (a) 13. (b) 14. (a) 15. (c) 16. (a) 17. (d) 18. (a) 19. (a) 20. (b)
21. (a) 22. (c) 23. (c) 24. (c) 25. (b) 26. (b) 27. (b) 28. (c) 29. (a) 30. (b)
31. (d) 32. (a) 33. (d) 34. (d) 35. (c) 36. (b) 37. (a) 38. (d) 39. (c) 40. (d)
41. (d) 42. (b) 43. (a) 44. (b) 45. (a) 46. (c) 47. (b) 48. (b) 49. (c) 50. (b)
51. (d) 52. (a) 53. (d) 54. (b) 55. (c) 56. (a) 57. (b) 58. (a) 59. (c) 60. (d)

CHEMISTRY

1. (d) 2. (d) 3. (a) 4. (b) 5. (c) 6. (c) 7. (a) 8. (c) 9. (c) 10. (c)
11. (a) 12. (b) 13. (b) 14. (a) 15. (c) 16. (b) 17. (a) 18. (b) 19. (d) 20. (a)
21. (a) 22. (a) 23. (a) 24. (d) 25. (b) 26. (b) 27. (a) 28. (b) 29. (b) 30. (a)
31. (a) 32. (c) 33. (a) 34. (b) 35. (b) 36. (c) 37. (c) 38. (c) 39. (c) 40. (b)
41. (d) 42. (b) 43. (b) 44. (d) 45. (d) 46. (b) 47. (a) 48. (b) 49. (d) 50. (b)
51. (b) 52. (d) 53. (a) 54. (b) 55. (c) 56. (c) 57. (c) 58. (a) 59. (b) 60. (c)

MATHEMATICS

1. (a) 2. (d) 3. (c) 4. (a) 5. (c) 6. (c) 7. (b) 8. (d) 9. (a) 10. (c)
11. (c) 12. (c) 13. (c) 14. (b) 15. (c) 16. (a) 17. (a) 18. (b) 19. (c) 20. (c)
21. (a) 22. (b) 23. (d) 24. (b) 25. (d) 26. (c) 27. (b) 28. (b) 29. (c) 30. (b)
31. (a) 32. (b) 33. (a) 34. (a) 35. (c) 36. (c) 37. (b) 38. (d) 39. (c) 40. (d)
41. (c) 42. (b) 43. (d) 44. (b) 45. (d) 46. (b) 47. (d) 48. (a) 49. (c) 50. (b)
51. (c) 52. (c) 53. (c) 54. (a) 55. (c) 56. (d) 57. (b) 58. (a) 59. (c) 60. (c)