

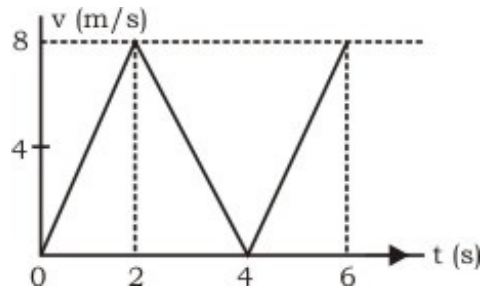
# UPSEE - 2005

## Full Paper

### Section-1

#### Physics

1. The v-t graph for a particle is as shown. The distance travelled in the first four seconds is :

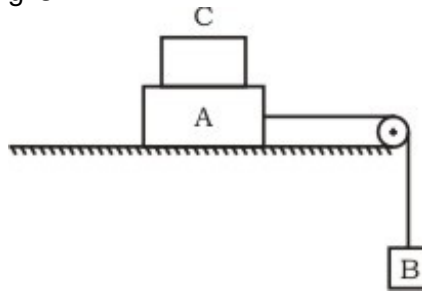


- 1) 12 m
  - 2) 16 m
  - 3) 20 m
  - 4) 24 m
2. An open pipe is suddenly closed at one end with the result that the frequency of third harmonic of the closed pipe is termed to be higher by 100 Hz, than the fundamental frequency of the open pipe. The fundamental frequency of the open pipe is :
- 1) 200 Hz
  - 2) 150 Hz
  - 3) 100 Hz
  - 4) 250 Hz
3. If a convex lens of focal length 75 cm and a concave lens of focal length 50 cm are combined together, what will be their resulting power ?
- 1) -6.6 D
  - 2) +0.66 D
  - 3) +6.6 D
  - 4) -0.66 D
4. When a ferromagnetic material is heated to temperature above its curie point, the material :
- 1) is permanently magnetized
  - 2) remains ferromagnetic
  - 3) behaves like a diamagnetic material
  - 4) behaves like a paramagnetic material

5. Light of energy 2.0 eV falls on a metal of work function 1.4 eV. The stopping potential is :

- 1) 0.6 V
- 2) 2.0 V
- 3) 3.4 V
- 4) 1.4 V

6. Two masses A and B of 15 kg and 10 kg are connected with a string passing over a frictionless pulley fixed at the corner of a table (as shown in figure). The coefficient of friction between the table and block is 0.4. The minimum mass of C, that may be placed on A to prevent it from moving is :



- 1) 10 kg
- 2) 5 kg
- 3) zero
- 4) 15 kg

7. During an isothermal expansion of an ideal gas :

- 1) its internal energy decreases
- 2) its internal energy does not change
- 3) the work done by the gas is equal to the quantity of heat absorbed by it
- 4) both (2) and (3) are correct

8. A logic gate and its truth table are shown below



A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

The gate is :

- 1) NOR
- 2) AND
- 3) OR
- 4) NOT

9. Find the dimensions of electric permittivity.

- 1)  $[A^2M^{-1}L^{-3}T^4]$
- 2)  $[A^2M^{-1}L^{-3}T^0]$

3)  $[AM^{-1}L^{-3}T^4]$

4)  $[A^2M^0L^{-3}T^4]$

10.  $1 \text{ Wb/m}^2$  is equal to :

1)  $10^4$  gauss

2)  $4\pi \times 10^{-3}$  gauss

3)  $10^2$  gauss

4)  $10^{-4}$  gauss

11. In Young's double slit experiment, the slits are 3 mm apart. The wavelength of light used is  $5000 \text{ \AA}$  and the distance between the slits and the screen is 90 cm. The fringe width in mm is :

1) 1.5

2) 0.015

3) 2.0

4) 0.15

12. A moving coil galvanometer has a resistance of  $10\Omega$  and full scale deflection of 0.01 A. It can be converted into voltmeter of 10 V full scale by connecting into resistance of :

1)  $9.90 \Omega$  in series

2)  $10 \Omega$  in series

3)  $990 \Omega$  in series

4)  $0.10 \Omega$  in series

13. A circular disc of radius R rolls without slipping along the horizontal surface with constant velocity  $v_0$ . We consider a point A on the surface of the disc. Then the acceleration of the point A is :

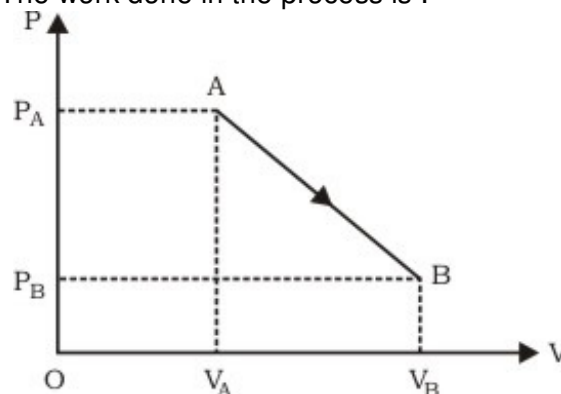
1) constant in magnitude as well as direction

2) constant in direction

3) constant in magnitude

4) constant

14. An ideal gas is taken from point A to the point B, as shown in the P-V diagram, keeping the temperature constant. The work done in the process is :



1)  $(P_A - P_B)(V_B - V_A)$

2)  $\frac{1}{2}(P_B - P_A)(V_B + V_A)$

- 3)  $\frac{1}{2} (P_B - P_A) (V_B - V_A)$
- 4)  $\frac{1}{2} (P_A + P_B) (V_B - V_A)$

15. The number of free electrons per 100 mm of ordinary copper wire is  $2 \times 10^{21}$ . Average drift speed of electrons is 0.25 mm/s. The current flowing is :

- 1) 5 A
- 2) 80 A
- 3) 8 A
- 4) 0.8 A

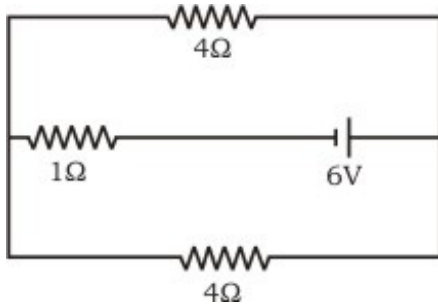
16. A Carnot engine whose low temperature reservoir is at  $7^\circ \text{C}$  has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased ?

- 1) 840 K
- 2) 280 K
- 3) 560 K
- 4) 380 K

17. In nuclear forces between two protons, between two neutrons and between a proton and a neutron are  $f_{pp}$ ,  $f_{nn}$  and  $f_{pn}$  respectively, then :

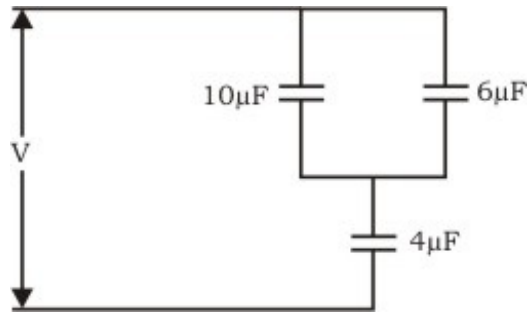
- 1)  $f_{pn} < f_{pp} < f_{nn}$
- 2)  $f_{pp} = f_{nn} < f_{pn}$
- 3)  $f_{pp} < f_{pn} < f_{nn}$
- 4)  $f_{pp} > f_{pn} > f_{nn}$

18. The current in the  $1 \Omega$  resistor shown in the circuit is :



- 1)  $\frac{2}{3}$  A
- 2) 3 A
- 3) 6 A
- 4) 2 A

19. The equivalent capacitance of the combination of the capacitors is :



- 1) 3.20 μF
- 2) 7.80 μF
- 3) 3.90 μF
- 4) 2.16 μF

20. Water is flowing through a pipe of constant cross-section. At some point the pipe becomes narrow and the cross-section is halved. The speed of water is :

- 1) reduced to zero
- 2) decreased by factor of 2
- 3) increased by a factor of 2
- 4) unchanged

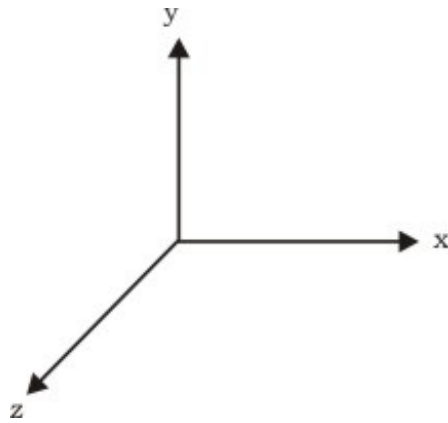
21. In Millikan's oil drop experiment, an oil drop of mass  $16 \times 10^{-6}$  kg is balanced by an electric field of  $10^6$  V/m. The charge in coulomb on the drop is : (assuming  $g = 10 \text{ m/s}^2$ )

- 1)  $6.2 \times 10^{-11}$
- 2)  $16 \times 10^{-9}$
- 3)  $16 \times 10^{-11}$
- 4)  $16 \times 10^{-13}$

22. The minimum wavelength of X-ray emitted from X-ray machine operating at an accelerating potential of V volts is :

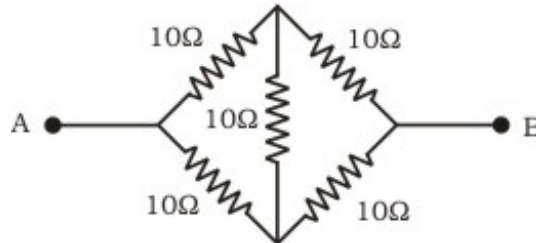
- 1)  $hc/eV$
- 2)  $Vc/eh$
- 3)  $eh/Vc$
- 4)  $eV/hc$

23. Light wave is travelling along y-direction. If the corresponding  $\vec{E}$  vector at any time is along the x-axis, the direction of  $\vec{B}$  vector at that time is along :



- 1) y-axis
- 2) x-axis
- 3) +z-axis
- 4) -z-axis

24. Each resistance in the given network has the value of  $10\ \Omega$ . The equivalent resistance between points, A and B will be :



- 1)  $30\ \Omega$
- 2)  $10\ \Omega$
- 3)  $20\ \Omega$
- 4)  $2\ \Omega$

25. Two plane mirrors are inclined to each other such that a ray of light incident on the first mirror and parallel to the second is reflected from the second mirror parallel to the first mirror. The angle between the two mirrors is :

- 1)  $30^\circ$
- 2)  $45^\circ$
- 3)  $60^\circ$
- 4)  $75^\circ$

26. A radioactive material has a half-life of 8 yr. The activity of the material will decrease to about  $1/8$  of its original value in :

- 1) 256 yr
- 2) 128 yr
- 3) 64 yr
- 4) 24 yr

27. Which of the following is not equal to 1 in Boolean algebra ?

- 1)  $\overline{A \cdot \bar{A}}$
- 2)  $A \cdot \bar{A}$
- 3)  $A + \bar{A}$
- 4)  $A + 1$

28. The number of beats produced per second by two vibrations

$$x_1 = x_0 \sin 646 \pi t \text{ and } x_2 = x_0 \sin 652 \pi t \text{ is :}$$

- 1) 2
- 2) 3
- 3) 4
- 4) 6

29. An engine is supposed to operate between two reservoirs at temperature  $727^\circ\text{C}$  and  $227^\circ\text{C}$ . The maximum possible efficiency of such an engine is :

- 1)  $1/2$
- 2)  $1/4$
- 3)  $3/4$
- 4) 1

30. Two rods of different materials having coefficients of thermal expansion  $\alpha_1$  and  $\alpha_2$  and Young's moduli  $Y_1$  and  $Y_2$  respectively are fixed between two rigid walls. The rods are heated, such that they undergo the same increase in temperature. There is no bending of rods. If  $\alpha_1/\alpha_2 = 2/3$  and stresses developed in two rods are equal, then  $(Y_1/Y_2)$  is :

- 1)  $3/2$
- 2) 1
- 3)  $2/3$
- 4)  $1/2$

31. A string vibrates according to the equation :

$$Y = 5 \sin (2\pi x/3) \cos 20 \pi t$$

where  $x$  and  $y$  are in cm and  $t$  in second. The distance between two adjacent nodes is :

- 1) 3 cm
- 2) 4.5 cm
- 3) 6 cm
- 4) 1.5 cm

32. On Centigrade scale the temperature of a body increases by  $30^\circ$ . The increase in temperature on Fahrenheit scale is :

- 1)  $50^\circ$
- 2)  $40^\circ$
- 3)  $30^\circ$
- 4)  $54^\circ$

33. The relation gives the value of  $x$  as  $x = (a^3 b^3 / c \sqrt{d})$ . Find the percentage error in  $x$ , if the percentage error in  $a$ ,  $b$ ,  $c$ ,  $d$ , are 2%, 1%, 2%, and 4% respectively :

- 1)  $\pm 13\%$
- 2)  $\pm 5\%$
- 3)  $\pm 9\%$
- 4)  $\pm 8\%$

34. A particle performs uniform circular motion with an angular momentum  $L$ . If the frequency of particle's motion is doubled and its KE is halved, the angular momentum becomes :

- 1)  $L/2$
- 2)  $2 L$

- 3) 4 L
- 4) L/4

35. An electron initially at rest is accelerated through a potential difference of 1V. The energy acquired by electron is :

- 1)  $10^{-19}$  J
- 2)  $1.6 \times 10^{-19}$  erg
- 3)  $1.6 \times 10^{-19}$  J
- 4) 1 J

36. Two polaroids are placed in the path of unpolarized beam of intensity  $I_0$  such that no light is emitted from the second polaroid. If a third polaroid whose polarization axis makes an angle  $\theta$  with the polarization axis of first polaroid, is placed between these polaroids, then the intensity of light emerging from the last polaroid will be :

- 1)  $(I_0/8) \sin^2 2\theta$
- 2)  $(I_0/4) \sin^2 2\theta$
- 3)  $(I_0/2) \cos^4 \theta$
- 4)  $I_0 \cos^4 \theta$

37. A nucleus decays by  $\beta^+$ -emission followed by  $\alpha$ -emission. If the atomic and mass numbers of the parent nucleus are Z and A respectively, the corresponding numbers for the daughter nucleus are respectively :

- 1) Z - 1 and A - 1
- 2) Z + 1 and A
- 3) Z - 1 and A
- 4) Z + 1 and A - 1

38. An iron bar of length 10 m is heated from  $0^\circ\text{C}$  to  $100^\circ\text{C}$ . If the coefficient of linear thermal expansion of iron is  $10 \times 10^{-6}/^\circ\text{C}$ , the increase in the length of bar is :

- 1) 0.5 cm
- 2) 1.0 cm
- 3) 1.5 cm
- 4) 2.0 cm

39. A balloon going upward with a velocity of 12 m/s is at a height of 65 m from the earth's surface at any instant. Exactly at this instant a ball drops from it. How much time will the ball take in reaching the surface of earth ? ( $g = 10 \text{ m/s}^2$ )

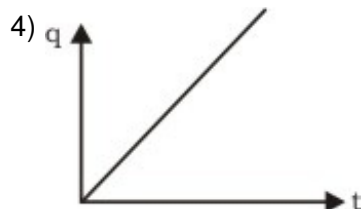
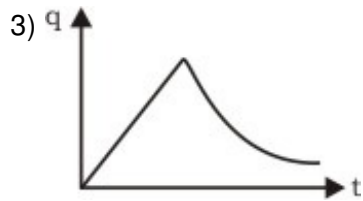
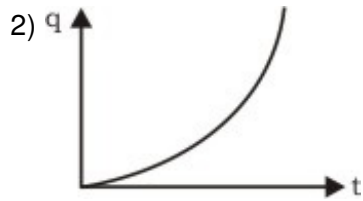
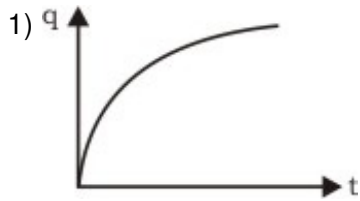
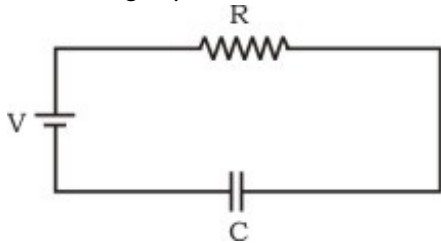
- 1) 5 s
- 2) 15 s
- 3) 10 s
- 4) None of these



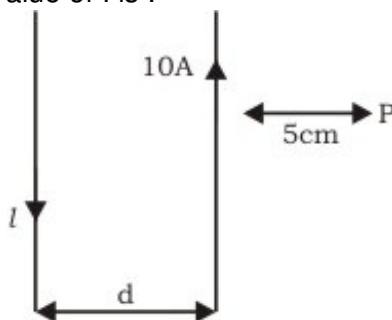
40. A block moving on a surface with velocity 20 m/s comes to rest because of surface friction over a distance of 40 m. Taking ( $g = 10 \text{ m/s}^2$ ), the coefficient of dynamic friction is :

- 1) 0.5                      2) 0.3                      3) 0.2                      4) 0.1

41. The charge  $q$  in the circuit shown here varies with time  $t$  as :



42. Two long parallel conductors carry currents in opposite directions as shown. One conductor carries a current of 10 A and the distance between the wires is  $d = 10 \text{ cm}$ . Current  $I$  is adjusted, so that the magnetic field at P is zero. P is at a distance of 5 cm to the right of the 10 A current. Value of  $I$  is :



- 1) 40 A

- 2) 30 A
- 3) 20 A
- 4) 10 A

43. A dielectric slab is inserted between the plates of an isolated charged capacitor. Which of the following quantities remain unchanged ?

- 1) The charge on the capacitor
- 2) The stored energy in the capacitor
- 3) The potential difference between the plates
- 4) The electric field in the capacitor

44. In a medium of dielectric constant  $K$ , the electric field is  $\vec{E}$ . If  $\epsilon_0$  is permittivity of the free space, the electric displacement vector is :

- 1)  $K\vec{E}/\epsilon_0$
- 2)  $\vec{E}/K\epsilon_0$
- 3)  $\epsilon_0\vec{E}/K$
- 4)  $K\epsilon_0 \vec{E}$

45. The phenomenon of polarization of light indicates that :

- 1) light is a longitudinal wave
- 2) light is a transverse wave
- 3) light is not a wave
- 4) light travels with the velocity of  $3 \times 10^8$  m/s

46. A ray of light passes from vacuum into a medium of refractive index  $\mu$ . The angle of incidence is found to be twice the angle of refraction. Then the angle of incidence is :

- 1)  $2\cos^{-1} (\mu/2)$
- 2)  $\sin^{-1} (\mu)$
- 3)  $\sin^{-1} (\mu/2)$
- 4)  $\cos^{-1} (\mu/2)$

47. A body dropped from top of a tower fall through 60 m during the last two seconds of its fall. The height of tower is : ( $g = 10 \text{ m/s}^2$ )

- 1) 95 m
- 2) 60 m
- 3) 80 m
- 4) 90 m

48. A compound microscope has an eyepiece of focal length 10 cm and an objective of focal length 4 cm. Calculate the magnification, if an object is kept at a distance of 5 cm from the objective, so that final image is formed at the least distance of distinct vision 20 cm :

1) 12

2) 11

3) 10

4) 13

49. The ratio of the velocity of sound in oxygen to that in hydrogen at same temperature and pressure is approximately :

1) 16 : 1

2) 1 : 16

3) 4 : 1

4) 1 : 4

50. The ratio  $(g/gh)$ , where  $g$  and  $gh$  are the accelerations due to gravity at the surface of the earth and at a height  $h$  above the earth's surface respectively, is :

1)  $(1 + (h/R))^2$

2)  $(1 + (R/h))^2$

3)  $(R/h)^2$

4)  $(h/R)^2$

51. In order that the light reflected from the surface of a medium of refractive index  $\mu$  is plane polarized, the angle of incidence should be :

1)  $\sin^{-1}(\mu)$

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

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

4)  $\tan^{-1}(1/\mu)$

52. An electron moves along the line PQ which lies in the same plane as a circular loop of conducting wire as shown in figure. What will be the direction of the induced current in the loop ?



1) Anticlockwise

2) Clockwise

3) Alternating

4) No current will be induced

53. The magnetic field at the centre of a current carrying circular loop is  $B$ . If the radius of the loop is doubled, keeping the current same, the magnetic field at the centre of the loop would be :

1)  $B/4$

2)  $B/2$

3)  $2B$

4)  $4B$

54. Let  $V$  be the electric potential at a given point. Then the electric field  $E_x$  along  $x$ -direction at that point is given by :

- 1)  $\int_0^{\infty} V dx$
- 2)  $dV/dx$
- 3)  $-(dV/dx)$
- 4)  $-V(dV/dx)$

55. Potential at any point inside a charged hollow sphere :

- 1) increases with distance
- 2) is a constant
- 3) decreases with distance from centre
- 4) is zero

56. The length of a simple pendulum is increased by 44 %. What is the percentage increase in its time period ?

- 1) 10%
- 2) 20%
- 3) 40%
- 4) 44%

57. Four charges  $q_1 = 2 \times 10^{-8}$  C,  $q_2 = -2 \times 10^{-8}$  C,  $q_3 = -3 \times 10^{-8}$  C and  $q_4 = 6 \times 10^{-8}$  C are placed at four corners of a square of side  $\sqrt{2}$  m. What is the potential at the centre of the square ?

- 1) 270 V
- 2) 300 V
- 3) Zero
- 4) 100 V

58. A point charge  $+q$  is placed at the mid point of a cube of side  $L$ . The electric flux emerging from the cube is :

- 1)  $q/\epsilon_0$
- 2)  $q/6L^2\epsilon_0$
- 3)  $6qL^2/\epsilon_0$
- 4) zero

59. In which of the following is the interference due to the division of wavefront ?

- 1) Young's double slit experiment
- 2) Fresnel's biprism experiment
- 3) Lloyd's mirror experiment
- 4) Demonstration colours of thin film

60. The electric field due to an extremely short dipole at distance  $r$  from it is proportional to :

- 1)  $1/r$

- 2)  $1/r^2$
- 3)  $1/r^3$
- 4)  $1/r^4$

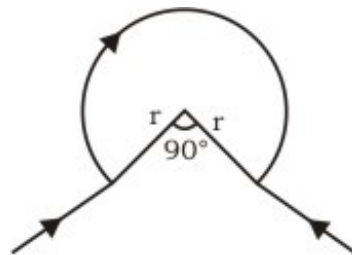
61. A source of sound of frequency 500 Hz is moving towards a stationary observer with velocity 30 m/s. The speed of sound is 330 m/s. The frequency heard by the observer will be :

- 1) 545 Hz
- 2) 580 Hz
- 3) 458.3 Hz
- 4) 550 Hz

62. A ball is hit at  $45^\circ$  to the horizontal with a kinetic energy  $E_k$ . The kinetic energy at the highest point is :

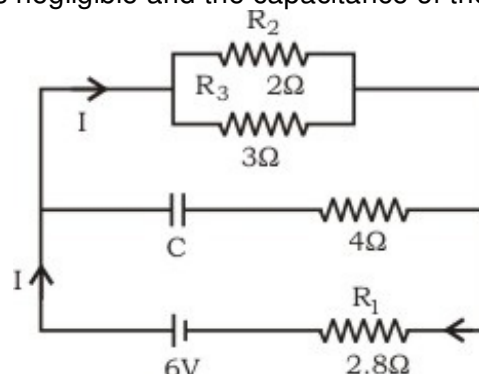
- 1)  $E_k$
- 2)  $E_k/2$
- 3)  $E_k/\sqrt{2}$
- 4) zero

63. A wire shown in figure carries a current of 40 A. If  $r = 3.14$  cm, the magnetic field at point P will be:



- 1)  $1.6 \times 10^{-3}$  T
- 2)  $3.2 \times 10^{-2}$  T
- 3)  $4.8 \times 10^{-3}$  T
- 4)  $6.0 \times 10^{-4}$  T

64. Calculate the steady state current in the resistor, shown in figure. The internal resistance of the battery is negligible and the capacitance of the capacitor C is  $0.2 \mu\text{F}$ .



- 1) 1.0 A
- 2) 0.9 A
- 3) 1.2 A
- 4) 0.8 A

65. In stream line flow of liquid, the total energy of liquid is constant at :

- 1) all points
- 2) inner points
- 3) outer points
- 4) none of these

66. The magnetic field at the point of intersection of diagonals of a square loop of side L carrying a current I is :

- 1)  $\mu_0 I / \pi L$
- 2)  $2\mu_0 I / \pi L$
- 3)  $\sqrt{2}\mu_0 I / \pi L$
- 4)  $2\sqrt{2}\mu_0 I / \pi L$

67. The force on a charged particle moving with a velocity  $\vec{v}$  in a magnetic field  $\vec{B}$  is :

- 1) perpendicular to both  $\vec{v}$  and  $\vec{B}$
- 2) maximum, if  $\vec{v}$  perpendicular to  $\vec{B}$
- 3) maximum, if  $\vec{v}$  parallel to  $\vec{B}$
- 4) zero, if  $\vec{v}$  is parallel to  $\vec{B}$

68. If a magnetic dipole of dipole moment M rotated through an angle  $\theta$  with respect to the direction of the field H, then the work done is :

- 1)  $MH \sin \theta$
- 2)  $MH (1 - \sin \theta)$
- 3)  $MH \cos \theta$
- 4)  $MH (1 - \cos \theta)$

69. Two thin lenses of focal lengths  $f_1$  and  $f_2$  are placed in contact with each other. The focal length of the combination is :

- 1)  $(f_1 + f_2)/2$
- 2)  $\sqrt{f_1 f_2}$
- 3)  $(f_1 f_2)/(f_1 + f_2)$
- 4)  $(f_1 f_2)/(f_1 - f_2)$

70. For ionising an excited hydrogen atom, the energy required (in eV) will be :

- 1) a little less than 13.6

- 2) 13.6
- 3) more than 13.6
- 4) 3.4 or less

71. A hollow sphere of charge does not produce an electric field at any :

- 1) interior point
- 2) outer point
- 3) beyond 2 m
- 4) beyond 10 m

72. When a force of 0.1 N is applied, the spring is stretched by 1.5 cm. The spring is cut into three parts and one part is stretched by 3 cm. Find the force required for doing so

- 1) 0.2 N
- 2) 0.3 N
- 3) 0.4 N
- 4) 0.6 N

73. A bomb at rest explodes into 3 parts of the same mass. The momentum of the 2 parts is  $-2p \hat{i}$  and  $p \hat{j}$ . The momentum of the third part will have a magnitude of :

- 1)  $p$
- 2)  $\sqrt{3}p$
- 3)  $p\sqrt{5}$
- 4) zero

74. A couple produces a :

- 1) pure linear motion
- 2) pure rotational
- 3) no motion
- 4) both linear and rotational motion

75. If the external forces acting on a system have zero resultant, the centre of mass :

- 1) may move but not accelerate
- 2) may accelerate
- 3) must not move
- 4) none of the above

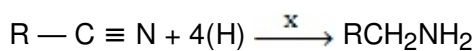
## Section-2

### Chemistry

76. Which of the following concentration units is independent of temperature ?

- 1) Normality
- 2) Molarity
- 3) Formality
- 4) Molality

77. In the reaction



X can be :

- 1)  $LiAlH_4$
- 2)  $H_2SO_4$
- 3) Ni
- 4)  $2KBr$

78. At a given temperature the equilibrium constant for the reaction of :

$PCl_5 \rightleftharpoons PCl_3 + Cl_2$  is  $2.4 \times 10^{-3}$ . At the same temperature, the equilibrium constant for the reaction

$PCl_3(g) + Cl_2(g) \rightleftharpoons PCl_5(g)$  is :

- 1)  $2.4 \times 10^{-3}$
- 2)  $-2.4 \times 10^{-3}$
- 3)  $4.2 \times 10^2$
- 4)  $4.8 \times 10^{-2}$

79. Which of the following is called polyamide ?

- 1) Terylene
- 2) Rayon
- 3) Nylon
- 4) Orlon

80. For the gaseous reaction  $C_2H_4 + H_2 \rightleftharpoons C_2H_6$ ,  $\Delta H = -130 \text{ kJ mol}^{-1}$  carried in a closed vessel, the equilibrium concentration of the  $C_2H_6$  can definitely be increased by :

- 1) increasing temperature and decreasing pressure
- 2) decreasing temperature and increasing pressure
- 3) increasing temperature and pressure both
- 4) decreasing temperature and pressure both

81. The number of electrons in the valence shell of sulphur in  $SF_6$  is :

- 1) 12
- 2) 10
- 3) 8
- 4) 11

82. The minimum energy required for the reacting molecules to undergo reaction is :

- 1) potential energy
- 2) kinetic energy
- 3) thermal energy
- 4) activation energy

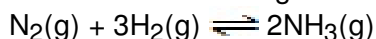
83. The only non-metal which is liquid at ordinary temperature is :

- 1) Hg
- 2)  $Br_2$



- 3) NH<sub>3</sub>
- 4) none of these

84. Which of the following is correct for the reaction ?



- 1)  $K_p = K_c$
- 2)  $K_p < K_c$
- 3)  $K_p > K_c$
- 4) Pressure is required to predict the correlation

85. The rate constant of a first order reaction is  $6.9 \times 10^{-3} \text{ s}^{-1}$ . How much time will it take to reduce the initial concentration to its 1/8<sup>th</sup> value ?

- 1) 100 s
- 2) 200 s
- 3) 300 s
- 4) 400 s

86. Which has the minimum freezing point ?

- 1) One molal NaCl aq. solution
- 2) One molal CaCl<sub>2</sub> aq. solution
- 3) One molal KCl aq. solution
- 4) One molal urea aq. solution

87. sp<sup>3</sup>d hybridization results in :

- 1) a square planar molecule
- 2) an octahedron molecule
- 3) a trigonal bipyramidal molecule
- 4) a tetrahedron molecule

88. The compound having the lowest oxidation state of iron is :

- 1) K<sub>4</sub>Fe(CN)<sub>6</sub>
- 2) K<sub>2</sub>FeO<sub>4</sub>
- 3) Fe<sub>2</sub>O<sub>3</sub>
- 4) Fe(CO)<sub>5</sub>

89. Among the following, the most acidic is :

- 1) CH<sub>3</sub>COOH
- 2) ClCH<sub>2</sub>COOH
- 3) Cl<sub>2</sub>CHCOOH
- 4) Cl<sub>2</sub>CHCH<sub>2</sub>COOH

90. Rutherford's experiment on the scattering of  $\alpha$ -particles showed for the first time that the atom has :

- 1) electrons
- 2) protons
- 3) nucleus
- 4) neutrons

91. For a Bohr atom angular momentum  $M$  of the electron is : ( $n = 0, 1, 2, \dots$ )

- 1)  $nh^2/4\pi$
- 2)  $n^2h^2/4\pi$
- 3)  $\sqrt{(nh^2)}/4\pi$
- 4)  $nh/2\pi$

92. An example of dispersion of a liquid in a gas is :

- 1) milk
- 2) vegetable oil
- 3) foam
- 4) mist

93. Which of the following combination will form an electrovalent bond ?

- 1) P and Cl
- 2)  $\text{NH}_3$  and  $\text{BF}_3$
- 3) H and Ca
- 4) H and S

94. How many moles of  $\text{Al}_2(\text{SO}_4)_3$  would be in 50 g of the substance ?

- 1) 0.083 mol
- 2) 0.952 mol
- 3) 0.481 mol
- 4) 0.140 mol

95. Teflon polymer is formed by polymerization of:

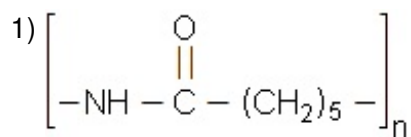
- 1)  $\text{CH}_2 = \text{CH} - \text{CN}$
- 2)  $\text{F}_2\text{C} = \text{CF}_2$
- 3)  $\text{Cl}_2\text{C} = \text{CH}_2$
- 4)  $\text{H}_2\text{C} = \text{CHCl}$

96. The IUPAC name of the compound  $\text{CH}_2\text{CONHBr}$  is :

- 1) 1-bromoacetamide

- 2) ethanoylbromide
- 3) N-bromoethanamide
- 4) none of the above

97. Which of the following is a condensation polymer ?



- 2) Rubber
- 3) Polyvinyl chloride
- 4) Polyethylene

98. The solubility of  $\text{CaF}_2$  in pure water is  $2.3 \times 10^{-4} \text{ mol dm}^{-3}$ . Its solubility product will be :

- 1)  $4.6 \times 10^{-4}$
- 2)  $4.6 \times 10^{-8}$
- 3)  $6.9 \times 10^{-12}$
- 4)  $4.9 \times 10^{-11}$

99. Copper sulphate solution, when added to an excess of ammonium hydroxide, forms a complex compound due to :

- 1)  $[\text{Cu}(\text{NH}_3)_2]^{2+}$
- 2)  $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- 3)  $[\text{Cu}(\text{NH}_3)_6]^{2+}$
- 4)  $\text{Cu}^{2+}$

100. If a solution containing 0.072 g atom of sulphur in 100 g of a solvent ( $k_f = 7.0$ ) gave a freezing point depression of  $0.84^\circ\text{C}$ , the molecular formula of sulphur in the solutions is :

- 1)  $\text{S}_6$
- 2)  $\text{S}_7$
- 3)  $\text{S}_8$
- 4)  $\text{S}_9$

101. Which of the following is a dynamic isomerism ?

- 1) Metamerism
- 2) Geometrical isomerism
- 3) Tautomerism
- 4) Co-ordinate isomerism

102. When  $\text{K}_2\text{Cr}_2\text{O}_7$  is converted into  $\text{K}_2\text{CrO}_4$ , the change in oxidation number of chromium is :

- 1) 0                      2) 5                      3) 7                      4) 9

103. Which of the following will be most effective in the coagulation of  $\text{Fe}(\text{OH})_3$  Sol ?

- 1) KCN  
2)  $\text{BaCl}_2$   
3) NaCl  
4)  $\text{Mg}_3(\text{PO}_4)_2$

104. For d block elements the first ionization potential is of the order :

- 1)  $\text{Zn} > \text{Fe} > \text{Cu} > \text{Cr}$   
2)  $\text{Sc} = \text{Ti} < \text{V} = \text{Cr}$   
3)  $\text{Zn} < \text{Cu} < \text{Ni} < \text{Co}$   
4)  $\text{V} > \text{Cr} > \text{Mn} > \text{Fe}$

105. In (+) glucose the number of chiral centres is :

- 1) 4                      2) 6                      3) 0                      4) 5

106. Mohr salt is made up of which combination of salt ?

- 1) Ammonium sulphate and potash  
2) Ammonium sulphate and ferrous sulphate  
3) Ammonium sulphate and copper sulphate  
4) Ammonium sulphate and magnesium sulphate

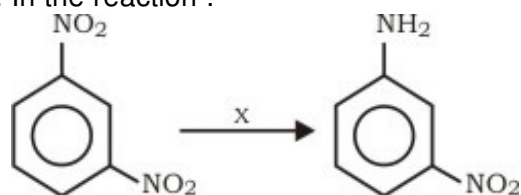
107. High basicity of  $\text{Me}_2\text{NH}$  relative to  $\text{Me}_3\text{N}$  is attributed to :

- 1) effect of solvent  
2) inductive effect of Me  
3) shape of  $\text{Me}_2\text{NH}$   
4) shape of  $\text{Me}_3\text{N}$

108. Which is the correct order of electronegativity ?

- 1)  $\text{F} > \text{N} < \text{O} > \text{C}$   
2)  $\text{F} > \text{N} > \text{O} > \text{C}$   
3)  $\text{F} > \text{N} > \text{O} < \text{C}$   
4)  $\text{F} < \text{N} < \text{O} = \text{C}$

109. In the reaction :



X is :

- 1) SiC
- 2) H<sub>2</sub>SO<sub>4</sub>
- 3) KMnO<sub>4</sub>
- 4) Fe/HCl

110. In Grignard reagent the carbon-magnesium bond is :

- 1) electrovalent
- 2) covalent
- 3) dative
- 4) hydrogen bonding

111. The radius of hydrogen atom in the ground state is 0.53 Å. The radius of Li<sup>2+</sup> ion (atomic number = 3) in a similar state is :

- 1) 0.176 Å
- 2) 0.30 Å
- 3) 0.53 Å
- 4) 1.23 Å

112. Tyndall effect shown by colloids is due to :

- 1) scattering of light by the particles
- 2) movements of particles
- 3) reflection of light by the particles
- 4) coagulation of particles

113. Iodine is a :

- 1) electrovalent solid
- 2) atomic solid
- 3) molecular solid
- 4) covalent solid

114. Fe<sup>2+</sup> ion is distinguished from Fe<sup>3+</sup> ion by :

- 1) BaCl<sub>2</sub>
- 2) KCN
- 3) NaNO<sub>3</sub>
- 4) NH<sub>4</sub>SCN

115. Among the following, the monosaccharide is :

- 1) cellulose
- 2) starch
- 3) fructose
- 4) sucrose

116. Lattice energy of a solid increases if :
- 1) size of ions are small
  - 2) charges of ions are small
  - 3) ions are neutral
  - 4) none of the above
117. Which of the following will not give a positive iodoform test ?
- 1)  $\text{CH}_3\text{CH}_2\text{CHOHCH}_3$
  - 2)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COCH}_3$
  - 3)  $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_3$
  - 4)  $\text{CH}_3\text{COC}_6\text{H}_5$
118. The reason for the loss of optical activity of lactic acid when OH group is changed by H is that :
- 1) chiral centre of the molecule is destroyed
  - 2) molecules acquires asymmetry
  - 3) due to change in configuration
  - 4) structural changes occurs
119. To distinguish between salicylic acid and phenol one can use :
- 1)  $\text{NaHCO}_3$  solution
  - 2) 5%  $\text{NaOH}$  solution
  - 3) neutral  $\text{FeCl}_3$
  - 4) bromine water
120. C—H bond energy is about 101 kcal/mol for methane, ethane and other alkanes but is only 77 kcal/mol for C—H bond of  $\text{CH}_3$  in toluene. This is because :
- 1) of inductive effect due to —  $\text{CH}_3$  in toluene
  - 2) of the presence of benzene ring in toluene
  - 3) of resonance among the structures of benzyl radical in toluene
  - 4) aromaticity of toluene
121. In a 1st order reaction, reactant concentration C varies with time  $t$  as :
- 1)  $1/C$  increases linearly with  $t$
  - 2)  $\log C$  decreases linearly with  $t$
  - 3) C decreases with  $1/t$
  - 4)  $\log C$  decreases with  $1/t$
122. Which of the following ions can be replaced by  $\text{H}^+$  ions when  $\text{H}_2$  gas is bubbled through the solutions containing these ions ?

- 1) Li
- 2) Ba<sup>2+</sup>
- 3) Cu<sup>2+</sup>
- 4) Be<sup>2+</sup>

123. Among BMe<sub>3</sub>, BF<sub>3</sub>, BCl<sub>3</sub> and B<sub>2</sub>H<sub>6</sub> which one will be the best Lewis acid ?

- 1) BCl<sub>3</sub>
- 2) BMe<sub>3</sub>
- 3) B<sub>2</sub>H<sub>6</sub>
- 4) BF<sub>3</sub>

124. Alum is added to muddy water because :

- 1) it acts as disinfectant
- 2) it results in coagulation of clay and sand
- 3) clay is soluble in alum, hence removes it
- 4) it makes water alkaline, which is good for health

125. NH<sub>3</sub> gas is dried over :

- 1) CaO
- 2) HNO<sub>3</sub>
- 3) P<sub>2</sub>O<sub>5</sub>
- 4) CuSO<sub>4</sub>

126. Which one of the following is not correct for an ideal solution ?

- 1) It must obey Raoult's law
- 2)  $\Delta H = 0$
- 3)  $\Delta C = 0$
- 4)  $\Delta H = \Delta V \neq 0$

127. Borax bead test of Cr (chromium) is :

- 1) green
- 2) blue
- 3) violet
- 4) brown

128. A catalyst :

- 1) lowers the activation energy
- 2) change the rate constant
- 3) change the product
- 4) itself destroys in the reaction

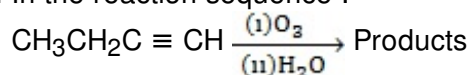
129. Which of the following is cross-linked polymer ?

- 1) Teflon
- 2) Orlon
- 3) Nylon
- 4) Bakelite

130. The IUPAC name of  $\text{CH}_3 - \text{CH}_2 - \text{CHO}$  :

- 1) propanal-1
- 2) 2-methylbutanal
- 3) butanal-1
- 4) pentanal-1

131. In the reaction sequence :



Products will be :

- 1)  $\text{CH}_3\text{COCH}_3$
- 2)  $\text{CH}_3\text{COCH}_2\text{OH}$
- 3)  $\text{CH}_3\text{COOH} + \text{HCOOH}$
- 4)  $\text{CH}_3\text{CHO} + \text{HCHO}$

132. The conditions for aromaticity is :

- 1) molecule must have clouds of delocalised  $\pi$  electrons
- 2) molecule must contain  $(4n + 2)$   $\pi$  electrons
- 3) both (1) and (2)
- 4) none of the above

133. Vinyl chloride undergoes :

- 1) only addition reactions
- 2) only elimination reactions
- 3) both (1) and (2)
- 4) substitution reactions

134. Which of the following increases the octane number ?

- 1) Branching of chain
- 2) Absence of double and triple bond
- 3) Non-cyclic alkanes
- 4) None of the above

135. Ethyl alcohol can be prepared from Grignard reagent by the reaction of :

- 1) HCHO



- 2)  $R_2CO$
- 3)  $RCN$
- 4)  $RCOCl$

136. Chlorobenzene gives aniline with :

- 1)  $NH_3/Cu_2O$
- 2)  $NH_3/H_2SO_4$
- 3)  $NaNH_2$
- 4) none of these

137. In  $CsCl$  type structure the co-ordination of  $Cs^+$  and  $Cl^-$  are :

- 1) 6, 6
- 2) 6, 8
- 3) 8, 8
- 4) 8, 6

138. Hess's law is used to calculate :

- 1) enthalpy of reaction
- 2) entropy of reaction
- 3) work done in reaction
- 4) all of the above

139. Which of the following is not a Lewis base ?

- 1)  $NH_3$
- 2)  $H_2O$
- 3)  $AlCl_3$
- 4) None of these

140. Allene ( $C_3H_4$ ) contains :

- 1) one double bond, one triple bond and one single bond
- 2) one triple and two double bonds
- 3) two triple and one double bond
- 4) two double and four single bond

141. Active charcoal is a good catalyst because :

- 1) made up of carbon atoms
- 2) is very reactive
- 3) has more adsorption power
- 4) has inert nature toward reagent

142.  $H_2$  cannot be displaced by :

- 1)  $Li^+$
- 2)  $Sr^{2+}$
- 3)  $Al^{3+}$
- 4)  $Ag^+$

143. Which of the following is amphoteric ?

- 1)  $V_2O_3$
- 2)  $CuO$
- 3)  $V_2O_5$
- 4)  $NiO$

144. The emf of the cell, ( $E_{Zn^{2+}/Zn} = -0.76$  V)  $Zn/Zn^{2+}$  (1M) ||  $Cu^{2+}$  (1M)  $Cu$  ( $E_{Cu^{2+}/Cu} = +0.34$  V) will be :

- 1) +1.10 V
- 2) -1.10 V
- 3) +0.42 V
- 4) -0.42 V

145. Which of the following is correct number of carbon atom present as the constituent of kerosene oil ?

- 1)  $C_{10} - C_{16}$
- 2)  $C_4 - C_6$
- 3)  $C_8 - C_{16}$
- 4)  $C_{12} - C_{18}$

146. Plaster of Paris is a white powder of formula :

- 1)  $CaSO_4 \cdot (1/2) H_2O$
- 2)  $CaSO_4 \cdot 2H_2O$
- 3)  $CaSO_4 \cdot H_2O$
- 4)  $CaSO_4 \cdot (3/2) H_2O$

147. Water possesses a high dielectric constant, therefore :

- 1) it always contains ions
- 2) it is a universal solvent
- 3) can dissolve covalent compounds
- 4) can conduct electricity

148. Ribose is an example of :

- 1) ketohexose

- 2) disaccharide
- 3) pentose
- 4) polysaccharide

149. Aldehydes can be oxidised by :

- 1) Tollen's reagent
- 2) Fehling solution
- 3) Benedict solution
- 4) All of the these

150. The  $\Delta H^\circ_f$  for  $\text{CO}_2(\text{g})$ ,  $\text{CO}(\text{g})$  and  $\text{H}_2\text{O}(\text{g})$  are -393.5, -110.5 and -241.8 kJ/mol respectively. The standard enthalpy change (in kJ) for the reaction  $\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$  is :

- 1) 524.1
- 2) 41.2
- 3) -262.5
- 4) -41.2

### Section-3

#### Mathematics

151. Of a total of 600 bolts, 20% are too large and 10% are too small. The remainder are considered to be suitable. If a bolt is selected at random, the probability that it will be suitable is :

- 1) 1/5
- 2) 7/10
- 3) 1/10
- 4) 3/10

152. The area enclosed within the curve  $|x| + |y| = 1$  is :

- 1) 1 sq unit
- 2)  $2\sqrt{2}$  sq unit
- 3)  $\sqrt{2}$  sq unit
- 4) 2 sq unit

153. If  $P(B) = (3/4)$ ,  $P(A \cap B \cap \bar{C}) = (1/3)$  and  $P(\bar{A} \cap B \cap \bar{C}) = (1/3)$ , then  $P(B \cap C)$  is :

- 1) 1/12
- 2) 1/6
- 3) 1/15
- 4) 1/9

154. Two masses are projected with equal velocity  $u$  at angle  $30^\circ$  and  $60^\circ$  respectively. If the ranges covered by the masses be  $R_1$  and  $R_2$ , then :

- 1)  $R_1 > R_2$
- 2)  $R_1 = R_2$
- 3)  $R_1 = 4R_2$
- 4)  $R_2 > R_1$



3)  $(xy/(x - y + 1))$

4)  $(xy/(x + y + 1))$

163.  $\cos^4 \theta - \sin^4 \theta$  is equal to :

1)  $1 + 2 \sin^2 (\theta/2)$

2)  $2 \cos^2 \theta - 1$

3)  $1 - 2 \sin^2 (\theta/2)$

4)  $1 + 2 \cos^2 \theta$

164. If  $y = f(x) = ((x + 2)/(x - 1))$ , then :

1)  $x = f(y)$

2)  $f(1) = 3$

3)  $y$  increases with  $x$  for  $x < 1$

4)  $f$  is a rational function of  $x$

165. If two like parallel forces of  $(P/Q)$  N and  $(Q/P)$  N have a resultant 2 N, then :

1)  $P = Q$

2)  $2P = Q$

3)  $P^2 = Q$

4)  $P = 2Q$

166. A person standing on the bank of a river observes that the angle subtended by a tree on the opposite bank is  $60^\circ$ . When he retreats 20 ft from the bank, he finds the angle to be  $30^\circ$ . The breadth of the river in feet is :

1) 15

2)  $15\sqrt{3}$

3)  $10\sqrt{3}$

4) 10

167. If  $\alpha, \beta, \gamma$  are the cube roots of a positive number  $p$ , then for any real  $x, y, z$  the

expression  $\left( \frac{\alpha x + \beta y + \gamma z}{\beta x + \gamma y + \alpha z} \right)$  equals :

1)  $\frac{-1 - \sqrt{3}i}{2}$

2)  $\frac{-1 + \sqrt{3}i}{2}$

3)  $\frac{1 + \sqrt{3}i}{2}$

4)  $\frac{1 - \sqrt{3}i}{2}$

168. If  $\tan \alpha = (m/(m + 1))$  and  $\tan \beta = (1/(2m + 1))$ , then  $\alpha + \beta$  is equal to :
- 1)  $\pi/3$
  - 2)  $\pi/4$
  - 3) zero
  - 4)  $\pi/2$
169. If  $f(x) = x[\sqrt{x} - \sqrt{x + 1}]$ , then :
- 1)  $f(x)$  is continuous but not differentiable at  $x = 0$
  - 2)  $f(x)$  is not differentiable at  $x = 0$
  - 3)  $f(x)$  is differentiable at  $x = 0$
  - 4) none of the above
170.  $\tan \alpha + 2 \tan 2\alpha + 4 \tan 4\alpha + 8 \cot 8\alpha$  is equal to :
- 1)  $\tan 16 \alpha$
  - 2) 0
  - 3)  $\cot \alpha$
  - 4) none of these
171. A book contains 1000 pages numbered consecutively. The probability that the sum of the digits of the number of a page is 9, is :
- 1) zero
  - 2)  $55/1000$
  - 3)  $33/1000$
  - 4)  $44/1000$
172. The value of  $[\vec{a} + \vec{b} \vec{b} + \vec{c} \vec{c} + \vec{a}]$  is :
- 1)  $2[\vec{a} \vec{b} \vec{c}]$
  - 2)  $[\vec{a} \vec{b} \vec{c}]$
  - 3) 1
  - 4) none of these
173. A number is chosen at random among the first 120 natural numbers. The probability of the number chosen being a multiple of 5 or 15 is :
- 1)  $1/8$
  - 2)  $1/5$
  - 3)  $1/24$
  - 4)  $1/6$
174. Let A, B and C be  $n \times n$  matrices. Which one of the following is a correct statement ?
- 1) If  $AB = AC$ , then  $B = C$
  - 2) If  $A^3 + 2A^2 + 3A + 5I = 0$ , then A is invertible
  - 3) If  $A^2 = 0$ , then  $A = 0$
  - 4) None of the above
175. If  $\vec{a} = 2\hat{i} + \hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} - 2\hat{j} - \hat{k}$ ,  $\vec{c} = \hat{i} + \hat{j} + \hat{k}$ , then  $\vec{a} \times (\vec{b} \times \vec{c})$  equals :
- 1)  $5\hat{i} - 7\hat{j} - 3\hat{k}$

- 2)  $5\hat{i} + 7\hat{j} - 3\hat{k}$
- 3)  $5\hat{i} - 7\hat{j} + 3\hat{k}$
- 4) zero

176. If  $\overline{AB} \times \overline{AC} = 2\hat{i} - 4\hat{j} + 4\hat{k}$ , then the area of  $\Delta ABC$  is :

- 1) 3 sq unit
- 2) 4 sq unit
- 3) 16 sq unit
- 4) 9 sq unit

177. The coefficient of  $x^4$  in the expansion of  $((x/2) - (3/x^2))^{10}$  is :

- 1) 504/259
- 2) 450/263
- 3) 405/256
- 4) none of these

178. Equation of the ellipse whose foci are (2, 2) and (4, 2) and the major axis is of length 10, is :

- 1)  $\frac{(x + 3)^2}{24} + \frac{(y + 2)^2}{25} = 1$
- 2)  $\frac{(x - 3)^2}{24} + \frac{(y - 2)^2}{25} = 1$
- 3)  $\frac{(x + 3)^2}{25} + \frac{(y + 2)^2}{24} = 1$
- 4)  $\frac{(x - 3)^2}{25} + \frac{(y - 2)^2}{24} = 1$

179. The volume of the solid generated by the revolution of the curve  $y = (a^3/(a^2 + x^2))$  about x-axis is :

- 1)  $(1/2) \pi^3 a^2$
- 2)  $\pi^3 a^2$
- 3)  $(1/2) \pi^2 a^3$
- 4)  $\pi^2 a^3$

180. The radius of the circle  $|(z - i)/(z + i)| = 5$  is given by :

- 1) 13/12
- 2) 5/12
- 3) 5
- 4) 625

181. If  $\vec{a} = (1, p, 1)$ ,  $\vec{b} = (q, 2, 2)$ ,  $\vec{a} \cdot \vec{b} = r$  and  $\vec{a} \times \vec{b} = (0, -3, -3)$ , then p, q, r are in that order :

- 1) 1, 5, 9
- 2) 9, 5, 1

- 3) 5, 1, 9
- 4) none of these

182. If the circle passes through the point  $(a, b)$  and cuts the circle  $x^2 + y^2 = k^2$  orthogonally, then the locus of its centre is given by :

- 1)  $2ax + 2by - (a^2 + b^2 + k^2) = 0$
- 2)  $2ax + 2by + (a^2 + b^2 - k^2) = 0$
- 3)  $2ax + 2by + (a^2 + b^2 + k^2) = 0$
- 4) none of the above

183. The foci of an ellipse are  $(0, \pm 4)$  and the equations for the directrices are  $y = \pm 9$ . The equation for the ellipse is :

- 1)  $5x^2 + 9y^2 = 4$
- 2)  $2x^2 - 6y^2 = 28$
- 3)  $6x^2 + 3y^2 = 45$
- 4)  $9x^2 + 5y^2 = 180$

184. The straight lines  $x + y = 0$ ,  $3x + y - 4 = 0$  and  $x + 3y - 4 = 0$  form a triangle which is :

- 1) right angled
- 2) equilateral
- 3) isosceles
- 4) none of these

185. The eccentricity of the hyperbola

$$9x^2 - 16y^2 - 18x - 64y - 199 = 0 \text{ is :}$$

- 1)  $16/9$
- 2)  $5/4$
- 3)  $25/16$
- 4) zero

186. A four-digit number is formed by the digits 1, 2, 3, 4 with no repetition. The probability that the number is odd, is :

- 1) zero
- 2)  $1/3$
- 3)  $1/4$
- 4) none of these

187. The coefficient of  $x^n$  in the expansion of  $((a - bx)/e^x)$  is :

- 1)  $((-1)^n/n!) (a + bn)$
- 2)  $((-1)^n/n!) (b + zn)$
- 3)  $((-1)^{n+1}/n!) (a + bn)$
- 4) none of these

188. A and B are two independent events. The probability that both A and B occur is  $1/6$  and



the probability that neither of them occurs is  $1/3$ . The probability of occurrence of A is :

- 1)  $5/6$
- 2)  $1/6$
- 3)  $1/2$
- 4) none of these

189. The value of  $\cot^{-1} 9 + \operatorname{cosec}^{-1} (\sqrt{41}/4)$  is given by :

- 1) 0
- 2)  $\pi/4$
- 3)  $\tan^{-1} 2$
- 4)  $\pi/2$

190. Let a, b, c be distinct non-negative numbers. If the vectors  $a\hat{i} + a\hat{j} + c\hat{k}$ ,  $\hat{i} + \hat{k}$  and  $c\hat{i} + c\hat{j} + b\hat{k}$  lie in a plane, then :

- 1)  $c^2 = ab$
- 2)  $a^2 = bc$
- 3)  $b^2 = ac$
- 4) none of these

191. The greatest coefficient in the expansion of  $(1 + x)^{2n}$  is :

- 1)  ${}^{2n}C_n$
- 2)  ${}^{2n}C_{n+1}$
- 3)  ${}^{2n}C_{n-1}$
- 4)  ${}^{2n}C_{2n+1}$

192. The value of  $\lim_{x \rightarrow 0} \frac{e^x + \log(1+x) - (1-x)^{-2}}{x^2}$  is equal to :

- 1) 0
- 2) -3
- 3) -1
- 4) infinity

193. The values of k for which the equations  $x^2 - kx - 21 = 0$  and  $x^2 - 3kx + 35 = 0$  will have a common roots are :

- 1)  $k = \pm 4$
- 2)  $k = \pm 1$
- 3)  $k = \pm 3$
- 4)  $k = 0$

194.  $\vec{a}$  and  $\vec{b}$  are two non-zero vectors, then  $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b})$  is equal to :

- 1)  $a + b$
- 2)  $(a - b)^2$

3)  $(a + b)^2$

4)  $(a^2 - b^2)$

195. If  $\sin x + \sin^2 x = 1$ , then  $\cos^6 x + \cos^{12} x + 3 \cos^{10} x + 3 \cos^8 x$  is equal to :

1) 1

2)  $\cos^3 x \sin^3 x$

3) 0

4)  $\infty$

196. The integrating factor of the differential equation  $(dy/dx) + (1/x)y = 3x$  is :

1)  $x$

2)  $\ln x$

3) 0

4)  $\infty$

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

1)  $\pi^2/32$

2)  $\pi^2/16$

3)  $\pi/32$

4) none of these

198. If H is harmonic mean between P and Q, then the value of  $(H/P) + (H/Q)$  is :

1) 2

2)  $(PQ/(P + Q))$

3)  $((P + Q)/PQ)$

4) none of these

199. The value of 'p' for which the equation  $x^2 + pxy + y^2 - 5x - 7y + 6 = 0$  represents a pair of straight lines is :

1)  $5/2$

2) 5

3) 2

4)  $2/5$

200. Angle between the vectors  $\sqrt{3}(\vec{a} \times \vec{b})$  and  $\vec{b} - (\vec{a} \cdot \vec{b})\vec{a}$  is :

1)  $\pi/2$

2) 0

3)  $\pi/4$

4)  $\pi/3$

201. The equation of the circle passing through (4, 5) having the centre (2, 2) is :

1)  $x^2 + y^2 + 4x + 4y - 5 = 0$

2)  $x^2 + y^2 - 4x - 4y - 5 = 0$

3)  $x^2 + y^2 - 4x = 13$

4)  $x^2 + y^2 - 4x - 4y + 5 = 0$

202. The smallest positive integer  $n$  for which  $((1 + i)/(1 - i))^n = 1$  is :

- 1)  $n = 8$
- 2)  $n = 12$
- 3)  $n = 16$
- 4) none of these

203. The equation of tangents drawn from the origin to the circle  $x^2 + y^2 - 2rx - 2hy + h^2 = 0$  are :

- 1)  $x = 0, y = 0$
- 2)  $x = 1, y = 0$
- 3)  $(h^2 - r^2)x - 2rhy = 0, y = 0$
- 4)  $(h^2 - r^2)x - 2rhy = 0, x = 0$

204. The value of  $9^{1/3} \times 9^{1/9} \times 9^{1/27} \times \dots \infty$  is :

- 1) 9
- 2) 1
- 3) 3
- 4) none of these

205. If  $\vec{a}, \vec{b}, \vec{c}$  are any three coplanar unit vectors, then :

- 1)  $\vec{a} \cdot (\vec{b} \times \vec{c}) = 1$
- 2)  $\vec{a} \cdot (\vec{b} \times \vec{c}) = 3$
- 3)  $(\vec{a} \times \vec{b}) \cdot \vec{c} = 0$
- 4)  $(\vec{c} \times \vec{a}) \cdot \vec{b} = 1$

206. Let  $0 < P(A) < 1, 0 < P(B) < 1$  and  $P(A \cup B) = P(A) + P(B) - P(A)P(B)$ , then :

- 1)  $P(B/A) = P(B) - P(A)$
- 2)  $P(A' \cup B') = P(A') + P(B')$
- 3)  $P(A \cap B) = P(A')P(B')$
- 4) none of the above

207. The probability that in the toss of two dice we obtain the sum 7 or 11, is :

- 1)  $1/6$
- 2)  $1/18$
- 3)  $2/9$
- 4)  $23/108$

208. If  $2^x + 2^y = 2^{x+y}$ , then  $(dy/dx)$  is equal to :

- 1)  $\frac{(2^x + 2^y)}{(2^x - 2^y)}$
- 2)  $\frac{(2^x + 2^y)}{(1 + 2^{x+y})}$
- 3)  $2^{x-y} \left( \frac{2^y - 1}{1 - 2^x} \right)$

$$4) \frac{2^{x+y} - 2^x}{2^y}$$

209. If the probability of A to fail in an examination is 0.2 and that for B is 0.3, then probability that either A or B is fail, is :

- 1) 0.5                      2) 0.44                      3) 0.8                      4) 0.25

210. If the line  $ax + by + c = 0$  is a normal to the curve  $xy = 1$ , then :

- 1)  $a > 0, b > 0$   
 2)  $a > 0, b < 0$   
 3)  $a < 0, b < 0$   
 4) data is insufficient

211. If  $f(x) = \cos(\log x)$ , then

$$f(x) f(y) - \frac{1}{2} \left[ f\left(\frac{x}{y}\right) + f(xy) \right] \text{ has the value :}$$

- 1) -1                      2) 1/2                      3) -2                      4) zero

212. If  $y = 3^{x-1} + 3^{-x-1}$  ( $x$  real), then the least value of  $y$  is :

- 1) 2  
 2) 6  
 3) 2/3  
 4) none of these

213. The value of  $\theta$  lying between  $\theta = 0$  and  $(\pi/2)$  and satisfying the equation

$$\begin{vmatrix} 1 + \sin^2 \theta & \cos^2 \theta & 4 \sin 4\theta \\ \sin^2 \theta & 1 + \cos^2 \theta & 4 \sin 4\theta \\ \sin^2 \theta & \cos^2 \theta & 1 + 4 \sin 4\theta \end{vmatrix} = 0 \text{ are :}$$

- 1)  $7\pi/24$   
 2)  $5\pi/24$   
 3)  $11\pi/24$   
 4)  $\pi/24$

214.  $\left(\frac{-1 + \sqrt{-3}}{2}\right)^{100} + \left(\frac{-1 - \sqrt{-3}}{2}\right)^{100}$  is equal to :

- 1) 2                      2) zero                      3) -1                      4) 1

215. If  $\alpha, \beta$  be the two roots of the equation  $x^2 + x + 1 = 0$ , then the equation whose roots are  $(\alpha/\beta)$  and  $(\beta/\alpha)$  is :

- 1)  $x^2 + x + 1 = 0$   
 2)  $x^2 - x + 1 = 0$

3)  $x^2 - x - 1 = 0$

4)  $x^2 + x - 1 = 0$

216. In a binomial distribution, the mean is 4 and variance is 3. Then, its mode is :

1) 5

2) 6

3) 4

4) none of these

217. If a force  $\vec{F} = 3\hat{i} + 2\hat{j} - 4\hat{k}$  is acting at the point P(1, -1, 2), then the moment of  $\vec{F}$  about the point Q(2, -1, 3) is :

1)  $\sqrt{57}$

2)  $\sqrt{39}$

3) 12

4) 17

218. The equation of a line passing through (-2, -4) and perpendicular to the line  $3x - y + 5 = 0$  is :

1)  $3y + x - 8 = 0$

2)  $3x + y + 6 = 0$

3)  $x + 3y + 14 = 0$

4) none of these

219.  $\lim_{x \rightarrow 0} (\operatorname{cosec} x)^{1/\log x}$  is equal to :

1) 0

2) 1

3)  $1/e$

4) none of these

220. The minimum value of

$f(x) = \sin^4 x + \cos^4 x, 0 \leq x \leq (\pi/2)$  is :

1)  $1/2\sqrt{2}$

2)  $1/4$

3)  $-1/2$

4)  $1/2$

221. Which of the following is a true statement ?

1)  $\{a\} \in \{a, b, c\}$

2)  $\{a\} \subseteq \{a, b, c\}$

3)  $\phi \in \{a, b, c\}$

4) none of these

222. A vector of magnitude 5 and perpendicular to  $(\hat{i} - 2\hat{j} + \hat{k})$  and  $(2\hat{i} + \hat{j} - 3\hat{k})$  is:

1)  $(5\sqrt{3}/3)(\hat{i} + \hat{j} + \hat{k})$

- 2)  $(5\sqrt{3}/3) (\hat{i} + \hat{j} - \hat{k})$
- 3)  $(5\sqrt{3}/3) (\hat{i} - \hat{j} + \hat{k})$
- 4)  $(5\sqrt{3}/3) (-\hat{i} + \hat{j} + \hat{k})$

223.  $\int_{-\pi/3}^{\pi/3} \frac{x \sin x}{\cos^2 x} dx$  is:

- 1)  $(1/3) (4\pi + 1)$
- 2)  $(4\pi/3) - 2 \log \tan (5\pi/12)$
- 3)  $(4\pi/3) + \log \tan (5/12)$
- 4) none of these

224.  $\sum_{r=0}^m {}^{n+r}C_r$  is equal to :

- 1)  ${}^{n+m+1}C_{n+1}$
- 2)  ${}^{n+m+2}C_n$
- 3)  ${}^{n+m+3}C_{n-1}$
- 4) none of these

225. The angle between the lines  $2x = 3y = -z$  and  $6x = -y = -4z$  is :

- 1)  $90^\circ$
- 2)  $0^\circ$
- 3)  $30^\circ$
- 4)  $45^\circ$

### Answer Key

1) 2	2) 1	3) 4	4) 4	5) 1	6) 1	7) 4	8) 3	9) 1	10) 1
11) 4	12) 3	13) 1	14) 4	15) 4	16) 4	17) 2	18) 4	19) 1	20) 3
21) 3	22) 1	23) 3	24) 2	25) 3	26) 4	27) 2	28) 2	29) 1	30) 1
31) 4	32) 4	33) 1	34) 4	35) 3	36) 1	37) 3	38) 2	39) 1	40) 1
41) 1	42) 2	43) 1	44) 4	45) 2	46) 1	47) 3	48) 1	49) 4	50) 1
51) 2	52) 1	53) 2	54) 3	55) 2	56) 2	57) 1	58) 1	59) 2	60) 3
61) 4	62) 2	63) 4	64) 2	65) 1	66) 4	67) 2	68) 4	69) 3	70) 2
71) 1	72) 4	73) 3	74) 2	75) 1	76) 4	77) 1	78) 3	79) 3	80) 2
81) 1	82) 4	83) 2	84) 2	85) 3	86) 2	87) 3	88) 4	89) 3	90) 3
91) 4	92) 4	93) 3	94) 4	95) 2	96) 3	97) 1	98) 4	99) 2	100) 1
101) 3	102) 1	103) 4	104) 1	105) 1	106) 2	107) 1	108) 1	109) 4	110) 2
111) 1	112) 1	113) 3	114) 4	115) 3	116) 1	117) 3	118) 1	119) 1	120) 3
121) 2	122) 3	123) 1	124) 2	125) 1	126) 4	127) 1	128) 1	129) 4	130) 1
131) 4	132) 3	133) 3	134) 1	135) 1	136) 1	137) 3	138) 1	139) 3	140) 4
141) 3	142) 4	143) 2	144) 1	145) 1	146) 1	147) 2	148) 3	149) 4	150) 2
151) 2	152) 4	153) 1	154) 1	155) 1	156) 1	157) 4	158) 1	159) 2	160) 2
161) 1	162) 1	163) 2	164) 1	165) 1	166) 4	167) 1	168) 2	169) 3	170) 3
171) 2	172) 1	173) 2	174) 2	175) 1	176) 1	177) 3	178) 4	179) 3	180) 2
181) 4	182) 1	183) 4	184) 3	185) 2	186) 4	187) 1	188) 3	189) 2	190) 1
191) 1	192) 2	193) 1	194) 4	195) 1	196) 1	197) 1	198) 1	199) 1	200) 1
201) 2	202) 4	203) 4	204) 3	205) 3	206) 4	207) 3	208) 3	209) 2	210) 2
211) 4	212) 3	213) 1	214) 3	215) 1	216) 3	217) 1	218) 3	219) 3	220) 4
221) 2	222) 1	223) 2	224) 1	225) 1					