# PHYSICS

1) Dimensions ($ML^{-1}T^{-1}$) are related to
   a) torque b) work
   c) energy d) coefficient of viscosity

2) A body is moved along a straight line by a machine delivering a constant power. The distance moved by the body in time 't' is proportional to
   a) $t^{3/4}$ b) $t^{3/2}$
   c) $t^{1/4}$ d) $t^{1/2}$

3) A constant power P is applied to a particle of mass m. The distance travelled by the particle when its velocity increases from $v_1$ to $v_2$ is (neglect friction)
   a) $\frac{m}{3P}\left(v_2^3 - v_1^3\right)$ b) $\frac{m}{3P}\left(v_2 - v_1\right)$
   c) $\frac{3P}{m}\left(v_2^2 - v_1^2\right)$ d) $\frac{m}{3P}\left(v_2^2 - v_1^2\right)$

4) A force is required to break a wire of length l and radius r. What force is required to break a wife, of same material having twice the length and six times the radius?
   a) F b) 3F
   c) 9F d) 36F

5) At time t = 0 a particle starts moving along the x-axis if its kinetic energy increases uniformly with time 't' the net force acting on it must be proportional to
   a) Constant b) t
   c) $\frac{1}{\sqrt{t}}$ d) $\sqrt{t}$

6) A particle of mass 100 g is thrown vertically upwards with a speed of 5 m/s. The work done by the force of gravity during the time the particle goes up is
   a) –0.5 J b) –1.25 J
   c) 1.25 J d) 0.5 J

7) A particle of mass 0.2 kg is moving in one dimension under a force that delivers a constant power 0.5 W to the particle. If the initial speed (in $ms^{-1}$) after 5 s is.
   a) 0.8 m/s b) 4 m/s
   c) 3.6 m/s d) 5 m/s

8) A bomb of mass 3.0 kg explodes in air into two pieces of masses 2.0 kg and 1.0 kg. The smaller mass goes at a speed of 80 m/s. The total energy imparted to the two fragments is
   a) 1.07 kJ b) 2.15 kJ
   c) 2.4 kJ d) 4.8 kJ

9) A round disc of moment of inertia $I_2$ about its axis perpendicular to its plane and passing through its centre is placed over another disc of moment of inertia $I_1$ rotating with an angular velocity ω about the same axis. The final angular velocity of the combination of discs is
   a) $\frac{I_2\omega}{I_1 + I_2}$ b) ω
   c) $\frac{I_2\omega}{I_1 - I_2}$ d) $\frac{(I_1 + I_2)\omega}{I_1}$

10) Gravitational acceleration on the surface of a planet is $\frac{\sqrt{6}}{11}$ g. Where g is the gravitational acceleration on the surface of the earth. The average mass density of the planet is 2/3 times that of the earth. If the escape speed on the surface of the earth is taken to be 11 $kms^{-1}$, the escape speed on the surface of the planet in $kms^{-1}$ will be
   a) 4 b) 6
   c) 3 d) 5

11) Two bodies of masses m and 4 m are placed at a distance r. The gravitational potential at a point on the line joining them where the gravitational field is zero :
   a) $-\frac{4Gm}{r}$ b) $-\frac{6Gm}{r}$
   c) $-\frac{9Gm}{r}$ d) Zero

*Space for Rough Work*

12) If a ball of steel (density $\rho = 7.8$ g cm$^{-3}$) attains a terminal velocity of 10 cm s$^{-1}$ when falling in water (co-efficient of viscosity $\eta_{water}$ = 8.5 × 10$^{-4}$ pa.s), then its terminal velocity in glycerine ($\rho = 1.2$ g cm$^{-3}$, $\eta = 13.2$ Pa.s ) would be nearly
a) 6.25 × 10$^{-4}$ cm s$^{-1}$
b) 6.25 × 10$^{-4}$ cm s$^{-1}$
c) 1.5 × 10$^{-5}$ cm s$^{-1}$
d) 1.6 × 10$^{-5}$ cm s$^{-1}$

13) Two wires are made of the same material and have the same volume. However wire 1 has cross-sectional area A and wire 2 has cross-sectional area 3A. If the length of wire 1 increases by Δx on the applying force F, how much force is needed to stretch wire 2 by the same amount ?
a) 4 F b) 6 F
c) 9 F d) F

14) 0.8 J work is done in rotating a magnet by 60º, placed parallel to a uniform magnetic field. How much work is done in rotating it 30º further ?
a) 0.8 × 107 erg b) 0.8 erg
c) 8 J d) 0.4 J

15) A spherical body of area A and emissivity e = 0.6 is kept inside a perfectly black body. Total heat radiated by the body at temperature T
a) 0.4 AT$^4$ b) 0.8 AT$^4$
c) 0.6 AT$^4$ d) 1.0 AT$^4$

16) The average translational kinetic energy of $O_2$ (relative molar mass 32) molecules at a particular temperature is 0.048 eV. The translational kinetic energy of $N_2$ (relative molar mass 28) molecules in eV at the same temperature is :
a) 0.0015 b) 0.003
c) 0.048 d) 0.768

17) A planet in a distant solar system is 10 times more massive than the earth and its radius is 10times smaller. Given that the escape velocity from the earth is 11 km s$^{-1}$, the escape velocity from the surface of the planet would be
a) 1.1 km s$^{-1}$ b) 11 km s$^{-1}$
c) 110 km s$^{-1}$ d) 0.11km s$^{-1}$

18) The Speed of sound in oxygen ($O_2$) at a certain temperature is 460 ms$^{-1}$. The speed of sound in helium (He) at the same temperature will be (assume both gases to be ideal)
a) 1421 ms$^{-1}$ b) 500 ms$^{-1}$
c) 650 ms$^{-1}$ d) 330 ms$^{-1}$

19) 100 g of water is heated from 30ºC to 50ºC. Ignoring the slight expansion of the water, of the water, the change in its internal energy is (specific heat of water is 4184 J/kg/K)
a) 8.4 kJ b) 84 kJ
c) 2.1 kJ d) 4.2 kJ

20) A particle of mass m executes simple harmonic motion with amplitude a and frequency v. The average kinetic energy during its motion from the position of equilibrium to the end is
a) $2\pi^2ma^2v^2$ b) $\pi^2ma^2v^2$
c) 1/4 $ma^2v^2$ d) $4\pi^2ma^2v^2$

21) If x, v and a denote the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period T, then, which of the following does not change with time?
a) aT/x b) aT + 2πv
c) aT/v d) $a^2T^2 + 4\pi^2v^2$

22) 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 its is in water. The fundamental frequency of the air-column is now:
a) f b) f/2
c) 3f/4 d) 2f

23) The potential difference in open circuit for a cell is 2.2 V. When a 4Ω resistor is connected between its two electrodes the potential difference becomes 2 V. The internal resistance of the cell will be
a) 1 Ω b) 0.2 Ω
c) 2.5 Ω d) 0.4 Ω

24) We wish to see inside an atom. Assuming the atom to have diameter of 100 pm, this means that one must be able to resolve a width of say 10 pm. If an electron microscope is used, the minimum electron energy required is about
a) 1.5 keV b) 15 keV
c) 150 keV d) 1.5 MeV

25) Three concentric metallic spherical shells of radii R, 2R, 3R, are given charge $Q_1$, $Q_2$, $Q_3$, respectively. It is found that the surface change densities on the outer surfaces of the shells Are equal. Then, the ratio of the charges given to the shells $Q_1 : Q_2 : Q_3$ is
a) 1 : 2 : 3 b) 1 : 3 : 5
c) 1 : 4 : 9 d) 1 : 8 : 18

26) Capacitance of a capacitor made by a thin metal foil is 2 μF. If the foil is folded with paper of thickness 0.15 mm, dielectric constant of paper is 2.5 and width of paper is 400 mm, the length of the foil will be
a) 0.34m b) 1.33 m
c) 13.4 m d) 33.9

27) A sheet of aluminium foil of negligible thickness is introduced between the plates of a capacitor. The capacitance of the capacitor.
a) decreases
b) remains unchanged
c) becomes infinite
d) increases

28) An electric wife of resistance R carries a current I. When a magnetic field is applied perpendicular to the wire, the
a) current I will decrease
b) current I will increase
c) resistance R will increase
d) resistance R will decrease

29) A beam of a proton with a velocity $4 \times 10^5$ m/sec enters a uniform magnetic field of 0.3 tesla at an angle of 60° to the magnetic field. Find the radius of the helical path taken by the proton beam.
a) 0.05 m b) 0.12 m
c) 0.021 m d) 0.012 m

30) A particle of mass m and charge q is moving in a region where uniform, constant electric and magnetic fields E and B are present. E and B are parallel to each other. At time t = 0, the velocity $v_0$ of the particle is perpendicular to E. (Assume that its speed is always << c, the speed of light in vacuum.) Find the velocity v of the particle at time t.

a) $\vec{v}_0 \cos\left(\frac{qBt}{m}\right) + \vec{E}\frac{qt}{m} + \frac{(\vec{v}_0 \times \vec{B})}{B}\sin\left(\frac{qBt}{m}\right)$

b) $\vec{v}_0 \cos\left(\frac{qBt}{m}\right) + \vec{E}\frac{qt}{m} - \frac{(\vec{v}_0 \times \vec{B})}{B}\sin\left(\frac{qBt}{m}\right)$

c) $\vec{v}_0 \cos\left(\frac{qt}{Bm}\right) + \vec{E}\frac{qt}{m} - \frac{(\vec{v}_0 \times \vec{B})}{B}\sin\left(\frac{qBt}{m}\right)$

d) $\vec{v}_0 \cos\left(\frac{qBt}{m}\right) + \vec{E}\frac{qt}{m} - \frac{(\vec{v}_0 \times \vec{B})}{B}\sin\left(\frac{qt}{Bm}\right)$

31) A moving coil galvanometer has 48 turns and area of coil is $4 \times 10^{-2}$ m$^2$. If the magnetic field is 0.2 T, then to increase the current sensitivity by 25% without changing area (A) and field (B) the number of turns should become
a) 24 b) 36
c) 60 d) 54

32) Two identical conducting wires AOB and COD are placed at right angles to each other. The wire AOB carries an electric current $I_1$ and COD carries a current $I_2$. The magnetic

field on a point lying at a distance d from O, in a direction perpendicular to the plane of the wires AOB and COD, will be given by

a) $\frac{\mu_0}{2\pi d}(I_1^2 + I_2^2)$ b) $\frac{\mu_0}{2\pi}\left(\frac{I_1 + I_2}{d}\right)^{\frac{1}{2}}$

c) $\frac{\mu_0}{2\pi d}\left(I_1^2 + I_2^2\right)^{\frac{1}{2}}$ d) $\frac{\mu_0}{2\pi d}(I_1 + I_2)$

33) A long straight wire of radius a carries a steady current *i*. The current is uniformly distributed across its cross section. The ratio of the magnetic field at a/2 and 2a is

a) 1/2 b) 1/4
c) 4 d) 1

34) What is self inductance of a coil when a charge of current from 0 to 2A in 0.05 second induces an emf of 40 V in it

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

35) A fully charged capacitor C with initial charge $q_0$ is connected to a coil of self inductance L at t = 0. The time at which the energy is stored equally between the electric and magnetic field.

a) $\frac{\pi}{4}\sqrt{LC}$ b) $2\pi\sqrt{LC}$

c) $\sqrt{LC}$ d) $\pi\sqrt{LC}$

36) The flux linked with a circuit is given by $\phi = t^3 + 3t - 7$. The graph between time (x-axis) and induced emf (y-axis) will be

a) a straight line through the origin
b) straight line with positive intercept
c) straight line with negative intercept
d) parabola not through origin

37) The intensity of radiation emitted by two stars A and B are in the ratio of 16 : 1. The wavelength corresponding to their peak emission of radiation will be in the ratio of

a) 2 : 1 b) 4 : 1
c) 1 : 2 d) 16 : 1

38) A square of side 3 cm is located at a distance 25 cm from a concave mirror of focal length 10 cm. The centre of square is at the axis of mirror. The area enclosed by the image of the square is

a) 4 $cm^2$ b) 6 $cm^2$
c) 16 $cm^2$ d) 36 $cm^2$

39) A spherical black body with a radius of 12 cm radiates 450 W power at 500 K. If the radius were halved and temperature be doubled, the power radiated in watt would be

a) 1800 b) 900
c) 3600 d) 850

40) The wavelengths of the lines emitted in the Lyman series of the spectrum of hydrogen atom correspond to transitions between energy levels and total quantum numbers

a) n = 3 to n = 1
b) n = 3 to n = 2
c) n =4 to n =1
d) n = 4 to n = 2

41) The work function of sodium is 2.3 eV. The threshold wavelength of sodium will be

a) 2900 Å b) 2500 Å
c) 5380 Å d) 2000 Å

42) A radio transmitter operator at a frequency of 880 kHz and power of 10 kW. The number of photons emitted per second is

a) $13.27 \times 10^4$ b) $13.27 \times 10^{34}$
c) $1327 \times 10^{34}$ d) $1.71 \times 10^{31}$

43) An electron, in a hydrogen-like atom, is in an excited state. It has a total energy of –3.4 eV. Calculate. The kinetic energy and the de Broglie wavelength of the electron

a) 3.4eV & $0.66 \times 10^{-9}$m
b) 4.3eV & $0.88 \times 10^{-8}$m
c) 2eV & $1 \times 10^{-9}$m
d) 6.5eV & $0.5 \times 10^{-6}$m

44) As the beam enters the medium, it will
a) diverge
b) converge
c) diverge near the axis and converge near the periphery
d) travel as a cylindrical beam

45) The initial shape of the wavefront of the beam is
a) convex
b) concave
c) convex near the axis and concave
d) planar

46) The speed of the light in the medium is
a) minimum of the axis of the beam
b) the same everywhere in the beam
c) directly proportional to the intensity I
d) maximum on the axis of the beam

47) The rms value of the electric field of the light coming from the sun is 720 N/C. The average total energy density of electromagnetic wave is
a) $4.58 \times 10^{-6}$ J/m$^3$ b) $6.37 \times 10^{-9}$ J/m$^3$
c) $81.35 \times 10^{-12}$ J/m$^3$ d) $3.3 \times 10^{-3}$ J/m$^3$

48) If an electron jumps from the 4th orbit to the 2nd orbit of hydrogen atom, then the frequency of emitted radiation in the hertz will be (Take Rydberg's constant, R = $10^5$ cm$^{-1}$)
a) $3/4 \times 10^{15}$ b) $3/16 \times 10^5$
c) $3/16 \times 10^{15}$ d) $9/16 \times 10^{15}$

49) In a common base mode of a transistor, the collector current is 5.488 mA for an emitter current of 5.60 mA. The value of the base current amplification factor (β) will be
a) 49 b) 50
c) 51 d) 48

50) In a nuclear reaction $^{235}$U undergoes fission liberating 200 MeV of energy. The reactor has a 10% efficiency and produced 1000 MW power. If the reactor is to function for 10 years, find the total mass of uranium required.
a) 38451 kg b) 38466 kg
c) 38441 kg d) 37456 kg

****

*Space for Rough Work*

51. 4.08 g of a mixture of BaO and an unknown carbonate $MCO_3$ was heated strongly. The residue weighed 3.64 g. This was dissolved in 100ml of 1 N HCL. The excess acid required 16 ml of 2.5 N NaOH solution for complete neutralization. Identify the metal M. (At. Wt. H=1, C=12, O=16, Cl=35.5, Ba=138)
a) Ca b) Mg
c) Na d) Cl

52. Study the following table

| Compound (molecular weight) | Weight of compound (in g) taken |
|---|---|
| I. $CO_2$ (44) | 4.4 |
| II. $NO_2$ (46) | 2.3 |
| III. $H_2O_2$ (34) | 6.8 |
| IV. $SO_2$ (64) | 1.6 |

Which two compound have least weight of oxygen ?(molecular weights of compound are given in brackets)
a) II and IV b) I and III
c) I and II d) III and IV

53. A gaseous mixture contains oxygen and nitrogen in the ratio of 1 : 4 by weight. Therefore the ratio of their number of molecules is
a) 1:4 b) 1:8
c) 7:32 d) 3:16

54. If 0.50 mole of $BaCl_2$ is mixed with 0.20 mole of $Na_3PO_4$, the maximum number of moles of $Ba_3(PO_4)_2$ that can be formed is
a) 0.70 b) 0.50
c) 0.20 d) 0.10

55. Which of the following expressions correctly represents the relationship between the average molar kinetic energy, $\overline{KE}$, of CO and $N_2$ molecules at the same temperature?
a) $\overline{KE}_{CO} < \overline{KE}_{N_2}$
b) $\overline{KE}_{CO} > \overline{KE}_{N_2}$
c) $\overline{KE}_{CO} = \overline{KE}_{N_2}$
d) cannot be predicted unless volumes of the gases are given

56. The ratio of the rate of diffusion of helium and methane under identical condition of pressure and temperature will be
a) 4 b) 0.2
c) 2 d) 0.5

57. An element, X has the following isotopic composition:
$^{200}X$ : 90%
$^{199}X$ : 8.0%
$^{202}X$ : 2.0%
The weighted average atomic mass of the naturally occurring element X is closest to
a) 200u b) 201u
c) 202u d) 199u

58. The bohr orbit radius for the hydrogen atom (n = 1) is approximately 0.530A° the radius for the first excited state (n=2) orbit is (in A°)
a) 0.13 b) 1.06
c) 4.77 d) 2.17

59. Correct set of four quantum number for the valence (outermost) electron of rubidium (Z= 37) is :
a) 5,0,0,+1/2 b) 5,1,0,+1/2
c) 5,1,1,+1/2 d) 6,0,0,+1/2

60. The correct order of C—O bond length among CO, $CO_3^{2-}$, $CO_2$ is
a) $CO < CO_3^{2-} < Co_2$
b) $CO_3^{2-} < CO_2 < CO$
c) $CO < CO_2 < Co_3^{2-}$
d) $CO_2 < CO_3^{2-} < CO$

61. The bond length of HCL molecule is 1.275Å and its dipole moment is 1.03D. the ionic character of the molecule (in percent) (charge of the electron = $4.8 \times 10^{-10}$ esu) is
a) 100 b) 67.3
c) 33.66 d) 16.83

62. Match the list-I (Equations) with list-II (type of processes) and select the correct option.

| List I Equation | List II |
|---|---|
| Non spontaneous | Type of Processes |
| (1) $Kp > Q$ | (i) Non spontaneous |
| (2) $\Delta G^\circ < RT \ln Q$ | (ii) Equilibrium |

(3) $Kp = Q$ (iii) Spontaneous & endothermic

(4) $T > \frac{\Delta H}{\Delta S}$ (iv) Spontaneous

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| a) | (ii) | (i) | (iv) | (iii) |
| b) | (i) | (ii) | (iii) | (iv) |
| c) | (iii) | (iv) | (ii) | (i) |
| d) | (iv) | (i) | (ii) | (iii) |

63. One mole of an ideal gas at 300k is expanded isothermally from an initial volume of 1 litre to 10 litres. The ΔE for this process is (R=2 cal. $mol^{-1}$ $K^{-1}$)
a) 163.7 cal b) zero
c) 1381.1 cal d) 9 lit.atm

64. the vapour pressure of solvent decrease by 10mm of a mercury when a non volatile solute was added to the solvent . the mole fraction of the solute in the solution is 0.2.what should be the mole fraction of the solvent if the decrease in the vapour pressure is to be 20mm of mercury?
a) 0.8 b) 0.6
c) 0.4 d) 0.2

65. A solution contain $1.2046 \times 10^{24}$ hydrochloric acid molecules in 1 $dm^3$ of the solution . the strength of the solution is
a) 6N b) 2N
c) 4N d) 8N

66. At 25ºC, the dissociation of a base, BOH, is $1.0 \times 10^{-12}$. The concentration of hydroxyl ions in 0.01 M aqueous solution of the base would be
a) $1.0 \times 10^{-5}$ mol $L^{-1}$
b) $1.0 \times 10^{-6}$ mol $L^{-1}$
c) $2.0 \times 10^{-6}$ mol $L^{-1}$
d) $1.0 \times 10^{-7}$ mol $L^{-1}$

67. Which of the following solution will have pH close to 1.0?
a) 100 ml of (M/10)HCL + 100 ml (M/10) NaOH
b) 55 ml of (M/10)HCL + 45 ml (M/10)NaOH
c) 10 ml of (M/10)HCL + 90 ml (M/10) NaOH
d) 75 ml of (M/5)HCL + 25 ml (M/5) NaOH

68. Zn gives $H_2$ gas with $H_2SO_4$ and HCL but not with $HNO_3$ because
a) Zn acts as oxidizing agent when it react with $HNO_3$
b) $HNO_3$ is weaker acid than $H_2SO_4$ and HCL
c) In electrochemical series, Zn is above hydrogen
d) $NO_3^{\ominus}$ is reduced in preference to hydronium ion

69. $Cu^{2+} + Ag \longrightarrow Cu + Ag^{+}$ oxidation half-reaction is
a) $Cu^{2+} \longrightarrow Cu$
b) $Ag \longrightarrow Ag^{+}$
c) $Cu \longrightarrow Cu^{2+}$
d) All of these

70. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation $k = Ae^{-E_a/RT}$. Activation energy ($E_a$) of the reaction can be calculated by plotting
a) log k vs T b) log k vs 1/T
c) k vs T d) k vs 1/logT

71. In the reaction

$$BrO_3^-(aq) + 5Br^-(aq) + 6H^+ \rightarrow 3Br_2(l) + 3H_2O(l)$$

The rate of appearance of bromine ($Br_2$) is related to rate of disappearance of the bromide ions as following

a) $\frac{d[Br_2]}{dt} = -\frac{3}{5}\frac{d[Br^-]}{dt}$

b) $\frac{d[Br_2]}{dt} = \frac{5}{3}\frac{d[Br^-]}{dt}$

c) $\frac{d[Br_2]}{dt} = -\frac{5}{3}\frac{d[Br^-]}{dt}$

d) $\frac{d[Br_2]}{dt} = \frac{3}{5}\frac{d[Br^-]}{dt}$

72. According to the adsorption theory of catalysis, the speed of the reaction increases because-
a) Adsorption lowers the activation energy of the reaction
b) The concentration of reactant molecules at the active centers of the catalyst becomes high due to strong adsorption
c) In the process of adsorption , the activation energy of the molecules becomes large
d) Adsorption produces heat which increases the speed of the reaction

73. The protecting power of lyophilic colloidal sol is expressed in terms of:
a) Coagulation value
b) Gold number
c) Critical miscelle concentration
d) Oxidation number

74. Among the following, the number of elements showing only one non-zero oxidation state is O, Cl, F, N, P, Sn, Tl, Na, Ti
a) 1 b) 2
c) 3 d) 4

75. Total number of rare earth element is
a) 8 b) 32
c) 14 d) 10

76. Which of the following pair of metals is purified by van arkel method?
a) Ni and Fe b) Ga and In
c) Zr and Ti d) Ag and Au

77. Among the following statements, the incorrect one is
a) Calamine and siderite are carbonates
b) Argentite and cuprite are oxide
c) Zinc blende and pyrites are sulphides
d) Malachite and azurite are ores of copper

78. The hydride ion, $H^-$ is a stronger base than the hydroxide ion. $OH^-$ .which of the following reactions will occur if sodium hydride (NaH) is dissolved in water?
a) $H^-(aq) + H_2O(l) \rightarrow H_3O^-(aq)$
b) $H^-(aq) + H_2O(l) \rightarrow OH^-(aq) + H_2(g)$
c) $H^-(aq) + H_2O(l) \rightarrow OH^-(aq) + 2H^+(aq) + 2e$
d) $H^-(aq) + H_2O(l) \rightarrow$ No reaction

79. The formula of exhausted permutit is
a) $CaAl_2Si_2O_8 \cdot xH_2O$
b) $Na_2Al_2Si_2O_8 \cdot xH_2O$
c) $CaB_2Si_2O_8 \cdot xH_2O$
d) $K_2Al_2Si_2O_8 \cdot xH_2O$

80. The alkali metals form salt-like hydride by the direct synthesis at elevated temperature. The thermal stability of these hydrides decreases in which of the following order?
a) CsH > RbH > KH > NaH > LiH
b) KH > NaH > LiH > CsH > RbH
c) NaH > LiH > KH > RbH > CsH
d) LiH > NaH > KH > RbH > CSH

81. The main product obtained when a solution of sodium carbonate reacts with mercuric chloride is
a) $Hg(OH)_2$ b) $HgCO_3 \cdot HgO$
c) $HgCO_3$ d) $HgCO_3 \cdot Hg(OH)_2$

82. Which one of the following is the correct statement?
a) Boric acid is a protonic acid
b) Beryllium exhibits coordination number of six
c) Chlorides of both beryllium and aluminium have bridged chloride structures in solid phase
d) $B_2H_6 \cdot 2NH_3$ is known as inorganic benzene

83. Glass reacts with HF to produce
a) $SiF_4$ b) $H_2SiF_6$
c) $H_2SiO_3$ d) $Na_3AlF_6$

84. The transition element have a general electronic configuration
a) $ns^2, np^6, nd^{1-10}$
b) $(n-1)d^{1-10}, ns^{0-2}, np^{0-6}$
c) $(n-1)d^{1-10}, ns^{1-2}$
d) $nd^{1-10}, ns^{-2}$

*Space for Rough Work*

85. Identify the correct statement of the following
a) Lanthanoid contraction is the accumulation of successive shrinkages
b) As a result of lanthanoid contraction, the properties of 4d series of the transition elements have no similarities with the 5d series of elements
c) Shielding power of 4f electrons is quite weak.
d) There is a decrease in the radii of the atoms or ions as one proceeds from La to Lu

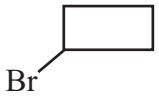
86. The ionization isomer of $[Cr(H_2O)_4\ Cl(NO_2)\ C]$ is
a) $[Cr(H_2O)_4\ (O_2N)]Cl_2$
b) $[Cr(H_2O)_4\ Cl_2]\ (No_2)$
c) $[Cr(H_2O)_4\ Cl\ (ONO)]Cl$
d) $[Cr(H_2O)_4\ Cl_2\ (NO_2)] \cdot H_2O$

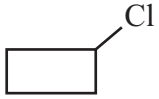
87. The hypothetical complex chlorodiaquotrimmine cobalt (III) chloride can be represented as
a) $[CoCl(NH_3)_3\ (H_2O)_2]\ Cl_2$
b) $[Co(NH_3)_3\ (H_2O)Cl_3]$
c) $[Co(NH_2)_3\ (H_2O)_2\ Cl]$
d) $[Co(NH_3)_3\ (H_2O)_3]\ Cl_3$

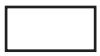
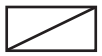
88. Roasting of sulphides gives the gas X as a by product. This is colorless gas with choking smell of burnt sulphur and caused great damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic ,acts as a reducing agent and its has never been isolated. The gas X is:
a) $SO_2$ b) $Co_2$
c) $SO_3$ d) $H_2S$

89. The process of 'eutrophication' is due to
a) Increase in concentration of insecticide in water
b) Increase in concentration of fluride ion in water.
c) The reduction in concentration of the dissolved oxygen in water due to phosphate pollution in water
d) Attack of younger leaves of a plant by peroxyacetyl nitrate

90. The maximum Number of isomers for an alkene with the molecular formula $C_4H_8$ is
a) 2 b) 3
c) 4 d) 5

91. What would be the product formed when 1-bromo-3-chlorocyclobutane react with two equivalents of metallic sodium in ether?
a) 

b) 

c) 
d) 

92. The major product obtain on treatment of $CH_3CH_2CH(F)CH_3$ with $CH_3O^-/CH_3OH$ is
a) $CH_3CH_2CH(OCH_3)CH_3$
b) $CH_3CH{=}CHCH_3$
c) $CH_3CH_2CH{=}CH_2$
d) $CH_3CH_2CH_2CH_2OCH_3$

93. Compound 'A' (Molecular formula $C_3H_8O$) is treated with acidified potassium dichromate a product 'B' (Molecular formula $C_3H_6O$). 'B' forms a shining silver mirror on warning with ammonical silver nitrate. 'B' when treated with an aqueous solution of $H_2\ NCONHNH_2$. HCL and sodium acetate gives a product ' C ' identify the structure of 'C'.
a) $CH_3CH_2CH{=}NNHCONH_2$
b) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}{=}NNHCONH_2$
c) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}{=}NCONHNH_2$
d) $CH_3CH_2{=}NCONHNH_2$

94. Write the structure of the foul smelling compound obtained when aniline is treated with chloroform in the presence of KOH.
a) PhNC b) PhCl
c) PhOH d) PhNo3

*Space for Rough Work*

95 .Which of the following statement is not true?

a) The vulcanization, the formation of sulphur bridges between different chain make rubber harder and stronger.

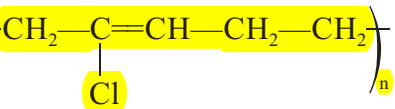
b) Natural rubber has the trans configuration at every double bond

c) Buna-S is a copolymer of butadiene and styrene.

d) Natural rubber is a 1,4-polymer of isoprene.

96) Structure of some common polymer are given. Which one is not correctly presented?

a) Teflon $-(-CF_2—CF_2-)_n-$

b) Neoprene 

c) Terylene 

d) Nylon-66 $-(-NH(CH_2)_6NHCO(CH_2)_4-CO-)_2-$

97) A certain compound gives negative test with ninhydrin and positive test with benedict's solution. The compound is

a) protein b) monosaccharide

c) lipid d) amino acid

98) Which of the following is correct about H bonding in nucleotide?

a) A---A and T---T

b) G---T and A---C

C) A---G and T---C

d) A---T and G---C

99) Which of the following is pheromone?

a) Linalool b) Disparlure

c) BHA d) Alifame

100. The statement which is not correct, is

a) Chlorophyll is responsible for the synthesis of carbohydrates in plants

b) The compound formed by the addition of oxygen to haemoglobin is called oxyhaemoglobin

c) acetyl salicyclic acid is known as aspirin

d) the metal ion present in vitamin $B_{12}$ is $Mg^{2+}$

****

*Space for Rough Work*

101) The general solution of $\sin x - 3\sin 2x + \sin 3x = \cos x - 3\cos 2x + \cos 3x$ is

a) $n\pi + \frac{\pi}{8}$ b) $\frac{n\pi}{2} + \frac{\pi}{8}$

c) $(-1)^n \frac{n\pi}{2} + \frac{\pi}{8}$ d) $2n\pi + \cos^{-1}\frac{3}{2}$

102) The graph of the function $y = f(x)$ is symmetrical about the line $x = 2$, then

a) $f(x+2) = f(x-2)$

b) $f(2+x) = f(2-x)$

c) $f(x) = f(-x)$

d) $f(x) = -f(-x)$

103) Domain of definition of the function $f(x) = \frac{3}{4-x^2} + \log_{10}(x^3 - x)$, is

a) $(1, 2)$

b) $(-1, 0) \cup (1, 2)$

c) $(1, 2) \cup (2, \infty)$

d) $(-1, 0) \cup (1, 2) \cup (2, \infty)$

104) Let $f(\theta) = \sin\theta(\sin\theta + \sin 3\theta)$. Then $f(\theta)$ is

a) $\geq 0$ only when $\theta \geq 0$

b) $\leq 0$ for all real $\theta$

c) $\geq 0$ for all real $\theta$

d) $\leq 0$ only when $\theta \leq 0$

105) The number of integral values of $k$ for which the equation $7\cos x + 5\sin x = 2k + 1$ has a solution is

a) 4 b) 8

c) 10 d) 12

106) The equation of the circumcircle of the triangle formed by the lines $x = 0$, $y = 0$, $2x + 3y = 5$ is :

a) $6(x^2 + y^2) + 5(3x - 2y) = 0$

b) $x^2 + y^2 - 2x - 3y + 5 = 0$

c) $x^2 + y^2 + 2x - 3y - 5 = 0$

d) $6(x^2 + y^2) - 5(3x + 2y) = 0$

107) If $z = x - iy$ and $z^{1/3} = p + iq$, then $\left(\frac{x}{p} + \frac{y}{q}\right) \Big/ (p^2 + q^2)$ is equal to

a) 1 b) –1

c) 2 d) –2

108) The sum of the first $n$ terms of the series $1^2 + 2.2^2 + 3^2 + 2.4^2 + 5^2 + 2.6^2 + \ldots$ is $\frac{n(n+1)^2}{2}$ when $n$ is even. When $n$ is odd the sum is

a) $\frac{3n(n+1)}{2}$ b) $\frac{n^2(n+1)}{2}$

c) $\frac{n(n+1)^2}{4}$ d) $\left[\frac{n(n+1)}{2}\right]^2$

109) If $a$, $b$, $c$ are in AP, then $\frac{a}{bc}, \frac{1}{c}, \frac{2}{b}$ are in :

a) AP b) GP

c) HP d) none of these

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

a) ${}^{2n}G_n$ b) ${}^{2n}G_{n+1}$

c) ${}^{2n}G_{n-1}$ d) ${}^{2n}G_{2n-1}$

111) From 6 different novels and 3 different dictionaries, 4 novels and 1 dictionary are to be selected and arranged in a row on the shelf so that the dictionary is always in the middle. Then, the number of such arrangements is

a) at least 500 but less than 750

b) at least 750 but less than 1000

c) at least 1000

d) less than 500

112) If in a frequency distribution, the mean and median are 21 and 22 respectively, then its mode is approximately

a) 24.0 b) 25.5

c) 20.5 d) 22.0

113) The mean and variance of a random variable X having a binomial distribution are 4 and 2

respectively, then P(X = 1) is

a) 1/32 b) 1/16

c) 1/8 d) 1/4

114) A man takes a step forward with probability 0.4 and backwards with probability 0.6. Find the probability that at the end of eleven steps he is one step away from the starting point.

a) 0.25 b) 0.15

c) 0.57 d) 0.37

115) Six boys and six girls sit in a row randomly. Find the probability that the six girls sit together and the boys and girls sit alternately.

a) 1/462, 1/132 b) 1/162, 1/132

c) 1/122, 1/133 d) 1/132, 1/462

116) The system of equations

$$\alpha x + y + z = \alpha - 1$$
$$x + \alpha y + z = a - 1$$
$$x + y + \alpha z = \alpha - 1$$

has no solution, if $\alpha$ is

a) 1 b) not –2

c) either –2 or 1 d) –2

117) Let $A = \begin{vmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{vmatrix}$

If $|A^2| = 25$, then $|\alpha|$ equals

a) $5^2$ b) 1

c) 1/5 d) 5

118) If the system of linear equations

$$x + 2ay + az = 0$$
$$x + 3by + bz = 0$$
$$\text{and } x + 4cy + cz = 0$$

has a non-zero solution, then $a$, $b$, $c$

a) are in AP

b) are in GP

c) are in HP

d) satisfy $a + 2b + 3c = 0$

119) $\lim_{x \to 0} x \log \sin x$ is equal to :

a) zero

b) $\infty$

c) 1

d) cannot be determined

120) If $\sin^{-1}\left(\frac{x}{5}\right) + \text{cosec}^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then a value of $x$ is

a) 1 b) 3

c) 4 d) 5

121) If $\sin(\alpha + \beta) = 1$, $\sin(\alpha - \beta) = 1/2$, then $\tan(\alpha + 2\beta) \tan(2\alpha + \beta)$ is equal to

a) 1 b) –1

c) zero d) none of these

122) The number of values of $x$ in the interval $[0, 3\pi]$ satisfying the equation $2 \sin^2 x + 5 \sin x - 3 = 0$ is

a) 6 b) 1

c) 2 d) 4

123) Solve for $x$;

$$(5 + 2\sqrt{6})^{x^2-3} + (5 - 2\sqrt{6})^{x^2-3} = 10$$

a) $\pm\sqrt{3}, \pm\sqrt{2}$ b) $\pm\sqrt{2}, \pm\sqrt{2}$

c) $\pm\sqrt{2}, \pm 2$ d) $\pm 2, \pm\sqrt{2}$

124) Find the solution set of the system

$$x + 2y + z = 1;$$
$$2x - 3y - w = 2;$$
$$x \geq 0; y \geq 0; z \geq 0; w \geq 0.$$

a) x = 0, y = 1, z = 0, w = 0

b) x = 1, y = 0, z = 0, w = 0

c) x = 0, y = 0, z = 1, w = 0

d) x = 0, y = 0, z = 0, w = 1

1 25) If $x^m y^n = (x + y)^{m+n}$, then $dy/dx$ is

a) $\frac{x+y}{xy}$ b) $xy$

*Space for Rough Work*

c) $\frac{x}{y}$ d) $\frac{y}{x}$

126) The function $f(x) = \cot^{-1} x + x$ increases in the interval

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

c) $(-\infty, \infty)$ d) $(0, \infty)$

127) If $\lim_{x\to 0} \frac{\log(3+x) - \log(3-x)}{x} = k$, the value of $k$ is

a) 0 b) –1/3

c) 2/3 d) –2/3

128) $\int_0^{\pi} [\cot x]\,dx$, $[.]$ denotes the greatest integer function, is equal to

a) π/2 b) 1

c) –1 d) – π/2

129) The value of the integral $I = \int_0^1 x(1-x)^n\,dx$ is

a) $\frac{1}{n+1}$ b) $\frac{1}{n+2}$

c) $\frac{1}{n+1} - \frac{1}{n+2}$ d) $\frac{1}{n+1} + \frac{1}{n+2}$

130) $\lim_{x\to\infty} \sum_{r=1}^{n} \frac{1}{n} e^{r/n}$ is

a) $e$ b) $e - 1$

c) $1 - e$ d) $e + 1$

131) Evaluate $\int \frac{(x+1)}{x(1+xe^x)^2}\,dx$.

a) $\log[(1+xe^x)/xe^x] + 1/(1+xe^x) + c$

b) $\log[(1+xe^x)/xe^x] - 1/(1+xe^x) + c$

c) $\log[(1+xe^x)/xe^x] - 1/(1+e^x) + c$

d) $\log[(1+e^x)/xe^x] + 1/(1+xe^x) + 5c$

132) If $\overrightarrow{AB} \times \overrightarrow{AC} = 2\hat{i} - 4\hat{j} + 4\hat{k}$, then the area of ΔABC is :

a) 3 sq unit b) 4 sq unit

c) 16 sq unit d) 9 sq unit

133) If f $(a + b - x) = f(x)$, then $\int_a^b xf(x)dx$ is equal to

a) $\frac{a+b}{2}\int_a^b (b-x)dx$

b) $\frac{a+b}{2}\int_a^b f(x)dx$

c) $\frac{b-a}{2}\int_a^b f(x)dx$

d) $\frac{a+b}{2}\int_a^b f(a+b+x)dx$

134) Find the value of $\int_{-1}^{3/2} |x \sin mx|\,dx$

a) $2/\pi + 1/\pi^2$ b) $3/\pi + 1/\pi^2$

c) $2/\pi + 1/\pi^3$ d) $3/\pi + 1/\pi^3$

135) Compute the area of the region bounded by the curves $y = ex\,In\,x$ and $y = \frac{In\,x}{ex}$ where $In\,e = 1$.

a) $(e^2 - 4)/4e$ b) $(e^2 - 5)/4e$

c) $(e^3 - 4)/4e$ d) $(e^3 - 5)/4e$

136) Find the area bounded by the curves $x^2 = y$, $x^2 = -y$, and $y^2 = 4x - 3$.

a) 1/2 sq unit b) 1/3 sq unit

c) 1/4 sq unit d) 2/5 sq unit

137) The solution of the differential equation $y\,dx + (x + x^2y)\,dy = 0$ is

a) $-\frac{1}{xy} = c$ b) $-\frac{1}{xy} + \log y = c$

c) $\frac{1}{xy} + \log y = c$ d) $\log y = cx$

138) Solution of the differential equation $\cos x\,dy = y(\sin x - y)\,dx$, $0 < x < \pi/2$, is

a) $\sec x = (\tan x + c)\,y$

b) $y \sec x = \tan x + c$

c) $y \tan x = \sec x + c$

d) $\tan x = (\sec x + c)\,y$

139) The solution of the differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is :

a) $y = e^{x-y} - x^2 e^{-y} + c$

b) $e^y - e^x = 1/3x^3 + c$

c) $e^x + e^y = 1/3x^3 + c$

d) $e^x - e^y = 1/3x^3 + c$

140) If the pair of straight lines $x^2 - 2pxy - y^2 = 0$ and $x^2 - 2qxy - y^2 = 0$ be such that each pair bisects the angle between the other pair, then

a) $p = q$ b) $p = -q$

c) $pq = 1$ d) $pq = -1$

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

a) $x^2 + y^2 + 2x - 2y = 62$

b) $x^2 + y^2 + 2x - 2y = 47$

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

d) $x^2 + y^2 - 2x + 2y = 62$

142) The equation of the circle passing through the point (1, 0) and (0, 1) and having the smallest radius is

a) $x^2 + y^2 + x + y - 2 = 0$

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

c) $x^2 + y^2 - x - y = 0$

d) $x^2 + y^2 + 2x + 2y - 7 = 0$

143) A straight line through the point A(3, 4) is such that its intercept between the axes is bisected at A. Its equation is

a) $3x - 4y + 7 = 0$ b) $4x + 3y = 24$

c) $3x + 4y = 25$ d) $x + y = 7$

144) For the hyperbola $\frac{x^2}{\cos^2\alpha} - \frac{y^2}{\sin^2\alpha} = 1$, which of the following remains constant when $\alpha$ varies ?

a) Eccentricity

b) Directrix

c) Abscissae of vartices

d) Abscissae of foci

145) The centre of the circle given by $\vec{r}\cdot(\hat{i}+2\hat{j}+2\hat{k}) = 15$ and $|\vec{r} - (\hat{j}+2\hat{k})| = 4$ is

a) (0, 1, 2) b) (1, 3, 4)

c) (–1, 3, 4) d) none of these

146) The image of the point (–1, 3, 4) in the plane $x - 2y = 0$ is

a) (15, 11, 4) b) (–17/3, –19/3, 1)

c) (8, 4, 4) d) (9/5, –13/5, 4)

147) The distance of the point (1, –5, 9) from the plane $x - y + z = 5$ measured along a straight line $x = y = z$ is

a) $3\sqrt{5}$ b) $10\sqrt{3}$

c) $5\sqrt{3}$ d) $3\sqrt{10}$

148) The distance between the line $\vec{r} = 2\hat{i} - 2\hat{j} + 3\hat{k} + \lambda(\hat{i} - \hat{j} + 4\hat{k})$ and the plane $\vec{r}\cdot(\hat{i} + 5\hat{j} + \hat{k}) = 5$ is

a) 10/3 b) 3/10

c) $\frac{10}{3\sqrt{3}}$ d) 10/9

149) If $\vec{u}, \vec{v}, \vec{w}$ are non-coplanar vectors and p, q are real numbers, then the equality $[3\vec{u}\ p\vec{v}\ p\vec{w}] - [p\vec{v}\ \vec{w}\ q\vec{u}] - [2\vec{w}\ q\vec{v}\ q\vec{u}] = 0$ holds for

a) exactly two values of $(p, q)$

b) more than two but not all values of $(p, q)$

c) all values of $(p, q)$

d) exactly one value of $(p, q)$

150) If $\vec{u}, \vec{v}$ and $\vec{w}$ are three non-coplanar vectors, then $(\vec{u} + \vec{v} - \vec{w})\cdot[(\vec{u} - \vec{v}) \times (\vec{v} - \vec{w})]$ equals

a) 0 b) $\vec{u}\cdot\vec{v}\times\vec{w}$

c) $\vec{u}\cdot\vec{w}\times\vec{v}$ d) $3\vec{u}\cdot\vec{v}\times\vec{w}$

*Space for Rough Work*