EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER–2001

PHYSICS

1. A nichrome wire 50 cm long and 1 mm^2 cross-section carries a current of 4 A. When connected to 2 volt battery. The resistivity of nichrome wire in Ω–m is :
   (a) 1×10^{-6} (b) 4×10^{-7}
   (c) 3×10^{-7} (d) 2×10^{-7}

2. If the charge on a body is increased by 2 C, the energy stored in it increases by 21%. The original charge on the body in coulomb is :
   (a) 10 (b) 20 (c) 30 (d) 40

3. Two electric charges of 9 μC and – 3 μC are placed 0.16 m apart in air. There will be a point '*P*' at which electric potential is zero on the line joining two charges and in between them. The distance of *P* from 9 μC is :
   (a) 0.14 m (b) 0.12 m
   (c) 0.08 m (d) 0.06 m

4. A 20 F capacitor is charged to 5 V and isolated. It is then connected in parallel with an uncharged 30 F capacitor. The decrease in the energy of the system will be :
   (a) 25 J (b) 100 J (c) 125 J (d) 150 J

5. There is a uniform electric field of strength 10^3 V m^{-1} along *y*-axis. A body of mass 1 g and charge 10^{-6} C is projected into the field from origin along the positive *X*-axis with a velocity 10 ms^{-1}. Its speed in ms^{-1} after 10 sec is :
   (Neglect gravitation)
   (a) 10 (b) $5\sqrt{2}$ (c) $10\sqrt{2}$ (d) 20

6. A body of capacity 4 μF is charged to 80 V and another body of capacity 6 μF is charged to 30 V. When they are connected the energy lost by 4 μF capacitor is :
   (a) 9.8 mJ (b) 4.6 mJ (c) 3.2 mJ (d) 2.5 mJ

7. A magnet freely suspended in a vibration magnetometer makes 40 oscillations per minute at place '*A*' and 20 oscillations per minute at a place '*B*'. If the horizontal component of earth's magnetic field at '*A*' is 36×10^{-6} T, then its value at '*B*' is :
   (a) 30×10^{-6} T (b) 9×10^{-6} T
   (c) 144×10^{-6} T (d) 288×10^{-6} T

8. A magnet of length 10 cm and magnetic moment 1 Am^2 is placed along side *AB* of an equilateral triangle *ABC*. If the length of the side *AB* is 10 cm. The magnetic induction at the point '*C*' is :
   ($\mu_0 = 4\pi \times 10^{-7}$ Hm^{-1})
   (a) 10^{-9} T (b) 10^{-7} T (c) 10^{-5} T (d) 10^{-4} T

9. The difference in the number of wavelengths, when yellow light propagates through air and vacuum columns of the same thickness, is one. The thickness of the air column is :
   Refractive index of air $\mu_c = 1.0003$
   Wavelength of yellow light in vacuum = 6000 Å
   (a) 1.8 mm (b) 2 mm (c) 2 cm (d) 2.2 cm

10. Light waves producing interference have their amplitudes in the ratio 3 : 2. The intensity ratio of maximum and minimum of interference fringes is :
    (a) 36 : 1 (b) 9 : 4 (c) 25 : 1 (d) 6 : 4

11. When a glass prism of refracting angle 60° is immersed in a liquid its angle of minimum deviation is 30°. The critical angle of glass with respect to the liquid medium is :
    (a) 42° (b) 45° (c) 50° (d) 52°

12. One face of the glass prism is silver polished. A light ray falls at an angle of 45° on the other face. After reflection it is subsequently reflected from the silvered face and then retraces its path. The refracting angle of prism is 30°. The refractive index of the prism is :
(a) $\frac{3}{2}$ (b) $\sqrt{2}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\sqrt{3}$

13. In the visible region the dispersive powers and the mean angular deviations for crown and flint glass prisms are ω, ω' and d, d' respectively. The condition of getting dispersion with zero deviation, when the two prisms are combined is :
(a) $\sqrt{\omega d} + \sqrt{\omega' d'} = 0$
(b) $\omega' d + \omega d' = 0$
(c) $\omega d + \omega' d' = 0$
(d) $(\omega d)^2 + (\omega' d')^2 = 0$

14. The sound waves of wavelengths 5 m and 6 m formed 30 beats in 3 seconds. The velocity of sound is :
(a) 300 ms^{-1} (b) 310 ms^{-1}
(c) 320 ms^{-1} (d) 330 ms^{-1}

15. In order to double the frequency of the fundamental note emitted by a stretched string, the length is reduced to $\frac{3}{4}$ th of the original length and the tension is changed. The factor by which the tension is to be changed is :
(a) $\frac{3}{8}$ (b) $\frac{2}{3}$ (c) $\frac{8}{9}$ (d) $\frac{9}{4}$

16. The wavelength of maximum intensity of radiation emitted by a star is 289.8 nm. The radiation intensity of the star is :
(Stefan's constant $= 5.67 \times 10^{-8}\ Wm^2\ K^{-4}$, constant $b = 2898\ \mu mK$)
(a) $5.67 \times 10^8\ W/m^2$
(b) $5.67 \times 10^{12}\ W/m^2$
(c) $10.67 \times 10^7\ W/m^2$
(d) $10.67 \times 10^{14}\ W/m^2$

17. The pressure and density of a diatomic gas $\left(\gamma = \frac{7}{5}\right)$ changes adiabatically from (P, d) to (P', d'). If $\frac{d'}{d} = 32$. Then $\frac{P'}{P}$ is :
(a) $\frac{1}{128}$ (b) 32 (c) 128 (d) 256

18. A lead bullet of mass 10 g travelling at 300 m/s strikes against a block of wood and comes to rest. Assuming 50% of heat is absorbed by the bullet, the increase in its temperature is :
(specific heat of lead = 150 J/kg-°C)
(a) 100°C (b) 125°C (c) 150°C (d) 200°C

19. When an air bubble of radius 'r' rises from the bottom to the surface of a lake. Its radius becomes $\frac{5r}{4}$ (the pressure of the atmosphere is equal to the 10 m height to water column). If the temperature is constant and the surface tension is neglected the depth of the lake is :
(a) 5.53 m (b) 6.53 m
(c) 9.53 m (d) 12.53 m

20. A closed hollow insulated cylinder is filled with gas at 0°C and also contains an insulated piston of negligible weight and negligible thickness at the middle point. The gas in one side of the piston is heated to 100°C. If the piston moves 5 cm. The length of the hollow cylinder is :
(a) 15.65 cm (b) 27.3 cm
(c) 38.6 cm (d) 64.6 cm

21. When a resistor of 11 Ω is connected in series with an electric cell, the current flowing in it is 0.5 A. Instead, when a resistor of 5 Ω is connected to the same electric cell in series, the current increases by 0.4 A. The internal resistance of the cell is :
(a) 1.5 Ω (b) 2 Ω (c) 2.5 Ω (d) 3.5 Ω

22. Thomson coefficient of a conductor is 10 μ VK. The two ends of it are kept at 50°C and 60°C respectively. Amount of heat absorbed by the conductor when a charge of 10 C flows through it, is :
(a) 1000 J (b) 100 J (c) 100 mJ (d) 1 mJ

23. A wire in the form of a square of side 'a' carries a current 'i'. Then the magnetic induction at the centre of the square is :
(Magnetic permeability of free space = μ_0)
(a) $\frac{\mu_0 i}{2\pi a}$ (b) $\frac{\mu_0 i\sqrt{2}}{\pi a}$
(c) $\frac{2\sqrt{2}\mu_0 i}{\pi a}$ (d) $\frac{\mu_0 i}{\sqrt{2}\pi a}$

24. If a change in current of 0.01 A in one coil produces a change in magnetic flux of 2×10^{-2} Wb in the other coil, then the mutual inductance of the two coils in henry is :
(a) zero (b) 0.5 (c) 2 (d) 3

25. A particle of mass 0.6 g and having charge of 25 nC is moving horizontally with a uniform velocity 1.2×10^4 ms^{-1} in a uniform magnetic field, then the value of the magnetic induction is : ($g = 10$ ms^{-2})
(a) zero (b) 10 T
(c) 20 T (d) 200 T

26. Photoelectric emission is observed from a metallic surface for frequencies ν_1 and ν_2 of the incident light rays ($\nu_1 > \nu_2$). If the maximum values of kinetic energy of the photoelectrons emitted in the two cases are in the ratio of 1 : k, then the threshold frequency of the metallic surface is :
(a) $\frac{\nu_2 - \nu_1}{k-1}$ (b) $\frac{k\nu_1 - \nu_2}{k-1}$
(c) $\frac{k\nu_2 - \nu_1}{k-1}$ (d) $\frac{\nu_2 - \nu_1}{k}$

27. The de-Broglie wavelength of an electron having 80 eV energy is nearly :
(1 eV = 1.6×10^{-19} J)
Mass of the electron = 9×10^{-31} kg
Planck's constant = 6.6×10^{-34} J-s)
(a) 140 Å (b) 0.14 Å
(c) 14 Å (d) 1.4 Å

28. Consider the following statements *A* and *B* and identify the correct choice in the given answers.
A. Tightly bound electrons of target material scatter *X*-ray photon, resulting in the Compton effect.
B. Photoelectric effect takes place with free electrons.
(a) Both *A* and *B* are true
(b) *A* is true but *B* is false
(c) *A* is false but *B* is true
(d) Both *A* and *B* are false

29. A heavy nucleus at rest breaks into two fragments which fly off with velocities in the ratio 3 : 1. The ratio of radii of the fragments is :
(a) 1 : $3^{1/3}$ (b) $3^{1/3}$: 4
(c) 4 : 1 (d) 2 : 1

30. While a collector to emitter voltage is constant in a transistor, the collector current ehanges by 8.2 mA when the emitter current changes by 8.3 mA. The value of forward current ratio is :
(a) 82 (b) 83 (c) 8.2 (d) 8.3

31. In CGS system the magnitude of the force is 100 dynes. In another system where the fundamental physical quantities are kilogram, meter and minute, the magnitude of the force is :
(a) 0.036 (b) 0.36 (c) 3.6 (d) 36

32. In an experiment of simple pendulum, the errors in the measurement of length of the pendulum (L) and time period (T) are 3% and 2% respectively. The maximum percentage error in the value of $\frac{L}{T^2}$ is :
(a) 5% (b) 7% (c) 8% (d) 1%

33. An electron moves with speed 2×10^5 m/s along the positive x-direction in the presence of a magnetic field of induction $\vec{B} = \hat{i} + 4\hat{j} - 3\hat{k}$ (in tesla). The magnitude of the force experienced by the electron in newtons is :
(Charge on the electron = 1.6×10^{-19} C)
(a) 1.18×10^{-13} (b) 1.28×10^{-13}
(c) 1.6×10^{-13} (d) 1.72×10^{-13}

34. A particle falls from a height 'h' upon a fixed horizontal plane and rebounds. If 'e' is the coefficient of restitution, the total distance travelled before rebound- ing has stopped is :
(a) $h\left(\frac{1+e^2}{1-e^2}\right)$ (b) $h\left(\frac{1-e^2}{1+e^2}\right)$
(c) $\frac{h}{2}\left(\frac{1-e^2}{1+e^2}\right)$ (d) $\frac{h}{2}\left(\frac{1+e^2}{1-e^2}\right)$

35. An object is projected with a velocity of 20 m/s making an angle of 45° with horizontal. The equation for the trajectory is "$h = Ax - Bx^2$" where 'h' is height, 'x' is horizontal distance A and B are constats.
The ratio A : B is : ($g = 10$ m/s^2)
(a) 1 : 5 (b) 5 : 1 (c) 1 : 40 (d) 40 : 1

36. A body of mass 6 kg is under a force which causes displacement in it given by "$s = \frac{t^2}{4}$" metres where 't' is time. The work done by the force in 2 seconds is :
(a) 12 J (b) 9 J
(c) 6 J (d) 3 J

37. A force applied by an engine on a train of mass 2.05×10^6 kg changes its velocity from 5 m/s to 25 m/s in 5 minutes. The power of the engine is :
(a) 1.025 MW (b) 2.05 MW
(c) 5 MW (d) 6 MW

38. The velocities of three particles of masses 20 g, 30 g and 50 g are $10\,\hat{i}$, $10\,\hat{j}$ and $10\,\hat{k}$ respectively. The velocity of the centre of mass of the three particles is :
(a) $2\hat{i} + 3\hat{j} + 5\hat{k}$
(b) $10\,(\hat{i} + \hat{j} + \hat{k})$
(c) $20\hat{i} + 30\hat{j} + 5\hat{k}$
(d) $2\hat{i} + 30\hat{j} + 50\hat{k}$

39. A body of weight "64N" is pushed with just enough force to start it moving across a horizontal floor and the same force continues to act afterwards. if the coefficients of static and dynamic friction are 0.6 and 0.4 respectively, the acceleration of the body is : (acceleration due to gravity $= g$)
(a) $\frac{g}{6.4}$ (b) $0.64\,g$ (c) $\frac{g}{32}$ (d) $0.2\,g$

40. A particle is projected up along a rough inclined plane of inclination 45° with the horizontal. If the coefficient of friction is 0.5, the acceleration is : (g = Acceleration due to gravity)
(a) $\frac{g}{2}$ (b) $\frac{g}{2\sqrt{2}}$ (c) $\frac{3g}{2\sqrt{2}}$ (d) $\frac{g}{\sqrt{2}}$

41. A uniform metal rod of length 'L' and mass 'M' is rotating about an axis passing through one of the ends & perpendicular to the rod with angular speed 'ω'. If the temperature increases by t°C, then the change in its angular velocity is proportional to which of the following? (Coefficient of linear expansion of rod = α)
(a) $\sqrt{\omega}$ (b) ω (c) ω^2 (d) $\frac{1}{\omega}$

42. From a uniform wire, two circular loops are made (i) P of radius 'r' and (ii) Q of radius nr. If the moment of inertia of Q about an axis passing through its centre and perpendicular to its plane is 8 times that of P about a similar axis, the value of 'n' is (diameter of the wire is very much smaller than i or nr) :
(a) $8\sqrt{2}$ (b) $6\sqrt{2}$ (c) $4\sqrt{2}$ (d) $2\sqrt{2}$

43. Mass M is divided into two parts "xm" and "$(1-x)m$". For a given separation the value of x for which the gravitational attraction between the two pieces becomes maximum is :
(a) $\frac{1}{2}$ (b) $\frac{3}{5}$ (c) 1 (d) 2

44. Two particles P and Q start from origin and execute simple harmonic motion along X-axis with the same amplitude but with period 3 seconds and 6 seconds respectively. The ratio of the velocities of P and Q when they meet is :
(a) 1 : 2 (b) 2 : 1 (c) 2 : 3 (d) 3 : 2

45. A body is executing simple harmonic motion. At a displacement x its potential energy is E_1 and at a displacement y it potential energy is E_2. The potential energy (E) at displacement $(x + y)$ is :
(a) $\sqrt{E} = \sqrt{E_1} - \sqrt{E_2}$ (b) $\sqrt{E} = \sqrt{E_1} + \sqrt{E_2}$
(c) $E = E_1 + E_2$ (d) $E = E_1 - E_2$

46. The length of an elastic string is 'a' metres when the longitudinal tension is 4 N and 'b' meters when the longitudinal tension is 5 N. The length of the string in metres when the longitudinal tension is 9 N is :
(a) $a - b$ (b) $5b - 4a$
(c) $2b - \frac{1}{4}a$ (d) $4a - 3b$

47. A mercury drop of radius 1 cm is sprayed into 10^6 drops of equal size. The energy expended in joules is :
(Surface tension of mercury is 460×10^{-3} N/m)
(a) 0.057 (b) 5.7
(c) 5.7×10^{-4} (d) 5.7×10^{-3}

48. Water is conveyed through a uniform tube of 8 cm in diameter and 3140 m in length at the rate $2 \times 10^{-3}\ m^3$ per second. The pressure required in maintain the flow is : (Viscosity of water = 10^{-3} SI units)
(a) $6.25 \times 10^3\ Nm^{-2}$
(b) $0.625\ Nm^{-2}$
(c) $0.0625\ Nm^{-2}$
(d) $0.00625\ Nm^{-2}$

49. A tank with vertical walls is mounted so that its base is at a height H above the horizontal ground. The tank is filled with wate to a depth 'h'. A hole is punched in the side wall of the tank at a depth 'x' below the water surface. To have maximum range of the emerging stream, the value of x is :
(a) $\frac{H+h}{4}$ (b) $\frac{H+h}{2}$
(c) $\frac{H+h}{3}$ (d) $\frac{3(H+h)}{4}$

50. A steel meter scale is to be ruled so that millimeter intervals are accurate within about 5×10^{-5} m at a certain temperature. The maximum temperature variation allowable during the ruling is : (Coefficient of linear expansion of steel = $10 \times 10^{-6}\ K^{-1}$)
(a) 2°C (b) 5°C (c) 7°C (d) 10°C

CHEMISTRY

1. Which one of the following reactions is an example of heterogeneous catalysis ?
(a) $2CO\ (g) + O_2(g) \xrightarrow{NO\ (g)} 3CO_2$
(b) $2SO_2\ (g) + O_2(g) \xrightarrow{NO\ (g)} 2SO_3$
(c) $2CO\ (g) + O_2\ (g) \xrightarrow{Pt\ (s)} 2CO_2$
(d) $CH_3CHO\ (g) \xrightarrow{I_2\ (g)} CH_4 + CO$

2. In which of the following reactions, H_2O_2 acts as a reducing reagent ?
(a) $PbO_2\ (s) + H_2O_2\ (aq) \longrightarrow PbO\ (s) + H_2O\ (l) + O_2\ (g)$
(b) $Na_2SO_3\ (aq) + H_2O_2\ (aq) \longrightarrow Na_2SO_4\ (aq) + H_2O\ (l)$
(c) $2KI\ (aq) + H_2O_2\ (aq) \longrightarrow 2KOH\ (aq) + I_2\ (s)$
(d) $KNO_2\ (aq) + H_2O_2\ (aq) \longrightarrow KNO_3\ (aq) + H_2O\ (l)$

3. ..... process is used for the removal of hardness of water :
(a) Calgon (b) Baeyer
(c) Serpeck (d) Hoope

4. The electronic configuration of elements A, B and C are $[He]\ 2s^1$, $[Ne]\ 3s^1$ and $[Ar]\ 4s^1$ respectively, which one of the following order is correct for the first ionization potentials (in k.J. mol^{-1}) of A, B and C ?
(a) $A > B > C$ (b) $C > B > A$
(c) $B > C > A$ (d) $C > A > B$

5. In organic reactions, sodium in liquid ammonia is used as :
(a) reducing agent (b) hydrating agent
(c) oxidising agent (d) precipitating agent

6. During the electrolytic reduction of alumina, the reaction at cathode is :
(a) $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$
(b) $3F^- \longrightarrow 3F + 3e^-$
(c) $Al^{3+} + 3e^- \longrightarrow Al$
(d) $2H^+ + 2e^- \longrightarrow H_2$

7. What is the molecular formula of borazole ?
(a) B_2H_6 (b) $B_6N_6H_6$
(c) $B_3N_3H_6$ (d) $B_3N_3H_3$

8. The catenation tendency of C, Si and Ge is in the order Ge < Si < C. The bond energies (in kJ mol^{-1}) of C—C, Si—Si and Ge—Ge bonds, respectively are :
(a) 167, 180, 348 (b) 180, 167, 348
(c) 348, 167, 180 (d) 348, 180, 167

9. Ionic radius (in Å) of As^{3+}, Sb^{3+} and Bi^{3+} follow the order :
(a) $As^{3+} > Sb^{3+} > Bi^{3+}$
(b) $Sb^{3+} > Bi^{3+} > As^{3+}$
(c) $Bi^{3+} > As^{3+} > Sb^{3+}$
(d) $Bi^{3+} > Sb^{3+} > As^{3+}$

10. What are the products obtained when ammonia is reacted with excess chlorine ?
(a) N_2 and NCl_3
(b) N_2 and HCl
(c) N_2 and NH_4Cl
(d) NCl_3 and HCl

11. What are the products formed when chlorine is passed through aqueous hypo solution ?
(a) $Na_2SO_3 + HCl + S$
(b) $Na_2SO_3 + SO_3 + HCl$
(c) $Na_2SO_4 + HCl + S$
(d) $Na_2SO_4 + HCl + SO_2$

12. Which one of the following order is correct for the bond energies of halogen molecules ?
(a) $I_2 > Cl_2 > Br_2$ (b) $Br_2 > Cl_2 > I_2$
(c) $I_2 > Br_2 > Cl_2$ (d) $Cl_2 > Br_2 > I_2$

13. Which one of the following halogens liberates oxygen, when passed through hot concentrated KOH solution ?
(a) I_2 (b) Cl_2 (c) Br_2 (d) F_2

14. The number of lone pairs of electrons present on Xe in XeF_4 is :
(a) 3 (b) 4 (c) 1 (d) 2

15. Which one of the following ions exhibits highest magnetic moment ?
(a) Cu^{2+} (b) Ti^{3+} (c) Ni^{2+} (d) Mn^{2+}

16. Which one of the following is mainly responsible for depletion of ozone layer ?
(a) Methane
(b) Cabon dioxide
(c) Water
(d) Chloro-fluoro carbons

17. The structural formula of 2-methyl-2-butene is :
(a) $CH_3—CH(CH_3)—CH= CH_2$
(b) $CH_3—CH_2—C(CH_3)= CH_2$
(c) $CH_3—CH= CH—CH_3$
(d) $CH_3—CH= C(CH_3)—CH_3$

18. Which one of the following pairs of compounds are functional isomers ?
(a) $CH_3CH_2CH_2OH$, $(CH_3)_2CHCH_2OH$
(b) $CH_3CH_2CH_2CH_2OH$, $(CH_3)_2CHCH_2OH$
(c) $CH_3CH_2CH_2OH$, $CH_3CH_2CH_2Cl$
(d) $CH_3CH_2CH_2OH$, $CH_3—O—CH_2CH_3$

19. Consider the following reactions,

$$C_2H_2 \xrightarrow[500°C]{\text{red hot iron tube}} A$$

$$A \xrightarrow[70°C]{\text{conc. } HNO_3, \text{ conc. } H_2SO_4} B$$

$$B \xrightarrow{LiAlH_4} C_6H_5—N= N—C_6H_5$$

A and B are :
(a) $A = C_2H_4$, $B = C_6H_6$
(b) $A = C_2H_6$, $B = C_6H_5NH_2$
(c) $A = C_2H_4$, $B = C_6H_5NH_2$
(d) $A = C_6H_6$, $B = C_6H_5NO_2$

20. Which one of the following is used in the preparation of styrene ?
(a) CH_3CHO (b) P_2O_5
(c) CH_4 (d) C_6H_6

21. Ethanol, when reacted with PCl_5 gave A, $POCl_3$ and HCl. A reacts with silver nitrite to form B (major product) and AgCl. A and B are respectively :
(a) C_2H_5Cl and $C_2H_5OC_2H_5$
(b) C_2H_6 and $C_2H_5OC_2H_5$
(c) C_2H_5Cl and $C_2H_5NO_2$
(d) C_2H_6 and $C_2H_5NO_2$

22. Chloroethane reacts with X to form diethyl ether. What is X ?
(a) NaOH (b) H_2SO_4
(c) C_2H_5ONa (d) $Na_2S_2O_3$

23. 3 moles of ethanol reacts with one mole of phosphorus tribromide to form 3 moles of bromo-ethane and one mole of X. Which of the following is X ?
(a) H_3PO_4 (b) H_3PO_2
(c) HPO_3 (d) H_3PO_3

24. Absolute alcohol (100% alcohol) is prepared by distilling rectified spirit over :
(a) Na (b) $CaCl_2$
(c) Mg (d) $Mg(OC_2H_5)_2$

25. What is Y in the following reaction ?
$C_2H_5I + NaOC_2H_5 \longrightarrow X + NaI$

$$X + 2HI \xrightarrow{\Delta} 2Y + H_2O$$

(a) C_2H_6 (b) C_2H_5I
(c) C_2H_4 (d) $C_2H_5OC_2H_5$

26. Dry distillation of calcium acetate and calcium formate forms :
(a) methanol (b) ethanal
(c) ethanol (d) acetone

27. When acetaldehyde is reacted with $LiAlH_4$, what is the product formed ?
(a) CH_3COOH (b) CH_3CH_2OH
(c) CH_3OH (d) HCOOH

28. Acetic acid is reacted with metallic sodium to form hydrogen and X. When X is heated with sodalime, Y and sodium carbonate are formed. Y is ..... :
(a) C_2H_6 (b) CH_4
(c) CH_3COONa (d) CH_3CONH_2

29. Consider the following reaction :
$C_6H_5NO_2 \xrightarrow{Sn/HCl} X \xrightarrow{C_6H_5COCl} Y + HCl$
What is Y ?
(a) Acetanilide
(b) Benzanilide
(c) Azo-benzene
(d) Hydrazo-benzene

30. The metal ion present in vitamin B_{12} is :
(a) Co^{3+} (b) Co^{2+}
(c) Fe^{2+} (d) Fe^{3+}

31. The energy of an electron present in Bohr's second orbit of hydrogen atom is :
(a) -1312 J atom^{-1} (b) -328 kJ mol^{-1}
(c) -328 J mol^{-1} (d) -164 kJ mol^{-1}

32. In the ground state, an element has 13 electrons in M shell. The element is :
(a) copper (b) chromium
(c) nickel (d) iron

33. In a nuclide, one a.m.u. of mass is dissipated into energy to bind its nucleons. The energy equivalent of this mass is :
(a) 931.5 eV
(b) 931.5×10^6 eV
(c) 931.5×10^6 MeV
(d) 931.5 MV

34. What is X in the following reaction ?
$_{12}Mg^{26} + {}_1H^2 \longrightarrow {}_{12}Mg^{27} + X$:
(a) γ-ray (b) ${}_0n^1$
(c) ${}_1H^1$ (d) ${}_1D^2$

35. Let electronegativity, ionisation energy and electron affinity be represented as EN, IP and EA respectively. Which one of the following equation is correct according to Mulliken ?
(a) EN = IP × EA (b) EN = IP/EA
(c) $EN = \frac{IP + EA}{2}$ (d) EN = IP − EA

36. The element with atomic number 12 belongs to ..... group and ..... period :
(a) IA, third (b) III A, third
(c) II A, third (d) II A, second

37. Which of the following statements is true ?
(a) Hybridisation of the central atom in NH_3 and CH_4 is sp^2
(b) $BeCl_2$ has V shape while SO_2 is linear
(c) SF_6 is octahedral and F—S—F bond angle is 90°
(d) CO_2 has dipole moment

38. Bond dissociation energies of HF, HCl, HBr follow the order ..... :
(a) HCl > HBr > HF
(b) HF > HBr > HCl
(c) HF > HCl > HBr
(d) HBr > HCl > HF

39. What is the volume (in litres) of oxygen at STP required for complete combustion of 32 g of CH_4 ?
(Molecular weight of CH_4 is 16)
(a) 44.8 (b) 89.6 (c) 22.4 (d) 179.2

40. What are the oxidation numbers of nitrogen in NH_4NO_3 ?
(a) +3, −5 (b) −3, +5
(c) +3, −6 (d) +2, +2

41. The r.m.s. velocity of CO_2 at a temperature T (in kelvin) is x cm sec^{-1}. At what temperature (in kelvin), the r.m.s. velocity of nitrous oxide would be 4x cm sec^{-1} ? (Atomic weights of C, N and O are respectively 12, 14 and 16) :
(a) 16T (b) 2T (c) 4T (d) 32T

42. n moles of an ideal gas at temperature T (in kelvin) occupy V L of volume, exerting a pressure of P atmospheres. What is the concentration (in mol/L) ?
(a) $\frac{P}{RT}$ (b) $\frac{PT}{R}$ (c) $\frac{RT}{P}$ (d) $\frac{R}{PT}$

43. 250 mL of a sodium carbonate solution contains 2.65 g of Na_2CO_3. If 10 mL of this solution is diluted to one litre, what is the concentration of the resultant solution ?
(a) 0.1 M (b) 0.001 M
(c) 0.01 M (d) 10^{-4} M

44. The pK_a of a weak acid is 4.8. What should be the ratio of $\frac{[acid]}{[salt]}$, if a buffer of pH = 5.8 is required ?
(a) 0.1 (b) 10 (c) 1 (d) 2

45. Which of the following would produce a buffer solution when mixed in equal volumes ?
(a) 1 M CH_3COOH and 0.5 M NaOH
(b) 1 M CH_3COOH and 0.5 M HCl
(c) 1 M NH_4OH and 0.5 M NaOH
(d) 1 M NH_4Cl and 0.5 M HCl

46. One ampere of current is passed for 9650 seconds through molten $AlCl_3$. What is the weight in grams of Al deposited at cathode ? (atomic weight of Al = 27)
(a) 0.9 (b) 9.0 (c) 0.09 (d) 90.0

47. Molten $CuCl_2$ is electrolysed using platinum electrodes. The reaction occuring at anode is :
(a) $2Cl^- \longrightarrow Cl_2\,(g) + 2e^-$
(b) $Cl_2\,(g) + 2e^- \longrightarrow 2Cl$
(c) $Cu^{2+} + 2e^- \longrightarrow Cu\,(s)$
(d) $Cu\,(s) \longrightarrow Cu^{2+} + 2e^-$

48. Equilibrium constant for the reaction $H_2O\,(g) + CO\,(g) \rightleftharpoons H_2\,(g) + CO_2\,(g)$ is 81. If the velocity constant of the forward reaction is 162 L mol^{-1} s^{-1}. What is the velocity constant (in L mol^{-1} s^{-1}) for the backward reaction ?
(a) 13122 (b) 2 (c) 261 (d) 243

49. Consider the following reaction :
$A \longrightarrow$ Products
This reaction is completed in 100 minutes. The rate constant of this reaction at $t_1 = 10$ min, is 10^{-2} min^{-1}. What is the rate constant (in min^{-1}) at $t_2 = 20$ minutes ?
(a) 2×10^{-2} (b) 10^{-2} (c) 5×10^{-3} (d) 0.1

50. How many litres of oxygen (at STP) are required for complete combustion of 39 g of liquid benzene ?
(Atomic weights : C = 12, O = 16, H = 1)
(a) 84 (b) 22.4
(c) 42 (d) 11.2

MATHEMATICS

1. If $\vec{a} = \hat{i} + 4\hat{j}$, $\vec{b} = 2\hat{i} - 3\hat{j}$, $\vec{c} = 5\hat{i} + 9\hat{j}$, then $\vec{c}$ is equal to :
(a) $2\vec{a} + \vec{b}$ (b) $\vec{a} + 2\vec{b}$
(c) $3\vec{a} + \vec{b}$ (d) $\vec{a} + 3\vec{b}$

2. $ABCD$ is a parallelogram, with AC, BD as diagonals, then $\vec{AC} - \vec{BD}$ is equal to :
(a) $4\vec{AB}$ (b) $\vec{AB}$
(c) $3\vec{AB}$ (d) $2\vec{AB}$

3. If $\vec{a} = \hat{i} + \hat{j} + t\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$, then the values of '$t$' for which $(\vec{a} + \vec{b})$ and $(\vec{a} - \vec{b})$ are perpendicular, are :
(a) ± 2 (b) $\pm 2\sqrt{3}$
(c) $\pm 3\sqrt{2}$ (d) ± 3

4. If θ is the angle between $\vec{a}$ and $\vec{b}$ and $|\vec{a} \times \vec{b}| = |\vec{a} \cdot \vec{b}|$, then θ is equal to :
(a) 0 (b) π (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

5. $[\hat{i} - \hat{j}, \hat{j} - \hat{k}, \hat{k} - \hat{i}]$ is equal to :
(a) 0 (b) 1 (c) 2 (d) 3

6. $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are co-planar vectors, then $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d})$ is equal to :
(a) 0 (b) 1 (c) $\vec{a}$ (d) $\vec{b}$

7. In a competition A, B, C are participating the probability that A wins is twice that of B, the probability that B wins is twice that of C, then probability that A loses is :
(a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{4}{7}$ (d) $\frac{3}{7}$

8. The probability that a number selected at random from the set of numbers (1, 2, 3, ..., 100) is a cube, is :
(a) $\frac{1}{25}$ (b) $\frac{2}{25}$
(c) $\frac{3}{25}$ (d) $\frac{4}{25}$

9. The events A and B have probabilities 0.25 and 0.50 respectively. The probability that both A and B occur simultaneously is 0.14, then the probability that neither A nor B occurs, is :
(a) 0.39 (b) 0.29 (c) 0.11 (d) 0.25

10. Two dice are rolled simultaneously. The probability that the sum of the two numbers on the dice is a prime number, is :
(a) $\frac{5}{12}$ (b) $\frac{7}{12}$
(c) $\frac{9}{14}$ (d) none of these

11. Find the binomial probability distribution whose mean is 3 and variance is 2.
(a) $\left(\frac{2}{3}+\frac{1}{3}\right)^9$ (b) $\left(\frac{5}{3}+\frac{2}{3}\right)^9$
(c) $\left(\frac{3}{3}+\frac{1}{2}\right)^9$ (d) none of these

12. For a binominal variate X, if $n=4$ and $P(X=4)=6\,P(X=2)$, then the value of p is :
(a) $\frac{3}{7}$ (b) $\frac{4}{7}$ (c) $\frac{6}{7}$ (d) $\frac{5}{7}$

13. For all values of a and b the line $(a+2b)x+(a-b)y+(a+5b)=0$ passes through the point :
(a) $(-1, 2)$ (b) $(2, -1)$
(c) $(-2, 1)$ (d) $(1, -2)$

14. The lines $2x+3y=6$, $2x+3y=8$ cut the x-axis at A and B respectively. A line L drawn through the point $(2, 2)$ meets the x-axis as C in such a way that abscissae of A, B and C are in arithmetic progression. Then the equation of the line L is :
(a) $2x+3y=10$ (b) $8x+2y=10$
(c) $2x-3y=10$ (d) $8x-2y=10$

15. The number of circles that touch all the straight lines $x+y=4$, $x-y=-2$ and $y=2$ is :
(a) 1 (b) 2
(c) 3 (d) 4

16. The incentre of triangle formed by the lines $x+y=1$, $x=1$, $y=1$ is :
(a) $\left(1-\frac{1}{\sqrt{2}}, 1-\frac{1}{\sqrt{2}}\right)$
(b) $\left(1-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$
(c) $\left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$
(d) $\left(\frac{1}{\sqrt{2}}, 1-\frac{1}{\sqrt{2}}\right)$

17. The orthocentre of triangle formed by the lines $x+3y=10$ and $6x^2+xy-y^2=0$ is :
(a) (1, 3) (b) (3, 1)
(c) $(-1, 3)$ (d) $(1, -3)$

18. If one of the lines of pair of straight lines $ax^2+2hxy+by^2=0$ bisects the angle between the co-ordinate axes, then :
(a) $a^2+b^2=h^2$ (b) $(a+b)^2=4h^2$
(c) $a^2+b^2=4h^2$ (d) $(a+b)^2=h^2$

19. If the slope of one line is twice the slope of other in the pair of straight lines $ax^2+2hxy+by^2=0$, then $8h^2$ is equal to :
(a) $-9ab$ (b) $9ab$
(c) $-7ab$ (d) $7ab$

20. If the extremities of diagonal of a square $(1, -2, 3)$, $(2, -3, 5)$, then the length of its side, is :
(a) $\sqrt{6}$ (b) $\sqrt{3}$ (c) $\sqrt{5}$ (d) $\sqrt{7}$

21. The foot of the perpendicular from $(0, 2, 3)$ to the line $\frac{x+3}{5}=\frac{y-1}{2}=\frac{z+4}{3}$ is :
(a) $(-2, 3, 4)$ (b) $(2, -1, 3)$
(c) $(2, 3, -1)$ (d) $(3, 2, -1)$

22. If a line makes angle $\frac{\pi}{3}$ and $\frac{\pi}{4}$ with the x-axis and y-axis respectively, then the angle made by the line with the z-axis is :
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $\frac{5\pi}{12}$ (d) $\frac{\pi}{3}$

23. If the foot of the perpendicular from $(0, 0, 0)$ to the plane is $(1, 2, 2)$, then the equation of the plane is :
(a) $-x+2y+8z-9=0$
(b) $x+2y+2z-9=0$
(c) $x+y+z-5=0$
(d) $x+2y-3z+1=0$

24. If $P=(0, 1, 2)$, $Q=(4, -2, 1)$, $O=(0, 0, 0)$, then $\angle POQ$ is equal to :
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{6}$ (d) $\frac{\pi}{3}$

25. A variable plane is at a constant distance h from the origin and meets the co-ordinate axes in A, B, C. Locus of centroid of ΔABC is :
(a) $x^2+y^2+z^2=h^{-2}$ (b) $x^2+y^2+z^2=4h^{-2}$
(c) $x^2+y^2+z^2=16h^2$ (d) $\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{9}{h^2}$

26. The equation of the normal to the circle $x^2+y^2+6x+4y-3=0$ at $(1,-2)$ is :
(a) $y+1=0$ (b) $y+2=0$
(c) $y+3=0$ (d) $y-2=0$

27. The limiting points of the co-axial system containing the two circles $x^2+y^2+2x-2y+2=0$ and $25(x^2+y^2)-10x-80y+65=0$ are :
(a) $(1,-1),(-3,-40)$ (b) $(1,-1),\left(-\frac{1}{5},\frac{8}{5}\right)$
(c) $(-1,1),\left(\frac{1}{5},\frac{8}{5}\right)$ (d) $\left(-\frac{1}{5},-\frac{8}{5}\right)$

28. The radical axis of circles $x^2+y^2+5x+4y-5=0$ and $x^2+y^2-3x+5y-6=0$ is :
(a) $8y-x+1=0$ (b) $8x-y+1=0$
(c) $8x-8y+1=0$ (d) $y-8x+1=0$

29. If the polar of a point on the circle $x^2+y^2=p^2$ with respect to the circle $x^2+y^2=q^2$ touches the circle $x^2+y^2=r^2$, then p, q, r are in :
(a) AP (b) GP (c) HP (d) AGP

30. The length of latus rectum of parabola $y^2+8x-2y+17=0$ is :
(a) 2 (b) 4 (c) 8 (d) 16

31. If the normal to the parabola $y^2=4x$ at $P(1,2)$ meets the parabola again in Q, then co-ordinates of Q are :
(a) $(-6,9)$ (b) $(9,-6)$
(c) $(-9,-6)$ (d) $(-6,-9)$

32. The eccentricity of ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ is :
(a) $\frac{7}{16}$ (b) $\frac{5}{4}$ (c) $\frac{\sqrt{7}}{4}$ (d) $\frac{\sqrt{7}}{2}$

33. The products of lengths of perpendiculars from any point of hyperbola $x^2-y^2=8$ to its asymptotes, is :
(a) 2 (b) 3 (c) 4 (d) 8

34. The equation $16x^2+y^2+8xy-74x-78y+212=0$ represents :
(a) a cricle (b) a parabola
(c) an ellipse (d) a hyperbola

35. Equation of curve in polar co-ordinates is $\frac{l}{r}=2\sin^2\frac{\theta}{2}$, then it represents :
(a) a straight line
(b) a parabola
(c) a circle
(d) an ellipse

36. Evaluate $\int_{-1}^{1} f(x)\,dx$, where
$$f(x)=\begin{cases}1-2x, & x\le 0\\ 1+2x, & x\ge 0\end{cases}$$
(a) 0 (b) 2 (c) 4 (d) 6

37. $\lim\limits_{x\to\infty}\left(\frac{x+a}{x+b}\right)^{a+b}$ is equal to :
(a) 1 (b) e^{b-a} (c) e^{a-b} (d) e^{b}

38. $\lim\limits_{x\to 0}\left(\frac{x\,.\,10^x-x}{1-\cos x}\right)$ is equal to :
(a) log 10 (b) 2 log 10
(c) 3 log 10 (d) 4 log 10

39. If $f(x)=\frac{x^2-10x+25}{x^2-7x+10}$ and f is continuous at $x=5$, then $f(5)$ is equal to :
(a) 0 (b) 5 (c) 10 (d) 25

40. If $h(x)=x^{x^x}$, then at $x=1$ $\frac{h'(x)}{h(x)}$ is equal to :
(a) $h(x)$ (b) $\frac{1}{h(x)}$
(c) $1+\log h(x)$ (d) $-\log h(x)$

41. $\frac{d}{dx}\sin^{-1}(3x-4x^3)$ is equal to :
(a) $\frac{3}{\sqrt{4-x^2}}$ (b) $\frac{3}{\sqrt{1-x^2}}$
(c) $\frac{1}{\sqrt{4-x^2}}$ (d) $-\frac{1}{\sqrt{4-x^2}}$

42. If y_k is the kth derivative of y with respect to 'x', and $y=\cos(\sin x)$, then $y_1\sin x+y_2\cos x$ is equal to :
(a) $y\sin^3 x$ (b) $-y\sin^3 x$
(c) $y\cos^3 x$ (d) $-y\cos^3 x$

43. If $f(x) = \frac{x^2}{x+a}$, then $f''(a)$ is equal to :

(a) $4a$ (b) $\frac{1}{8a}$ (c) $\frac{1}{4a}$ (d) $8a$

44. The minimum value of $(x-\alpha)(x-\beta)$ is :

(a) 0 (b) $\alpha\beta$

(c) $\frac{1}{4}(\alpha-\beta)^2$ (d) $-\frac{1}{4}(\alpha-\beta)^2$

45. The equation of tangent to the curve $6y = 7 - x^3$ at (1, 1), is :

(a) $2x + y = 3$ (b) $x + 2y = 3$

(c) $x + y = -1$ (d) $x + y + 2 = 0$

46. The area (in square units) of the region bounded by $x^2 = 8y$, $x = 4$ and x-axis, is :

(a) $\frac{2}{3}$ (b) $\frac{4}{3}$ (c) $\frac{8}{3}$ (d) $\frac{10}{3}$

47. The maximum value of xy subject to $x + y = 7$ is :

(a) 10 (b) 12 (c) $\frac{49}{4}$ (d) $\frac{55}{4}$

48. If $u = e^{x^2 - y^2}$, then :

(a) $xu_x = yu_y$ (b) $yu_x = xu_y$

(c) $yu_x + xu_y = 0$ (d) $x^2u_y + y^2u_x = 0$

49. If $u = xy^2 \tan^{-1}\left(\frac{y}{x}\right)$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to :

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

50. $\int \frac{dx}{\sqrt{x}(x+9)}$ is equal to :

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

(c) $\tan^{-1}(\sqrt{x}) + c$ (d) $\tan^{-1}\left(\frac{\sqrt{x}}{3}\right) + c$

51. $\int (x+1)^2 e^x\, dx$ is equal to :

(a) $xe^x + c$ (b) $x^2x^x + c$

(c) $(x+1)e^x + c$ (d) $(x^2+1)e^x + c$

52. $\int \frac{dx}{a^2\sin^2 x + b^2\cos^2 x}$ is equal to :

(a) $\frac{1}{ab}\tan^{-1}\left(\frac{a\tan x}{b}\right) + c$

(b) $\tan^{-1}\left(\frac{a\tan x}{b}\right) + c$

(c) $\frac{1}{ab}\tan^{-1}\left(\frac{b\tan x}{a}\right) + c$

(d) $\tan^{-1}\left(\frac{b\tan x}{a}\right) + c$

53. $\int_0^{\pi/2} \sin^8 x\cos^2 x\, dx$ is equal to :

(a) $\frac{\pi}{512}$ (b) $\frac{3\pi}{512}$ (c) $\frac{5\pi}{512}$ (d) $\frac{7\pi}{512}$

54. $\int_{-1}^{1} (ax^3 + bx)\, dx = 0$ for :

(a) any value of a and b

(b) $a > 0, b > 0$ only

(c) $a > 0, b < 0$ only

(d) $a < 0, b > 0$ only

55. Using the Trapezoidal rule, the approximate value of $\int_1^4 y\, dx$.

x	1	2	3	4
y	0.7111	0.7222	0.7333	0.7444

(a) 0.1833 (b) 1.1833

(c) 2.1833 (d) 3.1833

56. The solution of $x\,dx + y\,dy = x^2y\,dy - xy^2\,dx$ is :

(a) $x^2 - 1 = c(1 + y^2)$

(b) $x^2 + 1 = c(1 - y^2)$

(c) $x^2 - 1 = c(1 - y^2)$

(d) $x^2 + 1 = c(1 - y^2)$

57. The family of curves in which the sub-tangent at any point to any curve is double the abscissa is given by :

(a) $x = cy^2$ (b) $y = cx^2$

(c) $x^2 = cy^2$ (d) $y^2 = cx^2$

58. The solution of $x^2 + y^2\frac{dy}{dx} = 4$ is :

(a) $x^2 + y^2 = 12x + c$

(b) $x^2 + y^2 = 3x + c$

(c) $x^2 + y^2 = 8x + c$

(d) $x^3 + y^3 = 12x + c$

59. The solution of $\frac{dy}{dx} + y = e^x$ is :

(a) $2y = e^{2x} + c$ (b) $2ye^x = e^x + c$

(c) $2ye^x = e^{2x} + c$ (d) $2ye^{2x} = 2e^x + c$

60. If $\tan\theta + \cot\theta = 2$, then $\sin\theta$ is equal to :
(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{\sqrt{3}}$ (c) $\frac{1}{2}$ (d) 1

61. $f(x) = (20 - x^4)^{1/4}$ for $0 < x < \sqrt{5}$, then $f(f(1/2))$ is equal to :
(a) 2^{-4} (b) 2^{-3} (c) 2^{-2} (d) 2^{-1}

62. Let Z denote the set of integers define
$f: Z \to Z$ by $f(x) = \begin{cases} \frac{x}{2}, & x \text{ is even} \\ 0, & x \text{ is odd} \end{cases}$
then f is :
(a) onto but not one-one
(b) one-one but not onto
(c) one-one and onto
(d) neither one-one nor onto

63. Let $f: R \to R$ be defined by
$f(x) = \begin{cases} x+2, & x \le -1 \\ x^2, & -1 < x < 1 \\ 2-x, & x \ge 1 \end{cases}$
Then the value of $f(-1.75) + f(0.5) + f(1.5)$ is :
(a) 0 (b) 1 (c) 2 (d) -1

64. Two functions $f: R \to R$, $g: R \to R$ are defined as follows
$f(x) = \begin{cases} 0, & x \text{ is rational} \\ 1, & x \text{ is irrational} \end{cases}$
$g(x) = \begin{cases} -1, & x \text{ is rational} \\ 0, & x \text{ is irrational} \end{cases}$
Then $(fog)(\pi) + (gof)(e)$ is equal to :
(a) 0 (b) -1 (c) 2 (d) 1

65. $\frac{\sqrt{8+\sqrt{28}} + \sqrt{8-\sqrt{28}}}{\sqrt{8+\sqrt{28}} - \sqrt{8-\sqrt{28}}}$ is equal to :
(a) 2 (b) 7 (c) $\sqrt{7}$ (d) $\sqrt{2}$

66. If $x = \log_{0.1} 0.001$, $y = \log_9 81$, then $\sqrt{x - 2\sqrt{y}}$ is equal to :
(a) $3 - \sqrt{2}$ (b) $\sqrt{3} - 2$
(c) $\sqrt{2} - 1$ (d) $\sqrt{2} - 2$

67. If $2^3 + 4^3 + 6^3 + \ldots + (2n)^3 = hn^2(n+1)^2$, then h is equal to :
(a) $\frac{1}{2}$ (b) 1 (c) $\frac{3}{2}$ (d) 2

68. If $y = A\cos nx + B\sin nx$, then $y_2 + n^2 y$ is equal to :
(a) 0 (b) 1 (c) y (d) -1

69. The number of ways in which 5 boys and 4 girls sit around a circular tables. So that no two girls sit together is :
(a) 5! 4! (b) 3! 3! (c) 5! (d) 4!

70. Using the digits 0, 2, 4, 6, 8 not more than once in any number, the number of 5 digited numbers that can be formed, is :
(a) 16 (b) 24 (c) 96 (d) 120

71. $1 + \frac{1}{4} + \frac{1.3}{4.8} + \frac{1.3.5}{4.8.12} + \ldots$ is equal to :
(a) $\sqrt{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\sqrt{3}$ (d) $\frac{1}{\sqrt{3}}$

72. The co-efficient of x^4 in the expansion of $\frac{(1-3x)^2}{(1-2x)}$ is equal to :
(a) 1 (b) 2 (c) 3 (d) 4

73. If $(1+x)^n = C_0 + C_1 x + C_2 x^2 + \ldots + C_n x^n$, then $C_0 + 2C_1 + 3C_2 + \ldots + (n+1)C_n$ is equal to :
(a) $2^n + n \cdot 2^{n-1}$ (b) $2^{n-1} + n \cdot 2^n$
(c) $2^n + (n+1)2^n$ (d) $2^{n-1} + (n-1)2^n$

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

75. $\frac{2}{2!} + \frac{2+4}{3!} + \frac{2+4+6}{4!} + \ldots$ is equal to :
(a) e (b) e^{-1} (c) e^{-2} (d) e^{-3}

76. $|x| < 1$, the co-efficient of x^3 in the expansion of $\log(1 + x + x^2)$ in ascending powers of x, is :
(a) $\frac{2}{3}$ (b) $\frac{4}{3}$ (c) $-\frac{2}{3}$ (d) $-\frac{4}{3}$

77. If α, β are the roots of the equation $x^2 + bx + c = 0$ and $\alpha + h, \beta + h$ are the roots of the equation $x^2 + qx + r = 0$, then h is equal to :
(a) $b + q$ (b) $b - q$
(c) $\frac{1}{2}(b+q)$ (d) $\frac{1}{2}(b-q)$

78. $20^{2-3x^2} = (40\sqrt{5})^{3x^2-2}$, then x is equal to :
(a) $\pm\sqrt{\frac{3}{2}}$ (b) $\pm\sqrt{\frac{2}{3}}$
(c) $\pm\sqrt{\frac{4}{3}}$ (d) $\pm\sqrt{\frac{5}{4}}$

79. Each of the roots of the equation $x^3 - 6x^2 + 6x - 5 = 0$ are increased by h. So that the new transformed equation does not contain x^2 term, then h is equal to :
(a) 1 (b) 2 (c) $\frac{1}{2}$ (d) $\frac{1}{3}$

80. The roots of the equation $x^3 - 14x^2 + 56x - 64 = 0$ are in :
(a) AGP (b) HP (c) AP (d) GP

81. If 1 is a multiple root of order 3 for the equation $x^4 - 2x^3 + 2x - 1 = 0$, then the other root is :
(a) 0 (b) -1 (c) 1 (d) 2

82. $\lim_{x \to 0} \frac{\sin x \sin^{-1} x}{x^2}$ is equal to :
(a) 0 (b) 1 (c) -1 (d) ∞

83. The bi-quadratic equation, two of whose roots are $1 + i$, $1 - \sqrt{2}$, is :
(a) $x^4 - 4x^3 + 5x^2 - 2x - 2 = 0$
(b) $x^4 + 4x^3 - 5x^2 + 2x + 2 = 0$
(c) $x^4 + 4x^3 - 5x^2 + 2x - 2 = 0$
(d) $x^4 + 4x^3 + 5x^2 - 2x + 2 = 0$

84. If $A = \begin{bmatrix} -2 & 2 \\ -3 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$, then $(B^{-1} A^{-1})^{-1}$ is equal to :
(a) $\begin{bmatrix} 2 & 2 \\ 2 & 3 \end{bmatrix}$ (b) $\begin{bmatrix} 3 & -2 \\ 2 & 2 \end{bmatrix}$
(c) $\frac{1}{10}\begin{bmatrix} 2 & 2 \\ -2 & 3 \end{bmatrix}$ (d) $\frac{1}{10}\begin{bmatrix} 3 & 2 \\ -2 & 2 \end{bmatrix}$

85. A square matrix $[a_{ij}]$ in which $a_{ij} = 0$ for $i \neq j$ and $a_{ij} = k$ (constant) for $i = j$ is called a :
(a) unit matrix (b) scalar matrix
(c) null matrix (d) diagonal matrix

86. If $A = \begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$, $hA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then the values of h, a, b are respectively :
(a) $-6, -12, -18$ (b) $-6, 4, 9$
(c) $-6, -4, -9$ (d) $-6, +12, 18$

87. If a is a complex number and b is a real number, then the equation $\bar{a} + a + b = 0$ represents a :
(a) straight line (b) parabola
(c) circle (d) hyperbola

88. If $\begin{vmatrix} 1-i & i \\ 1+2i & -i \end{vmatrix} = x + iy$, then x is equal to :
(a) -2 (b) -1 (c) 1 (d) 2

89. If $\theta = \frac{\pi}{6}$, then the 10th term of $1 + (\cos\theta + i\sin\theta) + (\cos\theta + i\sin\theta)^2 + (\cos\theta + i\sin\theta)^3 + \ldots$ is equal to :
(a) i (b) -1 (c) 1 (d) $-i$

90. $\frac{\sin 5\theta}{\sin\theta}$ is equal to :
(a) $16\cos^4\theta - 12\cos^2\theta + 1$
(b) $16\cos^4\theta + 12\cos^2\theta + 1$
(c) $16\cos^4\theta - 12\cos^2\theta - 1$
(d) $16\cos^4\theta + 12\cos^2\theta - 1$

91. If $\operatorname{cosec}\theta = \frac{p+q}{p-q}$, then $\cot\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$ is equal to :
(a) $\sqrt{\frac{p}{q}}$ (b) $\sqrt{\frac{q}{p}}$ (c) $\sqrt{pq}$ (d) pq

92. $\cos^2\left(\frac{\pi}{6} + \theta\right) - \sin^2\left(\frac{\pi}{6} - \theta\right)$ is equal to :
(a) $\frac{1}{2}\cos 2\theta$ (b) 0
(c) $-\frac{1}{2}\cos 2\theta$ (d) $\frac{1}{2}$

93. If A, B, C, D are angles of a cyclic quadrilateral, then $\cos A + \cos B + \cos C + \cos D$ is equal to :
(a) 0 (b) 1 (c) -1 (d) 4

94. The equation $\sqrt{3}\sin x + \cos x = 4$, has :
(a) only one solution
(b) two solution
(c) infinitely many solution
(d) no solution

95. $\sec^2(\tan^{-1} 2) + \operatorname{cosec}^2(\cot^{-1} 3)$ is equal to :
(a) 3 (b) 10 (c) 15 (d) 20

96. $\sinh^{-1}\left(\frac{x}{\sqrt{1-x^2}}\right)$ is equal to :
(a) $\coth^{-1} x$ (b) $\sinh^{-1} x$
(c) $-\tanh^{-1} x$ (d) $\tanh^{-1} x$

97. In a triangle ABC, $\frac{\cos C + \cos A}{c + a} + \frac{\cos B}{b}$ is equal to :
(a) $\frac{1}{a}$ (b) $\frac{1}{b}$ (c) $\frac{c+a}{b}$ (d) 1

98. In a triangle ABC, $\frac{a}{b^2-c^2}+\frac{c}{b^2-a^2}=0$, then B is equal to :

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

99. In a triangle ABC, $a^2 \sin 2C + c^2 \sin 2A$ is equal to :

(a) Δ (b) 2Δ (c) 3Δ (d) 4Δ

100. The shadow of a tower standing on a level ground is found to be 60 metres longer when the sun's altitude is 30° than when it is 45°. The height of the tower is :

(a) 30 m (b) 90 m

(c) $60\sqrt{3}$ m (d) $30(\sqrt{3}+1)$ m

Answers

Physics

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

Chemistry

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

Mathematics

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