EAMCET

ENGINEERING ENTRANCE EXAM

SOLVED PAPER–1994

PHYSICS

1. The time period of a simple pendulum measured inside a stationary lift is found to be T. If the lift starts acclerating upwards with an acceleration of $g/3$, the time period of the pendulum will be :
   (a) $\sqrt{3}T$ (b) $\frac{\sqrt{3}}{2}T$ (c) $T/\sqrt{3}$ (d) $T/3$

2. Under the application of force, a steel wire ($Y = 19 \times 10^{10} Nm^{-2}$) of 5 m in length suffers an elongation of 1 mm. The potential energy stored per unit volume in this process, in joules per m^3 is :
   (a) 1.9×10^3 (b) 9.5×10^3
   (c) 9.5×10^3 (d) 3.8×10^3

3. A spring of force constant k is cut into two equal parts. The force constant of each part is :
   (a) $k/2$ (b) k (c) $2k$ (d) $4k$

4. Work done by 0.1 mole of gas at 27°C when it expands to double its volume at constant pressure is : (assume $R = 2$ cal/mol - K)
   (a) 600 cal (b) 42 cal
   (c) 60 cal (d) 546 cal

5. A pyknometer weight 40 g when empty and 1040 g when filled with mercury at 0°C. On heating to 100°C, 10 g of mercury overflows. If the coefficient of real expansion of mercury is 0.0002/°C the coefficient of expansion of glass is :
   (a) 0.00001/°C (b) 0.0002/°C
   (c) 0.0002/°C (d) 0.0001/°C

6. To keep constant time, watches are fitted with a balance wheel made up of :
   (a) stainless steel (b) invar
   (c) tungsten (d) platinum

7. In an isothermal change, an ideal gas obeys :
   (a) Boyle's law (b) Charles' law
   (c) Gay-Lusac law (d) none of these

8. Water film of thickness 0.5 mm exists between two flat circular glass plates of diameter 10 cm each. If the surface tension of water is $7 \times 10^{-4} Nm^{-1}$, the force in newtons required to pull the plates aparts is :
   (a) $1.75\pi \times 10^{-6}$ (b) $7\pi \times 10^{-3}$
   (c) $7/\pi \times 10^{-5}$ (d) $7/10 \times 10^{-4}$

9. The phase difference between two vibrating particles separated by a distance of 11 metres into medium through which a progressive wave is travelling is 1320°. If the frequency of the disturbance is 105 Hz, the phase velocity of the progressive wave in ms^{-1} :
   (a) 315 (b) 330 (c) 350 (d) 300

10. A closed pipe 1 metre long, emitting its second overtone, is in unison with an open pipe emitting its third overtone. The length of the open pipe will be :
    (a) 1.2 m (b) 1.6 m
    (c) 2.5 m (d) 3.2 m

11. A geostationary satellite has an orbital period of :
    (a) 2 hours (b) 5 hours
    (c) 24 hours (d) 12 hours

12. A 2 kg stone tied at the end of a string of 1 m length, is whirled along a vertical circle at a constant speed of 4 m/s. The tension in the string has a value of 52 N when the stone is :
    (a) at the top of the circle
    (b) half way down
    (c) at the bottom of the circle
    (d) none of the above

13. The escape velocity of an object on a planet whose radius is 4 times that of the earth and value of 'g' is same as that on the earth, in km-s^{-1} is :
(a) 33.6 (b) 22.4 (c) 16.8 (d) 25.2

14. A helicopter of power P can maintain a maximum uniform speed V, while going up and a maximum uniform speed V_1 while travelling horizontally. If the force due to air resistance is 'k' times the velocity and the acceleration due to gravity, the mass of the helicopter is :
(a) $\frac{g^v}{k(V_1^2 - V^2)}$ (b) $\frac{k(V^2 + V_1^2)}{g^v}$
(c) $\frac{(P + kV^2)}{g}$ (d) $\frac{k(V^2 - V_1^2)}{g^v}$

15. A 2 kg mass moving on a smooth frictionless surface with a velocity of 10 m/s, hits another 2 kg mass kept at rest in an elastic collision. After collision, if they move together :
(a) they travel with a velocity of 5 ms^{-1} in the same direction
(b) they travel with a velocity of 10 ms^{-1} in the same direction
(c) they travel with a velocity of 10 ms^{-1} in the opposite direction
(d) they travel in the opposite direction with a velocity of 5 ms^{-1}

16. A motor car of mass 300 kg is moving with a velocity of 25 m/s, by applying brakes the car was brought to rest in a distance of 15 metres. The force of retardation in newton is :
(a) 2500 (b) 4500 (c) 6250 (d) 7500

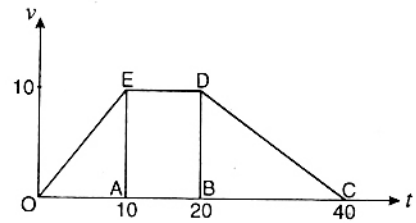
17. A gun is aimed at a target in line with its barrel. The target is released and allowed to fall under gravity, at the instant, the gun is fired. The bullet will :
(a) pass above the target
(b) pass below the target
(c) hit the target
(d) certainly hit the target

18. The coefficient of kinetic friction between a body and the surface of an inclined plane at 45° is 0.5. If $g = 9.8$ ms^{-2}, the acceleration of the body down the inclined plane, in ms^{-2} is :
(a) $4.9/\sqrt{2}$ (b) 4.9
(c) $4.9\sqrt{2}$ (d) $19.6\sqrt{2}$

19. The velocity of a body falling freely under gravitational field varies as $g^p h^q$, where g is gravitational acceleration and h is height from which the body is released. p and q are given by :
(a) $p = 2 : q = 1/2$ (b) $p = 1/2 : q = 1/2$
(c) $p = 1/2 : q = 1$ (d) $p = q = 1$

20. A body 'A' starts from rest with an acceleration a_1. After 2 seconds another body 'B' starts from rest with an acceleration a_2. If they travel equal distance in the 5th second after the start of 'A'. $a_1 : a_2$ is equal to :
(a) 5 : 9 (b) 5 : 7 (c) 9 : 5 (d) 9 : 7

21. In the following velocity-time graph, the distance travelled by the body, in metres is :



(a) 200 (b) 250 (c) 300 (d) 400

22. A person aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of 0.5 ms^{-1} at an angle of 120° with the direction of flow of water. The speed of water in the stream, in ms^{-1}, is :
(a) 1.00 (b) $1/\sqrt{3}$ (c) 0.25 (d) 0.433

23. If a unit vector is represented by $0.5\,\hat{i} + 0.8\,\hat{j} + c\hat{k}$, the value of c is :
(a) 1 (b) $\sqrt{0.11}$
(c) $\sqrt{0.011}$ (d) $\sqrt{0.39}$

24. The following physical quantity has a ratio of 10^3 between its SI units and CGS units :
(a) Universal gravitational constant
(b) Boltzmann's constant
(c) Planck's constant
(d) Young's modulus of elasticity

25. The ratio L/R, where L and R stand for inductance and resistance, has the same dimensions as those of :
(a) velocity (b) acceleration
(c) time (d) force

26. In a reverse biased condition of a p-n junction :
(a) the potential barrier increases
(b) the potential barrier decreases
(c) the current flow increases
(d) the potential barrier remains the same

27. Which one of the following is an incorrect statement?
(a) In an intrinsic semiconductor, the number of holes in the valence band is equal to the number of electrons in the conduction band
(b) When heated the counductivity of an intrinsic semiconductor, increases
(c) The fermi level lies near the valence band in an intrinsic semiconductor
(d) The majority carries in a p-type semiconductor are holes

28. Covalent bond exists in :
(a) sodium chloride crystal
(b) germanium
(c) copper
(d) helium

29. In a p-type semiconductor, the electrical conduction is due to :
(a) only holes
(b) only electrons
(c) a large number of holes and small number of electrons
(d) a large number of electrons and a small number of holes

30. When two deuterium nuclei fuse together to form tritium, we get a :
(a) neutron (b) proton
(c) α-particle (d) deuteron

31. Neutron was discovered by :
(a) Madam Curie (b) Moseley
(c) Rutherford (d) Chadwick

32. After two hours, 1/16 of the initial amount of a certain radioactive isotope remains undecayed. The half-life of the isotope is :
(a) 15 min (b) 30 min
(c) 45 min (d) 60 min

33. Which of the following is more effective in inducing nuclear fission ?
(a) Fast neutron (b) Fast proton
(c) Slow proton (d) Slow neutron

34. The radius of the hydrogen atom in the ground state is the order of :
(a) 10^{-4} cm (b) 10^{-5} cm
(c) 10^{-7} cm (d) 10^{-8} cm

35. A beam of charged particles of charge 'q' and mass m are accelerated from rest through a potential difference of 100 volts. They pass through crossed electric and magnetic fields which together produce null deflection. If these electronic and magnetic fields are respectively 15×10^3 volts/m and 5 weber/m^2, then 'q/m' has a value, in coulomb/kg, equal to :
(a) 9×10^4 (b) 15
(c) 4.5×10^4 (d) 4.5×10^2

36. Photons of energy 2.0 eV and wavelength λ fall on a metal plate and release photoelectrons with a maximum velocity v. By decreasing λ by 25% the maximum velocity of photoelectrons is doubled. The work function of the material of the metal plate, in eV is :
(a) 2.22 (b) 1.985 (c) 2/35 (d) 1.80

37. The Balmer's general formula for hydrogen is obtained by putting, n_1 equal to :
(a) 2 (b) 1 (c) 3 (d) ∞

38. A varying current in a coil changes from 10 A to zero in 0.5 seconds. If the average emf induced in the coil is 220 volts, the self-inductance of the coil is :
(a) 5.0 H (b) 10.0 H
(c) 11.0 H (d) 12.0 H

39. The equation connecting thermo emf with the temperature difference between the junctions 't' of a thermocouple, whose cold junction is maintained at 0°C, is given by $e = 2040\,t - 6.2\,t^2$. The neutral and inversion temperatures of the thermocouple in °C are respectively and nearly equal to :
(a) 164.5 and 329
(b) 329 and 164.5
(c) 82.25
(d) 164.5 and 82.25

40. A current is passed through two coils connected in series. The potential difference across the first coil is 3 volts and that of the second coil 4.5 volts. If the first coil has resistance of 2 ohm, the resistance of the second coil is :
(a) 3 Ω (b) 5 Ω (c) 7 Ω (d) 9 Ω

41. When a dielectric slab of the same area of cross-section and thickness equal to 2/3 of the separation is introduced between the plates of a parallel plate capacitor, its capacitance becomes 2.25 times the original value. The dielectric constant of the material of the slab is :
(a) 1.5 (b) 4.5 (c) 5.0 (d) 6.0

42. If the magnitude of the intensity of a magnetic field at a distance x on the axial line and at a distance y on the equitorial line of a given dipole have the same value the ratio $x : y$ is :
(a) $1 : \sqrt{2}$ (b) $\sqrt{2} : 1$ (c) 1 : 2 (d) $2^{1/3} : 1$

43. Substance which when placed in a magnetic field, acquire feeble magnetisation in a direction opposite to that of the applied field are called :
(a) diamagnetic substances
(b) paramagnetic subtances
(c) ferromagnetic substances
(d) ferrimagnetic substances

44. The couple acting on a magnet of length 10 cm placed in a uniform magnetic field of intensity 40 N/Am such that the axis of the magnet makes 45° with the field direction is $\sqrt{2}/10$ Nm. The pole strength of the magnet in weber is :
(a) 5×10^{-3} (b) 0.5 (c) 0.05 (d) 5.0

45. Which of the following wavelength is in the infrared region?
(a) 5460 Å (b) 5893 Å
(c) 4320 Å (d) 7000 Å

46. In Huygen's eyepiece the equivalent focal length is given by :
(a) $3f/4$ (b) $3f/2$
(c) $2f$ (d) f

47. If Foucoult's method for determining the velocity of light in air, the distance between the concave mirror and the rotating mirror was 5 km. The speed of rotation of the rotating mirror was 300 revolutions per second. If the reflected ray is displaced through $\pi/60$ radian, the velocity of light in air is :
(a) 3×10^3 km/s (b) 2.98×10^3 m/s
(c) 3×10^3 m/s (d) none of the abvoe

48. A hollow prism made of transparent glass is filled with a transparent liquid. The angle between the two refracting faces of the prism is 90°. If light incident on one of the faces at grazing angle comes out of the other also at a grazing angle, the refractive index of the liquid is :
(a) 1.414 (b) 1.333 (c) 1.35 (d) 1.4

49. When a wave travels in a medium the particles displacement is given by the equation $y(x, t) = 0.03 \sin \pi (2t - 0.01x)$ where y and x are in metres and t in seconds. The wavelength of the wave is :
(a) 10 m (b) 20 m (c) 100 m (d) 200 m

50. A tuning fork of frequency 392 Hz, resonates with 50 cm length of a string under tension T. If the length of the string is decreased by 2% keeping the tension constant the number of beats heard when the string and the tuning fork are made to vibrate simultaneously is :
(a) 8 (b) 12 (c) 4 (d) 6

CHEMISTRY

1. While phosphorus form PCl_5, nitrogen does not form NCl_5 because :
(a) nitrogen is more electro negative than phosphorus
(b) nitrogen atom is smaller than phosphorus
(c) the ionisation energy of nitrogen is greater than that of phosphorus
(d) unlike phosphorus, nitrogen has no 'd' orbital in its valence shell

2. The reagent used for concentrating silver ore is :
(a) HI (b) HNO_3 (c) KCN (d) NH_3

3. The metal that has the highest electrical conductivity is :
(a) Al (b) Cu (c) Ag (d) Au

4. Which one of the following is not an allotrope of carbon ?
(a) Graphite (b) Diamond
(c) Soot (d) Carborundum

5. Alcohol manufactured from water gas is :
(a) ethanol (b) butanol
(c) methanol (d) isobutanol

6. Thermite is a mixture of iron oxide and :
(a) sodium shavings
(b) aluminium powder
(c) zinc powder
(d) potassium metal

7. The formula of a metal chloride is MCl_3, It contains 20% of the metal. The atomic weight of the metal is approximately :
(a) 26.5 (b) 11.8 (c) 21.3 (d) 106.5

8. The metal that forms a self protecting film of oxide to prevent corrosion is :
(a) Cu (b) Al (c) Pt (d) Au

9. Which one of the following statements is not correct with respect to BF_3 ?
(a) It is an electron deficient compound
(b) It is a Lewis acid
(c) It is an ionic compound
(d) It forms adducts

10. The formula of dolomite is :
(a) $MgCO_3 . CaCl_2$ (b) $MgCO_3 . CaCO_3$
(c) $MgCO_3 . CaSO_4$ (d) $MgCl_2 . CaCO_3$

11. Permanent hardness of water is due to :
(a) the chlorides of Ca and Mg
(b) the sulphates of Ca and Mg
(c) both chlorides and sulphates of Ca and Mg
(d) the bicarbonates of Ca and Mg

12. In aqueous solutions H_2O_2 oxidises H_2S to :
(a) sulphur (b) sulphuric acid
(c) Caro's acid (d) Marshall's acid

13. A flask contains 3 g H_2 and 24 g O_2. The partial pressure of hydrogen in the mixture is :
(a) 1/8th of the total pressure
(b) 1/9th of the total pressure
(c) 1/2 of the total pressure
(d) 2/3 of the total pressure

14. Which one of the following gases contains the least number of molecules ?
(a) 4.0 g laughing gas
(b) 3.0 g phosphorus
(c) 2.0 g marsh gas (d) 10.0 g phosgene

15. The molecular weight of a gas that diffuses twice as rapidly as a gas with molecular weight 64 is :
(a) 6.4 (b) 8 (c) 128 (d) 16

16. An example of a non-transitional element is :
(a) cobalt (b) lead
(c) cerium (d) silver

17. The ion that is likely to be colourless in aqueous solution is :
(a) Ti^{3+} (b) V^{3+} (c) Mn^{2+} (d) Zn^{2+}

18. The oxidation state of Mo in $(Mo_2Cl_8)^{4-}$ ion is :
(a) – 4 (b) – 2 (c) + 6 (d) + 2

19. Which one of the following is the largest ion ?
(a) Na^+ (b) Mg^{2+} (c) O^{2-} (d) F^-

20. Among the following elements that has the lowest first ionisation potential is :
(a) nitrogen (b) oxygen
(c) fluorine (d) neon

21. BF_3 forms an adduct with NH_3 because :
(a) nitrogen has high electronegativity
(b) boron has smaller atomic radius than nitrogen
(c) boron has an empty '*p*' orbital and nitrogen has a lone pair of electrons
(d) boron has electropositive character

22. The number of β-particles emitted in the radioactive change :
$U_{92}^{238} \longrightarrow Pb_{82}^{206} + 8_2\,He^4$
(a) 2 (b) 4 (c) 6 (d) 8

23. The half-life period of a radioactive substance is 150 days. Starting with an initial quantity of 1 mg of the substance the fraction of that has disintegrated in 600 days is :
(a) 1/2 (b) 1/4 (c) 1/16 (d) 15/16

24. The constancy of *e/m* ratio for electrons inspite of variations of gas present in the discharge tube or of the material of the cathode shows that :
(a) electrons are negatively charged
(b) electrons are universal constituents of matter
(c) electrons are the lightest of all particles
(d) mass of the electron is 1/1838 of the mass of H-atom

25. The basic assumption of Bohr's model of hydrogen atom is that :
(a) the energy of the electron is quantised
(b) the angular momentum of the electron is quantised
(c) the radial distance of the electron is quantised
(d) the orbital velocity of the electron is quantised

26. Which one of the following is a tertiary amine ?
(a) *t*-butyl amine
(b) Methyl ethyl amine
(c) Dimethyl secondary butyl amine
(d) N-methyl aniline

27. Benzene molecule contains :
(a) 3π and 9 σ-bonds (b) 6π and 12 σ-bonds
(c) 6π and 6 σ-bonds (d) 3π and 12 σ-bonds

28. Aniline on treatment with bromine water gives a white precipitate of :
(a) mono-bromo aniline
(b) dibromo aniline
(c) sym-tribromo aniline
(d) tetra-bromo aniline

29. Among the following the hydrocarbon which decolourises bromine water but does not give precipitate with ammoniacal $AgNO_3$ is :
(a) CH_4 (b) C_2H_4 (c) C_2H_2 (d) C_6H_6

30. The method of converting high boiling hydrocarbons into low boiling hydrocarbons is known as :
(a) pyrolysis (b) isomerisation
(c) cracking (d) inversion

31. On heating with bleaching powder ethyl alcohol is converted into :
(a) CH_3COOH (b) CH_3CHO
(c) CH_3COCH_3 (d) $CHCl_3$

32. Which one of the following compounds is acidic ?
(a) C_6H_6 (b) C_2H_6 (c) C_2H_4 (d) C_2H_2

33. The equilibrium constant (K_c) for the reaction $HA + B \rightleftharpoons BH^+ + A^-$ is 100. If the rate constant for the forward reaction is 10^5, rate constant for the reverse reaction is :
(a) 10^{-3} (b) 10^{-5} (c) 10^7 (d) 10^3

34. The role of a catalyst in a reversible reaction is :
(a) it increases the rate of the forward reaction
(b) it decreases the rate of backward reaction
(c) it alters the equilibrium constant of the reaction
(d) it allows the equilibrium to be achieved quickly

35. In the equilibrium reaction $A_{(g)} + 2B_{(g)} \rightleftharpoons C_{(g)} + D_{(g)}$ the equilibrium constant K_c is given by the expression :
(a) $K_c = \frac{[C][D]}{[A][B]}$ (b) $K_c = \frac{[C][D]^2}{[A][B]}$
(c) $K_c = \frac{[A][B]^2}{[C][D]}$ (d) $K_c = \frac{[C][D]}{[A][B]^2}$

36. Consider the following reactions :
$C + O_2 \rightarrow CO_2$; $\Delta H = -400$ kJ mol^{-1}
$2H_2 + O_2 \rightarrow 2H_2O$; $\Delta H = -570$ kJ mol^{-1}
$CO_2 + 2H_2O \rightarrow CH_4 + 2O_2$; $\Delta H = 890$ kJ mol^{-1}
The heat of formation of methane is :
(a) -180 kJ mol^{-1}
(b) -1060 kJ mol^{-1}
(c) -720 kJ mol^{-1}
(d) -80 kJ mol^{-1}

37. Given that
$CH_3CHO + \frac{5}{2}O_2 \rightarrow 2CO_2 + 2H_2O$
$\Delta H = -1168$ kJ mol^{-1}
$CH_3COOH + 2O_2 \rightarrow 2CO_2 + 2H_2O$
$\Delta H = -876$ kJ mol^{-1}
ΔH for the reaction
$CH_3CHO + \frac{1}{2}O_2 \rightarrow CH_3COOH$ is :
(a) -292 kJ mol^{-1} (b) 378 kJ mol^{-1}
(c) 195 kJ mol^{-1} (d) -2044 kJ mol^{-1}

38. How many grams of copper will be deposited from a solution of $CuSO_4$ by passing 0.5 faraday of electricity :
(a) 31.75 (b) 63.5
(c) 15.875 (d) 127

39. The single electrode reactions
$Cd_{(s)} \rightarrow Cd^{2+}_{(0.1)} + 2e^-$ $E^\circ = 0.4030$
$Cu^{2+} + 2e^- \rightarrow Cu_{(s)}$ $E^\circ = 0.337$
can be combined to give the cell reaction
$Cd(s) + Cu^{2+} \longrightarrow Cd^{2+} + Cu(s)$
The emf of the cell is :
(a) 0.74 (b) 0.1354 (c) 0.66 (d) 0.066

40. The ionic product of water is 10^{-14}. What is the hydrogen ion concentration of a 0.1M NaOH solution ?
(a) 10^{-14} (b) 14M
(c) 13M (d) 10^{-13}M

41. The pH of a 0.05 M solution of H_2SO_4 is :
(a) 5 (b) 1 (c) 3 (d) 0.1

42. When the same amount of zinc is treated with excess of H_2SO_4 and with excess NaOH, the ratio of the volume of H_2 evolved is :
(a) 3 : 2 (b) 1 : 2 (c) 2 : 1 (d) 1 : 1

43. 5.85 g of NaCl (Mol. wt. 58.5) is dissolved in water and the solution made up to 500mL. The molarity of the solution will be :
(a) 0.1 (b) 0.2 (c) 1.0 (d) 0.117

44. The gas that is used for sterilising water is :
(a) SO_2 (b) NO_2 (c) O_3 (d) NH_3

45. The crystalline form of sulphur that is stable at room temperature :
(a) Engel's sulphur
(b) Rhombic sulphur
(c) Monoclinic sulphur
(d) Plastic sulphur

46. Bleaching action of chlorine in presence of moisture is an example of :
(a) oxidation (b) reduction
(c) displacement (d) substitution

47. In the electrolysis of HF - KF mixture for the production of fluorine, the role of KF is :
(a) to lower the oxidation potential of fluoride
(b) to make HF a conducting solution
(c) to minimise corrosion
(d) to lower the solubility of fluorine

48. When dilute H_2SO_4 is electrolysed at room temperature between platinum electrodes the substance liberated at the anode is :
(a) S (b) SO_2
(c) H_2 (d) O_2

49. In the reaction
$NO_2^- + OCl^- \rightarrow NO_3^- + Cl^-$ the oxidation state of chlorine :
(a) does not change
(b) changes from +1 to −1
(c) changes from −2 to −1
(d) changes from 0 to −1

50. *Meta*-phosphoric acid is represented by :
(a) H_3PO_3 (b) H_2PO_3
(c) HPO_3 (d) $H_4P_2O_7$

MATHEMATICS

1. The value of θ $(0 < \theta < 2\pi)$ satisfying $\text{cosec}\,\theta + 2 = 0$ are :
(a) 210°, 300° (b) 210°, 240°
(c) 210°, 330° (d) 240°, 300°

2. If $x = y\cos\frac{2\pi}{3} = z\cos\frac{4\pi}{3}$, then
$xy + yz + zx$ is equal to :
(a) −1 (b) 0
(c) 1 (d) 2

3. If $\sin\alpha = \sin\beta$ and $\cos\alpha = \cos\beta$, then :
(a) $\sin\frac{(\alpha+\beta)}{2} = 0$ (b) $\cos\frac{(\alpha+\beta)}{2} = 0$
(c) $\sin\left(\frac{\alpha-\beta}{2}\right) = 0$ (d) $\cos\frac{\alpha-\beta}{2} = 0$

4. If $\cos\alpha + \cos\beta + \cos\gamma = 0$
$= \sin\alpha + \sin\beta + \sin\gamma$, then values of
$\sin 2\alpha + \sin 2\beta + \sin 2\gamma$ and
$\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ are :
(a) 0 (b) 2 (c) −2 (d) 1

5. If A lies in the third quadrant and $3\tan A - 4 = 0$, then
$5\sin 2A + 3\sin A + 4\cos A$ is equal to :
(a) 0 (b) $-\frac{24}{5}$ (c) $\frac{24}{5}$ (d) $-\frac{48}{5}$

6. In a group $G = \{2, 4, 6, 8\}$, under multiplication modulo 10, the identity element is :
(a) 6 (b) 8
(c) 4 (d) 2

7. In the group G of question 6, the inverse of 4 is :
(a) 2 (b) 4 (c) 6 (d) 8

8. The order of $(x\ y\ z)\begin{pmatrix} a & h & g \\ h & b & f \\ g & f & c \end{pmatrix}\begin{pmatrix} x \\ y \\ z \end{pmatrix}$ is :
(a) 3×1 (b) 1×1
(c) 1×3 (d) 3×3

9. Suppose $\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and
$\Delta' = \begin{vmatrix} a_1 + pb_1 & b_1 + qc_1 & c_1 + ra_1 \\ a_2 + pb_2 & b_2 + ac_2 & c_2 + ra_2 \\ a_3 + pb_3 & b_3 + qc_3 & c_3 + ra_3 \end{vmatrix}$, then
(a) $\Delta' = \Delta$ (b) $\Delta' = \Delta(1 + p + q + r)$
(c) $\Delta' = \Delta(1 + pqr)$ (d) $\Delta' = \Delta(1 - pqr)$

10. $\begin{bmatrix} 1 & 3 \\ 3 & 10 \end{bmatrix}^{-1}$ is equal to :
(a) $\begin{bmatrix} 10 & 3 \\ 3 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 10 & -3 \\ -3 & 1 \end{bmatrix}$
(c) $\begin{bmatrix} 1 & 3 \\ 3 & 10 \end{bmatrix}$ (d) $\begin{bmatrix} -1 & 3 \\ 3 & -10 \end{bmatrix}$

11. $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, then A' is equal to :
(a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$
(c) $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

12. If $\frac{3x + 4}{(x+1)^2(x-1)} = \frac{A}{(x-1)} + \frac{B}{(x+1)} + \frac{C}{(x+1)^{2'}}$ then A is equal to :
(a) $-\frac{1}{2}$ (b) $\frac{15}{2}$ (c) $\frac{7}{4}$ (d) $-\frac{1}{4}$

13. $\begin{vmatrix} \sin^2 x & \cos^2 x & 1 \\ \cos^2 x & \sin^2 x & 1 \\ -10 & 12 & 2 \end{vmatrix}$ is equal to :
(a) 0
(b) $12\cos^2 x - 10\sin^2 x - 2$
(c) $12\sin^2 x - 10\cos^2 x - 2$
(d) $\sin 2x$

14. The system of linear equations $x + y + z = 2$, $2x + y - z = 3$, $3x + 2y + kz = 4$, has a unique solution, if k is equal to :
(a) $k = 0$ (b) $-1 < k < 1$
(c) $-2 < k < 2$ (d) $k \neq 0$

15. $\frac{C_0}{1} - \frac{C_1}{2} + \frac{C_2}{3} + \ldots + (-1)^n \frac{C_n}{n+1}$ is equal to :
(a) 0 (b) $\frac{1}{n+1}$ (c) $\frac{2^n}{n+1}$ (d) $\frac{2^n - 1}{n+1}$

16. If $(1 + 2x + x^2)^n = \sum_{r=0}^{2n} a_r n^r$, then a_r is :
(a) $\left({}^nC_r\right)^2$ (b) ${}^nC_r - {}^nC_{r-1}$
(c) ${}^{2n}C_r$ (d) ${}^{2n}C_{r+1}$

17. The coefficient of x^3 in $\left(\sqrt{x^5} + \frac{3}{\sqrt{x^3}}\right)^6$ is :
(a) 0 (b) 120 (c) 420 (d) 540

18. 11 persons are to be arranged at a round table. If two particular persons are sit together. The total number of arrangements is :
(a) 9 (10 !) (b) 2 (10 !) (c) 2 (9 !) (d) (11 !)

19. The condition that in the eqution s :
$ax^2 + bx + c = 0$ and $a'x^2 + b'x + c' = 0$ for one root to common
(a) $(ca' - c'a)(ab' - a'b)) = (bc' - b'c)^2$
(b) $(ca' - c'a)(bc' - b'c) = (ab' - a'b)^2$
(c) $(bc' - b'c)(ab' - a'b) = (ca' - c'a)^2$
(d) none of these

20. If $\log_2 x + \log_x 2 = \frac{10}{3} = \log_2 y + \log_y 2$ and $x \neq y$, then $x + y$ is equal to :
(a) $2^{1/3} + 3^2$ (b) $2^3 + 2^{1/3}$
(c) $3^{1/3} + 2^3$ (d) none of these

21. If the ratio of the roots of $x^2 + bx + c = 0$ and $x^2 + qx + r = 0$ be the same, then :
(a) $r^2c = qb^2$ (b) $r^2b = qc^2$
(c) $rb^2 = cq^2$ (d) $rc^2 = bq^2$

22. If α, β are the roots of $ax^2 + bx + c = 0$, the equation whose roots are $2 + \alpha, 2 + \beta$, is :
(a) $ax^2 + (4a - b)x + 4a - 2b + c = 0$
(b) $ax^2 + (4a - b)x + 4a + 2b + c = 0$
(c) $ax^2 + (b - 4a)x + 4a + 2b + c = 0$
(d) $ax^2 + (b - 4a)x + 4a - 2b + c = 0$

23. If $x = \sqrt{7+4\sqrt{3}}$; $x + \frac{1}{x}$ is equal to :
(a) 4 (b) 6 (c) 2 (d) 3

24. The number of bijective functions from set A to itself when A contains 106 elements, is :
(a) 106 (b) $(106)^2$ (c) 2^{106} (d) 106 !

25. $f(x) = |\sin x|$ has an inverse, if its domain is :
(a) $\left(\frac{\pi}{4}, \frac{\pi}{4}\right)$ (b) $\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$
(c) $\left(0, \frac{\pi}{4}\right)$ (d) $(0, \pi)$

26. The reflection of the point $(4, -13)$ in the line $5x + y + 6 = 0$ is :
(a) $(-1, -14)$ (b) $(3, 4)$
(c) $(1, 2)$ (d) $(-4, 13)$

27. A diagonal of the rectangle formed by the lines $x^2 - 7x + 6 = 0$ and $y^2 - 14y + 40 = 0$, is :
(a) $5x + 6y = 0$ (b) $5x - 6y = 0$
(c) $6x - 5y + 14 = 0$ (d) $6x - 5y - 14 = 0$

28. Let X be binomially distributed variate with mean 10 and variance 5. Then $P(X > 10)$:
(a) $\frac{1}{2^{20}} \sum_{k=0}^{20} {}^{20}C_k$ (b) $\frac{1}{2^{20}} \sum_{k=11}^{20} {}^{20}C_k$
(c) $\frac{1}{2^{20}} \sum_{k=1}^{20} {}^{20}C_k$ (d) $\sum_{k=10}^{20} {}^{30}C_k \frac{1}{3}\left(\frac{2}{3}\right)^{30-k}$

29. The probabilityof getting a total of 10 in a single throw of two dice, is :
(a) $\frac{1}{9}$ (b) $\frac{1}{12}$ (c) $\frac{1}{6}$ (d) $\frac{5}{36}$

30. In a binomial distribution $n = 400$, $p = \frac{1}{5}$, its standard deviation is :
(a) $10\sqrt{2}$ (b) $\frac{1}{800}$ (c) 4 (d) 8

31. The probability of getting exactly 2 tails in 6 tosses of a fair coin, is :
(a) $\frac{3}{8}$ (b) $\frac{1}{4}$ (c) $\frac{15}{64}$ (d) $\frac{49}{64}$

32. If X is a random poisson variate such that $\alpha = P(X = 1) = P(X = 2)$, then $P(X = 4)$ is equal to :
(a) 2α (b) $\frac{\alpha}{3}$ (c) αe^{-2} (d) αe^2

33. Given $A = \sin^2\theta + \cos^4\theta$, then for real values of θ :
(a) $1 \le A \le 2$ (b) $\frac{3}{4} \le A \le 1$
(c) $\frac{13}{16} \le A \le 1$ (d) $\frac{3}{4} \le A \le \frac{13}{16}$

34. If X follows a binomial distribution with parameters $n = 6$ and p. If $4P(X = 4) = P(X = 2)$, then p is equal to :
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

35. In a random experiment if E_1, E_2 are two events such that $P(E_1) \neq 0$ and $P(E_2) \neq 0$, then $P(E_1 \cap E_2)$ is :
(a) $P(E_1) \cdot P\left(\frac{E_2}{E_1}\right)$ (b) $P(E_2) \cdot P\left(\frac{E_1}{E_2}\right)$
(c) $P(E_1) \cdot P\left(\frac{E_1}{E_2}\right)$ (d) none of these

36. If $(1 + x)^n = C_0 + C_1 x + C_2 x^2 + \ldots + C_n x^n$, then $C_0 - C_2 + C_4 - C_6 + \ldots$ is equal to :
(a) 2^{n-1} (b) $2^{n/2} \cdot \sin\left(\frac{n\pi}{4}\right)$
(c) $2^{n/2} \cos\frac{n\pi}{4}$ (d) 0

37. If $\frac{\pi}{2} < \alpha < \frac{3\pi}{2}$, the modulus argument of $(1 + \cos 2\alpha) + i \sin 2\alpha$ is :
(a) $-2\cos\alpha \{\cos(\pi + \alpha) + i \sin(\pi + \alpha)\}$
(b) $2\cos\alpha (\cos\alpha + i \sin\alpha)$
(c) $2\cos\alpha \{\cos(-\alpha) + i \sin(-\alpha)\}$
(d) $-2\cos\alpha \{\cos(\pi - \alpha) + i \sin(\pi - \alpha)\}$

38. If the roots of $(z-1)^n = i(z+1)^n$ are plotted in the argand diagram they are :
(a) on a parabola (b) concylic
(c) collinear (d) none of these

39. If $\cos\alpha + \cos\beta = 0 = \sin\alpha + \sin\beta$, then $\cos 2\alpha + \cos 2\beta$ equals :
(a) $-2\sin(\alpha + \beta)$ (b) $-2\cos(\alpha + \beta)$
(c) $2\sin(\alpha + \beta)$ (d) $2\cos(\alpha + \beta)$

40. $\frac{\left(\sin\frac{\pi}{8} + i\cos\frac{\pi}{8}\right)^8}{\left(\sin\frac{\pi}{8} - i\cos\frac{\pi}{8}\right)^8}$ is equal to :
(a) -1 (b) 0 (c) 1 (d) $2i$

41. In any triangle ABC, r is is equal to :
(a) $(s-a)\tan\frac{B}{2}$ (b) $(s-b)\tan\frac{B}{2}$
(c) $(s-c)\tan\frac{C}{2}$ (d) none of these

42. $\cosh 2x$ is equal to :
(a) $\cosh^2 x + \sinh^2 x$
(b) $\cosh^2 x - \sinh^2 x$
(c) $\operatorname{sech}^2 x - 1$
(d) $2\sinh^2 x - 1$

43. If $x = \log(y + \sqrt{y^2 - 1})$, then y is :
(a) $\tanh x$ (b) $\coth x$
(c) $\sinh x$ (d) $\cosh x$

44. The angle of elevation of the top of a tower observed from each of 3 points A, B, C on the ground. Their angles of elevation are $\alpha, 2\alpha, 3\alpha$ respectively and $AB = a$, $BC = b$, then the height of the tower is :
(a) $\frac{a}{2b}\sqrt{(3b-a)(a+b)}$
(b) $\frac{a}{b}\sqrt{(3b+a)(a+b)}$
(c) $\frac{2a}{b}\sqrt{(3b-a)(a-b)}$
(d) none of these

45. If $y = \sqrt{x + \sqrt{x + \sqrt{x + \ldots \infty}}}$, then $(2y-1)\frac{dy}{dx}$ is :
(a) -1 (b) 1 (c) 2 (d) -2

46. In a ΔABC, $\tan\frac{A}{2} = \frac{5}{6}$, $\tan\frac{C}{2} = \frac{2}{5}$, then :
(a) a, c, b are in AP (b) a, b, c are in AP
(c) b, a, c are in AP (d) a, b, c are in GP

47. If $\cot\frac{A}{2} = \frac{b+c}{a}$, then the triangle is a/an :
(a) isosceles (b) equilateral
(c) right angled (d) none of these

48. If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2\cos^6 x + \cos^4 x$ is equal to :
(a) 0 (b) -1 (c) 2 (d) 1

49. If $\sin^{-1} x + \sin^{-1} y = \frac{2\pi}{3}$, then $\cos^{-1} x + \cos^{-1} y$ is :
(a) $\frac{2\pi}{3}$ (b) $\frac{\pi}{3}$ (c) $\frac{\pi}{6}$ (d) π

50. $\tan^{-1}\frac{1}{4} + \tan^{-1}\frac{2}{9}$ is equal to :
(a) $\frac{1}{2}\cos^{-1}\left(\frac{3}{5}\right)$ (b) $\frac{1}{2}\sin^{-1}\left(\frac{3}{5}\right)$
(c) $\frac{1}{2}\tan^{-1}\left(\frac{3}{5}\right)$ (d) $\tan^{-1}\left(\frac{1}{2}\right)$

51. Consider the function $f(x) = x\sin\frac{1}{x}$, $x \neq 0$ & $f(0) = 0$, then :
(a) it is continuous for all real values of x
(b) it is discontinuous everywhere
(c) $f(x)$ exists and discontinuous at $x = \frac{\pi}{2}$
(d) none of these

52. $\lim_{x\to 0}\frac{e^{\tan x} - e^x}{\tan x - x}$ is equal to :
(a) 1 (b) e (c) e^{-1} (d) 0

53. $\lim_{x\to 1}\left[\frac{\sqrt{x^2-1} + \sqrt{x-1}}{\sqrt{x^2-1}}\right]$ is :
(a) $\frac{1}{2}$ (b) $\sqrt{2}$ (c) $1 + \frac{1}{\sqrt{2}}$ (d) $\frac{1}{\sqrt{2}}$

54. In an ellipse the distance between its foci is 6 and its minor axis is 8. Then its eccentricity is :
(a) $\frac{4}{5}$ (b) $\frac{1}{\sqrt{52}}$ (c) $\frac{3}{5}$ (d) $\frac{1}{2}$

55. The tangents at the points $(at_1^2, 2at_1)$, $(at_2^2, 2at_2)$ on the parabola $y^2 = 4ax$ are at right angle, then :
(a) $t_1 t_2 = -1$ (b) $t_1 t_2 = 1$
(c) $t_1 t_2 = 2$ (d) $t_1 t_2 = -2$

56. The combined equation of asymptotes of hyperbola $xy + x + y + 5 = 0$ is :
(a) $xy = 0$
(b) $(x-1)(y-1) = 0$
(c) $(x-1)(y+1) = 0$
(d) $(x+1)(y+1) = 0$

57. The centre and eccentricity of the ellipse $9x^2 + 25y^2 - 18x - 100y - 116 = 0$ are :
(a) $(1, 2), \frac{4}{5}$ (b) $(2, 1), \frac{5}{4}$
(c) $(-1, 2), \frac{3}{5}$ (d) $(2, -1), \frac{4}{5}$

58. If e_1, e_2 are the eccentricity of a hyperbola and its conjugate, then :
(a) $e_1^2 + e_2^2 = 3$ (b) $e_1 + e_2 = 4$
(c) $e_1^2 + e_2^2 = e_1^2 e_2^2$ (d) $e_1 - e_2 = 2$

59. The curve represented by $x = 2(\cosh\theta + \sin\theta)$ $y = 2(\cosh\theta - \sinh\theta)$ is :
(a) hyperbola (b) ellipse
(c) parabola (d) circle

60. The equation of the conic with focus at $(1, -1)$, directrix along $x - y + 1 = 0$ and with eccentricity $\sqrt{2}$ is :
(a) $x^2 - y^2 = 1$
(b) $xy = 1$
(c) $2xy - 4x + 4y + 1 = 0$
(d) $2xy + 4x + 4y - 1 = 0$

61. The equation of circle described on the common chord of circles $x^2 + y^2 + 2x = 0$, $x^2 + y^2 + 2y = 0$ as diameter, is :
(a) $x^2 + y^2 - x - y = 0$
(b) $x^2 + y^2 + x + y = 0$
(c) $x^2 + y^2 - x + y = 0$
(d) $x^2 + y^2 + x - y = 0$

62. A circle passes through the origin & has its centre lies on $y = x$. If it cuts $x^2 + y^2 - 4x - 6y + 10 = 0$ orthogonally, its equation is :
(a) $x^2 + y^2 - x - y = 0$
(b) $x^2 + y^2 - 6x + 4y = 0$
(c) $x^2 + y^2 - 2x - 2y = 0$
(d) $x^2 + y^2 + 2x + 2y = 0$

63. The radical centre of the three circles :
$x^2 + y^2 - x + 3y - 3 = 0$,
$x^2 + y^2 - 2x + 2y + 2 = 0$
and $x^2 + y^2 + 2x + 3y - 9 = 0$ is :
(a) $(3, 2)$ (b) $(2, 3)$
(c) $(2, -3)$ (d) $(3, -2)$

64. The number of common tangents to the circles $x^2 + y^2 - x = 0$, $x^2 + y^2 + x = 0$ is :
(a) 1 (b) 2 (c) 3 (d) 4

65. Consider the circles $x^2 + (y-1)^2 = 9$, $(x-1)^2 + y^2 = 25$. They are such that :
(a) touch each other
(b) one of these circles lies entirely inside the other
(c) each of their circles lies outside the other
(d) intersect in two points

66. The length of tangent from $(0, 0)$ to the circle $2(x^2 + y^2) + x - y + 5 = 0$ is :
(a) $\sqrt{5}$ (b) $\frac{\sqrt{5}}{2}$ (c) $\sqrt{2}$ (d) $\sqrt{\frac{5}{2}}$

67. The circumcentre of triangle formed by the lines $xy + 2x + 2y + 4 = 0$, $x + y + 2 = 0$ is :
(a) $(0, 0)$ (b) $(-2, -2)$
(c) $(-1, -1)$ (d) $(-1, -2)$

68. The angle between the pair of lines $2x^2 + 5xy + 2y^2 + 3x + 3y + 1 = 0$, is :
(a) $\cos^{-1}\left(\frac{4}{5}\right)$ (b) $\tan^{-1}\left(\frac{4}{5}\right)$
(c) 0 (d) $\frac{\pi}{2}$

69. The distance between the parallel lines $9x^2 - 6xy + y^2 + 18x - 6y + 8 = 0$ is :
(a) $\frac{1}{\sqrt{10}}$ (b) $\frac{2}{\sqrt{10}}$
(c) $\frac{4}{\sqrt{10}}$ (d) $\sqrt{10}$

70. A point equidistant from the lines $4x + 3y + 10 = 0$, $5x - 12y + 26 = 0$ and $7x + 24y - 50 = 0$ is :
(a) $(1, -1)$ (b) $(1, 1)$
(c) $(0, 0)$ (d) $(0, 1)$

71. The lines $2x + y - 1 = 0$, $ax + 3y - 3 = 0$, $3x + 2y - 2 = 0$ are concurrent :
(a) for all a (b) for $a = 4$ only
(c) for $-3 \le a \le 3$ (d) for $a > 0$ only

72. The diagonals of parallelogram whose sides are $lx + my + n = 0$, $lx + my + n' = 0$, $mx + ly + n = 0$ and $mx + ly + n' = 0$ include an angle :
(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$
(c) $\tan^{-1}\frac{1^2 - m^2}{1 + m^2}$ (d) $\tan^{-1}\frac{2lm}{l^2 + m^2}$

73. The equation to the sides of a triangle are $x + 2y = 0$, $4x + 3y = 5$ and $3x + y = 0$, The line $3x - 4y = 0$ passes through :
(a) incentre (b) centroid
(c) circumcentre (d) orthocentre

74. A straight line through $P(1, 2)$ is such that its intercept between the axes is bisected at P. Its equation is :
(a) $x+2y=5$ (b) $x-y+1=0$
(c) $x+y-3=0$ (d) $2x+y-4=0$

75. If 'S' is the circumcentre, 'G' is the centroid, 'O' is the orthocentre of a triangle ABC, then $\vec{SA}+\vec{SB}+\vec{SC}$ is equal to :
(a) $\vec{SG}$ (b) $\vec{OS}$ (c) $\vec{SO}$ (d) $\vec{OG}$

76. If $\vec{a}=4\hat{i}$, then $(\vec{a}\times\hat{j}).(2\hat{j}-3\hat{k})$ is equal to :
(a) 12 (b) 2
(c) 0 (d) -12

77. $\vec{a}\times(\vec{b}+\vec{c})+\vec{b}\times(\vec{c}+\vec{a})+\vec{c}\times(\vec{a}+\vec{b})$ is equal to :
(a) 0 (b) 1 (c) -1 (d) $\frac{1}{2}$

78. A vector of magnitude 9 perpendicular to both the vectors $\vec{a}=4\hat{i}-\hat{j}+3\hat{k}$ and $\vec{b}=-2\hat{i}+\hat{j}-2\hat{k}$, is :
(a) $-3\hat{i}+6\hat{i}+6\hat{k}$ (b) $3\hat{i}-6\hat{j}-6\hat{k}$
(c) $-3\hat{i}-6\hat{j}+6\hat{k}$ (d) none of these

79. If $|\vec{a}|=3$, $|\vec{b}|=4$ and $|\vec{a}-\vec{b}|=5$, then $|\vec{a}+\vec{b}|$ is equal to :
(a) 6 (b) 4 (c) 3 (d) 5

80. The sides of a triangle are in AP. Then the line joining the centroid to the incentre is parallel to :
(a) largest side (b) the smallest side
(c) middle side (d) none of these

81. The median of a triangle ABC is bisected at E. BE meets AC in F. If $AF=\lambda AC$, then λ is :
(a) $\frac{3}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

82. If the vectors $2\hat{i}-3\hat{j}+4\hat{k}$, $\hat{i}+2\hat{j}-\hat{k}$, $x\hat{i}-\hat{j}+2\hat{k}$ are coplanar, then x is equal to :
(a) $\frac{8}{5}$ (b) $\frac{5}{8}$ (c) 0 (d) 1

83. A river is 40 meters wide and the depth is d metres at a distance x metres from a bank is given the following table. Using simpson's rule an estimate of the area of cross section to the river in square metres, is :

x	0	10	20	30	40
d	0	4	16	6	0

(a) 280 (b) 260
(c) 240 (d) 220

84. $\lim\limits_{n\to\infty}\dfrac{1^{99}+2^{99}+\ldots+n^{99}}{n^{100}}$ is equal to :
(a) $\frac{99}{100}$ (b) $\frac{1}{100}$ (b) $\frac{1}{99}$ (d) $\frac{1}{101}$

85. $\int_0^1\sqrt{x(1-x)}\,dx$ is equal to :
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{8}$

86. $I_{(m,n)}=\int_0^1 x^m(\log x)^n\,dx$ is equal to :
(a) $\frac{n}{m+1}I_{(m,n-1)}$ (b) $-\frac{m}{n+1}I_{(m,n-1)}$
(c) $-\frac{n}{m+1}I_{(m,n-1)}$ (d) $\frac{m}{n+1}I_{(m,n-1)}$

87. If $U=\log(ax+x^2)$, then nth derivative of U, *i.e.* U_n is equal to :
(a) $(-1)^{n-1}(n-1)!\left[\frac{1}{x^n}+\frac{1}{(a+x)^n}\right]$
(b) $(-1)^n n!\left[\frac{1}{x^n}+\frac{1}{(a+x)^n}\right]$
(c) $(-1)^{n-1}.n!\left[\frac{1}{x^n}+\frac{1}{(a+x)^n}\right]$
(d) $(-1)^n.(n-1)!\left[\frac{1}{x^n}+\frac{1}{(a+x)^n}\right]$

88. $\int_0^{\pi/2}\dfrac{dx}{1+\tan x}$ is equal to :
(a) 1 (b) $\log 2$
(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

89. If the edges of rectangular parallelopiped be a, b, c, then angle between the four diagonals is :
(a) $\cos^{-1}\left(\dfrac{\pm a^2\pm b^2\pm c^2}{a^2+b^2+c^2}\right)$
(b) $\cos^{-1}\left(\dfrac{a^2+b^2+c^2}{\pm a^2\pm b^2\pm c^2}\right)$
(c) $\cos^{-1}\left(\dfrac{a^2+b^2+c^2}{a^2-b^2-c^2}\right)$
(d) none of these

90. If $u = \tan^{-1}\frac{x^3+y^3}{x-y}$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is equal to :
(a) $\sin 2u$ (b) $\cos 2u$ (c) $\tan 2u$ (d) $\sec 2u$

91. The rectangle of maximum area that can be inscribed in a circle of radius r, the area of rectangle is :
(a) $\frac{\pi r^2}{2}$ sq. units (b) $2r^2$ sq. units
(c) $\frac{\pi r^2}{4}$ sq. units (d) 1 sq. unit

92. The maximum value of $x^3 - 3x$ in the interval $[0, 2]$ is :
(a) 0 (b) -2 (c) 1 (d) 2

93. The function $\frac{\log x}{x}$ is increasing in the interval :
(a) $(1, 2e)$ (b) $(0, e)$ (c) $(e, 2e)$ (d) $\left(\frac{1}{e}, 2e\right)$

94. The angle at which the two curves $x^3 - 3xy^2 = 4$ and $3x^2y - y^3 = 4$ intersect is :
(a) $\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{6}$ (d) 0

95. For the parabola $y^2 = 4ax$ the ratio of subtangent to the abscissa is :
(a) 1 : 1 (b) 2 : 1
(c) $x : y$ (d) $x^2 : y$

96. $\frac{d^{20}}{dx^{20}}(2\cos x \cos 3x)$ is equal to :
(a) $2^{20}(\cos 2x - 2^{20}\cos 4x)$
(b) $2^{20}(\cos 2x + 2^{20}\cos 4x)$
(c) $2^{20}(\sin 2x + 2^{20}\sin 4x)$
(d) $2^{20}(\sin 2x - 2^{20}\sin 4x)$

97. If $x = t^2, y = t^3$, then $\frac{d^2y}{dx^2}$ is equal to :
(a) $\frac{3}{2}$ (b) $\frac{3}{4t}$ (c) $\frac{3}{2t}$ (d) $\frac{3t}{2}$

98. $y = a + bx^2$, where a, b are arbitrary constants, then :
(a) $\frac{d^2y}{dx^2} = 2xy$ (b) $x\frac{d^2y}{dx^2} = \frac{dy}{dx}$
(c) $x\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0$ (d) $x\frac{d^2y}{dx} = 2xy$

99. If $3\sin xy + 4\cos(xy) = 5$, then $\frac{dy}{dx}$ is equal to :
(a) $-\frac{y}{x}$
(b) $\frac{3\sin(xy) + 4\cos(xy)}{3\sin(xy) - 4\cos(xy)}$
(c) $\frac{3\cos xy + 4\sin xy}{3\cos xy - 4\sin xy}$
(d) $\tan(xy)$

100. If $a_1, a_2, a_3, \ldots, a_n$ are in harmonic progression, then $a_1a_2 + a_2a_3 + \ldots + a_{n-1}a_n$ is equal to :
(a) $(n-1)a_1a_n$ (b) na_1a_n
(c) $n(n-1)a_1a_n$ (d) none of these

Answers

Physics

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

Chemistry

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

Mathematics

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

Hints & Solutions

PHYSICS

1. Time period of simple pendulum (in stationary lift)

$$T = 2\pi\sqrt{\frac{l}{g}}$$

In moving lift

$$T' = 2\pi\sqrt{\frac{l}{g'}}$$

$$\therefore \quad \frac{T'}{T} = \sqrt{\frac{g}{g'}}$$

Lift is accelerating upwards with acceleration $g/3$.

$$\therefore \quad g' = g + \frac{g}{3} = \frac{4g}{3}$$

So, $$\frac{T'}{T} = \sqrt{\frac{g}{4g/3}} \Rightarrow \frac{T'}{T} = \sqrt{\frac{3}{4}}$$

$$T' = \frac{\sqrt{3}}{2}T$$

2. Potential energy stored per unit volume

$$U = \frac{1}{2} \times \text{stress} \times \text{strain} = \frac{1}{2} \times Y \times (\text{strain})^2$$

$$\left[\because \text{Young's modulus } Y = \frac{\text{stress}}{\text{strain}}\right]$$

$$U = \frac{1}{2} \times 19 \times 10^{10}\left(\frac{\Delta l}{l}\right)^2$$

$$= \frac{1}{2} \times 19 \times 10^{10}\left(\frac{1 \times 10^{-3}}{5}\right)^2$$

$$= 3.8 \times 10^9 \times 10^{-6}$$

$$= 3.8 \times 10^3 \text{ J/m}^3$$

3. Force constant of spring is inversely proportional to the length of the spring. So force constant of each part will be $2k$.

4. $n = 0.1$, $T = 27°C = 27 + 273 = 300$ K

Work done at constant pressure.

$$W = 2.3026\, nRT \log_{10}\frac{V_2}{V_1}$$

$$= 2.3026 \times 0.1 \times 2 \times 300 \log_{10}\frac{2V}{V}$$

$$= 2.3026 \times 0.1 \times 600 \times \log_{10} 2$$

$$= 2.3026 \times 0.1 \times 600 \times 0.3010 \approx 42 \text{ cal}$$

5. Weight of empty pyknometer = 40 g

Weight of pyknometer with mercury = 1040 g

$\therefore$ Weight of mercury = 1040 – 40 = 1000 g