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Product Name : Topic wise Solved papers for Medical Entrance 2nd Edition (Kerala PMT/ AIPMT/ AIIMS/ JIPMER)

Product Description : "Topic wise Solved papers for Medical Entrance (Kerala PMT/ JIPMER/ AIPMT/ AIIMS) • Topic wise Solved papers for Medical Entrance is a collection of topic-wise MCQ's from carefully selected past question papers of various Medical entrance exams. The book is useful for Kerala PMT/ AIPMT/ AIIMS/ JIPMER 2015. • The chapterisation of the book has been designed on the pattern of class 11 and 12 syllabus as prescribed by NCERT. • The book contains past 6 year papers of Kerala PMT (2009-14), NEET(2013), past 5 year papers of AIPMT(2009-12,2014) and past 3 year papers of AIIMS (2012-14) solved papers. • All papers are distributed into topics so that student can practice it along with his/ her regular studies - after each and every chapter. • The book contains 'Chapter-wise MCQs' which covers all the important concepts and applications required to crack the mentioned exams. • The solutions to each and every question is provided at the end of the book. The solutions have been prepared in a manner that a student can easily understand them. • The book contains 28/ 30/ 38 chapters in Physics, Chemistry and Biology respectively covering a total of 3000+ MCQs with solutions. • This is an ideal book to practice and revise the complete syllabus of the mentioned exams."
1. An electric dipole consists of two charges of 2.0 C separated by a distance of 2.0 cm. The dipole is placed in an external electric field of $1 \times 10^4$ NC$^{-1}$. The maximum torque experienced by the dipole is
   (a) 4 Nm  
   (b) $4 \times 10^{-7}$ Nm  
   (c) $4 \times 10^{-4}$ Nm  
   (d) $4 \times 10^{-3}$ Nm  
   (e) $4 \times 10^{-2}$ Nm

2. If conductor A is positively charged and conductor B is negatively charged, then the conductor (s)
   (a) A has lost electrons  
   (b) B has lost electrons  
   (c) both A and B have lost electrons  
   (d) A has lost protons  
   (e) B has lost protons

3. Electric conductivity is the reciprocal of
   (a) Mobility  
   (b) Conductance  
   (c) Resistivity  
   (d) Resistance  
   (e) Current density

4. Nichrome is used electrical heating element because of its
   (a) Negative temperature coefficient of resistance  
   (b) Strong dependence of resistivity with temperature  
   (c) Low melting point  
   (d) Weak dependence of resistivity with temperature  
   (e) Semiconducting nature

5. The circuit element to which Ohm’s law is applicable is
   (a) Junction diode  
   (b) Zener diode  
   (c) Resistor  
   (d) Transistor  
   (e) Photodiode

6. The magnetic field at any point on the axial line of a short bar magnet at a distance $r$ from its centre is proportional to
   (a) $r$  
   (b) $\frac{1}{r}$  
   (c) $\frac{1}{r^2}$  
   (d) $r^3$  
   (e) $\frac{1}{r^3}$

7. If a helium nucleus makes a full rotation in a circle of radius 0.8 m in 2 nano-second, then the magnetic induction at the centre of the circle is
   (a) $2 \pi \times 10^{-18}$ T  
   (b) $4 \pi \times 10^{-17}$ T  
   (c) $2 \pi \times 10^{-17}$ T  
   (d) $4 \pi \times 10^{-16}$ T  
   (e) $1.6 \times 10^{-18}$ T

8. The vertical component of earth’s magnetic field is $\frac{I}{\sqrt{3}}$ times the horizontal component at a certain place. Angle of dip at that place is
   (a) 90°  
   (b) 45°  
   (c) 0°  
   (d) 60°  
   (e) 30°

9. Choose the wrong statement
   (a) Magnetic flux is a scalar quantity  
   (b) Coefficient inductance is a vector quantity  
   (c) The mutual inductance of a pair of solenoids depends on their relative orientation  
   (d) Lenz law gives the direction of the induced emf  
   (e) AC generator converts mechanical energy into electrical energy

10. Two different coils having self-inductance values $L_1 = 8$ mH and $L_2 = 2$ mH are kept far apart. If the rate of change of current in the second coil is twice that in the first coil, then the ratio of induced emf in the first coil to that in second coil is
    (a) 2 : 3  
    (b) 1 : 2  
    (c) 1 : 1  
    (d) 2 : 1  
    (e) 1 : 3

11. In an ac generator, mechanical energy is converted into electrical energy by virtue of
    (a) electrostatic  
    (b) magnetic induction  
    (c) electric induction  
    (d) electromagnetic induction  
    (e) mutual induction

12. Choose the wrong statement
    (a) Electromagnetic waves travel at the speed of light  
    (b) Electromagnetic waves are transverse waves  
    (c) The ratio of the electric field to the magnetic field in an electromagnetic wave equals the speed of light  
    (d) Electromagnetic waves carry both energy and momentum  
    (e) Electromagnetic waves can be deflected by magnetic field

13. Two convex lenses of focal lengths 10 cm and 20 cm are kept in contact. The effective power of the lens system is
    (a) 30 D  
    (b) 15 D  
    (c) 20 D  
    (d) 12 D  
    (e) 25 D

14. The emergent ray of light after refraction at a rectangular glass slab
    (a) Suffers deviation  
    (b) Suffers no lateral displacement with respect to the incident ray  
    (c) Emerges perpendicular to the incident ray  
    (d) Emerges parallel to the incident ray  
    (e) Emerges along the incident ray direction
15. When unpolarised light is incident at Brewster’s angle on the boundary between two transparent media, the reflected light is polarized with its electric vector in
(a) a plane parallel to the plane of incidence
(b) a plane 45° to the plane of incidence
(c) a plane perpendicular to the plane of incidence
(d) a plane 30° to the plane of incidence
(e) a plane 60° to the plane of incidence

16. The following pair of physical quantities of the photoelectric phenomenon that gives a straight line graph is
(a) intensity of radiation and photoelectric current
(b) potential of the anode and photoelectric current
(c) threshold frequency and velocity of photoelectrons
(d) intensity of radiation and stopping potential
(e) frequency of incident radiation and the photoelectric current

17. If 10% of a radioactive material decays in 10 days, the percentage of the material that decays in 20 days is
(a) 20% (b) 41% (c) 81% (d) 19% (e) 90%

18. $^{22}$Ne nucleus, decays into two alpha particles and an unknown nucleus. The unknown nucleus is
(a) Nitrogen (b) Carbon (c) Boron (d) Oxygen (e) Fluorine

19. A device which is used to detect optical signals is a
(a) junction diode (b) light emitting diode (c) photovoltaic device (d) Zener diode (e) photodiode

20. Identify the incorrect matching among the following
(a) Transistor - Switch in saturation state
(b) Photodiode - Forward biased p-n junction diode
(c) Zener diode - Heavily doped p-n junction diode
(d) Solar cell - Unbiased photodiode
(e) Light emitting diode - Heavily doped forward biased p-n junction diode

21. The angular frequency of tuned collector oscillator having LC feedback network is
(a) $\sqrt{LC}$ (b) $LC$ (c) $L/\sqrt{C}$ (d) $L/C$ (e) $\frac{L}{\sqrt{C}}$

22. The layer which reflects HF waves efficiently during night time is
(a) troposphere (b) thermosphere (c) lower part of stratosphere

23. In a receiver, the device which changes the AM wave into a lower frequency wave before its detection is
(a) IF stage amplifier (b) amplifier (c) rectifier (d) envelope detector (e) band-pass filter

24. Digital signals
(a) provide a continuous set of values
(b) can utilize decimal as well as binary systems
(c) can utilize only decimal systems
(d) represent values as discrete steps
(e) cannot utilize binary systems

25. Two physical quantities P and Q have different dimensions. The physically meaningful mathematical relation is
(a) $P + Q$ (b) $P - Q$ (c) $PQ$ (d) $(P - Q)/Q$ (e) $(P + Q)/Q$

26. In one dimension, the angle between velocity vector and acceleration vector of an object is
(a) either $0^\circ$ or $180^\circ$ (b) between $0^\circ$ and $180^\circ$
(c) between $90^\circ$ and $180^\circ$ (d) more than $180^\circ$ (e) $90^\circ$

27. If a train of length 300 m crosses a bridge at a speed of 108 km/hr in 30 s, then the length of the bridge is
(a) 200 m (b) 600 m (c) 400 m (d) 300 m (e) 100 m

28. The y-component of the velocity of a body moving with a velocity, $\vec{v} = 4\hat{i} + 3\hat{j}$ m/s⁻¹ is
(a) 1 m/s⁻¹ (b) 5 m/s⁻¹ (c) 4 m/s⁻¹ (d) 7 m/s⁻¹ (e) 3 m/s⁻¹

29. Two particles each of mass $m_1$ and $m_2$ are moving in concentric circles of radii $r_1$ and $r_2$ respectively such that their periods are same. Then the ratio of their centripetal accelerations is
(a) $r_1/r_2$ (b) $r_2/r_1$ (c) $r_1/2r_2$ (d) $2r_2/r_1$ (e) $r_1/r_2$

30. The propulsion of a rocket is based on the principle of conservation of
(a) angular momentum (b) mass
31. Identify the incorrect statement
(a) rolling friction is always less than sliding friction
(b) the mechanical efficiency of a machine increases with the use of lubricants
(c) inertia of a body is a measure of its mass
(d) cream separator is an example of centrifuge
(e) Newton’s laws hold good in a non-inertial frame

32. A force of 1 N acting on a body of mass 2 kg produces in it an acceleration of (in m/s²)
(a) 1
(b) 0.5
(c) 1.5
(d) 2
(e) 4

33. When the same force of 5 N is applied to two balls A and B separately, they move along the direction of the force with a velocity 5 m/s and 10 m/s respectively. The rate of work done on the ball A to that on B are in the ratio
(a) 1 : 3
(b) 1 : 2
(c) 1 : 1
(d) 2 : 1
(e) 3 : 1

34. When a rigid body has neither linear acceleration nor angular acceleration then it is said to be in
(a) rotational equilibrium
(b) relative equilibrium
(c) mechanical equilibrium
(d) partial equilibrium
(e) translational equilibrium

35. The pair of rigid bodies with mass M and radius R, having the moment of inertia \( \frac{MR^2}{2} \) can be
(a) a ring and a solid cylinder
(b) a ring and a hollow cylinder
(c) a disc and a hollows cylinder
(d) a solid cylinder and a solid sphere
(e) a solid sphere and a hollow cylinder

36. Kepler’s second law (law of areas) of planetary motion leads to law of conservation of
(a) total energy
(b) linear momentum
(c) gravitational potential energy
(d) kinetic energy
(e) angular momentum

37. The ratio between the altitude and depth (<< radius of earth R) from the surface of the earth at which the change in the value of g is same, is
(a) 2 : 1
(b) 1 : 2
(c) 1 : 1
(d) \( \sqrt{2} : 1 \)
(e) 1 : \( \sqrt{2} \)

38. The equation of continuity in incompressible fluid flow is based on the principle of conservation of
(a) potential energy of the fluid
(b) kinetic energy of the fluid
(c) total energy of the fluid
(d) fluid mass
(e) fluid momentum

39. The maximum length of a wire of density \( \rho \) and breaking stress \( S \) that can be hang freely without breaking is
(a) \( \frac{S}{\rho g} \)
(b) \( \frac{2S}{\rho g} \)
(c) \( \frac{\rho g}{2S} \)
(d) \( \frac{3S}{\rho g} \)
(e) \( \frac{\rho gS}{2} \)

40. The flow of liquid in a tube is laminar, when the value of Reynolds’ number lies between
(a) 1000 and 3000
(b) zero and 2000
(c) 2000 and 4000
(d) zero and 3000
(e) 2000 and 5000

41. A monoatomic gas at pressure \( P \) is compressed adiabatically to \( \frac{1}{8} \) of its initial volume. Then the pressure of the gas will be change to
(a) 8 \( P \)
(b) 16 \( P \)
(c) \( \frac{40}{3} P \)
(d) \( \frac{22}{5} P \)
(e) 32 \( P \)

42. In a refrigerator, if the system extracts heat \( Q_2 \) from the cold reservoir and releases heat \( Q_1 \) to the hot reservoir, then the coefficient of the performance of the refrigerator is
(a) \( \frac{Q_1}{Q_1 - Q_2} \)
(b) \( \frac{Q_2}{Q_1 - Q_2} \)
(c) \( \frac{Q_1}{Q_2} \)
(d) \( \frac{Q_2}{Q_1} \)
(e) \( \frac{Q_1 - Q_2}{Q_2} \)

43. Equal masses of a diatomic gas in separate containers undergo same change of temperature by two different processes, one at constant volume and another constant pressure. The ratio of the respective heats supplied is
(a) 1 : 1
(b) 1 : 2
(c) 2 : 5
(d) 5 : 7
(e) 3 : 5

44. A linear harmonic oscillator with force constant \( 3.2 \times 10^6 \) Nm⁻¹ and amplitude 0.01 m has a
(a) maximum potential energy 80J
(b) maximum potential energy 160J
(c) maximum kinetic energy 80J
(d) maximum kinetic energy 160J
(e) minimum potential energy 100J
45. Motion of a planet around the sun is a
(a) periodic and simple harmonic motion
(b) non-periodic but simple harmonic motion
(c) periodic but not simple harmonic motion
(d) oscillatory but simple harmonic motion
(e) non-periodic but damped harmonic motion

46. During wave propagation in a medium, whenever the temperature of the medium changes, there is a change in
(a) time period (b) wavelength (c) frequency (d) phase (e) amplitude

47. The fundamental frequency of a closed organ pipe is 256 Hz. The unallowed overtone frequency is
(a) 512 Hz (b) 768 Hz (c) 1280 Hz (d) 1792 Hz (e) 2304 Hz

48. The SI unit of surface integral of electric field is
(a) Cm³ (b) V (c) Vm⁻¹ (d) Vm (e) NC⁻¹m

CHEMISTRY

49. CH₃ – CH == CH₂ reacts readily with B₂H₆ and the product on oxidation with alkaline H₂O₂ gives
(a) CH₃ – CH(OH) – CH₂OH
(b) CH₃ – CO – CH₂
(c) CH₃ – CH₂ – CH₂ – OH
(d) CH₃ – CH₂ – CHO
(e) CH₃ – CH₂ – CH₂ – CHO

50. Which one of the following exhibits positive resonance effect (+R effect)?
(a) – CHO (b) – CN (c) – COOH (d) – OCOR (e) – NO₂

51. Finkelstein reaction is an example of
(a) Aliphatic nucleophilic substitution reaction
(b) Aliphatic electrophilic substitution reaction
(c) Aromatic electrophilic substitution reaction
(d) Aliphatic free radical substitution reaction
(e) Aliphatic elimination reaction

52. Consider the following haloalkanes
(I) 1-Bromobutane
(II) 2-Bromo-2-methylpropane
(III) 2-Bromobutane

The boiling points of the above isomeric haloalkanes decrease in the order
(a) (I) > (II) > (III) (b) (III) > (II) > (I) (c) (II) > (III) > (I) (d) (II) > (I) > (III)

53. Which one of the following compounds will show geometrical isomerism?
(a) BrCH = CHBr (b) CH₅CH = CH₂ (c) (CH₃)₂C = CHCH₃ (d) CH₃CH₂CH = CH₂ (e) 1, 2 Dimethylbenzene

54. Compound ‘A’ with molecular formula C₄H₁₀O reacts instantaneously with cold HCl in the presence of anhydrous ZnCl₂ to form a compound ‘B’. ‘B’ when heated with metallic sodium in dry ether forms a compound ‘C’. Compound C is

\[ \text{CH}_3\text{CH}_3 \]

(a) Cl – CH₂ – C – C – CH₂Cl
(b) CH₃CH₂CH₂CH₂CH₂CH₃
(c) CH₃ – C – C – CH₃
(d) CH₃ – C – CH – CH₃
(e) Cl – CH₂ – C – C – CH₂OH

55. Which one of the following is an achiral molecule?
(a) 2-Butanol (b) 2, 3-Dihydroxypropanal (c) Bromochloroiodomethane (d) Ethylene glycol (e) Lactic acid

56. The major product obtained when 4-Chloronitrobenzene is heated with NaOH at 443 K and then treated with dil. HCl is
(a) Nitrobenzene (b) p-Aminophenol (c) Bromochloroiodomethane (d) Ethylene glycol (e) Lactic acid

57. The product formed when acetone is heated with Ba(OH)₂
58. Which one is preferred reagent for the conversion ester to aldehyde?
(a) Sn/HCl  (b) Pt/BaSO₄
(c) DIBAL-H  (d) CO/HCl
(e) Sn/HCl

59. A compound ‘A’ with molecular formula C₅H₁₀O gives a positive 2,4 DNP test but a negative Tollen’s test. On treatment with sodium hypochlorite, it gives CHCl₃ and compound ‘B’. Compound ‘B’ is
(a) Sodium propanate  (b) Sodium butanoate
(c) Sodium acetate  (d) n-Butane
(e) Isobutane

60. Which of the following reactions can convert butanone to n-butane?
(I) Rosenmund’s reduction
(II) Clemmensen reduction
(III) Reduction with NiAlH₄
(IV) Wolff-kishner reduction
Choose the correct answer from the codes given below
(a) (I), (II) and (IV)  (b) (I) and (II)
(c) (I), (II), (III) and (IV)  (d) (II) and (IV)
(e) (I) and (IV)

61. Which one of the following compounds will give propanamine in Hofmann’s bromamide reaction?
(a) Nitropropane  (b) Propanamide
(c) Butanamide  (d) Propanenitrile
(e) Butanamine

62. Which one is preferred reagent for the reduction of nitrobenzene to aniline?
(a) H₂/Pd/Ethanol  (b) H₂/Pt/Ethanol
(c) Finely divided Nickel  (d) Zn/NaOH
(e) Fe/HCl

63. When aniline is treated with excess CH₃I, the major product obtained is
(a) N-Methylaniline  (b) N,N-Dimethylaniline
(c) p-Toluidine  (d) 2, 4, 6-Trimethylaniline
(e) Trimethylphenyl ammonium iodide

64. N-Pheny lethalamide is treated with Br₂ in acetic acid and the major product formed is hydrolysed by dilute alkali to get compound ‘A’. Compound ‘A’ is
(a) 2-Bromoaniline  (b) 3-Bromoaniline
(c) Aniline  (d) 4-Bromoaniline
(e) 2-Brombenzoic acid

65. The linkage of the two monosaccharide units in lactose is
(a) C₁ of the one glucose with C₂ of another glucose
(b) C₁ of the one glucose with C₄ of another glucose
(c) C₁ of glucose with C₄ of galactose
(d) C₁ of galactose with C₂ of glucose
(e) C₁ of galactose with C₄ of glucose

66. Which of the following vitamin is responsible for increased fragility of RBCs?
(a) Vitamin B₁  (b) Vitamin E
(c) Vitamin K  (d) Vitamin C
(e) Vitamin B₆

67. Which one of the following is incorrectly matched?
(a) ‘a’ and ‘b’ - Glucose - Anomer
(b) Amylose - Starch
(c) Glycogen - Animal starch
(d) Cellulose - Polymer of β-D-glucose
(e) Myosin - Globular protein

68. The three bases present both in DNA and RNA are
(a) Guanine, cytosine and uracil
(b) Adenine, guanine and thymine
(c) Adenine, guanine and uracil
(d) Adenine, guanine and cytosine
(e) Adenine, thymine and uracil

69. One of the builders present in scouring soaps?
(a) Trisodium phosphate  (b) Sodium sulphate
(c) Sodium rosinate  (d) Borax
(e) Glycerol

70. The major contributor to global warming is
(a) Methane  (b) Carbon dioxide
(c) Ozone  (d) Water vapour
(e) CFCs

71. The number of molecules in 100 mg of heptanes is ...............
(a) 4 times greater  (b) 4 times lasser
(c) 2.5 times lesser  (d) 2.5 times greater
(e) 16 times greater

72. The value of the de Broglie wavelength of the atom at – 173°C is how many times its de Broglie wavelength at 327°C?
(a) $\sqrt{5}$  (b) $\sqrt{6}$
(c) $\sqrt{2}$  (d) $\sqrt{12}$
(e) $\sqrt{15}$

73. Two electrons I and II have the following set of quantum numbers
I = 3, 2, 0, -1/2  II = 4, 0, 0, +1/2
Which of the following statements is true?
(a) Electrons I and II have same energy.
(b) Electrons I has lower energy than II
(c) Electrons I is in 3p orbital while electron II is in 4s orbital
(d) Electrons I has higher energy than II
(e) Electrons I has clockwise spin while electron II has anti-clockwise spin

74. Which of the following species among the following are iso eletronic?
Na	extsuperscript{+}, K	extsuperscript{+}, Ne, Mg	extsuperscript{2+}, and Cl	extsuperscript{–}
(a) Na	extsuperscript{+}, K	extsuperscript{+}, and Li	extsuperscript{+}
(b) Ne, Mg	extsuperscript{2+} and Cl	extsuperscript{–}
(c) Li	extsuperscript{+}, Ne and Cl	extsuperscript{–}
(d) Na	extsuperscript{+}, Ne and Mg	extsuperscript{2+}
(e) K	extsuperscript{+}, Cl	extsuperscript{–} and Mg	extsuperscript{2+}

75. The correct ascending order of atomic radius in the following atoms is
(a) B < Be < Li < Al
(b) B < Li < Be < Al
(c) B < Be < Al < Li
(d) Be < B < Al < Li
(e) Be < B < Li < Al

76. Which one of the following diatomic molecules has the highest dipole moment?
(a) H	extsubscript{2}
(b) HF
(c) HCl
(d) HBr
(e) HI

77. The species with fractional bond order is
(a) O	extsuperscript{2+}
(b) O	extsuperscript{2–}
(c) CO
(d) He	extsubscript{2}
(e) N	extsubscript{2}

78. Equal mass of a gas X and oxygen were present in a closed vessel at 2.5°C . The partial pressure of oxygen was found to be (5/6) times of the total pressure. The molar mass of the gas X in mol	extsuperscript{-1} is
(a) 64
(b) 60
(c) 160
(d) 80
(e) 128

79. At constant temperature, a bulb ‘A’ of volume 100 mL containing an ideal gas was connected to another evacuated bulb ‘B’. The pressure fell down to 40% of its initial pressure. The volume of bulb ‘B’(in mL) is
(a) 75
(b) 150
(c) 125
(d) 200
(e) 250

80. The compressibility factor (Z) of one mole of a van der Waals’ gas with negligible ‘a’ value is
(a) bP/RT
(b) [1 – (bP/RT)]
(c) [1 + (bP/RT)]
(d) (1/bP)
(e) RT/bP

81. The element used in jewellery occupying the position of 6	extsuperscript{th} period and 10	extsuperscript{th} group in the long term of the periodic table is
(a) Ag
(b) Au
(c) Cu
(d) Pt
(e) Ir

82. The increasing order of electronegativity of the three elements O, F and Na is
(a) Na < O < F
(b) O < F < Na
(c) Na < F < O
(d) F < O < Na
(e) O < Na < F

83. What is the IUPAC official name of element with atomic number 110?
(a) Darmstadtium
(b) Hassium
(c) Seaborgium
(d) Nobelium
(e) Bohrium

84. What are the constituents present in German silver?
(a) Cu, Zn and Fe
(b) Pb, Ag and Ge
(c) Cu, Zn and Ni
(d) Al, Ag and Ge
(e) Ni, Zr and In

85. Froth floatation is not used in the concentration of
(a) Magnetite
(b) Iron pyrites
(c) Copper pyrites
(d) Zinc blende
(e) Copper glance

86. The liquid alkali metal used as coolant in fast breeder nuclear reactors is
(a) Lithium
(b) Sodium
(c) Potassium
(d) Rubidium
(e) Caesium

87. In which one of the following oxyacids, phosphorus exhibits +4 oxidation state?
(a) Metaphosphoric Acid
(b) Hypophosphorous acid
(c) Pyrophosphorous acid
(d) Orthophosphorous acid
(e) Hypophosphoric acid

88. When B	extsubscript{2}H	extsubscript{6} is heated with NH	extsubscript{3}, the final products is
(a) Borazine
(b) Boron nitride
(c) Boron trioxide
(d) Boron
(e) Boric acid

89. Which one of the following oxides of nitrogen has linear shape?
(a) N	extsubscript{2}O	extsubscript{3}
(b) NO	extsubscript{3}
(c) N	extsubscript{2}O	extsubscript{4}
(d) N	extsubscript{2}O	extsubscript{5}
(e) N	extsubscript{2}O
90. The hybridized state of the bromine atom is BrF$_5$ is
(a) sp$^3$d (b) dsp$^2$
(c) sp$^3$d$^3$ (d) sp$^3$d$^2$
(e) sp$^3$

91. Which pair of the following 4d series of elements has the same number of electrons in 4d subshell?
(a) Mo and Tc (b) Nb and Mo (c) Pd and Ag (d) Rh and Pd (e) Ru and Rh

92. In which of the following pairs, both the ions are coloured in aqueous solutions?
(a) Ni$^{2+}$, Ti$^{4+}$ (b) Ni$^{2+}$, Ti$^{3+}$ (c) Sc$^{3+}$, Ti$^{3+}$ (d) Cr$^{3+}$, Zn$^{2+}$ (e) Sc$^{3+}$, Mn$^{2+}$

93. In which one of the following actinoid elements 6d subshell is vacant?
(a) Pa (b) Np (c) Lr (d) Cm (e) Pu

94. Which one of the lanthanoide ions is diamagnetic?
(a) Pr$^{3+}$ (b) Nd$^{4+}$ (c) Ce$^{4+}$ (d) Er$^{3+}$ (e) sm$^{3+}$

95. The work done on the system when one mole of an ideal gas is compressed isothermally to a final volume of 0.01 m$^3$ at constant external pressure of 5 bar is 20KJ. What is the initial volume of the gas?
(a) 0.045 m$^3$ (b) 0.035 m$^3$ (c) 0.025 m$^3$ (d) 0.05 m$^3$ (e) 0.04 m$^3$

96. The values of $\Delta H$ and $\Delta S$ for the reaction
C(graphite) + CO$_2$(g) $\rightarrow$ 2CO(g)
Are 170 kJ and 170 JK$^{-1}$ respectively. The reaction will be spontaneous only at
(a) 910 K (b) 510 K (c) 710 K (d) 1110 K (e) 810 K

97. The value of $(\Delta H - \Delta E)$ for the reaction
C$_6$H$_6$(l) + 7$\frac{1}{2}$O$_2$(g) $\rightarrow$ 6CO$_2$(g) + 3H$_2$O(l) at 27°C is $(R = 2$ cal K$^{-1}$ mol$^{-1}$)
(a) 0.9 Kcal (b) 9 Kcal (c) -0.9 Kcal (d) -9 Kcal (e) -1.8 Kcal

98. The pH of a solution obtained by mixing 60 mL of 0.1 M NaOH solution at 40mL of 0.15 m HCl solution is
(a) 10 (b) 12 (c) 2 (d) 8 (e) 7

99. The solubility product ($K_{sp}$) of the following compounds are given at 298K

<table>
<thead>
<tr>
<th>Compound</th>
<th>$K_{sp}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>BaSO$_4$</td>
<td>$1.0 \times 10^{-10}$</td>
</tr>
<tr>
<td>CaSO$_4$</td>
<td>$9.0 \times 10^{-6}$</td>
</tr>
<tr>
<td>MnS</td>
<td>$2.5 \times 10^{-13}$</td>
</tr>
<tr>
<td>Ni(OH)$_2$</td>
<td>$5.0 \times 10^{-16}$</td>
</tr>
</tbody>
</table>

The most soluble and least soluble compound are respectively
(a) BaSO$_4$, CaSO$_4$ (b) MnS and Ni(OH)$_2$ (c) CaSO$_4$ and MnS (d) BaSO$_4$ and Ni(OH)$_2$ (e) MnS and CaSO$_4$

100. The equilibrium constant for the following reactions
N$_2$(g) + 3H$_2$(g) $\leftrightarrow$ 2NH$_3$(g), N$_2$(g) + O$_2$(g) $\leftrightarrow$ 2NO(g) and
H$_2$(g) + $\frac{1}{2}$O$_2$(g) $\leftrightarrow$ H$_2$O(1g) are $K_1$, $K_2$ and $K_3$ respectively.

The equilibrium constant $(K)$ for the reaction 2NH$_3$ $\rightarrow$ $\frac{5}{2}$O$_2$(g) $\rightarrow$ 2NO(g) + 3H$_2$O(l)
(a) $K_2$, $K_3$/$K_1$ (b) $K_2$, $K_3$/$K_1$ (c) $K_2$ $K_3$ (d) $K_2$ $K_3$ (e) $K_2$ $K_3$

101. Consider the following equilibrium reaction
2CO$_2$(g) $\leftrightarrow$ 2CO(g) + O$_2$(g)
Let Chatelier’s principles predicts that adding O$_2$(g) to the reaction container at constant temperature will
(a) decrease the partial pressure of CO$_2$(g) at equilibrium (b) increase the value of the equilibrium constant (c) increase the partial pressure of CO$_2$(g) at equilibrium (d) increase the partial pressure of CO(g) at equilibrium (e) decrease the value of the equilibrium constant

102. A solution obeying Raoult’s law has an elevation of boiling point of 1°C. What is the mass percentage of solute in the solution?
(a) 10 (b) 12 (c) 8 (d) 2 (e) 4

103. An aqueous solution of glucose containing 60 g glucose (C$_6$H$_{12}$O$_6$) per litre an osmotic pressure of 5.2 bar at 300 K. The concentration of the glucose solution having osmotic pressure of 1.3 bar at the same temperature is
(a) 1/10M (b) 1/5M (c) 1/20M (d) 1/3M (e) 1/12M
104. A solution contains 4 g of NaOH and 16.2 g of water. The mole fraction solute and solvent are respectively
(a) 0.1, 0.9 (b) 0.2, 0.8
(c) 0.5, 0.5 (d) 0.4, 0.6
(e) 0.3, 0.7

105. Three elements x, y and z have the respective oxidation states –2, + 3 and +6 which one of the following could be possible formula of the compound form by these elements?
(a) $x_2(yx_4)_3$ (b) $y_2(zx_4)_3$
(c) $x_2(yx_4)_3$ (d) $y_2(zx_4)_3$
(e) $z_2(yx_4)_3$

106. Given the standard reduction potential $F_2/F^- = +2.85 \text{ V}$, $Cl_2/Cl^- = +1.36$, $Br_2/Br^- = +1.06 \text{ V}$ and $I_2/I^- = + 0.53 \text{ V}$. The strongest oxidizing and reducing agents respectively among these species are
(a) $F_2$ and $I^-$ (b) $Br_2$ and $Cl^-$
(c) $Cl_2$ and $Br^-$ (d) $Cl_2$ and $I_2$
(e) $F^-$ and $I_2$

107. At a particular temperature, the ratio of molar conductivity to conductivity of 0.1N solution of sodium chloride is
(a) $10^4 \text{ cm}^3$ (b) $10^3 \text{ cm}^3$
(c) $10^{-1} \text{ cm}^3$ (d) $10^2 \text{ cm}^3$

108. In the electrolysis of aqueous sodium chloride solution, the products are
(a) NaOH and $Cl_2$ only
(b) NaOH, $Cl_2$ and $O_2$ only
(c) NaOH, $Cl_2$, $O_2$ and $H_2$
(d) Na and $Cl_2$ only
(e) NaOH, $Cl_2$ and $H_2$ only

109. The time required for 75% completion of a first order reaction is (k = rate constant)
(a) $0.6932/k$ (b) $0.3466/k$
(c) $0.6932 \times 4/3$ (d) $0.6932 \times 3/4k$
(e) $1.3864/k$

110. The slope of Arrhenius plot (ln k vs 1/T) of a first order reaction is – 5 $\times 10^3$. The value of $E_a$ of the reaction is (R = 8.3 JK$^{-1}$mol$^{-1}$)
(a) 41.5 kJ mol$^{-1}$ (b) 83 kJ mol$^{-1}$
(c) – 41.5 kJ mol$^{-1}$ (d) – 83 kJ mol$^{-1}$
(e) 166 kJ mol$^{-1}$

111. A reaction $P \rightarrow Q$ has an activation energy of 25 kJmol$^{-1}$ and enthalpy change of – 5kJ mol$^{-1}$. The activation energy for the reaction $Q \rightarrow P$ is
(a) 30 kJ mol$^{-1}$ (b) 20 kJ mol$^{-1}$
(c) 15 kJ mol$^{-1}$ (d) 25 kJ mol$^{-1}$
(e) 30 kJ mol$^{-1}$

112. Which one is not correctly matched?
(a) Lyophobic colloid - Metal sulphide sol
(b) Multimolecular colloid - Gold sol
(c) Lyophilic colloid - Sulphur sol
(d) Macromolecular colloid - Cellulose
(e) Associated colloid - Detergent

113. In a Freundlich’s adsorption isotherm, the slope is unity and k is 0.1 The extent of adsorption at 2 atmosphere is (log 2 = 0.3010)
(a) 0.6 (b) 0.2
(c) 0.4 (d) 0.3
(e) 0.8

114. Match the correct pair

<table>
<thead>
<tr>
<th>Process</th>
<th>Adsorbent</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Control of humidity</td>
<td>(i) Activated charcoal</td>
</tr>
<tr>
<td>(B) Gas masks in coal mine</td>
<td>(ii) Nickel</td>
</tr>
<tr>
<td>(C) Adsorption indicators</td>
<td>(iii) Silica get</td>
</tr>
<tr>
<td>(D) Hydrogenation of oils</td>
<td>(iv) Silver halides</td>
</tr>
</tbody>
</table>

115. Identify the heteroleptic complex
(a) $[Zn(NH_3)_4]^{2+}$ (b) $[CoF_6]^{3-}$
(c) $[Pt(NH_3)_2Cl_2]$ (d) $[Cr(C_2O_4)_3]^{3-}$
(e) $[Fe(CN)_6]^{3-}$

116. Among the following complexes
(i) $[Ni(CO)_4]$ (ii) $[Ni(CN)_4]^{2-}$ (iii) $[NiCl_4]^{2-}$
(a) (i) and (ii) are diamagnetic but (iii) is paramagnetic
(b) (i) and (ii) are diamagnetic but (ii) is paramagnetic
(c) (ii) and (iii) are diamagnetic but (i) is paramagnetic
(d) (i) and (iii) are paramagnetic but (ii) is diamagnetic
(e) (ii) and (iii) are paramagnetic but (i) is diamagnetic
1. Water pollinated plants have
   (a) Bright colour  (b) Fragrance
   (c) Nectar  (d) Tassels
   (e) Mucilage covering over pollen grains

2. Many fresh water animals cannot live for long in sea water mainly because of the
   (a) Change in the atmosphere
   (b) Change in the levels of thermal tolerance
   (c) Variations in light intensity
   (d) Osmotic problems they would face
   (e) Change of temperature and light

3. Match mean annual precipitation in Column I with the biome in Column II and choose the right option.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 0-50 cm</td>
<td>(A) Tropical forest</td>
</tr>
<tr>
<td>(2) 50-100 cm</td>
<td>(B) Coniferous forest</td>
</tr>
<tr>
<td>(3) 150-400 cm</td>
<td>(C) Grassland</td>
</tr>
<tr>
<td>(4) 50-250 cm</td>
<td>(D) Desert</td>
</tr>
<tr>
<td>(a) (1) (D)</td>
<td>(2) (C)</td>
</tr>
<tr>
<td>(b) (1) (C)</td>
<td>(2) (A)</td>
</tr>
<tr>
<td>(c) (1) (C)</td>
<td>(2) (D)</td>
</tr>
<tr>
<td>(d) (1) (B)</td>
<td>(2) (D)</td>
</tr>
<tr>
<td>(e) (1) (D)</td>
<td>(2) (A)</td>
</tr>
</tbody>
</table>

4. The association that includes herbivores and phytophagous insects is called
   (a) Competition  (b) Parasitism
   (c) Predation     (d) Commensalism
   (e) Mutualism

5. The number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration is known as
   (a) Emigration  (b) Mortality
   (c) Natality    (d) Immigration
   (e) Adaptations

6. The monreal Protocol (1987) refers to
   (a) Presistent organic pollutants
   (b) Global warming and climatic changes
   (c) Biosafety of genetically modified organisms
   (d) Controlling the emission of ozone depleting substances
   (e) Controlling the radioactive wastes

7. Organisms that tolerate narrow range of salinity are
   (a) Euryhaline  (b) Stenohaline
   (c) Eurythermal (d) Hypersaline
   (e) Stenothermal

8. The gross primary productivity of an ecosystem is 170 tons of organic matter and amount used in respiration is 50 tons. Calculate the net primary productivity of the ecosystem
   (a) 120 tons  (b) 100 tons
   (c) 70 tons  (d) 12 tons
   (e) 17 tons

9. The number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration is known as
   (a) Emigration  (b) Mortality
   (c) Natality    (d) Immigration
   (e) Adaptations

10. Match the environmental activist in Column I with the environmental issue in Column II and choose the right option.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Ramesh Chandra Dagar</td>
<td>(A) Conservation of forests</td>
</tr>
<tr>
<td>(2) Ahmed Khan</td>
<td>(B) Organic farming</td>
</tr>
<tr>
<td>(3) Amrita Devi</td>
<td>(C) Plastic waste recycling</td>
</tr>
<tr>
<td>(a) (1) (B)</td>
<td>(2) (A)</td>
</tr>
<tr>
<td>(b) (1) (C)</td>
<td>(2) (A)</td>
</tr>
<tr>
<td>(c) (1) (A)</td>
<td>(2) (B)</td>
</tr>
<tr>
<td>(d) (1) (B)</td>
<td>(2) (A)</td>
</tr>
<tr>
<td>(e) (1) (A)</td>
<td>(2) (C)</td>
</tr>
</tbody>
</table>

11. The pioneer species in xerarch and hydrarch succession are respectively
   (a) Lichens and sedges
   (b) Phytoplanktons and sedges
   (c) Lichens and zooplanktons
   (d) Lichens and phytoplanktons
   (e) Phytoplanktons and lichens
12. Match the items in Column I with their uses in Column II and choose the right option.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) ELISA</td>
<td>(1) Antigen-antibody interaction</td>
</tr>
<tr>
<td>(B) PCR</td>
<td>(2) Gene amplification</td>
</tr>
<tr>
<td>(C) Biolistics</td>
<td>(3) Direct introduction of recombinant DNA</td>
</tr>
<tr>
<td>(D) Micro-injection</td>
<td>(4) Gold coated DNA</td>
</tr>
</tbody>
</table>

(a) (A)3 (B)4 (C)1 (D)3
(b) (A)2 (B)1 (C)4 (D)3
(c) (A)4 (B)1 (C)2 (D)3
(d) (A)1 (B)4 (C)2 (D)3
(e) (A)1 (B)2 (C)4 (D)3

13. Match the items in Column I with their uses in Column II and choose the right option.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Bacillus thuringiensis</td>
<td>(1) Restriction endonuclease</td>
</tr>
<tr>
<td>(B) Agrobacterium tumefaciens</td>
<td>(2) Thermostable DNA polymerase</td>
</tr>
<tr>
<td>(C) Thermus aquaticus</td>
<td>(3) Insecticidal protein</td>
</tr>
<tr>
<td>(D) Escherichia coli</td>
<td>(4) Tiplasmid</td>
</tr>
</tbody>
</table>

(a) (A) (B) (C) (D)
(b) (A) (B) (C) (D)
(c) (A) (B) (C) (D)
(d) (A) (B) (C) (D)
(e) (A) (B) (C) (D)

14. Which of the following statements about transgenic animals is/are false?

(i) Transgenic animals are designed to study how genes are regulated
(ii) They are specially made to serve as models for human diseases
(iii) Transgenic Cow, Rosie was created to produce the human protein α-1-antitrypsin
(iv) Transgenic mice are used to test the safety of vaccines

(a) (i) only
(b) (i) and (ii) only
(c) (ii) only
(d) (iii) and (iv) only
(e) (iii) only

15. Match the following and choose the correct combination from the options given.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Yeast</td>
<td>(1) Reproductive by true regeneration</td>
</tr>
<tr>
<td>(B) Planaria</td>
<td>(2) Reproduce by budding</td>
</tr>
</tbody>
</table>

(C) Mules (3) Multiply by fragmentation
(D) Protonema (4) Do not reproduce

16. An analytical taxonomic aid for identifying plants and animals based on similarities and dissimilarities is called

(a) Catalogue (b) Flora
(c) Manual (d) Key
(e) Monograph

17. Which of these is wrong about diatoms?

(a) Microscopic (b) Planktonic
(c) Overlapping shells (d) Spores with 2 flagella
(e) Silica cell wall

18. Pick out the statement that does not apply to viroids

(a) Infectious agents smaller than viruses
(b) Cause potato spindle tuber disease
(c) Have free DNA
(d) Lack protein coat
(e) Discovered by T.O. Diener

19. Which of the following does not belong to Class Basidiomycetes?

(i) Agaricus (ii) Trichoderma
(iii) Puccinia (iv) Saccharomyces
(v) Ustilago

(a) (i) and (ii) only
(b) (ii) and (iii) only
(c) (iii), (iv) and (v) only
(d) (ii), (iii) and (iv) only
(e) (ii) and (iv) only

20. Match Column I with Column II and choose the right option

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Amoeba</td>
<td>(i) Has flagella for locomotion</td>
</tr>
</tbody>
</table>

(A) Yeast (B) Planaria

21. Archaeobacteria and Eubacteria have been included under the kingdom

(a) Monera (b) Plantae
(c) Fungi (d) Protista
(e) Animalia

22. Match Column I with Column II and choose the right option

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
</table>

(A) Amoeba (B) Planaria

(C) Mules (D) Protonema

(a) (A) (B) (C) (D)
(b) (A) (B) (C) (D)
(c) (A) (B) (C) (D)
(d) (A) (B) (C) (D)
(e) (A) (B) (C) (D)
23. Find out the wrong statements
(A) Ulothrix and Spirogyra are filamentous forms
(B) Porphyra and Laminaria are fresh water algae
(C) Stored food is in the form of mannitol in Rhodophycean members
(D) Chlorella and Spirulina are unicellular algae
(a) (A) and (B) (b) (B) and (C)
(c) (A) and (C) (d) (A) and (D)
(e) (B) and (D)

24. Oogamous type of reproduction is seen in
(i) Fucus (ii) Anabaena
(iii) Nostoc (iv) Volvox
(a) (i) only (b) (i) and (ii) only
(c) (i) and (ii) only (d) (iii) only
(e) (i) and (iv) only

25. Diplontic type of life cycle is seen in
(i) Fucus (ii) Gymnosperms
(iii) Pteridophytes (iv) Bryophytes
(a) (i) only (b) (i) and (iv) only
(c) (i) and (iii) only (d) (iii) only
(e) (i) and (ii) only

26. Which of the following statements is Wrong about Bryophytes?
(a) Bryophytes are also called amphibians of the plant kingdom
(b) The gametophyte is the main plant body
(c) Sexual reproduction takes place in the presence of water
(d) Sporophyte is not free-living but attached to the photosynthesis gametophyte
(e) Zygote develops into a gametophyte

27. Which of the following statements about Pteridophytes is true?
(a) The homosporous forms are precursors to the seed habit
(b) Gametophyte is the dominant plant body
(c) First terrestrial plants to possess vascular tissues
(d) Equisetum is a member of pteropsida
(e) Photosynthetic thalloid sporophyte is called prothallus

28. The modified supporting roots called prop roots and stilt roots are seen respectively in
(i) Banyan and maize (ii) Banyan and sugarcane
(iii) maize and banyan (iv) Sugarcane and maize

29. Consider the following statements with respect to fungi
(a) They show a great diversity in morphology and habitat
(b) The white spots seen on mustard leaves are due to a saprophytic fungus
(c) They prefer to grow in cold and humid places
(d) The cell walls of fungi are composed of chitin and polysaccharides of the above statements
(a) (a) and (b) are correct
(b) (a) and (d) are correct
(c) (a) and (c) are correct
(d) (b) and (d) are correct
(e) (b) and (c) are correct

30. Which one of the following is not a characteristic feature of Fabaceae?
(a) Fruit is a berry
(b) Sepals five, gamosepalous and imbricate aestivation
(c) Stamens ten
(d) Ovary superior, monocarpellary and unilocular with many ovules
(e) Petals five, polypetalous and papilionaceous

31. Which of these plants has pinnately compound leaf at a node?
(a) Alstonia (b) Calotropis
(c) Guava (d) Mustard
(e) Neem

32. The mango fruit is a drupe type in which are mesocarp is
(a) Fibrous (b) Stony hard
(c) Thin and fleshy (d) Fleshy and edible
(e) Thin and dry

33. Which of the following meristems are lateral meristems?
(a) Apical meristem, interfascicular cambium and cork cambium
(b) Fascicular vascular cambium, interfascicular cambium and cork cambium
(c) Apical meristem, intercalary meristem and cork cambium
(d) Intercalary meristem, interfascicular cambium and cork cambium
(e) Fascicular cambium, apical meristem and cork cambium

34. Monocotyledonous seed consists of one large shield shaped cotyledon called
(a) Coleoptile (b) Testa
(c) Tegmen (d) Hilum
(e) Scutellum

35. Pick out the correct statement
(a) Spring wood is otherwise called late wood
(b) Autumn wood is otherwise called early wood
(c) In old trees, the heart wood is involved in the conduction of water
(d) In old trees, the sap wood does not conduct water
(e) The cambial cells present between primary xylem and primary phloem constitute the intrafascicular cambium
36. Which among these statements about collenchymas is true?
(a) Collenchyma cells are usually dead without protoplasts 
(b) The cells are long and narrow with thick lignified walls 
(c) Collenchyma occurs in layers below the epidermis in dicotyledonous plants 
(d) These cells are found in the pulp of fruits like guava, pear and sapota 
(e) Collenchyma may be either fibres or solereids

37. Slime layer and capsule in bacteria are modifications of the 
(a) Glycocalyx (b) Cell wall 
(c) Plasma membrane (d) Pellicle 
(e) Tonoplast

38. The smooth endoplasmic reticulum is the major site for synthesis of 
(a) Protein (b) Lipid 
(c) Glycoproteins (d) Carbohydrates 
(e) Hydrolytic enzymes

39. Which of these is wrongly matched?
(a) 70 S ribosomes — Prokaryotes 
(b) 80 S ribosomes — Eukaryotes 
(c) Axoneme — Cilia 
(d) Centromere — Centrosome 
(e) Thylakoids — Chloroplast

40. Pick out the alkaloid among the following 
(a) Morphine (b) Curcumin 
(c) Cellulose (d) Ricin 
(e) Am

41. In a polypeptide, amino acids are linked by 
(a) An ester bond (b) A hydrogen bond 
(c) A covalent bond (d) A glycosidic bond 
(e) A peptide bond

42. Which of the following is/are cellulosic? 
(i) Paper (ii) Cotton fibre 
(iii) Chitin (iv) Glycogen 
(a) (i) and (ii) only (b) (i) and (iii) only 
(c) (i), (iii) and (iv) only (d) (iii) and (iv) only 
(e) (iii) only

43. Which of the following statements about amino acids is false? 
(a) Based on the nature of the carboxyl group there are many amino acids 
(b) Amino acids are substituted methane 
(c) Amino acids have an amino group and acidic group as substituent on the α-carbon 
(d) There are four substituent groups occupying the four valency positions 
(e) Tryptophan is an aromatic amino acid

44. Which of the following phases correspond to the interval between mitosis and initiation of DNA replication? 
(a) S phase (b) G1 phase 
(c) G2 phase (d) M phase 
(e) Telophase

45. Which of these is not a key feature of meiosis? 
(a) Meiosis involves two sequential cycles of nuclear and cell division 
(b) Meiosis involves pairing of homologous chromosomes 
(c) Two cycles of DNA replication occur during meiosis 
(d) Three is recombination between the paired homologous chromosomes 
(e) Four haploid cells are formed at the end of meiosis II

46. When a molecule moves across a membrane independent of other molecules the process is called 
(i) Uniport (ii) Symport 
(iii) Antiport 
(a) (i) only (b) (i) and (ii) only 
(c) (i) and (iii) only (d) (ii) and (iii) only 
(e) (iii) only

47. Apoplastic movement of water occurs exclusively through the 
(i) Intercellular spaces 
(ii) Walls of the cells 
(iii) Plasmodesmata 
(iv) Cytoplasm 
(a) (i), (ii) and (iv) only (b) (iii) and (iv) only 
(c) (i) and (ii) only (d) (ii) and (iv) only 
(e) (iv) only

48. Which of the following is not a role played by potassium in plant growth? 
(a) Translocation of carbohydrates 
(b) Maintaining anion-cation balance 
(c) Opening and closing of stomata 
(d) Synthesis of protein 
(e) Maintaining turgidity of cells

49. Which of the following microbes produces nitrogen-fixing nodules in non-leguminous plants? 
(a) Rhizobium (b) Frankia 
(c) Azotobacter (d) Pseudomonas 
(e) Rhodospirillum

50. Splitting of water molecules during the light reaction of photosynthesis is associated with 
(a) PSI resulting in the release of O2, Protons and transfer of electrons of PS II 
(b) PSII resulting in the release of O2, Protons and transfer of electrons of PS I 
(c) PSII resulting in the release of O2, Protons and transfer of electrons of PS II 
(d) PSI resulting in the release of O2, Protons and transfer of electrons of PS I 
(e) PSI and PSII

51. \[ N_2 + 8e^- + 8H^+ + 16ATP \rightarrow 2NH_3 + H_2 + 16ADP + 16Pi \] The above equation refers to 
(a) Nitrification (b) Reductive amination 
(c) Denitrification (d) Transamination 
(e) Nitrogen fixation

52. Match Column I with Column II and choose the right option 
Column I 
(A) Acetyl CoA 
(B) Malic acid
Column II 
(1) 3-carbon compound 
(2) 6-carbon compound
34. Kranz anatomy is not seen in
(a) Maize (b) Sorghum
(c) Tomato
(d) (i) and (ii) only
(e) (i) only

54. In photorespiration, the number of ATP and NADPH synthesised are respectively
(a) 1 and 3
(b) 2 and 3
(c) 3 and 4
(d) 0 and 0
(e) 1 and 2

55. The respiratory quotient value of 0.7 is obtained for
(a) Anaerobic respiration
(b) Glucose
(c) Proteins
(d) Organic acids
(e) Tripalmitin

56. In which one of the following steps of citric and cycle FAD is reduced to FAD
2

(a) Pyruvate
(b) Succinic acid
(c) Malic acid
(d) Citric acid
(e) α – Ketoglutaric acid

57. Horizontal growth of seedlings, swelling of the axis and apical hook formation in dicot seedlings is brought about by
(a) Auxins
(b) Gibberellins
(c) Ethylene
(d) Kinetin
(e) Abscissic acid

58. The cell derived from meristems differentiate and regain the capacity to divide by a phenomenon called
(a) Differentiation
(b) Dedifferentiation
(c) Redifferentiation
(d) Totipotency
(e) Regeneration

59. Which of the these is not a part of the anther wall?
(a) Epidermis
(b) Middle layers
(c) Endothecium
(d) Nucellus
(e) Tapetum

60. Consider the following statements with respect to pollen grains
(a) The exine is a thin and continuous layer made up of cellulose and pectin
(b) The hard outer layer called the exine is made up of sporopollenin
(c) Sporopollenin is present in germ pores
(d) The exine exhibits a fascinating array of patterns and designs of the above statements
(e) (a) and (b) alone are correct
(f) (a) and (c) alone are correct
(g) (b) and (d) alone are correct
(h) (d) and (c) alone are correct
(i) (c) and (d) alone are correct

61. Lactational amenorrhea means
(a) Medical termination of pregnancy
(b) Oral administration of progestogen
(c) Coitus interrupts
(d) Intrauterine insemination
(e) Absence of menstruation during intense lactation

62. Foetal ejection reflex in human female induces
(a) The release of hormones from the placenta
(b) The growth and development of ovarian follicles
(c) The release of oxytocin from the maternal pituitary
(d) The release of gonadotropins
(e) The release of prolactin from pituitary

63. Identify the ecologist from the given hints
(i) Has carried out long-term ecosystem experiments using outdoor plots
(ii) In his experiments he showed that increased diversity contributed to higher productivity
(a) Ahmed Khan
(b) David Tilman
(c) Stanley Choien
(d) Ernest Chain
(e) Herbert Boyer

64. Which one of the following is not in situ conservation method?
(a) National parks
(b) Wild life sanctuary
(c) Biosphere reserves
(d) Scared groves
(e) Zoological parks

65. Which of the following microbes is used for the commercial production of ethanol?
(a) Clostridium butylicum
(b) Trichoderma polysporum
(c) Monascus purpureus
(d) Saccharomyces cerevisiae
(e) Aspergillus niger

66. Match the following
(i) Statins — (A) Propionibacterium shermanii
(ii) Swiss cheese — (B) Streptococcus
(iii) Cyclosporin A — (C) Aspergillus niger
(iv) Citric Acid — (D) Trichoderma polysporum
(v) Clot buster — (E) Monaseus purpureus

67. Which of the following statements is false?
(a) (i) (E) (ii) (A)
(b) (i) (B) (ii) (A)
(c) (i) (C) (ii) (A)
(d) (i) (C) (ii) (A)
(e) (i) (B) (iv) (C)
67. Short-lived immunity acquired from mother to foetus across the placenta or through mother's milk to the infant is categorized as
(a) Active immunity (b) Passive immunity (c) CMI (d) Autoimmunity (e) Innate immunity

68. Morphine, used as an analgesic is obtained from
(a) Erythoxylum coca (b) Atropa belladonna (c) Papaver somniferum (d) Cannabis sativa (e) Datura metal

69. Which of these are examples of evolution by anthropogenic action?
(i) Adaptive radiation of marsupials of Australia (ii) Appearance of antibiotic resistant microbes (iii) Evolution in finches Galapagos island (iv) Appearance of dark winged moth in England during post industrialization period (v) Convergent evolution of placental mammals in Australia
(a) (i) and (iii) only (b) (v) only (c) (ii) only (d) (ii) and (iv) only (e) (iii) and (v)

70. In a population, a gene has two alleles 'A' and 'a'. The frequency of allele 'A' is 0.4. What will be the frequency of allele 'a'?
(a) 0.4 (b) 0.6 (c) 0.48 (d) 0.16 (e) 0.36

71. Evolution of different species in a given geographical area, starting from a point and spreading to other geographical areas is known as
(a) Geographic isolation (b) Migration (c) Parallel evolution (d) Natural selection (e) Adaptive radiation

72. One of these is not a feature of non-chordates
(a) Absence of post-anal tail (b) Ventrally located central nervous system (c) Absence of notochord (d) Ventrally located heart (e) Absence of gill slits

73. Identify the phylum from the statements given below
1. Their body is circular in cross section
2. They may be free living, aquatic and terrestrial or parasitic in plants and animals
3. They are bilaterally symmetrical, triploblastic and pseudoceolomates
(a) Cnidaria (b) Ashelminthes (c) Annelida (d) Arthropoda (e) Platyhelminthes

74. Match Column I with Column II and Column III. Choose the correct option

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
<th>Column III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cnidocytes</td>
<td>Ctenoplana</td>
<td>Balancing</td>
</tr>
<tr>
<td>2. Statocyst</td>
<td>Fasciola</td>
<td>Defense</td>
</tr>
<tr>
<td>3. Radula</td>
<td>Penatnula</td>
<td>Feeding</td>
</tr>
<tr>
<td>4. Flame cells</td>
<td>Locusta</td>
<td>Locomotion</td>
</tr>
<tr>
<td>5. Comb plates</td>
<td>Pila</td>
<td>Osmoregulation</td>
</tr>
<tr>
<td>(a) (1) (A) (ii)</td>
<td>(2) (A) (v)</td>
<td>(3) (E) (iii) (4) (C) (i) (5) (E) (iv)</td>
</tr>
<tr>
<td>(b) (1) (B) (iii)</td>
<td>(2) (A) (iv)</td>
<td>(3) (E) (v) (4) (C) (ii) (5) (D) (i)</td>
</tr>
<tr>
<td>(c) (1) (C) (ii)</td>
<td>(2) (D) (i)</td>
<td>(3) (E) (iii) (4) (B) (v)</td>
</tr>
<tr>
<td>(d) (1) (D) (i)</td>
<td>(2) (C) (ii)</td>
<td>(3) (A) (v) (4) (B) (iii) (5) (A) (v)</td>
</tr>
<tr>
<td>(e) (1) (C) (ii)</td>
<td>(2) (A) (v)</td>
<td>(3) (D) (iv) (4) (B) (i) (5) (E) (iii)</td>
</tr>
</tbody>
</table>

75. Read the following statements and choose the correct option
(i) Aves are homoiothermous (ii) Pinnae are present in mammals (iii) Operculum is present in Chondrichthyes (iv) Skin of amphibians are dry and horny (v) Open type of circulation is found in cyclostomes
(a) (i) and (ii) only are wrong (b) (ii), (iii) and (iv) only are wrong (c) (i), (ii) and (iv) only are wrong (d) (iii), (iv) and (v) only are wrong (e) (i), (iv) and (v) only are wrong

76. Role of calciferous glands in the stomach of earthworm is to
(a) Neutralize the humic acid in the humus (b) Produce HCl (c) Emulsify fats (d) Increase the absorptive area (e) Secrete slime

77. Through mosaic vision, a cockroach can receive
(a) Several images of an object with less sensitivity but less resolution (b) Only one image of an object with less sensitivity but less resolution (c) Several image of an object with less sensitivity but more resolution (d) Only one image of an object with less sensitivity but more resolution
78. Match the following regarding the morphology of cockroach and choose the correct option

(i) Tergites — (A) Forewings
(ii) Tegmina — (B) Upper lip
(iii) Hypopharynx — (C) Dorsal sclerite
(iv) Labium — (D) Tongue
(v) Labrum — (E) Lower lip

(a) (i) (D) (ii) (E) (iii) (C) (iv) (B) (v) (A)
(b) (i) (B) (ii) (C) (iii) (E) (iv) (D) (v) (A)
(c) (i) (E) (ii) (A) (iii) (C) (iv) (D) (v) (B)
(d) (i) (C) (ii) (A) (iii) (D) (iv) (E) (v) (B)
(e) (i) (C) (ii) (B) (iii) (E) (iv) (A) (v) (D)

79. Mesorchium in frog in a/an

(a) Opening of conus arteriosus
(b) Peritoneal fold which adheres the testis to the upper part of the kidneys
(c) Part of the hind brain
(d) Tissue by which ovaries are attached to the peritoneal cavity
(e) Opening of the bidder’s canal

80. Choose the wrong statement

(a) Tight junctions helps to stop substances from leaking across a tissue
(b) Adhering junctions perform cementing to keep neighbouring cells together
(c) Gap junctions facilitate the cells to communicate with each other by connecting the nuclei of adjoining cells
(d) The main functions of Cuboidal epithelium are secretion and absorption
(e) Compound epithelium has a limited role in secretion and absorption

81. Match the following

(i) Squamous epithelium — (A) Bone
(ii) Dense regular connective tissue — (B) Skin
(iii) Glandular epithelium — (C) Air sacs of lungs
(iv) Specialized connective tissue — (D) Tendon
(v) Dense irregular connective tissue — (E) Goblet cells

(a) (i) (B) (ii) (E) (iii) (C) (iv) (D) (v) (A)

82. Two pink flowered snapdragon plants (Rr) are self-pollinated. The probability of the off springs to have white flowers are

(a) 25% (b) 50% (c) 75% (d) 2.5% (e) 7.5%

83. In a polynucleotide chain of a DNA molecule, the two nucleotides are linked through

(a) hydrogen bonds (b) 5' – 3' phosphoester linkage (c) 3' – 5' phosphodiester linkage (d) N-glycosidic linkage (e) Peptide bonds

84. Find the correctly matched enzyme with the rRNAs they transcribe

I. RNA polymerase — I. 28 S, 18 S and 5.8 S rRNAs
II. RNA polymerase — III. 28 S, 18 S and 5.8 S rRNAs
III. RNA polymerase — II. tRNA, 5SrRNA and Sn(lc)RNAs
IV. RNA polymerase — II. hnRNA

(a) I and II only (b) III and III only (c) II only (d) III and IV only (e) I and IV only

85. If the total amount of adenine and thymine in a double stranded DNA is 55%, the amount of guanine in this DNA will be

(a) 45% (b) 27.5% (c) 25% (d) 22.5% (e) 40%

86. When Mendel self-hybridised the F1 plants of genotype RrYy, in the F2 generation they yellow and green colour segregated in the ratio

(a) 1:2:1 (b) 3:1 (c) 9:3:3:1 (d) 1:1 (e) 9:7

87. Structure of a polynucleotide chain of DNA is given below. Identify the locations (numbered 1 to 5) that show errors in the structure
88. Which of the following disorder is caused by autosomal aneuploidy?
(a) Down's syndrome (b) Haemophilia (c) Sickle cell anemia (d) Phenylketonuria

89. Identify the scientists from the hints given below
1. They used chromosome movement to explain Mendel's law
2. They noted that the behaviour of chromosome was parallel to the behaviour of genes
(a) Morgan and Correns (b) De Vries and Boveri (c) Brides and Correns (d) Bridges and Sutton (e) Sutton and Boveri

90. The 'terminator/stop codons UGA, UAG and UAA (a) Initiate translation (b) Do not code for any; amino acids (c) Code for only one amino acid (d) Code for more than one amino acid (e) Initiate transcription

91. The variable number of tandem repeats used as a probe in DNA fingerprinting is (a) Expressed sequence tag (b) Satellite DNA (c) Bacterial artificial chromosome (d) Restriction enzyme (e) Yeast artificial chromosome

92. Assertion (a) In Eukaryotes, replication and transcription occur in the nucleus but translation occurs in the cytoplasm. Reasoning (R): mRNA is transferred from the nucleus to the cytoplasm where ribosomes and amino acids are available for protein synthesis
(a) A is true but R is false (b) A is false but R is true (c) Both A and R are false (d) Both A and R are true but R is not the correct explanation for A (e) Both A and R are true and R is the correct explanation for A

93. Consider the statements regarding lac operon and choose the correct option
(i) lactose is the substrate for the enzyme beta-galactosidase and regulates switching on and off of the operon
(ii) lac operon consists of three regulatory genes
(iii) lac operon consists of one structural gene
(iv) regulation of lac operon by repressor is referred to as positive regulation
(a) (i) and (ii) only are correct (b) (iii) and (iv) only are correct (c) (i) only is correct (d) (iv) only is correct (e) (ii) and (iii) only are correct

94. How many different types of gametes are produced, if the genotype of a plant is AABB?
(a) 8 (b) 6 (c) 4 (d) 2 (e) 1

95. If the four bases of DNA have to code for twenty amino acids, the code should constitute a combination of bases. This was proposed by
(a) Rosalind (b) Har Gobind Khorana (c) George Gamow (d) Marshall Nirenberg (e) Meisher

96. In Eukaryotes, the removal of RNA polymerase III from the nucleoplasm will affect the transcription of
(a) mRNA (b) hnRNA (c) tRNA (d) 5.8S rRNA (e) 18S rRNA

97. Which one of the following does not follow the central dogma in molecular biology?
(a) HIV (b) E.coli (c) Mucor (d) Chlamydomonas (e) Yeast

98. Which among these are correctly matched
(i) Down's syndrome (ii) Klinefelter's syndrome (iii) Turner's syndrome (a) 1 and (ii) only (b) (i) only (c) (i) and (ii) only (d) (iii) only (e) (i), (ii) and (iii)
99. The scientists(s) who performed experiments with heavy isotopes of nitrogen to prove that DNA replicates semi-conservatively is/are
(a) Fredrick Griffith  (b) Watson and Crick
(c) Taylor          (d) Meselson and Stahl
(e) Jacob and Monday

100. X and y are diseases in infants. X is produced by deficiency of proteins and calories. Y is produced by protein deficiency unaccompanied by calories deficiency. X and Y are respectively
(a) Kwashiokar; Marasmus  (b) Diabetes; Goitre
(c) Goitre; Diabetes       (d) Marasmus; Kwashiokar
(e) Kwashiokar; Goitre

101. Read the following reactions and choose the correct option
(1) Pepsinogen $\xrightarrow{\text{HCl}}$ Pepsin
(2) Proteins $\xrightarrow{\text{Pepsinogen}}$ Proteases + peptones
(3) Trypsinogen $\xrightarrow{\text{HCl}}$ Trypsin
(4) Chymotrypsinogen $\xrightarrow{\text{Enterokinase}}$ Chymotrypsin
(5) Peptones $\xrightarrow{\text{Trypsin}}$ Dipeptides
(a) (1) and (5) alone are correct
(b) (3) and (5) alone are correct
(c) (3) and (5) alone are correct
(d) (2), (4) and (5) alone are correct
(e) (2) alone is correct

102. The natural antibodies in the plasma of a person with blood group 'O' is
(a) Anti- A only
(b) anti - B only
(c) Anti-A and Anti-B only
(d) Anti-B and Anti-D only
(e) Anti-D only

103. Choose the wrong statement regarding human ear
(a) The stapes is attached to the tympanic membrane
(b) The Eustachian tube connects the middle ear cavity with the pharynx
(c) The middle ear contains three ossicles
(d) The space within the cochlea called scala media is filled with Endolymph
(e) Membranous labyrinth is filled with a fluid called Endolymph

104. In mammals, ammonia produced by metabolism is converted into urea in the
(a) Kidney   (b) Liver
(c) Spleen   (d) Blood
(e) Lymph

105. Anaerobic breakdown of glycogen due to repeated activation of muscles leads to the accumulation of
(a) uric acid  (b) phenylalanine
(c) lactic acid  (d) glutamic acid
(e) tyrosine

106. Read the following statements and choose the correct option
(i) The glomerular filtration rate in a healthy individual is about 180 ml per day
(ii) All the constituents of the plasma pass into the lumen of Bowman’s capsule.
(iii) 70/80% of electrolytes and water are reabsorbed in the PCT
(iv) Angiotensin II increases the glomerular blood pressure and GFR
(v) The counter current systems contribute in concentrating the filtrate
(a) (i) and (ii) only are correct
(b) (v) alone is correct
(c) (ii), (iii) and (iv) only are correct
(d) (iii), (iv) and (v) only are correct
(e) (i), (iv) and (v) only are correct

107. Large number of processes that project from the apical part of each hair cell of the organ of Corti is called
(a) Otolith organ  (b) Stereocilia
(c) Crista ampullaris  (d) Utricle
(e) Saccule

108. The visible coloured portion of the eye is
(a) Retina  (b) Iris
(c) Pupil  (d) Choroid
(e) Cornea

109. The parts labeled as (A), (B), (C), (D) and (E) of renal corpuscle represents
(a) (A) Afferent arteriole (B) Efferent arteriole
(C) Glomerulus (D) Bowman’s capsule
(E) Proximal convoluted tubule
(b) (A) Efferent arteriole (B) Afferent arteriole
(C) Glomerulus (D) Bowman’s capsule
(E) Proximal convoluted tubule
(c) (A) Afferent arteriole (B) Efferent arteriole
(C) Glomerulus (D) Bowman’s capsule
(E) Distal convoluted tubule
(d) (A) Afferent arteriole (B) Efferent arteriole
(C) Bowman’s capsule (D) Glomerulus
(E) Proximal convoluted tubule
(e) (A) Afferent arteriole (B) Efferent arteriole
(C) Bowman’s capsule (D) Glomerulus
(E) Collecting tubule

110. Read the statements about human neural system and find the wrong one
(a) The CNS includes the brain and the spinal cord
(b) The PNS is divided into somatic and autonomic neural system
(c) The somatic neural system is classified into sympathetic and parasympathetic neural system
(d) The autonomic neural system transmits impulses from the CNS to the involuntary organs and smooth muscles
(e) The somatic neural system relays impulses from the CNS to the skeletal muscles

111. Choose the wrong statement regarding human blood and circulatory system
(a) Persons with blood group AB can receive blood from any person with any blood group
(b) Calcium ions play an important role in blood clotting
(c) Angina is acute chest pain when enough oxygen does not reach the brain
(d) In a myogenic heart the normal activities are regulated intrinsically
(e) Thrombocytes are produced from megakaryocytes

112. The central hollow portion of the human vertebra is called
(a) Acromion (b) Centrum (c) Neural canal (d) Sternum (e) Glenoid cavity

113. In a cardiac cycle, if the stroke volume is 70 ml and heart rate is 72 beats/minute, then cardiac output is
(a) 142 ml/minute (b) 72 ml/minute (c) 1070 ml/minute (d) 70 ml/minute (e) 5040 ml/minute

114. This hormone reduces cellular glucose uptake and utilization
(a) Glucagon (b) Insulin (c) Aldosterone (d) Thymosin (e) Melatonin

115. The collagenous connective tissue layer holding the muscle bundles together is
(a) Pleura (b) Pericardium (c) Sarcolemma (d) Fascia (e) Sarcoplasma

116. The granulocytes which secrete histamine, serotonin and heparin are
(a) Neutrophils (b) Basophils (c) Eosinophils (d) Lymphocytes (e) Monocytes

117. Choose the correct correctly matched pair
(a) CAD - Atherosclerosis (b) Tetany - Disorder of the neuromuscular junction
(c) Gout - Rapid spasms in muscles (d) Goitre - Hyperthyroidism (e) Asthma - Alveolar walls are damaged

118. Excretory structures in Rotifers are
(a) Green glands (b) Malpighian tubules (c) Flame cells (d) Gill (e) Kidney's

119. The main function of the lacteals in the villi of human small intestine is to absorb
(a) Fat globules (b) Water and mineral salts (c) Amino acids (d) Glucose and amino acids (e) Glucose and water

120. Match the following

<table>
<thead>
<tr>
<th>List I</th>
<th>List II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Contraceptive pill</td>
<td>(1) Prevents sperms reaching the female reproductive tract</td>
</tr>
<tr>
<td>B) Condom</td>
<td>(2) Inhibits ovulation and implantation</td>
</tr>
<tr>
<td>C) Vasectomy</td>
<td>(3) Increases phagocytosis of sperms</td>
</tr>
<tr>
<td>D) Copper I</td>
<td>(4) Blocks gamete transport</td>
</tr>
<tr>
<td>E) A</td>
<td>(A) (4)</td>
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<tr>
<td>F</td>
<td>(B) (1)</td>
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<td>G</td>
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<td>(C) (4)</td>
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<tr>
<td>P</td>
<td>(D) (3)</td>
</tr>
</tbody>
</table>
1. (e) Maximum torque on dipole of moment $P$ in an external field
\[ \tau_{\text{max}} = PE = (q \times 2a) \times E = 0.2 \times 10^{-6} \times 2 \times 10^{-2} \times 10^5 \]
\[ = 4 \times 10^{-4} \text{Nm} \]
2. (a) Atoms are electrically neutral so atoms lost electrons and become positively charged and after gain of electrons it becomes negatively charged.
3. (c) Reciprocal of resistivity ($\rho$) is called conductivity ($\sigma$), i.e, $\sigma = \frac{1}{\rho}$ with units mho/m.
4. (d) Nichrome has high resistivity and high melting point. Nichrome is an alloy of nickel and chromium and low value for $\alpha$ (temperature coefficient of resistance).
5. (c) Non-ohmic conductors such as gases, crystal, rectifiers, thermionic valves, transistor, diodes, etc., for these V-I characteristics curve is non-linear but for ohmic circuit elements $V \propto I$, i.e, linear obeying ohm’s law.
6. (e) Magnetic field due to a bar magnet on the axial line is given by
\[ B_{\text{axial}} = \frac{\mu_0 2M}{4\pi r^3} \]
Hence, $B \propto \frac{1}{r^3}$
7. (b) Magnetic induction at the centre of the circle is given by
\[ B = \frac{\mu_0 I}{2\pi r} = \frac{\mu_0 2e}{2rt} = \frac{4\pi \times 10^{-7} \times 2 \times 1.6 \times 10^{-19}}{2 \times 0.8 \times 2 \times 10^{-9}} \text{T} \]
\[ = 4\pi \times 10^{-17} \text{T} \]
8. (e) \[ \tan \theta = \frac{B_v}{B_H} \Rightarrow B_v = \frac{1}{\sqrt{3}} B_H \]
\[ \tan \theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30^\circ \]
Thus, Angle of dip $\theta = 30^\circ$
9. (b) Magnetic flux is a scalar quantity, hence coefficient of inductance $L$ is a scalar quantity.
10. (d) By Faraday’s second Law,
\[ \text{induced emf} = -L \frac{\text{di}}{\text{dt}} \]
\[ \frac{E_1}{E_2} = \left( \frac{L_1}{L_2} \right) \times \frac{\text{di}_1 / \text{dt}}{\text{di}_2 / \text{dt}} = \frac{8 \times 1}{2 \times 2} = 2 : 1 \]
11. (d) AC generator works on the principle of electromagnetic induction, i.e., when a coil is rotated in uniform magnetic field, an induced emf is produced in it.
12. (e) Electromagnetic waves have no charge.
13. (b) When two lens are in contact, $P = P_1 + P_2$
as $P_1 = \frac{100}{10} = 10 \text{D}$ and $P_2 = \frac{100}{20} = 5 \text{D}$
Hence, effective power of lens $(10 + 5) = 15 \text{D}$
14. (d) When a light ray passes through a glass slab it is reflected twice at the two parallel faces and finally emerges out parallel to its incident direction i.e, the ray undergoes no deviation $\delta = 0$.
15. (c) Vibration are perpendicular to the plane of incidence.

16. (a) In photoelectric effect, the saturation photoelectric current is directly proportional to the intensity of incident radiation but it is independent of its frequency.

<table>
<thead>
<tr>
<th>Photocurrent (i)</th>
<th>Intensity (I)</th>
</tr>
</thead>
</table>

17. (d) \[ \frac{N}{N_0} = \frac{9}{10} \Rightarrow \frac{N}{N_0} = \left( \frac{1}{2} \right)^{10} \text{T} \ldots (i) \]
\[ \frac{N'}{N_0} = \left( \frac{1}{2} \right)^{10} \times 2 \] \ldots (ii)
\[ \left( \frac{N_0 - N'}{N_0} \right) \times 100 = \left( \frac{100 - 81}{100} \right) \times 100 = 19\% \]
18. (b) $^{10}\text{Ne}^{22} \rightarrow ^{2}\text{He}^{4} + ^{2}\text{He}^{4} + ^{4}\text{C}^{14}$
Atomic mass of 2 alpha particles = 8
Mass of unknown nucleus = $(22 - 8) = 14$ (Carbon)
19. (e) Photodiode is a special type of photodector in which by measuring the change in the conductance (or resistance) of the semiconductor, one can measure the intensity of optical signal.
20. (b) Photodiode $\rightarrow$ Forward biased p-n junction diode
21. (c) Frequency of a tuned collector oscillator
\[ f = \frac{1}{2\pi \sqrt{LC}} \Rightarrow \omega = \frac{1}{\sqrt{LC}} \]
22. (b) Thermosphere
23. (a) I.F stage amplifier are used in superheterodyne radio receivers, in which an incoming signal is shifted to an IF for amplification before final detection is done.

24. (d) Digital signal represents a sequence of discrete values that alternates between a discrete set of wave forms of variable electric current, voltage, intensity and phase, etc.

25. (c) \[ P \quad Q \]

26. (a) either 0° or 180°

27. (b) Total distance = length of train + length of bridge
Distance = speed \times time
\[ x = 600 \text{ m} \]

28. (e) x-component of velocity \( u_x = 4 \text{ m/s} \)
y-component of velocity \( u_y = 3 \text{ m/s} \)

29. (a) Centripetal acceleration \[ a_c = \frac{u^2}{r} \]

30. (c) Conservation of linear momentum is equivalent to Newton’s third law of motion in which total momentum is conserved, e.g, recoiling of a gun, rocket propulsion, etc.

31. (e) Newton’s I and II law hold good in inertial frame of reference.

32. (b) Newton’s second law of motion, \[ F = ma \]
\[ a = \frac{F}{m} = \frac{1}{2} = 0.5 \text{ ms}^{-2} \]

33. (b) As we know, Rate of work = Power = Fv
\[ \frac{P_A}{P_B} = \frac{FV_A}{FV_B} = \frac{5}{10} = \frac{1}{2} \]

34. (c) No linear acceleration \( F \times t = \text{zero} \)
No angular acceleration text = zero

35. (a) As we know, Ring about diameter \( I = \frac{MR^2}{2} \)
Solid cylinder about its own axis \( I = \frac{MR^2}{2} \)

36. (e) The line joining the sun to the planet sweeps out equal areas in equal interval of time, i.e, aerial velocity is constant.
a regular interval of time is called **periodic motion**. S.H.M is a special type of periodic motion in which a particle moves to and fro repeatedly about a mean position. Since motion of planet is not and fro hence it is periodic not S.H.M.

46. (b) Speed of wave, \( v = \sqrt{\frac{\nu RT}{M}} \)

so \( v \propto \sqrt{T} \)

As temperature increases, velocity increases, frequency constant , wavelength increases.

47. (a) In closed organ pipe only odd harmonics are present.

As \( n = \frac{(2n-1)v}{4l} \)

\( n_1 : n_2 : n_3 ... = \frac{v}{4l} : \frac{3v}{4l} : \frac{5v}{4l} \) ....

\( \left( \frac{v}{4l} \right. \text{ fundamental node frequency} \)

= 256,3 x 256,5 x 256,....

48. (d) The surface integral of electric field,

\[ \int_{S} E \cdot \text{ds} = \text{field} \times \text{area} = \frac{\text{volt}}{\text{m}} \times \text{m}^2 = \text{volt m (Vm)} \]

**CHEMISTRY SOLUTION**

49. (c) In **hydroboration-oxidation** reaction three moles of alkene react with one mole of BH\(_3\) to form three moles of alcohol.

\[ \text{CH}_3\text{CH} = \text{CH}_2 \overset{(i) \text{(BH}_3)_2}{\longrightarrow} \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \]

50. (d) –CHO, –CN, –COOH and –NO\(_2\) are electron withdrawing group but –OCOR is electron donating group.

51. (a) Finkelstein reaction is a halogen exchange reaction between haloalkane and a salt of a different halogenide.

\[ \text{R} - \text{CH}_2 - \text{Cl} + \text{KI} \longrightarrow \text{R} - \text{CH}_2 - \text{I} + \text{KCl} \]

This is an equilibrium process and it is driven forward by taking advantage of the poor solubility in acetone of the newly formed metal halide salt (Le Chatelier’s principle). The mechanism for this reaction is a simple, single-step bimolecular nucleophilic substitution reaction (S\(_{N2}\)) which like all S\(_{N2}\) reactions occur with inversion of stereochemistry.

\[ \text{R} \text{Cl} \overset{\text{KI}}{\longrightarrow} \text{Acetone} \rightarrow \text{R} \text{I} + \text{KCl} \]

52. (e) Among isomeric alkanes, the boiling point decreases as \( 1^\circ > 2^\circ > 3^\circ \).

53. (a) Only compound A will show geometrical isomerism as both the atoms attached to – C = C – are different

54. (c) 3\(^\circ\) alcohols are highly reactive towards lucas reagent whereas 1\(^\circ\) and 2\(^\circ\) alcohols are poorly reactive.

55. (d) A chiral carbon atom is a carbon which is attached with four different atoms or groups.

56. (d)
57. (d) $\text{CH}_3\text{C} = \text{O} + \text{CH}_3\text{CO.CH}_3 \xrightleftharpoons{\text{OH}^-} \text{CH}_3\text{C} = \text{O} + \text{CH}_3\text{CH}_2\text{C} = \text{CH}_3$

4-Hydroxy-4-methyl-2-pentanone

58. (c) $\text{CH}_3\text{(CH}_2\text{)}_{10}\text{C} \xrightarrow{(\text{iso-Bu})_2\text{AlH}} \text{OC}_2\text{H}_5$

$\text{CH}_3\text{(CH}_2\text{)}_{10}\text{CH} \xrightarrow{\text{H}_2\text{O}} \text{CH}_3\text{(CH}_2\text{)}_{10}\text{CHO}$

59. (b) Both aldehydes and ketones give positive test with 2,4 dinitrophenyl hydrazones. Hence both aldehydic and ketonic group.

Further Aldehydes give a positive test with Tollens reagent while ketones do not - hence a ketonic group is present.

With hypohalite it gives CHCl₃ and sod. salt of acid with one carbon atom less. Hence compound must have

$\text{O}$

$\text{CH}_3\text{C} = \text{C}^-$ group. Therefore, the compound 'B' would be CH₃CH₂CH₂COONa.

60. (d) Aldehydes and ketones can be reduced to hydrocarbons by the action (i) of amalgamated zinc and concentrated hydrochloric acid (Clemmensen reduction), or (b) of hydrazine (NH₂NH₂) and a strong base like NaOH, KOH or potassium tert-butoxide in a high-boiling alcohol like ethylene glycol or triethylene glycol (Wolf-Kishner reduction).

$\text{C} = \text{O} \xrightarrow{\text{Zn(Hg), HCl or NH}_2\text{NH}_2, \text{KOH, glycol}} \text{CH}_2$

61. (c) In Hofmann bromamide reaction, unsubstituted amides are degraded to amines with one carbon atom less.

62. (e) $\text{C}_6\text{H}_5\text{NO}_2 \xrightarrow{\text{H}_2, \text{Catalyst}} \text{C}_6\text{H}_5\text{NH}_2$

Nitrobenzene

Aniline

63. (e)

$\text{NH}_2 \xrightarrow{\text{CH}_3\text{J}} \text{HN} \xrightarrow{\text{CH}_3\text{J}} \text{HN} \xrightarrow{\text{CH}_3\text{J}} \text{HN}$

Trimethylphenyl ammonium iodide

64. (d)

65. (d) The galactose and glucose units are joined by an acetal oxygen bridge between C₁ of galactose and C₄ of glucose.
66. (b) Deficiency of vitamin E leads to weakness in muscles and increases the fragility of red blood cells.
67. (e) Myosin is a fibrous protein.
68. (d) 
69. (a) Scouring soaps contain a scouring agent (abrasive) such as powdered pumice or finely divided sand and builders like sodium carbonate and trisodium phosphate. Builders make the soaps act more quickly.
70. (b) CO\(_2\) contributes about 50% of global warming.
71. (a) No. of moles of 100 mg of heptane (\(n_1\))
\[
\frac{100 \times 10^{-3}}{100} = 10^{-3}
\]
\[
= 10^{-3} \times N_A \text{molecules}
\]
No. of moles of 10 mg of propyne (\(n_2\))
\[
\frac{10 \times 10^{-3}}{40} = 0.25 \times 10^{-3}
\]
\[
= 0.25 \times 10^{-3} \times N_A \text{molecules}
\]
\[
\therefore \frac{n_1}{n_2} = 0.25 \times 10^{-3} \times N_A
\]
\[
\therefore n_1 = 0.25 \times 10^{-3} \times N_A
\]
\[
\therefore n_2 = 4 \times n_2
\]
72. (b) de-Broglie wavelength \(\lambda = \frac{h}{mv}\)
\[
\therefore \lambda_1 = \frac{v_2}{v_1} \sqrt{\frac{T_2}{T_1}}
\]
\[
\lambda_2 = \sqrt{\frac{600}{100}} = \sqrt{6}
\]
73. (d) I is 3d and II is 4s and the energy of 3d > 4s.
74. (d) Na\(^{+}\) = 10e\(^{-}\)
Li\(^{+}\) = 2e\(^{-}\)
Mg\(^{2+}\) = 10e\(^{-}\)
K\(^{+}\) = 20e\(^{-}\)
Ne = 10e\(^{-}\)
Cl\(^{-}\) = 18e\(^{-}\)
\(\therefore\) Na\(^{+}\), Ne and Mg\(^{2+}\) are isoelectronic.
75. (c) Atomic radius generally decreases across period from left to right as the nuclear charge increases. Further on moving down in a group atomic radius increases, hence the correct order is B < Be < Al < Li
76. (b) Fluorine is most electronegative hence the difference in the electronegativities between H and F will be highest.
77. (a) **Species**

<table>
<thead>
<tr>
<th>Bond order</th>
</tr>
</thead>
</table>

78. (c) 
\[
\frac{P_{O_2}}{P_x} = \frac{P_{O_2}}{n_x} = \frac{M_x}{32}; \quad \frac{5}{6} = \frac{5}{32};
\]
\[
M_x = 5 \times 32 = 160
\]
79. (b) 
\[
P_1V_1 = P_2V_2
\]
\[
100 \times 100 = 40 \times V_2
\]
\[
V_2 = 250
\]
\(\therefore\) Vol. of second bulb = (250 – 100) = 150 mL
80. (c) At high pressure, volume V will be quite small. The quantity \(\frac{n}{V^2}\) become negligible but ‘b’ cannot be ignored.
\[
P(V - b) = RT
\]
or \[
\frac{PV}{RT} = 1 + \frac{Pb}{RT}; \quad \therefore Z > 1
\]
At high pressure the gases show positive deviation
81. (d) 
82. (a) In a period, EN increases from left to right due to decrease in size and increase in nuclear charge.
83. (a)
84. (c) German silver is an alloy of Cu, Zn and Ni.
85. (a) Froth floatation technique is used for sulphide ore. Magnetite - Fe\(_3\)O\(_4\)
Iron Pyrites - FeS\(_2\)
Copper Pyrites - CuFeS\(_2\)
Zinc blende - ZnS
Copper glance - Cu\(_2\)S
Hence Magnetite cannot be concentrated by this method.
86. (b) The alkali metal sodium is used as a coolant in fast breeder nuclear reactors.
87. (e) **Name**

<table>
<thead>
<tr>
<th>Formula</th>
<th>Oxidation State of P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypophosphorus acid</td>
<td>H(_3)PO(_2)</td>
</tr>
<tr>
<td>Hypophosphoric acid</td>
<td>H(_4)P(_2)O(_6)</td>
</tr>
<tr>
<td>Metaphosphoric acid</td>
<td>HPO(_3)</td>
</tr>
<tr>
<td>Pyrophosphorous acid</td>
<td>H(_4)P(_2)O(_5)</td>
</tr>
<tr>
<td>Phosphorus acid</td>
<td>H(_3)PO(_3)</td>
</tr>
</tbody>
</table>
88. (a) 
\[
B_2H_6 + 2NH_3 \xrightarrow{\text{high temperature}} B_2H_6 \cdot 2NH_3
\]
\(\text{Addition Compound}\)
\[
\xrightarrow{\text{2}} \frac{2}{3} \text{B}_3\text{N}_3\text{H}_6 + 4\text{H}_2
\]
\(\text{Borazine}\)
89. (e) 
\[
N = N - \tilde{\text{O}}
\]
There is no lone-pair attached to the central nitrogen (N) atom. Based on VSEPR theory, the electron clouds around the atoms will repel each other and move as far away from each other while remaining bonded to the
central N-atom. As a result they will be on opposite sides of the central N-atom giving N₂O linear shape.

90. (d) All interhalogen compounds of the type XX⁻ involve sp²d² hybridisation of the central atom X and hence have octahedral (or square pyramidal) geometry with one position occupied by a lone pair.

91. (c) Pd – [Kr] 4d¹⁰ 5s⁰
Ag – [Kr] 4d¹⁰ 5s¹

92. (b) Ti³⁺ and Ni²⁺ ions are coloured because both have incomplete d-subshells.
Ti³⁺ – [Ar] 3d¹ 4s⁰ and Ni²⁺ – [Ar] 3d⁸

93. (e) Pu – [Rn] 5f⁶ 6d⁰ 7s²

94. (c) In diamagnetic species all electrons are spin-paired.
Here, only Ce⁴⁺ all electrons are spin-paired.
Ce⁴⁺ – [Xe] 4f⁰ 5d⁰ 6s⁰

95. (d) \[ W_{\text{exp}} = -PAV = -P(V_2 - V_1) \]
Given, \( P = 5 \text{ bar} = 5 \times 10^5 \text{ Nm}^{-2} \); \( V_2 = 0.01 \text{ m}^3 \)
\[ \therefore W_{\text{exp}} = 20 \text{ kJ} = 20 \times 10^3 \text{ J} \]
Hence, \( 20 \times 10^3 = -5 \times 10^5 \times (0.01 - V_1) \)
\[ \Rightarrow -4 \times 10^{-2} = 0.01 - V_1 \]
\[ \Rightarrow V_1 = 0.01 + 0.04 = 0.05 \text{ m}^3 \]

96. (d) For a reaction to be spontaneous, \( \Delta G = -\text{ve} \)
\[ \Delta G = \Delta H - T \Delta S \]
Here, \( \Delta H = 170 \text{ kJ} = 170 \times 10^3 \text{ J} \)
and \( \Delta S = 170 \text{ JK}^{-1} \)
Now, \( \Delta G = 170 \times 10^3 - T \times 170 \)
\[ \Rightarrow \Delta G = -\text{ve} \text{ only if } T > 10^3 \text{ K i.e. 1000 K.} \]

97. (c) \[ \Delta H = \Delta E + \Delta E_{\text{rot}} \]
\[ \Delta E_g = n_p - n_s = 6 - \frac{7}{2} = -\frac{3}{2} \]
\[ T = 27°C = (27 + 273) \text{K} = 300 \text{K} \]
Now, \( \Delta H = -\Delta E_g \text{RT} \)
\[ = -\left( \frac{3}{2} \text{ mol} \right) \times 2 \text{ cal K}^{-1} \text{mol}^{-1}(300 \text{ K}) \]
\[ = -900 \text{ cal} = -0.9 \text{ Kcal} \]

98. (e) After mixing, total volume = \((60 + 40) \text{ ml} = 100 \text{ ml} \)
Since \( M_1 \times V_1 = M_2 \times V_2 \)
Molarity of NaOH solution in the final solution \( \frac{60 \times 0.1}{100} = 0.06 \text{ M} \)
Molarity of HCl solution in the final mixture \( \frac{40 \times 0.15}{100} = 0.06 \text{ M} \)
In the final solution, molarities of NaOH and HCl are equal and hence they will neutralise each other.
So, the pH of the final solution = 7.

99. (c) **Compound** | **Solubility (g mol⁻¹ L⁻¹)**
--- | ---
BaSO₄ | \( s = \sqrt{K_{sp}} = \sqrt{1.0 \times 10^{-10}} = 10^{-5} \)
CaSO₄ | \( s = \sqrt{K_{sp}} = 3 \times 10^{-3} \)
MnS | \( s = \sqrt{K_{sp}} = 5 \times 10^{-7} \)

\[ \text{Ni(OH)₂} \quad s = \left( \frac{K_{sp}}{4} \right)^{1/3} = 5 \times 10^{-6} \]

From above, we can see that solubility of CaSO₄ is highest and MnS is lowest.

100. (a) Given,
\[ \text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3; \quad K_1 \quad \text{....(i)}\]
\[ \text{N}_2 + \text{O}_2 \longrightarrow 2\text{NO}; \quad K_2 \quad \text{....(ii)}\]
\[ \text{H}_2 + \frac{1}{2}\text{O}_2 \longrightarrow \text{H}_2\text{O}; \quad K_3 \quad \text{...(iii)}\]

We have to calculate
\[ 4\text{NH}_3 + 3\text{O}_2 \longrightarrow 4\text{NO} + 6\text{H}_2\text{O}; \text{ K = ?} \]
or \[ 2\text{NH}_3 + \frac{5}{2}\text{O}_2 \longrightarrow 2\text{NO} + 3\text{H}_2\text{O} \]

For this equation, \[ K = \frac{[\text{NO}]^2 [\text{H}_2\text{O}]^3}{[\text{NH}_3]^2 [\text{O}_2]^{5/2}} \]
but \[ K_1 = \frac{[\text{NH}_3]^2 [\text{H}_2\text{O}]^3}{[\text{H}_2][\text{O}_2]^3} \]
\[ \& K_3 = \frac{[\text{H}_2\text{O}]^3}{[\text{H}_2]^3 [\text{O}_2]^{3/2}} \]
Now operate,
\[ \frac{K_2 \cdot K_3^3}{K_1} \]
\[ = \frac{[\text{NO}]^2 [\text{H}_2\text{O}]^3}{[\text{NH}_3]^2 [\text{H}_2][\text{O}_2]^{5/2}} \]
\[ \frac{[\text{NH}_3]^2 [\text{H}_2\text{O}]^3}{[\text{H}_2][\text{O}_2]^{3/2}} \]
\[ \therefore K = \frac{K_2 \cdot K_3^3}{K_1} \]

101. (c) According to Le-Chatlier’s principle, on adding O₂ (g) to the reaction container at constant temperature will increase the partial pressure of CO₂ (g) because equilibrium will shift to the left.

102. (e) We have \[ \pi_1 = n_1RT \text{ and } \pi_2 = n_2RT \]
Hence, \[ \frac{\pi_1}{\pi_2} = \frac{n_1}{n_2} \]
\[ n_1 = \frac{60}{180} = \frac{1}{3} \] (Molar mass of glucose = 180)
\[ \pi_1 = 5.2 \text{ bar and } \pi_2 = 1.3 \text{ bar} \]
\[ \frac{5.2}{1.3} = \frac{1}{3} = \frac{n_1}{n_2} \]
\[ \Rightarrow 4 = \frac{1}{3} \cdot n_2 \Rightarrow n_2 = \frac{1}{12} \]
104. (a) \[ n_{\text{NaOH}} = \frac{4}{40} = 0.1 \]

\[ n_{\text{H}_2\text{O}} = \frac{16.2}{18} = 0.9 \]

\[ x_{\text{NaOH}} = \frac{n_{\text{NaOH}}}{n_{\text{NaOH}} + n_{\text{H}_2\text{O}}} = \frac{0.1}{0.1 + 0.9} = 0.1 \]

\[ \therefore x_{\text{H}_2\text{O}} = 0.9 \]

105. (d) Sum of the oxidation states of the elements must be equal to zero.

For: \[ y_2(zx_4)_3 \Rightarrow 2 \times 3 + 18 - 24 = 0 \]

106. (a) Higher the reduction potential, stronger the oxidising agent and vice versa.

107. (a) We know that

\[ \lambda_m = \frac{1000k}{C_m} \]

\[ \therefore \lambda_m = \frac{1000}{0.1} = 10^4 \text{ cm}^{-3} \]

108. (e) Reaction at the cathode-

\[ \text{H}_2\text{O}(l) + 2e^- \rightarrow \text{H}_2(g) + 2\text{OH}^- \]

Reaction at the anode-

\[ \text{Cl}^- \rightarrow \frac{1}{2}\text{Cl}_2(g) + 1e^- \]

Overall reaction is-

\[ \text{NaCl}(aq) + \text{H}_2\text{O}(l) \]

\[ \rightarrow \text{Na}^+(aq) + \text{OH}^-(aq) + \text{H}_2(g) + \frac{1}{2}\text{Cl}_2(g) \]

109. (e) The expression for first order reaction rate is

\[ t = \frac{2.303 \log [A]_0}{k} \cdot \frac{[A]_t}{[A]_0} \]

Here, \([A]_0 = 100\) and \([A]_t = 25\)

\[ t_{7.5} = \frac{2.303 \log 100}{25} = \frac{2.303 \log 4}{k} = \frac{1.3864}{k} \]

110. (a) The slope of Arrhenius plot of \( \ln k \) vs \( \frac{1}{T} \) is \( -\frac{E_a}{R} \)

Hence, \( -\frac{E_a}{R} = -5 \times 10^3 \)

\( \Rightarrow E_a = R \times 5 \times 10^3 = 8.3 \times 5 \times 10^3 = 41.5 \text{ kJ mol}^{-1} \)

111. (e) \( P \longrightarrow Q \)

For the above reaction-

\[ E_a^f - E_a^0 = \Delta H \]

\[ E_a^f = 25 \text{ kJ mol}^{-1}, \ E_a^0 = ? \]

\( \Delta H = -5 \text{ kJ mol}^{-1} \)

Hence, \( E_a^0 = E_a^f - \Delta H = 25 - (-5) = 30 \text{ kJ mol}^{-1} \)

112. (c) Sulphur solution is lyophobic.

113. (b) Freundlich’s adsorption isotherm is given by

\[ \frac{x}{m} = kp^{1/n} \text{ or } \log \frac{x}{m} = \log k + \frac{1}{n} \log P \]

Plot of \( \frac{x}{m} \) versus \( \log P \) is linear with slope \( \frac{1}{n} \) and intercept \( \log k \).

slope \( \frac{1}{n} = 1 \Rightarrow n = 1 \)

\( k = 0.1 \) and \( P = 2 \text{ atm.} \)

Hence, \( \frac{x}{m} = 0.1 \times 2 = 0.2 \)

114. (b) Complexes in which the metal atom or ion is linked to only one type of ligands are called homoleptic complexes. The complexes in which the metal atom or ion is linked to more than one kind of ligands are called heteroleptic complex.

116. (a) We know \( \text{Ni} - [\text{Ar}] 3d^84s^2 \)

\[ 3d \quad 4s \quad 4p \]

(i) \[ [\text{Ni(CO)}_4]^0 \]

\( \quad \text{sp}^3 \text{ hybridisation} \)

Four electron pairs donated by CO molecules

(Diamagnetic due to absence of unpaired electrons)

(ii) \[ [\text{Ni(CN)}_4]^2- \]

\( \quad \text{dsp}^2 \text{ hybridisation} \)

Four electron pairs donated by four CN ions

(Diamagnetic)

(iii) \[ [\text{Ni(CO)}_4]^0 \]

\( \quad \text{sp}^3 \text{ hybridisation} \)

Four electron pairs donated by four Cl molecules

(Paramagnetic because of unpaired electrons at d-orbitals).

**BIOLOGY SOLUTION**

1. (e) Water pollinated species have pollen grains are protected from wetting by mucilaginous covering.

2. (d) Fresh water animals cannot live for long in sea water it disturb the osmolarity. Fresh water fishes when enters the salt water, the water comes out of them and they
Archaebacteria and Eubacteria.

Living forms which is divided in two groups

Kingdom Monera is considered to be the most ancient

Photosynthesis.

They also contain

They also possess, long tail called flagella, which they

Fresh water. They have outer covering called pellicle,

Trichoderma and Saccharomyces as both belong to

Class Ascomycetes.

The protein coat typical of viruses.

Viroid consist of just a short section of RNA, but without

It acts as dormat stage in life cycle of Diatoms also

Diatoms spore are specialised cells called auxosposes,

Dissimilarities.

Taxonomic key is a device used by biologists for identifying unknown organisms. Keys are constructed so that the user is presented with series of choice about the characteristics of unknown organism. Also used to identify organisms on the basis of similarities and dissimilarities.

Diatoms spore are specialised cells called auxosposes, it acts as dormat stage in life cycle of Diatoms also referred as "resting spores".

Viroid consist of just a short section of RNA, but without the protein coat typical of viruses.

Trichoderma and Saccharomyces as both belong to class Ascomycetes.

Euglena are single celled protists that live mostly in fresh water. They have outer covering called pellicle, they also possess, long tail called flagella, which they use to move through water. They also contain chloroplasts and produce their own food through photosynthesis.

Kingdom Monera is considered to be the most ancient living forms which is divided in two groups Archaeabacteria and Eubacteria.

Amoeba locomotory organ is pseudopodia, Paramecium have cilia and Trypanosoma moves with the help of flagella.

Porphyra and haminaria are both fresh water algae

Stored food material in Rhodophycean algae is flourished starch.

Fucus and volvox have Oogamous type of sexual reproduction.

Diplontic type of life cycle are observed in fucus and gymnosperms.

In Bryophytes zygotes develops into sporophyte.

Evolutionarily, Pteridophytes are the first terrestrial plants to possess vascular tissue – xylem and phloem,

Banyan tree have supporting roots system which support its branches whereas maize and sugarcane have stilt root which help plant to stand erect.

Fungi show great diversity in respect to their morphology as well as habitat. Chemical composition of cell wall of fungi is chitin and polysaccharides.

Fruit of fabaceae is Legume.

Neem plant have pinnately compound leaf at a node.

Mesocarp layer is fleshy and pulpy layer. This is the edible portion of mango.

Fascicular vascular cambium, interfascicolar cambium and cork cambium are the type of lateral meristems.

Scutellum refers to their cotyledonin monocots with high surface area and serves to absorb nutrients from the endosperm during germination.

The cambium arising between the vascular bundle is interfascicolar cambium.

Col lenchyma cells are found is the pulp of fruits like guava, pear and sapota.

Glycocalyx is a glycoprotein – polysaccharide covering that surrounds the cell- membranes of some bacteria, epithelia and other cells. Most animal epithelial cells have a fuzz-like coat on the external surface of their plasma membranes.

Smooth endoplasmic reticulum is involved in the synthesis of phospholipids the main lipid of the cell membrane.

Centromere is the point on a chromosome by which it is attached to a spindle fibre during all division. Whereas the centromere is an organelle near the nucleus of a cell which contains the centrioles (in animal cells) and from which the spindle fibres develop in cell division.

Morphine was the first alkaloid to be extracted from opium.

A peptide bond is a chemical bond formed between two molecules when the carboxyl group of one molecule reacts with the amino group. Many amino acids binds together with pptide bond in a chain called polypeptide.

Paper and cotton fibre are cellulose, whereas chitin is a polymer N-acetyl glucosamine and glycogen is a polysaccharide of glucose.

No amino acid is categorised on the basis of carboxyl group.
44. (b) The G₁ phase, or Gap₁ phase, is the first four phases of the cell cycle that takes place in eukaryotic cell division. In this part of interphase, the cell synthesizes mRNA and proteins in preparation of subsequent steps leading to mitosis. G₁ phase ends when the cell moves into the S phase of interphase.

45. (c) In meiosis there are 2 division of chromosomes and cytoplasm to reduce the number of chromosomes (Only one division occurs in mitosis). In prophase I, there is a pairing of homologous chromosomes in process called synopsis.

46. (a) Uniporter is an integral membrane protein that is involved in facilitated diffusion. They can be either ion channels or carrier proteins.

47. (c) Apoplastic movement of water occur through intercellular spaces and cell wall of the cells.

48. (a) Boron is involved in carbohydrate transport.

49. (b) Frankia is a genus of nitrogen fixing, filamentous bacteria that live in a symbiosis non leguminous plants.

50. (c) When the electrons leave the chlorophyll molecules of PSII, it leaves behind a ‘hole’. This electron hole is filled in by a water molecule that is oxidized, or loses electrons, as it essentially splits into two hydrogen atoms, or protons, and an oxygen atom.

51. (e) Nitrogen fixation is a process in which nitrogen (N₂) in the Earth's atmosphere is converted to ammonia.

52. (d) (a) – 4, (b) – 3, (c) – 1, (d) – 2

53. (d) Sorghum shows C₃ pathway whereas maize and tomato show C₄ pathway.

54. (d) In the photorespiratory pathway there is no synthesis of ATP or NADPH. Therefore photorespiration is a wasteful method in terms of energy production.

55. (e) Respiratory Quotient (RQ) or respiratory ratio can be defined as the ratio of the volume of CO₂ evolved to the volume of O₂ consumed during respiration. The value of respiratory quotient depends on the type of respiratory substrat. Its value is one for carbohydrates. RQ is about 0.7 for most of the common foods (Tripalmitin).

56. (b) During the synthesis of malic acid from succinic acid FAD⁺ get reduced to FADH₂ in citric acid cycle.

57. (c) Ethylene breaks seed and bud dormancy, initiates germination in peanut seeds. Sprouting of potato tubers.

58. (b) The living differentiated cells, that by now have lost the capacity to divide can regain the capacity of division under certain conditions. This phenomenon is termed as dedifferentiation.

59. (d) Exine is a part of female gametophyte.

60. (c) Exine is made up of sporopollenin which is one of the most resistant organic material known. It can be withstand.

61. (e) Lactational amenorrhea is the temporary postnatal infertility that occur when a woman is amenorrheic (not menstruating) and fully breast-feeding.

62. (c) Foetal ejection reflex in human female is induced by release of oxytocin from pituitary.

63. (b) David Tilman has carried out long-term ecosystem experiments using outdoor plots in which he showed that increased diversity contributed to higher productivity.

64. (e) Zoological park is an ex situ conservation method whereas National parks, wildlife sanctuary, Biosphere reserve and sacred groves.

65. (d) Yeast (Saccharomyces cerevisiae) is the most important element in wine making. Yeast convert the sugars of wine grapes into alcohol and carbon dioxide through the process of fermentation.

66. (a) (i) - e, (ii) - a, (iii) - d, (iv) - c, (v) - b

67. (b) Passive immunity is the short-term immunity which results from the introduction of antibodies from another person or animal.

68. (c) Morphine is obtained from Pap over somniferum

69. (d) Appearance of antibiotic resistant microbes and convergent evolution of placental mammals in Australia are example of evolution by anthropogenic action.

70. (b) For any alleles A + a =1

\[
0.4 + a = 1 \\
\Rightarrow a = 1 - 0.4 \\
\Rightarrow a = 0.6
\]

71. (e) Adaptive radiation, shows evolution of an animal or plant group into a wide variety of types adapted to specialized mode of life.

72. (d) In case of non-chordates heart is located in dorsal position of the body whereas in chordates heart is present ventrally.

73. (b) Aschelminthes are round worms having elongated cylindrical circular in crosssection. They are bilaterally symmetrical with pseudocoel type of body cavity.

74. (c) 1-c-(ii), 2-d-(i), 3-e-(iii), 4-b-(v), 5-a-(iv)

75. (d) Aves are homoiotherms as it can maintain its body temperature. In mammals the ear is usually described as having three parts - the outer ear, middle ear and inner ear. The outer ear consists of the pinna and the ear canal.

76. (a) Soil passes through the esophagus, which has calciferous glands that release calcium carbonate to rid the earthworm's body of excess calcium.

77. (a) Eye of cockroach contains about 2,000 ommatidia, the pigment separating ommatidia. Each ommatidium forms a complete image of the entire field of vision and all the images together form a continuous through partly overlapping super-position image. Super-position images are formed in dim light and are not sharp.

78. (d) (I) - C, (II) - A, (III) - D, (IV) - E, (V) - B

79. (b) Mesorchium is the fibrous sheath which attaches vascular and avascular structure of spermatic card together.

80. (c) Gap junction allow the exchange of ions, second messengers and small metabolites between adjacent cells and are formed by two unrelated protein families.

81. (c) (I) - C, (II) - D, (III) - E, (IV) - A, (V) - B
82. (a) 

\[ \begin{align*}
\text{(Rr)} & \times \text{(Rr)} \\
\text{R} & \text{r} \\
\text{gametes} & \\
\text{(RR)} & \text{(Rr)} & \text{(rr)} & \text{(icr)} & \text{(red)} & \text{(pink)} & \text{(pink)} & \text{(white)}
\end{align*} \]

25% offspring can have white flowers.

83. (c) Phosphodiester bond forms the backbone of the strand of the nucleic acid. When nucleotides are incorporated into DNA, adjacent nucleotides are lined by a phosphodiester bond, a covalent bond is formed between the 5' phosphate group of one nucleotide and the 2' - OH group of another.

84. (e) RNA polymerase I synthesises ribosomal RNA (28S, 18S and 5.8Sr RNAs.) RNA Polymer as e-II synthesizes hnRNA.

85. (d) 

\[ A = T \text{ and } C = G \]

\[ 100 - 55\% = 45\% \]

\[ \text{guanine} = \frac{45}{2} = 25.5\% \]

86. (b) 

\[ \begin{align*}
\text{RY} & \quad \text{Ry} & \quad \text{rY} & \quad \text{ry} \\
\text{RY} & \text{RY} & \text{RYy} & \text{RrYy} & \text{RrYy} \\
\text{Ry} & \text{RrYY} & \text{RrYY} & \text{rY} & \text{rrYY} & \text{rrYy} \\
\text{rY} & \text{rrYY} & \text{rrYY} & \text{rrYy} \\
\text{ry} & \text{rrYY} & \text{rrYY} & \text{rrYy}
\end{align*} \]

Phenotypic ratio : round yellow : round green : wrinkled yellow : wrinkled green 9 : 3 : 3 : 1

\[ \frac{9 + 3 + 3 + 1}{4} = 12 : 4 \\
= 3 : 1 \]

87. (d) 2 and 4

88. (a) The term aneuploidy refers to cytogenetic abnormalities in which all or part of one or more chromosome is added or deleted. Example of autosomal aneuploidy is down's syndrome.

89. (e) Theodor Boveri observed that proper embryonic development of sea urchins does not occur unless chromosomes are present. Water Sutton observed the separation of chromosomes into daughter cells during meiosis. Together, these observations led to the development of the chromosomal theory of inheritance.

90. (b) Termination codon UGA, UAG and UAA do not code for any amino acid.

91. (b) Satellite DNA consists of very large arrays of tandemly repeating, non-coding DNA. Satellite DNA is the main component of functional centromeres, and form the main structural constituent of heterochromatin.

92. (e) DNA are confined to nucleus in case of eukaryotes. So replication (duplication of DNA) occur in nucleus. After replication, transcription (DNA to RNA) also occur in nucleus which later transferred to the cytoplasm. In cytoplasm transcribed mRNA will be used for protein synthesis with the help of ribosomes in the process of translation.

93. (c) Lac operon consists of three genes LIC Z, Lac Y and Lac A. The CAP binding site is a positive regulatory site that is bond by Catabolite Activator Protein (CAP). When CAP is bond to this site, it promotes transcription by helping RNA polymerase bind to the promotor. Operator is a negative regulatory site bond by the lac repressor protein.

94. (e) Only one type (AB) of gametes are produced.

95. (c) Gamow's suggested that the twenty combinations of four DNA bases taken three at a time corresponded to the twenty amino acid that form proteins. This led rich and Watson to enumerate the twenty amino acid common to proteins. Gamow's contributions to solving the problem of genetic coding gave rise to important model of biological degeneracy.

96. (c) In eukaryotes RNA polymerase III transcribes DNA to synthesize ribosomal 5Sr RNA/ t RNA and other small RNAs.

97. (a) Retrovirus HIV deviates from the central dogma as instead of creating proteins from DNA, it uses its host cell to create DNA from the virus's own RNA.

98. (b) Down syndrome shows trisomy 21, Klinefelter's syndrome shows 47, XXY or XYY, Turner's syndrome shows 45, X.

99. (d) Meselson and stahl tested the hypothesis of DNA replication. They cultured bacteria in a 15N medium. 15N is a heavy isotope of nitrogen so the DNA synthesized is of heavy density. They then shifted the bacteria to a 14N medium, DNA was isolated at different times corresponding to replication cycle 0, 1 and 2.

100. (d) Marasmus is a form of severe malnutrition characterized by energy and protein deficiency. Kwashiroker occurs when their is not enough protein.

101. (b) Trypsinogen is the precursor form of trypsin. It become active in presence of HCl. Trypsin is used to convert the protein molecules into dipeptides.

102. (c) O blood group has both antibodies.

103. (a) The stapes articulates with the incus through the incudostapedial joint and is attached to the membrane of the fenestra ovalis, the elliptical or oval window or opening between the middle ear and the vestibule of the inner ear. It is the smallest bone in the body.
104. (b) When ammonia is metabolised it is converted to urea in liver, end product is excreted out in from of urine.

105. (c) Anaerobic breakdown of glycogen leads to the formation of lactic acid.

106. (d) Glomerular filtration rate in a healthy individual is about 180 litre per day. All the constitutes of the plasma except protein, is passes into the lumen of Bowman’s capsule.

107. (b) Organ of corti is a structure located on the basilar membrane which contains hair cells that act as auditory receptors. The hair cells are present in rows on the internal side of the organ of corti. The basal end of the hair cell is in close contact with the afferent none fibres. A large number of processes called stereocilia are projected from the apical part of each hair cell. Above the rows of the hair cells is a their elastic membrane called tectorial membrane.

108. (b) Iris is a flat ring-shaped membrane behind the cornea of the eye, with an adjustable circular opening (Pupil) in the centre and provide colour to the eye.

109. (a) Afferent arteriole – are a group of blood vessels that supply the nephrons in excretory system.
Efferent arteriole – efferent arteriole carries blood away from the glomerulus
Glomerulus – it is a network of capillaries located at the beginning of a nephron in the kidney.
Bowman's capsule – it is cup like sack at the beginning of the tubular component of a nephron in mammalian kindney that performs the first step in the filtration of blood to form urine.
Proximal convoluted tubule – it is part of vertebrate nephron that lies between Bowman’s capsule and the loop of Henle and functions specially in the resorption of sugar. Sodium and chloride ions and water.

110. (c) Somatic system is the part of the peripheral nervous system associated with skeletal muscle, voluntary controls the body movement.

111. (c) Angina is a severe pain in the chest, which may spread to the shoulders, arms and neck, owing to an inadequate blood supply to the heart.

112. (c) The central portion of the human vertebra is called neural canal.

113. (e) Cardiac output is the volume of blood being pumped by the heart in a minute. It is equal to the heart rate multiplied by the stroke volume. So if there are 70 beats per minute, and 70 ml blood is ejected with each beat of the heart, the cardiac output is 5040 ml/minute.

114. (a) Glucagon is a peptide hormone, produced by alpha cells of the pancreas. It works to raise the concentration of glucose in the bloodstream.

115. (d) Sarcoplasm is the cytoplasm of muscle cells which helps to hold the muscle bundle together.

116. (b) Basophils secretes histamine, serotonin and heparin.

117. (a) Coronary Artery Disease (CAD) is a condition which affect the arteries that supply the heart with blood. It is usually caused by atherosclerosis which is a buildup of plaque inside the artery walls.

118. (c) Flame cell is a specialize excretory cell found in the simplest freshwater invertebrates including flatworms, rotifers and nemertean.

119. (a) Lacteal is a lymphatic capillary that absorbs dietary fats in the villi of the small intestine. Lacateals help to absorb fat globules.

120. (e) (A) - 2, (B) - 1, (C) - 4, (D) - 3,