INDRAPRASTHA CET

Engineering Entrance Exam
Solved Paper 2010

Physics

1. A wire whose cross-section area is 4 mm^2 is stretched by 0.1 mm by a certain weight. How far will a wire of the same material and length stretch, if its cross-sectional area is 8 mm^2 and the same weight is attached?
   (a) 0.5 mm   (b) 1.0 mm
   (c) 0.05 mm   (d) 0.06 mm

2. A body has a charge of $-2 \mu C$. If it has 2.5×10^{13} protons, then how many electrons the body has?
   (a) 1.25×10^{13} (b) 2.5×10^{13}
   (c) 3.75×10^{13} (d) None of these

3. When light passes from one medium to other, then which of the following may change?
   (a) Velocity and frequency
   (b) Frequency and colour
   (c) Velocity, wavelength and colour
   (d) Velocity and wavelength

4. Mark the correct option.
   (a) Ampere's law states that flux of B through any closed surface is μ_0 times the current passing through the area bounded by closed surface
   (b) Gauss's law for magnetic field in magnetostatics serves the same purpose as Gauss's law for electric field in electrostatics
   (c) Gauss's law for magnetic field states that the flux of B through any closed surface is always zero, whether or not there are currents within the surface
   (d) All of the above

5. When a particle is moving in vertical circle, then
   (a) its radial and tangential acceleration both are constant

   (b) its radial and tangential acceleration both are varying
   (c) its radial acceleration is constant but tangential acceleration is varying
   (d) its radial acceleration is varying but tangential acceleration is constant

6. 1 g of steam at 100°C and equal mass of ice at 0°C are mixed. The temperature of the mixture in steady state will be (latent heat of steam = 540 cal/g, latent heat of ice = 80 cal/g)
   (a) 50°C   (b) 100°C
   (c) 67°C   (d) 33°C

7. A tuning fork of frequency 580 Hz is employed to produce transverse waves on a long rope. The distance between the nearest crests is found to be 20 cm. The velocity of the wave is
   (a) 58 ms^{-1} (b) 580 ms^{-1}
   (c) 20 ms^{-1} (d) 116 ms^{-1}

8. Two instruments having stretched strings are being played in unison. When the tension of one of the instruments is increased by 1%, 3 beats are produced in 2 s. The initial frequency of vibration of each wire is
   (a) 300 Hz   (b) 500 Hz
   (c) 1000 Hz   (d) 400 Hz

9. A circular coil of 20 turns and radius 10 cm is placed in an uniform magnetic field of 0.1 T normal to the plane of the coil. The coil carries a current of 5 A. The coil is made up of copper wire of cross-sectional area 10^{-5} m^2 and the number of free electrons per unit volume of copper is 10^{29}. The average force experienced by an electron in the coil due to magnetic field is
   (a) 5×10^{-25} N   (b) Zero
   (c) 8×10^{-24} N   (d) None of these

). Long distance short-wave radio broad casting uses

(a) ground wave   (b) ionospheric wave
(c) direct wave   (d) sky wave

1. If the charge of $10\,\mu C$ and $-2\,\mu C$ are given to two plates of a capacitor which are connected across a battery of 12 V, find the capacitance of the capacitor.

(a) $0.33\,\mu F$ (b) $0.5\,\mu F$
(c) $0.41\,\mu F$ (d) $0.66\,\mu F$

2. When 1 g of water changes from liquid to vapour phase at constant pressure of 1 atm, the volume increases from 1 cc to 1671 cc. The heat of vaporization at this pressure is 540 cal/g. Find the increase in internal energy of water.

(a) 2268 J   (b) 2099.33 J
(c) 2000 J   (d) 2019.65 J

13. With the usual notations, the following equation $s_t = u + \frac{1}{2}a(2t-1)$ is

(a) only numerically correct
(b) only dimensionally correct
(c) Both numerically and dimensionally correct
(d) Neither numerically nor dimensionally correct

14. A body is sliding down on a smooth inclined plane slides down 1/4th distance in 2 s. It will slide down the complete plane in

(a) 4 s   (b) 5 s
(c) 2 s   (d) 3 s

15. If a H_2 nucleus is completely converted into energy, the energy produced will be around

(a) 1 MeV   (b) 939 MeV
(c) 9.39 MeV   (d) 238 MeV

16. A transistor is used in common-emitter configuration. Given its $\alpha = 0.9$, calculate the change in collector current when the base current changes by $2\,\mu A$.

(a) $1\,\mu A$ (b) $0.9\,\mu A$
(c) $30\,\mu A$ (d) $18\,\mu A$

17. A, B and C are parallel conductors of equal lengths carrying currents I, I and 2I respectively. Distance between A and B is x. Distance between B and C is also x. F_1 is the force exerted by B on A. F_2 is the force exerted by C on A. Choose the correct answer.

(a) $F_1 = 2F_2$ (b) $F_2 = 2F_1$
(c) $F_1 = F_2$ (d) $F_1 = -F_2$

18. What is the modulation index if an audio signal of amplitude one-half of the carrier amplitude is used in AM?

(a) 1   (b) 0
(c) 0.5   (d) > 1

19. A steel wire 10 m long and $10^{-5}\,m^2$ in cross-sectional area elongates by 0.01 m under a tension of 2500 N. Young's modulus for steel from this data is computed as

(a) $2.5 \times 10^7\,Nm^{-2}$ (b) $2.5 \times 10^9\,Nm^{-2}$
(c) $2.5 \times 10^{11}\,Nm^{-2}$ (d) None of these

20. A wire of length L and radius r is fixed at one end. When a stretching force F is applied at free end, the elongation in the wire is L When another wire of same material but of length 2L and radius 2r, also fixed at one end is stretched by a force 2F applied at free end, then elongation in the 2nd wire will be

(a) $l/2$ (b) l
(c) $2l$ (d) $l/4$

21. A block rest on a horizontal table which is executing SHM in the horizontal with an amplitude a if the coefficient of friction is μ, then the block just start to slip when the frequency of oscillation is

(a) $\frac{1}{2\pi}\sqrt{\frac{\mu g}{a}}$ (b) $2\pi\sqrt{\frac{a}{\mu g}}$

(c) $\frac{1}{2\pi}\sqrt{\frac{a}{\mu g}}$ (d) $\sqrt{\frac{a}{\mu g}}$

22. Three objects coloured black, grey and white can withstand hostile conditions at $2800°C$. These objects are thrown into furnace where each of them attains a temperature of $2000°C$. Which object will glow brightest?

(a) The white object
(b) The black object
(c) All glow with equal brightness
(d) Grey object

23. A block body is at a temperature of 2880 K. The energy of radiation emitted by this object with wavelength between 499 nm and 500 nm is U_1, between 999 nm and 1000 nm is U_2 and between 1499 nm and 1500 nm is U_3. The Wien's constant, $b = 2.88 \times 10^6$ nm-K. Then,

(a) $U_1 = 0$ (b) $U_3 = 0$
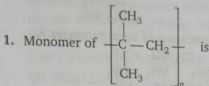(c) $U_1 > U_2$ (d) $U_2 > U_1$

24. For light of wavelength λ in nanometer, the photon energy hf in electron-volt is
  (a) $\dfrac{1240}{\lambda}$ (b) $\dfrac{1200}{\lambda}$
  (c) $\dfrac{\lambda}{1240}$ (d) $\dfrac{1360}{\lambda}$

25. Light of wavelength 200 nm shines on an aluminium, 4.20 eV is required to eject an electron. What is the kinetic energy of the fastest ejected electrons?
  (a) 0.5 eV (b) 1.00 eV
  (c) 2.00 eV (d) 4.00 eV

26. A body dropped from a height h with an initial speed zero reaches the ground with a velocity of 3 km/h. Another body of the same mass was dropped from the same height h with an initial speed 4 km/h will reach the ground with a velocity of
  (a) 3 km/h (b) 4 km/h
  (c) 5 km/h (d) 12 km/h

27. When the plane surface of a planoconvex lens of refractive index 1.5 is silvered, it behaves like a concave mirror of focal length 30 cm. When its convex surface is silvered, it will behave like a concave mirror of focal length
  (a) 10 cm (b) 20 cm
  (c) 30 cm (d) 45 cm

28. In the visible region of the spectrum the rotation of the plane of polarization is given by
  $$\theta = a + \dfrac{b}{\lambda^2}$$
  The optical rotation produced by a particular material is found to be 30° per mm at $\lambda = 5000$ Å and 50° per mm at $\lambda = 4000$ Å. The value of constant a will be
  (a) $+\dfrac{50°}{9}$ per mm (b) $-\dfrac{50°}{9}$ per mm
  (c) $+\dfrac{9°}{50}$ per mm (d) $-\dfrac{9°}{50}$ per mm

29. 3.0 mW of 400 nm light is incident on a photoelectric cell, if 0.1% of the photons are contributing in ejection of electrons, then the current in the cell is
  (a) 0.48 μA
  (b) resistance value not given
  (c) zero
  (d) 0.96 μA

30. The scale of a spring balance reading from 0 to 10 kg is 0.25 m long. A body suspended from the balance oscillates vertically with a period of π/10 s. The mass suspended is (neglect the mass of the spring)
  (a) 10 kg (b) 0.98 kg
  (c) 5 kg (d) 20 kg

31. At the height 80 m, an aeroplane is moving with 150 m/s. A bomb is dropped from it so as to hit a target. At what distance from the target should the bomb be dropped?
  (Given $g = 10$ m/s^2)
  (a) 605.3 m (b) 600 m
  (c) 80 m (d) 230 m

32. A spring balance and a physical balance are kept in a lift. In these balances equal masses are placed. If now the lift starts moving upwards with constant acceleration, then
  (a) the reading of spring balance will increase and the equilibrium position of the physical balance will disturb
  (b) the reading of spring balance will remain unchanged and physical balance will remain in equilibrium
  (c) the reading of spring balance will decrease and physical balance will remain in equilibrium
  (d) the reading of spring balance will increase

33. Starting from rest a body slides down a 45° inclined plane in twice the time it takes to slide down the same distance in the absence of friction. The coefficient of friction between the body and the inclined plane is
  (a) 0.33 (b) 0.25
  (c) 0.75 (d) 0.80

34. A bomb of mass 1 kg explodes into 2 pieces of mass 3 kg and 6 kg. The velocity of mass 3 kg is 1.6 m/s, the KE of mass 6 kg is
  (a) 3.84 J (b) 9.6 J
  (c) 1.92 J (d) 2.92 J

35. There are two bodies of masses 100 kg and 10000 kg separated by a distance 1 m. At what distance from the smaller body, the intensity of gravitational field will be zero?
  (a) $\dfrac{1}{9}$ m (b) $\dfrac{1}{10}$ m
  (c) $\dfrac{1}{11}$ m (d) $\dfrac{10}{11}$ m

36. If longitudinal strain for a wire is 0.03 and its Poisson ratio is 0.5, then its lateral strain is
  (a) 0.003 (b) 0.0075
  (c) 0.015 (d) 0.4

37. Equal masses of water and a liquid of density 2 are mixed together, then the mixture has a density of

(a) $\frac{2}{3}$

(b) $\frac{4}{3}$

(c) $\frac{3}{2}$

(d) 3

38. The volume of a gas at 21°C temperature and 76.8 mm pressure is 1 L. If the density of the gas is 1.2 g/L at NTP, then its mass will be

(a) 4 g

(b) 4.21 g

(c) 1.13 g

(d) 10 g

39. When heat is given to gas in an isothermal change, the result will be

(a) external work done

(b) rise in temperature

(c) increase in internal energy

(d) external work done and also rise in temperature

40. The temperature gradient of 0.5 m long rod is 80°C/m. If the temperature of hotter end of the rod is 30°C, then the temperature of the cooler end is

(a) 40°C

(b) –10°C

(c) 10°C

(d) 0°C

41. For any SHM, amplitude is 6 cm. If instantaneous potential energy is half the total energy then distance of particle from its mean position is

(a) 3 cm

(b) 4.2 cm

(c) 5.8 cm

(d) 6 cm

42. Electric potential at any point is $V = -5x + 3y + \sqrt{15}z$, then the magnitude of the electric field is

(a) $3\sqrt{2}$

(b) $4\sqrt{2}$

(c) $5\sqrt{2}$

(d) 7

43. The insulation property of air breaks down at $E = 3 \times 10^6$ V/m. The maximum charge that can be given to a sphere of diameter 5 m is approximately (in coulomb)

(a) 2×10^{-2}

(b) 2×10^{-3}

(c) 2×10^{-4}

(d) 2×10^{-5}

44. Two wires A and B of same material and mass have their lengths in the ratio 1 : 2. On connecting them to the same source, the rate of heat dissipation in B is found to be 5 W. The rate of heat B dissipation in A, is

(a) 10 W

(b) 5 W

(c) 20 W

(d) None of these

45. Maximum kinetic energy of the positive ion in the cyclotron is

(a) $\frac{q^2 B r_0}{2m}$

(b) $\frac{qB^2 r_0}{2m}$

(c) $\frac{q^2 B^2 r_0^2}{2m}$

(d) $\frac{qB r_0}{2m^2}$

46. The magnet can be completely demagnetized by

(a) breaking the magnet into small pieces

(b) heating it slightly

(c) droping it into ice cold water

(d) A reverse field of appropriate strength

47. The magnetic flux linked with a coil at any instant t is given by $\phi = 5t^3 - 100t + 300$, the emf induced in the coil at $t = 2$ is

(a) – 40 V

(b) 40 V

(c) 140 V

(d) 300 V

48. A photon of energy 3.4 eV is incident on a metal having work function 2 eV. The maximum KE of photo electrons is equal to

(a) 1.4 eV

(b) 1.1 eV

(c) 5.4 eV

(d) 6.8 eV

49. Order of magnitude of density of uranium nucleus is ($m_p = 1.67 \times 10^{-27}$ kg)

(a) 10^{20} kg/m³

(b) 10^{17} kg/m³

(c) 10^{14} kg/m³

(d) 10^{11} kg/m³

50. A ball is thrown from the ground with a velocity of $20\sqrt{3}$ ms⁻¹ making an angle of 60° with the horizontal. The ball will be at a height of 40 m from the ground after a time t equal to ($g = 10$ ms⁻²)

(a) $\sqrt{2}$ s
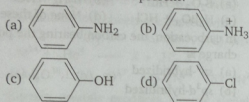
(b) $\sqrt{3}$ s

(c) 2 s

(d) 3 s

Chemistry

U n f o l d   E v e r y   Q u e s t i o n

1. Monomer of

$$\left[\begin{array}{c} CH_3 \\ | \\ -C-CH_2- \\ | \\ CH_3 \end{array}\right]_n$$ is

   (a) 2-methylpropene   (b) styrene
   (c) propylene   (d) ethene

2. In which of the following molecules, the resonance effect is not present?

   (a) ⬡–NH₂   (b) ⬡–$\overset{+}{N}H_3$

   (c) ⬡–OH   (d) ⬡–Cl

3. CsCl crystallises in a cubic lattice that has a Cl^- at each corner and Cs^+ at the centre of the unit cell. If $(r_{Cs^+}) = 1.69$ Å and $(r_{Cl^-}) = 1.81$ Å, what is the value of edge length a of the cube?

   (a) 4.04   (b) 3.50
   (c) 3.03   (d) 1.95

4. Boron nitride has the structure of the type
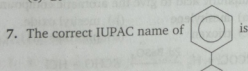   (a) graphite type
   (b) diamond type
   (c) both diamond and graphite type
   (d) NaCl type

5. The number of π-electrons present in naphthalene is

   (a) 6   (b) 4
   (c) 10   (d) 14

6. Which of the following elements is a metalloid?
   (a) C   (b) Ge
   (c) Bi   (d) Sn

7. The correct IUPAC name of ⬡ (with isopropyl substituent) is

   (a) iso-propyl benzene
   (b) cumene
   (c) phenyl iso-propene
   (d) 2-phenyl propane

8. Atom bombs are based on
   (a) natural radioactivity
   (b) nuclear fission
   (c) nuclear fusion
   (d) spontaneous chemical reaction

9. Use of the salt bridge in Galvanic cell is
   (a) to complete the electrical circuit
   (b) to separate the cathode solution from anode solution
   (c) to reduce electrical resistance
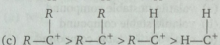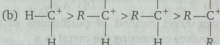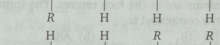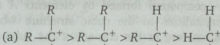   (d) to supply the salts to the chemical reactions taking place in the cell

10. Mark the smallest atom
    (a) F   (b) Cl
    (c) Br   (d) I

11. Of the following, the anhydride of nitric acid is
    (a) N_2O (b) NO
    (c) NO_2 (d) N_2O_5

12. The decreasing order of stability of alkyl carbocation is

    (a) $R-\overset{R}{\underset{R}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{R}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > H-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+$

    (b) $H-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{R}{\underset{R}{\overset{|}{\underset{|}{C}}}}^+$

    (c) $R-\overset{R}{\underset{R}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > H-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+$

    (d) $R-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{R}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+ > R-\overset{H}{\underset{R}{\overset{|}{\underset{|}{C}}}}^+ > H-\overset{H}{\underset{H}{\overset{|}{\underset{|}{C}}}}^+$

13. Westron has the formula
    (a) CF_2Cl_2 (b) $CHCl_3$
    (c) $C_2H_2Cl_4$ (d) CHF_3

14. Primary, secondary and tertiary alcohols are distinguished by
    (a) oxidation method
    (b) Lucas test
    (c) Victor Meyer's method
    (d) All of the above

15. Formalin is
    (a) aqueous solution of HCHO and CH_3CHO
    (b) alcoholic solution of formaldehyde
    (c) 40% aqueous solution of formic acid
    (d) 40% aqueous solution of formaldehyde

16. **Assertion** Cannizaro reaction converts HCHO into HCOONa and CH₃OH.
    Reason It is a proton-hydride transfer reaction.
    (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
    (b) Both Assertion and Reason are correct but Reason is not the correct explanation of Assertion.
    (c) Assertion is correct but Reason is incorrect.
    (d) Assertion is incorrect but Reason is correct.

17. Which of the following is a secondary pollutant?
    (a) CO_2 (b) N_2O
    (c) SO_2 (d) PAN

18. A compound formed by elements A and B crystallizes in the cubic structure where A atoms are at the corners of the cube and B atoms are at the face centres. The formula of the compound is
    (a) AB_3 (b) AB
    (c) A_3B (d) A_2B_2

19. van Arkel method of purification of metals involves converting the metal to a
    (a) volatile unstable compound
    (b) volatile stable compound
    (c) non-volatile stable compound
    (d) None of the above

20. Which of the following alcohols is used as a beverage?
    (a) Propanol   (b) 2-butanol
    (c) Methanol   (d) Ethanol

21. Which of the following will give phenol with CaO and NaOH?
    (a) Salicylic acid   (b) Picric acid
    (c) Benzoic acid   (d) Amino acid

22. The solution showing positive deviation
    (a) have ΔV (mixing) = +ve
    (b) have ΔH (mixing) = −ve
    (c) form maximum boiling azeotropes
    (d) have lower vapour pressure of each component in the solution than their pure vapour pressure

23. The efficiency of packing is 68% in
    (a) hcp structure
    (b) ccp structure
    (c) fcc structure
    (d) bcc structure

24. Which of the following fluorides does not exist?
    (a) NF_5 (b) PF_5
    (c) AsF_5 (d) SbF_5

25. Correct gradation of basic character is
    (a) $NH_3 > CH_3NH_2 > NF_3$
    (b) $CH_3NH_2 > NH_3 > NF_3$
    (c) $NF_3 > CH_3NH_2 > NH_3$
    (d) $CH_3NH_2 > NF_3 > NH_3$

26. Which of the following compounds are formed when BCl_3 is treated with water?
    (a) B_2O_3 + HCl   (b) B_2H_6 + HCl
    (c) H_3BO_3 + HCl (d) None of these

27. In carbocation, the carbon bearing the positive charge is
    (a) sp^2-hybridized
    (b) sp^3d-hybridized
    (c) sp-hybridized
    (d) sp^3-hybridized

28. The alkyl halide is converted into alcohol by
    (a) elimination   (b) halogenation
    (c) addition   (d) substitution

29. The hybridization of carbon in diamond, graphite and acetylene is respectively
    (a) sp^3, sp, sp^2 (b) sp, sp^2, sp^3
    (c) sp^3, sp^2, sp (d) sp^2, sp^3, sp

30. Which of the following properties is different for neutral atoms of the isotopes of the same element?
    (a) Atomic number
    (b) Mass
    (c) Number of electrons
    (d) General chemical reactions

31. An important reaction of acetone is autocondensation in presence of concentrated sulphuric acid to give the aromatic compound
    (a) mesitylene   (b) mesityl oxide
    (c) trioxane   (d) phorone

32. $RCOCl + H_2 \xrightarrow{Pd \cdot BaSO_4} RCHO + HCl$
    The reaction is known as
    (a) Rosenmund's reduction
    (b) Stephen's reaction
    (c) Wolff-Kishner reduction
    (d) Clemmensen's reduction

33. Euchloine is a mixture of
    (a) Cl_2 and SO_2
    (b) free chlorine and ClO_2
    (c) Cl_2 and CO
    (d) None of the above

34. The rate of a particular reaction triples when temperature changes from $50°C$ to $100°C$. What is the activation energy of the reaction (in kJ mol^{-1})?

($\log 3 = 0.4771$, $R = 8.314$ J K^{-1} mol^{-1})

(a) 24.012×10^{-3} (b) 24.012×10^3
(c) 22.012×10^{-3} (d) 22.012×10^3

35. For spontaneity of cell, which is correct?

(a) $\Delta G = 0$, $\Delta H = 0$ (b) $\Delta G = -$ve, $\Delta H = 0$
(c) $\Delta G = +$ve, $\Delta H = 0$ (d) $\Delta G = -$ve

36. Galvanised iron sheets are coated with

(a) C   (b) Cu   (c) Zn   (d) Ni

37. $_7M^{14} + {}_2He^4 \longrightarrow X + {}_1H^1$, X is

(a) $_8O^{18}$ (b) $_8O^{17}$ (c) $_8N^{14}$ (d) $_7N^{15}$

38. Certain crystals produces electric signals on application of pressure. This phenomenon is called

(a) ferroelectricity   (b) ferrielectricity
(c) pyroelectricity   (d) piezoelectricity

39. Catalysis is a phenomenon in which

(a) a substance alters the speed of the chemical reaction
(b) heat is evolved in a chemical reaction
(c) the reaction is induced by light
(d) None of the above

40. Number of lone pairs of electrons on Xe atoms in XeF_2, XeF_4 and XeO_3 molecules are respectively

(a) 3, 2 and 1   (b) 4, 3 and 2
(c) 2, 3 and 1   (d) 3, 2 and 0

41. Which of the following compound is tribasic acid?

(a) H_3PO_2 (b) H_3PO_3
(c) H_3PO_4 (d) $H_4P_2O_7$

42. What is the percentage of water crystallisation in the sample of blue vitri ($CuSO_4 \cdot 5H_2O$)?

(a) 30.07   (b) 32.07
(c) 36.07   (d) None of these

43. Which of the following remains unchanged o descending a group in the Periodic Table?

(a) Valence electrons (b) Atomic size
(c) Density   (d) Metallic character

44. The ion that is isoelectronic with CO is

(a) O_2^- (b) N_2^+
(c) CN^- (d) O_2^+

45. The number of atoms in 52 moles of He is

(a) 3.131×10^{25} (b) 7.828×10^{24}
(c) 39.948×10^{24} (d) 8.546×10^{23}

46. What is the kinetic energy of 1 g of O_2 at $47°C$?

(a) 1.24×10^2 J   (b) 2.24×10^2 J
(c) 1.24×10^3 J   (d) 3.24×10^2 J

47. For $A \longrightarrow B$,
$\Delta H = 4$ kcal mol^{-1}, $\Delta S = 10$ cal mol^{-1} K^{-1}
Reaction is spontaneous when temperature is

(a) 400 K   (b) 300 K
(c) 500 K   (d) None of these

48. The conjugate acid of NH_2^- is

(a) NH_4^+ (b) NH_3
(c) NH_2OH (d) N_2H_4

49. For electron affinity of halogens which of the following is correct?

(a) $Br > F$ (b) $F > Cl$
(c) $Br > Cl$ (d) $F > I$

50. Which of the following oxides is neutral?

(a) CO   (b) SnO_2
(c) ZnO   (d) SiO_2

Mathematics

1. If $|z_1 - 1| < 1$, $|z_2 - 2| < 2$, $|z_3 - 3| < 3$, then $|z_1 + z_2 + z_3|$

(a) is less than 6
(b) is more than 3
(c) is less than 12
(d) lies between 6 and 12

2. If z_1 and z_2 are two complex numbers such that $|z_1| = |z_2| + |z_1 - z_2|$, then

(a) $\text{Im}\left(\dfrac{z_1}{z_2}\right) = 0$

(b) $\text{Re}\left(\dfrac{z_1}{z_2}\right) = 0$

(c) $\text{Re}\left(\dfrac{z_1}{z_2}\right) = \text{Im}\left(\dfrac{z_1}{z_2}\right)$

(d) None of the above

3. The largest term common to the sequences 1, 11, 21, 31, ... to 100 terms and 31, 36, 41, 46 ... to 100 terms is

(a) 381   (b) 471
(c) 281   (d) None of these

If the roots of $a_1x^2 + b_1x + c_1 = 0$ are α_1, β_1 and those of $a_2x^2 + b_2x + c_2 = 0$ are α_2, β_2 such that $\alpha_1\alpha_2 = 1 = \beta_1\beta_2$, then

(a) $\dfrac{a_1}{a_2} = \dfrac{b_1}{b_2} = \dfrac{c_1}{c_2}$

(b) $\dfrac{a_1}{c_2} = \dfrac{b_1}{b_2} = \dfrac{c_1}{a_2}$

(c) $a_1a_2 = b_1b_2 = c_1c_2$

(d) None of the above

The number of real roots of $(x + 3)^4 + (x + 5)^4 = 16$ is

(a) 0   (b) 2

(c) 4   (d) None of these

The number of six digits numbers that can be formed from the digits 1, 2, 3, 4, 5, 6 and 7. So, that digits do not repeat and the terminal digits are even, is

(a) 144   (b) 72

(c) 288   (d) 720

7. The value of the expression $^{K-1}C_{K-1} + {}^{K}C_{K-1} + \dots + {}^{n+K-2}C_{K-1}$ is

(a) $^{n+K-1}C_{K-1}$ (b) $^{n+K-1}C_K$

(c) $^{n+K}C_K$ (d) None of these

8. The system of equations
$$x + 2y + 3z = 4$$
$$2x + 3y + 4z = 5$$
$$3x + 4y + 5z = 6 \text{ has}$$

(a) many solutions   (b) no solution

(c) unique solution   (d) None of these

9. A skew symmetric matrix S satisfies the relation $S^2 + I = 0$, where I is an unit matrix, then SS' is equal to

(a) I (b) $2I$

(c) $-I$ (d) None of these

10. A die is rolled so that the probability of face i is proportional to i, $i = 1, 2 \dots, 6$. The probability of an even number occuring when the die is rolled, is

(a) $\dfrac{7}{4}$ (b) $\dfrac{4}{7}$

(c) $\dfrac{5}{7}$ (d) None of these

11. If $\tan^{-1}\left(\dfrac{\sqrt{1+x^2} - \sqrt{1-x^2}}{\sqrt{1+x^2} + \sqrt{1-x^2}}\right) = \alpha$, then x^2 is equal to

(a) $\sin 2\alpha$ (b) $\sin \alpha$

(c) $\cos 2\alpha$ (d) $\cos \alpha$

12. $\tan\left(\dfrac{\pi}{4} + \dfrac{1}{2}\cos^{-1}\dfrac{a}{b}\right) + \tan\left(\dfrac{\pi}{4} - \dfrac{1}{2}\cos^{-1}\dfrac{a}{b}\right)$ is equal to

(a) $\dfrac{2a}{b}$ (b) $\dfrac{a}{b}$

(c) $\dfrac{b}{a}$ (d) $\dfrac{2b}{a}$

13. In a $\triangle ABC$, $A : B : C = 3 : 5 : 4$, then $a + b + c\sqrt{2}$ is equal to

(a) $2b$ (b) $2c$

(c) $3b$ (d) $3a$

14. The set of values of x for which $\dfrac{\tan 3x - \tan 2x}{1 + \tan 3x \cdot \tan 2x} = 1$ is

(a) ϕ

(b) $\left\{\dfrac{\pi}{4}\right\}$

(c) $\left\{n\pi + \dfrac{\pi}{4}, n = 1, 2, 3, \dots\right\}$

(d) $\left\{2n\pi + \dfrac{\pi}{4}, n = 1, 2, 3, \dots\right\}$

15. Which of the two $3x - 4y + 4 = 0$ and $3x - 3y + 12 = 0$ is nearer to origin?

(a) $4x - 3y + 12 = 0$ (b) $3x - 3y + 12 = 0$

(c) $3x - 4y + 4 = 0$ (d) None of these

16. If the equal sides AB and AC (each equal to a) of a right angled isosceles $\triangle ABC$ be produced to P and Q so that $BP \cdot CQ = AB^2$, then the line PQ always passes through the fixed point

(a) $(a, 0)$ (b) $(0, a)$

(c) (a, a) (d) None of these

17. ABC is a variable triangle with the fixed vertex $C(1, 2)$ and A, B having the coordinates $(\cos t, \sin t)$, $(\sin t, -\cos t)$ respectively where t is a parameter as the centroid of the $\triangle ABC$ is

(a) $3(x^2 + y^2) - 2x - 4y - 1 = 0$

(b) $3(x^2 + y^2) - 2x - 4y + 1 = 0$

(c) $3(x^2 + y^2) + 2x + 4y - 1 = 0$

(d) $3(x^2 + y^2) + 2x + 4y + 1 = 0$

18. A variable circle having fixed radius 'a', passes through origin and meets the coordinate axes in point A and B. Locus of centroid of $\triangle OAB$, O being the origin, is

(a) $9(x^2 + y^2) = 4a^2$ (b) $9(x^2 + y^2) = a^2$

(c) $9(x^2 + y^2) = 2a^2$ (d) $9(x^2 + y^2) = 8a^2$

The condition that the straight line $cx - by + b^2 = 0$ may touch the circle $x^2 + y^2 = ax + by$, is

(a) $abc = 1$
(b) $a = c$
(c) $b = ac$
(d) None of these

If two circles $(x - 1)^2 + (y - 3)^2 = r^2$ and $x^2 + y^2 - 8x + 2y + 8 = 0$ intersect in two distinct points, then

(a) $2 < r < 8$
(b) $r < 2$
(c) $r = 2$
(d) $r > 2$

1. The number of distinct normals that can be drawn from $(-2, 1)$ to the parabola $y^2 - 4x - 2y - 3 = 0$, is

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

2. The parabola $y^2 = \lambda x$ and $25[(x - 3)^2 + (y + 2)^2] = (3x - 4y - 2)^2$ are equal, if λ is equal to

(a) 1
(b) 2
(c) 3
(d) 6

23. The eccentricity of an ellipse whose pair of a conjugate diameter are $y = x$ and $3y = -2x$ is

(a) $\dfrac{2}{3}$
(b) $\dfrac{1}{3}$
(c) $\dfrac{1}{\sqrt{3}}$
(d) None of these

24. If the foci of the ellipse $\dfrac{x^2}{25} + \dfrac{y^2}{b^2} = 1$ and the hyperbola $\dfrac{x^2}{144} - \dfrac{y^2}{81} = \dfrac{1}{25}$ coincide, then the value of b is

(a) 18
(b) −16
(c) 16
(d) −18

25. The number of vectors of unit length perpendicular to the vectors $\vec{a} = \hat{i} + \hat{j}$ and $\vec{b} = \hat{j} + \hat{k}$, is

(a) −1
(b) 2
(c) 4
(d) Infinite

26. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 4\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{c} = \hat{i} + \alpha\hat{j} + \beta\hat{k}$ are linearly dependent vectors and $|\vec{c}| = \sqrt{3}$, then

(a) $\alpha = 1,\ \beta = -1$
(b) $\alpha = 1,\ \beta = \pm 1$
(c) $\alpha = -1,\ \beta = \pm 1$
(d) $\alpha = \pm 1,\ \beta = 1$

27. Let the pairs $\vec{a}, \vec{b}$ and $\vec{c}, \vec{d}$ each determines a plane, then the planes are parallel, if

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

28. The equation of the plane perpendicular to the yz-plane and passing through the point $(1, -2, 4)$ and $(3, -4, 5)$ is

(a) $y + 2z = 5$
(b) $2y + z = 5$
(c) $y + 2z = 6$
(d) $2y + z = 6$

29. If the planes $\vec{r} \cdot (2\hat{i} + \lambda\hat{j} - 3\hat{k}) = 0$ and $\vec{r} \cdot (\lambda\hat{i} + 3\hat{j} + \hat{k}) = 5$ are perpendicular, then λ is equal to

(a) 2
(b) −2
(c) 3
(d) −3

30. The sine of the angle between the straight line $\dfrac{x - 2}{3} = \dfrac{y - 3}{4} = \dfrac{z - 4}{5}$ and the plane $2x - 2y + z = 5$ is

(a) $\dfrac{10}{6\sqrt{5}}$
(b) $\dfrac{4}{5\sqrt{2}}$
(c) $\dfrac{\sqrt{2}}{10}$
(d) $\dfrac{2\sqrt{3}}{5}$

31. If $y = \cos^{-1}\sqrt{\dfrac{\sqrt{1 + x^2} + 1}{2\sqrt{1 + x^2}}}$, then $\dfrac{dy}{dx}$ is equal to

(a) $\dfrac{1}{1 + x^2}$
(b) $\dfrac{1}{1 - x^2}$
(c) $\dfrac{1}{2(1 + x^2)}$
(d) None of these

32. The value of $\lim\limits_{x \to \infty} [\sqrt{x + \sqrt{x + \sqrt{x}}} - \sqrt{x}]$ is

(a) $\dfrac{1}{2}$
(b) 1
(c) 0
(d) None of these

33. The values of a, b and c which make the function $f(x) = \begin{cases} \dfrac{\sin (a + 1)x + \sin x}{x}, & x < 0 \\ c, & x = 0 \\ \dfrac{\sqrt{x + bx^2} - \sqrt{x}}{x^{3/2}}, & x > 0 \end{cases}$

Continuous at $x = 0$ are

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

(b) $a = \frac{3}{2}$, $c = \frac{1}{2}$, $b \neq 0$

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

(d) None of the above

34. If the slope of the curve $y = \frac{ax}{b-x}$ at the point $(1, 1)$ is 2, then the values of a and b are respectively.

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

(c) $1, 2$ (d) None of these

35. The sum of intercepts of the tangent to the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ upon the coordinates axes is

(a) $2a$ (b) a

(c) $2\sqrt{2}\,a$ (d) None of these

36. The function $f(x) = \frac{\sin x}{x}$ is decreasing in the interval

(a) $\left(-\frac{\pi}{2}, 0\right)$ (b) $\left(0, \frac{\pi}{2}\right)$

(c) $\left(-\frac{\pi}{4}, 0\right)$ (d) None of these

37. The set of points where the function $f(x) = |x - 2| \cos x$ is differentiable, is

(a) $(-\infty, \infty)$ (b) $(-\infty, \infty) - \{2\}$

(c) $(0, \infty)$ (d) None of these

38. The domain of the function

$f(x) = \sin^{-1}\left\{\log_2\left(\frac{1}{2} x^2\right)\right\}$ is

(a) $[-2, -1] \cup [1, 2]$ (b) $(-2, -1] \cup [1, 2]$

(c) $[-2, -1] \cup [1, 2]$ (d) $(-2, -1) \cup (1, 2)$

39. If f is an even function and g is an odd function, then the function fog is

(a) an even function

(b) an odd function

(c) neither even nor odd

(d) a periodic function

40. $\int \sec^2 x \tan x \, dx$ is equal to

(a) $\frac{\sec^n x}{n} + c$ (b) $\frac{\sec^2 x}{2} + c$

(c) $\frac{\tan x}{n} + c$ (d) $\frac{(\sec^n x) \tan x}{n} + c$

41. $\int_{\pi/6}^{\pi/3} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} \, dx$ is equal to

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{6}$

(c) $\frac{\pi}{12}$ (d) None of these

42. The area enclosed by $|x| + |y| = 1$ is

(a) 2 sq unit   (b) 3 sq unit

(c) $\frac{1}{2}$ sq unit   (d) $\sqrt{2}$ sq unit

43. Maximum value of $z = 3x + 4y$ subject to $x - y \leq -1$, $-x + y \leq 0$, $x, y \geq 0$ is given by

(a) 1 (b) 4

(c) 6 (d) None of these

44. The constraints

$-x_1 + x_2 \leq 1$

$-x_1 + 3x_2 \leq 9$

$x_1, x_2 \geq 0$ defines on

(a) bounded feasible space

(b) unbounded feasible space

(c) both bounded and unbounded feasible space

(d) None of the above

45. If a variate takes values $a, ar, ar^2, ..., ar^{n-1}$ which of the relation between means hold?

(a) $AH = G^2$ (b) $\frac{A+H}{2} = G$

(c) $A > G > H$ (d) $A = G = H$

46. If for $n = 4$ the approximate value of integral $\int_1^9 x^2 dx$ by trapezoidal rule is $2\left[\frac{1}{2}(1 + 9^2) + \alpha^2 + \beta^2 + 7^2\right]$, then

(a) $\alpha = 1$, $\beta = 3$ (b) $\alpha = 2$, $\beta = 4$

(c) $\alpha = 3$, $\beta = 5$ (d) $\alpha = 4$, $\beta = 6$

47. The value of

$2\cos\frac{\pi}{13} \cdot \cos\frac{9\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$ is equal to

(a) 2 (b) 0

(c) 1 (d) 3

48. The angle of elevation of the top of a vertical tower from two points at distances a and b $(a > b)$ from the base and in the same line with it, are complementary. If θ is the angle subtended at the top of the tower by the line joining these points, then $\sin \theta$ is equal to

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

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

9. The probability that out of 10 persons, all born in April, at least two have the same birthday is

(a) $\dfrac{{}^3C_{10}}{(30)^{10}}$

(b) $1 - \dfrac{{}^{30}C_{10}}{30!}$

(c) $\dfrac{30^{10} - {}^{30}C_{10}}{(30)^{10}}$

(d) None of these

50. There are n-persons sitting in a row. Two of them are selected at random. The probability that two selected persons are not together, is

(a) $\dfrac{2}{n}$

(b) $1 - \dfrac{2}{n}$

(c) $\dfrac{}{(n+1)!}$

(d) None of these

Answers

Physics

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

Chemistry

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

Mathematics

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