EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER–2000

PHYSICS

1. Two long parallel copper wires carrying currents in the opposite directions of 5 A each. If the wires are separated by a distance of 0.5 m, then the force per unit length between the two wires is :
   (a) 10^{-5} N attractive force
   (b) 10^{-5} N repulsive force
   (c) 2×10^{5} N attractive force
   (d) 10^{-5} N repulsive force

2. A charged particle of mass 3×10^{-6} kg is held stationary in spacing in an electric field of strength $10^{6}\,NC^{-1}$ directed vertically downwards. The charge on the particle is : ($g = 10\,ms^{-2}$)
   (a) $-20 \times 10^{-3}\,\mu C$ (b) $-3 \times 10^{-5}\,\mu C$
   (c) $5 \times 10^{-5}\,\mu C$ (d) $20 \times 10^{-5}\,\mu C$

3. Electric charges of 1 μC, 1 μC and 2 μC are placed in air at the corners of A, B and C respectively of an equilateral triangle ABC having the length of the side 10 cm. The resultant forces at C is :
   $\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{9}\,\frac{N\text{-}m^2}{C^2}\right)$
   (a) 0.9 N (b) $1.8\sqrt{3}$ N
   (c) 2.7 N (d) 3.6 N

4. The pole strength of a 12 cm long bar magnet is 2 . 0 A-m. The magnetic induction at a point 10 cm away from the centre of the magnet on the axial line is :
   $\left(\frac{\mu_0}{4\pi} = 10^{-7}\,Hm^{-1}\right)$
   (a) 1.1×10^{-4} T (b) 2.2×10^{3} T
   (c) 1.1×10^{-2} T (d) 2.2×10^{-2} T

5. There is no couple acting when two bar magnets are placed coaxially separated by a distance because :
   (a) there are no forces on the poles
   (b) the forces are parallel and their lines of action do not coincide
   (c) the forces are perpendicular to each other
   (d) the forces act along the same line

6. Two similar bar magnets P and Q each of magnetic moment M are taken. If P is cut along its axial line and Q is cut along its equatorial line all the four pieces obtained have each of :
   (a) equal pole strength
   (b) magnetic moment $\frac{M}{4}$
   (c) magnetic moment $\frac{M}{2}$
   (d) magnetic moment M

7. A short bar magnet with its north pole facing north forms a neutral point at P in the horizontal plane. If the magnet is rotated by 90° in the horizontal plane, the net magnetic induction at P is : (Horizontal component of earth's magnetic field = B_H)
   (a) zero (b) $2\,B_H$
   (c) $\frac{\sqrt{5}}{2}\,B_H$ (d) $\sqrt{5}\,B_H$

8. Under minimum deviation condition in a prism, if a ray is incident at an angle of 30°. The angle between the emergent ray and the second refracting surface of the prism is :
   (a) 0° (b) 30°
   (c) 45° (d) 60°

9. Consider the following statements A and B and identify the correct choice in the given answers :
(A) Line spectra is due to atoms in gaseous state.
(B) Band spectra is due to molecules
(a) Both A and B are false
(b) A is true and B is false
(c) A is false and B is true
(d) Both A and B are true

10. In a compound microscope cross wires are fixed at the point :
(a) where the image is formed by the objective
(b) where the image is formed by the eye-piece
(c) where the focal point of objective lies
(d) where the focal point of eye-piece lies

11. An ammeter and a voltmeter of resistance R are connected in series to an electric cell of negligible internal resistance. Their readings are A and V respectively. If another resistance R is connected in parallel with voltmeter :
(a) both A and V will increase
(b) both A and V will decrease
(c) A will decrease and V will increase
(d) A will increase and V will decrease

12. Two electric charges 12 μC and -6 μC are placed 20 cm apart in air, there will be a point P at which electric potential is zero on the line joining these two charges and out side excluding the region between them. The distance of P from -6 μC charge is :
(a) 0.10 m (b) 0.15 m
(c) 0.20 m (d) 0.25 m

13. Two wires of equal diameters of resistivities ρ_1 and ρ_2 and lengths x_1 and x_2 respectively are joined in series. The equivalent resistivity of the combination is :
(a) $\frac{\rho_1 x_1 + \rho_2 x_2}{x_1 + x_2}$ (b) $\frac{\rho_1 x_2 - \rho_2 x_1}{x_1 - x_2}$
(c) $\frac{\rho_1 x_2 + \rho_2 x_1}{x_1 + x_2}$ (d) $\frac{\rho_1 x_1 - \rho_2 x_2}{x_1 - x_2}$

14. The X-ray wavelength of L_a line of platinum ($Z = 78$) is 1.30 Å. The X-ray wavelength of L_a line of molybdenum ($Z = 42$) is :
(a) 5.41 Å (b) 4.59 Å
(c) 2.70 Å (d) 1.35 Å

15. When a metal surface is illuminated by a light of wavelength 400 nm and 250 nm. The maximum velocities of the photo electrons ejected are v and $2v$ respectively. The work function of the metal is : (h = Planck's constant, c = velocity of light in air)
(a) $2hc \times 10^6$ J (b) $1.5hc \times 10^6$ J
(c) $hc \times 10^6$ J (d) $0.5hc \times 10^6$ J

16. The energy of an X-ray photon of wavelength 1.65 Å is : ($h = 6.6 \times 10^{-34}$ Js, $c = 3 \times 10^8$ ms^{-1} ; 1 eV = 1.6×10^{-19} J)
(a) 3.5 keV (b) 5.5 keV
(c) 7.5 keV (d) 9.5 keV

17. The ratio of the longest and shortest wave-lengths in Bracket series of hydrogen spectra is :
(a) $\frac{25}{9}$ (b) $\frac{17}{6}$
(c) $\frac{9}{5}$ (d) $\frac{4}{3}$

18. In Bohr model of hydrogen atom, the ratio of period of revolution of an electron in $n = 2$ and $n = 1$ orbit is :
(a) 2 : 1 (b) 4 : 1
(c) 8 : 1 (d) 16 : 1

19. To generate power of 3.2 MW, the number of fissions of U^{235} per minute is : (Energy released per fission = 200 MeV; 1 eV = 1.6×10^{-19} J)
(a) 6×10^{18} (b) 6×10^{17}
(c) 10^{17} (d) 6×10^{16}

20. Consider the following statements A and B and identify the correct choice of the given answers :
(A) The width of the depletion layer in a p-n junction diode increases in forward bias.
(B) In a intrinsic semiconductor the fermi energy level is exactly in the middle of the forbidden energy gap.
(a) A is true and B is false
(b) Both A and B are false
(c) A is false and B is true
(d) Both A and B are true

21. The fundamental physical quantities that have same dimensions in the dimensional formula of torque and angular momentum are :
(a) mass, time (b) time, length
(c) mass, length (d) time, mole

22. If pressure P, velocity v and time T are taken as fundamental physical quantities the dimensional formula of the force is :
(a) $P^1 v^2 T^2$ (b) $P^{-1} v^2 T^{-2}$
(c) PvT^2 (d) $P^{-1} v T^2$

23. The displacement r of a charge Q in an electric field $\vec{E} = c_1 \hat{i} + c_2 \hat{j} + c_3 \hat{k}$ is $\vec{r} = a \hat{i} + b \hat{j}$. The work done is :
(a) $Q(ac_1 + bc_2)$
(b) $Q\sqrt{(ac_1)^2 + (bc_2)^2}$
(c) $Q(c_1 + c_2)\sqrt{a^2 + b^2}$
(d) $Q\left(\sqrt{c_2^2 + c_1^2}\right)(a + b)$

24. A body is thrown vertically upwards with an initial velocity u reaches maximum height in 6 sec. The ratio of distance travelled by the body in the first and seventh second is :
(a) 1 : 1 (b) 11 : 1 (c) 1 : 2 (d) 1 : 11

25. A body is thrown horizontally from the top of a tower of 5 m height. It touches the ground at a distance of 10m from the foot of the tower. The initial velocity of the body is :
(a) 2.5 ms^{-1} (b) 5 ms^{-1}
(c) 10 ms^{-1} (d) 20 ms^{-1}

26. Four bodies P, Q, R and S are projected with equal velocities having angles of projection 15°, 30°, 45° and 60° with the horizontal respectively. The body having shortest range is :
(a) P (b) Q (c) R (d) S

27. A force of 5 N making an angle θ with the horizontal acting on an object displaces it by 0.4 m along the horizontal direction. If the object gains kinetic energy of 1 J the horizontal component of the force is :
(a) 1.5 N (b) 2.5 N (c) 3.5 N (d) 4.5 N

28. A body of mass m_1 moving with a velocity 10 ms^{-1} collides with another body at rest of mass m_2. After collision the velocities of the two bodies are 2 ms^{-1} and 5 ms^{-1} respectively, along the direction of motion of m_1. The ratio $\frac{m_1}{m_2}$ is :
(a) $\frac{5}{12}$ (b) $\frac{5}{8}$ (c) $\frac{8}{5}$ (d) $\frac{12}{5}$

29. A ball is projected vertically down with an initial velocity from a height of 20 m on to a horizontal floor. During the impact it loses 50% of the energy and rebounds to the same height, the initial velocity of its projection is :
(a) 20 ms^{-1} (b) 15 ms^{-1}
(c) 10 ms^{-1} (d) 5 ms^{-1}

30. A 1.0 HP motor pumps out water from a well of 30 m and fills a water tank of volume 2238 litres at a height of 10 m from the ground. The running time of the motor to fill the empty water tank is :
(a) 5 min (b) 10 min (c) 15 min (d) 20 mir

31. A body is sliding down an inclined plane having coefficient of friction 0.5. If the normal reaction is twice that of the resultant downward force along the incline the angle between the inclined plane and the horizontal is :
(a) 15° (b) 30° (c) 45° (d) 60°

32. The radius of gyration of a sphere of mass M and radius R about the axis parallel to the axis passing through its centre and tangent to the sphere is :
(a) $\frac{7}{5}R$ (b) $\frac{3}{5}R$ (c) $\left(\sqrt{\frac{7}{5}}\right)R$ (d) $\left(\sqrt{\frac{3}{5}}\right)$

33. A wheel has a speed of 1200 revolution per minute and is made to slow down at a rate of 4 radian/sec^2. The number of revolutions it makes before coming to rest is :
(a) 143 (b) 272 (c) 314 (d) 722

34. R and r are the radii of the earth and moon respectively, ρ_e and ρ_m are densities of earth and moon respectively. The ratio of the acceleration due to gravity on the surfaces of the moon & earth, is :
(a) $\frac{R}{r} \cdot \frac{\rho_e}{\rho_m}$ (b) $\frac{r}{R} \cdot \frac{\rho_e}{\rho_m}$
(c) $\frac{r}{R} \cdot \frac{\rho_m}{\rho_e}$ (d) $\frac{R}{r} \cdot \frac{\rho_m}{\rho_e}$

35. The height of the point vertically above the earth's surface at which acceleration due to gravity becomes 1% of its value at the surface is : (Radius of the earth = R)
(a) $8R$ (b) $9R$ (c) $10R$ (d) $20R$

36. A body of mass 1 kg is executing simple harmonic motion. Its displacement y cm at t sec is given by $y = 6 \sin\left(100\, t + \frac{\pi}{4}\right)$ its maximum kinetic energy is :
(a) 6 J (b) 18 J (c) 24 J (d) 36 J

37. A particle executing simple harmonic motion has an amplitude of 6 cm. Its acceleration at a distance from the mean position 2 cm is 8 cm/sec^2. The maximum speed of the particle is :
(a) 8 cm/sec (b) 12 cm/sec
(c) 16 cm/sec (d) 24 cm/sec

38. When a uniform wire of radius r, is stretched by a 2 kg weight the increase in its length is 2.00 mm. If the radius of the wire is $\frac{r}{2}$ and other conditions remaining the same, the increase in its length is :
(a) 2.00 mm (b) 4.00 mm
(c) 6.00 mm (d) 8.00 mm

39. 8000 identical water drops are combined to form a big drop. Then the ratio of final surface energy to the initial surface energy of all the drops together is :
(a) 1 : 10 (b) 1 : 15 (c) 1 : 20 (d) 1 : 25

40. When a liquid in a glass vessel, is heated its apparent expansion is 10.30×10^{-4}/°C same liquid when heated in a metal its apparent expansion 10.06×10^{-4}/°C. The coefficient of linear expansion of the metal is : (coefficient of linear expansion of glass $= 9 \times 10^{-6}$ /°C) :
(a) 51×10^{-6}/°C (b) 43×10^{-6}/°C
(c) 25×10^{-6}/°C (d) 17×10^{-6}/°C

41. A vessel is filled with an ideal gas at a pressure of 10 atmosphere and temperature 27°C. Half of the mass of the gas is removed from the vessel and temperature of the remaining gas is increased to 87°C. Then the pressure of the gas in the vessel will be :
(a) 5 atm (b) 24 atm
(c) 7 atm (d) 8 atm

42. During an adiabatic process, if the pressure of an ideal gas is proportional to the cube of its temperature the ratio $\gamma = \frac{c_p}{c_v}$ is :
(Specific heat at constant volume = c_v specific heat at constant pressure = c_p)
(a) $\frac{1}{5}$ (b) $\frac{4}{3}$ (c) $\frac{5}{3}$ (d) $\frac{3}{2}$

43. A flask is filled with 1.3 g of an ideal gas at 27°C and its temperature is raised to 52°C. The mass of the gas that has to be released to maintain the temperature of the gas in the flask at 52°C and the pressure remaining the same is :
(a) 2.5 g (b) 20 g (c) 1.5 g (d) 0.1 g

44. An ideal gas at a pressure of 1 atm and temperature of 27°C is compressed adiabatically until its pressure becomes 8 times the initial pressure, then final temperature is : ($\gamma = 3/2$)
(a) 627°C (b) 527°C
(c) 427°C (d) 327°C

45. The liquids at temperature 60°C and 30°C respectively have masses in the ratio 3 : 4 and their specific heats in the ratio 4 : 5. If the two liquids are mixed, the resultant temperature is :
(a) 70°C (b) 50°C
(c) 40°C (d) 41.25°C

46. Two metal rods A and B of equal lengths and equal cross-sectional areas are joined end to end. The coefficients of thermal conductivities of A and B are in the ratio 2 : 3, when the free end of A is maintained at 100° C and the free end of B is maintained at 0° C, the temperature of the junction is :
(a) 30° C (b) 40° C (c) 50° C (d) 60° C

47. The frequency of a stretched unifrom wire under tension is in resonance with the fundamental frequency of a closed tube. If the tension in the wire is increased by 8 N, it is in resonance with the first over- tone of the closed tube. The initial tension in the wire is :
(a) 1 N (b) 4 N
(c) 8 N (d) 16 N

48. If vibrating tuning fork of frequency 255 Hz is moving with a velocity 4 ms^{-1} towards the wall the number of beats heard per second is (speed of sound in air = 340 ms^{-1}) :
(a) 3 (b) 4 (c) 5 (d) 6

49. A source producing sound of frequency 170 Hz is approaching a stationary observer with a velocity of 17 ms^{-1}. The apparent change in the wavelength of sound heard by the observer is : (speed of sound in air = 340 ms^{-1})
(a) 0.1 m (b) 0.2 m (c) 0.4 m (d) 0.5 m

50. The focal length of the lenses of an astronomical telescope are 50 cm and 5 cm. The length of the telescope when the image is formed at the least distance of distinct vision is :
(a) 45 cm (b) 55 cm (c) $\frac{275}{6}$ cm (d) $\frac{325}{6}$ cm

CHEMISTRY

1. Which of the following reacts with ethanol to form chloroform ?
(a) $SOCl_2$ (b) PCl_5
(c) HCl (d) $CaOCl_2/H_2O$

2. A non-volatile solute (A) is dissolved in a volatile solvent (B). The vapour pressure of the resultant solution is P_S. The vapour pressure of pure solvent is P_B°. If X_B is the mole fraction of the solvent which of the following is correct :
(a) $P_S = X_A.P_B^\circ$ (b) $P_B^\circ = P_S.X_A$
(c) $P_S = X_B.P_B^\circ$ (d) $P_B^\circ = P_S.X_B$

3. The total pressure of a mixture of 6.4 of O_2 and 5.6 g of N_2 present in a 2 litre vessel is 1200 mm. What is the partial pressure (in mm) of nitrogen ?
(a) 1200 (b) 600 (c) 900 (d) 200

4. The r.m.s. velocity of an ideal gas at 300 K is 12240 cm/sec., What is the most probable velocity at that temperature ?
(a) 10000 cm/s (b) 11280 cm/s
(c) 13250 cm/s (d) 12240 cm/s

5. Calculate the heat of formation (ΔH) of CO (in kcal) from the following data :
I. $C_{(graphite)} + O_{2(g)} \longrightarrow CO_{2(g)}$
$\Delta H = -94$ kcal
II. $CO_{(g)} + \frac{1}{2} O_{2(g)} \longrightarrow CO_{2(g)}$
$\Delta H = -68$ kcal
(a) –1.3 (b) –26
(c) –162 (d) –82

6. Which of the following is a sulphide ore ?
(a) Calamine (b) Cryolite
(c) Zinc blende (d) Haematite

7. Which of the following ions is colourless in aqueous solution ?
(a) Ti^{3+} (b) Cu^{2+} (c) Ni^{2+} (d) Zn^{2+}

8. Which of the following is the strongest oxidising agent ?
(a) F_2 (b) Br_2 (c) Cl_2 (d) O_2

9. What is the oxidation state of chlorine in hypochlorous acid ?
(a) + 1 (b) + 3 (c) + 5 (d) + 7

10. Which of the following has the lowest bond angle ?
(a) H_2O (b) CH_4 (c) H_2S (d) NH_3

11. Which of the following is the isotope of Ge_{32}^{76} ?
(a) As_{33}^{77} (b) Ge_{32}^{77} (c) Se_{34}^{77} (d) Br_{35}^{80}

12. What are the values of n_1 and n_2 for the 2nd line in the Lyman series of hydrogen atomic spectrum ?
(a) 3 and 5 (b) 2 and 3
(c) 1 and 3 (d) 2 and 4

13. What is the catalyst used in the manufacture of sulphuric acid by contact process ?
(a) Nickel powder
(b) Platinised asbestos
(c) Anhydrous Al_2O_3
(d) Aluminium powder

14. The equilibrium constant for the reaction $H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$ is 64 at a certain temperature. The equilibrium concentrations of H_2 and HI are 2 mol/L and 16 mol/L respectively. What is the equilibrium concentrations (in mol/L) of I_2 ?
(a) 16 (b) 4 (c) 8 (d) 2

15. What is the approximate quantity of electricity (in coulomb) required to deposit all the silver from 250 mL of 1M $AgNO_3$ aqueous solution ?
(a) 96500 (b) 24125
(c) 48250 (d) 12062.5

16. A solid organic compound *Y* on heating is converted into vapour directly; which on cooling solidifies, which of the following is the correct method of purifying it ?
(a) Sublimation
(b) Distillation
(c) Distillation at reduced pressure
(d) Steam distillation

17. Chloroethane reacts with magnesium in dry ether to form *X*. When *X* is hydrolysed a carbon compound *Y* and *Z* are formed. Which of the following is *Y* ?
(a) C_2H_4 (b) C_2H_2 (c) C_2H_6 (d) C_6H_6

18. Ethylene reacted with bromine in CCl_4 to form *X*. *X* is treated with alcoholic KOH to give *Y*. *X* and *Y* are respectively :
(a) $BrCH_2—CH_2Br$ and C_2H_2
(b) C_2H_5Br and C_2H_4
(c) C_2H_5Br and C_6H_6
(d) $C_2H_5Br_3$ and C_2H_4

19. Which of the following reacts with ammoniacal cuprous chloride ?
(a) CH_4 (b) C_2H_2 (c) C_2H_6 (d) C_6H_6

20. Which of the following hydrocarbon has least carbon-carbon bond length ?
(a) C_2H_6 (b) C_2H_4 (c) C_6H_6 (d) C_2H_2

21. Which of the following react with water to give ethane ?
(a) CH_4 (b) C_2H_5MgBr
(c) C_2H_5OH (d) $C_2H_5—O—C_2H_5$

22. Which of the following reacts with BCl_3 to form diborane ?
(a) NH_3 (b) $LiAlH_4$
(c) Na Hg (d) $K_2Cr_2O_7$

23. During Serpeck's process silica is eliminated as :
(a) Si (*solid*) (b) SiO_2 (*vapour*)
(c) SiO_2 (*solid*) (d) Si (*vapour*)

24. What is the molecular formula of white phosphorus ?
(a) P_2 (b) P_4 (c) P_5 (d) P_{16}

25. Which of the following is an acid ?
(a) $Ca(OH)_2$ (b) $P(OH)_3$
(c) NH_4OH (d) NaOH

26. What is the approximate calorific value of water gas in kcal m^{-3} ?
(a) 500 (b) 2700 (c) 4000 (d) 1000

27. Which of the following is used in the preparation of generated water (soda) ?
(a) CO (b) CO_2 (c) SO_2 (d) HCl

28. What is the molecular formula of gypsum ?
(a) $CaSO_4 . H_2O$ (b) $CaSO_4 . 2H_2O$
(c) $2CaSO_4 . H_2O$ (d) $CaSO_4 . 3H_2O$

29. In the Castner's process of extraction of sodium, cathode is :
(a) iron rod (b) nickel rod
(c) copper rod (d) graphite rod

30. In which of the following reactions H_2O_2 acts as a reducing agent ?
(a) $PbS + 4H_2O_2 \longrightarrow PbSO_4 + 4H_2O$
(b) $Na_2SO_3 + H_2O_2 \longrightarrow Na_2SO_4 + H_2O$
(c) $Ag_2O\ (moist) + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$
(d) $NaNO_2 + H_2O_2 \longrightarrow NaNO_3 + H_2O$

31. Brass is an alloy of :
(a) Ag and Cu (b) Sn and Zn
(c) Cu and Sn (d) Cu and Zn

32. Which one of the VI group element has the highest catenation power ?
(a) O (b) Se (c) S (d) Te

33. The half-life of a radioactive element is 100 years. What is its disintegration constant (in $years^{-1}$) ?
(a) 6.93×10^3 (b) 6.93
(c) 6.93×10^{-3} (d) 0.693

34. How many electrons are present in the *M* shell of an atom of an element with atomic number 24 ($Z = 24$) ?
(a) 5 (b) 6 (c) 12 (d) 13

35. Which of the following reactions does not involve change in the oxidation state of the metal ?
(a) $VO^{2+} \longrightarrow V_2O_3$ (b) $Na \longrightarrow Na^+$
(c) $CrO_4^{2-} \longrightarrow Cr_2O_7^{2-}$ (d) $Zn^{2+} \longrightarrow Zn$

36. What is the value (in litres) of CO_2 liberated at STP when 2.12 g of sodium carbonate (mol. wt. 106) is treated with excess dilute HCl ?
(a) 2.28 L (b) 0.448 L
(c) 44.8 L (d) 22.4 L

37. Which of the following is correct for acid buffer ? [salt = S, acid = A] :
(a) $pK_a = pH + \log \frac{[S]}{[A]}$
(b) $pH = pK_a + \log \frac{[S]}{[A]}$
(c) $pK_a = pH - \frac{[A]}{[S]}$
(d) $pH = pK_a + \log \frac{[A]}{[S]}$

38. The pH of an aqueous solution of a salt is 10. The salt is :
(a) NaCl (b) NH_4Cl
(c) CH_3COONa (d) $(NH_4)_2SO_4$

39. The electronic configuration of group III elements is :
(a) ns^1np^2 (b) ns^2np^3 (c) ns^2np^2 (d) ns^2np^1

40. Which of the following has the highest first IP ?
(a) Al (b) Si (c) K (d) P

41. Which of the following is the correct pair ?
(a) $BeCl_2$-linear (b) NH_3-linear
(c) CO_2-tetrahedral (d) BF_3-octahedral

42. What is the crystal structure of caesium chloride ?
(a) Body centred cubic
(b) Face centred cubic
(c) Tetrahedral
(d) Octahedral

43. What is X in the following reaction ?
$2CH_3CHO \xrightarrow{NaOH} X$:
(a) $CH_3CH(OH)CHO$ (b) $CH_3-C(=O)-CH_2-CHO$
(c) $CH_3CH(OH)CH_2CHO$
(d) $CH_3-CH_2-CH(OH)-CHO$

44. Which of the following converts acetic acid into acetyl chloride ?
(a) NaCl (b) HCl (c) Cl_2/P (d) PCl_3

45. Nitrobenzene on reduction with Sn/HCl gives A, which on reaction with acetyl chloride form B. Which of the following is B ?
(a) $C_6H_5-C(=O)-CH_3$ (b) $C_6H_5-NH-C(=O)-CH_3$
(c) C_6H_5-NHCl (d) $C_6H_5-O-C(=O)-CH_3$

46. Which of the following converts acetone to acetone oxime ?
(a) H_2N-NH_2 (b) 2, 4 D.N.P.
(c) $C_6H_5-NHNH_2$ (d) NH_2OH

47. Which of the following is a secondary amine ?
(a) $C_6H_5NH_2$ (b) CH_3-NH_2
(c) $C_6H_5-N(CH_3)-CH_3$ (d) $C_6H_5-N(H)-CH_3$

48. Chloroethane reacts with Y to form NaCl and Z. One mole of Z reacts with two moles of HI to form water and iodo ethane. Which of the following is Y ?
(a) CH_3COOH (b) CH_3CHO
(c) $C_2H_5OC_2H_5$ (d) C_2H_5ONa

49. Which of the following is Lucas reagent ?
(a) Ammoniacal $AgNO_3$ (b) Br_2/CCl_4
(c) $ZnCl_2$/conc. HCl
(d) Cold alk. $KMnO_4$

50. Which of the following is a tertiary alcohol ?
(a) $CH_3-CH(CH_3)-CH_2OH$
(b) $CH_3CH_2CH_2CH_2OH$
(c) $CH_3CH_2-CH(CH_3)-OH$
(d) $CH_3-C(CH_3)(CH_3)-OH$

1. Two consecutive sides of a parallelogram are $4x+5y=0$ and $7x+2y=0$. If the equation to one diagonal is $11x+7y=9$, then the equation of the other diagonal is :
(a) $x+2y=0$ (b) $2x+y=0$
(c) $x-y=0$ (d) none of these

2. The equation of pair of lines through the point (a, b) parallel to co-ordinate axes is :
(a) $(x-b)(y-a)=0$
(b) $(x-a)(y+b)=0$
(c) $(x-a)(y-b)=0$
(d) $(x+a)(y-b)=0$

3. If the equation $\lambda x^2-5xy+6y^2+x-3y=0$, represents a pair of straight lines, then their point of intersection is :
(a) $(-3,-1)$ (b) $(-1,-3)$
(c) $(3,-1)$ (d) $(1, 3)$

4. The centre of circle which touch the y-axis at $(0, 3)$ and making an intercept of 2 units on the positive x-axis, is :
(a) $(10, \sqrt{3})$ (b) $(\sqrt{3}, 10)$
(c) $(\sqrt{10}, 3)$ (d) $(3, \sqrt{10})$

5. The slope m of a tangent through the point $(7, 1)$ to the circle $x^2+y^2=25$, satisfy the equation :
(a) $12m^2+7m-12=0$
(b) $16m^2-24m+9=0$
(c) $12m^2-7m-12=0$
(d) $9m^2+24m+16=0$

6. Two circles of equal radii cut orthogonally, if their centres are $(2, 3)$ and $(5, 6)$, then r is equal to :
(a) 1 (b) 2
(c) 3 (d) 4

7. The number of common tangents that can be drawn to the circles $x^2+y^2=1$ and $x^2+y^2-2x-6y+6=0$, is :
(a) 1 (b) 2 (c) 3 (d) 4

8. If $(1, 2)$ is a limiting point of a co-axial system of circles containing the circle $x^2+y^2+x-5y+9=0$, then the equation of radical axis is :
(a) $x+3y+9=0$ (b) $3x-y+4=0$
(c) $x+9y-4=0$ (d) $3x-y-1=0$

9. If $\left(m_i, \frac{1}{m_i}\right)$, $i=1, 2, 3, 4$ are concyclic points, then the value of $m_1m_2m_3m_4$ is :
(a) 1 (b) -1
(c) 0 (d) none of these

10. The vertex of the parabola $x^2+8x+12y+4=0$ is :
(a) $(-4, 1)$ (b) $(4, -1)$
(c) $(-4, -1)$ (d) $(4, 1)$

11. The line $4x+6y+9=0$, touches the parabola $y^2=4x$ at the point :
(a) $\left(-3, \frac{9}{4}\right)$ (b) $\left(3, -\frac{9}{4}\right)$
(c) $\left(\frac{9}{4}, -3\right)$ (d) $\left(-\frac{9}{4}, -3\right)$

12. The eccentricity of the ellipse $5x^2+9y^2=1$ is :
(a) $\frac{2}{3}$ (b) $\frac{3}{4}$ (c) $\frac{4}{5}$ (d) $\frac{1}{2}$

13. The product of the length of perpendiculars from the foci on any tangent to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, is :
(a) 9 (b) a^2-b^2
(c) b^2 (d) $\sqrt{a^2+b^2}$

14. The curve represented by $x=2(\cos t+\sin t)$, $y=5(\cos t-\sin t)$ is :
(a) a circle (b) a parabola
(c) an ellipse (d) hyperbola

15. The radius of the circle $r^2-2\sqrt{2}r(\cos\theta+\sin\theta)-5=0$ is :
(a) 0 (b) 3 (c) 2 (d) 5

16. $\lim\limits_{\theta\to\pi/2}\frac{1-\sin\theta}{\cos\left(\frac{\pi}{2}-\theta\right)}$ is equal to :
(a) 0 (b) $\frac{1}{2}$
(c) -1 (d) 1

17. $\lim\limits_{x\to 0}\frac{\log_e(1+x)}{3^x-1}$ is equal to :
(a) $\log_e 3$ (b) 0 (c) 1 (d) $\frac{1}{\log_e 3}$

18. If the function $f(x)=\begin{cases}\frac{\sin 3x}{x}, & x\neq 0\\ \frac{k}{2}, & x=0\end{cases}$ is continuous at $x=0$, then k is equal to :
(a) 3 (b) 6 (c) 9 (d) 12

19. If $y=2^{2x}$, then $\frac{dy}{dx}$ is equal to :
(a) $y(\log_{10}2)^2$ (b) $y(\log_e 2)^2$
(c) $y\log_e 2^2$ (d) $y\log_e 2$

20. $\frac{d}{dx}\left\{\cos^{-1}\left(\frac{4x^3}{27}-x\right)\right\}$ is equal to :
(a) $\frac{3}{\sqrt{9-x^2}}$ (b) $-\frac{3}{\sqrt{9-x^2}}$
(c) $\frac{1}{\sqrt{9-x^2}}$ (d) $-\frac{1}{\sqrt{9-x^2}}$

21. If $xy=(x+y)^n$ and $\frac{dy}{dx}=\frac{y}{x}$, then n is equal to :
(a) 1 (b) 2 (c) 3 (d) 4

22. The distance moved by the particle in time t is given by $s=t^3-12t^2+6t+8$. At the instant when its acceleration is zero, the velocity is :
(a) 42 (b) − 42 (c) 48 (d) − 48

23. The angle between the curves $y^2=4x, x^2=4y$ at (4, 4), is :
(a) $\tan^{-1}\left(\frac{1}{2}\right)$ (b) $\tan^{-1}\left(\frac{3}{4}\right)$
(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

24. If $l^2+m^2=1$, then the maximum value of $l+m$ is :
(a) 1 (b) ∞ (c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}$

25. The minimum value of x^x is :
(a) e (b) e^x (c) $e^{-1/e}$ (d) $e^{1/e}$

26. Area of the triangle formed by the normal to the curve $x=e^{\sin y}$ at (1, 0) with the co-ordinate axes is :
(a) 1 sq unit (b) $\frac{1}{4}$ sq unit
(c) $\frac{1}{2}$ sq unit (d) $\frac{3}{4}$ sq unit

27. $\frac{d^n}{dx^n}(e^x\sin x)$ is equal to :
(a) $2^{n/2}e^x\cos\left(x+\frac{n\pi}{4}\right)$
(b) $2^{n/2}e^x\cos\left(x-\frac{n\pi}{2}\right)$
(c) $2^{n/2}e^x\sin\left(x+\frac{n\pi}{4}\right)$
(d) $2^{n/2}e^x\sin\left(x-\frac{n\pi}{4}\right)$

28. If $u=\log_e(x^2+y^2)+\tan^{-1}(y/x)$, then $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}$ is equal to :
(a) 0 (b) $2a$
(c) $\frac{1}{2}u$ (d) u

29. $u=\cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, then $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ is equal to :
(a) $\frac{1}{2}\cot u$ (b) $3\cot u$
(c) $2\cot u$ (d) $-\frac{1}{2}\cot u$

30. $\int e^x(1+\cot x+\cot^2 x)\,dx$ is equal to :
(a) $e^x\cot x+c$ (b) $-e^x\cot x+c$
(c) $e^x\operatorname{cosec} x+c$ (d) $-e^x\operatorname{cosec} x+c$

31. $\int\frac{\sin^6 x}{\cos^8 x}dx$ is equal to :
(a) $\tan 7x+c$ (b) $\frac{\tan^7 x}{7}+c$
(c) $\frac{\tan 7x}{7}+c$ (d) $\sec^7 x+c$

32. $\int e^{x\log a}.\,e^x\,dx$ is equal to :
(a) $\frac{a^x}{\log_a e}+c$ (b) $\frac{e^x}{1+\log_e a}+c$
(c) $(ae)^x+c$ (d) none of these

33. If $\tan A=\frac{1}{2}$ and $\tan B=\frac{1}{3}$, then $A+B$ is equal to :
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{6}$

34. If $f(x)$ is integrable on $(0, a)$, then $\int_0^a \frac{f(x)}{f(x)+f(a-x)}dx$ is equal to :

(a) 0 (b) 1 (c) a (d) $\frac{a}{2}$

35. $\lim_{x\to 0}\frac{a^x - b^x}{x}$ is equal to :

(a) $\log\frac{b}{a}$ (b) $\log\frac{a}{b}$

(c) $\log a$ (d) $\log b$

36. The area (in square units) of the region bounded by the curve $x^2 = 4y$, the line $x = 2$ and the x-axis is equal to :

(a) 1 sq unit (b) $\frac{2}{3}$ sq unit

(c) $\frac{4}{3}$ sq unit (d) $\frac{8}{3}$ sq unit

37. The area in square units bounded by the curves $y = x^3, y = x^2$ and the ordinates $x = 1, x = 2$ is equal to :

(a) $\frac{17}{12}$ sq unit (b) $\frac{12}{17}$ sq unit

(c) $\frac{2}{7}$ sq unit (d) $\frac{7}{2}$ sq unit

38. If c is a parameter, then the differential equation whose solution is $y = c^2 + \frac{c}{x}$, is :

(a) $y = \left(\frac{dy}{dx}\right)^2 - \frac{d^2y}{dx^2}$ (b) $y = x^4\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx}$

(c) $y = \left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx}$ (d) $y = x\frac{dy}{dx} - 2x^2\frac{d^2y}{dx^2}$

39. The equation of the curve passing through the origin and satisfying the differential equation $\frac{dy}{dx} = (x-y)^2$, is :

(a) $e^{2x}(1-x+y) = (1+x-y)$

(b) $e^{2x}(1+x-y) = (1-x+y)$

(c) $e^{2x}(1-x+y) = -(1+x+y)$

(d) $e^{2x}(1+x+y) = (1-x+y)$

40. If $OACB$ is a parallelogram with $\overrightarrow{OC} = \vec{a}$ and $\overrightarrow{AB} = \vec{b}$, then $\overrightarrow{OA}$ is equal to :

(a) $\vec{a}+\vec{b}$ (b) $\vec{a}-\vec{b}$

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

41. If θ is an acute angle and the vector $(\sin\theta)\hat{i} + (\cos\theta)\hat{j}$ is perpendicular to the vector $\hat{i} - \sqrt{3}\hat{j}$, then θ is equal to :

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{5}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{3}$

42. If two out of the three vectors are unit vectors. $\vec{a}+\vec{b}+\vec{c} = 0$ and $2(\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}) + 3 = 0$, then the third vector is of length :

(a) 0 unit (b) 1 unit

(c) 2 unit (d) 3 unit

43. If θ is the angle between the vectors $2\hat{i} + 2\hat{j} + 4\hat{k}$ and $3\hat{i} + \hat{j} + 2\hat{k}$, then $\sin\theta$ is equal to :

(a) $\frac{2}{7}$ (b) $\frac{2}{\sqrt{7}}$ (c) $\frac{\sqrt{2}}{7}$ (d) $\sqrt{\frac{5}{21}}$

44. If $\vec{a} = 2\hat{i} + 3\hat{j} - 4\hat{k}$, $\vec{b} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{c} = 4\hat{i} + 2\hat{j} + 3\hat{k}$, then $|\vec{a}\times(\vec{b}\times\vec{c})|$ is equal to :

(a) $\sqrt{10}$ (b) 1 (c) 2 (d) $\sqrt{5}$

45. $(\vec{b}\times\vec{c})\times(\vec{c}\times\vec{a})$ is equal to :

(a) $[\vec{a}\,\vec{b}\,\vec{c}]\vec{c}$ (b) $[\vec{a}\,\vec{b}\,\vec{c}]\vec{b}$

(c) $[\vec{a}\,\vec{b}\,\vec{c}]\vec{a}$ (d) $\vec{a}.(\vec{b}\times\vec{c})$

46. Probability of choosing a number divisible by 6 or 8 from among 1 to 90 is :

(a) $\frac{1}{6}$ (b) $\frac{11}{90}$ (c) $\frac{1}{30}$ (d) $\frac{23}{90}$

47. The probabilities of two events A and B are 0.25 and 0.40 respectively and $P(A \cap B) = 0.15$. The probabilities that neither A nor B occurs is :

(a) 0.35 (b) 0.65 (c) 0.5 (d) 0.75

48. The probability distribution of a random variable X is given below, then k is equal to :

n	1	2	3	4
$P(X=n)$	$2k$	$4k$	$3k$	k

(a) 0.1 (b) 0.2

(c) 0.3 (d) 0.4

49. Let x, y, z be three positive numbers. The progression in which $\sqrt{x}, \sqrt{y}, \sqrt{z}$ can be three terms (not necessarily consecutive), is :

(a) AP (b) GP

(c) HP (d) none of these

50. If $(1+x)^n = C_0 + C_1 x + \ldots + C_n x^n$, then the value of $\sum_{r=0}^{n} \sum_{s=0}^{n} C_r C_s$ is equal to :
(a) 2^n (b) 2^{2n} (c) 2^{n+1} (d) 2^{3n}

51. Let X and Y be subsets of R which is the set of all real numbers, the function $F : X \to Y$ defined by $F(x) = x^2$ for $x \in X$ is one-one but not onto if R^+ is the set of all +ve real numbers, then :
(a) $X = Y = R^+$ (b) $X = R, Y = R^+$
(c) $X = R^+, Y = R$ (d) $X = Y = R$

52. If $F : R \to R$ is defined by $f(x) = 2x + |x|$, then $f(2x) + f(-x) - f(x)$ is equal to :
(a) $2x$ (b) $2|x|$
(c) $-2x$ (d) $-2|x|$

53. If $f : R \to R$ and $g : R \to R$ are defined by $f(x) = 2x + 3$ and $g(x) = x^2 + 7$, then the values of x for which $f(g(x)) = 25$, are :
(a) ± 1 (b) ± 2 (c) ± 3 (d) ± 4

54. If $x = \frac{2}{3+\sqrt{7}}$, then $(x-3)^2$ is equal to :
(a) 1 (b) 3 (c) 6 (d) 7

55. If $5^x = (0.5)^y = 1000$, then $\frac{1}{x} - \frac{1}{y}$ is equal to :
(a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{4}$

56. If ${}^nC_3 : {}^{n-1}C_4 = 8 : 5$, then n is equal to :
(a) -8 (b) 8 (c) 9 (d) 7

57. The number of ways in which 13 gold coins can be distributed among three persons such that each one gets at least two gold coins is :
(a) 6 (b) 12 (c) 24 (d) 36

58. The number of quadratic expressions with the coefficient drawn from the set {0, 1, 2, 3} is :
(a) 21 (b) 36 (c) 48 (d) 64

59. If $a_k = \frac{1}{k(k+1)}$ for $k = 1, 2, 3, \ldots n$, then $\left[\sum_{k=1}^{n} a_k\right]^2$ is equal to :
(a) $\frac{n}{n+1}$ (b) $\frac{n^2}{(n+1)^2}$
(c) $\frac{n^4}{(n+1)^4}$ (d) $\frac{n^6}{(n+1)^6}$

60. If $C_0, C_1, C_2, \ldots$ are binomial coefficients, then $C_1 + C_2 + C_3 + C_4 + \ldots + C_r + \ldots + C_n$ is equal to :
(a) 2^n (b) $2^n - 1$ (c) $2^n - 1$ (d) 2^{2n}

61. The coefficient of x^{-n} in $(1+x)^n\left(1+\frac{1}{x}\right)^n$ is :
(a) 0 (b) 1 (c) 2^n (d) ${}^{2n}C_n$

62. If the coefficient of rth term and $(r+1)$th term in the expansion of $(1+x)^{3n}$ are in the ratio 1 : 2, then r is equal to :
(a) $\frac{6}{5}(n+1)$ (b) $\frac{1}{3}(3n+1)$
(c) $\frac{1}{4}(n+2)$ (d) $\frac{1}{3}(3n+2)$

63. If $\frac{n^2+5}{(n^2+2)^2} = \frac{1}{(n^2+2)} + \frac{k}{(n^2+2)^2}$, then k is equal to :
(a) 1 (b) 2 (c) 3 (d) 4

64. The locus of the z in the argand plane for which $|z+1|^2 + |z-1|^2 = 4$, is a :
(a) straight line
(b) pair of straight lines
(c) circle
(d) parabola

65. If θ is real, the modulus of $\frac{1}{(1+\cos\theta) + i\sin\theta}$ is :
(a) $\frac{1}{2}\sec\frac{\theta}{2}$ (b) $\frac{1}{2}\cos\frac{\theta}{2}$
(c) $\sec\frac{\theta}{2}$ (d) $\cos\frac{\theta}{2}$

66. If $1, \omega, \omega^2$ are the roots of unity, then $(a+b)^3 + (a\omega + b\omega^2)^3 + (a\omega^2 + b\omega)^3$ is equal to :
(a) $a^3 + b^3$ (b) $3(a^3 + b^3)$
(c) $a^2 - b^3$ (d) $a^3 + b^3 + 3ab$

67. In the argand plane the area in square units of the triangle formed by the points $1+i, 1-i, 2i$ is :
(a) $\frac{1}{2}$ (b) 1
(c) $\sqrt{2}$ (d) 2

68. If $3+i$ is a root of $x^2+ax+b=0$, then a is equal to :
(a) 3 (b) -3 (c) 6 (d) -6

69. The equation formed by decreasing each root of $ax^2+bx+c=0$ by 1 is $2x^2+bx+2=0$, then :
(a) $a=-b$ (b) $b=-c$
(c) $c=-a$ (d) $b=a+c$

70. If α, β are the roots of the equation $9x^2+6x+1=0$, then the equation with the roots are $\frac{1}{\alpha}, \frac{1}{\beta}$, is equal to :
(a) $2x^2+3x+18=0$ (b) $x^2+6x-9=0$
(c) $x^2+6x+9=0$ (d) $x^3-6x+9=0$

71. The set $\{x \in R : x-2+x^2=0\}$ is equal to:
(a) $\{-1, 2\}$ (b) $\{1, 2\}$
(c) $\{-1, -2\}$ (d) $\{1, -2\}$

72. Summation $\sum_{k=1}^{n} k\left[1+\frac{1}{n}\right]^{k-1}$ is equal to:
(a) $n(n-1)$ (b) $n(n+1)$
(c) n^2 (d) $(n+1)^2$

73. $\frac{\frac{1}{2}\cdot\frac{2}{2}}{1^3}+\frac{\frac{2}{2}\cdot\frac{3}{2}}{1^3+2^3}+\frac{\frac{3}{2}\cdot\frac{4}{2}}{1^3+2^3+3^3}+\ldots\ldots+n$ terms:
(a) $\frac{n-1}{n}$ (b) $\frac{n}{n+1}$
(c) $\frac{n+1}{n+2}$ (d) $\frac{n+1}{n}$

74. If A and B are two square matrices such that $B=-A^{-1}BA$, then $(A+B)^2$ is equal to :
(a) 0 (b) A^2+B^2
(c) $A^2+2AB+B^2$ (d) $A+B$

75. If $A=\begin{bmatrix}1 & 3\\ 2 & 1\end{bmatrix}$, then the determinant of A^2-2A is :
(a) 5 (b) 25 (c) -5 (d) -25

76. If d is the determinant of a square matrix A of order m, then the determinant of its adjoint, is :
(a) d^m (b) d^{m-1} (c) d^{m-2} (d) d

77. If $a \neq b, b, c$ satisfy $\begin{vmatrix}a & 2b & 2c\\ 3 & b & c\\ 4 & a & b\end{vmatrix}=0$, then b^2 is equal to :
(a) $a+b+c$ (b) 0
(c) ac (d) $ad+bc$

78. In the expression of $\left(x^4-\frac{1}{x^3}\right)^{15}$ coefficient of x^{32} is equal to :
(a) 1365 (b) 1356 (c) 1256 (d) 1255

79. The length of normal to the curve $y=\frac{1}{2}a(e^{x/a}+e^{-x/a})$ is :
(a) $\frac{y^2}{a}$ (b) $\frac{a}{y^2}$ (c) $\frac{a}{y}$ (d) $\frac{y}{a}$

80. $\left[\frac{\sqrt{3}+2\cos A}{1-2\sin A}\right]^3+\left[\frac{1+2\sin A}{\sqrt{3}-2\cos A}\right]^3$ is equal to :
(a) 1 (b) 0 (c) -1 (d) $\sqrt{3}$

81. If $\frac{\cos A}{\cos B}=n, \frac{\sin A}{\sin B}=m$, then $(m^2-n^2)\sin^2 B$ is equal to :
(a) $1-n^2$ (b) $1+n^2$ (c) $1-n$ (d) $1+n$

82. If $(\sin\alpha+\text{cosec}\,\alpha)^2+(\cos\alpha+\sec\alpha)^2 = k+\tan^2\alpha+\cot^2\alpha$, then k is equal to :
(a) 3 (b) 5
(c) 7 (d) 9

83. $\frac{\sin(-660°)\tan(1050°)\sec(-420°)}{\cos(225°)\,\text{cosec}\,(315°)\cos(510°)}$ is equal to :
(a) $\frac{\sqrt{3}}{4}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{2}{\sqrt{3}}$ (d) $\frac{4}{\sqrt{3}}$

84. $\cos 6°\sin 24°\cos 72°$ is equal to :
(a) $-\frac{1}{8}$ (b) $-\frac{1}{4}$ (c) $\frac{1}{8}$ (d) $\frac{1}{4}$

85. If $\sin\alpha+\sin\beta=a, \cos\alpha+\cos\beta=b$, then $\sin(\alpha+\beta)\cos^2\left(\frac{\alpha-\beta}{2}\right)$ is equal to :
(a) $\frac{ab}{2}$ (b) $\frac{a+b}{2}$
(c) $\frac{2ab}{a^2-b^2}$ (d) $\frac{2b}{a^2+b^2-1}$

86. If $\tan\theta_1=k\cot\theta_2$, then $\frac{\cos(\theta_1-\theta_2)}{\cos(\theta_1+\theta_2)}$ is equal to :
(a) $\frac{1+k}{1-k}$ (b) $\frac{1-k}{1+k}$ (c) $\frac{k+1}{k-1}$ (d) $\frac{k-1}{k+1}$

87. If $\tan\theta + \sec\theta = \sqrt{3}$, then the principal value of $\theta + \frac{\pi}{6}$ is equal to :
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{3}$ (c) $\frac{2\pi}{3}$ (d) $\frac{3\pi}{4}$

88. If $\tan^{-1} 3 + \tan^{-1} n = \tan^{-1} 8$, then n is equal to :
(a) 5 (b) $\frac{1}{5}$ (c) $\frac{5}{14}$ (d) $\frac{14}{5}$

89. $\cosh 2 + \sinh 2$ is equal to :
(a) $\frac{1}{e}$ (b) e (c) $e^{1/2}$ (d) e^2

90. If $\cosh x = \log_e (2 + \sqrt{3})$, then x is equal to :
(a) 1 (b) 2 (c) 3 (d) 5

91. If in a ΔABC, a, b, c are in AP then $\tan\frac{A}{2}\tan\frac{C}{2}$ is equal to :
(a) 3 (b) 4 (c) $\frac{1}{4}$ (d) $\frac{1}{3}$

92. In a ΔABC, $\cos A + \cos B + \cos C$ is equal to :
(a) $1 + \frac{r}{R}$ (b) $1 - \frac{r}{R}$ (c) $1 - \frac{R}{r}$ (d) $1 + \frac{R}{r}$

93. In a ΔABC, $r_1 + r_2 - r_3 - r$ is equal to :
(a) $4R\cos A$ (b) $4R\cos B$
(c) $4R\cos C$ (d) $4R$

94. If two towers of height h_1 and h_2 subtend angles 60° and 30° respectively at the mid point of the line joining their feet, then $h_1 : h_2$ is equal to :
(a) 1 : 2 (b) 1 : 3 (c) 2 : 1 (d) 3 : 1

95. A straight rod of length 9 units slides with its ends. A and B always on the x and y axis respectively, then the locus of the centroid of ΔOAB is :
(a) $x^2 + y^2 = 3$ (b) $x^2 + y^2 = 9$
(c) $x^2 + y^2 = 1$ (d) $x^2 + y^2 = 81$

96. The vertices of a triangle are (6, 6), (0, 6) and (6, 0) the distance between its circumcentre and centroid is :
(a) $2\sqrt{2}$ (b) 2 (c) $\sqrt{2}$ (d) 1

97. If the point $[x_1 + t(x_2 - x_1), y_1 + t(y_2 - y_1)]$ divides the join of the (x_1, y_1) and (x_2, y_2) internally, then :
(a) $t < 0$ (b) $0 < t < 1$
(c) $t > 1$ (d) $t = 1$

98. If the points (1, 2) and (3, 4) were to be on the same side of the line $3x - 5y + a = 0$, then :
(a) $7 < a < 11$ (b) $a = 7$
(c) $a = 11$ (d) $a < 7$ or $a > 11$

99. The co-ordinate of the image of the origin O with respect to the straight line $x + y + 1 = 0$ is :
(a) $\left(-\frac{1}{2}, -\frac{1}{2}\right)$ (b) $(-2, -2)$
(c) (1, 1) (d) $(-1, -1)$

100. The area of the triangle formed by the axes and the line
$(\cos h\,\alpha - \sin h\,\alpha)x + (\cosh\alpha + \sinh\alpha)y = 2$,
in square units, is :
(a) 1 (b) 2 (c) 3 (d) 4

Answers

Physics

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

Chemistry

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

Mathematics

1.	(c)	2.	(c)	3.	(a)	4.	(c)	5.	(c)	6.	(c)	7.	(d)	8.	(b)	9.	(a)	10.	(a)
11.	(c)	12.	(a)	13.	(c)	14.	(c)	15.	(b)	16.	(c)	17	(d)	18.	(b)	19.	(c)	20.	(b)
21.	(b)	22.	(b)	23.	(b)	24.	(d)	25.	(c)	26.	(c)	27.	(c)	28.	(a)	29.	(d)	30.	(a)
31.	(b)	32.	(d)	33.	(c)	34.	(d)	35.	(b)	36.	(b)	37.	(a)	38.	(b)	39.	(a)	40.	(d)
41.	(d)	42.	(b)	43.	(d)	44.	(d)	45.	(a)	46.	(d)	47.	(c)	48.	(a)	49.	(b)	50.	(b)
51.	(c)	52.	(b)	53.	(b)	54.	(d)	55.	(c)	56.	(b)	57.	(d)	58.	(a)	59.	(b)	60.	(c)
61.	(b)	62.	(b)	63.	(c)	64.	(c)	65.	(a)	66.	(b)	67.	(b)	68.	(d)	69.	(b)	70.	(c)
71.	(d)	72.	(c)	73.	(b)	74.	(b)	75.	(b)	76.	(b)	77.	(c)	78.	(a)	79.	(a)	80.	(b)
81.	(a)	82.	(c)	83.	(c)	84.	(c)	85.	(a)	86.	(a)	87.	(b)	88.	(b)	89.	(d)	90.	(b)
91.	(d)	92.	(a)	93.	(d)	94.	(d)	95.	(c)	96.	(c)	97.	(b)	98.	(d)	99.	(d)	100.	(b)

Hints & Solutions

PHYSICS

1. $i_1 = i_2 = 5$ A, $r = 0.5$ m

Force per unit length between the two wires

$$F = \frac{\mu_0}{2\pi}\frac{i_1 i_2}{r} = 2 \times 10^{-7} \times \frac{5 \times 5}{0.5}$$

$$= 10^{-5} \text{ N}$$

The currents are in the opposite direction, So, force will be repulsive.

2. $m = 3 \times 10^{-6}$ kg, $E = 10^6$ N/C

For particle to be stationary

Electric force = weight of the particle

$$qE = -mg$$

($\because$ Electric field is vertically downward)

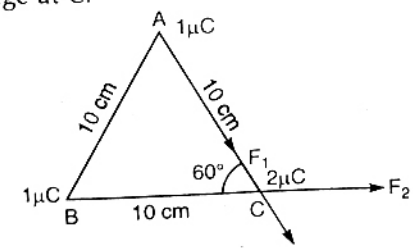
$$\therefore \quad q = \frac{-mg}{E} = \frac{-3 \times 10^{-6} \times 10}{10^6}$$

$$= -3 \times 10^{-11} \text{ C}$$

$$= -3 \times 10^{-5} \mu\text{C}$$

3. $AB = BC = AC = 10 \text{ cm} = 10 \times 10^{-2}$ m

Force applied by the charge on A, on the charge at C.



$$F_1 = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{AC^2}$$

$$= 9 \times 10^9 \times \frac{(1 \times 10^{-6})(2 \times 10^{-6})}{(10 \times 10^{-2})^2} = 1.8 \text{ N}$$

Similarly, force applied by the charge on B, on the charge at C

$$F_2 = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{BC^2}$$

$$= 9 \times 10^9 \frac{(1 \times 10^{-6})(2 \times 10^{-6})}{(10 \times 10^{-2})^2}$$

$$= 1.8 \text{ N}$$

Resultant of F_1 and F_2

$$F = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$$

$$= \sqrt{(1.8)^2 + (1.8)^2 + 2(1.8)(1.8)\cos 60}$$

$$= \sqrt{(1.8)^2 + (1.8)^2 + 2(1.8)^2 \times \frac{1}{2}}$$

$$= 1.8\sqrt{3} \text{ N}$$

4. Length of magnet $2l = 12$ cm

$$= 12 \times 10^{-2} \text{ m}$$

Pole strength $m = 2$ A-m

$$d = 10 \text{ cm} = 10 \times 10^{-2} \text{ m}$$

Magnetic field in the axial position

$$B = \frac{\mu_0}{4\pi}\frac{2md}{(d^2 - l^2)^2}$$

$$= \frac{\mu_0}{4\pi}\frac{2(m \times 2l) \times d}{(d^2 - l^2)^2}$$