UPSEE- 2009

Physics

1. If 3.8×10^{-6} is added to 4.2×10^{-5} giving due regard to significant figures, then the result will be
   (a) 4.58×10^{-5}
   (b) 4.6×10^{-5}
   (c) 4.5×10^{-5}
   (d) None of these

2. A ball is dropped from a bridge at a height of 176.4 m over a river. After 2 s, a second ball is thrown straight downwards. What should be the initial velocity of the second ball so that both hit the water simultaneously ?
   (a) 2.45 ms^{-1}
   (b) 49 ms^{-1}
   (c) 14.5 ms^{-1}
   (d) 24.5 ms^{-1}

3. Which of the following are true ?
   (i) A body having constant speed can have varying velocity.
   (ii) Position time graphs for two objects with zero relative velocity are parallel.
   (iii) The numerical ratio of velocity to speed of an object can never be more than one.
   (a) (i)
   (b) (ii) and (iii)
   (c) All
   (d) None of these

4. The centripetal acceleration of a body moving in a circle of radius 100 m with a time period of 2 s will be
   (a) 98.5 ms^{-2}
   (b) 198.5 ms^{-2}
   (c) 49.29 ms^{-2}
   (d) 985.9 ms^{-2}

5. How many NAND gates are used in an OR gate ?
   (a) Four
   (b) Two
   (c) Three
   (d) Five

6. A 5000 kg rocket is set for vertical firing. The exhaust speed is 800 ms^{-1}. To give an initial upward acceleration of 20 ms^{-2}, the amount of gas ejected per second to supply the needed thrust will be $(g = 10 \text{ ms}^{-2})$
   (a) 127.5 kg s^{-1}
   (b) 187.5 kg s^{-1}
   (c) 185.5 kg s^{-1}
   (d) 137.5 kg s^{-1}

7. Induction furnace is based on the heating effect of
   (a) electric field
   (b) eddy current
   (c) magnetic field
   (d) gravitational field

8. A 5.0 µF capacitor is charged to a potential difference of 800 V and discharged through a conductor. The energy given to the conductor during the discharge is
   (a) $1.6 \times 10^{-2} \text{ J}$
   (b) 3.2 J
   (c) 1.6 J
   (d) 4.2 J

9. If the electric field is given by $(5\hat{i} + 4\hat{j} + 9\hat{k})$, the electric flux through a surface of area 20 unit lying in the Y-Z plane will be
   (a) 100 unit
   (b) 80 unit
   (c) 180 unit
   (d) 20 unit

10. An aluminium (Al) rod with area of cross-section $4 \times 10^{-6} \text{ m}^2$ has a current of 5 A flowing through it. Find the drift velocity of electron in the rod. Density of Al $= 2.7 \times 10^3 \text{ kgm}^{-3}$ and atomic wt. $= 27$ u. Assume that each Al atom provides one electron.
   (a) $8.6 \times 10^{-4} \text{ ms}^{-1}$
   (b) $1.3 \times 10^{-4} \text{ ms}^{-1}$
   (c) $2.8 \times 10^{-2} \text{ ms}^{-1}$
   (d) $3.8 \times 10^{-3} \text{ ms}^{-1}$

11. Taking the internal resistance of the battery as negligible, the steady state current in the 2Ω resistor shown in the figure will be
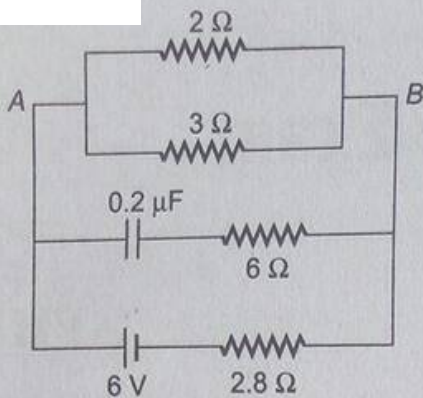
(a) 1.8 A   (b) 2.9 A

(c) 0.9 A   (d) 2.8 A

12. Which statement is true ?
   (i) Kirchhoff's law is equally applicable to both AC and DC.
   (ii) Semiconductors have a positive temperature coefficient of resistance.
   (iii) Meter bridge is greater sensitive when the resistance of all the four arms of the bridge are of the same order.
   (iv) The emf of a cell depends upon the size and area of electordes.

   (a) (i) and (iv)   (b) (ii) and (iv)
   (c) (iii) and (iv)   (d) None of these

13.
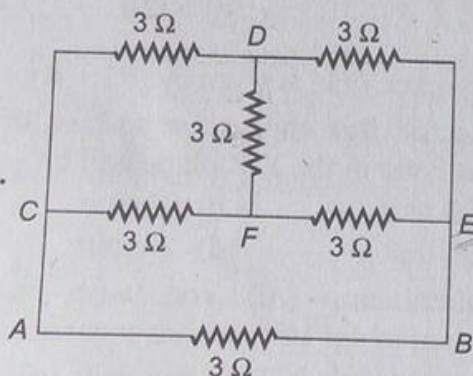
Six resistors, each of value 3Ω are connected as shown in the figure. A cell of emf 3 V is connected across AB. The effective resistance across AB and the current through the arm AB will be

(a) $0.6\,\Omega$, 1 A   (b) $1.5\,\Omega$, 2 A
(c) $0.6\,\Omega$, 2 A   (d) $1.5\,\Omega$, 1 A

14. If t_1 and t_2 are the times taken by two different coils for producing same heat with same supply, then the time taken by them to produce the same heat when connected in parallel will be
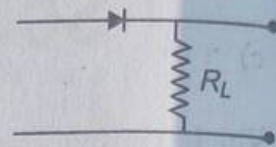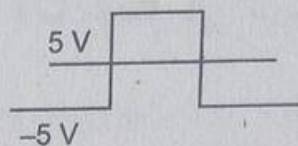
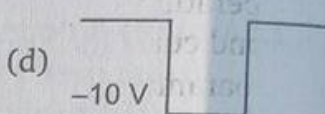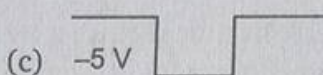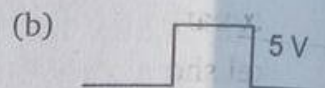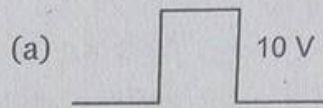(a) $\dfrac{t_1 t_2}{t_1 + t_2}$ (b) $t_1 + t_2$

(c) $t_1 t_2$ (d) $\dfrac{t_1 + t_2}{t_1 t_2}$

15.

In a p-n junction diode, a square input signal of 10 V is applied as shown in figure. The output signal across R_L will be

16. Neutrino emission in β-decay was predicted theoretically by
   (a) Planck   (b) Heisenberg
   (c) Laue   (d) Pauli

17. A telescope consists of two thin lenses of focal lengths 0.3 m and 3 cm respectively. It is focused on moon which subtends on angle of 0.5° at the objective. Then, the angle subtended at the eye by the final image will be
   (a) 5°   (b) 0.25°
   (c) 0.5°   (d) 0.35°

18. A ray of light passes through an equilateral prism such that the angle of incidence is equal to the angle of emergence and the latter is equal to $\dfrac{3}{4}$ the angle of prism. The angle of deviation is
   (a) 25°   (b) 30°   (c) 45°   (d) 35°

19. A parallel monochromatic beam of light is incident normally on a narrow slit. A diffraction pattern is formed on a screen placed perpendicular to the direction of the incident beam. At the first minimum of the diffraction pattern, the phase difference between the rays coming from the two edges of slit is
   (a) zero
   (b) π
   (c) $\dfrac{\pi}{2}$
   (d) 2π

20. A wire of length 2 m carrying a current of 1 A is bent to form a circle, the magnetic moment of the coil is

(a) 2π Am^2
(b) $\dfrac{1}{\pi}$ Am^2

(c) π Am^2
(d) $\dfrac{2}{\pi}$ Am^2

21. Which of the following particles will describe the smallest circle when projected with the same velocity perpendicular to the magnetic field ?

(a) Electron
(b) Proton
(c) α-particle
(d) Deuteron

22. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond curie temperature, then it will show

(a) paramagnetism
(b) diamagnetism
(c) anti-ferromagnetism
(d) no magnetic property

23. A metal disc of radius 100 cm is rotated at a constant angular speed of 60 rads^{-1} in a plane at right angles to an external field of magnetic induction 0.05 Wbm^{-2}. The emf induced between the centre and a point on the rim will be

(a) 3 V
(b) 1.5 V
(c) 6 V
(d) 9 V

24. Which of the following is NOT an illustration of Newton's third law ?

(a) Flight of a jet plane
(b) A cricket player lowering his hands while catching a cricket ball
(c) Walking on floor
(d) Rebounding of a rubber ball

25. Four blocks of same mass connected by cords are pulled by a force F on a smooth horizontal surface, as shown in figure. The tensions T_1, T_2 and T_3 will be

$$F \longleftarrow \boxed{M} \xrightarrow{T_1} \boxed{M} \xrightarrow{T_2} \boxed{M} \xrightarrow{T_3} \boxed{M}$$
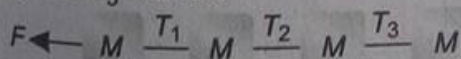
(a) $T_1 = \dfrac{1}{4}F, T_2 = \dfrac{3}{2}F, T_3 = \dfrac{1}{4}F$

(b) $T_1 = \dfrac{1}{4}F, T_2 = \dfrac{1}{2}F, T_3 = \dfrac{1}{2}F$

(c) $T_1 = \dfrac{3}{4}F, T_2 = \dfrac{1}{2}F, T_3 = \dfrac{1}{4}F$

(d) $T_1 = \dfrac{3}{4}F, T_2 = \dfrac{1}{2}F, T_3 = \dfrac{1}{2}F$

26. An artillary piece which consistently shoots its shells with the same muzzle speed has a maximum range R. To hit a target which is $\dfrac{R}{2}$ from the gun and on the same level, the elevation angle of the gun should be

(a) 15°
(b) 45°
(c) 30°
(d) 60°

27. Which of the following statements is wrong ?

(a) KE of a body is independent of the direction of motion
(b) In an elastic collision of two bodies, the momentum and energy of each body is conserved
(c) If two protons are brought towards each other, the PE of the system decreases
(d) A body can not have energy without momentum

28. A car is moving along a circular path of radius 500 m with a speed of 30 ms^{-1}. If at some instant, its speed increases at the rate of 2 ms^{-2}, then at that instant the magnitude of resultant acceleration will be

(a) 4.7 ms^{-2}
(b) 3.8 ms^{-2}
(c) 3 ms^{-2}
(d) 2.7 ms^{-2}

29. A constant power P is applied to a car starting from rest. If v is the velocity of the car at time t, then

(a) $v \propto t$
(b) $v \propto \dfrac{1}{t}$
(c) $v \propto \sqrt{t}$
(d) $v \propto \dfrac{1}{\sqrt{t}}$

30. The effect of rotation of the earth on the value of acceleration due to gravity is

(a) g is maximum at the equator and minimum at the poles
(b) g is minimum at the equator and maximum at the poles
(c) g is maximum at both places
(d) g is minimum at both places

31. A heat engine is a device
    (a) which converts mechanical energy into heat energy
    (b) which converts heat energy into mechanical energy
    (c) absorbs heat from a sink at a lower temperature and rejects to the source at high temperature
    (d) None of the above

32. The ratio of the radii of gyration of a circular disc about a tangential axis in the plane of the disc and of a circular ring of the same radius about a tangential axis in the plane of the ring is
    (a) $\sqrt{3}:\sqrt{5}$
    (b) $\sqrt{12}:\sqrt{3}$
    (c) $1:\sqrt{3}$
    (d) $\sqrt{5}:\sqrt{6}$

33. Two blocks of masses 6 kg and 4 kg are placed on a frictionless surface and connected by a spring. If the heavier mass is given a velocity of 14 ms^{-1} in the direction of lighter one, then the velocity gained by the centre of mass will be
    (a) 7.4 ms^{-1}
    (b) 14 ms^{-1}
    (c) 8.4 ms^{-1}
   (d) 10 ms^{-1}

34. Two identical pendulums are oscillating with amplitudes 4 cm and 8 cm. The ratio of their energies of oscillation will be
    (a) 1/3
    (b) 1/4
    (c) 1/9
    (d) 1/2

35. Fundamental frequency of a sonometer wire is n. If the length and diameter of the wire are doubled keeping the tension same, then the new fundamental frequency is
    (a) $\dfrac{2n}{\sqrt{2}}$
    (b) $\dfrac{n}{2\sqrt{2}}$
    (c) $\sqrt{2}n$
    (d) $\dfrac{n}{4}$

36. Which of the following p-V diagrams best represents an isothermal process ?
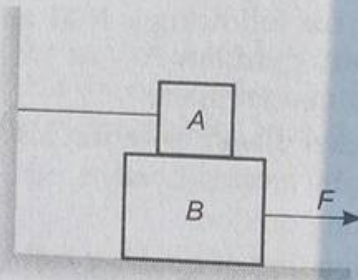   (a)
    (b)
    (c)
    (d)
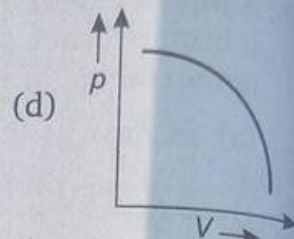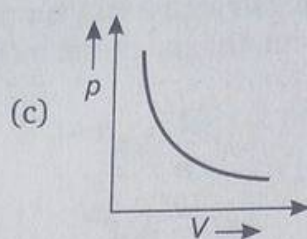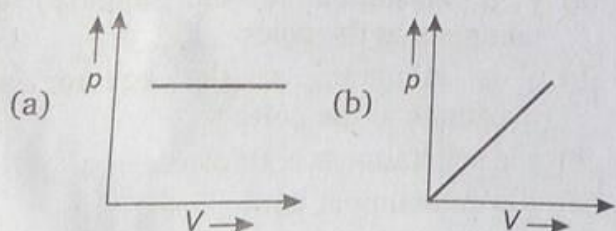
37. A body floats in a liquid contained in a beaker. If the whole system falls under gravity, then the upthrust on the body due to liquid is
    (a) equal to the weight of the body in air
    (b) equal to the weight of the body in liquid
    (c) zero
    (d) equal to the weight of the immersed part of the body

38. A car sounding its horn at 480 Hz moves towards a high wall at a speed of 20 ms^{-1}. If the speed of sound is 340 ms^{-1}, the frequency of the reflected sound heard by the girl sitting in the car will be closest to
    (a) 540 Hz
    (b) 524 Hz
    (c) 568 Hz
    (d) 480 Hz

39. A block A of mass 100 kg rests on another block B of mass 200 kg and is tied to a wall as shown in the figure. The coefficient of friction between A and B is 0.2 and that between B and the ground is 0.3. The minimum force F required to move the block B is ($g = 10$ ms^{-2})
   (a) 900 N
    (b) 200 N
    (c) 1100 N
    (d) 700 N

40. A body takes n times as much time to slide down a 45° rough incline as it takes to slide down a smooth 45° incline. The coefficient of friction is
    (a) $1 - \dfrac{1}{n^2}$
    (b) $\dfrac{1}{1-n^2}$
    (c) $\sqrt{1-\dfrac{1}{n^2}}$
    (d) $\dfrac{1}{\sqrt{1-n^2}}$

41. A force of $(5 + 3x)$ N acting on a body of mass 20 kg along the x-axis displaces it from $x = 2$ m to $x = 6$ m. The work done by the force is
(a) 20 J
(b) 48 J
(c) 68 J
(d) 86 J

42. A rock of mass m is dropped to the ground from a height h. A second rock with mass $2m$ is dropped from the same height. When second rock strikes the ground, what is its kinetic energy ?
(a) Twice that of the first rock
(b) Four times that of the first rock
(c) The same as that of the first rock
(d) Half that of the first rock

43. The escape velocity from the earth is 11 kms^{-1}. The escape velocity from a planet having twice the radius and same mean density as that of earth is
(a) 5.5 kms^{-1}
(b) 11 kms^{-1}
(c) 22 kms^{-1}
(d) None of these

44. If one mole of a monoatomic gas $\left(\gamma = \dfrac{5}{3}\right)$ is mixed with one mole of a diatomic gas $\left(\gamma = \dfrac{7}{5}\right)$, the value of γ for the mixture is
(a) 1.40
(b) 1.50
(c) 1.53
(d) 3.07

45. Two rods of the same length and diameter having thermal conductivities K_1 and K_2 are joined in parallel. The equivalent thermal conductivity of the combination is
(a) $\dfrac{K_1 K_2}{K_1 + K_2}$
(b) $K_1 + K_2$
(c) $\dfrac{K_1 + K_2}{2}$
(d) $\sqrt{K_1 K_2}$

46. A body initially at 80°C cools to 64°C in 5 min and to 52°C in 10 min. The temperature of the surrounding is
(a) 26°C
(b) 16°C
(c) 36°C
(d) 40°C

47. A cylindrical tube open at both ends, has a fundamental frequency f in air. The tube is dipped vertically in water so that half of it is in water. The fundamental frequency of air column is now
(a) $f/2$
(b) f
(c) $3f/4$
(d) $2f$

48. Two plane mirrors are inclined at an angle θ. It is found that a ray incident on one mirror at any angle is rendered parallel to itself after reflection from both the mirrors. The value of θ is
(a) 30°
(b) 60°
(c) 90°
(d) 120°

49. When a ray of light enters a glass slab from air
(a) its wavelength decreases
(b) its wavelength increases
(c) its frequency increases
(d) neither its wavelength nor its frequency changes

50. Critical angle of light passing from glass to water is minimum for
(a) red colour
(b) green colour
(c) yellow colour
(d) violet colour

51. A ray of light falls on a transparent glass slab of refractive index 1.62. If the reflected ray and the refracted ray are mutually perpendicular, the angle of incidence is
(a) $\tan^{-1}(1.62)$
(b) $\tan^{-1}\left(\dfrac{1}{1.62}\right)$
(c) $\tan^{-1}(1.33)$
(d) $\tan^{-1}\left(\dfrac{1}{1.33}\right)$

52. An object A has a charge of $+2\mu C$ and the object B has a charge of $+6\mu C$. Which statements is true ?
(a) $F_{AB} = -3F_{BA}$
(b) $F_{AB} = -F_{BA}$
(c) $3F_{AB} = -F_{BA}$
(d) $F_{AB} = 4F_{BA}$

53. The equivalent capacitance between A and B for the combination of capacitors shown in figure, where all capacitances are in microfarad is
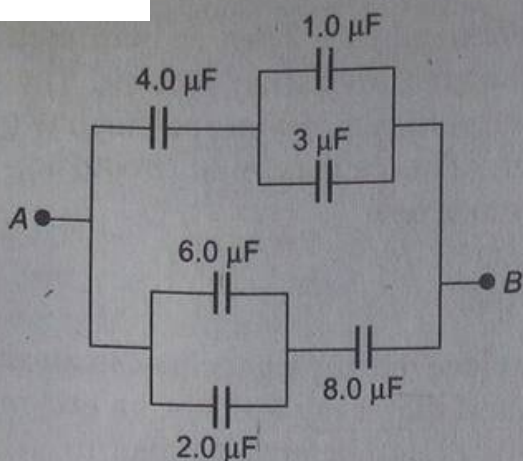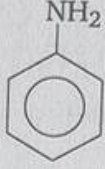
(a) $6.0\ \mu F$
(b) $4.0\ \mu F$
(c) $2.0\ \mu F$
(d) $3.0\ \mu F$

54. Two charged particles are projected into a region in which a magnetic field is perpendicular to their velocities. After they enter the magnetic field, you can conclude that
   (a) the charges are deflected in opposite directions
   (b) the charges continue to move in a straight line
   (c) the charges move in circular paths
   (d) the charges move in circular paths but in opposite directions

55. A solenoid consists of 100 turns of wire and has a length of 10.0 cm. The magnetic field inside the solenoid when it carries a current of 0.500 A will be
   (a) 6.28×10^{-4} T
   (b) 6.28×10^{-5} T
   (c) 3.14×10^{-4} T
   (d) None of these

56. An AC voltage source has an output of $\Delta V = (200\ V)\sin 2\pi ft$. This source is connected to a $100\ \Omega$ resistor. RMS current in the resistance is
   (a) 1.41 A
   (b) 2.41 A
   (c) 3.41 A
   (d) 0.71 A

57. A generator at a utility company produces 100 A of current at 4000 V. The voltage is stepped up to 240000 V by a transformer before it is sent on a high voltage transmission line. The current in transmission line is
   (a) 3.67 A
   (b) 2.67 A
   (c) 1.67 A
   (d) 2.40 A

58. The energy of a photon of wavelength λ is
   (a) $hc\lambda$
   (b) $\dfrac{hc}{\lambda}$
   (c) $\dfrac{\lambda}{hc}$
   (d) $\dfrac{h\lambda}{c}$

59. In the Bohr model of the hydrogen atom, lowest orbit corresponds to
   (a) infinite energy
   (b) maximum energy
   (c) minimum energy
   (d) zero energy

60. Consider α-particles, β-particles and γ-rays each having an energy of 0.5 MeV. increasing order of penetrating powers, the radiations are
   (a) α, β, γ
   (b) α, γ, β
   (c) β, γ, α
   (d) γ, β, α

61. The figure shows the symbol of a

   (a) AND gate
   (b) OR gate
   (c) NOT gate
   (d) NAND gate

62. In β^+ decay process, the following change take place inside the nucleus
   (a) ${}^A_Z X \longrightarrow {}^A_{Z-1}Y + e^+ + \gamma$
   (b) ${}^A_Z X \longrightarrow {}^A_{Z+1}Y + e^- + \bar{\gamma}$
   (c) ${}^A_Z X \longrightarrow {}^A_Z Y + e^- + \gamma$
   (d) ${}^A_Z X \longrightarrow {}^A_Z Y + e^- + \bar{\gamma}$

63. In a transistor the base is
   (a) an insulator
   (b) a conductor of low resistance
   (c) a conductor of high resistance
   (d) an extrinsic semiconductor

64. A particle moves along a straight line such that its position x at any time t is $x = 6t^2 - t$ Where x is in metre and t is in second, then
   (a) at $t = 0$ acceleration is 12 ms^{-2}
   (b) x-t curve has maximum at 4 s
   (c) Both (a) and (b) are wrong
   (d) Both (a) and (b) are correct

65. A particle is subjected simultaneously to two SHM's, one along the x-axis and the other along the y-axis. The two vibrations are in phase and have unequal amplitudes. The particle will execute
(a) straight line motion
(b) circular motion
(c) elliptic motion
(d) parabolic motion

66. X-rays are diffracted from a crystal of lattice plane spacing 2Å. The maximum wavelength that can be diffracted is
(a) 1 Å
(b) 2 Å
(c) 2.5 Å
(d) 4 Å

67. If α and β are the collector emitter short circuit current amplification factor and collector base short circuit current amplification factor respectively of a transistor, then α is equal to
(a) $\dfrac{(1+\beta)}{\beta}$
(b) $\dfrac{\beta}{(1-\beta)}$
(c) $\dfrac{(1-\beta)}{\beta}$
(d) $\dfrac{\beta}{(1+\beta)}$

68. The resistance of a straight conductor does not depend on its
(a) length
(b) temperature
(c) material
(d) shape of cross-section

69. In a given network, each resistance has value of 6 Ω. The point X is connected to point A by a copper wire of negligible resistance and point Y is connected to point B by the same wire. The effective resistance between X and Y will be

(a) 18 Ω
(b) 6 Ω
(c) 3 Ω
(d) 2 Ω

70. A length of wire carries a steady current. It is bent first to form a circular coil of one turn. The same length is now bent more sharply to give a double loop of smaller radius. The magnetic field at the centre caused by the same current is
(a) double of its first value
(b) quarter of its first value
(c) four times of its first value
(d) same as the first value

71. The work done in carrying a charge q once around a circle of radius r with a charge Q placed at the centre will be
(a) $\dfrac{Qq}{(4\pi \, \varepsilon_0 r^2)}$
(b) $\dfrac{Qq}{(4\pi \, \varepsilon_0 r)}$
(c) zero
(d) $\dfrac{Qq^2}{(4\pi \, \varepsilon_0 r)}$

72. Two wires of same material and radius have their lengths in ratio 1 : 2. If these wires are stretched by the same force, the strain produced in the two wires will be in the ratio
(a) 2 : 1
(b) 1 : 1
(c) 1 : 2
(d) 1 : 4

73. A student has measured the length of a wire equal to 0.04580 m. This value of length has the number of significant figures equal to
(a) five
(b) four
(c) six
(d) None of these

74. The volume of an ideal diatomic gas is doubled isothermally. The internal energy
(a) is doubled
(b) is halved
(c) is increases four times
(d) is remains unchanged

75. A small power station supplies electricity to 5000 lamps connected in parallel. Each lamp has a resistance of 220 Ω and is operated at 220 V. The total current supplied by the station is
(a) 2500 A
(b) 3500 A
(c) 5000 A
(d) 10000 A

76. Which of the following sets of quantum numbers is correct ?
    (a) $n = 5, l = 4, m = 0, s = +\dfrac{1}{2}$
    (b) $n = 3, l = 3, m = +3, s = +\dfrac{1}{2}$
    (c) $n = 6, l = 0, m + 1, s = -\dfrac{1}{2}$
    (d) $n = 4, l = 2, m = +2, s = 0$

77. Which of the following is not a colligative property ?
    (a) Optical activity
    (b) Osmotic pressure
    (c) Depression of freezing point
    (d) Elevation of boiling point

78. Which of the following when dissolved in water forms a solution, ie, non-conducting?
    (a) Chile salt petre
    (b) Potash alum
    (c) Green vitriol
    (d) Ethyl alcohol

79. The best way to prevent rusting of iron is
    (a) making it cathode
    (b) putting in saline water
    (c) Both (a) and (b)
    (d) None of the above

80. In NaCl crystal each Cl^- ion is surrounded by
    (a) $4 Na^+$ ions
    (b) $6 Na^+$ ions
    (c) $1 Na^+$ ion
    (d) $2 Na^+$ ions

81. Stainless steel has iron and
    (a) Cr
    (b) Cu
    (c) Co
    (d) Zn

82. Naphthalene can be easily purified by
    (a) sublimation
    (b) crystallisation
    (c) distillation
    (d) vaporisation

83. When acetylene is passed through dil H_2SO_4 in presence of $HgSO_4$, the compound formed is
    (a) ether
    (b) acetaldehyde
    (c) acetic acid
    (d) ketone

84. Cross aldol condensation occurs between
    (a) two same aldehydes
    (b) two same ketones
    (c) two different aldehydes and ketones
    (d) None of the above

85. Which is more powerful to coagulate the negative colloid ?
    (a) $ZnSO_4$
    (b) Na_3PO_4
    (c) $AlCl_3$
    (d) $K_4[Fe(CN)_6]$

86. Cannizaro reaction is performed by
    (a) formaldehyde
    (b) formaldehyde and acetaldehyde
    (c) benzaldehyde
    (d) formaldehyde and benzaldehyde

87. The monosaccharides having anomeric carbon atom are
    (a) geometrical isomers
    (b) α-and β-optical isomers
    (c) having symmetrical carbon atoms
    (d) None of the above

88. Diacidic base is
    (a) $CH_2(OH)_2$
    (b) $Ca(OH)_2$
    (c) $CH_3CH(OH)_2$
    (d) All of these

89. Which of the following behaves as Lewis acid and not as Bronsted acid ?
    (a) HCl
    (b) H_2SO_4
    (c) HSO_3^-
    (d) SO_3

90. Thermite process is used in reduction of
    (a) Cr_2O_3
    (b) Al_2O_3
    (c) PbO_2
    (d) CuO

91. Example of geometrical isomerism is
    (a) 2-butanol
    (b) 2-butene
    (c) butanal
    (d) 2-butyne

92. Mustard gas is a
    (a) oil gas
    (b) poisonous gas
    (c) fuel gas
    (d) life gas

93. The pair of elements having approximately equal ionisation potential is
    (a) Al, Ga
    (b) Al, Si
    (c) Al, Mg
    (d) Al, B

94. Bakelite is a
    (a) natural polymer
    (b) addition polymer
    (c) condensation polymer
    (d) homopolymer

95. Name of method use to separate primary, secondary and tertiary amines is
    (a) Hofmann method
    (b) Lucas method
    (c) Victor Meyer method
    (d) Kolbe method

96. Main product obtained from the reaction of ammonia and formaldehyde is
    (a) formic acid   (b) methylamine
    (c) methanol   (d) urotropine

97. TEL is a compound used as
    (a) antibiotic   (b) antiseptic
    (c) antiknocking   (d) antioxidant

98. Water is well known amphoprotic solvent. In which chemical reaction water is behaving as a base ?
    (a) $H_2SO_4 + H_2O \longrightarrow H_3O^+ + HSO_4^-$
    (b) $H_2O + H_2O \longrightarrow H_3O^+ + OH^-$
    (c) $H_2O + NH_2^- \longrightarrow NH_3 + OH^-$
    (d) $H_2O + NH_3 \longrightarrow NH_4^+ + OH^-$

99. Which of the following is not a physical equilibrium ?
    (a) Ice $\rightleftharpoons$ Water   (b) $I_2(s) \rightleftharpoons I_2(g)$
    (c) $S(l) \rightleftharpoons S(g)$ (d) $3O_2 \rightleftharpoons 2O_3$

100. The polymer which is used in non-sticky kitchenware is
    (a) PVC   (b) teflon
    (c) rayon   (d) isoprene

101. The chemical which is used for plastering the broken bones is
    (a) $(CaSO_4)_2H_2O$ (b) $MgSO_4 \cdot 7H_2O$
    (c) $FeSO_4 \cdot 7H_2O$ (d) $CuSO_4 \cdot 5H_2O$

102. Dry ice is
    (a) solid H_2O (b) solid CO_2
    (c) solid N_2O_4 (d) solid NH_3

103. Precipitate of AgCl is soluble in liquid NH_3, the compound forms
    (a) $Ag(NH_4)_2OH$ (b) $Ag(NH_4)_2Cl$
    (c) $Ag(NH_3)_2OH$ (d) $Ag(NH_3)_2Cl$

104. In qualitative analysis, in III group NH_4Cl is added before NH_4OH because
    (a) to increase the concentration of NH_4^+ ions
    (b) to increase the concentration of Cl^- ions
    (c) to reduce the concentration of OH^- ions
    (d) to increase the concentration of OH^- ions

105. Solution of sodium thiosulphate in photography works as
    (a) to shine film
    (b) to develop film
    (c) to dissolve silver bromide
    (d) to change negative into positive

106. Phenol on treatment with diethyl sulphate in presence of NaOH gives
    (a) phenetole   (b) anisole
    (c) diphenyl ether   (d) diethyl ether

107. 2.5 L of NaCl solution contain 5 moles of the solute. What is the molarity ?
    (a) 5 M   (b) 2 M
    (c) 2.5 M   (d) 12.5 M

108. The most abundant element in the universe is thought to be
    (a) carbon   (b) oxygen
    (c) hydrogen   (d) nitrogen

109. Electromeric effect is
    (a) permanent effect
    (b) temporary effect
    (c) resonance effect
    (d) inductive effect

110. The calculated bond order in O_2^- ion is
    (a) 1   (b) 1.5
    (c) 2   (d) 2.5

111. The entropy of a perfectly crystalline material is zero at 0°C. This is statement of
    (a) first law of thermodynamics
    (b) second law of thermodynamics
    (c) third law of thermodynamics
    (d) law of conservation of energy

112. In acidic medium, the equivalent weight of $K_2Cr_2O_7$ (Mol. wt. $= M$) is
    (a) M (b) $\dfrac{M}{2}$
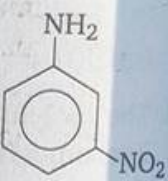   (c) $\dfrac{M}{3}$ (d) $\dfrac{M}{6}$

113. When a metal atom combines with a non-metal atom, the non-metal atom will
(a) lose electrons and decrease in size
(b) lose electrons and increase in size
(c) gain electrons and decrease in size
(d) gain electrons and increase in size

114. What is the total number of moles of H_2SO_4 needed to prepare 5.0 L of a 2.0 M solution of H_2SO_4 ?
(a) 2.5
(b) 5.0
(c) 10
(d) 20

115. Which combination of atoms can form a polar covalent bond ?
(a) H and H
(b) H and Br
(c) N and N
(d) Na and Br

116. How many joules of heat are absorbed when 70.0 g of water is completely vaporised at its boiling point ?
(a) 23,352
(b) 7,000
(c) 15,813
(d) 158,130

117. Which quantities are conserved in all oxidation- reduction reactions?
(a) Charge only
(b) Mass only
(c) Both charge and mass
(d) Neither charge nor mass

118. Which of the following compounds would have the highest boiling point ?
(a) $CH_3CH_2CH_2CH_3$
(b) CH_3NH_2
(c) CH_3OH
(d) CH_2F_2

119. In any chemical reaction, a quantity that decrease to a minimum is
(a) free energy
(b) entropy
(c) temperature
(d) enthalpy

120. Which of the following is the weakest acid?
(a) HCl
(b) HF
(c) H_2SO_4
(d) HNO_3

121. Which of the following contains greatest number of oxygen atoms ?
(a) 1 g of O
(b) 1 g of O_2
(c) 1 g of O_3
(d) All have the same number of atoms

122. The pH of 10^{-8} M NaOH aqueous solution at 25°C, is
(a) 7.02
(b) 7.0
(c) 6.89
(d) 6.0

123. Decrease in atomic number is not observed during
(a) α-emission
(b) β-emission
(c) positron emission
(d) electron capture

124. The buffering action of an acidic buffer is maximum when its pH is equal to
(a) 5
(b) 7
(c) 1
(d) pK_a

125. Which of the following will increase with the increase in temperature ?
(a) Surface tension
(b) Viscosity
(c) Molality
(d) Vapour pressure

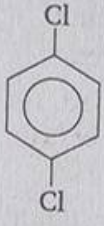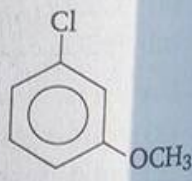126. Which of the following will have larger dipole moment ?

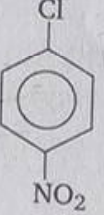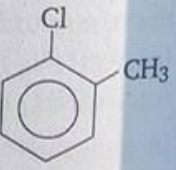127. Which of the following would react most readily with nucleophiles ?

128. Hydrogen transfer takes place in
(a) Frankland method
(b) Wurtz reaction
(c) Cannizaro's reaction
(d) Wolff-Kishner reduction

129. An organic compound C_3H_6O neither gives precipitate with semicarbazide nor reacts with sodium. It could be
(a) CH_3CH_2CHO
(b) CH_3COCH_3
(c) $CH_2=CHCH_2OH$
(d) $CH_2=CHOCH_3$

130. Which of the following is an organometallic compound ?
(a) Lithium methoxide
(b) Lithium acetate
(c) Lithium dimethylamine
(d) Methyl lithium

131. The quality of diesel is expressed by
(a) octane number
(b) cetane number
(c) antiknock compound
(d) presence of additives

132. Ketone upon treatment with Grignard reagent gives
(a) primary alcohol
(b) secondary alcohol
(c) tertiary alcohol
(d) aldehyde

133. Racemic compound has
(a) equimolar mixture of enantiomers
(b) 1 : 1 mixture of enantiomer and diastereomer
(c) 1 : 1 mixture of diastereomers
(d) 1 : 2 mixture of enantiomers

134. Geometry of methyl free radical is
(a) pyramidal
(b) planar
(c) tetrahedral
(d) linear

135. The reaction of sodium ethoxide with iodoethane to form diethyl ether is termed as
(a) electrophilic substitution
(b) nucleophilic substitution
(c) electrophilic addition
(d) radical substitution

136. In which of the following ways does the hydride ion tend to function ?
(a) An electrophile
(b) A nucleophile
(c) A free radical
(d) An acid

137. The following compound differ in
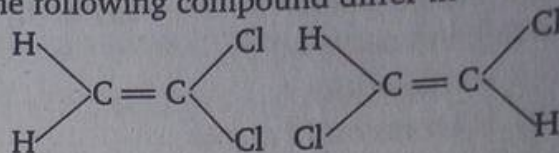
(a) configuration
(b) conformation
(c) structure
(d) chirality

138. The correct name for the following hydrocarbon is
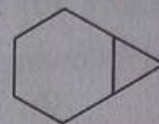
(a) tricyclo [4.1.0] heptane
(b) bicyclo [5.2.1] heptane
(c) bicyclo [4.1.0] heptane
(d) bicyclo [4.1.0] hexane

139. Which of the following compounds would be the main product of an aldol condensation of acetaldehyde and acetone ?
(a) $CH_3CH=CH \cdot CHO$
(b) $CH_3CH=CHCOCH_3$
(c) $(CH_3)_2C=CH \cdot CHO$
(d) $(CH_3)_2C=CHCOCH_3$

140. Which one of the following compounds will not react with CH_3MgBr ?
(a) Ethyl acetate
(b) Acetone
(c) Dimethyl ether
(d) Ethanol

141. The number of isomeric alkanes having the molecular formula C_5H_{12} is
(a) three
(b) five
(c) nine
(d) thirty two

142. Which organic compound is an electrolyte ?
(a) CH_3Cl
(b) $HCOOH$
(c) CH_3OH
(d) $C_6H_{12}O_6$

143. The electron configuration of the oxide ion is much most similar to the electron configuration of the
(a) sulphide ion
(b) nitride ion
(c) oxygen atom
(d) nitrogen atom

144. Which substance has the greatest ionic character ?
(a) Cl_2O
(b) NCl_3
(c) $PbCl_2$
(d) $BaCl_2$

145. The lattice points of a crystal of hydrogen iodide are occupied by
    (a) HI molecules
    (b) H atoms and I atoms
    (c) H^+ cations and I^- anions
    (d) H_2 molecules and I_2 molecules

146. Dehydration of alcohol usually goes by
    (a) E1 mechanism
    (b) E2 mechanism
    (c) E1 cb mechanism
    (d) $S_N 2$ mechanism

147. Which one of the following is a copolymer ?
    (a) Saran
    (b) Orlon
    (c) PVC
    (d) Teflon

148. Formation of coloured ions by transition metals signifies;
    (a) absorption of light from UV range
    (b) emission of light
    (c) presence of unpaired electrons in s and p orbitals
    (d) complimentary colours to the absorbed light

149. Transition metal ions show colour because
    (a) they absorb light
    (b) they emit light
    (c) they are paramagnetic
    (d) they exhibit d-d transition

150. Which one of the following compounds will not undergo aldol condensation ?
    (a) Acetaldehyde
    (b) Formaldehyde
    (c) Propionaldehyde
    (d) Acetone

10

» MATHEMATICS

1. The length of the normal to the curve $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$ at $\theta = \dfrac{\pi}{2}$ is
    (a) $2a$
    (b) $\dfrac{a}{2}$
    (c) $\dfrac{a}{\sqrt{2}}$
    (d) $\sqrt{2}\,a$

2. The maximum value of $\dfrac{\log x}{x}$ is
    (a) e
    (b) $2e$
    (c) $\dfrac{1}{e}$
    (d) $\dfrac{2}{e}$

3. In the interval $\left[-\dfrac{\pi}{4}, \dfrac{\pi}{4}\right]$, the number of real solutions of the equations
$$\begin{vmatrix} \sin x & \cos x & \cos x \\ \cos x & \sin x & \cos x \\ \cos x & \cos x & \sin x \end{vmatrix} = 0 \text{ is}$$
    (a) 0
    (b) 2
    (c) 1
    (d) 3

4. If $f(x) = \begin{cases} x\sin\dfrac{1}{x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k will be
    (a) 1
    (b) -1
    (c) 0
    (d) None of these

5. The sum of all odd numbers between 1 and 1000 which are divisible by 3 is
    (a) 83667
    (b) 90000
    (c) 83660
    (d) None of these

6. In a college 25% boys and 10% girls offer Mathematics. There are 60% girls in the college. If a Mathematics student is chosen at random, then the probability that the student is a girl, will be
    (a) $\dfrac{1}{6}$
    (b) $\dfrac{3}{8}$
    (c) $\dfrac{5}{8}$
    (d) $\dfrac{5}{6}$

7. Differential equation of those circles which passes through origin and their centres lie on y-axis will be
    (a) $(x^2 - y^2)\dfrac{dy}{dx} + 2xy = 0$
    (b) $(x^2 - y^2)\dfrac{dy}{dx} = 2xy$
    (c) $(x^2 - y^2)\dfrac{dy}{dx} = xy$
    (d) $(x^2 - y^2)\dfrac{dy}{dx} + xy = 0$

11.

12.

13.

14.

8. If $\tan\alpha - k\cot\beta$, then $\dfrac{\cos(\alpha-\beta)}{\cos(\alpha+\beta)}$ is equal to

(a) $\dfrac{1+k}{1-k}$

(b) $\dfrac{1-k}{1+k}$

(c) $\dfrac{k+1}{k-1}$

(d) $\dfrac{k-1}{k+1}$

9. If $\cot(\cos^{-1}x) = \sec\left(\tan^{-1}\dfrac{a}{\sqrt{b^2-a^2}}\right)$, then x is equal to

(a) $\dfrac{b}{\sqrt{2b^2-a^2}}$

(b) $\dfrac{a}{\sqrt{2b^2-a^2}}$

(c) $\dfrac{\sqrt{2b^2-a^2}}{a}$

(d) $\dfrac{\sqrt{2b^2-a^2}}{b}$

10. If distance between directrices of a rectangular hyperbola is 10, then distance between its foci will be

(a) $10\sqrt{2}$

(b) 5

(c) $5\sqrt{2}$

(d) 20

11. Number of solutions of the equation

$\tan^{-1}\left(\dfrac{1}{2x+1}\right) + \tan^{-1}\left(\dfrac{1}{4x+1}\right) = \tan^{-1}\left(\dfrac{2}{x^2}\right)$ is

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

12. $\displaystyle\int_0^\pi x\sin^4 x\, dx$ is equal to

(a) $\dfrac{3\pi}{16}$

(b) $\dfrac{3\pi^2}{16}$

(c) $\dfrac{16\pi}{3}$

(d) $\dfrac{16\pi^2}{3}$

13. $\displaystyle\int 5^{5^{5^x}}\, 5^{5^x}\, 5^x\, dx$ is equal to

(a) $5^{5^{5^x}}(\log 5)^3 + c$ (b) $\dfrac{5^{5^{5^x}}}{(\log 5)^3} + c$

(c) $\dfrac{5^{5^x}}{(\log 5)^3} + c$

(d) $5^{5^x}(\log 5)^3 + c$

14. If $f(x) = \sin^2 x + \sin^2\left(x + \dfrac{\pi}{3}\right)$
$+ \cos x\cos\left(x + \dfrac{\pi}{3}\right)$
and $g\left(\dfrac{5}{4}\right) = 1$, then $gof(x)$ is equal to

(a) 1   (b) –1   (c) 2   (d) –2

15. $\vec{A}, \vec{B}, \vec{C}$ are three non-zero vectors; no two of them are parallel. If $\vec{A}+\vec{B}$ is collinear to $\vec{C}$ and $\vec{B}+\vec{C}$ is collinear to $\vec{A}$, then $\vec{A}+\vec{B}+\vec{C}$ is equal to

(a) $\vec{A}$

(b) $\vec{B}$

(c) $\vec{C}$

(d) $\vec{0}$

16. In tossing of a coin $(m+n)(m>n)$ times, the probability of coming consecutive heads at least m times is

(a) $\dfrac{n+2}{2^{m+1}}$

(b) $\dfrac{m-n}{2^{m+n}}$

(c) $\dfrac{m+n}{2^{m+n}}$

(d) $\dfrac{mn}{2^{m+n}}$

17. If $f(x) = \dfrac{4^x}{4^x + 2}$, then

$f\left(\dfrac{1}{97}\right) + f\left(\dfrac{2}{97}\right) + \ldots + f\left(\dfrac{96}{97}\right)$ is equal to

(a) 1

(b) 48

(c) – 48

(d) –1

18. Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that $\vec{a}\cdot\vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a}\times\vec{b}$ and $\vec{c}$ is 30°, then $|(\vec{a}\times\vec{b})\times\vec{c}|$ is equal to

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

(b) $\dfrac{3}{2}$

(c) 2

(d) 3

19. The value of $\displaystyle\int_2^4\{|x-2|+|x-3|\}\, dx$ is

(a) 1 sq unit

(b) 2 sq unit

(c) 3 sq unit

(d) 5 sq unit

20. The differential equation of all circles touching the axis of y at origin and centre on the x-axis is given by

(a) $xy\dfrac{dy}{dx} - x^2 + y^2 = 0$

(b) $2xy\dfrac{dy}{dx} - x^2 - y^2 = 0$

(c) $(x^2 + y^2)\dfrac{dy}{dx} - 2xy = 0$

(d) None of the above

21. The solution of the differential equation $\left(e^{-2\sqrt{x}} - \dfrac{y}{\sqrt{x}}\right)\dfrac{dx}{dy} = 1$ is given by

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

  (c) $y = \sqrt{x}$ (d) $y = 3\sqrt{x}$

22. The solution of the equation $\dfrac{dy}{dx} = \sqrt{\dfrac{1 - y^2}{1 - x^2}}$ is

  (a) $\sin^{-1} y - \sin^{-1} x = c$

  (b) $\sin^{-1} y + \sin^{-1} x = c$

  (c) $\sin^{-1}(xy) = 2$

  (d) None of the above

23. If $f(x) = \begin{cases} x^p \cos\left(\dfrac{1}{x}\right), & x \neq 0 \\ 0, & x = 0 \end{cases}$ is differentiable at $x = 0$, then

  (a) $p < 0$ (b) $0 < p < 1$

  (c) $p = 1$ (d) $p > 1$

24. If a real valued function f of a real variable x is such that

$$\dfrac{1}{(1 + x)(1 + x^2)} = \dfrac{A}{1 + x} + \dfrac{f(x)}{1 + x^2},$$ then $f(x)$ is equal to

  (a) $\dfrac{1 - x}{2}$ (b) $\dfrac{x^2 + 1}{2}$

  (c) $1 - x$ (d) None of these

25. If the vectors $\hat{i} - 2\hat{j} + 3\hat{k}$, $-2\hat{i} + 3\hat{j} - 4\hat{k}$, $\lambda\hat{i} - \hat{j} + 2\hat{k}$ are linearly dependent, then the value of λ is equal to

  (a) 0   (b) 1

  (c) 2   (d) 3

26. If $\vec{a}$ and $\vec{b}$ are two non-zero non-collinear vectors, then

$2[\vec{a}\ \vec{b}\ \hat{i}]\hat{i} + 2[\vec{a}\ \vec{b}\ \hat{j}]\hat{j} + 2[\vec{a}\ \vec{b}\ \hat{k}]\hat{k} + [\vec{a}\ \vec{b}\ \vec{a}]$ is equal to

  (a) $2(\vec{a} \times \vec{b})$ (b) $\vec{a} \times \vec{b}$

  (c) $\vec{a} + \vec{b}$ (d) None of these

27. If $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2 = 676$ and $|\vec{b}| = 2$, then $|\vec{a}|$ is equal to

  (a) 13   (b) 26

  (c) 39   (d) None of these

28. If a, b, c are in GP, then the equation $ax^2 + 2bx + c = 0$ and $dx^2 + 2ex + f = 0$ have a common root, if $\dfrac{d}{a}, \dfrac{e}{b}, \dfrac{f}{c}$ are in

  (a) AP   (b) HP

  (c) GP   (d) None of these

29. If $x = \sqrt{7} - \sqrt{5}$ and $y = \sqrt{13} - \sqrt{11}$, then

  (a) $x > y$ (b) $x < y$

  (c) $x = y$ (d) None of these

30. If one root of equation $x^2 + ax + 12 = 0$ is 4 while the equation $x^2 + ax + b = 0$ has equal roots, then the value of b is

  (a) $\dfrac{4}{49}$ (b) $\dfrac{49}{4}$

  (c) $\dfrac{7}{4}$ (d) $\dfrac{4}{7}$

31. One of the square roots of $6 + 4\sqrt{3}$ is

  (a) $\sqrt{3}(\sqrt{3} + 1)$ (b) $-\sqrt{3}(\sqrt{3} - 1)$

  (c) $\sqrt{3}(-\sqrt{3} + 1)$ (d) None of these

32. If $\cos 20° - \sin 20° = p$, then $\cos 40°$ is equal to

  (a) $p^2\sqrt{2 - p^2}$ (b) $p\sqrt{2 - p^2}$

  (c) $p + \sqrt{2 - p^2}$ (d) $p - \sqrt{2 - p^2}$

33. If $\tan x = \dfrac{b}{a}$, then the value of $a \cos 2x + b \sin 2x$ is

  (a) 1   (b) ab

  (c) b (d) a

34. If $S_n = \cos^n \theta + \sin^n \theta$, then the value of $3S_4 - 2S_6$ is given by

  (a) 4   (b) 0

  (c) 1   (d) 7

35. The distance between the parallel lines $9x^2 - 6xy + y^2 + 18x - 6y + 8 = 0$ is

(a) $\dfrac{-}{\sqrt{10}}$

(b) $\dfrac{1}{\sqrt{10}}$

(c) $\dfrac{4}{\sqrt{10}}$

(d) None of these

36. The lines $2x - 3y = 5$ and $3x - 4y = 7$ are diameters of a circle of area 154 sq unit. Then, the equation of the circle is

(a) $x^2 + y^2 + 2x - 2y = 51$

(b) $x^2 + y^2 - 2x - 2y = 49$

(c) $x^2 + y^2 + 2x + 2y = 47$

(d) $x^2 + y^2 - 2x + 2y = 47$

37. Two dice are thrown n times in succession. The probability of obtaining a double six at least once is

(a) $\left(\dfrac{1}{36}\right)^n$

(b) $1 - \left(\dfrac{35}{36}\right)^n$

(c) $\left(\dfrac{1}{12}\right)^n$

(d) None of these

38. A and B toss a coin alternately on the understanding that the first to obtain heads wins the toss. The probability that A wins the toss

(a) $\dfrac{1}{3}$

(b) $\dfrac{2}{3}$

(c) $\dfrac{1}{4}$

(d) $\dfrac{3}{4}$

39. In an assembly of 4 persons the probability that at least 2 of them have the same birthday, is

(a) 0.293

(b) 0.24

(c) 0.0001

(d) 0.016

40. A particle is thrown with the velocity v with the angle α from the horizontal plane and its range on the horizontal plane is twice to the maximum height gained. Then, $\tan \alpha$ is equal to

(a) 9

(b) 5

(c) 2

(d) 1

41. If $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$ and x, y, z are all distinct, then xyz is equal to

(a) -1

(b) 1

(c) 0

(d) 3

42. If $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then A^{100} is equal to

(a) $100\,A$

(b) $2^{99}\,A$

(c) $2^{100}\,A$

(d) $99\,A$

43. If sum of n terms of two AP's are in the ratio $2n + 3 : 6n + 5$, then the ratio of their 13th term is

(a) $\dfrac{29}{83}$

(b) $\dfrac{27}{77}$

(c) $\dfrac{31}{89}$

(d) $\dfrac{53}{155}$

44. Let a relation R be defined on set of all real numbers by $a\,R\,b$ if and only if $1 + ab > 0$. Then, R is

(a) reflexive, transitive but not symmetric

(b) reflexive, symmetric but not transitive

(c) symmetric, transitive but not reflexive

(d) an equivalence relation

45. If $\dfrac{xy}{x+y} = \dfrac{2}{3}$, $\dfrac{yz}{y+z} = \dfrac{6}{5}$, $\dfrac{xz}{x+z} = \dfrac{3}{4}$, then (x, y, z) is equal to

(a) $(1, 2, 3)$

(b) $(2, 1, 3)$

(c) $(3, 1, 2)$

(d) $(3, 2, 1)$

46. If positive numbers a, b, c are in HP and $c > a$, then $\log (a + c) + \log (a - 2b + c)$ is equal to

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

(b) $2 \log (a + c)$

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

(d) $2 \log (a - c)$

47. Two dice are thrown together. Then the probability that the sum of numbers appearing on them is a prime number, is

(a) $\dfrac{5}{12}$

(b) $\dfrac{7}{18}$

(c) $\dfrac{13}{36}$

(d) $\dfrac{11}{36}$

48. In a triangle ABC, $AB = 1$, $AC = 2$ and $\angle A = 60°$, its largest angle is equal to

(a) 75°

(b) 90°

(c) 120°

(d) 135°

49. From the top of a cliff 50 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 45°. The height of tower is
(a) 50 m
(b) $50\sqrt{3}$ m
(c) $50(\sqrt{3}-1)$ m
(d) $50\left(1-\dfrac{\sqrt{3}}{3}\right)$ m

50. The points 0, $2+3i$, i, $-2-2i$ in the argand plane are the vertices of a
(a) rectangle
(b) rhombus
(c) trapezium
(d) parallelogram

51. One of the values of $\left(\dfrac{1+i}{\sqrt{2}}\right)^{2/3}$ is
(a) $\sqrt{3}+i$
(b) $-i$
(c) i
(d) $-\sqrt{3}+i$

52. The value of $\tan^{-1}\dfrac{1}{2}+\tan^{-1}\dfrac{1}{3}+\tan^{-1}\dfrac{7}{8}$ is
(a) $\tan^{-1}\dfrac{7}{8}$
(b) $\cot^{-1}15$
(c) $\tan^{-1}15$
(d) $\tan^{-1}\dfrac{25}{24}$

53. The locus of points of intersection of perpendicular tangents to a parabola is a
(a) straight line
(b) circle
(c) parabola
(d) hyperbola

54. The middle point of the chord $x+3y=2$ of the conic $x^2+xy-y^2=1$ is
(a) $(5,-1)$
(b) $(1,1)$
(c) $(2,0)$
(d) $(-1,1)$

55. If tangents at extremities of a focal chord AB of the parabola $y^2=4ax$ intersect at a point C, then $\angle ACB$ is equal to
(a) $\dfrac{\pi}{4}$
(b) $\dfrac{\pi}{3}$
(c) $\dfrac{\pi}{2}$
(d) $\dfrac{\pi}{6}$

56. The smallest circle with centre on y-axis and passing through the point $(7,3)$ has radius
(a) $\sqrt{58}$
(b) 7
(c) 3
(d) 4

57. The pair of lines joining origin to the points of intersection of the two curves
$$ax^2+2hxy+by^2+2gx=0$$
and $a'x^2+2h'xy+b'y^2+2g'x=0$
will be at right angles, if
(a) $(a'+b')g'=(a+b)g$
(b) $(a+b)g'=(a'+b')g$
(c) $h^2-ab=h'^2-a'b'$
(d) $a+b+h^2=a'+b'+h'^2$

58. If sum of two numbers is 6, the minimum value of the sum of their reciprocals is
(a) $\dfrac{6}{5}$
(b) $\dfrac{3}{4}$
(c) $\dfrac{2}{3}$
(d) $\dfrac{1}{2}$

59. If $b>a$, then $\displaystyle\int_a^b \dfrac{dx}{\sqrt{(x-a)(b-x)}}$ is equal to
(a) $\dfrac{\pi}{2}$
(b) π
(c) $\dfrac{\pi}{2}(b-a)$
(d) $\dfrac{\pi}{4}(b-a)$

60. The solution of differential equation $(1+x)y\,dx+(1-y)x\,dy=0$ is
(a) $\log_e(xy)+x-y=c$
(b) $\log_e\left(\dfrac{x}{y}\right)+x+y=c$
(c) $\log_e\left(\dfrac{x}{y}\right)-x+y=c$
(d) $\log_e(xy)-x+y=c$

61. The value of $\displaystyle\lim_{x\to 0}(\cos x)^{\cot^2 x}$ is
(a) e^{-1}
(b) $e^{-1/2}$
(c) 1
(d) not existing

62. The normal to the curve $x=a(\cos\theta+\theta\sin\theta)$, $y=a(\sin\theta-\theta\cos\theta)$ at any point θ is such that
(a) it makes a constant angle with x-axis
(b) it passes through origin
(c) it is at a constant distance from origin
(d) None of the above

63. If $\sin y = x \sin(a+y)$, then $\dfrac{dy}{dx}$ is equal to

(a) $\dfrac{\sin(a+y)}{\sin a}$

(b) $\dfrac{\sin^2(a+y)}{\sin a}$

(c) $\dfrac{2\sin(a+y)}{\sin a}$

(d) $\dfrac{\sin^2(a+y)}{\sin y}$

64. $\displaystyle\int e^x \dfrac{x^2+1}{(x+1)^2}\,dx$ is equal to

(a) $\dfrac{-e^x}{x+1}+c$

(b) $\dfrac{e^x}{x+1}+c$

(c) $e^x\dfrac{x-1}{x+1}+c$

(d) $\dfrac{xe^x}{x+1}+c$

65. The function $f(x) = \log(1+x) - \dfrac{2x}{2+x}$ is increasing on

(a) $(-1, \infty)$

(b) $(-\infty, 0)$

(c) $(-\infty, \infty)$

(d) None of these

66. If $\vec{a}$ is any vector, then $\hat{i}\times(\vec{a}\times\hat{i})+\hat{j}\times(\vec{a}\times\hat{j})+\hat{k}\times(\vec{a}\times\hat{k})$ is equal to

(a) $\vec{a}$

(b) $2\vec{a}$

(c) $3\vec{a}$

(d) $\vec{0}$

67. The product of two times of flight from a point P to another point Q with a given velocity of projection is

(a) $\dfrac{PQ}{g}$

(b) $\dfrac{2PQ}{g}$

(c) $\dfrac{PQ}{2g}$

(d) $\dfrac{3PQ}{g}$

68. A stone of mass m is thrown vertically upwards with a velocity of $9.8\ ms^{-1}$. The height of the point where $KE = PE$ is $(g = 9.8\ ms^{-2})$

(a) 9.8 m

(b) 4.9 m

(c) 2.45 m

(d) 2 m

69. Three sides of a square are formed by bending a rod of length 36 cm. The distance of its CG from an open end is

(a) 12 cm

(b) $6\sqrt{2}$ cm

(c) $8\sqrt{2}$ cm

(d) 10 cm

70. If the resultant of two forces of magnitude P and $P\sqrt{3}$ acting on a particle is of magnitude P, then the angle between them is

(a) $60°$

(b) $120°$

(c) $90°$

(d) $150°$

71. A particle is dropped from a height 12 g metre and 4 s after another particle is projected from the ground towards it with a velocity $4\ g\ ms^{-1}$. The time after which the second particle meets first is

(a) 4 s

(b) 2 s

(c) $\dfrac{1}{2}$ s

(d) 1 s

72. A uniform ladder rests in limiting equilibrium with its lower end on a rough horizontal plane with coefficient of friction μ and its upper end against a smooth vertical wall. If θ is the inclination of the ladder with the wall, then θ is equal to

(a) $\tan^{-1}\mu$

(b) $\cot^{-1}\mu$

(c) $\cot^{-1}(2\mu)$

(d) $\tan^{-1}(2\mu)$

73. If $\dfrac{2z_1}{3z_2}$ is a purely imaginary number, then $\left|\dfrac{z_1-z_2}{z_1+z_2}\right|$ is equal to

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

(b) 1

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

(d) $\dfrac{4}{9}$

74. An orthogonal matrix is

(a) $\begin{bmatrix} \cos\alpha & 2\sin\alpha \\ -2\sin\alpha & \cos\alpha \end{bmatrix}$

(b) $\begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$

(c) $\begin{bmatrix} \cos\alpha & \sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

75. If $y = 3x + 6x^2 + 10x^3 + \dots$, then the value of x in terms of y is

(a) $1-(1-y)^{-1/3}$

(b) $1-(1+y)^{1/3}$

(c) $1+(1+y)^{-1/3}$

(d) $1-(1+y)^{-1/3}$

Answers

PHYSICS

1. (b)	2. (d)	3. (c)	4. (a)	5. (c)	6. (b)	7. (b)	8. (c)	9. (a)	10. (b)
11. (c)	12. (a)	13. (d)	14. (a)	15. (b)	16. (d)	17. (a)	18. (b)	19. (d)	20. (b)
21. (a)	22. (a)	23. (b)	24. (b)	25. (c)	26. (a)	27. (d)	28. (d)	29. (c)	30. (a)
31. (b)	32. (d)	33. (c)	34. (b)	35. (d)	36. (c)	37. (a)	38. (a)	39. (c)	40. (a)
41. (c)	42. (a)	43. (c)	44. (b)	45. (c)	46. (b)	47. (b)	48. (c)	49. (a)	50. (d)
51. (a)	52. (b)	53. (a)	54. (c)	55. (a)	56. (a)	57. (c)	58. (b)	59. (c)	60. (a)
61. (d)	62. (a)	63. (b)	64. (d)	65. (a)	66. (d)	67. (d)	68. (d)	69. (d)	70. (a)
71. (c)	72. (c)	73. (a)	74. (d)	75. (c)					

CHEMISTRY

76. (a)	77. (a)	78. (d)	79. (a)	80. (b)	81. (a)	82. (a)	83. (b)	84. (c)	85. (c)
86. (d)	87. (b)	88. (b)	89. (d)	90. (a)	91. (b)	92. (b)	93. (a)	94. (c)	95. (a)
96. (d)	97. (c)	98. (a)	99. (d)	100. (b)	101. (a)	102. (b)	103. (d)	104. (c)	105. (c)
106. (a)	107. (b)	108. (c)	109. (b)	110. (b)	111. (c)	112. (d)	113. (d)	114. (c)	115. (b)
116. (d)	117. (c)	118. (c)	119. (a)	120. (b)	121. (d)	122. (a)	123. (b)	124. (d)	125. (d)
126. (d)	127. (c)	128. (c)	129. (d)	130. (d)	131. (b)	132. (c)	133. (a)	134. (b)	135. (b)
136. (b)	137. (c)	138. (c)	139. (b)	140. (c)	141. (a)	142. (b)	143. (b)	144. (d)	145. (a)
146. (a)	147. (a)	148. (d)	149. (d)	150. (b)					

MATHEMATICS

1. (d)	2. (c)	3. (c)	4. (c)	5. (a)	6. (b)	7. (b)	8. (a)	9. (a)	10. (d)
11. (b)	12. (b)	13. (b)	14. (a)	15. (d)	16. (a)	17. (b)	18. (b)	19. (c)	20. (d)
21. (*)	22. (a)	23. (d)	24. (a)	25. (a)	26. (a)	27. (a)	28. (a)	29. (a)	30. (b)
31. (d)	32. (b)	33. (d)	34. (c)	35. (a)	36. (d)	37. (b)	38. (b)	39. (d)	40. (c)
41. (a)	42. (b)	43. (d)	44. (b)	45. (a)	46. (c)	47. (a)	48. (b)	49. (d)	50. (d)
51. (c)	52. (c)	53. (a)	54. (d)	55. (c)	56. (b)	57. (b)	58. (c)	59. (b)	60. (a)
61. (b)	62. (c)	63. (b)	64. (c)	65. (a)	66. (b)	67. (b)	68. (c)	69. (*)	70. (d)
71. (c)	72. (d)	73. (b)	74. (b)	75. (d)					

Note : * None of the given options is correct.