## Single Correct Answer Type

1. Given, potential difference $V=(8 \pm 0.5)$ volt and current $I = (2 \pm 0.2)$A. The value of resistance R is
   a) $4 \pm 16.25\%$ b) $4 \pm 6.25\%$
   c) $4 \pm 10\%$ d) $4 \pm 8\%$

2. The units of modulus rigidity are
   a) $N - m$ b) N/m c) $N - m^2$ d) N/m^2

3. A point initially at rest moves along x-axis. Its acceleration varies with time as $a = (6t + 5)$in ms^{-2}. It starts from origin, the distance covered in 1 s is
   a) 3 m   b) 3.5 m   c) 4 m   d) 4.5 m

4. The magnitudes of the two vectors $\vec{a}$ and $\vec{b}$ are a and b respectively. The vector product of $\vec{a}$ and $\vec{b}$ cannot be
   a) equal to zero
   b) less than ab
   c) equal to ab
   d) greater than ab

5. Neglecting the air resistance, the time of flight of a projectile is determined by
   a) $U_{vertical}$
   b) $U_{horizontal}$
   c) $U = U_{vertical}^2 + U_{horizontal}^2$
   d) $U = U(U_{vertical}^2 + U_{horizontal}^2)^{1/2}$

6. In the figure, the ball A is released from rest when the spring is at its natural length. For the block B of mass M to leave contact with the ground at same stage, the minimum mass of A must be
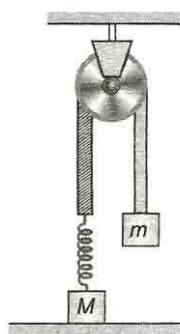
   a) $2M$
   b) M
   c) $\dfrac{M}{2}$

d) A function of M and the force constant of the spring

7. A mass of 6 kg is suspended by a rope of length 2 m from a ceiling. A force of 50 N is applied in the horizontal direction at the mid-point of the rope. The angel made by the rope, with the vertical, in equilibrium position will be (take $g = 10$ ms^{-2}, neglect the mass of the rope)
   a) 90°   b) 60°   c) 50°   d) 40°

8. A uniform chain of length $2m$ is kept on a table such that a length of $60\ cm$ hangs freely from the edge of the table. The total mass of the chain is $4kg$. What is the work done in pulling the entire chain on the table
   a) 7.2 J b) 3.6 J c) 120 J d) 1200 J

9. A drum of radius R and mass M, rolls down without slipping along an inclined plane of angle θ. The frictional force
   a) Converts translational energy to rotational energy
   b) Dissipates energy as heat
   c) Decreases the rotational motion
   d) Decreases the rotational and translational motions

10. A particle of mass m moves along line PC with velocity v as shown. What is the angular momentum of the particle about O
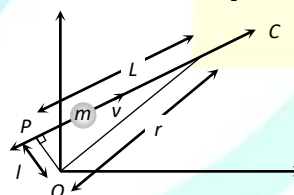
   a) mvL b) mvl c) mvr d) Zero

11. The weight of a body on surface of earth is 12.6 N. When it is raised to a height half the radius of earth its weight will be
   a) 2.8 N   b) 5.6 N   c) 12.5 N   d) 25. 2N

12. A wire of length L is hanging from a fixed support. The length changes to L_1 and L_2 when masses M_1 and M_2 are suspended respectively from its free end. Then L is equal to
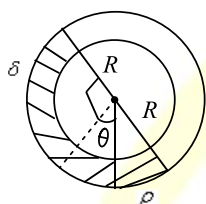   a) $\dfrac{L_1 + L_2}{2}$ b) $\sqrt{L_1 L_2}$

c) $\dfrac{L_1 M_2 + L_2 M_1}{M_1 + M_2}$ d) $\dfrac{L_1 M_2 - L_2 M_1}{M_2 + M_1}$

13. A wooden ball of density ρ is immersed in water of density ρ_0 to depth h and then released. The height H above the surface of water upto which the ball jump out of water is

   a) Zero b) h c) $\dfrac{\rho_0 h}{\rho}$ d) $\left(\dfrac{\rho_0}{\rho} - 1\right) h$

14. A uniform long tube is bent into a circle of radius R and it lies in a vertical plane. Two liquids of same volume but densities ρ and δ fill half the tube. The angle θ is


   a) $\tan^{-1}\left(\dfrac{\rho - \delta}{\rho + \delta}\right)$ b) $\tan^{-1}\dfrac{\rho}{\delta}$

   c) $\tan^{-1}\dfrac{\delta}{\rho}$ d) $\tan^{-1}\left(\dfrac{\rho + \delta}{\rho - \delta}\right)$

15. A black body at a temperature of $227°C$ radiates heat at the rate of $5\ \text{calcm}^{-2}\text{s}^{-1}$. At a temperature of $727°C$ the rate of heat radiated per unit area in $\text{calcm}^{-2}\text{s}^{-1}$ is

   a) 400 b) 80 c) 40 d) 15

16. In a mechanical refrigerator, the low temperature coils are at a temperature of $-23°C$ and the compressed gas in the condenser has a temperature of $27°C$. The theoretical coefficient of performance is

   a) 5 b) 8 c) 6 d) 6.5

17. Following figure shows an adiabatic cylindrical container of volume V_0 divided by an adiabatic smooth piston (area of cross-section $= A$) in two equal parts. An ideal gas $(C_P/C_V = \gamma)$ is at pressure P_1 and temperature T_1 in left part and gas of pressure P_2 and temperature T_2 in right part. The piston is slowly displaced and released at a position where it can stay in equilibrium. The final pressure of the two parts will be

   (Suppose $x = $ displacement of the piston)
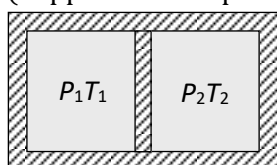
   a) P_2 b) P_1

c) $\dfrac{P_1 \left(\frac{V_0}{2}\right)^\gamma}{\left(\frac{V_0}{2} + Ax\right)^\gamma}$ d) $\dfrac{P_2 \left(\frac{V_0}{2}\right)^\gamma}{\left(\frac{V_0}{2} + Ax\right)^\gamma}$

18. Six moles of O_2 gas is heated from $20°C$ to $35°C$ at constant volume. If specific heat capacity at constant pressure is 8 cal $\text{mol}^{-1} - \text{K}^{-1}$ and $R = 8.31\ \text{Jmol}^{-1} - \text{K}^{-1}$, what is change in internal energy of gas?

   a) 180 cal b) 300 cal c) 360 cal d) 540 cal

19. A mass $m = 100\ g$ is attached at the end of a light spring which oscillates on a frictionless horizontal table with an amplitude equal to $0.16\ metre$ and time period equal to $2\ sec$. Initially the mass is released from rest at $t = 0$ and displacement $x = -0.16\ metre$. The expression for the displacement of the mass at any time t is

   a) $x = 0.16 \cos(\pi t)$
   b) $x = -0.16 \cos(\pi t)$
   c) $x = 0.16 \sin(\pi t + \pi)$
   d) $x = -0.16 \sin(\pi t + \pi)$

20. The displacement of a particle along the x axis is given by $x = a \sin^2 \omega t$. The motion of the particle corresponds to
   a) Simple harmonic motion of frequency $\omega/2\pi$
   b) Simple harmonic motion of frequency ω/π
   c) Simple harmonic motion of frequency $3\omega/2\pi$
   d) Non simple harmonic motion

21. The wavelength of ultrasonic waves in air is of the order of
   a) $5 \times 10^{-1} cm$ b) $5 \times 10^{-3} cm$
   c) $5 \times 10^1 cm$ d) $5 \times 10^3 cm$

22. Two point charges $+3\mu C$ and $+8\mu C$ repel each other with a force of 40 N. If a charge of $+5\mu C$ is added to each of them, then the force between them will become
   a) -10 N b) $+10$ N c) $+20$ N d) -20 N

23. Let E_a be the electric field due to a dipole in its axial plane distant l and let E_q be the field in the equatorial plane distant l', then the relation between E_a and E_q will be
   a) $E_a = 4E_q$ b) $E_q = 2E_a$
   c) $E_a = 2E_q$ d) $E_q = 3E_a$

24. If the plates of a parallel plate capacitor are not equal in area, then quantity of charge
   a) On the plates will be same but nature of charge will differ
   b) On the plates as well as nature of charge will

be different
c) On the plates will be different but nature of charge will be same
d) As well as nature of charge will be same

25. What is the reading of voltmeter in the following figure
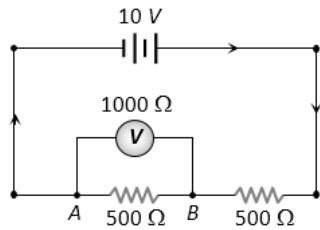
a) $3\,V$ b) $2\,V$ c) $5\,V$ d) $4\,V$

26. Combination of two identical capacitors, a resistor R and a DC voltage source of voltage 6 V is used in an experiment on $C - R$ circuit. It is found that for a parallel combination of the capacitor the time in which the voltage of the fully charged combination reduces to half its original voltage is 10s. For series combination the time needed for reducing the voltage of the fully charged series combination by half is
a) 200s   b) 10s   c) 5s   d) 2.5s

27. A potentiometer wire of length L and resistance 10 Ω is connected in series with a battery of e.m.f. 2.5 V and a resistance in its primary circuit. The null point corresponding to a cell of e.m.f. $1V$ is obtained at a distance $\frac{L}{2}$. If the resistance in the primary circuit is doubled then the position of new null point will be
a) 0.4 L b) 0.5 L c) 0.6 L d) 0.8 L

28. The ratio of the magnetic field at the centre of a current carrying circular wire and the magnetic field at the centre of a square coil made from the same length of wire will be
a) $\dfrac{\pi^2}{4\sqrt{2}}$ b) $\dfrac{\pi^2}{8\sqrt{2}}$ c) $\dfrac{\pi}{2\sqrt{2}}$ d) $\dfrac{\pi}{4\sqrt{2}}$

29. What happens to the force between magnetic poles when their pole strength and the distance between them are both doubled
a) Force increases to two times the previous value
b) No change
c) Force decreases to half the previous value
d) Force increases to four times the previous value

30. The correct measure of magnetic hardness of a material is
a) Remanant magnetism

b) Hysterses loss
c) Coercivity
d) Curie temperature

31. A square loop of side 22 cm is converted into circular loop in 0.4s. A uniform magnetic field of 0.2 T directed normal to the loop then the emf induced in the loop is
a) $6.6 \times 10^{-3}\ V$ b) $6.6 \times 10^{-5}\ V$
c) $4.6 \times 10^{-4}\ V$ d) $4.60 \times 10^{-8}\ V$

32. In AC circuit in which inductance and capacitance are joined in series. Current is found to be maximum when the value of inductance is 0.5 H and the value of capacitance is 8 μF. The angular frequency of applied alternating voltage will be
a) 4000 Hz   b) 5000 Hz
c) 2×10^5 Hz   d) 500 Hz

33. An inductor of inductance $L = 400$ mH and resistors of resistances $R_1 = 4\Omega$ and $R_2 = 2\Omega$ are connected to battery of emf 12 V as shown in the figure. The internal resistance of the battery is negligible. The switch S is closed at $t = 0$. The potential drop across L as a function of time is
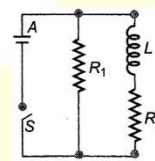
a) $6e^{-5t}$V   b) $\dfrac{12}{t}e^{-3t}$V
c) $6(1 - e^{-t/0.2})$ V   d) $12\,e^{-5t}$V

34. Which of the following has zero average value in a plane electromagnetic wave?
a) Kinetic energy   b) Magnetic field
c) Electric field   d) Both (b) and (c)

35. All of the following statements are correct except
a) The magnification produced by a convex mirror is always less than one
b) A virtual, erect, same-sized image can be obtained using a plane mirror
c) A virtual, erect, magnified image can be formed using a concave mirror
d) A real, inverted, same-sized image can be formed using a convex mirror

36. The diameter of moon is 3.5×10^3km and its distance from the earth is 3.8×10^5 km. The focal length of the objective and eye-piece are 4 m and 10 cm respectively. The diameter of the image of the moon will be approximately
a) $2°$

b) 21°
c) 40°
d) 50°

37. Which one of the following is the property of a monochromatic, plane electromagnetic wave in free space
   a) Electric and magnetic fields have a phase difference of $\pi/2$
   b) The energy contribution of both electric and magnetic fields are equal
   c) The direction of propagation is in the direction of $\vec{B} \times \vec{E}$
   d) The pressure exerted by the wave is the product of its speed and energy density

38. In the phenomenon of electron discharge through gases at low pressure, the coloured glow in the tube appears as a result of
   a) Collisions between the charged particles emitted from the cathode and the atoms of the gas
   b) Collision between different electrons of the atoms of the gas
   c) Excitation of electrons in the atoms
   d) Collision between the atoms of the gas

39. Bragg's equation will have no solution is
   a) $\lambda > 2d$ b) $\lambda < 2d$ c) $\lambda < d$ d) $\lambda = d$

40. The wavelength of the first spectral line of sodium is 5896 Å. The first excitation potential of sodium atom will be ($h = 6.63 \times 10^{-34}$Js)
   a) 4.2 V   b) 3.5 V
   c) 2.1 V   d) None of these

41. A moderator is used in nuclear reactors in order to
   a) Slow down the speed of the neutrons
   b) Accelerate the neutrons
   c) Increase the number of neutrons
   d) Decrease the number of neutrons

42. What fraction of a radioactive material will get disintegrated in a period of two half-lives
   a) Whole   b) Half
   c) One-fourth   d) Three-fourth

43. The coordination number of hexagonal close packing (hcp) is
   a) 6   b) 8   c) 12   d) 16

44. In hydrogen spectrum, the wavelength of H_α line is 656 nm, whereas in the spectrum of a distant galaxy, H_α wavelength is 706 nm. Estimated speed of the galaxy with respect to earth is
   a) $2 \times 10^8 ms^{-1}$ b) $2 \times 10^7 ms^{-1}$

c) $2 \times 10^6 ms^{-1}$ d) $2 \times 10^5 ms^{-1}$

45. The principle of laser action involves
   a) Amplification of particular frequency emitted by the system
   b) Population inversion
   c) Stimulated emission
   d) All of the above

46. An unknown element forms an oxide. What will be the equivalent weight of the element if the oxygen content is 20% by weight?
   a) 16   b) 32   c) 8   d) 64

47. If isotopic distribution of C-12 and C-14 is 98% and 2% respectively then the number of C-14 atoms in 12 g of carbon is
   a) 1.032×10^{22} b) 3.01×10^{22} c) 5.88×10^{23} d) 6.023×10^{23}

48. If E_e, E_a and E_p represent the kinetic energies of an electron, alpha particle and a proton respectively, each moving with same de-Broglie wavelength then
   a) $E_e = E_\alpha = E_p$ b) $E_e > E_\alpha > E_p$
   c) $E_\alpha > E_p > E_e$ d) $E_e > E_p > E_\alpha$

49. 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) $n = 4, l = 2, m = +2, s = 0$

50. The ionic radii (Å) of C^{4-} and O^{2-} respectively are 2.60 and 1.40. The ionic radius of the isoelectronic ion N^{3-} would be
   a) 2.6   b) 1.71   c) 1.4   d) 0.95

51. Which of the following compounds would have the highest boiling point?
   a) CH_3CH_2Cl b) CH_3NH_2 c) CH_3OH d) CH_2F_2

52. Which is a pyramidal structure?
   a) Trimethylamine   b) Methanol
   c) Acetylene   d) Water

53. A metal has bcc structure and the edge length of its unit cell is 3.04 Å. The volume of the unit cell in cm^3 will be
   a) 1.6×10^{21} cm^3 b) 2.81×10^{-23}cm^3
   c) 6.02×10^{-23} cm^3 d) 6.6×10^{-24}cm^3

54. Human body is an example of
   a) Open system   b) Closed system
   c) Isolated system   d) None of these

55. In a reversible process, $\Delta S_{system} +$

$\Delta S_{surrounding}$ is

a) > 0 b) < 0 c) ≥ 0 d) $= 0$

56. A sample of $Na_2CO_3 \cdot H_2O$ weighing 0.62 g is added to 100 mL of 0.1 N $(NH_4)_2SO_4$ solution. What will be the resulting solution?
    a) Acidic
    b) Neutral
    c) Basic
    d) None of these

57. Which of the following is a redox reaction?
    a) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$
    b) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$
    c) $Ca(OH)_2 + 2NH_4Cl$
    $\rightarrow CaCl_2 + 2NH_3 + 2H_2O$
    d) $2K[Ag(CN)_2] + Zn \rightarrow 2Ag + K_2[Zn(CN)_4]$

58. Of the following reactions, only one is a redox reaction. Identify this reaction.
    a) $Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$
    b) $2S_2O_7^{2-} + 2H_2O \rightarrow 2SO_4^{2-} + 4H^+$
    c) $BaCl_2 + MgSO_4 \rightarrow BaSO_4 + MgCl_2$
    d) $Cu_2S + 2FeO \rightarrow 2Cu + 2Fe + SO_2$

59. Which of the following is not correct regarding the electrolytic preparation of H_2O_2?
    a) Lead is used as cathode
    b) 50% H_2SO_4 is used
    c) Hydrogen is liberated at anode
    d) Sulphuric acid undergoes oxidation

60. The metal ion, that plays an important role in muscle contraction, is
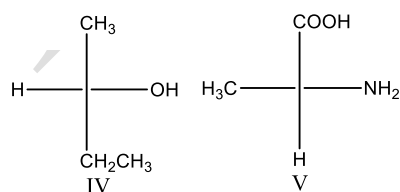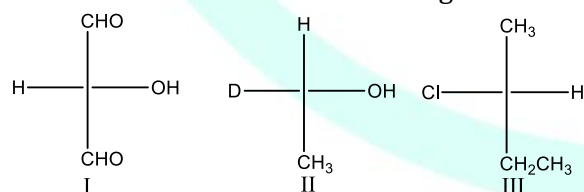   a) Be^{2+} b) Mg^{2+} c) Ca^{2+} d) Ba^{2+}

61. Sugar of lead is
    a) $2PbSO_4 \cdot PbO$
    b) $PbCO_3 \cdot Pb(OH)_2$
    c) $PbCO_3$
    d) $(CH_3COO)_2Pb$

62. Which one of the following ores is best concentrated by froth-floatation method?
    a) Magnetite
    b) Cassiterite
    c) Galena
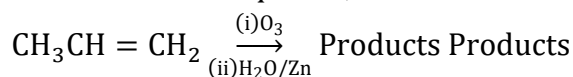   d) Malachite

63. Select R-isomers from the following

a) I and III
b) II, IV and V
c) I, II and III
d) II and III

64. Which of the following gives methane

65. [CH₄] on hydrolysis?
    a) Fe_3O_4 b) Al_2O_3 c) CaC_2 d) Al_4C_3

66. In the reaction sequence,
    $$CH_3CH = CH_2 \xrightarrow[(ii)H_2O/Zn]{(i)O_3} \text{Products Products}$$
    will be
    a) CH_3COCH_3
    b) CH_3COCH_2OH
    c) $CH_3COOH + HCOOH$
    d) $CH_3CHO + HCHO$

66. The biotic and abiotic components that are affected adversely from harmful substances are called
    a) Target
    b) Receptor
    c) Atmosphere
    d) Both (a) and (b)

67. A compound of 'A' and 'B' crystallises in a cubic lattice in which 'A' atoms occupy the lattice points at the corners of the cube. The 'B' atoms occupy the centre of each face of the cube. The probable empirical formula of the compound is
    a) AB_2 b) A_3B c) AB d) AB_3

68. Number of atoms in the unit cell of Na(bcc type crystal) and Mg(fcc type crystal) are respectively
    a) 4,4   b) 4,2   c) 2,4   d) 1,1

69. If α is the degree of dissociation of Na_2SO_4 the van't Hoff factor (i) used for calculating the molecular mass is
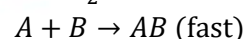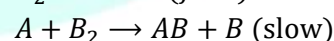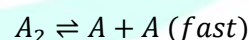   a) $1 - 2\alpha$ b) $1 + 2\alpha$ c) $1 - \alpha$ d) $1 + \alpha$

70. The osmatic pressure of a 5% (wt./vol) solution of cane sugar at 150°C is
    a) 3.078 atm
    b) 4.078 atm
    c) 5.078 atm
    d) 2.45 atm

71. For gold plating, the electrolyte used is
    a) $AuCl_3$
    b) $HAuCl_4$
    c) $K[Au(CN)_2]$
    d) None of these

72. A hypothetical reaction $A_2 + B_2 \rightarrow 2AB$ follows the mechanism as given below,
    $A_2 \rightleftharpoons A + A \ (fast)$
    $A + B_2 \rightarrow AB + B \ (slow)$
    $A + B \rightarrow AB \ (fast)$
   The order of the overall reaction is
    a) 2   b) 1   c) $1\frac{1}{2}$ d) 0

73. Give relation between half reaction time $(t_{1/2})$ and initial concentration of reactant for $(n - 1)$ order reaction.
    a) $t_{1/2} \propto [R]_0$
    b) $t_{1/2} \propto [R]_0^{2-n}$
    c) $t_{1/2} \propto [R]_0^{n+1}$
    d) $t_{1/2} \propto [R]_0^{n-2}$

74. Term catalyst was given by
    a) Rutherford
    b) Berzilius
    c) Wohler
    d) Kolbe
75. Which is statement is incorrect?
    a) Galena is an ore of Pb
    b) Electrostatic separation is used for lead sulphide
    c) Ore is heated strongly, above its melting point in roasting
    d) Silica acts as acidic flux
76. The forth-floatation process is based upon
    a) The difference in the specific gravity of ore and gangue particles
    b) The magnetic properties of gangue and ore
    c) Preferential wetting of gangue perticles by oil
    d) The solubility of ore particles in suitable regent
77. Argon is used
    a) In filling airships
    b) To obtain low temperature
    c) In high temperature welding
    d) In readiotherapy for treatment of cancer
78. Which of the following methods can't be used to prepare anhydrous zinc chloride?
    a) Passing dry chlorine over heated zinc
    b) Passing dry hydrogen chloride over heated zinc
    c) Heating the crystal of $ZnCl_2 \cdot 2H_2O$
    d) Distilling metallic zinc with mercury (II) chloride
79. The formula of azurite is
    a) $CuCO_3 . Cu(OH)_2$
    b) $2CuCO_3 . Cu(OH)_2$
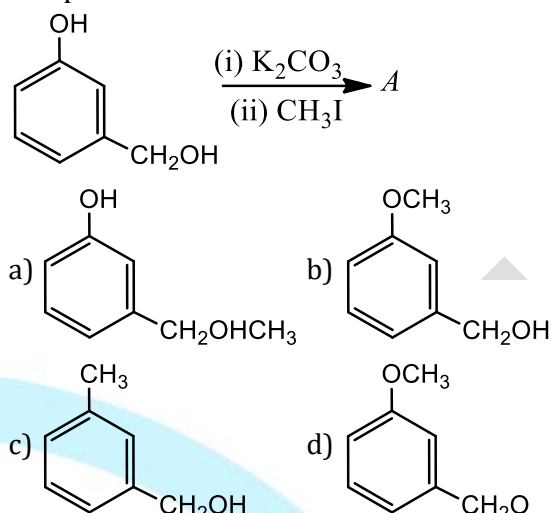   c) $CuCO_3 . 2Cu(OH)_2$
    d) $CuSO_4 . Cu(OH)_2$
80.
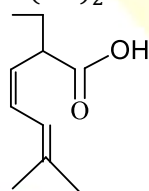
The IUPAC name of the compound is
    a) 2-ethenyl-3-methyl cyclohexa-1, 3-diene
    b) 2, 5-dimethyl hepta-2, 6-dienoic acid
    c) 2, 6-dimethyl hepta-2, 5dienoic acid
    d) 2, 3-dimethyl epoxyethane
81. An alkyl halide (RX) reacts with Na to from 4, 5-diethyloctane. Compound RX is
    a) $CH_3(CH_2)_3Br$
    b) $CH_3(CH_2)_2CH(Br)CH_2CH_3$
    c) $CH_3(CH_2)_3CH(Br)CH_3$
    d) $CH_3(CH_2)_5Br$

82. The product A is

$$\xrightarrow[\text{(ii) } CH_3I]{\text{(i) } K_2CO_3} A$$

a) [structure with OH and CH_2OHCH_3]
b) [structure with OCH_3 and CH_2OH]
c) [structure with CH_3 and CH_2OH]
d) [structure with OCH_3 and CH_2O]

83. In the following reaction sequence
$$R-OH \xrightarrow{P+I_2} R-I \xrightarrow{AgNO_2} RNO_2 \xrightarrow{HNO_2} \text{no}$$
reaction The alcohol is a
    a) Primary alcohol
    b) Secondary alcohol
    c) Tertiary alcohol
    d) Phenol
84. Benedict's solution is not reduced by
    a) Formaldehyde
    b) Acetaldehyde
    c) Glucose
    d) Acetic anhydride
85. Complete the following reaction
$RNH_2 + H_2SO_4 \rightarrow$
    a) $[RNH_3]^+HSO_4^-$
    b) $[RNH_3]_2^+SO_4^{2-}$
    c) $RNH_2 . H_2SO_4$
    d) No reaction
86. Benzyl amine reacts with nitrous acid to give
    a) Azobenzene
    b) Benzene
    c) Benzyl alcohol
    d) Phenol
87. Waxes are esters of
    a) Glycerol
    b) Long chain alcohols
    c) Glycerol and fatty acid
    d) Long chain alcohols and long chain acids
88. Natural rubber is not used in making footwear for polar regions because
    a) Natural rubber becomes soft at temperature lower than 10°C.
    b) Natural rubber becomes brittle at temperature lower than 10°C.
    c) Natural rubber melts at temperature lower than 10°C.
    d) Natural rubber becomes stronger at temperature lower than 10°C.
89. A polymer containing nitrogen is
    a) Bakelite
    b) Dacron
    c) Rubber
    d) Nylon-66
90. The drug
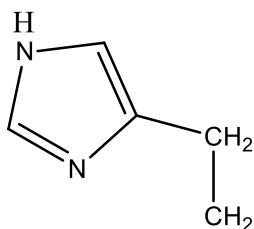
is used as

a) Vasodilator b) Analgesics
c) Antacid d) Antiseptic

91. Which one among the following is accurately arranged in descending specificity
   a) Species → Family → Class → Order → Division
   b) Species → Genus → Division → Class → Kingdom
   c) Species → Genus → Family → Order → Class
   d) Class → Order → Family → Genus → Species

92. Two different genera are classified in the same taxonomic category family. Which statement is correct about their classification?
   a) The same class, but different species
   b) A different class and different order
   c) The same phylum, but different class
   d) A different kingdom and different phylum

93. Which is the only kingdom occupied by BGA, nitrogen fixing bacteria and methanogenic bacteria in five kingdom classification?
   a) Plantae b) Protista
   c) Monera d) Fungi

94. Botanical name of species, which causes white rust of crucifers?
   a) *Peronospora parasitica*
   b) *Puccinia graminis*
   c) *Pythium debarganum*
   d) *Albugo candida*

95. Find out the pairs, which are correctly matched?
   I. Cyanobacteria –Biopesticides
   II. Mycorrhiza – Solubilization of phosphate
   III. *Bacillus thuringiensis – cry* protein
   IV. Single cell protein – Rhizobia
   a) I and II b) II and III
   c) III and IV d) I and III

96. Two adjacent filaments of *Spirogyra affinis* each 10 cells participating in reproduction. How many new *Spirogyra* plants are produced during sexual reproduction?
   a) 5 b) 10 c) 20 d) 40

97. Anther produces
   a) Pollen grains b) Spores
   c) Gametes d) Egg cell

98. Ampullae of Lorenzini are present in
   a) Fish b) Lizard c) Frog d) Rabbit

99. Which of the following phyla are schizocoela?
   a) Annelida, Platyhelminthes and Mollusca
   b) Annelida, Arthropoda and Mollusca
   c) Platyhelminthes, Aschelminthes and Annelida
   d) Aschelminthes, Annelida and Mollusca

100. The skeleton of animals belonging to phylum-Porifera are made up of
   a) Spicules
   b) Spiracles
   c) Spines
   d) Spongocytes

101. Two plants 'A' and 'B' belonging to Solanaceae are observed. In plant 'A', the number of locules in the ovary of a flower is half of that of its carpel number. In plant B, the number of locules in the ovary of a flower is double the number of carpels. Identify the plants 'A' and 'B' respectively
   a) *Capsicum, Datura*
   b) *Cestrum, Petunia*
   c) *Withania, Solanum*
   d) *Lycopersicon, Nicotiana*

102. Angiosperms differ from gymnosperms in
   a) Seeds b) Fruits
   c) Male gametophyte d) Female gametophyte

103. Identify the type of aestivation in the given diagram (*A* to *D*)

   a) A-Twisted, B-Valvate, C-Vexillary, D-Imbricate
   b) A-Valvate, B-Twisted, C-Imbricate, D-Vexillary
   c) A-Valvate, B-Twisted, D-Vexillary, D-Imbricate
   d) A-Valvate, B-Vexillary, C-Twisted, D-Imbricate

104. Gynoecium is the
   a) Female reproductive part of flower made up of one carpel
   b) Female reproductive part of flower made up of many carpel

c) Female reproductive part of flower made up of two carpel

d) All of the above

105. Cells of collenchyma have thickened corners due to the deposition of
a) Cellulose
b) Hemicellulose
c) Pectin
d) All of these

106. I. Pith is large and well-developed in monocots
II. Monocot root don't undergo any secondary growth
In accordance to the above statements, identify the correct one
a) I is incorrect, but II is correct
b) II is incorrect, but I is correct
c) I and II are incorrect
d) I and II are correct

107. In earthworm, a single female genital pore is present in the mid-ventral line of the segment number
a) 14 th
b) 16 th
c) 15 th
d) 17 th

108. The average diameter of red blood corpuscles of man is
a) $7.2 \, \mu m$
b) $8.1 \, \mu m$
c) $9.2 \, \mu m$
d) $10.3 \, \mu m$

109. Ultimate unit of DNA is
a) Nucleotide
b) Nucleosome
c) Nucleoside
d) Polynucleotide

110. In DNA of certain organisms, guanine constitutes 20% of the bases. What percentage of the bases would be adenine?
a) 0%
b) 10%
c) 20%
d) 30%

111. Enzymes that catalyses the removal of groups from substrates by mechanism other than hydrolysis, addition of groups to double bonds are called
a) Lyases
b) Ligases
c) Hydrolases
d) Dehydrogenases

112. The following reaction is catalysed by which of the enzyme?

$$NADH + H^+ + \frac{1}{2}O_2 \rightarrow NAD^+ + H_2O$$
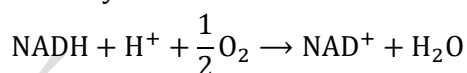
a) Hydrolases
b) Cytochrome oxidases
c) Transferases
d) Lyases

113. What type of plant is formed when colchicines is used in the process of development of *Raphanobrassica*?
a) Triploid
b) Haploid
c) Autotetraploid
d) Allotetraploid

114. Meiosis occurs in which of the following cells?
a) Sperm cells
b) Unicellular organisms
c) Liver cells
d) All of these

115. Plants develops force for upward conduction of water against gravity is derived from
a) Photosynthesis process
b) Transpiration
c) Root pressure
d) Both (b) and (c)

116. Munch hypothesis is based on
a) Translocation of food due to TP gradient and imbibition force
b) Translocation of food due to turgor pressure (TP) gradient
c) Translocation of food due to imbibition force
d) None of the above

117. The force responsible for the water movement against gravity even up to a 130 m of tall free comes from
a) Root pressure
b) Transpiration pull
c) Diffusion pressure
d) Pulsation

118. Who demonstrated the concept of hydroponics for the first time?
a) Hewitt
b) Julius von Sachs
c) Dalton
d) None of these

119. An essential element is that which
a) Improves health of the plant
b) Is irreplaceable and indispensable for growth of plants
c) Is found in plant ash
d) Is available in the soil

120. Large number of chloroplast are present in which of the following cells?
a) Parenchymatous cell
b) Mesophyll cell
c) Peroxisomal cell
d) Cell wall

121. Electrons which gets excited in PS-I must replaced. These replacement ultimately come from
a) ATP
b) H_2O
c) PS-II
d) NAD

122. In fermentation NADH is oxidised to NAD^+ in ..... rate
a) Fast
b) Slow
c) Usual
d) None of these

123. Read the following table and choose the

correct pair.

1.	DCMU	Herbicide	Inhibitor of non-cyclic electron transport
2.	PMA	Fungicide	Reduce transpiration
3.	Colchicine	Alkaloid	Causes male sterility
4.	Soilrite	Sodium alginate	Encapsulation of somatic embryos

a) I, II

b) I, III

c) II, III

d) II, IV

124. The shedding of leaves, flowers or fruits due to change in the hormonal balance in plants, is referred as

a) Senescence   b) Ascission

c) Photoperiodism   d) vernalization

125. Respiratory climacteric is related with

a) ABA   b) C_2H_4 c) Auxin   d) GA

126. I. Lag phase

II. Stationary phase

III. Exponential phase

Arrange the above steps of geometrical growth (from beginning to last) in a correct sequence of their occurrence and choose the correct option accordingly

a) I → II → III   b) I → III → II

c) III → II → I   d) III → I → II

127. The diagram given below depicts the digestive system in humans. Label it from A to F and choose the correct option accordingly
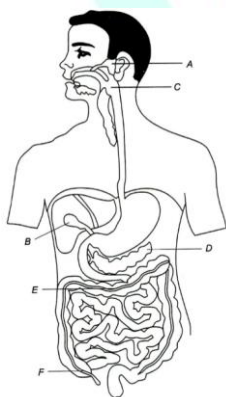
a) A-Parotid gland, B-Liver, C-Larynx, D-Pancreas, E-Transverse colon, F-Caecum

b) A-Parotid gland, B-Gall bladder, C-Pharynx, D-Pancreas, E-Transverse colon, F-Caecum

c) A-Parotid gland, B-Liver, C-Pharynx, D-Pancreas, E-Ascending colon, F-Caecum

d) A-Parotid gland, B-Gall bladder, C-Thymus, D-Pancreas, E-Ascending colon, F-Caecum

128. Carboxypeptidase is an enzyme secreted by

a) Salivary gland   b) Stomach

c) Gall bladder   d) Intestine

129. Air entering the lungs is

a) Warm and filtered

b) Contains only oxygen

c) Cool and filtered

d) Enriched with CO_2 and NO_2

130. Haemoglobin (Hb) is a

a) Reproductive pigment

b) Respiratory pigment

c) Carbohydrate

d) Fat

131. Identify A, B and C in the given diagram
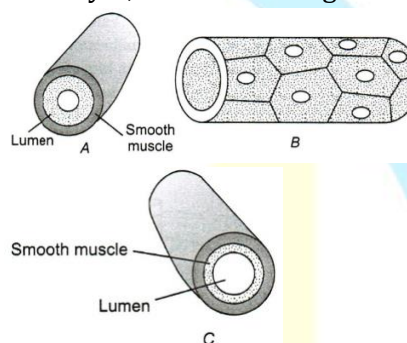
Choose the correct option

a) A-Artery, B-Capillary, C-Vein

b) A-Artery, B-Vein, C-Capillary

c) A-Vein, B-Artery, C-Capillary

d) A-Capillary, B-Artery, C-Vein

132. Which of the following is an example of buffer system in blood?

a) Haemoglobin and oxyhaemoglobin

b) Oxygen and carbon dioxide

c) Albumin and globulin

d) Sodium bicarbonate and carbonic acid

133. Which term is used both for a part of kidney and a part of skeleton in the mammals?

a) Centrum   b) Pelvis

c) Cortex   d) Medulla

134. Polyuria is a condition in which

a) Amount of urine pass out is more

b) Amount of urine pass out is less

c) No urine pass out

d) No urine formation

135. Which of the following is right statement?

I. Angiotensin-II, being a powerful vasoconstrictor, increases glomerular pressure and thereby GFR

II. Angiotensin-II activates the adrenal cortex to release aldosterone

III. Aldosterone promotes reabsorption of

Na^+ and water from the DCT and CT leading to an increase in GBP and GFR

IV. ANF causes vasoconstriction

Select right combination

a) I, II and III   b) I, II and IV

c) I, III and IV   d) II, III and IV

136. Common among all mammals is
   a) Ventral nerve cord
   b) Seven cervical vertebrae
   c) All are carnivores
   d) All are producers

137. Actin and myosin filaments of muscles are also called
   a) Thick and thin filaments respectively
   b) Thin and thick filaments respectively
   c) Black and white filaments respectively
   d) White and black filaments respectively

138. Gout happens due to accumulation of is joints
   a) Glucose crystals   b) Uric acid crystals
   c) Urea crystals   d) Ammonia crystals

139. Centre for thinking and learning is present in which part of brain?
   a) Cerebrum   b) Cerebellum
   c) Dienceohalon   d) Medulla oblongata

140. The glands, which help on absorbing odoriferous substances to stimulate olfactory nerve are
   a) Cerumenous glands   b) Meibomian glands
   c) Bowman's glands   d) Cowper's glands

141. Which is correct regarding the functions of posterior pituitary gland?
   a) The posterior pituitary gland secretes growth hormone
   b) The posterior pituitary secretes epinephrine
   c) Vasopressin regulates the uptake of water by the cells of the collecting duct
   d) Oxytocin stimulates milk production

142. Which of the following is both exocrine and endocrine gland?
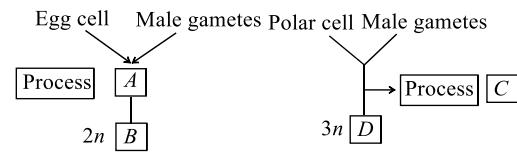   a) Liver   b) Pancreas
   c) Thyroid   d) Adrenal

143. Man is:
   a) Unisexual   b) Bisexual
   c) Hermaphroditic   d) Protogynous

144. Juvenile phase in plants, is
   a) Vegetative phase   b) Reproductive phase
   c) Growth phase   d) Senescence phase

145. Identify A, B, C and D

Egg cell   Male gametes   Polar cell   Male gametes

Process A Process C

$2n$ B $3n$ D

   a) A-Syngamy, B-Embryo, C-Triple fusion, D-Endosperm
   b) A- Endosperm, B- Syngamy, C- Embryo, D-Triple fusion
   c) A- Endosperm, B- Triple fusion, C- Syngamy, D-Embryo
   d) A- Endosperm, B- Triple fusion, C- Embryo, D-Syngamy

146. Number of seeds is equals to the
   a) Number of ovules
   b) Number of ovaries
   c) Both (a) and (b)
   d) None of these

147. Fertilization of egg takes place inside
   a) Anther   b) Stigma
   c) Pollen tube   d) Embryo sac

148. Which part of the sperm assist first mitotic division?
   a) Acrosome   b) Neck
   c) Middle part   d) Tail part

149. Bartholin glands are also called
   a) Vestibular glands
   b) Lenticular glands
   c) Rudimentary glands
   d) Does not exist

150. Graafian follicle after releasing ovum is called
   a) Corpus luteum   b) Polar body
   c) Nuclear body   d) Ootid

151. When released from ovary, human egg contains
   a) One Y-chromosome   b) Two X-chromosomes
   c) One X-chromosome   d) XY-chromosomes

152. Which of the following is a technique of direct introduction of gametes into the oviduct:
   a) MTS   b) ET   c) IVF   d) POST

153. MTP stands for
   a) Medical Termination of Pregnancy   b) Mental Trauma Phase   c) Menstrual Pain   d) None of the above

154. Haemophilia in man is due to
   a) Sex-linked inheritance
   b) Sex-limited inheritance
   c) Sex-influenced inheritance
   d) Primary non-disjunction

155. The plasma membrane of the red blood cells has ...A... polymers that protrude from its surface and the kind of sugar is controlled by the gene. The gene I has three alleles ...B... The alleles I^A and I^B produce a slightly different form of the sugars, while allele i doesn't produce any ...C...

Choose the correct option for A, B and C

a) A-protein, B − $I^AI^BI^O$, C-protein
b) A-protein, B − $I^AI^BI^O$, C-sugar
c) A-sugar, B − $I^AI^BI^O$, C-protein
d) A-sugar, B − I^AI^BI, C-sugar

156. Mendel work later formulated into laws of
I. Linkage
II. Segregation
III. Incomplete dominance
IV. Independent assortment
Choose the correct option
a) I, III and IV
b) II and IV
c) II, III and IV
d) I, II and III

157. DNA $\xrightarrow{Enzyme\ A}$ ...B RNA $\xrightarrow{splicing}$ mRNA $\xrightarrow{C}$ from $5' − 3' m$RNA

Name enzyme A, B, C spot in statement
a) A-RNA polymerase, B-hn, C-Post transcription modification
b) A-DNA polymerase, B-hn, C-Post transcription modification
c) A-DNA polymerase, B-Modification of bases, C-Post transcription modification
d) A-RNA polymerase, B-Modification of bases, C-Post transcription modification

158. In transgenics, expression of transgene in target tissue is determined by
a) Enhancer
b) Transgene
c) Promoter
d) Reporter

159. *Homo erectus* had large brain around ...A... cc. *Homo erectus* was probably ...B... . Here A and B refers to
a) A-700 cc, B-carnivorous
b) A-700 cc, B-herbivorous
c) A-900 cc, B-omnivorous
d) A-800 cc, B-herbivorous

160. Organs which are anatomically different, but performs similar functions are called
a) Analogous organs
b) Homologous organ
c) Vestigial organs
d) Heterologous organs

161. What is the name of complex formed at the time of action of T-cells?
a) HLA
b) STD antigen complex
c) HLA antigen complex
d) MHC antigen complex

162. Which of the following disorders is not hereditary?
a) Haemophilia
b) Cataract
c) Sickle cell anaemia
d) Colour blindness

163. Lung cancer is caused by
a) Tabacco smoke
b) X-rays
c) UR rays
d) Vehicle smoke

164. In protoplast fusion, the enzymes required are
a) Cellulose, hemicellulose, pectinase
b) Pectinase
c) Ligase, hemicellulose
d) Hemicellulose

165. Shakti, Rattan and Protina are three important lysine rich varieties of
a) Rice
b) Pulses
c) Wheat
d) Maize

166. Bacillus thuringiensis is used as
a) Biofungicide
b) Biopesticide
c) Biocontroller
d) Bioweapon

167. *Nosemabombycis,* which causes pebrine in silk worms is a
a) Fungus
b) Virus
c) Bacterium
d) Protozoan

168. Totipotency in cell is:
a) Flower in a culture medium
b) Development of fruit from a flower in a culture medium
c) Development of an organism from cell in culture medium
d) Development of all tissues of all kinds from a cell in a culture medium

169. DNA fingerprinting method is very useful for:
a) DNA tests for identity and relationships
b) Forensic studies
c) Polymorphism
d) All of the above

170. *Bt* tobacoo was first cultured to kill
a) Hornworm
b) Bollworm
c) Stem borer
d) Tobacco budworm

171. For production of haploids, we culture
a) Shoot tip
b) Anther
c) Root tip
d) None of these

172. Satellite DNA is useful tool in
a) Organ transplantation
b) Sex determination
c) Forensic science
d) Genetic engineering

173. I. Salmon   II. Shark   III. Sting ray
Which of them is/are stenohaline and

euryhaline?

StenohalineEuryhaline

a) I, III   II

b) I, II   III

c) II, III   I

d) I   II, III

174. An interaction favourable to both population, but no obligatory to either is
   a) Proto-cooperation   b) Mutualism
   c) Commensalism   d) Parasite

175. Net primary productivity is utilised by
   a) Autotrophs   b) Heterotrophs
   c) Decomposers   d) All of the above

176. The aquatic organism that can actively swim at will against the water current is
   a) Neuston   b) Plankton   c) Nekton   d) Benthos

177. Which group of vertebrates comprises the highest number of endangered species?
   a) Reptiles   b) Birds
   c) Mammals   d) Fishes

178. Which one of the following pairs of organisms are exotic species introduced in India?
   a) *Ficus religiosa*, *Lantana camara*
   b) *Lantana camara*, water hyacinth
   c) Water hyacinth, *Prosopis cineraria*
   d) Nile perch, *Ficus religiosa*

179. The main component of photochemical smog is
   a) SO_2 b) PAN
   c) O_3 d) Both (b) and (c)

180. Montreal protocol aims at
   a) Reduction of ozone depleting substances
   b) Biodiversity conservation
   c) Control of water pollution
   d) Control of CO_2 emission

Meritstore

NEET TEST ID: 16

Time : 03:00:00 **Marks** : 720

: ANSWER KEY :

1)	a	2)	d	3)	b	4)	d	5)	a	6)	c	7)	d
8)	b	9)	a	10)	b	11)	b	12)	d	13)	d	14)	a
15)	b	16)	a	17)	c	18)	d	19)	b	20)	d	21)	a
22)	a	23)	c	24)	a	25)	d	26)	d	27)	c	28)	b
29)	b	30)	c	31)	a	32)	d	33)	d	34)	d	35)	d
36)	b	37)	b	38)	c	39)	a	40)	c	41)	a	42)	d
43)	c	44)	b	45)	d	46)	b	47)	a	48)	d	49)	a
50)	b	51)	c	52)	a	53)	b	54)	a	55)	a	56)	a
57)	d	58)	d	59)	c	60)	c	61)	d	62)	c	63)	c
64)	d	65)	d	66)	d	67)	d	68)	c	69)	b	70)	c
71)	c	72)	c	73)	b	74)	b	75)	c	76)	d	77)	c
78)	c	79)	b	80)	c	81)	b	82)	b	83)	c	84)	d
85)	d	86)	c	87)	d	88)	b	89)	d	90)	a	91)	c
92)	a	93)	c	94)	d	95)	b	96)	b	97)	a	98)	a
99)	b	100)	a	101)	a	102)	b	103)	b	104)	d	105)	d
106)	d	107)	a	108)	a	109)	a	110)	d	111)	a	112)	b
113)	d	114)	a	115)	b	116)	b	117)	b	118)	b	119)	b
120)	b	121)	b	122)	b	123)	a	124)	b	125)	b	126)	b
127)	b	128)	d	129)	a	130)	b	131)	c	132)	d	33)	b
134)	a	135)	a	136)	b	137)	b	138)	b	139)	a	140)	c
141)	c	142)	b	143)	a	144)	a	145)	a	146)	a	147)	d
148)	b	149)	a	150)	a	151)	c	152)	c	153)	d	154)	a
155)	d	156)	b	157)	a	158)	d	159)	c	160)	a	161)	d
162)	b	163)	a	164)	a	165)	d	166)	b	167)	d	168)	c
169)	d	170)	a	171)	b	172)	c	173)	c	174)	a	175)	b
176)	c	177)	c	178)	c	179)	d	180)	a				

: HINTS AND SOLUTIONS :

Single Correct Answer Type

1 **(a)**

$V = (8 + 0.5)$

$I = (2 + 0.2)$

$R = \dfrac{8}{2} = 4$

$\dfrac{\Delta R}{R}\% = \left(\dfrac{\Delta V}{V} + \dfrac{\Delta I}{I}\right)$

$= \left(\dfrac{0.5}{8} + \dfrac{0.2}{2}\right) \times 100 = 16.25\%$

$\therefore\ R = (4 \pm 16.25\%)$

3 **(b)**

$a = \dfrac{dv}{dt} = 6t + 5$ or $dv = (6t + 5)dt$

Integrating it, we have

$v = \dfrac{6t^2}{2} + 5t + C = 3t^2 + 5t + C$

where C is constant of integration

When $v = 0$ so $c = 0$

$\therefore\ v = \dfrac{ds}{dt} = 3t^2 + 5t$ or $ds = (3t^2 + 5t)dt$

Integrating it within the conditions of motion *ie*,as

t changes from 0 to 1 s changes from 0 to s, we have $s = t^3 + \frac{5t^2}{2} = 1 + \frac{5}{2} = 3.5$ m.

4 **(d)**

$|\vec{a} \times \vec{b}| = ab \sin\theta$

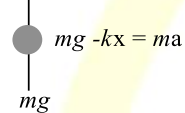$\sin\theta$ cannot be greater than 1.

$\therefore |\vec{a} \times \vec{b}|$ cannot be greater than ab.

5 **(a)**

Time of flight $= \frac{2u \sin\theta}{g} = \frac{2u_y}{g} = \frac{2 \times u_{\text{vertical}}}{g}$

6 **(c)**

For minimum mass of m, mass M breaks off contact when elongation in spring is maximum At the time of break off, block A is at lowest position and its speed is zero. At an instant t_1

$mg - kx = ma$

$v\frac{dv}{dx} = \frac{mg - kx}{m}$

$T = kx$

$mg - kx = ma$

mg

$\int_0^0 vdv = \int_0^x \left(g - \frac{k}{m}x\right)dx$

Where x_0 is maximum elongation is spring
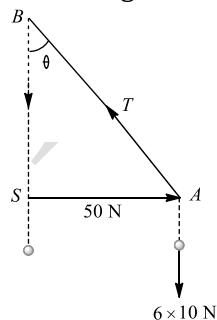
$0 = gx_0 - \frac{kx_0^2}{2m}$

$x = \frac{2mg}{k}$

At the time of break off of block B

$Mg = kx_0$

$Mg = 2mg$

$m = \frac{M}{2}$

7 **(d)**

The three forces acting on the mass at location A have been shown in figure. Since the mass is in equilibrium, therefore, the three forces acting on the mass must be represented by the three sides of a triangle taken in one order. Hence

$\frac{50}{SA} = \frac{6 \times 10}{SB}$ or $\frac{SA}{SB} = \frac{50}{60} = \frac{5}{6}$

or $\tan\theta = \frac{SA}{SB} = \frac{5}{6} = 0.8333$

$= \tan 40°$

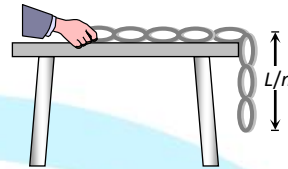$\therefore \theta = 40°$

8 **(b)**

Fraction of length of the chain hanging from the table

$= \frac{1}{n} = \frac{60 \, cm}{200 \, cm} = \frac{3}{10} \Rightarrow n = \frac{10}{3}$

Work done in pulling the chain on the table

$W = \frac{mgL}{2n^2}$

$= \frac{4 \times 10 \times 2}{2 \times (10/3)^2} = 3.6 \, J$

9 **(a)**

When a body rolls down without slipping along an inclined plane of inclination θ, it rotates about a horizontal axis through its centre of mass and also its centre of mass moves. Therefore, rolling motion may be regarded as a rotational motion about an axis through its centre of mass plus a translational motion of the centre of mass. As it rolls down, it suffers loss in gravitational potential energy provided translational energy due to frictional force is converted into rotational energy.

10 **(b)**

Angular momentum = linear momentum × Perpendicular distance of line of action of linear momentum from the axis of rotation $= mv \times l$

11 **(b)**

Weight of body on the surface of earth $mg = 12.6$ N

At height h, the value of g' is given by
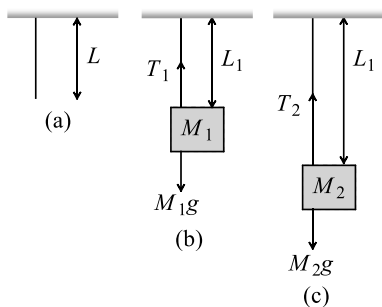
$g' = g\frac{R^2}{(R + h)^2}$

Now, $h = \frac{R}{2}$

$\therefore \qquad g' = g\left(\frac{R}{R + (R/2)}\right)^2 = g\frac{4}{9}$

Weight at height $h = mg\frac{4}{9}$

$= 12.6 \times \frac{4}{9} = 5.6$ N

12 **(d)**

L be original length of the wire

When a mass M_1 is suspended from the wire, change in length of wire is $\Delta L_1 = L_1 - L$

When a mass M_2 is suspended from it, change in length of wire is $\Delta L_2 = L_2 - L$

From figure (b), $T_1 = M_1 g$ ...(i)

From figure (c), $T_2 = M_2 g$ ...(ii)

As young's modulus, $Y = \dfrac{T_1 L}{A\Delta L_1} = \dfrac{T_2 L}{A\Delta L_2}$

$\dfrac{T_1}{\Delta L_1} = \dfrac{T_2}{\Delta L_2} \Rightarrow \dfrac{T_1}{L_1 - L} = \dfrac{T_2}{L_2 - L}$

$\dfrac{M_1 g}{L_1 - L} = \dfrac{M_2 g}{L_2 - L}$ [Using (i) and (ii)]

$M_1(L_2 - L) = M_2(L_1 - L)$

$M_1 L_2 - M_1 L = M_2 L_1 - M_2 L$

$L(M_2 - M_1) = L_1 M_2 - L_2 M_1 \Rightarrow L = \dfrac{L_1 M_2 - L_2 M_1}{M_2 - M_1}$

13 **(d)**

Let V be the volume of wooden ball. The mass of ball is $m = V \rho$

Upward acceleration,

$a = \dfrac{\text{upward thrust} - \text{weight of ball}}{\text{mass of ball}}$

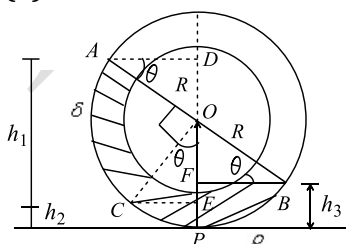$= \dfrac{V \rho_0 g - V \rho g}{V \rho} = \dfrac{(\rho_0 - \rho)g}{\rho}$

If v is the velocity of ball on reaching the surface after being released at depth h is

$v = \sqrt{2as} = \left[2\left(\dfrac{\rho_0 - \rho}{\rho}\right)gh\right]^{1/2}$

If h' is the vertical distance reached by ball above the surface of water, then

$h' = \dfrac{v^2}{2g} = \dfrac{2(\rho_0 - \rho)}{\rho}gh \times \dfrac{1}{2g}$

$= \left(\dfrac{\rho_0 - \rho}{\rho}\right)h = (\rho_0/\rho)$

14 **(a)**

Vertical height of the liquid in portion AC

$h_1 = DO + OE = R\sin\theta + R\cos\theta$

$= R(\sin\theta + \cos\theta)$

Vertical height of the liquid in portion CP

$h_2 = R - R\cos\theta = R(1 - \cos\theta)$

Vertical height of the liquid in portion PB

$h_3 = R - R\sin\theta = R(1 - \sin\theta)$

In equilibrium, the pressure due to liquid on the both sides must be equal at the lowest point P

$\delta g h_1 + \rho g h_2 = \rho g h_3$ [As pressure $= h\rho g$]

$\delta g R(\sin\theta + \cos\theta) + \rho g R(1 - \cos\theta)$
$\qquad = \rho g R(1 - \sin\theta)$

$\delta(\sin\theta + \cos\theta) + \rho(1 - \cos\theta) = \rho(1 - \sin\theta)$

$(\rho + \delta)\sin\theta = (\rho - \delta)\cos\theta$

$\tan\theta = \dfrac{(\rho - \delta)}{(\rho + \delta)} \Rightarrow \theta = \tan^{-1}\left(\dfrac{\rho - \delta}{\rho + \delta}\right)$

15 **(b)**

According to Stefan's law radiant energy emitted by a perfectly black body per unit area per sec (ie, emissive power of black body) is directly proportional to the fourth power of its absolute temperature ie $E \propto T^4$

$\Rightarrow \dfrac{E_1}{E_2} = \dfrac{T_1^4}{T_2^4}$

$\dfrac{5}{E_2} = \dfrac{(273 + 227)^4}{(273 + 727)^4}$

$E_2 = 5 \times \left[\dfrac{1000}{500}\right]^4$

$\qquad = 5 \times 16 = 80 \text{ cal cm}^{-2}s^{-1}$

16 **(a)**

Coefficient of performance $K = \dfrac{T_2}{T_1 - T_2}$

$= \dfrac{(273 - 23)}{(273 + 27) - (273 - 23)} = \dfrac{250}{300 - 250} = \dfrac{250}{50}$

$\qquad = 5$

17 **(c)**

As finally the piston is in equilibrium, both the gases must be at same pressure P_f. It is given that displacement of piston be in ideal state x and if A is the area of cross-section of the piston. Hence the final volumes of the left and right part finally can be given by figure as
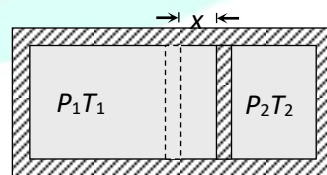
$V_L = \dfrac{V_0}{2} + Ax$ and

$V_R = \dfrac{V_0}{2} - Ax$

As it is given that the container walls and the piston are adiabatic in left side and the gas undergoes adiabatic expansion and on the right

side the gas undergoes adiabatic compression. Thus we have for initial and final state of gas on left side

$$P_1 \left(\frac{V_0}{2}\right)^\gamma = P_f \left(\frac{V_0}{2} + Ax\right)^\gamma \quad \text{...(i)}$$

Similarly for gas in right side, we have

$$P_2 \left(\frac{V_0}{2}\right)^\gamma = P_f \left(\frac{V_0}{2} - Ax\right)^\gamma \quad \text{...(ii)}$$

From eq. (i) and (ii)

$$\frac{P_1}{P_2} = \frac{\left(\frac{V_0}{2} + Ax\right)^\gamma}{\left(\frac{V_0}{2} - Ax\right)^\gamma} \Rightarrow Ax = \frac{V_0}{2}\left[\frac{P_1^{1/\gamma} - P_2^{1/\gamma}}{P_1^{1/\gamma} + P_2^{1/\gamma}}\right]$$

Now from equation (i) $P_f = \dfrac{P_1\left(\frac{V_0}{2}\right)^\gamma}{\left[\frac{V_0}{2} + Ax\right]^\gamma}$

18 **(d)**

Consider n moles of a gas which undergo isochoric process, ie, V=constant. From first law of thermodynamics,

$\Delta Q = \Delta W + \Delta U$
...(i)

Here, $\Delta W = 0$ as $V = $ constant

$\Delta Q = nC_V \Delta T$

Substituting in Eq. (i), we get

$\Delta U = nC_V \Delta T$
...(ii)

Mayer's relation can be written as

$C_p - C_V = R$

$\Rightarrow C_V = C_p - R$
...(iii)

From Eqs. (ii) and (iii), we have

$\Delta U = n(C_p - R)\Delta T$

Given, $n = 6$, $C_p = 8 \text{ cal mol}^{-1} - \text{K}^{-1}$,

$R = 8.31 \text{ J mol}^{-1} - \text{K}^{-1}$

$\approx 2 \text{ cal mol}^{-1} - \text{K}^{-1}$

Hence, $\Delta U = 6(8 - 2)(35 - 20)$

$= 6 \times 6 \times 15 = 540 \text{ cal}$

19 **(b)**

Standard equation for given condition

$$x = a \cos \frac{2\pi}{T} t \Rightarrow x = -0.16 \cos(\pi t)$$

[As $a = -0.16 \ meter, T = 2 \ s$]

20 **(d)**

$$x = a \sin^2 \omega t = \frac{a}{2}(1 - \cos 2\omega t)$$

21 **(a)**

$\lambda = \dfrac{v}{n}; n \approx 50,000 \ Hz, v = 330 m/sec \Rightarrow \lambda$

$$= \frac{330}{50000}m$$

$= 6.6 \times 10^{-1} cm \approx 5 \times 10^{-1} cm$

22 **(a)**

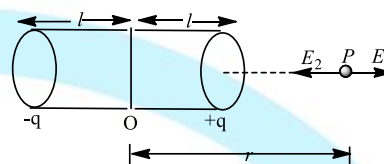Here, $F = 40 = \dfrac{k(3)(8)}{r^2} = \dfrac{24k}{r^2}$

$F' = \dfrac{k(3-5)(8-5)}{r^2} = \dfrac{-6k}{r^2}$

$\dfrac{F'}{F} = \dfrac{-6k}{r^2} \times \dfrac{r^2}{24k} = -\dfrac{1}{4}$

$F' = -\dfrac{F}{4} = -\dfrac{40}{4} = -10N$

23 **(c)**

Intensity of electric field at a point on the axis of dipole is given by

$$E_a = \frac{1}{4\pi\varepsilon_0} \cdot \frac{2p}{r^3} \frac{N}{C} \quad \text{..... (i)}$$

Where, p is dipole moment.

Intensity of electric field at a point on the

Equatorial line of dipole is given by
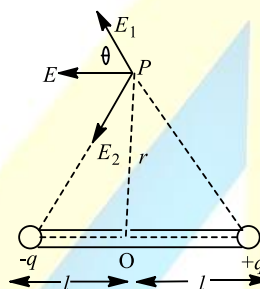
$$E_q = \frac{1}{4\pi\varepsilon_0} \cdot \frac{p}{r^3} \frac{N}{C} \quad \text{..... (ii)}$$

Dividing Eq. (i) by Eq. (ii), we get

$$\frac{E_a}{E_q} = \frac{2}{1}$$

$$\Rightarrow E_a = 2E_q$$

24 **(a)**

If the plates of a parallel plate capacitor are not equal in area, then quantity of charge on the plates will be same but nature of charge will differ.

25 **(d)**

Resistance between A and B = $\dfrac{1000 \times 500}{(1500)} = \dfrac{1000}{3}$

So, equivalent resistance of the circuit

$$R_{eq} = 500 + \frac{1000}{3} = \frac{2500}{3}$$

∴Current drawn from the cell

$$i = \frac{10}{(2500/3)} = \frac{3}{250} A$$

Reading of voltmeter $i.e.$

Potential difference across $AB = \frac{3}{250} \times \frac{1000}{3} = 4\,V$
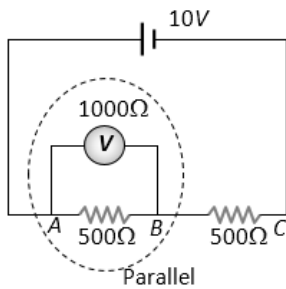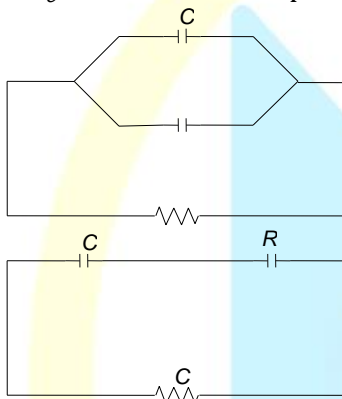
26 **(d)**

If C_e be the effective capacitance, then

$$V_C = \frac{1}{2} V_0$$

$$\frac{q}{C_e} = \frac{q_0}{2C_e}$$

$$\Longrightarrow q_0 \left(1 - e^{-\frac{t}{RC_e}}\right) = \frac{q_0}{2}$$

$$\Longrightarrow \quad t = RC_e \, In2$$

For parallel grouping

$$C_e = \frac{2C}{2}$$

$$\therefore \quad t_2 = 2RC \, In2$$

For series grouping

$$C_e = \frac{C}{2}$$

$$t_1 = \frac{RC}{2} In\, 2$$

$$\frac{t_2}{t_1} = \frac{1}{4} t_2 = 2.5s$$

27 **(c)**

$$I = \frac{E}{R_T} = \frac{2.5}{10+R} \text{ and } V = I.R = \frac{2.5 \times 10}{10+R} = \frac{25}{10+R}$$

$$x = \frac{V}{L} = \frac{25}{(10+R)L}$$

$$E = x.l_1$$

$$\Rightarrow 1 = \frac{25}{(10+R)L} \times \frac{L}{2} \Rightarrow 25 = 20 + 2R$$

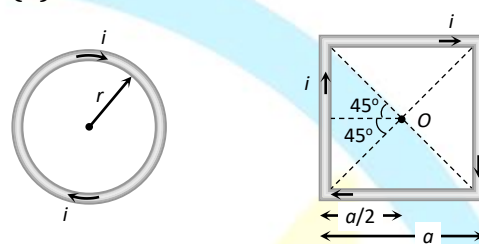$$\Rightarrow 2R = 5 \Rightarrow R = \frac{5}{2}$$

∴Now the resistance is doubled

$$R^1 = \frac{5}{2} \times 2 = 5\Omega$$

$$\therefore x = \frac{25}{(10+5)L} = \frac{25}{15.L} = \frac{5}{3L}$$

$$E = x.l_2$$

$$\Rightarrow 1 = \frac{5}{3L}.l_2 \Rightarrow l_2 = \frac{3L}{2} = 0.6L$$

28 **(b)**

Magnetic field at the centre of circular coil

$$B_{circular} = \frac{\mu_0}{4\pi}.\frac{2\pi i}{r} = \frac{\mu_0}{4\pi}.\frac{4\pi^2 i}{L}$$

Magnetic field at the centre of square coil

$$B_{square} = \frac{\mu_0}{4\pi}.\frac{8\sqrt{2}i}{a} = \frac{\mu_0}{4\pi}.\frac{32\sqrt{2}i}{L}$$

Hence $\frac{B_{circular}}{B_{square}} = \frac{\pi^2}{8\sqrt{2}}$

29 **(b)**

$$F \propto \frac{m_1 m_2}{r^2}$$

30 **(c)**

The correct measure of hardness of a material is its coercivity, ie, the field strength required to be applied in opposite direction to reduce the residual magnetism of the specimen to zero.

31 **(a)**

$$e = \frac{d\phi}{dt} = \frac{BdA}{dt} = \frac{2(\pi r^2 - L^2)}{dt} = 6.6 \times 10^{-3} V$$

32 **(d)**

For current to be maximum , $X_L = X_C$

Hence, resonant frequency

$$f = \frac{1}{2\pi} = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{0.5 \times 8 \times 10^{-6}}} = \frac{10^3}{4\pi}$$

But angular frequency

$$\omega = 2\pi f$$

$$\omega = \frac{2\pi \times 1000}{4\pi} = 500 \text{ Hz}$$

33 **(d)**

$$l_1 = \frac{F}{R_1} = \frac{12}{2} = 6\,A$$

$$E = L\frac{dl_2}{dt} + R_2 \times l_2$$

$I_2 = I_0(1 - e^{-t/t_c})$

$\Rightarrow \quad I_0 = \dfrac{E}{R_2} = \dfrac{12}{2} = 6A$

$t_c = \dfrac{L}{R} = \dfrac{400 \times 10^{-3}}{2} = 0.2$

$I_2 = 6(1 - e^{-t/0.2})$

Potential drop across

$L = E - R_2 L_2 = 12 - 2 \times 6(1 - e^{-bt}) = 12e^{-5t}$

34 (d)

In electromagnetic wave, the average value of electric filed or magnetic field is zero

35 (d)

Convex mirror always forms, virtual, erect and smaller image

36 (b)

$\alpha = \dfrac{3.5 \times 10^3}{3.8 \times 10^5}\text{rad} = \dfrac{3.5}{3.8 \times 100} \times \dfrac{180°}{\pi}$

$= \dfrac{3.5 \times 180 \times 7°}{38 \times 100 \times 22}$

Also, $M = \dfrac{f_o}{f_e} = \dfrac{400}{10} = 40$

$\beta = \dfrac{40 \times 35 \times 180 \times 7°}{35 \times 100 \times 22} = 21.1° \approx 21°$

37 (b)

In electromagnetic wave, electric and magnetic fields are in phase

Electromagnetic wave carry energy as they travel through space and this energy is shared equally by electric and magnetic fields

The direction of the propagation of electromagnetic wave is the direction of $\vec{E} \times \vec{B}$

The pressure exerted by the wave is equal to its energy density

In electromagnetic wave, the magnitudes of $\vec{E}$ and $\vec{B}$ are related by $\dfrac{E}{B}$

39 (a)

Bragg's law states that $2d \sin\theta = n\lambda$ where $=$ 1, 2, 3 …… . If $\lambda > 2d$, then $\sin\theta$ will be greater than 1 for $n = 1$, which is not possible

40 (c)

The energy of first excitation of sodium is

$$E = hv = \dfrac{hc}{\lambda}$$

Where h is Planck's constants, v is frequency, c is speed of light and λ is wavelength.

$$E = \dfrac{6.63 \times 10^{-34} \times 3 \times 10^8}{5896 \times 10^{-10}}$$

$$E = 3.37 \times 10 - 19J$$

Also since $1.6 \times 10 - 19J = 1eV$

$$\therefore \quad E = \dfrac{3.37 \times 10^{-19}}{1.6 \times 10^{-19}} \text{ eV}$$

$$E = 2.1 \text{ eV}$$

Hence, corresponding first excitation potential is 2.1 V.

41 (a)

Moderator slows down neutrons

42 (d)

$\dfrac{N}{N_0} = \left(\dfrac{1}{2}\right)^n, n = 2 \Rightarrow \dfrac{N}{N_0} = \left(\dfrac{1}{2}\right)^2 = \dfrac{1}{4}$

So disintegrated part $= 1 - \dfrac{N}{N_0} = 1 - \dfrac{1}{4} = \dfrac{3}{4}$

43 (c)

Hexagonal close packing is 12 for face centred crystal.

44 (b)

The wavelength of light emitted by a moving object is shifted. This effecd is called the Doppler's shift given by

$\lambda = \lambda_0 \left(1 + \dfrac{v}{c}\right)$ … (i)

Where λ is perceived wavelength, v the velocity and c the speed of light.

From Eq. (i) $v = c\left(\dfrac{\lambda - \lambda_0}{\lambda_0}\right)$

Given, $\lambda_0 = 656\,\text{nm}, \lambda = 706\,\text{nm},$

$c = 3 \times 10^8 \text{ms}^{-1}$

$v = 3 \times 10^8 \left(\dfrac{706 - 656}{656}\right)$

$v = 3 \times 10^8 \times \dfrac{50}{656} \approx 2 \times 10^7 \text{ms}^{-1}$

45 (d)

Laser action involves all the given phenomenon

(i) Amplification of particular frequency

(ii) Population inversion

(iii) Stimulated emission

46 (b)

Given that, oxygen contents in element oxide is 20% by weight.

Hence, element contents in element oxide is 80% by weight.

Then, equivalent weight of unknown element$=$

$\dfrac{80}{20} \times 8$

$\therefore$ Equivalent weight of unknown element$=32$

47 (a)

In 12 g carbon, mass of C-14 isotope $= 12 \times \dfrac{2}{100} =$ $0.24g$

$\therefore$ Number of C-14 atoms in 12 g of $C =$

$\dfrac{0.24}{14} \times 6.02 \times 10^{23}$

$= 1.032 \times 10^{22}$

48 (d)

$\lambda = \dfrac{h}{mv} \quad [mv = \sqrt{2m \cdot KE}]$

$$\lambda = \frac{h}{\sqrt{2m \cdot KE}}$$

$$KE \propto \frac{1}{\lambda^2 \sqrt{2m}}$$

Since, λ is same,

$$KE \propto \frac{1}{m}$$

The order of mass of electron, alpha particle and proton is $m_a > m_p > m_e$

Thus, the order of KE is $E_e > E_p > E_a$

49 (a)

When, $n = 5, l = 0, 1, 2, 3$ or 4 and $m = -4$ to $+4$

$\therefore n = 5, l = 4, m = 0, s = +\frac{1}{2}$ is a correct set of quantum numbers.

50 (b)

C^{4-}, N^{3-} and O^{2-} are isoelectronic species. The ionic radius of isoelectronic species decreases with increase the nuclear charge. Hence, the order of ionic radius is

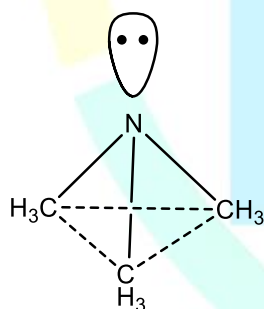Species $C^{4-} > N^{3-} > O^{2-}$

Ionic radii(Å)   2.60   1.71   1.40

51 (c)

Among the given, only CH_3OH and CH_3NH_2 are able to form H-bonds but H-bonding in CH_3OH due to high electronegativity of O-atom is strong. Hence, CH_3OH has the highest boiling point.

52 (a)

The structure of trimethyl amine is pyramidal.

53 (b)

Volume of unit cell $(V) = a^3$

$= (3.04 \times 10^{-8})^3$

$= 2.81 \times 10^{-23} cm^3$

54 (a)

Human body is an example of open system as it can exchange both mass and energy with the surroundings.

55 (a)

For a reversible process

$\Delta S_{system} + \Delta S_{surroundings} > 0$

56 (a)

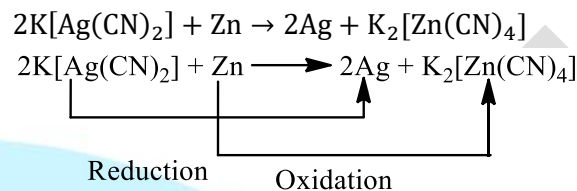g equivalent of $(NH_4)_2SO_4 = \frac{100}{1000} \times \frac{1}{10} \times 66 = 0.66$

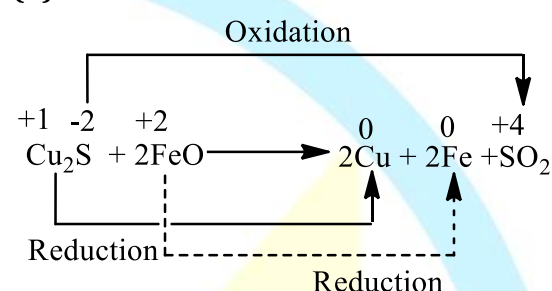g equivalent of $Na_2CO_3 \cdot H_2O = \frac{0.62}{62} = 0.01$

left $(NH_4)_2SO_4$ is $0.66 - 0.01 = 0.65$

$(NH_4)_2SO_4$ is a salt of strong acid and weak base

57 (d)

$2K[Ag(CN)_2] + Zn \rightarrow 2Ag + K_2[Zn(CN)_4]$

58 (d)

In this reaction Cu and Fe undergo reduction while sulphur undergoes oxidation. Hence, this is a redox reaction.

59 (c)

H_2O_2 canbe prepared by electrolysis of 50% H_2SO_4. In this method, hydrogen is liberated at cathode.

$H_2SO_4 \rightleftharpoons 2H^+ + 2HSO_4^-$

At anode :$2HSO_4^- \rightarrow H_2S_2O_8 + 2e^-$

$H_2S_2O_8 + 2H_2O \rightarrow 2H_2SO_4 + H_2O_2$

At cathode :$2H^+ + 2e^- \rightarrow H_2 \uparrow$
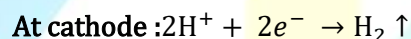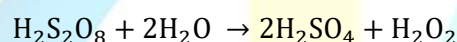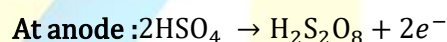
62 (c)

Froth-floatation is used to concentrate sulphide ores [Galena (PbS)].

64 (d)

We know that,

$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$
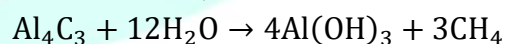
Thus, in this reaction methane (CH_4) is produced.

65 (d)

The reaction is ozonolysis. During the reaction $C = C$ breaks to give carbonyl compounds.

$$CH_3CH = CH_2 \xrightarrow[H_2O_2]{O_3} CH_3CHO + HCHO$$

Acetaldehyde formaldehyde

67 (d)

A occupies corners, thus number of A atoms per unit cell

$$= 8 \times \frac{1}{8} = 1$$

B occupies face centres, thus number of B atoms per unit cell

$$= 6 \times \frac{1}{2} = 3$$

$\therefore$ The empirical formula of the compound is AB_3.

68 (c)

Number of atoms in unit cell of Na are 2 (bcc).
Number of atoms in unit cell of Mg (fcc) are 4.

69 (b)

$$Na_2SO_4 \rightleftharpoons 2Na^+ + SO_4^{2-}$$

van't Hoff factor $i = [1 + (y-1)\alpha]$
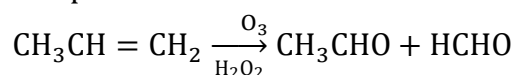where y is the number of ions from one mole solute, (in this case $=3$), α the degree of dissociation.
$i = (1 + 2\alpha)$

70 (c)

$$C = \frac{5}{342} \times \frac{1}{100} \times 1000 = \frac{50}{342} \text{ mol/L}$$

$$\pi = \frac{50}{342} \times 0.082 \times 423 = 5.07 \text{ atm}$$

71 (c)

For gold plating the electrolyte $K[Au(CN)_2]$ is used.

72 (c)

From slow step, rate $= k[B_2][A]$

From 1st equation $k_{eq} = \frac{[A]^2}{[A_2]}$

$Or\ [A] = \sqrt{k_{eq}[A_2]} = k_{eq}^{1/2} A_2^{1/2}$

Hence, rate $= k[B_2] k_{eq}^{1/2} A_2^{1/2}$

$= k'[A_2]^{1/2}[B_2]$

Hence, order

$$= 1\frac{1}{2}$$

73 (b)

Relation between $(t_{1/2})$ and initial concentration of reactant for $(n-1)$ order reaction

$$t_{1/2} \propto [R]_0^{2-n}$$

75 (c)

Roasting is the process in which the ore is heated strongly below its melting point is presence of air

76 (d)

The fourth –floatation process is based upon the preferential wetting of ore particle by oil

78 (c)

$$ZnCl_2 \cdot 2H_2O \xrightarrow{\Delta} Zn(OH)Cl + HCl + H_2O$$

$$Zn(OH)Cl \rightarrow ZnO + HCl$$
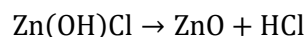
79 (b)

Azurite $[2CuCO_3 \cdot Cu(OH)_2]$ is an ore of copper.

80 (c)
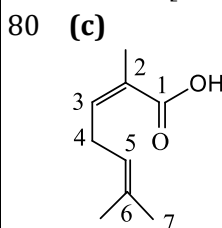
2,6-dimethyl hepta-2, 5-dienoic acid

81 (b)

Since, the alkyl halide RX gives 4, 5-diethyloctane, when reacts with Na, it must be
$CH_3(CH_2)_2CH(Br)CH_2CH_3$.

$$2CH_3CH_2CH_2CH-Br \xrightarrow[\text{Dry ether}]{Na}$$

The reaction is known as Wurtz reaction.
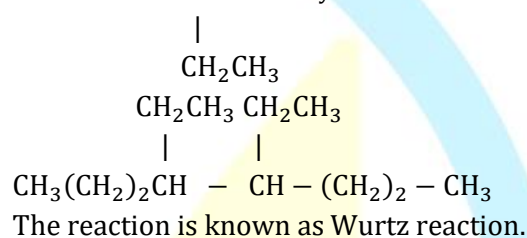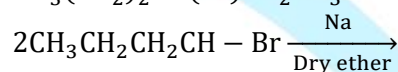
83 (c)

In the given sequence of reaction, the alcohol is tertiary.
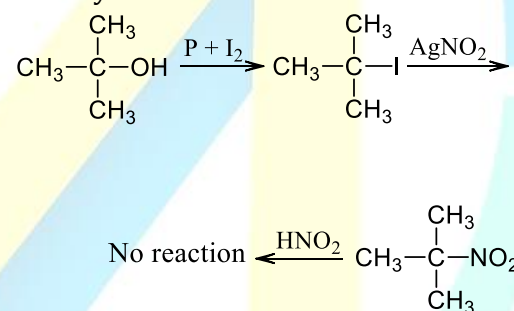
84 (d)

Benedict solution is readily reduced by aldehyde. It doesn't oxidise anhydrides.

85 (d)

Bases react with acid to form salt.
$\therefore$ Amines are basic in nature.
$\therefore$ It forms salt on reaction with H_2SO_4
$$2RNH_2 + H_2SO_4 \rightarrow [RNH_3]_2^+ SO_4^{2-}$$

87 (d)

Waxes are the esters of higher fatty acids with higher monohydric alcohols such as mericyl and cetyl alcohols.

88 (b)

Natural rubber is a linear polymer of isoprene (2-methyl-1, 3-butadiene). It becomes soft at high temperature (335 K) and brittle at low temperature (< 283), so it is not used in making footwear for polar regions.

89 (d)
Nylon-6 6 is polymer of
COOH —$(CH_2)_4$ —COOH
Adipic acid and H_2N —$(CH_2)_6$ —NH_2
(hexamethylenediamine)
∴Nylon-66 has nitrogen in it.

90 (a)
The given structure is of histamine that acts as a neurotransmitter and vasodilator.

91 (c)
The accurate arrangement of species in order to descending specificity is
Species → Genus → Family → Order → Class
As in the taxonomical hierarchy similarity increases from highest category to lowest category

92 (a)
In taxonomic categories family occupy the position between class and species (lowest) family can accomodate different genera but species are different like dog, jackal, wolf belong to same genera *Cannis* but species are different. But they belong to same class. More similar characteristic of order are grouped in same class

93 (c)
Kingdom-Monera of five kingdom classification consists of blue-green algae, nitrogen fixing bacteria and methanogens

94 (d)
White rust of crucifers is caused by a fungus *Albugo candida*, which is mycelial and eucarpic, mycellium intercellular, branched, asepatate and multinucleate (coenocytic).

95 (b)
Fungus of mycorrhiza helps in solubilization of phosphate. *Bacillus thuringiensis* has *cry* gene responsible for synthesis of cry protein.

96 (b)
In *Spirogyra affinis*, the sexual reproduction occurs through conjugation (indirect lateral) in which adjacent cells of same filament conjugate, the protoplast of one cell (male gamete) migrates to the other (female gamete) then these protoplasts fuse to form zygospore which on germination forms, a single new filament.

Thus, from two adjacent filaments with 10 cells participating in reproduction 10 new filaments will be formed.

97 (a)
Pollen grains.

Male sex organ is stamen also known as androecium. It consists of an anther lobe and a filament. Anther produces pollen grains

98 (a)
In *Scoliodon* or dog fish, there are present some pores, the ampullary pores on the upper and lower surface of the head, each of which leads into an ampulla (pl. ampullae) called ampulla of Lorenzini. Through these, the fish receives information of the temperature fluctuations in the surrounding water.

99 (b)
When the coelom arises as a result of a split in the mesoderm sheet, it is called schizocoel. In enterocoel, the coelom arises as an outgrowth of the enteron. The pouches pinch off and enlarge until they squeeze out off the blastocoel. Schizocoel is seen in Annelida, Arthropoda, Mollusca and Chordates. Echinodermata are entercoelomates

100 (a)
Animals belonging to the phylum-Porifera are supported by spicules or sponging fibres

101 (a)
In Datura stramonium, gynoecium is bicarpellarysyncarpous, ovary superior, bilocular, becoming tetralocular due to formation of a false septa. Therefore, plant B is *Datura*. In *Capsicum*, gynoecium is bicarpellary, syncarpous, ovary superior. The cross wall ovary is unilocular in the upper part.

102 (b)
Fruit formation is the characteristic feature of angiosperms. There is no fruit formation in gymnosperms because there is no ovary.

103 (b)
Aestivation
A – Valvate, *e. g.*, *Calotropisprocera*
B – Twisted, *e. g.*, lady's finger and cotton
C – Imbricate, *e. g.*, *Cassia* and gulmohar
D – Vexillary, *e. g.*, bean and pea

104 (d)
Gynoecium is the female reproductive part of the flower and is made up of one or more carpels. A carpel consists of the three parts namely stigma, style and ovary.
Stigma It is usually the tip of style and is the receptive surface for pollen grains.
Style Tube-like structure connects the stigma and ovary.
Ovary Enlarged base part contain ovules

105 (d)
Cullulase, hemicellulose, pectin. *All of the above*
The **collenchyma** occurs in layers below the epidermis in dicotyledonous plants. It is found either as a homogenous layer or in patches. It consists of cells which are much thickened at the corners due to the deposition of cellulose, hemicellulose and pectin. Collenchymatous cells may be oval, spherical or polygonal and often contain chloroplasts. These cells assimilate food when they contain chloroplasts. Intercellular spaces are absent. They provide mechanical support to the growing parts of the plant such as young stem and petiole of a leaf

106 (d)
Pith is well developed in the monocots and is small, inconspicuous in dicots
In monocot, is there is no secondary growth due to the absence of vascular cambium between the xylem and phloem. But secondary growth is the characteristic of dicotyledonous plants

107 (a)
A single female genital pore is present in the mid-ventral line of 14th segment of human

108 (a)
In mammals, RBC_S are roughly circular, biconcave, disc like, non-nucleated corpuscles. In human, theRBC_S are 6.5 μ to 8 μ in diameter (average diameter 7.2 μ) and $1-2$ μ thick.

109 (a)
DNA is a polymer of nucleotides, so nucleotide is the ultimate unit of DNA.

110 (d)
According to Chargaff's rule, in DNA, the proportion of adenine always equals to that of thymine and proportion of guanine always equal to that of cytosine, *i. e.*, A=T and G=C. Thus, in a DNA, if guanine is 20%, cytosine also will be 20%. So, both adenine and thymine together will be 60%, *i. e.*, 30% adenine and 30% thymine.

111 (a)
Lyasescatalyse the breakage of specific covalent bonds and removal of groups without hydrolysis. Example histidine decarboxylase splits $C-C$bonds of histidine forming CO_2 and histamine

112 (b)
$$NADH + H^+ + 1/2O_2 \xrightarrow[\text{oxidase}]{\text{Cytochrome}} NAD^2 + H_2O$$
Cytochrome oxidases catalyses the transfer of hydrogen to oxygen, forming water in the last reaction of electron transport system

113 (d)
Colchinine ($C_{22}H_{25}O_6N$) is used to induce polyploidy. *Raphanobrassica* ($4n = 36$) was produced by **G D Karpechenko** (1927) by crossing radish (*Raphanus sativus* $2n = 18$) and cabbage (*Brassica oleracea* $2n = 18$). It is the first **allotetraploid**.

114 (a)
Meiosis reduces chromosome number from diploid ($2n$) to haploid (n). It occurs in germ cells (eggs or sperm)

115 (b)
Transpiration pull.
If the stem of plant is cut under a state of tension in xylem sap, the air will be pulled into the xylem and the transport of water (xylem sap) remains in continuity. However, it can be discontinued with the introduction of air bubble in the xylem. Copeland (1902) believed that air bubbles enter into the xylem and break the tensile strength or cohesion force between the water molecule

116 (b)
Munch hypothesis is based on translocation of food due to turgor pressure (TP) gradient.

117 (b)
Cohesion tension theory or transpiration pull was proposed by Dixon and Jolly. Cohesion force is responsible to produce continuous water column in tracheary elements while the force of adhesion between the cells of tracheary elements and water molecule produce surface tension that accounts for high capillary through tracheary elements. Loss of water from aerial parts through transpiration causes a suction pressure in the water column of plants and this is known as transpiration pull

118 (b)
In 1860, Julius Von Sachs, a prominent German botanist, demonstrated for the first time that the plants could be grown to maturity in a defined nutrient solution in the complete absence of soil

119 (b)
Essential element has following features:
1.It is indispensable for the growth of plants.

2.Cannot be replaced by any other element.

3.Absence/deficiency produces disorders.

4.Has nutritive value.

5.Necessary for completion of vegetative or reproductive phase.

6.These are- C, H, O, N, P, K, S, Mg, Ca, Fe, B, Mn, Cu, Zn, Mo and Cl.

120 **(b)**
Chloroplasts are found in the mesophyll cells of the leaves. Leaves have a maximum number of chloroplasts

121 **(b)**
Electron excited by PS-I used in the formation of $NADPH + H^+$. These electrons come ultimately from H_2O through photosynthesis

122 **(b)**
NADH is oxidised to NAD^+ slowly in fermentation, through the reaction is very vigorous in case of aerobic respiration

123 **(a)**
DCMU is a herbicide which acts as an inhibitor of non-cyclic electron transport; PMA is fungicide which reduces transpiration; colchicines is an antimicrobial drug, it causes prevention of mitotic spindle formation thus blocking the mitosis.

124 **(b)**
Abscission the shedding of a body part, commonly refers to the process by which a plant intentionally drops one or more of its parts, such as a leaf, fruit, flower or seed.

125 **(b)**
Ethylene (C_2H_4) enhances the respiration rate during ripening of fruit. This rise in rate of respiration is called climacteric respiration

126 **(b)**
Geometrical Growth In most system the initial growth is slow (lag phase), and it increases there after at a exponential rate (log or exponential phase). Both the progeny cells following mitotic cell division retains the ability to divide and continue to do so. However due to the limited nutrient supply, the growth slows down leading to stationary phase. If we plot the parameter of growth against time, a typical sigmoid curve is obtained.
It has following stages
1. During lag phase, organism adapt themselves to growth conditions. It is the period where the individual organism are maturing and not yet able to divide. During the lag phase of the bacterial growth cycle, synthesis of RNA, enzymes and other molecules occurs
2. The log phase (sometimes called the logarithmic phase or the exponential phase) is a period characterised by cell doubling. The number of new organism appering per unit time is proportional to the present population.
3. The stationary phase is often due to a growth-limiting factor such as the depletion of an essential nutrient, and/or the formation of an inhibitory product such as an organic acid. Stationary phase results from a situation in which growth rate and death rate are equal
4. Death phase, organism run out of nutrients and die
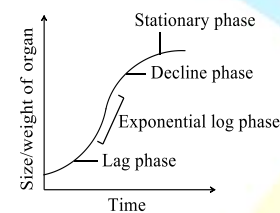
127 **(b)**
A – Parotid gland, B – Gall bladder, C – Pharynx, D – Pancreas, E – Transverse colon, F – Caecum

128 **(d)**
Carboxypeptidase is an enzyme secreted by pancreas. It breaks larger peptides into smaller peptides.

129 **(a)**
Air entering the lungs is warm and filtered.
Nasal Cavity It is the first part of the respiratory system. It opens to the exterior through nostrils. The small hairs present in the cavity helps to filter the particles of dust and other foreign matter. The air in the nasal cavity gets warmed (because nasal cavity has very good blood supply) and moistened before it enters to the lungs

130 **(b)**
Haemoglobin is an iron containing deep red coloured respiratory pigment. It becomes bright red when combined with oxygen.

131 **(c)**
A-vern, B-artery, C-capillary

132 **(d)**
A buffer is a chemical or combination of chemicals that can both take up and release hydrogen ions. Carbonic acid (H_2CO_3) and sodium bicarbonate $(NaHCO_3)$ help buffering human blood because H_2CO_3 is a weak acid that does not totally dissociate, when excess hydrogen ions are present in blood, the reaction goes to the left and carbonic acid forms to maintain the pH.

$$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

Carbonic acid   Hydrogen ion   Bicarbonate ion
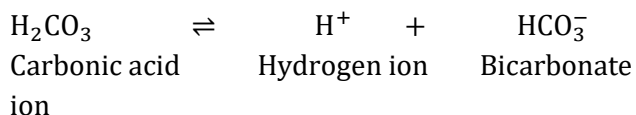
133 (b)

Pelvis is the main, basin-shaped cavity of the kidney into which urine is discharged by nephrons. The term 'pelvis' is also used for the basin-shaped structure formed by the hipbones together with the sacrum and coccyx (or caudal vertebrae).

134 (a)

Polyuria amount of urine passed out is more

135 (a)

ANF (Anti Natriuretic Factor) decrease the blood pressure vaso dilation and hence checks on renin-angiotensin mechanism

136 (b)

Presence of seven cervical vertebrae in the neck is common feature in all mammals. These vertebrae are acoelous, covered by cartilaginous pads, *i.e.*, epiphysis.

137 (b)

Thin and thick filament respectively.
Both proteins, *i.e.,* actin and myosin are arranged as rod-like structure, parallel to each other and also to the longitudinal axis of the myofibrils. Actin filaments are thinner as compared to myosin filaments, hence they are commonly called thin and thick filaments respectively

138 (b)

Gout is generally a old age disorder in which inflammation of joints accurs due to the line accumulation of uric acid crystals

139 (a)

Cerebrum consists of centre for thinking and learning.

140 (c)

Bowman's glands, present in the lining of nasal epithelium, secretes mucus. All odoriferous materials give off chemical particles, which are carried into the nose with inhaled air and stimulate the nerve cells of the olfactory region when dissolved in this mucus.

141 (c)

The posterior pituitary gland secretes two hormones, vasopressin (or ADH) and oxytocin. Vasopressin regulates the body's water balance. Oxytocin plays a role in lactation by stimulating the ejection of milk from the breast in response to sucking but milk production is promoted by prolactin secreted by the anterior pituitary.

142 (b)

Pancreas is partially exocrine and partially endocrine gland.

144 (a)

Juvenile phase is the phase of life span in which growth of body and full development of reproductive organ takes place. It is called vegetative phase in plants

Life span cycle
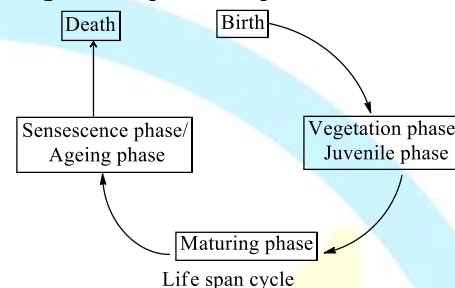
146 (a)

It is the ovules which develop into seed so number of seeds is equal to the number of ovules

147 (d)

Fertilization of egg takes place inside **embryo sac** because egg is the part of embryo sac.

148 (b)

The distal centriole of the sperm divides and forms two centrioles to generate the mitotic spindle formation for cell division. The mammalian secondary oocyte (egg) does not have centriole of its own

149 (a)

Vestibular gland.
Greater vestibular glands (Bartholin's gland) are packed glands situated on each side of vaginal orifice. These glands are homologous to male bulbourethral (Cowper's) gland and secretes viscus fluid that supplements the lubrication during sexual intercourse.
The lesser vestibular glands (paraurethral glands or glands of Skene) are numerous minute glands that are present on either side of the urethral orifice (opening). These glands are homologous to the male prostate glands and secrete mucus

150 (a)

After releasing ovum the structure left is called corpus luteum. It secretes progesterone, which maintains the pregnancy

151 (c)

The female individual contains two X chromosomes. The eggs are produced by the

meiosis, *i.e.,* reduction division. So, the egg contains one X-chromosome, when released from ovary. After fertilization, the diploid phase is restrored.

153 (d)
Induced abortion and intentional abortion, both the terms are used commonly for MTP (Medical Termination of Pregnancy)

154 (a)
Haemophilia is a sex-linked character (X-linked recessive trait). It is a rare human blood disorder, in which, blood clotting is deficient, resulting in severe bleeding internally and externally. The condition is due to lack of fibrin in the blood and is controlled by two closely linked genes on the blood and is controlled by two closely linked genes on the X-chromosome that are responsible for the production of different clotting factors.

155 (d)
A-Sugar, B-$I^A I^B$, C-Sugar

156 (b)
Linkage and incomplete dominance were the post Mendelian discoveries.
Post Mendelian Discoveries
Gene interaction is the influence of alleles and nonalleles ion the normal phenotypic expression of genes. It is two types, **intragenic** (allelic) and intergenic (nonallelic). In the intragenic interaction the two allels (present on the same gene locus on the two homologous chromosome) of a gene interact in such a way as to produce a phenotypic expression different from typical dominant-recessive phenotype, *e.g.,* incomplete dominance, codominance, multiple alleles.
In intergenic or non-allelic interaction, two or more independent gene present on the same or different chromosomes interact to produce different expression, *e.g.,* epistasis, duplicate genes, complementary genes, supplementary genes, lethal genes, inhibitory genes, etc.

157 (a)
Enzyme A – RNA polymerase
    B – *hn* (histonuclear)
   C – Post-transcription modification

158 (d)
Reporter genes are used to determine whether a particular DNA construct has been successfully introduced into a cell, organ or tissue.

159 (c)
A-900cc, B-Omnivorous

160 (a)
Analogous Organs The organs which have similar functions but are different in their details and origin are called analogous organs. The analogous organs shows convergent evolution
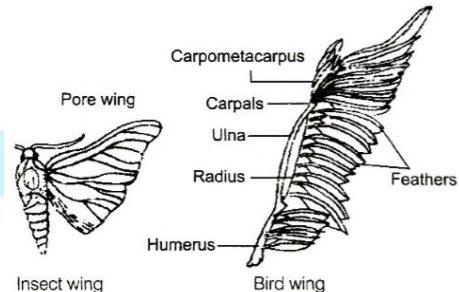
161 (d)
T-lymphocytes are involved in cell mediated immunity. T-cells largely recognize proteins that have been processed within antigen presenting cells and presented on the cell surface in a form that is bound to a molecule known as **MajorHistocompatiblityComplex**(MHC).

162 (b)
Cataract is an eye disorder in old age, in which the flexibility of the lens declines so, that the lens become less convex on both sides. Simultaneously, it may become somewhat opaque, acquire an amber colour and increased in its density.

163 (a)
The carcinogens present in tobacco smoke have been identified as a major cause of lung cancer

164 (a)
In protoplasm fusion the enzyme required are cellulose, hemicellulose and pectinase

165 (d)
Shakti, Rattan and Protina are recently developed composite (germplasm complex) varieties of maize, which have a higher lysine and tryptophan content than traditional maize varieties

166 (b)
Bacillus thuringiensis (*Bt*) is a Gram positive, soil-dwelling bacterium, commonly used as a biological alternative to a pesticide, alternatively, the cry toxin may be extracted and used as a pesticide.

167 (d)
*Nosemabombycis*is a protozoan, which causes the epidemic disease pebrine in silkworms, attacks all tissues and all developmental stages from embryo to adult. In advanced infections, small brown

spots cover the body of the silkworm.

170 **(a)**

Bt tobacco was first cultured to kill hornworm. Tobacco plants containing a gene from a bacterium, *Bacillus thruinginesis* have been produced. This bacterial gene specifies an insecticidal protein that destroys the stomach lining of insects and kills them. The tobacco plants with this gene produces their own insecticide

171 **(b)**

Haploids hae a single genome as found in the gametes of the species. A haploid has only one copy of each chromosome and is highly sterile. **Guha** and **Maheshwari** (1964), developed a culture technique to produce haploid plants. It is called androgenic haploid culture, in which very young unopened sterilised flowers are opened to remove young anthers. **Anthers** are introduced over **culture medium** for 4-6 weeks, to give rise to large number of **embryoids** (haploids).

173 **(c)**

Stenohaline (shark and string rays) and euryhaline (salmon).
Some organisms are tolerant to wide range of salinities called euryhaline, *e. g.*, salmon fish but others are restricted to narrow range called stenohaline like shark and string rays. Many freshwater animals cannot live for long in sea water and *vice-versa* because of the osmotic problems they would face

174 **(a)**

Proto-cooperation is the interaction between two living organisms of different species in which both are mutually benefied but they can live without each other.

175 **(b)**

Heterotrophs.
Net primary productivity is the weight of the organic matter stored by the producers in a unit area/volume for unit time. It is given by NPP = GPP – R (Gross Primary Productivity) where, R = Respiration losses. It is utilised by hetertrophs

176 **(c)**

Nekton are aquatic organisms that can actively swim at will against the water current. They live in shallow and deep ocean waters. Most nekton eat zooplankton, other nekton or thy scavange for waste.

177 **(c)**

Threatened species in India include about 81 species of wild mammals, 30 wild birds, 15 reptiles and amphibians and many invertebrates.

178 **(c)**

A species of organism that is not native to a locality and having been moved there from its natural range by humans or other agents is called exotic species, *e. g.*, water hyacinth, *Prosopis cineraria*, etc.

179 **(d)**

Main components of photochemical smog are ozone, peroxyacetyl nitrate, aldehydes, etc.

180 **(a)**

In August 1989, 44 countries and EEC ratified the Montreal protocol, which provides a mechanism to review the efficiency of control measures. In a policy statement called Helsinki Declaration, the attending nations agreed to phase out the production and consumption of controlled CFCs as soon as possible but not later than the year 2007. They also agreed to phase out the halons and to control and reduce other Ozone Depleting Substances (ODSs).