1. The relative density of material of a body is found by weighing it first in air and then in water. If the weight in air is (5.00 ± 0.05) $newton$ and weight in water is $(4.00 \pm 0.05)newton$. Then the relative density along with the maximum permissible percentage error is
   a) $5.0 \pm 11\%$ b) $5.0 \pm 1\%$
   c) $5.0 \pm 6\%$ d) $1.25 \pm 5\%$

2. If the units of M and L are increased three times, then the unit of energy will be increased by
   a) 3 times   b) 6 times   c) 27 times   d) 81 times

3. A car moves a distance of $200\ m$. It covers first half of the distance at speed $60\ kmh^{-1}$ and the second half at speed v. If the average speed is $40\ kmh^{-1}$, the value of v is
   a) $30\ kmh^{-1}$ b) $13\ kmh^{-1}$
   c) $60\ kmh^{-1}$ d) $40\ kmh^{-1}$

4. A body is tided with a string and is given a circular motion with velocity v in radius r. The magnitude of the acceleration
   a) $\dfrac{v}{r}$ b) $\dfrac{v^2}{r}$ c) $\dfrac{v}{r^2}$ d) $\dfrac{v^2}{r^2}$

5. A particle is moving with velocity $\vec{v} = K(y\hat{\imath} + x\hat{\jmath})$, where K is a constant. The general equation for its path is
   a) $y^2 = x^2 + $ constant   b) $y = x^2 + $ constant
   c) $y^2 = x + $ constant   d) $xy = $ constant

6. A coin of mass 10 g is placed over a book of length 50 cm. the coin is on the verge of sliding when one end of the book is lifted to 10 cm up. The coefficient of static friction between the book and the coin is
   a) 1.0   b) 0.4   c) 0.3   d) 0.2

7. A machine gun fires n bullets per second, each of mass m. If the speed of each bullet is u, then the force of recoil is
   a) mng b) mnv
   c) $mnvg$ d) $\dfrac{mnv}{g}$

8. Power of water pump is $2\ kW$. If $g = 10\ m/sec^2$, the amount of water it can raise in one minute to a height of $10\ m$ is
   a) $2000\ litre$ b) $1000\ litre$
   c) $100\ litre$ d) $1200\ litre$

9. A mass is whirled in a circular path with a constant angular velocity and its angular momentum is L. If the string is now halved keeping the angular velocity the same, the angular momentum is
   a) $L/4$ b) $L/2$ c) L d) $2L$

10. From a circular ring of mass M and R, an arc corresponding to a 90^0 sector is removed. The moment of inertia of the remaining part of the ring about an axis passing through the ring and perpendicular to the plane of ring is k times MR^2. Then the value of k is
   a) $\dfrac{3}{4}$ b) $\dfrac{7}{8}$ c) $\dfrac{1}{4}$ d) 1

11. In a certain region of space gravitational field is given by $I(Kr)$. Taking the reference point to be at $r = V_0$, find the potential.
   a) $K \log \dfrac{r}{r_0} + V_0$ b) $K \log \dfrac{r_0}{r} + V_0$
   c) $K \log \dfrac{r}{r_0} - V_0$ d) $\log \dfrac{r}{r_0} - V_0 r$

12. If the volume of a block of aluminium is decreased by 1%, the pressure (stress) on its surface is increased by (Bulk modulus of A1 $= 7.5 \times 10^{10} \text{Nm}^{-2}$)
   a) $7.5 \times 10^{10} \text{Nm}^{-2}$ b) $7.5 \times 10^{8} \text{Nm}^{-2}$
   c) $7.5 \times 10^{6} \text{Nm}^{-2}$ d) $7.5 \times 10^{4} \text{Nm}^{-2}$

13. If there were no gravity, which of the following will not be there for fluid?
   a) Viscosity
   b) Surface tension
   c) Pressure
   d) Archimedes' upward thrust

14. A cubical block of wooden edge I and a density ρ floats in water of density 2ρ. The lower surface of cube just touches the free end of a massless spring of force constant k fixed at the bottom of the vessel. The weight w put over the block so that it is completely immersed in water without wetting the weight is
   a) $a(l\rho g + k)$ b) $a(l^2 \rho g + k)$

c) $a\left(\dfrac{l\rho g}{2}+2k\right)$ d) $a\left(l^2\rho g+\dfrac{k}{2}\right)$

15. Five rods of same dimensions are arranged as shown in figure. They have thermal conductivities K_1, K_2, K_3, K_4 and K_5. When points A and B are maintained at different temperature, no heat would flow through central rod, if
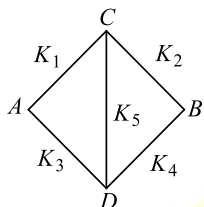
  a) $K_1K_4 = K_2K_3$

  b) $K_1 = K_4$ and $K_2 = K_3$

  c) $\dfrac{K_1}{K_4} = \dfrac{K_2}{K_3}$

  d) $K_1K_2 = K_3K_4$.

16. Graph of isometric process is

17. The coefficient of performance of a Carnot refrigerator working between 30°C and 0°C is

  a) 10   b) 1   c) 9   d) 0

18. A type kept outside in sunlight bursts off after sometime because of

  a) Increases in pressure b) Increases in volume

  c) Both (a) and (b)   d) None of these

19. A body has a time period T_1 under the action of one force and T_2 under the action of another force, the square of the time period when both the forces are acting in the same direction is

  a) $T_1^2 T_2^2$

  b) T_1^2 / T_2^2

  c) $T_1^2 + T_2^2$

  d) $T_1^2 T_2^2 / (T_1^2 + T_2^2)$

20. A particle executes simple harmonic motion with a time period of 16 s. At time $t = 2$ s, the particle crosses the mean position while at $t = 4$ s, velocity is 4 ms^{-1}. The amplitude of motion in metre is

  a) $\sqrt{2}\pi$ b) $16\sqrt{2}\pi$ c) $24\sqrt{2}\pi$ d) $\dfrac{32\sqrt{2}}{\pi}$

21. A wave travelling along the x-axis is described by the equation y(x, t) =0.005 cos (αx-βt). If the wavelength and the time period of the wave are 0.08m and 2.0s, respectively, than α and β in appropriate unit are

  a) a=25.00π, β π

  b) $\alpha = \dfrac{0.08}{\pi}, \beta = \dfrac{2.0}{\pi}$

  c) $\alpha = \dfrac{0.04}{\pi}, \beta = \dfrac{1.0}{\pi}$

  d) $\alpha = 12.5\pi, \beta = \dfrac{\pi}{2.0}$

22. A regular hexagon of side $'a'$ has a charge Q at each vertex. Potential at the centre of the hexagon is $\left(K = \dfrac{1}{4\pi\varepsilon_0}\right)$

  a) Zero   b) $\dfrac{KQ}{a}$ Volts   c) $12\dfrac{KQ}{a}$ d) $6\dfrac{KQ}{a}$

23. A capacitor 4 μF charged to 50 V is connected to another capacitor of $2\mu F$ charged to 100 V with plates of like charges connected together. The total energy before and after connection in multiples of $(10^{-2}J)$ is

  a) 1.5 and 1.33   b) 1.33 and 1.5

  c) 3.0 and 2.67   d) 2.67 and 3.0

24. Two capacitors of capacitance 2 μF and 4μF respectively are connected in series. The combination is connected across a potential difference of 10 V. The ratio of energies stored by capacitors will be

  a) $1 : \sqrt{2}$ b) $2 : 1$ c) $1 : 4$ d) $4 : 1$

25. A 5V battery with internal resistance 2 Ω and a 2V battery with internal resistance 1 Ω are connected to a 10 Ω resistor as shown in the figure
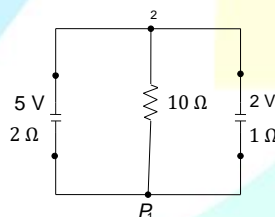

 The current in the 10 Ω resistor is

  a) 0.27A, $P_2 to P_1$ b) 0.03A, $P_1 to P_2$

  c) 0.03A, $P_2 tp P_1$ d) 0.27A, $P_1 to P_2$

26. The power of heater is 500 W at 800°C. What will be its power at 200°C ? (Given : temperature coefficient of resistance, $\alpha = 4 \times 10^{-4}°C^{-1}$)

  a) 484 W   b) 672 W   c) 526 W   d) 620 W

27. The mass of ions deposited during a given interval of time in the process of electrolysis depends on

a) The current　　　b) The resistance
c) The temperature　　d) The electric power

28. Circular loop of a wire and long straight wire carry currents I_c and I_e, respectively as shown in figure. Assuming that these are placed in the same plane. The magnetic fields will be zero at the centre of the loop when the separation H is
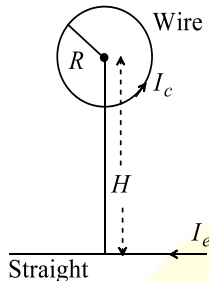
a) $\dfrac{I_e R}{I_c \pi}$　　b) $\dfrac{I_c R}{I_e \pi}$　　c) $\dfrac{\pi I_c}{I_e R}$　　d) $\dfrac{I_e \pi}{I_c R}$

29. The vertical component of the earth's magnetic field is zero at a place where the angle of dip is
   a) 0°　　b) 45°　　c) 60°　　d) 90°

30. At a place, if one earth's horizontal and vertical components of magnetic fields are equal, then the angle of dip will be
   a) 30°　　b) 90°　　c) 45°　　d) 0°

31. As shown in the figure, P and Q are two coaxial conducting loops separated by some distance. When the switch S is closed, a clockwise current I_P flows in P (as seen by E) and an induced current I_{Q_1} flows in Q. The switch remains closed for a long time. When S is opened, a current I_{Q_2} flows in Q. Then the directions of I_{Q_1} and I_{Q_2} (as seen by E) are
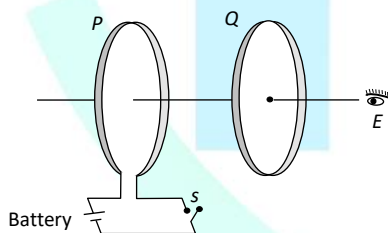

a) Respectively clockwise and anticlockwise
b) Both clockwise
c) Both anticlockwise
d) Respectively anticlockwise and clockwise

32. In the circuit shown below, the key K is closed at $t = 0$. The current through the battery is
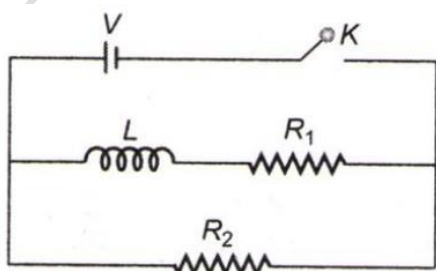
a) $\dfrac{V R_1 R_2}{\sqrt{R_1^2 + R_2^2}}$ at $t = 0$ and $\dfrac{V}{R_2}$ at $t = \infty$

b) $= 0$ and $\dfrac{V(R_1+R_2)}{R_1 R_2}$ at $t = \infty$

c) $\dfrac{V}{R_2}$ at $t = 0$ and $\dfrac{V R_1 R_2}{\sqrt{R_1^2 + R_2^2}}$ at $t = \infty$

d) $\dfrac{V(R_1+R_2)}{R_1 R_2}$ at $t = 0$ and $\dfrac{V}{R_2}$ at $t = \infty$

33. A square metal wire loop $PQRS$ of side 10 cm and resistance 1 Ω is moved with a constant velocity v_c in a uniform magnetic field of induction $B = 2$ Wbm^2, as shown in figure. The magnetic field lines are perpendicular to the plane of the loop (directed into the paper). The loop is connected to network $ABCD$ of resistors each of value 3 Ω. The resistance of the lead wires SB and RD are negligible. The speed of the loop so as to have a steady current of mA in the loop is
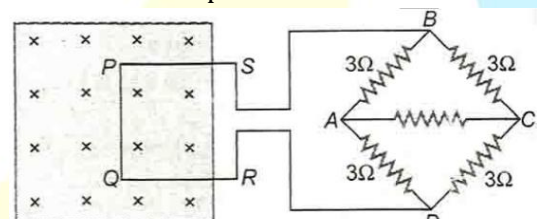
a) 2 ms^{-1}　　　　b) 2×10^{-2}ms^{-1}
c) 20 ms^{-1}　　　　d) 200 ms^{-1}

34. A TV tower has a height of 100 m. How much population is covered by the TV broadcast if the average population density around the tower is 100 km^{-2} (radius of the earth= 6.37×10^6 m)
   a) 4 lakh　b) 4 billion　c) 40,000　d) 40 lakh

35. The two lenses of an achromatic doublet should have
   a) Equal powers
   b) Equal dispersive powers
   c) Equal ratio of their power and dispersive power
   d) Sum of the product of their powers and dispersive power equal to zero

36. What should be the angle between two plane mirrors so that whatever be the angle of incidence, the incident ray and the reflected ray from the two mirrors be parallel to each other
   a) 60°　　b) 90°　　c) 120°　　d) 175°

37. A wave can transmit ………. from one place to another

a) Energy   b) Amplitude
c) Wavelength   d) Matter

38. Kinetic energy of emitted cathode rays is dependent on
a) Only voltage
b) Only work function
c) Both (a) and (b)
d) It does not depend upon any physical quantity

39. An electron and a proton have the same de-Broglie wavelength. Then the kinetic energy of the electron is
a) Zero
b) Infinity
c) Equal to kinetic energy of the proton
d) Greater than the kinetic energy of proton

40. Excitation energy of a hydrogen like atom in its first excitation state is 40.8eV. Energy needed to remove the electron from the ion in ground state is
a) 40.8eV   b) 27.2eV   c) 54.4eV   d) 13.6eV

41. The angular momentum of electron in n^{th} orbit is given by
a) nh b) $\dfrac{h}{2\pi n}$ c) $n\dfrac{h}{2\pi}$ d) $n^2\dfrac{h}{2\pi}$

42. In any fission process the ratio $\dfrac{\text{mass of fission products}}{\text{mass of parent nucleus}}$ is
a) Less than 1
b) greater than 1
c) Equal to 1
d) Depends on the mass of parent nucleus

43. To obtain electrons as majority charge carriers in a semiconductor, the impurity mixed is
a) Monovalent   b) Divalent
c) Trivalent   d) Pentavalent

44. Numerical aperture of optical fiber is a measure of
a) Its resolving power
b) Its light gathering power
c) The pulse dispersion
d) The attenuation of light through it

45. If sky wave with frequency of 50 MHz is incident on D region at an angle of 30°, then angle of refraction is
a) 15°   b) 30°   c) 60°   d) 45°

46. The mass of 112cm³ of CH_4 gas at STP is
a) 0.16 g   b) 0.8 g   c) 0.08 g   d) 1.6 g

47. If H_2SO_4 ionises as $H_2SO_4 + 2H_2O \rightarrow 2H_3O^+ + SO_4^{2-}$, then total number of ions produced by 0.1 M H_2SO_4 will be
a) 9.03×10^{21} b) 3.01×10^{22}
c) 6.02×10^{22} d) 1.8×10^{23}

48. Identify the least stable ion amongst the following
a) Li^- b) Be^- c) B^- d) C^-

49. The number of orbitals present in the shell with $n = 4$ is
a) 8   b) 16   c) 18   d) 32

50. Among, Al_2O_3, SiO_2, P_2O_3 and SO_2 the correct order of acid strength is
a) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$
b) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$
c) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$
d) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

51. Which one of the following compounds has the smallest bond angle in its molecule?
a) SO_2 b) OH_2 c) SH_2 d) NH_3

52. Amongst LiCl, RbCl, $BeCl_2$ and $MgCl_2$, the compounds with the greatest and the least ionic character, respectively
a) LiCl and RbCl
b) RbCl and $MgCl_2$
c) RbCl and $BeCl_2$
d) $MgCl_2$ and $BeCl_2$

53. The three states of matter are solid, liquid and gas. Which of the following statements is/ are true about them?
a) Gases and liquids have viscosity as a common property
b) The molecules in all the three states posses random translational motion
c) Gases cannot be converted into solids without passing through the liquid phase
d) Solids and liquids have vapour pressure as a common property

54. If a refrigerator's door is opened then, we get
a) Room heated
b) Room cooled
c) More amount of heat is passed out
d) No effect on room

55. Enthalpy is equal to
a) $T^2\left[\dfrac{\delta(G/T)}{\delta T}\right]_p$ b) $-T^2\left[\dfrac{\delta(G/T)}{\delta T}\right]_p$
c) $T^2\left[\dfrac{\delta(G/T)}{\delta T}\right]_V$ d) $-T^2\left[\dfrac{\delta(G/T)}{\delta T}\right]_V$

56. 2.5 mL of $\frac{2}{5}$ M weak monoacidic base ($K_b = 1 \times 10^{-12}$ at 25°C) is titrated with $\frac{2}{15}$ M HCl in water at 25°C. The concentration of H^+

at equivalence point is

$(K_w = 1 \times 10^{-14}$ at 25°C)

a) 3.7×10^{-13} M   b) 3.2×10^{-7} M

c) 3.2×10^{-2} M   d) 2.7×10^{-2} M

57. The reaction,

$Ag^{2+}(aq) + Ag(s) \rightleftharpoons 2Ag^+(aq)$

is an example of

a) Reduction   b) Oxidation

c) Comproportionation   d) Disproportionation

58. MnO_4^- is a good oxidising agent in different medium changing to

$MnO_4^- \rightarrow Mn^{2+}$

$\rightarrow MnO_4^{2-}$

$\rightarrow MnO_2$

$\rightarrow Mn_2O_3$

Changes in oxidation number respectively are

a) 1,3,4,5   b) 5,4,3,2   c) 5,1,3,4   d) 2,6,4,3

59. Under what conditions of temperature and pressure, the formation of atomic hydrogen from molecular hydrogen will be favoured more?

a) High temperature and low pressure

b) Low temperature and low pressure

c) High temperature and high pressure

d) Low temperature and high pressure

60. Shine at freshly cut sodium is because of

a) Due to oscillation of free electrons

b) Due to weak metallic bonding

c) Due to by absorption of light in crystal lattice

d) Due to presence of free valency at the surface

61. Alum is added to muddy water because

a) It acts as disinfectant

b) It results in coagulation of clay and sand

c) Clay is soluble in alum, hence removes it

d) It makes water alkaline which is good for health

62. Which of the following has most density?

a) Pb   b) B   c) Cu   d) Fe

63. With a change in hybridisation of the carbon bearing the charge, the stability of a carbanion increase in the order

a) $sp < sp^2 < sp^3$ b) $sp < sp^3 < sp^2$

c) $sp^3 < sp^2 < sp$ d) $sp^2 < sp < sp^3$

64. In the reactions,

$B \xleftarrow{\text{Lindlar catalyst/}H_2} RC \equiv CR \xrightarrow[H_2]{\text{Na/NH}_3} A$

A and B are geometrical isomers. Then,

a) A is cis and B is $trans$

b) A is $trans$ and B is cis

c) A and B are cis

d) A and B are $trans$

65. Which of the following will yield $trans$ product from butyne?

a) $LiAlH_4$ b) $Na/Liq. NH_3$

c) $NaBH_4$ d) Ni catalyst

66. An important product in the ozone depletion by chloroflurocarbons is

a) Cl_2 b) OCl c) OF_2 d) O_2F_2

67. Which of the following statements is correct?

a) Silicon doped with boron is an n −type semiconductor

b) Silicon doped with arsenic is a p −type semiconductor

c) Metals are good conductors of electricity

d) Electrical conductivity of semiconductors decreases with increasing temperature

68. Coordination number of Zn in ZnS (zinc blende) is

a) 6   b) 4   c) 8   d) 12

69. What is the amount of urea dissolved per litre if its aqueous solution is isotonic with 10% cane sugar solution? (mol.wt.of urea =60)

a) 200 g/L   b) 19.2 g/L

c) 17.54 g/L   d) 16.7 g/L

70. Volume of 0.6 M NaOH required to neutralise 30 cm^3 of 0.4 M HCl is

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

71. What is the cell reaction occurring in Daniel cell (Galvanic cell)?

a) $Cu(s) + ZnSO_4(aq) \rightarrow CuSO_4(aq) + Zn(s)$

b) $Zn(s) + CuSO_4(aq) \rightarrow Cu(s) + ZnSO_4(aq)$

c) $Ni(s) + ZnSO_4(aq) \rightarrow NiSO_4(aq) + Zn(s)$

d) $2Na(s) + CdSO_4(aq)$
$\rightarrow Na_2SO_4(aq) + Cd(s)$

72. The time required for 100% completion of a zero order reaction is

a) ak b) $\dfrac{a}{2k}$ c) $\dfrac{a}{k}$ d) $\dfrac{2k}{a}$

73. The reaction, $2N_2O_5 \rightleftharpoons 2N_2O_4 + O_2$ is

a) Bimolecular and second order

b) Unimolecular and first order

c) Bimolecular and first order

d) Bimolecular and zero order

74. Physical adsorption increases when

a) Temperature increases

b) Temperature decreases

c) Temperature remains constant

d) Temperature increases above 60°C

75. CaO act as … flux
    a) Neutral
    b) Acidic
    c) Basic
    d) Both (a) and (b)

76. Magnetic separation is used for increasing concentration of the following
    a) Calcite
    b) Horn silver
    c) Magnesite
    d) Haematite

77. H_3PO_3 has…… non ionisable P—H bonds
    a) 3
    b) 1
    c) 2
    d) None of these

78. KI and $CuSO_4$ solutions on mixing produce
    a) $Cu_2I_2 + K_2SO_4$
    b) $Cu_2I_2 + I_2 + K_2SO_4$
    c) $CuI_2 + K_2SO_4$
    d) $CuI_2 + I_2 + K_2SO_4$

79. Which of the following elements has the maximum first ionization potential?
    a) V
    b) Ti
    c) Mn
    d) Cr

80. The IUPAC name of the coordination compound $K_3[Fe(CN)_6]$ is
    a) Tripotassium hexacyanoiron (II)
    b) Potassium hexacyanoiron(II)
    c) Potassium hexacyanoferrate (III)
    d) Potassium hexacyanoferrate (II)
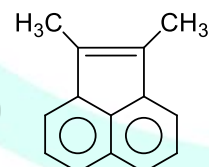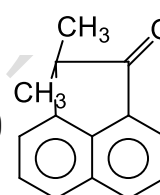
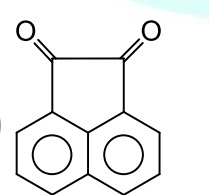81. 2, 2-dichloro propane on hydrolysis yields
    a) Acetone
    b) 2, 2-propane diol
    c) Isopropyl alcohol
    d) Acetaldehyde

82. Which of the following compounds is resistant to nucleophilic attack by hydroxyl ions?
    a) Acetamide
    b) Methyl acetate
    c) Diethyl ether
    d) Acetonitrile

83.
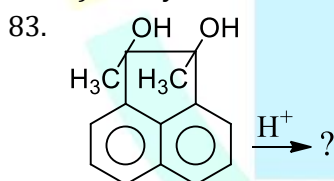
Product is

a)

b)

c)

d)

84. When acetamide is treated with Br_2 and caustic soda, the product formed is
    a) N-bromamide
    b) Bromoacetic acid

85. c) Methanamine   d) Ethanamine

85. Which compound is known as alkyl carbylamines?
    a) $R.CN$
    b) $R.NC$
    c) $Ar.CN$
    d) $Ar.NC$

86. Aniline reacts with acetaldehyde to form
    a) Schiff's base
    b) Carbylamine
    c) Immine
    d) None of these

87. In an amino acid, the carboxyl group ionizes at $pK_{a_1} = 2.34$ and ammonium ion at $pK_{a_2} = 9.6$. The isoelectric point of the amino acid is at pH
    a) 5.97
    b) 2.34
    c) 9.60
    d) 6.97

88. Which of the following is not a synthetic fibre?
    a) Rubber
    b) Nylon-6
    c) Nylon-6, 6
    d) Nylon-6,10

89. The catalyst used in the polymerization of high density polythene is
    a) Titanium oxide
    b) Titanium isoperoxide
    c) Lithium tetrachloride and triphenyl aluminium
    d) Titanium tetrachloride and trimethyl aluminium

90. Alizarin belongs to the class of
    a) Vat dyes
    b) Mordant dyes
    c) Basic dyes
    d) Reactive dyes

91. Identify from the following the only taxonomic category that has a real existence.
    a) Genus
    b) Species
    c) Phylum
    d) Kingdom

92. Abbreviation for International Code of Bacteriological Nomenclature is
    a) ICBN
    b) IC Bact N
    c) ICNB
    d) IC Bati N

93. Choose the correct classification for the given plant


a) Plantae, Anglosperm, Monocotyledons
b) Plantae, Anglosperm, Dicotyledons
c) Plantae, Gymnosperm, Monocot
d) Plantae, Pteridophytes, Dicot

94. Pasteurization temperature is
    a) 72°C for 20 minutes   b) 63°C for 15 seconds
    c) 67°C for 15 seconds   d) 65°C for 30 minutes
95. Early leaf spot disease in *Arachis hypogea* is
    caused due to infection of
    a) *Cercosporapersonata*
    b) *Gibberellafujikuroi*
    c) *Agrobacteriumtumefaciens*
    d) *Phytophthorainfestans*
96. Identify A, B and C in the following figure and
    choose the correct option

    Rhizome
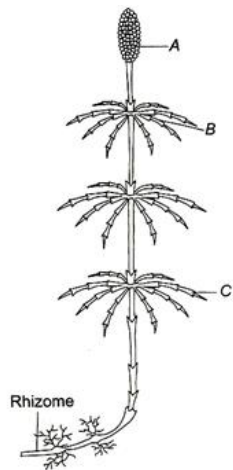
    a) A-Strobilus, B-Node,   b) A-Strobilus, B-node,
       C-leaves   C-branch
    c) A-Sporophyll, B-   d) A-Sporophyll, B-
       Node, C-Internode   Internode, C-Node
97. Which of the following gymnospermic
    corolloid roots are associated with N_2-fixing
    cyanobacteria?
    a) *Pinus*   b) *Cycas*   c) *Cedrus*   d) *Ginkgo*
98. The mantle in the phylum-Mollusca is a
    a) Calcareous shell
    b) Chitinous outer covering
    c) Soft spongy layer of skin
    d) None of these
99. Animal undergoes inactive stage during winter
    known as
    a) Aestivation   b) Hibernation
    c) Adaptation   d) Acclimatization
100. The dorsal diverticulum of urethra in male
    rabbit is
    a) Uterus   b) Uterus masculinus
    c) Prepuse   d) Vas deferens
101. Study the following statements and choose the
    correct option.
    I. Buds are present in the axil of leaflets of the
    compound leaf.
    II. Pulvinus leaf-base is present in some
    leguminous plants.

III. In *Alstonia*, the petioles expand, become
green and synthesize food.
IV. Opposite phyllotaxy is seen in guava.
    a) II and IV are correct b) I and III are correct
       but I and III are   but II and IV are
       wrong   wrong
    c) I and IV are correct   d) II, III and IV are
       but II and III are   correct but I is
       wrong   wrong
102. The flower, in which the gynoecium occupies
    the highest position on the thalamus leaving
    other parts below is called
    a) Hypogynous   b) Perigynous
    c) Epigynous   d) None of these
103. Lomentum is a kind of
    a) Inflorescence   b) Plant
    c) Fruit   d) Insect
104. Juicy hair-like structures observed in the
    lemon fruit develop from
    a) Endocarp
    b) Mesocarp and endocarp
    c) Exocarp
    d) Mesocarp
105. The surface area of leaves in monocotyledon
    plant can be regulated by the help of
    a) Mesophyll cells
    b) Parenchymatous cell
    c) Bulliform cells
    d) Guard cell
106. Viral infection is usually absent in
    a) Phloem cells   b) Xylem cells
    c) Pith cells   d) Apical meristem
107. The kind of tissue that forms the supportive
    structure in our pinna (external ears) is also
    found in
    a) Vertebrae   b) Nails
    c) Ear ossicles   d) Tip of the nose
108. In frog, undigested solid waste passes out
    through
    a) Rectum
    b) Cloaca
    c) Anus
    d) Intestine
109. Ribosomes are attached to endoplasmic
    reticulum through
    a) Ribophorin   b) Magnesium
    c) Peptidyl transferase d) *t*RNA
110. The chromosome in which centromere lies
    slightly away from the middle of the
    chromosome resulting in one shorter arm and
    one longer arm, is called

a) Metacentric b) Submetacentric
c) Acrocentric d) Telocentric

111. Identify the term 'ash' in term of living tissue sample analysis from the statements given below

Organic compounds oxidised to gaseous
a) form (CO_2 and water vapour) after burning of the tissue
b) The material left after burning the tissue which contains inorganic elements (*e.g.*, calcium, magnesium etc.)
c) Compounds removed in the form of gases
d) Compounds which may be soluble in intracellular fluid

112. Answer briefly
I. Which colour glycogen gives on its reaction with iodine solution?
II. What is satellite DNA?
III. Name three components of a nucleotide molecule
Correct option will all answers is
a) I-Blue
   II-Long sequences
   III-Phosphoric acid, pentose sugar and nitrogenous base
b) I-Red
   II-Repetitive base pairs
   III-Phosphoric acid, pentose sugar and nitrogenous organic base
c) I-Blue
   II-Non-repetitive base pairs
   III-Glucose phosphoric acid, nucleic acids
d) I-Red
   II-Non-repetitive base pairs
   III-Phosphoric acid, fructose, nucleotides

113. Cell would normally proceed to mitosis without interruption
a) Once it had started the S-period
b) Once it had entered the G_2-phase
c) At anytime during cell division
d) None of the above

114. Identify the diagram and name the phase of meiosis carefully

Spindle fibres

Bivalent showing crossing over in two places
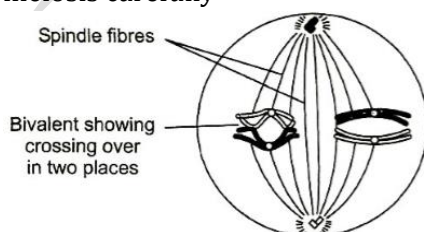
a) Telophase-I

b) Anaphase-I
c) Metaphase-I
d) Prophase-I

115. When the conditions are dry, a grass leaf curls inward to minimize water loss due to the pressure of
a) Thick cuticle
b) Large xylem cavities
c) Parallel venation
d) Bulliform cells

116. The phytohormone, which increases the concentration of potassium in guard cells is also responsible for the induction of
a) Apical dominance
b) Triple response growth
c) Cell division
d) Abscission

117. Arrange the events of opening stomata in correct sequence and choose the correct option accordingly
I. Lowering of osmotic potential of guard cells
II. Decline in guard cell solute
III. Rise of potassium ion level in guard cells
IV. Guard cells absorb water from neighbouring epidermal cells
V. Guard cells become flaccid
VI. Guard cells swells and make a pore between them
a) III, I, IV, V b) I, II, III, IV, V, VI
c) III, I, IV, VI d) III, I, IV, VI, II, V

118. Identify the A t D correctly in the given diagram of root nodule development and choose the correct option accordingly

Mature nodule
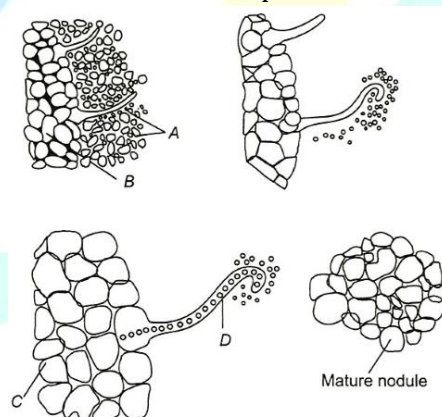
a) A-Rhizobial bacteria, B-Cortex cell, C-Outer cortex, D-Infection thread
b) A-Rhizobial bacteria, B-Cortex cell, , C-Inner cortex, D-Infection thread
c) A-Rhizobial bacteria,
d) A-*Nitrosomonas*

B-Endodermal cell,   bacteria, B-Cortex
C- Inner endodermis,   cell, C- Inner cortex,
D-Infection thread   D-Infection thread

119. Soil is able to maintain a regular supply of minerals by the help of which of the following?
I. Slow vegetation
II. Activity of decomposers
III. Soil erosion
IV. Weathering of rocks
a) Only IV
b) Only I
c) IV and II
d) All of the above

120. ...A... plants have the higher temperature optimum than ...B... the plants adapted climate
Here A and B refer to
a) A-Desert; B-Tropical
b) A-Temperature; B-Tropical
c) A-Tropical; B-Temperature
d) A-Desert; B-Temperature

121. Water stress makes plant leaves ...A... thus, ...B... the surface area of leaves and their metabolic activity as well
Here A and B refer to
a) A-wilt, B-increases
b) A-wilt, B-decreases
c) A-fall, B-decreases
d) A-fall, B-increases

122. For gaseous exchange plants have
a) Stomata
b) Lenticels
c) Pores
d) Both (a) and (b)

123. Which of the following is true regarding glycolysis?
I. Takes place in cytosol
II. Produces no ATP
III. Has no connection with electron transport chain
IV. Reduces two molecules of NAD^+ for every glucose molecule processed
Choose the correct option
a) Only I
b) I, II and III
c) I and II
d) None of these

124. What helps in flowering?
a) Cytochrome
b) ABA
c) Phytochrome
d) Ethylene

125. Apical dominance is caused by
a) Auxin
b) Cytokinin
c) Ethylene
d) Gibberellin

126. Photoperiod was first observed in
a) Potato
b) Maryland mammoth
c) Four O'clock
d) Evening primrose

127. Which is not used up in human body?
a) Calcium
b) Phosphorus
c) Zinc
d) Barium

128. If pancreas is removed, the compound, which remains undigested is
a) Carbohydrates
b) Fats
c) Proteins
d) All of these

129. Carbonic anhydrase is found in
a) Blood
b) Plasma
c) Both (a) and (b)
d) None of these

130. Under normal conditions, what amount of O_2 is delivered by 100 mL of the oxygenated blood?
a) 5 mL
b) 4 mL
c) 3 mL
d) 2 mL

131. Among the following stem cells, which are found in the umbilical cord?
a) Embryonic stem cells
b) Adult stem cells
c) Cord blood stem cells
d) All of these

132. Chordae tendinae are found in
a) Atria of heart
b) Ventricles of heart
c) Joints of legs
d) Joints of hands

133. RASS secretes which of the following hormone?
a) Mineralocorticoids
b) Glucocorticoids
c) Both (a) and (b)
d) None of the above

134. Urine formed by nephornes is ultimately carried to ...A... where at stored fill a voluntary signal is given by the ...B.... This signal is initiated by ...C... of urinary bladder as it gets filled with urine.
Choose the correct option for A, B and C to complete the given NCERT statement
a) A-urethra, B-CNS, C-PNS
b) A-urinary bladder, B-CNS, C-stretching
c) A-urethra, B-CNS, C-stretching
d) A-urethra, B-CNS, C-ANS

135. A fall in the GFR rate activates the
a) JG cells to release renin
b) JG cells to release aldosterone
c) JG cells to release epinephrine
d) JG cells to release nor-epinephrine

136. In a vertebrate, which germ layer forms the skeleton muscles?
a) Ectoderm
b) Endoderm
c) Mesoderm
d) Both (a) and (c)

137. Colle's fracture is associated with
a) Femur
b) Ulna
c) Humerus
d) Redius

138. For how long, contraction of the muscles continues in sliding filament theory?
a) Till ATP binds to myosin head
b) Till ADP binds to myosin head

c) Till Ca^{2+} present in sarcoplasm

d) Till polymerization of myosin head is going on

139. When the stimulus reaches the end of one neuron, it is conducted to the adjacent neuron through the secretions of
    a) Acetaldehyde
    b) Acetylcholine
    c) Acetylcholine esterase
    d) Acetyl Co-A

140. 'Adaptation' of eyes in dark is due to
    a) Depletion of vision pigment in rod
    b) Depletion of vision pigment in cones
    c) Repletion of vision pigment in rods
    d) Repletion of vision pigment in cones

141. Which one of the following pair correctly matches a hormone with a disease resulting from its deficiency?
    a) Parathyroid hormone— Tetany
    b) Insulin   — Diabetes insipidus
    c) Relaxin   — Gigantism
    d) Prolactin   — Cretinism

142. Androgens regulates
    a) Development of accessory sex organs
    b) Muscular growth
    c) Maturation of accessory sex organs
    d) All of the above

143. Bud grafting is commonly used in:
    a) Litchi   b) Pomegranate
    c) Rose   d) Jasmine

144. Bamboo species flower only in
    a) 50-100 yrs
    b) 25-50 yrs
    c) 75-100 yrs
    d) 60-80 yrs

145. What will be the gametic chromosome number of a cell, if somatic cell have 40 chromosomes?
    a) 10   b) 20   c) 30   d) 40

146. Bright colouration of flowers is an adaptation for
    a) Anemophily   b) Hydrophily
    c) Malacophily   d) Entomophily

147. Cleistogamous flowers are trictly autogamous because they remain
    a) Always open
    b) Always close
    c) Always fragrance
    d) Are brighty coloured

148. Most of the organs are formed during ..... of development
    a) 1st month
    b) 2nd month
    c) 3rd month
    d) 4th month

149. Oviducts are also called
    a) Fallopian tubes   b) Uterus
    c) Vagina   d) Ovary

150. Spermatogenesis is influenced by
    a) Progesterone   b) FSH
    c) STH   d) LTH

151. In menstrual cycle, the menstrual phase last for
    a) 3-5 days   b) 5-6 days
    c) 1-3 days   d) 2-3 days

152. MTP is of much risk in the phase of the pregnancy
    a) 2nd trimester   b) 1st trimester
    c) 1st week   d) 2nd week

153. Test tube baby is a technique where:
    a) Zygote is taken from the oviduct cultured and then implanted
    b) Ovum is taken out, then fertilized and implanted
    c) Sperm and ovum are fused and zygote grown in a test tube
    d) None of the above

154. ...A... gene produces all gametes that are similar, while a ....B... produces two kinds of gametes each having one allele with equal proportion
    Choose the correct option for A and B
    a) A-homozygous; B-heterozygous
    b) A-homozygous; B-dominance
    c) A-homozygous; B-recessive
    d) A-heterozygous; B-homozygous

155. A boy has a normal brother and a colourblind sister. What is true about his parents?
    a) His father was normal but mother was colourblind
    b) His father was colourblind but mother was carrier
    c) Both father and mother were colourblind
    d) Both father and mother were normal

156. Number of autosomes in human are
    a) 23 pairs
    b) 22 pairs
    c) 46 chromosomes
    d) 33 pairs of chromosomes

157. In a *lac* operon model, operator region is present

a) Adjacent to regulatory genes b) Adjacent to promoter genes c) Adjacent to structural genes d) Adjacent to introns

158. Which of the following statement about Griffith's experiment is right?
I. S-strain have capsule
II. Mouse will die if injected with living S-strain
III. Mouse will die if injected with living R-strain
IV. Transforming principle associated with capsule of S-strain
V. Transformation of R-strain into S-strain can take place in a test-tube
a) I and II   b) III and IV
c) I, II and V   d) III, IV and V

159. Artificial synthesis of ATP, porphyrin and nucleotides was detained by
a) Fox
b) Orgeal
c) Miller and Urey
d) Darwin

160. The early man whose skeleton is almost indistinguishable from that of modern man is
a) Neanderthal man   b) Peking man
c) *Homoerectus*   d) Cro- magnon man

161. Alpha-interferons
a) Activate the immune system
b) Help in destroying the tumour
c) Both (a) and (b)
d) None of the above

162. Which is correct pair of pathogen and its vector?
a) *Plasmodium and Anopheles*
b) *Plasmodium and culex*
c) *Virus and Anopheles*
d) Protozoan and *Aedes*

163. Bacterium, which is concerned with pertussis is
a) *Bordetella pertussis*
b) *Bacillus*
c) *Diplococcus*
d) *Mycobacterium tuberculum*

164. The plant cell without the cell wall is called
a) Protoplast
b) Cytoplast
c) Nucleoplast
d) None of these

165. The most commonly maintained species of bee by bee keepers is
a) *Apis mellifera*   b) *Apis dorsata*
c) *Apis indica*   d) *Apis florae*

166. Heroin is obtained from plant of family
a) Papaveraceae   b) Leguminosae
c) Cruciferae   d) Liliaceae

167. Carbamates pesticides act by combining with acetylcholinesterase enzyme. Which one of the following is a carbamate?
a) Propoxur (baygon)
b) Aldicarb (temik)
c) Carbofuran (furadan)
d) All of these

168. PCR technique was invented by
a) Boyer   b) Kary Mullis
c) Cohen   d) Sanger

169. Which of the following is associated with genetic engineering?
a) Plastids   b) Plasmids
c) Mutations   d) Hybrid vigour

170. A novel strategy was adopted to prevent *Meloidegyneincognitia* infection in tobacco plants that was based on the process of
a) DNA interference
b) RNA interference
c) RNA initiation
d) DNA initiation

171. Which of the following is/are considered as application (s) of biotechnology?
I. Waste treatment
II. Energy production
III. Bioremediation
IV. Processed food
V. Genetically modified crops for agriculture
VI. Diagnostics
VII. Therapeutics
Choose the correct option
a) I, II, III, IV and V   b) III, V, VI and VII
c) I, II, III, V and VII   d) All of these

172. Which step has been taken by Government of India to cater to the requirements of patent terms and other emergency provisions in this regards
a) Biopiracy act   b) Indian patents bill
c) Biowar act   d) Bioethics act

173. When there are large number of post-reproductive or older individuals and lesser number of pre-reproductive individuals then that population is
a) Growing   b) Decline
c) Stable   d) None of the above

174. If b is represented → Birth rate
If d is represented → Death rate

If dN is represented → Increase or decrease in population size

Then exponential growth is represented by

a) $dN/dt = (b + d) \times N$

b) $dN/dt = (b - d) \times N$

c) $dN/dt = (d - b) \times N$

d) $dN/dt = (d - b)^N$

175. The sunlight directly regulates the primary productivity because
   a) Gross primary productivity is utilised by plants in respiration
   b) The plants perform respiration with the help of sunlight
   c) The plants perform photosynthesis with the help of sunlight
   d) None of the above

176. Which of the following statement is true about ecosystem?
   a) The term 'ecosystem' was coined by Sir AG Tansley
   b) The size of the ecosystem varies from small pond to a large forest or sea
   c) In a forest ecosystem, trees occupy top vertical strata or layer, shrubs occupies the second layer and herbs and grasses occupies the bottom layers
   d) All of the above

177. Which one of the following contributes to social forestry?
   a) *Leucaenaleucocephala*
   b) *Mangiferaindica*
   c) *Jatropha*
   d) None of the above

178. In this soil conservation method, several grasses are left out in soil after the crop is harvested.
   a) Contour farming   b) Terrace farming
   c) Tillage   d) Crop rotation

179. BOD is concerned with
   a) Microbes
   b) Organic matter
   c) Microbes and organic matter
   d) None of the above

180. In which state of India, Ecosave toilets are not found?
   a) Kerala   b) Delhi
   c) Sri Lanka   d) None of these

: ANSWER KEY :

1)	a	2)	c	3)	a	4)	b	5)	a	6)	d	7)	b
8)	d	9)	a	10)	a	11)	a	12)	b	13)	d	14)	d
15)	a	16)	c	17)	c	18)	a	19)	d	20)	d	21)	a
22)	d	23)	a	24)	b	25)	c	26)	d	27)	a	28)	a
29)	a	30)	c	31)	d	32)	b	33)	b	34)	d	35)	d
36)	b	37)	a	38)	c	39)	d	40)	c	41)	c	42)	a
43)	d	44)	b	45)	b	46)	c	47)	d	48)	b	49)	b
50)	d	51)	c	52)	c	53)	a	54)	a	55)	b	56)	d
57)	c	58)	c	59)	a	60)	a	61)	b	62)	a	63)	c
64)	b	65)	b	66)	b	67)	c	68)	b	69)	c	70)	a
71)	b	72)	c	73)	c	74)	b	75)	c	76)	d	77)	b
78)	b	79)	c	80)	c	81)	a	82)	c	83)	c	84)	c
85)	b	86)	a	87)	a	88)	a	89)	d	90)	b	91)	b
92)	c	93)	b	94)	d	95)	a	96)	b	97)	b	98)	c
99)	b	100)	b	101)	a	102)	a	103)	c	104)	a	105)	c
106)	d	107)	d	108)	b	109)	a	110)	b	111)	b	112)	b
113)	a	114)	c	115)	d	116)	c	117)	c	118)	b	119)	b
120)	c	121)	b	122)	d	123)	a	124)	c	125)	a	126)	b
127)	d	128)	d	129)	c	130)	a	131)	c	132)	b	133)	a
134)	b	135)	a	136)	c	137)	d	138)	c	139)	b	140)	c
141)	a	142)	d	143)	c	144)	a	145)	b	146)	d	147)	b
148)	c	149)	a	150)	b	151)	a	152)	a	153)	b	154)	a
155)	b	156)	b	157)	b	158)	c	159)	a	160)	d	161)	c
162)	a	163)	a	164)	a	165)	a	166)	a	167)	d	168)	b
169)	b	170)	b	171)	d	172)	b	173)	b	174)	b	175)	c
176)	d	177)	a	178)	c	179)	c	180)	b				

: HINTS AND SOLUTIONS :

Single Correct Answer Type

1 (a)

Weight in air $= (5.00 \pm 0.05)N$

Weight in water $=(4.00 \pm 0.05)N$

Loss of weight in water $=(1.00 \pm 0.1)N$

Now relative density$=\dfrac{\text{weight in air}}{\text{weight loss in water}}$

$i.e. R.D = \dfrac{5.00 \pm 0.05}{1.00 \pm 0.1}$

Now relative density with max permissible error

$= \dfrac{5.00}{1.00} \pm \left(\dfrac{0.05}{5.00} + \dfrac{0.1}{1.00}\right) \times 100$

$\qquad = 5.0 \pm (1 + 10)\%$

$= 5.0 \pm 11\%$

2 (c)

$[\text{Energy}] = [ML^2T^{-2}]$. Increasing M and L by a factor of 3 energy is increased 27 times.

3 (a)

Time taken by the car to cover first half of the distance is

$t_1 = \dfrac{100}{60}$

Time taken by the car to cover speed half of the distance is

$t_2 = \dfrac{100}{v}$

Average speed , $v_{av} = \dfrac{\text{Total distance travelled}}{\text{TOtal time taken}}$

$v_{av} = \dfrac{100 + 100}{t_1 + t_2} \Rightarrow 40 = \dfrac{200}{\frac{100}{60} + \frac{100}{v}}$

$\dfrac{1}{60} + \dfrac{1}{v} = \dfrac{1}{20} \Rightarrow \dfrac{1}{v} = \dfrac{1}{20} - \dfrac{1}{60}$

$\dfrac{1}{v} = \dfrac{2}{60} = \dfrac{1}{30}$

$v = 30 kmh^{-1}$

4 (b)

Centripetal acceleration $a_c = v^2/r$

It acts along the radius and directed towards the centre of the circular path

5 (a)

$v = K(y\hat{\imath} + x\hat{\jmath})$

$v_x = Ky$

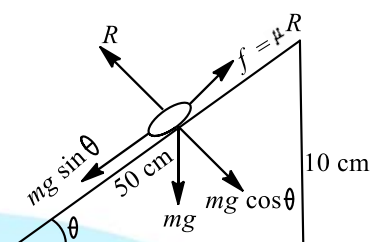$\dfrac{dx}{dt} = Ky$

Similarly, $\dfrac{dy}{dt} = Kx$

Hence $\dfrac{dy}{dx} = \dfrac{x}{y}$

$\Rightarrow ydy = xdx$, by integrating

$y^2 = x^2 + c$

6 (d)

The coin will not slide if

$mg \sin \theta = \mu R$

$ie, \; mg \sin \theta = \mu \, mg \cos \theta$ (as $R = mg \cos \theta$)

$ie, \tan \theta = \mu$

Here, $\qquad \tan \theta = \dfrac{10}{\sqrt{(50)^2 - (10)^2}} = 0.2$

$\therefore \quad \mu = 0.2$

7 (b)

Change of momentum of one bullet is mv

Time for 1 bullet $= \dfrac{1}{n}$

$\therefore$ Force $=$ time rate of change of momentum

$= \dfrac{mv}{1/n} = mnv$

8 (d)

$P = \dfrac{mgh}{t} \Rightarrow m = \dfrac{p \times t}{gh} = \dfrac{2 \times 10^3 \times 60}{10 \times 10}$

$\qquad = 1200 \; kg$

As volume $= \dfrac{\text{mass}}{\text{density}} \Rightarrow v = \dfrac{1200 kg}{10^3 kg/m^3} = 1.2 m^3$

Volume $= 1.2 m^3 = 1.2 \times 10^3 litre = 1200 litre$

9 (a)

Angular momentum, $L = I\omega = ml^2\omega$

When l is halved, new angular momentum

$L' = m(l/2)^2\omega = \dfrac{ml^2\omega}{4} = \dfrac{L}{4}$

10 (a)

The moment of inertia of ring $= MR^2$

The moment of inertia of removed sector $= \dfrac{1}{4} MR^2$

The moment of inertia of remaining part $= MR^2 - \dfrac{1}{4} MR^2$

$= \dfrac{3}{4} MR^2$

According to question, the moment of inertia of the remaining part $= kMR^2$

then, $\qquad k = \dfrac{3}{4}$

11 (a)

We know that intensity is negative gradient of potential,

$ie, mI = -(dV/dr)$ and as here $I = -(k/r)$, so

$\frac{dV}{dr} = \frac{k}{r}$, ie, $\int_0^v dV = k \int_{r_0}^r \frac{dr}{r}$

or $V - V_0 = k \log \frac{r}{r_0}$ so, $V = k \log \frac{r}{r_0} + V_0$

12 (b)

Given $\frac{\Delta V}{V} \times 100 = 1\% = \frac{1}{100}$

Bulk modulus,
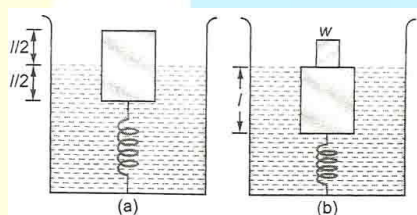
$B = \frac{P}{\frac{\Delta V}{V}} = \frac{pV}{\Delta V}$

or $p = \frac{B\Delta V}{V} = 7.5 \times 10^{10} \times \frac{1}{100}$

$= 7.5 \times 10^8 \, \text{Nm}^{-2}$

13 (d)

Archimedes' upward thrust will be absent for a fluid, if there were no gravity.

14 (d)

Initially the position of wooden block is as shown in figure. Since, the density of block is half than that of water, hence half of its volume is immersed in water

When weight w is put on the block, the remaining half of the volume of block is immersed in water, figure (b). Therefore, w =additional upthrust + spring force

$= l \times l \times \frac{1}{2} \times 2\rho \times \text{g} + k \left(\frac{1}{2} \right) = l \left(l^2 \rho \text{g} + \frac{k}{2} \right)$

15 (a)

The equivalent electrical circuit, figure in these cases is of Wheatstone bridge. No current would flow through central rod CD when the bridge is balanced. The condition for balanced Wheatstone bridge is $\frac{P}{Q} = \frac{R}{S}$ (in terms of resistances)

$\frac{1/K_1}{1.K_2} = \frac{1/K_3}{1/K_4}$ or $\frac{K_2}{K_1} = \frac{K_4}{K_3}$

Or $K_1 K_4 = K_2 K_3$

17 (c)

Coefficient of performance

$K = \frac{T_2}{T_1 - T_2} = \frac{273}{303 - 273} = \frac{273}{30} = 9.1 \approx 9$

19 (d)

$F_1 = \frac{m4\pi^2 a}{\pi^2}$ and $F_2 = \frac{m4\pi^2 a}{T_2^2}$

$F = F_1 + F_2 = \frac{4\pi^2 ma}{T_1^2} + \frac{4\pi^2 ma}{T_2^2}$

$= 4\pi^2 ma \left(\frac{1}{T_1^2} + \frac{1}{T_2^2} \right)$

Or $\frac{4\pi^2 ma}{T^2} = 4\pi^2 ma \left(\frac{1}{T_1^2} + \frac{1}{T_2^2} \right)$

Or $\frac{1}{T^2} = \frac{1}{T_1^2} + \frac{1}{T_2^2}$

Or $\frac{1}{T^2} = \frac{T_1^2 + T_2^2}{T_1^2 T_2^2}$ or $T^2 = \frac{T_1^2 T_2^2}{T_1^2 + T_2^2}$

20 (d)

For simple harmonic motion, $y = a \sin \omega t$

$\therefore \qquad\qquad y = a \sin \left(\frac{2\pi}{T} \right) t$

(at $t=2$ s)

$y_1 = a \sin \left[\left(\frac{2\pi}{16} \right) \times 2 \right]$

$\qquad\qquad\qquad = a \sin \left(\frac{\pi}{4} \right) = \frac{a}{\sqrt{2}}$

…(i)

At $t=4$ s or after 2 s from mean position.

$y_1 = \frac{a}{\sqrt{2}}$, velocity=4 ms^{-1}

$\therefore$ Velocity $= \omega \sqrt{a^2 - y_1^2}$

or $4 = \left(\frac{2\pi}{16} \right) \sqrt{a^2 - \frac{a^2}{2}}$

[From Eq. (i)]

or $4 = \frac{\pi}{8} \times \frac{a}{\sqrt{2}}$

or $a = \frac{32\sqrt{2}}{\pi}$ m

21 (a)

Given, y(x,t)=0.005 cos (ax-βt)

$\frac{2\pi}{\lambda} = a$ and $\frac{2\pi}{T} = \beta$

So,

$a = \frac{2\pi}{0.08} = 25\pi$ and $\beta = \frac{2\pi}{2} = \pi$

22 (d)

$V = 6 \times \left[\frac{1}{4\pi\varepsilon_0} \times \frac{Q}{a} \right]$

$V = 6 \times \frac{k.Q}{a}$

23 (a)

The total energy before connection

$= \frac{1}{2} \times 4 \times 10^{-6} \times (50)^2 + \frac{1}{2} \times 2 \times 10^{-6} \times (100)^2$

$= 1.5 \times 10^{-2} J$

When connected in parallel

$4 \times 50 + 2 \times 100 = 6 \times V \Rightarrow V = \frac{200}{3}$

Total energy after connection

$= \frac{1}{2} \times 6 \times 10^{-6} \times \left(\frac{200}{3} \right)^2 = 1.33 \times 10^{-2} J$

24 (b)

Given, $C = 2\mu F$, $C_2 = 4\mu F$, and $V = 10$volt

Capacitors are connected in series

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$\therefore C = \frac{4 \times 2}{4 + 2} = \frac{4}{3}$$

The charge of combination

$$q = CV = \frac{4}{3} \times 10 = \frac{40}{3}$$

The energy of $2\mu F$ capacitor

$$E = \frac{1}{2} \times \frac{q^2}{C_1} = \frac{1}{2} \times \frac{1600}{9 \times 2} = \frac{400}{9}$$
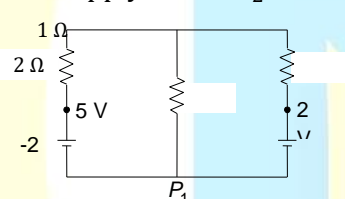
The energy of $4\mu F$ capacitor

$$E_2 = \frac{1}{2} \times \frac{q^2}{C_2} = \frac{1}{2} \times \frac{1600}{9 \times 4} = \frac{200}{9}$$

The ratio of energies is

$$\frac{E_1}{E_2} = \frac{\frac{400}{9}}{\frac{200}{9}} = \frac{2}{1}$$

25 (c)

Let potential of P_1 is 0 V and potential of P_2 is V_0. Now apply KCL at P_2.

$$\frac{V_0 - 5}{2} + \frac{V_0 - 0}{10} + \frac{V_0 - (-2)}{1} = 0$$

$$\Rightarrow V_0 = \frac{5}{16}$$

So, current through 10Ω resistor is $\frac{V_0}{10}$ from $P_2 to P_1$.

26 (d)

$$R_{200} = \frac{R_{800}}{1 + \alpha t}$$

$$R_{200} = \frac{R_{800}}{1 + 4 \times 10^{-4} \times 600} = \frac{R_{800}}{1.24}$$

$$\frac{V^2}{R_{800}} = P \qquad \ldots\ldots(i)$$

and $\frac{V^2}{R_{200}} = P' \qquad \ldots\ldots(ii)$

$$\therefore \frac{P'}{P} = \frac{R_{800}}{R_{200}} = \frac{R_{800}}{\left(\frac{R_{800}}{1.24}\right)}$$

$$P' = 1.24P = 1.24 \times 500 = 620 \, W$$

27 (a)

$$m \propto q \Rightarrow m \propto it$$

28 (a)

$$\frac{\mu_0 I_c}{2R} = \frac{\mu_0 I}{2\pi H} \Rightarrow H = \frac{I_e R}{\pi I_c}$$

29 (a)

The vertical component of earth's magnetic field is zero at equator where angle of dip is also zero

30 (c)

$B_V = B_H \tan\phi$; If $B_V = B_H$, then $\tan\phi = 1$ or $\phi = 45°$

31 (d)

When switch S is closed magnetic field lines passing through Q increases in the direction from right to left. So, according to Lenz's law induced current in $Q i.e. I_{Q_1}$ will flow in such a direction so that the magnetic field lines due to I_{Q_1} passes from left to right through Q. This is possible when I_{Q_1} flows in anticlockwise direction as seen by E. Opposite is the case when switch S is opened, i.e., I_{Q_2} will be clockwise as seen by E

32 (b)

At $t = 0$, inductor behaves like an infinite resistance. So at

$$t = 0, i = \frac{V}{R_2}$$

And at $t = \infty$, inductor behaves like a conducting wire,

$$i = \frac{V}{R_{eq}} = \frac{V(R_1 + R_2)}{R_1 R_2}$$

33 (b)

Wheatstone bridge is balanced. Current through AC is zero. Effective resistance R of bridge is

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{1}{3}, R = 3\Omega$$

Total resistance $= 1 + 3 = 4\Omega$

Induced emf

$$e = iR = Blv$$

$$\therefore v = \frac{iR}{Bl} = \frac{1 \times 10^{-3} \times 4}{2 \times 0.1}$$

$$= 2 \times 10^{-2} ms^{-1}$$

34 (d)

$$d = \sqrt{2hR}$$

Population covered

$= \pi d^2 \times$population density

$= 3.114 \times (2 \times 0.1 \times 6.37 \times 10^3) \times 1000 \approx 40$ lakh

35 (d)

The two lenses of an achromatic doublet should have, sum of the product of their powers and dispersive power equal to zero
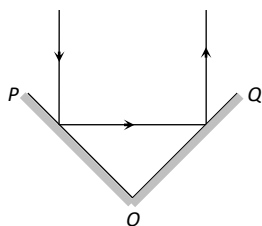
36 (b)

Incident ray and finally reflected ray are parallel to each other means $\delta = 180°$

From $\delta = 360 - 2\theta$

$\Rightarrow 180 = 360 - 2\theta$

$\Rightarrow \theta = 90°$

37 (a)

A wave can transmit energy from one place to another

38 (c)

Higher the voltage, higher is the KE. Higher the work function, smaller is the KE

39 (d)

As $E_K = \frac{1}{2}mv^2$ or $mv = \sqrt{2mE_K}$

As per question;

or $m_p v_p = m_e v_e$

or $\sqrt{2m_p E_{K_p}} = \sqrt{2m_e E_{K_e}}$

or $\frac{E_{K_e}}{E_{K_p}} = \frac{m_p}{m_e} > 1$

or $E_{K_e} > E_{K_p}$

40 (c)

The excitation energy in the first excited state is

$E = RhcZ^2 \left(\frac{1}{1^2} - \frac{1}{2^2}\right) = (13.6 \text{ eV}) \times Z^2 \times \frac{3}{4}$

$\therefore \qquad\qquad 40.8 = 13.6 \times Z^2 \times \frac{3}{4}$

$\Rightarrow \qquad\qquad\qquad Z = 2$

So, the ion in problem is He^+. The energy of the ion in the ground state is

$E = \frac{RhcZ^2}{1^2} = 13.6 \times 4 = 54.4 \text{ eV}$

Hence, 54.4 eV is required to remove the electron from the ion.

41 (c)

According to Bohr's second postulate

42 (a)

In fission process, when a parent nucleus breaks into daughter products, then some mass is lost in the form of energy. Thus, mass of fission products < mass of parent nucleus

$\Rightarrow \qquad \frac{\text{Mass of fission products}}{\text{Mass of parent nucleus}} < 1$

45 (b)

For D-region, $N = 10^9 \text{m}^{-3}$

$\mu = \sqrt{1 - \frac{81.45\,N}{v^2}} = \sqrt{1 - \frac{81.45 \times 10^9}{(50 \times 10^6)^2}} = 1$

$\mu = \frac{\sin i}{\sin r} = 1$

Or $\sin r = \sin i$ or $r = i = 30°$

46 (c)

$\because$ Mass of 22400 cm^3 of CH_4 at STP = 16 g

$\therefore \qquad$ Mass of 1 cm^3 of CH_4 at STP = $\frac{16}{22400}$ g

$\therefore$ Mass of 112 cm^3 of CH_4 at STP = $\frac{16}{22400} \times 112$

$= 0.08 \text{ g}$

47 (d)

1 mole of H_2SO_4 gives = 3 moles of ions or

$3 \times 6.023 \times 10^{23}$ ions

$\therefore$ 0.1 mole of H_2SO_4 will give = $0.1 \times 3 \times 6.023 \times 10^{23}$ ions

$= 1.8 \times 10^{23}$ ions

48 (b)

$Li^- = 1s^2, 2s^2$ (In it all subshells are saturated so, it is stable)

$Be^- = 1s^2, 2s^2, 2p^1$ (very much less stable)

$B^- = 1s^2, 2s^2, 2p^2$ (less stable)

$C^- = 1s^2, 2s^2, 2p^3$ (stable due to presence of half-filled 2p-subshell)

50 (d)

While moving along a group from top to bottom, acidic nature of oxides decreases and along a period left to right acidic nature increases.

	amphoteric	acidic		max. acidic
	Al	Si	P	S
Z	13	14	15	16
	Al_2O_3	SiO_2	P_2O_3	SO_2

amphoteric   acidic   max. acidic

Thus, $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

51 (c)

Molecule	Hybridisation	Repulsion	Bond angle
SO_2	sp^2	lp.bp, bp – bp	119°
OH_2	sp^3	lp – lp, bp – lpbp – bp	104.5°
SH_2	sp^3	–do–	
NH_3	sp^3	lp – bp, bp – bp	90° 107°

52 (c)

According to Fajan's rule, largest cation and smallest ions form ionic bond

53 (a)

Both gases and liquids posses fluidity and hence, viscosity. Molecules in the solid state do not have translational motion

54 (a)

The compressor has to run for longer time releasing more heat to the surroundings

55 (b)

The Gibb's-Helmholtz equation is as

$$G = H + T \left(\frac{\partial G}{\partial T} \right)_P$$

Dividing above equation by T^2

$$\frac{G}{T^2} = \frac{H}{T^2} + \frac{1}{T} \left(\frac{\partial G}{\partial T} \right)_P$$
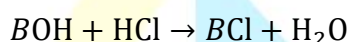
This on arrangement becomes

$$\left[\frac{\partial (G/T)}{\partial T} \right]_P = - \frac{H}{T^2}$$

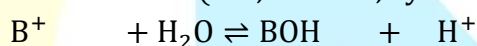$$H = T^2 \left[\frac{\partial (G/T)}{\partial T} \right]_P$$

where, H = enthalpy.

56 **(d)**
Weak monoacidic base *e.g.*, BOH is neutralised as follows
$$BOH + HCl \rightarrow BCl + H_2O$$
At equivalence point all BOH gets converted into salt and remember! The concentration of H^+ (or pH of solution) is due to hydrolysis of resultant salt (BCl, cationic, hydrolysis here)
$$B^+ \quad + H_2O \rightleftharpoons BOH \quad + \quad H^+$$
$$C(1-h) \qquad Ch \qquad Ch$$
Volume of HCl used up
$$V_a = \frac{N_b V_b}{N_a} = \frac{2.5 \times 2 \times 15}{2 \times 5} = 7.5 \text{ mL}$$
Concentration of salt
$$[BCl] = \frac{\text{conc. of base}}{\text{total volume}} = \frac{2 \times 2.5}{5(7.5 + 2.5)} = \frac{1}{10}$$
$$= 0.1$$
$$K_h = \frac{Ch^2}{1-h} = \frac{K_w}{K_b}$$
(h should be estimated whether that can be neglected or not)
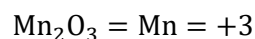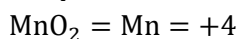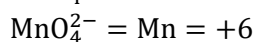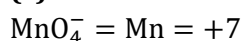on calculating h=0.27 (significant, not negligible)
$$[H^+] = Ch = 0.1 \times 0.27 = 2.7 \times 10^{-2} \text{M}$$

57 **(c)**
The reaction, in which two or more species undergo reduction as well as oxidation to give a single species are called comproportionation reaction. This is reverse of disproportionation reaction.
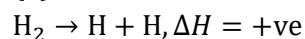$$Ag^{2+}(aq) + Ag(s) \rightleftharpoons 2Ag^+(aq)$$

58 **(c)**
$$MnO_4^- = Mn = +7$$
$$MnO_4^{2-} = Mn = +6$$
$$MnO_2 = Mn = +4$$
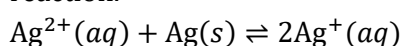
$$Mn_2O_3 = Mn = +3$$
Hence, changes in oxidation number are 5,1,3,4.

59 **(a)**
$$H_2 \rightarrow H + H, \Delta H = +ve$$
The reaction is favoured by low pressure and high temperature

61 **(b)**
Alum acts as coagulating agent, so it is used to purify water and separate mud from it.
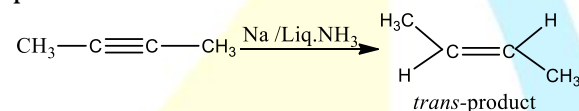
63 **(c)**
Carbanion is electron rich species. Stability of carbanion increases with increase in s −character of hybrid orbitals of carbon bearing the charge.
$$\therefore \quad sp^3 < sp^2 < sp$$
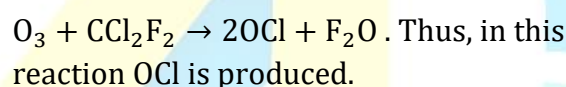(25%s-character) (33%s-character) (50%s-character)

65 **(b)**
Butyne reacts with $Na/liq. NH_3$ to give *trans*-product.

$$CH_3—C\equiv C—CH_3 \xrightarrow{Na/Liq.NH_3} \underset{H}{\overset{H_3C}{>}}C=C\underset{CH_3}{\overset{H}{<}}$$
trans-product

66 **(b)**
We know that,

$$O_3 + CCl_2F_2 \rightarrow 2OCl + F_2O$$. Thus, in this reaction OCl is produced.

68 **(b)**
In ZnS each sulphide ion is tetrahedrally surrounded by four zinc ions and each zinc ion is surrounded by four sulphide ions. Thus, zinc sulphide possesses $4:4$ coordination.

69 **(c)**
$$\pi V = \frac{W}{m} RT$$
for isotonic solutions, osmotic pressure (π) is same
$$\frac{W_1}{m_1 V_1} = \frac{W_2}{m_2 V_2}$$
$$V_1 = 1L, V_2 = 100 \, mL = 0.1L$$
$$\frac{W_1}{60 \times 1} = \frac{10}{342 \times 0.1}$$
$$W_1 = 17.54 \frac{g}{L}$$

70 **(a)**
Number of moles of ethyl alcohol $= \frac{138}{46} = 3$

Number of moles of water $= \frac{72}{18} = 4$

$$X_{C_2H_5OH} = \frac{3}{3+4} = \frac{3}{7}$$

$$X_{H_2O} = \frac{4}{3+4} = \frac{4}{7}$$

$$\frac{X_{C_2H_5OH}}{X_{H_2O}} = \frac{\frac{3}{7}}{\frac{4}{7}} = \frac{3}{4}$$

71 (b)
In Galvanic cell (Daniel cell) the electrical energy is produced from chemical reactions.

At anode $Zn \rightarrow Zn^{2+} + 2e^-$ (oxidation)
At cathode $Cu^{2+} + 2e^- \rightarrow Cu$ (reduction)
Cell reaction $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$
Or $Zn(s) + CuSO_4(aq) \rightarrow Cu(s) + ZnSO_4(aq)$

72 (c)
For zero order reaction,
$[A] = -kt + [A]0$
Where, $[A]0$= initial concentration=a
$[A]$=remaining concentration= $a - a = 0$
On putting value of $[A]_0$ and $[A]$,we get
$$t = \frac{a}{k}$$
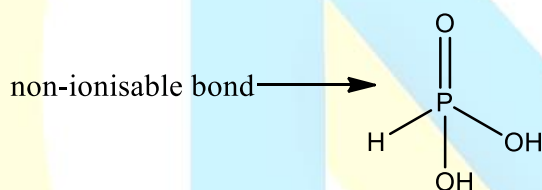
73 (c)
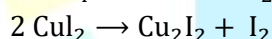$2N_2O_5 \rightleftharpoons 2N_2O_4 + O_2$ Bimolecular but of first order.

77 (b)
Structure of H_3PO_3 is

non-ionisable bond ⟶

78 (b)
$CuSO_4 + 2KI \rightarrow CuI_2 + K_2SO_4$
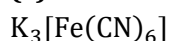$2\,CuI_2 \rightarrow Cu_2I_2 + I_2$
cuprous iodide
white ppt.

79 (c)
Among the given, manganese has the most stable electronic configuration, thus it is very hard to remove an electron from is outer shell. Hence, a large amount of energy is required. Therefore, manganese has the maximum first ionization potential
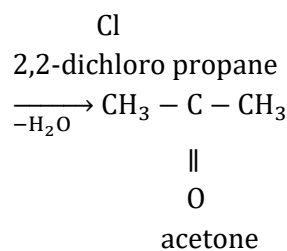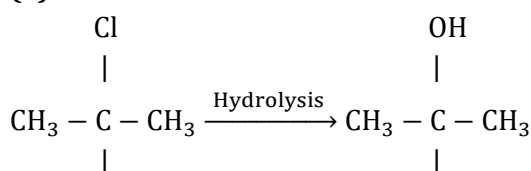
80 (c)
$K_3[Fe(CN)_6]$
cation   anion
Oxidation state of Fe in anion $=+3$
Thus, it is potassium hexacyanoferrate (III).

81 (a)

2,2-dichloro propane   unstable
$\xrightarrow{-H_2O}$ CH₃ − C − CH₃

acetone

82 (c)
Diethyl ether itself being a Lewis base is not attacked by nucleophiles, ie, OH^- ion. All others contain an electrophilic carbon and are readily attacked by nucleophile

84 (c)
Amides react with bromine and caustic soda to give their corresponding primary amines. Thus, acetamide gives methanamine. This reaction is known as Hofmann's bromamide degradation reaction.
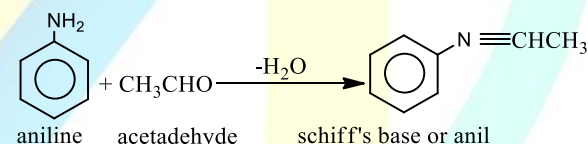

$H_3C - C - NH_2 + Br_2 + 4KOH \xrightarrow{343\,K} 2KBr$
$+ K_2CO_3 + H_3C - NH_2 + 2H_2O$
acetamide
methanamine
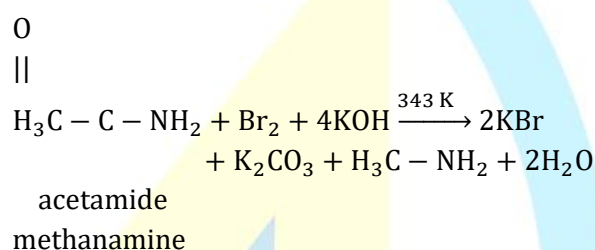
85 (b)
The name of isocyanides is carbylamine, and when it is attached with an alkyl group, the compound is called alkyl carbylamine, $i.e., R$NC.

86 (a)
Aniline or any 1° amine reacts with aldehyde to form Schiff's base or anils.

87 (a)
pH (at isoelectric point)=$\frac{2.34+9.6}{2} = 5.97$

88 (a)
Rubber is natural polymer. Nylon-6,nylon-6 6 and nylon 6,10 are synthetic fibre or man-made polymers.
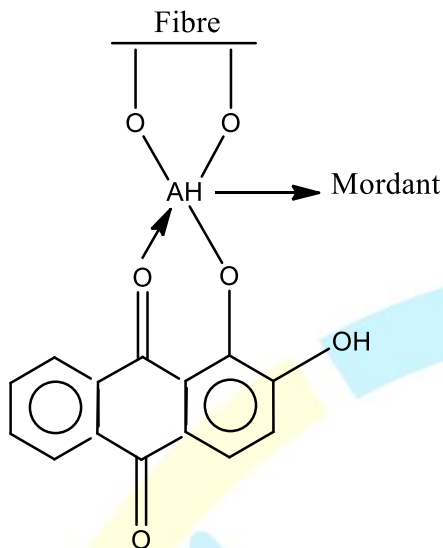
89 (d)
High density polythene is obtained, when ethane undergoes Ziegler-Natta polymerisation. In this process, Ziegler-Natta catalyst, a mixture of titanium tetrachloride ($TiCl_4$) and trimethyl aluminium $[(CH_3)_3Al]$ is used to catalyse the polmerisation.

90 (b)
Alizarin is mordant dye. Alizarin gives a bright

red colour with aluminium and a blue colour with barium.

91 (b)
Species is the smallest rank of taxonomic classification modern concept of species is biological species concept (E Mayr; 1942). Mayr defined he species as the group of interbreeding natural populations that are reproductively isolated from other such groups.

92 (c)
ICNB stands for International Code of Bacteriological Nomenclature

93 (b)
The given figure shows flowering plant so, plant belongs to angiosperm. And the leaf venation is reticulate so plant is dicot

94 (d)
Pasteurization involves the treatment of milk to destroy disease causing organisms. Milk is heated to 65°C for 30 minutes or to 72°C for 15 seconds followed by rapid cooling to below 10°C in pasteurization.

95 (a)

Causing Organism	Diseases
Phytophthora infestans	Late blight of potato
Gibberella fujikuroi	Foolish seedling disease of rice
Cercospora personata	Tikka disease of groundnut
Agrobacterium tumefaciens	Crown gall disease of grapes

96 (b)
A-Strobilus, B-Node, C-Branch

97 (b)
Corolloid root is developed in *Cycas*. It contain an algae zone in the cortex. This algal zone contains blue-green algae (cyanobacteria) like *Nostoc*, *Anabaena*, which grow in symbiotic association with corolloid root

98 (c)
The body of Mollusca is covered by a calcareous shell but the mantle is a soft and spongy layer of skin over the visceral hump

99 (b)
Hibernation is the inactive stage during winter or the dormancy during winter. It is known as winter sleep. During hibernation lung breathing is stopped while skin breathing continues which suffice the need of oxygen.

100 (b)
The dorsal diverticulum of urethara in male rabbit is uterus musculinus.

101 (a)
In some legumes the leaf base may become swollen, which is called the pulvinions.
In opposite phyllotaxy, a pair of leaves arises at each mode and lie opposite to each other as in *Calotropic* (akon/madar) and guava (*Psidium*) plants.

102 (a)
In hypogynous flower, the calyx, corolla and androecium arise from below the ovary (gynoecium), *i.e.*, the ovary becomes superior, *e.g.*, Cruciferae, Liliaceae.

103 (c)
Lomentum is a dry, many seeded fruit develops from monocarpellary, superior, unilocular ovary with marginal placentation.

104 (a)
In lemon, juicy hair-like structures develop from endcarp.

105 (c)
Bulliform cells in monocotyledons epidermis have bulliform cells, which regulate the surface area of leaves

106 (d)
The apical meristems are present in the apices of primary and secondary shoots and roots of the plant. The cells of apical meristem are in very active stage of division, have dense cytoplasm, thin cell wall and remain virus free.

107 (d)
Yellow fibrous cartilage tissue is found in pinna (external ear). It is also found at the tip of the nose.

108 (b)

The undigested solid waste moves into the rectum and passes out through the cloaca of frog

109 (a)
There are large non-membranous RNA protein complexes which are necessary for protein synthesis. There are dense granules of 150 to 200Å diameter (as revealed by electron microscope) and found either in free state or attached to the outside of cytoplasmic membrane just like that of ER or nuclear membrane, etc, through **ribophorins.**

110 (b)
The sub-metacentric chromosomes has centromere nearer to one end of the chromosome resulting in one shorter arm and one longer arm

111 (b)
After burning the dry tissues, all the organic compounds are oxidised to gaseous form (CO_2 and water vapour) and are removed. The material left is termed 'ash' which contains inorganic elements (*e.g.*, calcium, magnesium etc.)

112 (b)
I. Red
II. Long stretches of repetitive base pairs is called satellite DNA
III. Phosphoric acid, pentose sugar and nitrogenous organic base

113 (a)
Cell would normally proceed to mitosis without interruption once it had started the S-period.

114 (c)
Meiosis-I
(i) The bivalents become arranged around the equator of the spindle, attached by their centromeres
(ii) Each pair of the homologous chromosomes is called bivalent which pair up in the process of synapsis

115 (d)
The upper epidermises of monocots have large, thin walled and empty bulliform cells or motor cells containing water. These cells are mainly concerned with rolling and unrolling of leaf. The epidermis is cuticularized.

116 (c)
Cytokinins are the plant hormones which play an important role in the opening of stomata by the exchange of ions (entry of K^+ ions into guard cells and exit of H^+ ions). Cytokinins are also responsible for the activity of cell division.

117 (c)
According to active K^+ theory of Levitt, the stomatal opening and closing is regulated by ATP driven K^+ exchange pump. According to this theory, there is a accumulation of K^+ in the guard cells during day time 200. When guard cells have more K^+, endosmosis takes place, resulting in the lowering of osmotic potential of guard cells. They starts to absorb water from neighbouring cells and becomes turgid to make a pore or opening in the stoma.
Thus, stomatal opening takes place. Due to the loss of K^+ the osmotic concentration of guard cells in comparison to adjoining epidermal cells decreases. Therefore, exosmosis takes place and guard cells becomes flaccid due to the loss of turgidity. Thus, stomatal closure takes place

118 (b)
A-Rhizobial bacteria
B-Cortex cell
C-Inner cortex
D-Infection thread

119 (b)
Soil is able to maintain a regular supply of minerals by the help of slow vegetation

120 (c)
A-Tropical, B-Temperate. Tropical plants have a higher temperature optimum than the plants adopted to temperate climate

121 (b)
A-with, B-decrease. Water stages leaves with thus reducing the surface area of leaves and their metabolic activity as well

122 (d)
Plants, unlike animals have no specialised organs for gaseous exchange but they have stomata and lenticels for this purpose

**123 (a)**
In the process of glycolysis, 6 carbon molecules of glucose is split into 2, 3-carbon molecules of pyruvic acid. In this, one molecules of NAD^+ are reduced for each glucose molecule. The energy stored with the NADH is released in the electron transport chain. This process (glycolysis) occurs in cytosol

124 (c)
Phytochrome is an amorphous photoreceptor

protein pigment. It exists in two states, *i.e.,* phytochrome Red (P_r) and phytochrome far-red (P_{fr}).
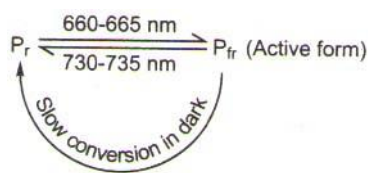
It is considered that during the day, P_{fr} from of the phytochrome is accumulated in the plant which is inhibitory to flowering in short-day plants, but is stimulatory in long day plants.

125 **(a)**
Apical dominance is a condition in plants where the stem apex prevents the development of side shoots from lateral buds near the apex. The dominance is controlled by the presence of high concentration of plant hormone auxin at the apex, produced by the apical bud.

126 **(b)**
Garner and Allard (1920) firstly observed photoperiod in 'Maryland' Mammoth'. A variety of tobacco could be made to flower in summers by reducing the amount of light hour along with artificial darkening. It could be made to remain vegetative in winters by proving extra light

127 **(d)**
Barium is not used in human body.

128 **(d)**
Carbohydrates, fats and proteins will remain undigested on removal of pancreas.

129 **(c)**
Carbonic anhydrase is found in the blood and the minute quantity of same is in plasma

130 **(a)**
Under the normal physiological conditions, 100 mL of the oxygenated blood can deliver around 5 mL O_2 to the body

131 **(c)**
During the 1970s, researcher discovered that umbilical cord blood could supply the same kinds of blood-forming (haematopoietic) stem cells as a bone marrow donor and so, umbilical cord blood began to be collected and stored. Cord blood stem cells also have the potential to give rise to other cell types in the body.

132 **(b)**
Chordae tendinae are string-like processes in the heart that attach the edges of the bicuspid and tricuspid valves to the walls of the ventricles, prevent them from being forced back into the atria when the ventricles contract.

133 **(a)**
Juxtaglomerular apparatus (JGA) operates a multihormonal **Renin-Angiotensin-Aldosterone System** RAAS. JGA releases an enzyme renin in the blood, which initiates chemical reactions that produces **angiotensin-II**, a potential stimulator of aldosterone (mineralocorticoids) release by the glomerulosa cell. It increases blood pressure, blood volume and completes the feedback circuit by supporting the release of renin.

134 **(b)**
A – Urinary bladder, B – CNS, C – Stretching

135 **(a)**
JG cells to release renin.
The kidneys have built in mechanisms for the regulation of glomerular filtration rate. One such efficient mechanism is carried out by juxta glomerular apparatus (JGA), JGA is the special sensitive region formed by cellular modification in the distal convoluted tubule and the afferent arteriole at the location of their contact. A fall in GFR can activate the JG cells to release renin, which can stimulate the glomerular blood flow and there by GFR back to normal

136 **(c)**

Germ Layer	Structure Formed
Ectoderm	Nervous system
Mesoderm	Connective tissue like bones, skeleton muscle
Endoderm	Respiratory system

137 **(d)**
A fracture of the distal end of radius, in which the distal fragment displaced posteriorly is called **Colles' fracture**.

138 **(c)**
Sliding of actin and myosin filaments constitutes till the Ca^{2+} ions are pumped back to the sarcoplasmic cisternae, resulting in masking the actin filaments. This causes the return of Z lines back to their original position, *i.e.,* relaxation

139 **(b)**
When a nerve stimulus reaches the end of one neuron, acetycholine, a neurotransmitter is released from the synptic vesicles of the neuron. This neurotransmitter helps in conducting the nerve stimulus to the adjacent neuron.

140 (c)

Retina of eye consists of photoreceptor neurons, $i.e.$, rods and cones. Rods contains rhodopsin, which consists of the protein scotopsin and retinene, (a derivative and vitamin-A). Rods are highly sensitive to dim light and are specialized for night, vision.

141 (a)

Hyposecretion of parathormone from parathyroid gland leads to tetany disorder. It causes the lowering of blood calcium level. Insulin deficiency leads to disease diabetes mellitus (hypoglycemia). Hypersecretion of growth hormone results of gigantism in children.

Relaxin deficiency prevents the process of parturition. Low secretion of thyroid hormone results of cretinism in infants and children. Deficiency of prolactin hinders the development of mammary glands and secretion of lactin.

142 (d)

Androgen regulate the development, maturation and functions of the male accessory sex organs like epididymis, vas deferens, seminal vesicles, prostate gland, etc. These hormones stimulate muscular growth, growth of facial and axillary hair, aggressiveness, low pitch of voice, etc. Androgens play a major stimulatory role in process of spermatogenesis (formation of spermatozoa)

144 (a)

Bamboo is the monocarpic plant (which reproduce once in their life time). They reproduce once in 50-100 yrs after their birth and after flowering they die

145 (b)

Gametes are haploid structures, containing chromosome number half of somatic cells. When somatic cell has 40 chromosomes, the gametes will have 20 chromosomes.

146 (d)

Bright coloured flowers attract the insects. These insects takes part in the pollination of these flowers, therefore, bright colouration of flowers is an adaptation for entomophily, $i.e,$ pollination by insects.

147 (b)

They remain close for ensuring self-pollination

148 (c)

3rd month.

Summary of important development changes in the human embryo

Time from Fertilisation	Organ Formed
Week 1	Fertilisation cleavage starts about 24 hours after fertilisation cleavage to form a blastocyst 4-5 days after fertilisation. More than 100 cells implantataion 6-9 days after fertilisation
Week 2	The three primary germ layers (ectoderm, endoderm and mesoderm) develop
Week 3	Woman will not have a period. This may be the first sign that she is pregnant. Beginning of the backbone. Neural tube develops, the beginning of the brain and spinal cord (first organs)
Week 4	Heart, blood vessels, blood and gut start forming. Umbilical cord developing
Week 5	Brain developing, 'Limb buds', small swelling which are the beginning of the arms and legs. Heart is a large tube and starts to beat, pumping blood. This can be seen an ultrasound scan
Week 6	Eyes and ears start to form
Week 7	All major internal organs developing. Face forming. Eyes have some colour. Mouth and tongue develop. Beginning of hand and feet
Week 12	Foetus fully formed, with all organs, muscles, bones toes and fingers. Sex organs well developed. Foetus is moving
Week 20	Hair beginning to grow including

	eyebrows and eyelashes. Fingerprints developed. Fingernails and toenails growing. Firm hand grip. Between 16 and 20 weeks baby usually felt moving for first time
Week 24	Eyelids open. Legal limit of abortion in most circumstances
By Week 26	Has a good chance of survival if born prematurely
By Week 28	Baby moving vigorously. Responds to touch and loud noises. Swallowing amniotic fluid and urinating
By Week 30	Usually lying head down ready for birth
40 Weeks	Birth

149 (a)
Oviducts are also called Fallopian tubes. These (two) terms are used interchangeability

150 (b)
FSH (follicle Stimulating Hormone) is secreted from the anterior lobe of pituitary. It stimulates growth of ovarian follicles and secretion of oestrogen in female and spermatogenesis in male.

152 (a)
Second trimester.
MTP is safe until Ist trimester (12 weeks) of the pregnancy. It becomes more risky after the Ist trimester period of pregnancy as the foetus becomes intimately associated with the maternal tissue

154 (a)
A-Homozygous; B-Heterozygous

155 (b)
If the father is colourblind (X^cY) and the mother is a carrier(X^cX), then their son will be normal(XY) and daughter will be colourblind (X^cX^c).

156 (b)
Human have 46 chromosomes out of which 22 pairs or 44 chromosomes are called **autosomes** and one pair of chromosomes (*i.e.*, XX in female and XY in male) are called **heterosomes** or **sex chromosomes**.

157 (b)
Operator region/gene present beside the promoter region. It lies in between the operator and the structural genes

158 (c)
In Griffith's experiment, mouse will live if injected with R-strain because R-strain is non-virulent. Transforming principle is associated with the genetic material (transforming material) of S-bacteria

159 (a)
SW Fox of the university of Miami had demonstrated that if a nearly dry mixture of amino acids was heated, polypeptide molecules were synthesized. Similarly, simple sugars could form polysaccharides and fatty acids could combine to produce fats. Amino acids could form proteins. Thus, the small simple organic molecules combined to form large complex organic molecules, *e. g.*, fatty acids and glycerol united to form fats, sugars, nitrogenous bases, and phosphates combined into nucleotides which polymerized into nucleic acids in the ancient oceans

160 (d)
Cro-magnon man (*Homosapiens*) is the closest ancestor of modern man. The cranial capacity was highest 1650 cc. He lived in France and Spain and made painting inside cave. He was omnivore with aesthetic sense.

161 (c)
Tumour cells have been shown to avoid detection and destruction by immune system. Therefore the patients are given substances called biological response modifiers such as α-interferon, which activates their immune system and helps in destroying the tumours

162 (a)
Malaria is caused by the toxins produced in the human body by the malaria parasite *Plasmodium*. The malarial parasites are carried from infected to healthy person by female *Anopheles* mosquito.

163 (a)
Pertussis (whooping coug) is caused by bacterium Brodetalla Pertussis, (whooping cough) is caused by bacterium *Bordetella pertussis*, a rod shaped Gram(-)ve bacterium. It is the most dangerous disease of childhood, and

affects respiratory passage resulting in there inflammation in association with cold cough, etc.

164 (a)
The plant cell without the cell wall is called protoplast. Naked protoplasts surrounded only by plasma membranes

165 (a)
The most commonly maintained species of the bee by bee keepers is *Apis mellifera.* At present time, *Apis mellifera* is used in apiaries for large scale production of honey and wax

166 (a)
Heroin is diamorphine or diacetylmorphine. It is a semi-synthetic opiate, derived from opium, which is a dried latex of unripe capsular fruits of poppy plant, *Papaver somniferum* of family- **Papaveraceae.**

167 (d)
Carbamates are organic esters of hypothetical carbonic acid. These have affinity for enzyme acetylcholinesterase, e.g., propoxur , aldicarb , carbofuran , dimetan, etc.

168 (b)
Kary Mullis
Gene encoding resistance to antibiotics like ampicillin, chloramphenicol, tetracycline or Kanamycin, are useful selectable markers for *E.coli.* The normal *E.coli* cells do not carry resistance against any of these antibiotics

170 (b)
RNA interference.
Nematodes is a group of organisms, which parasites a large number of plants and animals including human being. One of the common nematodes *Meloidegyne incognitia* infects the roots of tobacco plants and causes a great loss by causing reduction in yield.
This infestation was prevented by using a novel strategy, which was based on the process of RNA interference (RNAi). RNA is powerful reverse genetic tool to study gene function

171 (d)
All of these.
The application of biotechnology includes
(i) therapeutics
(ii) diagnostics
(iii) genetically modified crops for agriculture
(iv) processed food
(v) bioremediation
(vi) waste treatment and

(vii) energy production

172 (b)
Some nations are developing laws to prevent such unauthorised exploitation of their bioresearch and traditional knowledge. To check these problems, India parliament has recently cleared the second amendment of the **Indian Patents Bill**, that takes such issues into consideration

173 (b)
A population with large number of post-reproductive or older individuals and lesser number of pre-reproductive individuals will show a negative growth rate or decline growth.
**Age pyramid** Graphic representation of different age groups found in a population with pre-reproductive group at the base. Reproductive ones in the middle and post-reproductive group at the top is called age pyramid.
Age pyramid have three kinds
(i) **Triangular Age Pyramid** The number of pre-reproductive is very large. Number of reproductive individual is moderate and post-reproductive are fewer. Population size is growing
(ii) **Bell-shaped Age Pyramid** The number of prereproductive and reproductive individuals is almost equal. Post-reproductive individuals are comparatively fewer. Population size is stable
(iii) **Urn-shaped Age Pyramid** Proportion of reproductive age group is higher than the individuals in pre-reproductive age group. Number of post-reproductive individuals is also sizable. It is declining population with negative growth

Post-reproductive
Reproductive
Pre-reproductive
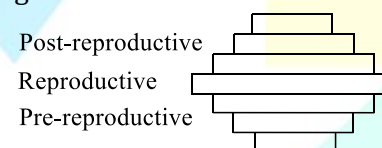
174 (b)
$dN/dt = (b - d) \times N$.
Exponential Growth Model When the resources availability is unlimited in the habitat, the population grows in an exponential or geometric fashion. As resources are unlimited than there is no inhibition from crowding.
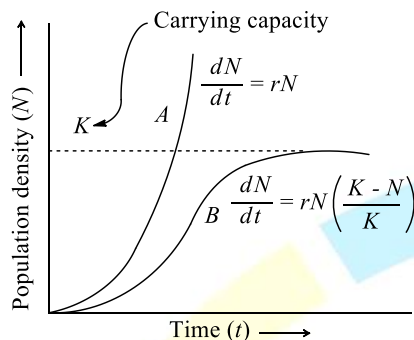The equation is; $dN/dt = (b - d) \times N$ [$b = $ Birth rate, $d = $ Death rate
$N = $ Population density, $\frac{dn}{dt} = $ Rate of change of population
Let (b-d) = r; then the equation is, $dN/dt = Rn$

r = Intrinsic rate of natural increase

When a population shows exponential growth, the curve plotted with N in relation to time, assume J shape

In this there is no fix carrying capacity

175 **(c)**

The sunlight directly regulates the primary productivity because the plants perform photosynthesis with the help of sunlight. The amount of biomass or organic matter produced per unit area over a time period in plants during photosynthesis is called primary production

176 **(d)**

(i) The term 'ecosystem' was coined by Sir AG Tansley (1935) to describe the whole complex of living organisms living together as a sociological units and their habitats

(ii) The entire biosphere is referred to as global ecosystem, which consists of several local ecosystems of earth. The size of the ecosystem varies from small pond to a large forest or sea

(iii) Vertical distribution of different species occupying different levels is called stratification, $e.\,g.$, in a forest ecosystem, trees occupy top vertical layer, shrubs the second and herbs and grasses occupy the bottom layers

177 **(a)**

The following species of plants are now widely used for social forestry: $Acacia, Leucaena$ (subabul), $Prosopis$(jand), $Sesbania$ (agastha), $Casuarina, Tectona$(teak), $Dalbergia$(sisham), $Moringa$(sahjan) and $Azadirachta indica$(neem).

178 **(c)**

Tillage is a method of soil conservation. In this method, the underground parts of several grasses are left out after the crop is harvested. These parts remain underground, which improves soil fertility. This method is also used for some plants such as maize, potato, etc.

179 **(c)**

Biochemical Oxygen Demand (BOD) is a measure of pollution by organic matter present in a sample of water

BOD is higher in polluted sewage water and is connected with both microbes and organic matter. More the organic pollution, specially sewage, more would be the BOD of water

180 **(b)**

An ecologically compatible system of disposal of human excreta is the use of dry composting toilets, called ecosave toilets. No water is required. Human excreta is converted into a resource as it forms natural fertilizer. Ecosan toilets are already working in many parts of Kerala and Sri Lanka