KERALA PMT 2015 - SOLVED PAPER

Paper-I : Physics & Chemistry

1. Which one of the following set of quantum numbers is possible?

(a) $n=3, l=3, m_l=-3, m_s=+1/2$

(b) $n=2, l=1, m_l=2, m_s=-1/2$

(c) $n=2, l=0, m_l=0, m_s=+1/2$

(d) $n=1, l=0, m_l=0, m_s=0$

(e) $n=3, l=2, m_l=3, m_s=-1/2$

2. The mass of $CaCO_3$ required to react completely with 20 mL of 1.0M HC1 as per the reaction,

$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ is (At. wt: Ca = 40, C = 12, O = 16)

(a) 1 g (b) 2 g

(c) 10 g (d) 20 g

(e) 200 g

3. Which one of the following has maximum number of molecules?

(a) 16 g of O_2 (b) 16 g of NO_2

(c) 4 g of N_2 (d) 2 g of H_2

(e) 32 g of N_2

4. The density of 2.0M solution of a solute is 1.2 g mL^{-1}. If the molecular mass of the solute is 100 g mol^{-1}, then the molality of the solution is

(a) 2.0m (b) 1.2m

(c) 1.0m (d) 0.6m

(e) 2.4m

5. Which of the following set of molecules contain the same number of lone pair electrons in the central atom?

(a) SO_2, ClF_3, BrF_3 (b) SF_4, NH_3, O_3

(c) ClF_3, XeF_2, H_2O (d) H_2O, SF_4, NH_3

(e) NH_3, XeF_2, O_3

6. Which one of the following does not match with respect to the shape of the molecule?

(a) NH_3 - Trigonal pyramidal

(b) SF_4 - Tetrahedral

(c) H_2S - Bent

(d) ClF_3 - T-shape

(e) XeF_4 - Square planar

7. Find the pair that has the same bond order with diamagnetic and paramagnetic properties respectively

(a) F_2 and O_2 (b) N_2 and O_2^{2-}

(c) Li_2 and B_2 (d) B_2 and O_2

(e) He and Ne

8. In which one of the following compounds does the central atom obeys the octet rule?

(a) XeF_4 (b) $XeOF_2$

(c) SCl_2 (d) $AlCl_3$

(e) BF_3

9. Equal masses of He, O_2 and SO_2 are taken in a closed container. The ratio of the partial pressures of gases He, O_2 and SO_2 would be

(a) 1 : 2 : 8 (b) 8 : 16 : 1

(c) 16 : 8 : 1 (d) 1 : 4 : 16

(e) 16 : 2 : 1

10. Which one of the following gases has the highest critical temperature?

(a) Nitrogen (b) Ammonia

(c) Water vapour (d) Carbon dioxide

(e) Hydrogen

11. Match the following

Compound		Magnetic Property
(A) NaCl	-	(i) Ferrimagnetic
(B) MnO	-	(ii) Paramagnetic
(C) $CrCl_3$	-	(iii) Ferromagnetic
(D) CrO_2	-	(iv) Diamagnetic
(E) $MgFe_2O_4$	-	(v) Antiferromagnetic

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

(b) (A) - (v), (B) - (ii), (C) - (iii), (D) - (i), (E) - (iv)

(c) (A) - (iii), (B) - (v), (C) - (ii), (D) - (i), (E) - (iv)

(d) (A) - (iv), (B) - (v), (C) - (ii), (D) - (iii), (E) - (i)

(e) (A) - (iv), (B) - (iii), (C) - (v), (D) - (ii), (E) - (i)

12. What would be the IUPAC name for the element with atomic number 120?

(a) Ununbium (b) Unnilbium

(c) Unnilunium (d) Ununtrium

(e) Unbinilium

13. Among Mg, Mg^{2+}, Al and Al^{3+} which will have the largest and the smallest size respectively?

(a) Mg, Al^{3+} (b) Al^{3+}, Mg

(c) Mg^{2+}, Al (d) Al, Mg^{2+}

(e) Mg^{2+}, Al^{3+}

14. How does the electron gain enthalpies vary across a period and down a group?

(a) More positive across a period and less positive down a group

(b) More negative across a period and less negative down a group

(c) Less positive across a period and less negative down a group

(d) More positive across a period and less negative down a group

(e) Less negative across a period and more negative down a group

15. The halide of which alkaline earth metal is covalent and soluble in organic solvents?

(a) Be (b) Mg

(c) Ca (d) Sr

(e) Ba

16. The element responsible for the neuromuscular function in the body is
(a) Calcium (b) Magnesium
(c) Potassium (d) Sodium
(e) Manganese

17. The salt of an alkali metal gives yellow colour in the flame test. Also its aqueous solution gives an insoluble white precipitate with barium chloride in acid medium. The salt is
(a) NaCl (b) K_2SO_4
(c) Na_2SO_4 (d) Li_2SO_4
(e) $NaNO_3$

18. The oxoacid of phosphorus that reduces silver nitrate into metallic silver is
(a) H_3PO_2 (b) $H_4P_2O_6$
(c) H_3PO_4 (d) $H_4P_2O_7$
(e) $(HPO_3)_n$

19. The compound that is used in nuclear industry as protective shields and control rods is
(a) metal carbonates (b) metal chlorides
(c) metal oxides (d) metal hydroxides
(e) metal borides

20. Which of the following oxides of nitrogen contains N-O-N bond?
(a) Dinitrogen oxide (b) Nitrogen monoxide
(c) Dinitrogen pentoxide (d) Dinitrogen trioxide
(e) Dinitrogen tetroxide .

21. Which of the following transition metals of 3*d* series has the lowest melting point?
(a) Ti(Z = 22) (b) V(Z = 23)
(c) Cr(Z = 24) (d) Mn(Z = 25)
(e) Fe(Z= 26)

22. Which of the following ions has the same number of unpaired electrons as those present in V^{3+}?
(a) Ti^{3+} (b) Fe^{3+}
(c) Ni^{2+} (d) Cr^{3+}
(e) Mn^{2+}

23. Among the following actinide pairs, the maximum oxidation states is shown by
(a) U and Np (b) Np and Pu
(c) Pu and Am (d) U and Pa
(e) Th and Pu

24. Among the transition metals of 3*d* series, the one that has the highest negative M^{2+}/M standard electrode potential is
(a) Ti (b) Cu
(c) Mn (D) Ni
(e) Zn

25. The enthalpies of solution for copper sulphate pentahydrate and anhydrous copper sulphate are respectively –11.7 and –65.5 kJ mol^{-1}. The hydration enthalpy of anhydrous copper sulphate is
(a) 53.8 kJmol^{-1} (b) – 9.8 kJmol^{-1}
(c) – 77.2 kJmol^{-1} (d) –53.8 kJmol^{-1}
(e) 77.2 kJmol^{-1}

26. The standard enthalpy of formation of $NH_3(g)$ is – 91.8 kJ mol^{-1}. The amount of heat required to decompose 34 g of $NH_3(g)$ into its elements is
(a) 183.6 kJ (b) 91.8 kJ
(c) 45.9 kJ (d) 137.7 kJ
(e) 275.4 kJ

27. Calculate the work done by 16 g of oxygen gas (assume ideal behavior) of molar mass 32 g mol^{-1} undergoing isothermal reversible expansion at 300 K from an initial volume of 2.5 L to the final volume of 25 L in litre atm.
($R = 8.2 \times 10^{-2}$ L atm. K^{-1} mol^{-1})
(a) –56.64 (b) 28.32
(c) 113.28 (d) 56.64
(e) –113.28

28. In which one of the following, the increase of pressure favours the backward reaction?
(a) Formation equilibrium of ammonia from $N_2(g)$ and $H_2(g)$
(b) Decomposition equilibrium of HI(g) to $H_2(g)$ and $I_2(g)$
(c) Synthesis of $SO_3(g)$ by contact process
(d) Production of 'syngas' by coal gasification
(e) Formation equilibrium of Fe_3O_4 by action of steam on iron

29. At 800 K in a sealed vessel, for the equilibrium
$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$, the equilibrium concentrations of $N_2(g)$,$O_2(g)$ and NO(g) are respectively 0.36×10^{-3}M, 4.41×10^{-3} M and 1.4×10^{-3} M. Then, the value of K_c for the reaction $NO(g) \rightleftharpoons 1\backslash 2\, N_2(g) + 1\backslash 2\, O_2(g)$ at 800 K is
(a) 1.1 (b) 0.9
(c) 3×10^3 (d) 9×10^{-3}
(e) 0.33

30. The solubility product of a salt MX_2 in water is 4×10^{-12}. The concentration of M^{2+} ions in the aqueous solution of the salt is
(a) 1×10^{-4}M (b) 4×10^{-4}M
(c) 16×10^{-6}M (d) 2×10^{-4}M
(e) 12×10^{-2}M

31. Which one of the following species cannot act as both Bronsted acid and base?
(a) H_2O (b) HCO_3^-
(c) HSO_4^- (d) NH_2^-
(e) NH_3

32. The correct equation for the degree of association 'α' of an associating solute, '*n*' molecules of which undergoes association in solution, is
(a) $\alpha = \dfrac{n(i-1)}{1-n}$ (b) $\alpha = \dfrac{i(n-1)}{1+n}$
(c) $\alpha = \dfrac{i(1+n)}{1-n}$ (d) $\alpha = \dfrac{i(n+1)}{n-1}$
(e) $\alpha = \dfrac{n(1-i)}{1-n}$

33. The vapour pressure of a solvent at 293 K is 100 mm Hg. Then the vapour pressure of a solution containing 1 mole of a strong electrolyte (AB_2) in 99 moles of the solvent at 293 K is (assume complete dissociation of solute)
(a) 103 mm Hg (b) 99 mm Hg
(c) 97 mm Hg (d) 101 mm Hg
(e) 98 mm Hg

34. The correct order of osmotic pressure of 0.01M aqueous solution of the following is
(a) Sucrose > CH_3COOH > KC1
(b) CH_3COOH > Sucrose > KC1
(c) Sucrose > KC1 > CH_3COOH
(d) KC1 > Sucrose > CH_3COOH
(e) KC1 > CH_3COOH > Sucrose

35. Among the following elements, which one exhibits both positive and negative oxidation states?
(a) Cs (b) Ne
(c) I (d) F
(e) K

36. Choose the disproportionation reaction among the following redox reactions
(a) $3Mg(s) + N_2(g) \rightarrow Mg_3N_2(s)$
(b) $P_4(s) + 3NaOH(aq) + 3H_2O(1) \rightarrow PH_3(g) + 3NaH_2PO_2(aq)$
(c) $Cl_2(g) + 2KI(aq) \rightarrow 2KCl(aq) + I_2(s)$
(d) $Cr_2O_3(s) + 2Al(s) \rightarrow Al_2O_3(s) + 2Cr(s)$
(e) $2NaH(s) \rightarrow 2Na(s) + H_2(g)$

37. Standard electrode potentials of three metals X, Y and Z are 0.52 V, –2.87 V and – 0.44 V respectively. The reducing power of these metals are
(a) X > Y > Z (b) X > Z > Y
(c) Y > X > Z (d) Z > X > Y
(e) Y > Z > X

38. In a first order reaction 80% of the reactant at an instant was reduced to 8% in 4606 seconds. The rate constant of the reaction is
(a) $2.303 \times 10^{-4} s^{-1}$ (b) $4.606 \times 10^{-3} s^{-1}$
(c) $5.000 \times 10^{-3} s^{-1}$ (d) $5.000 \times 10^{-4} s^{-1}$
(e) $4.606 \times 10^{-4} s^{-1}$

39. The decomposition of N_2O_5 in $CC1_4$ at 318 K is studied by monitoring the concentration of N_2O_5 in the solution. Initially the concentration of N_2O_5 is 2.4 mol L^{-1} and after 200 minutes, it is reduced to 2.00 mol L^{-1}. What is the rate of production of NO_2 during this period in mol L^{-1} min^{-1}?
(a) 4×10^{-3} (b) 2×10^{-3}
(c) 1×10^{-3} (d) 2×10^{-4}
(e) 5×10^{-3}

40. In a first order reaction, the concentration of the reactant decreases from 0.6M to 0.3M in 30 minutes. The time taken for the concentration to change from 0.1M to 0.025M is
(a) 60 min. (b) 30 min.
(c) 15 min. (d) 50 min.
(e) 90 min.

41. The correct ascending order of adsorption of the following gases on the same mass of charcoal at the same temperature and pressure is
(a) $CH_4 < H_2 < SO_2$ (b) $H_2 < CH_4 < SO_2$
(c) $SO_2 < CH_4 < H_2$ (d) $H_2 < SO_2 < CH_4$
(e) $CH_4 < SO_2 < H_2$

42. when H_2 and CO are reacted in the presence of Cu catalyst, the product/s obtained is/are
(a) methanol (b) methanal
(c) methane and H_2O (d) acetic acid
(e) ethanol

43. Which of the following statements is incorrect about physisorption?
(a) It is reversible in nature
(b) It forms multilayer
(c) It involves high activation energy
(d) The extent of physisorption decreases with increase of temperature
(e) It increases with increase in surface area

44. The compound $[Pt(NH_3)_2Cl_2]$ can exhibit
(a) linkage isomerism (b) coordination isomerism
(c) optical isomerism (d) geometrical isomerism
(e) ionization isomerism

45. Which one among the following is a homoleptic complex?
(a) Tris(ethane-l,2-diamine)cobalt(III) chloride
(b) Triamminetriaquachromium(III) chloride
(c) Diamminechloridonitrito-N-platinum(II)
(d) Dichloridobis(ethane-l,2-diamine)cobalt(III) chloride
(e) Pentamminecarbonatocobalt(III) chloride

46. The coordination number, oxidation number and the number of *d*-electrons in the metal ion of the complex $[CoCl_2(en)_2]Cl$, are respectively (atomic number of Co = 27)
(a) 4, 3 and 6 (b) 6, 2 and 6
(c) 6, 6 and 3 (d) 4, 2 and 6
(e) 6, 3 and 6

47. What is the IUPAC name of the following compound?



(a) Hexa-2, 6-dienone-6-ol
(b) 2-ketohexanoic acid
(c) 5-ketohexanoic acid
(d) 2-oxohexanoic acid
(e) 5-oxohexanoic acid

48. The number of σ and π bonds present in 1, 3-butadiene is respectively
(a) 9 and 2 (b) 8 and 2
(c) 9 and 3 (d) 9 and 1
(e) 8 and 1

49. Which one of the following is an aromatic compound?
(a) Cyclopentadienyl cation
(b) Cycloheptatrienyl cation
(c) Cycloheptatrienyl anion
(d) Cycloheptatriene
(e) Cyclopentadiene

50. *n*-hexane on heating to 773 K at 10-20 atmospheric pressure in the presence of oxides of vanadium supported over alumina, yields
(a) 1-hexene (b) 2-hexene
(c) benzene (d) 2-methylpentane
(e) 2, 2-dimethylbutane

51. Which one of the following is not an isomer of 3-methylbut-1-yne?
(a) Pent-1-yne (b) Buta-l, 3-diene
(c) Pent-2-yne (d) Penta-l, 3-diene
(e) 2-methylbuta-l, 3-diene

52. The correct decreasing order of acidic character of hydrogen in ethane, ethene and ethyne is
(a) ethane > ethene > ethyne
(b) ethene > ethane > ethyne
(c) ethyne > ethane > ethene
(d) ethyne > ethene > ethane
(e) ethane > ethyne > ethene

53. On ozonolysis, one molecule of a hydrocarbon produces two molecules of ethanal and one molecule of ethanedial. The hydrocarbon could be
(a) 1, 3-hexadiene (b) 1, 4-cyclohexadiene
(c) 1, 4-hexadiene (d) 2, 4-hexadiene
(e) 1, 3-cyclohexadiene

54. Acid catalysed hydration of alkene is an example for
(a) Free radical substitution
(b) Nucleophilic substitution
(c) Nucleophilic addition
(d) Electrophilic addition
(e) Electrophilic substitution

55. Which one of the following undergoes nitration reaction most readily?
(a) Acetophenone (b) Benzonitrile
(c) Benzaldehyde (d) Benzoic acid
(e) Benzene

56. The total number of optical isomers possible for 2,3-dibromobutane is
(a) 2 (b) 4
(c) 0 (d) 3
(e) 8

57. Dehydration of which one of the following alcohols produces an alkene exhibiting cis-trans isomerism?
(a) Isopropyl alcohol (b) Tertiary butyl alcohol
(c) *n*butyl alcohol (d) Neopentyl alcohol
(e) 3-pentanol

58. The products expected to be formed in the Wurtz reaction of a mixture of neopentyl bromide and isobutyl bromide are
(i) 2, 2, 4-trimethylpentane
(ii) 2, 2, 5, 5-tetramethylhexane
(iii) 2, 2, 4, 4-tetramethylhexane
(iv) 2, 5-dimethylhexane
(v) 2, 2, 5-trimethylhexane
(a) (ii), (iii) and (v) (b) (ii), (iv) and (v)
(c) (i), (iv) and (v) (d) (i), (iii) and (v)
(e) (i), (ii) and (iv)

59. Which one of the following organohalogen compounds when heated with alcoholic potassium hydroxide does not undergo dehydrohalogenation reaction?
(a) Secondary butyl chloride
(b) Isopropyl chloride
(c) Neopentyl chloride
(d) Isobutyl chloride
(e) Tertiary butyl chloride

60. By which one of the following reaction ketones cannot be prepared?
(a) Hydration of alkynes
(b) Hydrolysis of gem-dihalides
(c) Dry distillation of calcium carboxylates
(d) Stephen's reaction
(e) Ozonolysis of appropriately substituted alkenes

61. When a mixture of benzaldehyde and acetophenone is treated with dilute NaOH at 293 K, it forms
(a) 2, 3-diphenyl propanal
(b) l, l-diphenyl-propan-2-one-l-ol
(c) l, 3-diphenylprop-2-en-l-one
(d) l, 2-diphenylprop-2-en-l-one
(e) l, 3-diphenylprop-2-en-l-al

62. Glutaric acid is
(a) butane-1, 4-dioic acid
(b) propane-1, 3-dioic acid
(c) pentane-l, 5-dioic acid
(d) hexane-1, 6-dioic acid
(e) ethanedioic acid

63. 4-methoxyacetophenone can be prepared from anisole by
(a) Reimer-Tiemann reaction
(b) Kolbe's reaction
(c) Friedel-Crafts reaction
(d) Wurtz reaction
(e) Cannizzaro reaction

64. The total number of structural isomers possible for an amine with molecular formula $C_4H_{11}N$ is
(a) 6 (b) 5
(c) 7 (d) 4
(e) 8

65. Which one of the following amine cannot be prepared by Gabriel phthalimide synthesis?
(a) Ethylamine (b) Isopropylamine
(c) *n*-propylamine (d) Ethylmethylamine
(e) Allylamine

66. Which one of the following amines forms a nonacidic and alkali insoluble product with *p*-toluenesulphonyl chloride?
(a) Tertiary butylamine (b) *n*-butylamine
(c) Isobutylamine (d) Diethylamine
(e) N, N-dimethyl ethylamine

67. Which of the following compounds is most basic?
(a) Aniline (b) Cyclohexylamine
(c) *o*-nitroaniline (d) *o*-toluidine
(e) *p*-methoxyaniline

68. Glucose does not react with
(a) hydroxylamine (b) conc. HNO_3
(c) acetic anhydride (d) sodium bisulphite
(e) Br_2/H_2O

69. Which of the following is a water soluble vitamin?
(a) Vitamin A (b) Vitamin D
(c) Vitamin B_1 (d) Vitamin E
(e) Vitamin K

70. The polymer used in the manufacture of squeeze bottles is
(a) Polystyrene (b) Teflon
(c) Polypropene (d) High density polythene
(e) Low density polythene

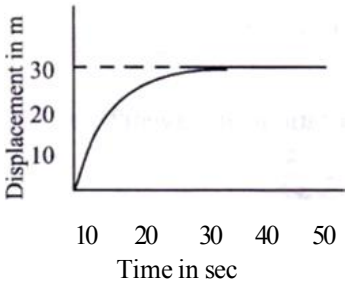
71. The drug Tegamet is
(a) Analgesic (b) Anti-depressant
(c) Anaesthetic (d) Antacid
(e) Antibiotic

72. Which one of the following is a cationic detergent?
(a) Sodium laurylsulphate
(b) Cetyltrimethyl ammonium bromide
(c) Sodium dodecylbenzene sulphonate
(d) Glyceryl palmitate
(e) Glyceryl oleate

73. The wrong unit conversion among the following is
(a) 1 angstrom = 10^{-10}m
(b) 1 fermi = 10^{-15}m
(c) 1 light year = 9.46×10^{15}m
(d) 1 parsec = 3.08×10^{16}m
(e) 1 astronomical unit = 1.496×10^{-11}m

74. Choose the wrong statement
(a) The motion of an object along a straight line is a rectilinear motion
(b) The speed in general is less than the magnitude of the velocity
(c) The slope of the displacement-time graph gives the velocity of the body
(d) The area under the velocity-time graph gives the displacement of the body
(e) The negative slope of speed-time graph indicates a retarded motion

75. The displacement of a particle as a function of time is shown in figure. It indicates that



(a) the velocity of the particle is constant throughout
(b) the acceleration of the particle is constant throughout
(c) the particle starts with a constant velocity and is accelerated
(d) the particle starts from rest and is accelerated throughout
(e) the motion is retarded and finally the particle stops

76. The range of a projectile is R when the angle of projection is 40°. For the same velocity of projection and range, the other possible angle of projection is
(a) 45° (b) 50°
(c) 60° (d) 40°
(e) 30°

77. The scalar quantity among the following is
(a) weight of body (b) temperature gradient
(c) elementary area (d) magnetic field strength
(e) electric potential

78. Which one of the following motions on a smooth plane surface does not involve force?
(a) Accelerated motion in a straight line
(b) Retarded motion in a straight line
(c) Motion with constant momentum along a straight line
(d) Motion along a straight line with varying velocity
(e) Motion in a circle with uniform speed

79. Pick out the wrong statement
(a) Newton's laws of motion hold good for both inertial and non-inertial frames
(b) During explosion, linear momentum is conserved
(c) Area under force-time graph gives the magnitude of impulse
(d) Force of friction is zero when no driving force is applied
(e) The apparent weight of a lift moving upwards with uniform velocity, equals its true weight.

80. Two bodies of different masses are moving with same kinetic energy. Then the ratio of their momenta is equal to the ratio of their
(a) masses (b) square of masses
(c) square root of masses (d) cube root of masses
(e) inverse of masses

81. Two bodies of masses 1 kg and 2 kg moving with same velocities are stopped by the same force. Then the ratio of their stopping distances is
(a) 1 : 2 (b) 2 : 1
(c) $\sqrt{2}$: 1 (d) 1 : $\sqrt{2}$
(e) 1 : $\sqrt{3}$

82. If two circular discs A and B are of same mass but of radii r and 2r respectively, then the moment of inertia of A is
(a) the same as that of B (b) twice that of B
(c) four times that of B (d) half that of B
(e) one-fourth that of B

83. Choose the wrong statement
(a) The centre of mass of a uniform circular ring is at its geometric centre
(b) Moment of inertia is a scalar quantity
(c) Radius of gyration is a vector quantity
(d) For same mass and radius, the moment of inertia of a ring is twice that of a uniform disc
(e) Force in translational motion is analogous to torque in rotational motion

84. Orbital velocity of earth satellite does not depend on
(a) mass of the earth
(b) mass of the satellite
(c) radius of the earth
(d) acceleration due to gravity
(e) its height from the surface of earth

85. Gravitational potential energy of a body of mass m at a height of h above the surface of earth (M = mass of earth; R = radius of earth) is

(a) $\frac{GMm}{h}$ (b) $\frac{GMm}{(R+h)}$

(c) $\frac{-GM}{(R+h)}$ (d) $\frac{Gm}{(R+h)}$

(e) $-\frac{GMm}{(R+h)}$

86. A boat carrying a few number of big stones floats in a water tank. If the stones are unloaded into water, the water level
(a) rises till half the number of stones are unloaded and then begins to fall
(b) remains unchanged
(c) rises
(d) falls till half the number of stones are unloaded and then begins to rise
(e) falls

87. Two wires of same length and same material but of radii r and 2r are stretched by forces F and f respectively to produce equal elongation. The ratio F to f is
(a) 1 : 1 (b) 1 : 2
(c) 2 : 1 (d) 1 : 4
(e) 4 : 1

88. Choose the correct statement
(a) Terminal velocities of rain drops are proportional to square of their radii
(b) Water proof agents decrease the angle of contact between water and fibres
(c) Detergents increase the surface tension of water
(d) Hydraulic machines work on the principle of Torricelli's law
(e) Venturimeter measures the flow speed of compressible fluids

89. If ΔU represents the increase in internal energy and W the work done by the thermodynamic system, then
(a) $\Delta U = -W$ is an isothermal process
(b) $\Delta U = W$ is an isothermal process
(c) $\Delta U = -W$ is an adiabatic process
(d) $\Delta U = W$ is an adiabatic process
(e) $\Delta U = W$ is an isochoric process

90. If the energy input to a Carnot engine is thrice the work it performs then, the fraction of energy rejected to the sink is

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$

(c) $\frac{2}{5}$ (d) $\frac{2}{3}$

(e) $\frac{3}{4}$

91. The ratio of rms speed of an ideal gas molecules at pressure P to that at pressure 2P is
(a) 1 : 2 (b) 2 : 1
(c) 1 : $\sqrt{2}$ (d) $\sqrt{2}$: 1
(e) 1 : 1

92. A pendulum of time period 2 s on earth is taken to another planet whose mass and diameter are twice that of earth. Then its time period on the planet is (in second)

(a) $\frac{1}{2}$ (b) $2\sqrt{2}$

(c) $\frac{1}{\sqrt{2}}$ (d) 2

(e) $\sqrt{2}$

93. The physical quantity which remains constant in simple harmonic motion is
(a) kinetic energy (b) potential energy
(c) restoring force (d) displacement
(e) frequency

94. Sound waves
(a) can be polarized
(b) can exhibit diffraction
(c) are transverse in nature
(d) can travel in free space
(e) travel slower in liquids than in air

95. If a closed organ pipe has the same third harmonic frequency as that of an open organ pipe, then their respective lengths are in the ratio
(a) 1 : 1 (b) 1 : 2
(c) 1 : 4 (d) 3 : 4
(e) 4 : 5

96. A particle of mass 1.96×10^{-15} kg is kept in equilibrium between two horizontal metal plates having potential difference of 400 V separated apart by 0.02 m. Then the charge on the particle is (e = electronic charge)
(a) 3e (b) 6e
(c) 2e (d) 5e
(e) 4e

97. Two small spherical shells A and B are given positive charge of 9 C and 4 C respectively and placed such that their centres are separated by 10 m. If P is a point in between them where the electric field intensity is zero, then the distance of the point P from the centre of A is
(a) 5m (b) 6m
(c) 7m (d) 8m
(e) 4m

98. Identify the wrong statement
(a) Charge is a vector quantity
(b) Current is a scalar quantity
(c) Charge can be quantised
(d) Charge is additive in nature
(e) Charge is conserved

99. When the rate of flow of charge through a metallic conductor of non uniform cross section is uniform, then the quantity that remains constant along the conductor is
(a) current density (b) electric field
(c) electric potential (d) drift velocity
(e) current

100. The resistance of a carbon resistor of colour code Red Red Green Silver is (in k Ω)
(a) $2200 \pm 5\%$ (b) $2200 \pm 10\%$
(c) $220 \pm 10\%$ (d) $220 \pm 5\%$
(e) $2200 \pm 1\%$

101. The slope of the graph showing the variation of potential difference V on .x-axis and current on y-axis gives conductor's
(a) resistance (b) resistivity
(c) reciprocal of resistance (d) conductivity
(e) impedance

102. Identify the mismatched pair
(a) Hard magnet - Alnico
(b) Soft magnet - Soft iron
(c) Bar magnet - Equivalent solenoid
(d) Electromagnet - Electric bells
(e) Permanent magnet - Loud speaker

103. When the temperature of a magnetic material decreases, the magnetization
(a) decreases in a diamagnetic material
(b) decreases in a paramagnetic material
(c) decreases in a ferromagnetic material
(d) remains the same in a ferromagnetic material
(e) remains the same in a diamagnetic material

104. The magnetic field at the centre of a circular coil carrying current I ampere is B.
If the coil is bent into smaller circular coil of n turns, its magnetic field at the centre is B'. The ratio between B'and B is
(a) 1 : 1 (b) n : 1
(c) $n^2 : 1$ (d) $2n : 1$
(e) $(n+1) : 1$

105. The magnetic flux linked with a circuit of resistance R changes by $\Delta\phi$ in a time Δt. Then the total quantity of charge Q that passes at any point in the circuit during the time Δt is
(a) $\frac{\Delta\phi}{R}$ (b) $\frac{1}{R}\frac{\Delta\phi}{\Delta t}$
(c) $R\frac{\Delta\phi}{\Delta t}$ (d) $\frac{\Delta\phi}{\Delta t}$
(e) $\frac{\Delta\phi}{R^2}$

106. In an LCR series resonant circuit, the capacitance is changed from C to 4C. For the same resonant frequency, the inductance should be changed from L to
(a) 2L (b) $\frac{L}{2}$
(c) 4L (d) $\frac{L}{4}$
(e) $\frac{L}{8}$

107. Changing magnetic fields can set up current loops in nearby metal bodies and the currents are called as
(a) eddy currents (b) flux currents
(c) alternating currents (d) leakage currents
(e) wattless currents

108. Ozone layer in the atmosphere absorbs
(a) radio waves (b) infrared waves
(c) ultraviolet rays (d) X-rays
(e) microwaves

109. The magnifying power of a convex lens of focal length 10 cm when the image is formed at the near point is
(a) 6 (b) 5.5
(c) 4 (d) 3.5
(e) 2

110. The waves that require a medium to travel is
(a) infrared radiation (b) ultraviolet radiation
(c) visible light (d) X-rays
(e) ultrasound

111. In Young's double slit experiment, the locus of the point P lying in a plane with a constant path difference between the two interfering waves is
(a) a hyperbola (b) a straight line
(c) an ellipse (d) a parabola
(e) a circle

112. The ratio of the respective de Broglie wavelengths associated with electrons accelerated from rest with the voltages 100 V, 200 V and 300 V is

(a) 1 : 2 : 3 (b) 1 : 4 : 9

(c) $1:\frac{1}{\sqrt{2}}:\frac{1}{\sqrt{3}}$ (d) $1:\frac{1}{2}:\frac{1}{3}$

(e) 3 : 2 : 1

113. A radioactive source of half-life 2 hours emits radiation of intensity which is 64 times the permissible safe level. The minimum time in hours after which it would be possible to work safely with the source is

(a) 12 (b) 8

(c) 6 (d) 24

(e) 3

114. Nuclear fusion is not found in

(a) thermonuclear reactor

(b) hydrogen bomb

(c) energy production in sun

(d) atom bomb

(e) energy production in stars

115. The approximate ratio of nuclear mass densities of $^{197}_{79}$Au and $^{107}_{47}$Ag nuclei is

(a) 197 : 107 (b) 47 : 79

(c) 79 : 47 (d) 1 : 1

(e) 107 : 197

116. Identify the gate used in the following diagram



(a) AND (b) OR

(c) NAND (d) NOR

(e) either NAND or NOR

117. Acceptor level in p-type semiconductors lies

(a) nearer to the conduction band

(b) at the middle of conduction band and valence band

(c) within the valence band

(d) nearer to the valence band

(e) within the conduction band

118. The frequencies that are reflected and transmitted at ionospheric layer respectively are

(a) 3 kHz and 10 MHz (b) 10 MHz and 40 MHz

(c) 10 MHz and 20 MHz (d) 35 MHz and 70 MHz

(e) 100 Hz and 100 kHz

119. The gap between the frequency of the side bands in an amplitude modulated wave is

(a) twice that of the carrier signal

(b) twice that of the message signal

(c) the same as that of the message signal

(d) the same as that of the carrier signal

(e) the sum or difference of the frequencies of carrier and message signal

120. A transmitting antenna at the top of a tower has a height of 20 m. For obtaining 40 km as the maximum distance between the transmitter and receiver for satisfactory communication in LOS mode, the height of receiving antenna should be (radius of the earth $R = 64 \times 10^5$ m)

(a) 30 m (b) 35 m

(c) 40 m (d) 45 m

(e) 50 m

Paper-II Biology

1. Consider the following statements and choose the correct option

(A) The ovule is attached to the placenta by means of a stalk called filament

(B) The ovule fuses with the stalk in the region called hilum

(C) The two protective envelopes of ovule are called integuments

(D) The small opening in the tip of ovule is called germ pore

Of the above statements

(a) (A) and (D) are correct

(b) (A) and (C) are correct

(c) (B) and (D) are correct

(d) (B) and (C) are correct

(e) (C) and (D) are correct

2. Who proved that blends of polyblend (plastic waste) and bitumen, when used to lay roads, enhanced the bitumen's water repellant properties and helped to increase road life?

(a) Amrita Devi (b) Ramdeo Misra

(c) W.H. Pearsall (d) Ramesh Chandra Dagan

(e) Ahmed Khan

3. Match the following.

(A) Earthworm	(1) Catabolism
(B) Bacterial and fungal enzymes	(2) Breaks down detritus into smaller particles
(C) Accumulation of dark coloured amorphous substance	(3) Detritivores
(D) Fragmentation	(4) Humus

(a) (A) - (3), (B) - (2), (C) - (4), (D) - (1),

(b) (A) - (3), (B) - (l), (C) - (4), (D) - (2),

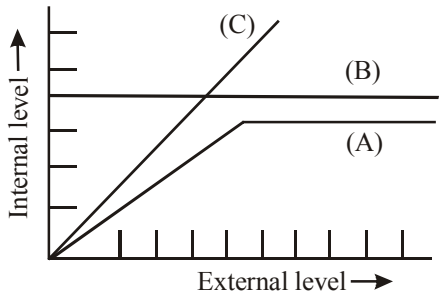
(c) (A) - (2), (B) - (1), (C) - (4), (D) - (3),

(d) (A) - (2), (B) - (3), (C) - (4), (D) - (1),

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

4. The first trophic level in an ecosystem consists of
(a) Primary producers (b) Primary consumers
(c) Secondary producers (d) Secondary consumers
(e) Top carnivores

5. The following figure given below is a diagrammatic representation of organismic response to abiotic factors. What do (a), (b) and (c) represent respectively?



(a) (A) Conformers (B) Regulators (C) Partial regulators
(b) (A) Regulators (B) Partial regulators(C) Conformers
(c) (A) Partial regulators (B) Regulators (C) Conformers
(d) (A) Partial regulators (B) Conformers (C) Regulators
(e) (A) Conformers (B) Partial regulators (C) Regulators

6. Select the correct statement
(a) Phosphorus cycle is an example of gaseous nutrient cycle
(b) The pyramid of biomass in sea is generally inverted
(c) By the process of humification, soluble inorganic nutrients go down into the soil horizon
(d) A given organism may not occupy more than one trophic level simultaneously
(e) Pyramid of energy is always inverted, can never be upright

7. The rate of biomass production and the rate of production of organic matter during photosynthesis are called respectively
(a) Total productivity, primary production
(b) Gross primary productivity, gross secondary productivity
(c) Net primary productivity, secondary productivity
(d) Net productivity, gross secondary productivity
(e) Productivity, gross primary productivity

8. Allen's rule applies to
(a) Tribes living in high altitudes
(b) Mammals from colder climates
(c) Fish living in Antarctic waters
(d) Desert lizards
(e) Marine invertebrates

9. Pick out the correct option from (a) to (e)
(A) Primary succession begins in areas where natural communities have been destroyed
(B) Hydrarch succession takes place in water
(C) The climax community is the community that is in near equilibrium with the immediate environment
(D) In newly cooled lava secondary succession occurs
(a) (A) and (B) are correct, (C) and (D) are incorrect
(b) (B) and (C) are correct, (A) and (D) are incorrect
(c) (A) and (D) are correct, (B) and (C) are incorrect
(d) (B) only is correct, (A), (C) and (D) are incorrect
(e) (A) only is correct, (B), (C) and (D) are incorrect

10. Select the wrong statement
(a) The presence of chromogenic substrate gives blue colour colonies, if the plasmid in the bacteria does not have an insert
(b) Retroviruses in animals have the ability to transform normal cells into cancerous cells
(c) In microinjection, cells are bombarded with high velocity microparticles of gold or tungsten coated with DNA
(d) Since DNA is a hydrophilic molecule it cannot pass through cell membranes
(e) DNA is a negatively charged molecule

11. Which of the following organisms breeds only once in lifetime?
(a) Bamboo (b) Oysters
(c) Pelagic fishes (d) Birds
(e) Mammals

12. Select the wrong statement
(a) Human insulin is being commercially produced from a transgenic species of Escherichia coli
(b) The genetically modified bacillus thuringiensis is used as biopesticide on the commercial scale
(c) Human protein, alpha-1 -antitrypsin is used to treat emphysema
(d) The first transgenic cow, Rosie, produced alpha lactalbumin, enriched milk
(e) Bt toxin genes Cry 1 Ac control the corn borer

13. Choose the correct statement
(a) Members of phycomycetes are facultative parasites on plants
(b) Fusion of protoplasms between two motile or non-motile gametes is called plasmogamy
(c) Kingdom Plantae includes all eukaryotic chlorophyll containing organisms and non-chlorophyll organisms called plants
(d) Trichoderma belongs to basidiomycetes
(e) Euglenoids include diatoms

14. Which of the following characters belong to the Kingdom Monera?
(a) Eukaryotic
(b) Heterotrophic
(c) Multicellular
(d) Presence of cell walls made of cellulose
(e) Presence of nuclear membrane

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

	Column I		Column II
(A)	Saprophytic protists	(1)	*Trypanosoma*
(B)	Golden algae	(2)	*Plasmodium*
(C)	Malarial parasite	(3)	Desmids
(D)	Sleeping sickness is caused by	(4)	Slime moulds

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

16. Of the following statements which are not relevant to Archaebacteria?
(A) They live in some of the most harsh habitats
(B) They are present in the gut of several ruminant animals
(C) They are characterized by the presence of a rigid cellulosic cell wall
(D) They include mycoplasma
(E) They are also referred to as blue-green algae
(a) (A), (B) and (C) (b) (A), (C) and (E)
(c) (C), (D) and (E) (d) (A), (C) and (D)
(e) (B), (C) and (E)

17. Which of the following is wrongly matched?
(a) T. O. Diener – Viroids are found to be a free DNA
(b) W. M. Stanley – Crystallised proteins
(c) M. W. Beijerinck – *Contagium vivum fluidum*
(d) D. J. Iwanowsky – Microbes smaller than bacteria cause mosaic disease of tobacco
(e) L. Pasteur – Virus means venom (or) poisonous fluid

18. Which one of the following is used extensively in biochemical and genetic work?
(a) *Saccharomyces*
(b) *Aspergillus*
(c) *Claviceps*
(d) *Penicillium*
(e) *Neurospora*

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

	I		II
(A)	*Claviceps*	(1)	Deuteromycetes
(B)	*Puccinia*	(2)	Ascomycetes
(C)	*Trichoderma*	(3)	Basidiomycetes

(a) (A) - (3), (B) - (1), (C) - (2)
(b) (A) - (2), (B) - (3), (C) - (1)
(c) (A) - (1), (B) - (3), (C) - (2)
(d) (A) - (3), (B) - (2), (C) - (l)
(e) (A) - (2), (B) - (1), (C) - (3)

20. Which one of the following is a very good pollution indicator?
(a) Fungi (b) Slime moulds
(c) Lichens (d) Euglenoids
(e) Protozoans

21. In one plant, underground stems are modified to store food and in another plant, the stem tendrils develop from axillary buds to help plants climb. They are
(a) Ginger, Cucumber
(b) Carrot, Jasmine
(c) Sweet potato, *Bougainvillea*
(d) *Opuntia*, *Eichhornia*
(e) Sweet potato, Mint

22. Consider the following statements
(A) In leguminous plants, leaf base becomes swollen, called pulvinus
(B) The fleshy leaves of onion and garlic store food
(C) The buds in Australian *Acacia* tree become green and synthesise food
(D) In *Alstonia*, leaves show alternate phyllotaxy
Of the above statements
(a) (B) and (D) are correct
(b) (A) and (C) are correct
(c) (A) and (B) are correct
(d) (A) and (D) are correct
(e) (B) and (C) are correct

23. Pick out the statement that does not apply to bryophytes
(a) Includes the ferns and horsetails
(b) Thallus is a gametophyte
(c) Sporophyte shows foot, seta and capsule
(d) Gemmae help in reproduction
(e) Water is required for fertilization

24. Which one of the following is considered important in the development of seed habit?
(a) Homospory (b) Heterospory
(c) Dependent sporophyte (d) Free living gametophyte
(e) Haplontic life-cycle

25. Which of the following is a characteristic feature of gymnosperms?
(a) The gymnosperms are homosporous
(b) The male and female gametophytes do not have independent free living existence
(c) The sporophyte is dependent on the gametophyte
(d) The ovules are enclosed by the ovary
(e) The pollen grain is released from the megasporangium

26. Consider the following statements with respect to angiosperms
(A) The male sex organ in a flower is the stamen
(B) The anthers following mitosis produce pollen grains
(C) In an embryosac, the primary endosperm nucleus (PEN) is diploid
(D) After double fertilization the ovules develop into seeds and ovaries develop into fruit.
Of the above statements
(a) (C) and (D) are correct
(b) (A) and (B) are correct
(c) (A) and (C) are correct
(d) (A) and (D) are correct
(e) (B) and (C) are correct

27. Select the wrong statement
(a) *Indigofera* is used as a dye
(b) Ashwagandha is a medicinal plant
(c) Seeds are non-endospermous in Fabaceae
(d) Leaves are alternate, simple and exstipulate in Solanaceae
(e) Ovary superior, bicarpellary with ovules on axile placentation in Liliaceae

28. Which of these is an example for a zygomorphic flower with diadelphous stamens and marginal placentation?
(a) Pea (b) Lemon
(c) Brinjal (d) Cucumber
(e) China rose

29. Select the wrongly matched pair
(a) Fibre - Sunhemp
(b) Spice - Belladonna
(c) Edible oil - Groundnut
(d) Fodder - Trifolium
(e) Fumigatory - Tobacco

30. Match the modification in Column I with the part modified in Column II and choose the right option.

	Column I		Column II
(1)	Pneumatophores in *Rhizophora*	(A)	Axillary buds
(2)	Tendrils in pea	(B)	Roots
(3)	Thorns in Citrus	(C)	Leaves

(a) (l) - (B), (2) - (A), (3) - (C)
(b) (l) - (C), (2) - (A), (3) - (B)
(c) (l) - (C), (2) - (B), (3) - (A)
(d) (l) - (B), (2) - (C), (3) - (A)
(e) (l) - (A), (2) - (B), (3) - (C)

31. Select the characters which are not applicable to the anatomy of dicot roots?
(A) Conjunctive tissue present
(B) Presence of protein compounds in the Casparian strips
(C) Polyarch xylem bundles
(D) Presence of pericycle
(a) (A) and (B) (b) (B) and (D)
(c) (C) and (D) (d) (A) and (D)
(e) (B) and (C)

32. Lenticels are involved in
(a) Photosynthesis (b) Food transport
(c) Conduction of water (d) Transpiration
(e) Gaseous exchange

33. Match the following.

(A)	Collenchyma	(1)	Specialized epidermal cells
(B)	Subsidiary cells	(2)	Mechanical support for growing plants
(C)	Casparian strips	(3)	Mesophyll tissue of dicot leaf
(D)	Spongy parenchyma	(4)	Suberin deposition in the radial walls of endodermis

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

34. Pick out the wrong statement
(a) Gymnosperms lack vessels in their xylem
(b) The cell wall of parenchyma is made up of pectin
(c) The first formed primary xylem elements are called protoxylem
(d) Gymnosperms have albuminous cells and have sieve cells in their phloem
(e) Intercellular spaces are absent in collenchyma

35. i. They help in respiration
ii. They help in cell wall formation
iii. They help in DNA replication
iv. They increase surface area of plasma membrane
Which of the following prokaryotic structures has all the above roles?
(a) Chromosome (b) Ribosome
(c) Mesosome (d) Lysosome
(e) Polysome

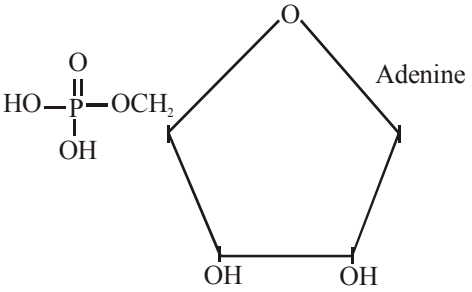
36. Match the Column I with that of Column II and choose the correct combination from the options given.

	Column I - Organelle		Column II - Site for
(A)	Rough ER	(1)	Synthesis of glycoproteins
(B)	Smooth ER	(2)	Aerobic respiration
(C)	Mitochondria	(3)	Synthesis of lipid
(D)	Golgi apparatus	(4)	Protein synthesis

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

37. Which of the following cell organelle is excluded from endomembrane system?
(a) Endoplasmic reticulum
(b) Mitochondria
(c) Golgi complex
(d) Lysosomes
(e) Vacuoles

38. The given organic compound is a diagrammatic representation of



(a) Lecithin (b) Adenosine
(c) Adenylic acid (d) Uridine
(e) Cholesterol

39. Which one of the following is the significance of mitosis?
(a) Restricted to haploid cells
(b) Cell repair
(c) Increases the genetic variability
(d) Recombination of chromosomes
(e) Leads to evolution of new genotypes

40. Which of the following statements about the structure of proteins is true?
(a) The sequence of amino acids in a protein represents the secondary structure
(b) The helices of proteins are always left handed
(c) Adult human hemoglobin consists of two subunits
(d) The left end of a protein is called the C-terminal and the right end is called the N-terminal
(e) Proteins are heteropolymers containing strings of amino acids

41. In a typical eukaryotic cell cycle, Gap 1, Synthesis and Gap 2 are the three phases included in the
(a) Prophase (b) Metaphase
(c) Anaphase (d) Interphase
(e) Telophase

42. Find out the correct statement
(a) During mitosis endoplasmic reticulum and nucleolus disappear completely at early prophase
(b) Chromosomes are arranged along the equator during prophase of mitosis
(c) Chromosome is made up of two sister chromatids at anaphase of mitosis
(d) A cell plate is laid down during interphase
(e) Small disc shaped structures at the surface of the centromeres that appear during metaphase are kinetochores

43. Which of the following secondary metabolites belong to the group drugs?
I. Morphine II. Curcumin III. Codeine IV . Vinblastine V. Abrin
(a) I and II only (b) I and V only
(c) II and III only (d) II and IV only
(e) III and IV only

44. Which of the following statements about the mass flow hypothesis is wrong?
(a) It is the accepted mechanism for translocation of sugars from source to sink
(b) As glucose is prepared at source it is converted to sucrose
(c) Sucrose is actively loaded into a sieve tube
(d) The process of loading at source produces a hypotonic condition in the phloem
(e) Water in the adjacent xylem moves into the phloem by osmosis

45. Pick out the wrong statement
(A) Apoplast is the system of adjacent cell walls that is continuous throughout the plant
(B) Endodermis is impervious to water molecules
(C) Pinus seeds germinate and establish without the presence of mycorrhizae
(a) (A) and (B) (b) (B) and (C)
(c) (C) only (d) (B) only
(e) (A) only

46. 3-phosphoglyceric acid (PGA) as the first CO_2 fixation product in algal photosynthesis was discovered by
(a) Joseph Priestley (b) Jan Ingenhousz
(c) T.W. Engelmann (d) Julius von Sachs
(e) Melvin Calvin

47. Match the following.

(A) Chlorophyll *a*	(1) yellow
(B) Chlorophyll *b*	(2) bright or blue green
(C) Xanthophyll	(3) yellow - yellow orange
(D) Carotenoids	(4) yellow green

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

48. Match the following and choose the correct option.

(A) Water potential	(i) It is usually positive
(B) Solute potential	(ii) It is zero for pure water
(C) Pressure potential	(iii) It is always negative

(a) (A) - (ii), (B) - (iii), (C) - (i)
(b) (A) - (i), (B) - (iii), (C) - (ii)
(c) (A) - (iii), (B) - (ii), (C) - (i)
(d) (A) - (ii), (B) - (i), (C) - (iii)
(e) (A) - (iii), (B) - (i), (C) - (ii)

49. Which of the following statements about plasmolysis is/ are true?

I. Plasmolysis occurs when water moves into the cell

II. Cells shrink in hypotonic solutions

III. If the external solution balances the osmotic pressure of the cytoplasm, it is said to be isotonic

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

50. FAD is electron acceptor in the citric acid cycle during the oxidation of

(a) Malic acid to oxaloacetic acid
(b) Succinic acid to malic acid
(c) Citric acid to alpha-ketoglutaric acid
(d) Alpha-ketoglutaric acid to succinic acid
(e) Oxaloacetic acid to citric acid

51. Maximum absorption of light by chlorophyll *a* occurs in which regions of the absorption spectrum?

(A) blue (B) red
(C) green (D) yellow
(a) (A) and (B) only (b) (B) and (C) only
(c) (A) and (D) only (d) (B) and (D) only
(e) (C) and (D) only

52. Match the Column I with that of Column II and choose the correct combination from the options given

	Column I - Essential elements		Column II - Deficiency causes
(A)	N, K, Mg, S, Fe, Mn, Zn, and Mo	(1)	Inhibit cell division
(B)	N, K, S and Mo	(2)	Necrosis
(C)	Ca, Mg, Cu and K	(3)	Delay in flowering
(D)	N, S and Mo	(4)	Chlorosis

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

53. In which one of the following reactions of glycolysis, oxidation takes place?

(a) Glucose 6-phosphate to fructose 6-phosphate
(b) Fructose 6-phosphate to fructose 1, 6-bisphosphate
(c) 1, 3-bisphosphoglycerate to 3-phosphogyceric acid
(d) 3-phosphoglyceraldehyde to 1, 3-bisphosphoglycerate
(e) 2-phosphoglycerate to phosphoenol pyruvate

54. Cyclic-photophosphorylation results in the formation of

(a) $NADPH + H^+$
(b) ATP and $NADPH + H^+$
(c) ADP
(d) ATP
(e) ADP and NADP

55. Select the correctly matched pair

(a) C. Darwin and S.F. Darwin – Gibberellic acid
(b) F.W. Went – Auxin
(c) E. Kurosawa – Ethylene
(d) Skoog and Miller – Abscisic acid
(e) Cousins – Cytokinin

56. One hormone stimulates the closure of stomata and another one influences the swelling of the axis in dicot plants. They are

(a) Gibberellins and ethylene
(b) Abscisic acid and cytokinins
(c) Gibberellins and cytokinins
(d) Auxin and cytokinins
(e) Abscisic acid and ethylene

57. Which of the following statements regarding photoperiodism is false?

(a) The response of plants to periods of light/day is termed photoperiodism
(b) The shoot apices cannot perceive photoperiods
(c) In day neutral plants there is no correlation between exposure to light duration and induction of flowering response
(d) Shoot apices modify themselves into flowering apices prior to flowering
(e) The site of perception of the light/dark duration is the flower

58. The residual persistent nucellus in the seed of black pepper and beet is called

(a) Perisperm (b) Endosperm
(c) Pericarp (d) Scutellum
(e) Apomixis

59. Consider the following statements with respect to flowering plants

(A) The pollen grains represent the male gametes
(B) The functional megaspore developing into the embryo sac represent the female gamete
(C) Transfer of pollen grains from anther to the stigma of different plant is known as xenogamy
(D) Transfer of pollen grains from anther to the stigma of another flower of the same plant is known as geitonogamy

Of the above statements

(a) (A) and (B) alone are correct
(b) (A) and (C) alone are correct
(c) (A) and (D) alone are correct
(d) (B) and (C) alone are correct
(e) (C) and (D) alone are correct

60. Which of the following is false in angiosperms?

(a) Egg cell – Haploid
(b) Megaspore – Diploid
(c) Pollen grain – Haploid
(d) Synergid – Haploid
(e) Endosperm – Triploid

61. Each secondary spermatocyte after second meiotic division produces
(a) four haploid spermatids
(b) only one haploid spermatid
(c) two haploid spermatids
(d) two diploid spermatids
(e) four diploid spermatids

62. The hormone releasing IUD is
(a) LNG20
(b) Lippes loop
(c) CuT
(d) Multiload 375
(e) Cu7

63. Read the statements regarding a stable community and choose the correct option
(1) must be resistant to occasional disturbances
(2) should show much variation in productivity from year to year
(3) must be resistant to invasions by alien species
(a) (1) and (2) are correct
(b) (1), (2) and (3) are correct
(c) (1) only is correct
(d) (2) and (3) are correct
(e) (1) and (3) are correct

64. Find the wrongly matched pair
(a) Endemism - species confined to a region and not found anywhere else
(b) Hot spots - Western ghats
(c) Sacred groves - Jaintia hills of Rajasthan
(d) *ex situ* conservation - Zoological parks
(e) Alien species to India - Water hyacinth

65. The cytokine barrier among these is
(a) Polymorphonuclear neutrophil
(b) Monocyte
(c) NK cell
(d) Interferon
(e) Macrophage

66. Ringworms are caused by
I. *Wuchereria* II. *Microsporum*
III. *Haemophilus* IV. *Epidermophyton*
(a) I and II (b) II and III
(c) II and IV (d) I and IV
(e) III and IV

67. Read the statements
(1) IgE antibodies are produced in an allergic reaction
(2) B-lymphocytes mediate cell mediated immunity
(3) The yellowish fluid colostrum has abundant IgE antibodies
(4) Spleen is a secondary lymphoid organ
Of the above statements
(a) (1) only is correct (b) (1) and (2) are correct
(c) (2) and (3) are correct (d) (3) and (4) are correct
(e) (1) and (4) are correct

68. The microbial biocontrol agent for butterfly caterpillar is
(a) *Bacillus thuringiensis* (b) *Sacchromyces*
(c) *Lactobacillus* (d) *Cyanobacteria*
(e) *Staphylococcus*

69. The first human-like hominid was called
(a) *Homo habilis* (b) *Homo erectus*
(c) *Homo sapiens* (d) Dryopithecus
(e) Ramapithecus

70. Oparin and Haldane proposed
(a) the theory of natural selection
(b) that migration affects genetic equilibrium
(c) that mutations caused speciation
(d) that the first form of life could have come from pre-existing non-living organic molecules
(e) that evolution of life forms had been driven by use and disuse of organs

71. Choose the wrong pair
(a) Divergent evolution – Forelimbs of whales, bats, cheetah and human
(b) Convergent evolution – Flippers of penguins and dolphins
(c) Homologous structures – Vertebrate hearts
(d) Analogous structures – Tendrils of *Bougainvillea* and *Cucurbita*
(e) Adaptive radiation – Darwin's finches

72. Flame cells of flatworms help in
(i) osmoregulation
(ii) digestion
(iii) reproduction
(iv) excretion
(v) bioluminescence
(a) (ii) only is correct
(b) (i) and (iv) are correct
(c) (iii) only is correct
(d) (i) and (v) are correct
(e) (iv) and (v) are correct

73. Read the statements regarding echinoderms and choose the correct option
(1) All are marine with organ system level of organisation
(2) Adults are bilaterally symmetrical
(3) They are dioecious
(4) Fertilisation is internal and indirect development is observed
(5) Triploblastic and acoelomate animals
(a) (1) and (3) are correct
(b) (5) alone is correct
(c) (1), (3) and (5) are correct
(d) (1) and (5) are correct
(e) (1) and (2) are correct

74. This class of animals are all ectoparasites on some fishes
(a) Amphibia (b) Osteichthyes
(c) Reptilia (d) Cyclostomata
(e) Chondrichthyes

75.

Organ	Phylum	Function
Parapodia	Annelida	?**A**
?**B**	Ctenophora	Locomotion
?**C**	Mollusca	Rasping organ
Malpighian tubules	Arthropoda	?**D**
Cnidoblasts	Coelenterata	?**E**

From the above table find out the missing organ or function – **A**, **B**, **C**, **D** and **E** respectively

(a) (A) swimming (B) comb plates (C) radula (D) excretion (E) defense

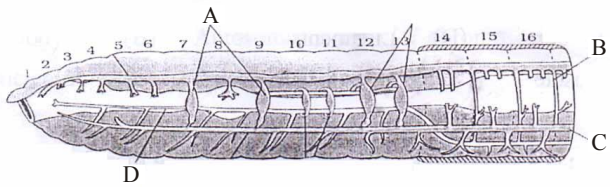
(b) (A) defense (B) radula (C) comb plates (D) excretion (E) swimming

(c) (A) defense (B) radula (C) comb plates (D) swimming (E) excretion

(d) (A) protection (B) parapodia (C) visceral mass (D) locomotion (E) excretion

(e) (A) swimming (B) parapodia (C) comb plates (D) anchorage (E) digestion

76. In the circulatory system of *Pheretima*, A, B, C and D represents



(a) (A) Lateral hearts (B) Sub neural vessel (C) Commissural vessel (D) Lateral oesophageal vessel

(b) (A) Lateral hearts (B) Lateral oesophageal vessel (C) Sub neural vessel (D) Commissural vessel

(c) (A) Lateral hearts (B) Commissural vessel (C) Sub neural vessel (D) Lateral oesophageal vessel

(d) (A) Commissural vessels (B) Lateral hearts (C) Lateral oesophageal vessel (D) Sub neural vessel

(e) (A) Commissural vessel (B) Lateral hearts (C) Sub neural vessel (D) Lateral oesophageal vessel

77. The structure in earthworm which serves as a wedge to force open cracks in the soil is

(a) Peristomium (b) Setae (c) Clitellum (d) Typhlosole (e) Prostomium

78. Which among these is not involved in excretion in cockroaches?

(a) Malphigian tubules (b) Nephrocytes (c) Urecose glands (d) Maxillary palps (e) Fat body

79. Frogs

(a) are uricotelic
(b) have olfactory lobes in the midbrain
(c) do not have renal portal system
(d) have lymphatic system
(e) have gall bladder which secretes bile

80. Most of the cartilages in vertebrate embryo are replaced in adult by

(a) Blood (b) Bones (c) Tendons (d) Ligaments (e) Muscle

81. Which one is a specialized connective tissue among these?

(a) Adipose tissue (b) Bone (c) Areolar tissue (d) Fibroblasts (e) Muscle

82. The moiety present at the 5' end of ribose sugar in a polynucleotide is

(a) OH (b) CH_2 (c) Phosphate (d) Adenine (e) 5' methyluracil

83. $\frac{1}{4}$ TT : $\frac{1}{2}$ Tt : $\frac{1}{4}$ tt is the binomial expansion of

(a) $\left(\frac{1}{2}T+\frac{1}{2}t\right)^2$ (b) $\left(\frac{1}{4}T+\frac{1}{4}t\right)^2$

(c) $\left(\frac{1}{4}T+\frac{1}{2}t\right)^2$ (d) $\left(\frac{1}{2}T+\frac{1}{4}t\right)^2$

(e) $\left(T+\frac{1}{2}t\right)^2$

84. Three alleles namely I^A, I^B and **i** control the blood grouping in human beings. How many different genotypes are likely to be present in the human population?

(a) 2 (b) 4 (c) 5 (d) 6 (e) 7

85. An example for codominance
(a) Eye colour in *Drosophila*
(b) Seed shape and colour in pea plants
(c) ABO blood group in man
(d) Haemophilia in man
(e) Baldness in man

86. The nuclear structure observed by Henkings in 50% of the insect sperm after spermatogenesis was
(a) X body (b) Autosome
(c) Y chromosome (d) Nucleolus
(e) Polar body

87. Physical association of genes on a chromosome is called
(a) Repulsion (b) Linkage
(c) Aneuploidy (d) Duplication
(e) Polyploidy

88. In the double-helical structure of DNA, the pitch of the helix is
(a) 3.4 nm (b) 0.34 nm
(c) 6.6 nm (d) 34 nm
(e) 6.6×10^{-9}m

89. In the ribose of RNA, unlike DNA, every nucleotide residue has an additional
(a) COOH group in the 2'position
(b) OH group in the 5' position
(c) OH group in the 2'position
(d) Phosphate group in the 2' position
(e) Uracil in the 5' position

90. What is a nucleosome?
(a) A vesicle containing positively charged histones within nucleolus
(b) They are similar to endosomes
(c) A structure formed by wrapping of negatively charged DNA around positively charged histone octamer
(d) They are the transforming principles discovered by Griffith
(e) Negatively charged histone octamers

91. Microsatellites are
(a) Repetitive DNA sequences
(b) ESTs
(c) YAC
(d) BAC
(e) UTR

92. Some amino acids are coded by more than one codon as the code is
(a) unambiguous (b) specific
(c) universal (d) punctuated
(e) degenerate

93. DNA replicates semi-conservatively was first shown in
(a) *Vicia faba*
(b) *E. coli*
(c) *Streptococcus pneumoniae*
(d) *Drosophila*
(e) *Caenorhabditis elegans*

94. The enzyme that catalyses transcription of RNA in bacteria
(a) DNA dependent RNA polymerase
(b) RNA polymerase I
(c) DNA polymerase
(d) RNA polymerase II
(e) RNA polymerase III

95. A molecule to act as a genetic material has the following properties
(i) should be able to replicate
(ii) should be structurally more stable
(iii) should be more reactive and labile
(iv) should provide scope for slow changes
Choose the correct option
(a) (i), (ii) and (iii) are correct
(b) (iii) alone is correct
(c) (iii) and (iv) are correct
(d) (i), (ii) and (iv) are correct
(e) (i) alone is correct

96. Choose the correct statement among the following
(a) Taylor and his colleagues used *E.coli* to prove semi-conservative replication of DNA
(b) In Griffith's experiment the mice infected with R-strain of *streptococcus pneumoniae* died due to pneumonia
(c) Hershey and Chase proved the transforming principle experimentally
(d) Meselson and Stahl grew *staphylococcus* in a medium containing cesium chloride to prove DNA is the genetic material
(e) Semi-conservative replication was experimentally proved by Meselson and Stahl

97. A nanometre is
(a) 10^{-9}m (b) 10^{-4}m
(c) 10^{-6}m (d) 10^{-12}m
(e) 10^{9}m

98. The precursor of eukaryotic mRNA is
(a) 5srRNA (b) tRNA
(c) rRNA (d) snRNA
(e) hnRNA

99. The disorder caused by point mutation is
(a) Down's syndrome (b) Sickle cell anemia
(c) Klinefelter's syndrome (d) Tetany
(e) Turner's syndrome

100. The secretions of the brush border cells of the intestinal mucosa along with the secretion of goblet cells constitute the
(a) succus entericus (b) chyme
(c) gastric juice (d) chylomicrons
(e) bolus

101. The volume of air that will remain in the lungs after a normal expiration is called
(a) vital capacity
(b) functional residual capacity
(c) residual volume
(d) total lung capacity
(e) inspiratory capacity

102. Choose the correct statement among the following
(a) The intestional mucosal epithelium has oxynitic cells
(b) Ptyalin converts proteins into proteoses and peptones
(c) Crypts of Lieberkuhn is seen between the bases of villi in the intestine
(d) Sphincter of Oddi is present at the junction of oesophagus and cardiac stomach
(e) Goblet cells secrete hydrochloric acid in stomach

103. The body temperature regulatory centre in the brain is
(a) cerebellum (b) corpus callosum
(c) hypothalamus (d) hippocampus
(e) amygdala

104. Identify the correctly matched structure and its secretion
(a) Brunner's gland - Salivary amylase
(b) Intestinal mucosa - Insulin
(c) Gall bladder - Bile
(d) Salivary gland - Lysozyme
(e) Goblet cells - HCl

105. The entry of food into the larynx is prevented by
(a) Mitral valve (b) Diaphragm
(c) Epiglottis (d) Hyoid
(e) Frenulum

106. Incomplete double circulation is seen in
(a) Fish (b) Amphibians
(c) Birds (d) Mammals
(e) Arthropods

107. Gliding joint is present between the
(a) Carpals
(b) Humerus and pectoral girdle
(c) Carpal and metacarpal of thumb
(d) Knee
(e) Atlas and Axis

108. Choose the correct statement among the following
(a) Atrio-ventricular node is the pace maker that generates action potential and initiates the atrial systole
(b) During each cardiac cycle, the 'lub' sound is due to the closure of semilunar valves
(c) Stroke volume in each cardiac cycle is approximately 170 ml of blood
(d) QRS complex in an ECG indicates depolarisation of ventricles
(e) The opening between right atrium and right ventricle is guarded by bicuspid valve

109. Choose the wrong statement regarding urine formation
(a) Filtration is non-selective process performed by glomerulus
(b) The glomerular capillary blood pressure causes filtration of blood through three layers
(c) GFR in a healthy individual is approximately 125 ml/min
(d) A fall in GFR activates the JG cells to release renin
(e) The ascending limb of the Henle's loop is permeable to water but allows transport of electrolytes actively or passively

110. Vasa recta refers to
(a) rectum region of the insects
(b) blood capillaries in invertebrates
(c) a fine blood capillary network of afferent arteriole
(d) a fine capillary which runs parallel to Henle's loop
(e) juxtaglomerular complex of nephrons

111. Find the wrongly matched pair.

	Animal		Excretory organ/Structure
(a)	Balanoglossus	-	Proboscis gland
(b)	Earthworm	-	Nephridia
(c)	Grasshopper	-	Malpighian tubules
(d)	Prawn	-	Flame cells
(e)	Amphioxus	-	Protonephridia

112. The condition in which the kidneys fail to conserve water leading to water loss and dehydration due to impaired ADH synthesis or release is
(a) Grave's disease
(b) Addison's disease
(c) Diabetes insipidus
(d) Cretinism
(e) Acromegaly

113. The lumbar region of the vertebral column in man is made up of
(a) 1 fused vertebra (b) 7 vertebrae
(c) 12 vertebrae (d) 5 vertebrae
(e) 2 vertebrae

114. Muscles of the heart are
(a) striated and voluntary
(b) non-striated and voluntary
(c) striated, unbranched and involuntary
(d) non-striated and involuntary
(e) striated, branched and involuntary

115. The skeletal muscle fibre is a 'syncytium', which means it is
(a) made up of many fibres
(b) made up of many proteins
(c) long and slender
(d) swollen in the middle with tapered ends
(e) multinucleated

116. The anterior portion of the sclera is called
(a) Lens (b) Iris
(c) Pupil (d) Ciliary body
(e) Cornea

117. The projecting ridge in ampulla of semi-circular canals in ear is called
(a) Succus entericus (b) Maccula
(c) Otolith (d) Crista ampullaris
(e) Cochlea

118. The pars distalis region of pituitary does not produce these hormones

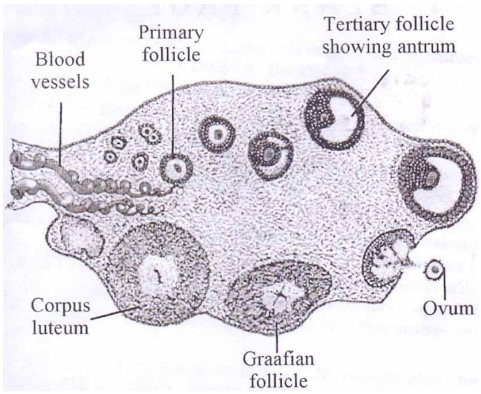
I. Melanocyte stimulating hormone
II. Vasopressin
III. Prolactin
IV. Growth hormone

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

119. Function of the somatostatin is to

(a) stimulate pituitary synthesis and release gonadotropins
(b) inhibit the release of gonadotropins from pituitary
(c) stimulate pituitary and promotes the secretion of growth hormone
(d) inhibit the release of growth hormone from the pituitary
(e) stimulate the secretion of thyrotropin from thyroid

120. Identify the wrongly labelled part



(a) Primary follicle
(b) Ovum
(c) Graafian follicle
(d) Corpus luteum
(e) Tertiary follicle

HINTS & SOLUTIONS

Paper-I : Chemistry & Physics

1. (c) (i) $n = 2, l = 0, m_l = 0, m_s = +1/2$ is a possible set

(ii) For $n = 3$, value of l and n cannot be the same

$\therefore \quad l \neq 3$

(iii) For $l = 1$, $m_l \neq 2$ as $m_l > l$ is not possible

(iv) $m_s = 0$ is incorrect

2. (a) 1000 mL of 1 M HCl contains HCl = 1 mole = 36.5g

$$20 \text{ mL of 1 M HCl will contain } = \frac{36.5 \times 20}{1000} = 0.73 \text{ HCl}$$

Given, $CaCO_3 + 2\,HCl \rightarrow CaCl_2 + CO_2 + H_2O$

2 mol of HCl i.e. $2 \times 36.5 = 73$g HCl react completly with $CaCO_3$ = 1 mol = 100g

$$0.73 \text{ g HCl will react with } CaCO_3 = \frac{100 \times 0.73}{73} = 1\text{g}.$$

3. (e) $$16 \text{ g of } O_2 = \frac{16}{32}\text{mole} = \frac{1}{2}\text{mole}$$

$$16\text{g of } NO_2 = \frac{16}{46}\text{mole} = \frac{8}{23}\text{mole}$$

$$4\text{g of } N_2 = \frac{4}{28}\text{mole} = \frac{1}{7}\text{mole}$$

$$2\text{g of } H_2 = \frac{2}{2}\text{mole} = 1\text{mole}$$

$$32\text{g of } N_2 = \frac{32}{28}\text{mole} = \frac{8}{7}\text{mole}$$

$\therefore$ 32g N_2 has maximum number of molecules.

4. (a) 2.0 M solution means 2 moles of solute in 1000 mL solution.

$$\text{Density} = 1.2\ \text{gmL}^{-1} = \frac{\text{Weight of solution}}{\text{Volume of solution}}$$

Weight of solution = $1.2 \times 1000 = 1200$ g

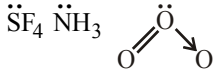
Weight of 2 moles of solute = $2 \times 100 = 200$g

Weight of solvent = 1200 g – 200g = 1000g

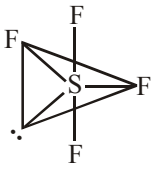
$$\text{Molality} = \frac{\text{Number of moles}}{\text{Weight of solvent}} \times 1000$$

$$= \frac{2}{1000} \times 1000 = 2\text{m}$$

5. (b) SF_4, NH_3 and O_3 contain one lone pair of electrons



6. (b) $\because$ SF_4 has see saw shaped.



7. (c) Electronic configuration of $Li_2 - \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2$

$$\text{B.O} = \frac{N_b - N_a}{2} = \frac{4-2}{2} = 1, \text{ No unpaired } e^-$$

$\therefore$ diamagnetic.

$B_2 - \sigma 1s^2, \sigma^* 1s^2, \sigma 2s^2, \sigma^* 2s^2, \pi 2p_x^{\,1}, \pi 2py^1$

$$\text{B.O} = \frac{N_b - N_a}{2} = \frac{6-4}{2} = 1, \text{ two unpaired } e^-s$$

$\therefore$ paramagnetic.

8. (c) SCl_2 obeys the octet rule.

In BF_3 and $AlCl_3$ the central atom has less than 8 electrons.

XeF_4 and $XeOF_2$ are compounds of noble gases which have already complete octets.

9. (e) Given,

Mass of He = mass of O_2 = mass of SO_2 = M

$$\text{Moles of He} = \frac{M}{2}$$

$$\text{Moles of } O_2 = \frac{M}{16}$$

$$\text{Moles of } SO_2 = \frac{M}{32}$$

$$\text{Mole fraction of He} = \frac{\frac{M}{2}}{\frac{M}{2}+\frac{M}{16}+\frac{M}{32}} = \frac{16}{19}$$

$$\text{Mole fraction of } O_2 = = \frac{\frac{M}{16}}{\frac{M}{2}+\frac{M}{16}+\frac{M}{32}} = \frac{2}{19}$$

$$\text{Mole fraction of } SO_2 = = \frac{\frac{M}{32}}{\frac{M}{2}+\frac{M}{16}+\frac{M}{32}} = \frac{1}{19}$$

Let total pressure = P

Partial pressure = mole fraction × Total pressure.

Partial pressure of He $= \frac{16}{19}P$

Partial pressure of $O_2 = \frac{2}{19}P$

Partial pressure of $SO_2 = \frac{1}{19}P$

Ratio of Partial pressure of He: $O_2 : SO_2$

$= \frac{16}{19}P : \frac{2}{19}P : \frac{1}{19}P = 16 : 2 : 1$

10. (c) Water vapour has highest critical temperature. It is easily liquefiable.

11. (d) NaCl - diamagnetic
MnO - anti ferromagnetic
$CrCl_3$ - paramagnetic
CrO_2 - ferromagnetic
$MgFe_2O_4$ - ferrimagnetic

12. (e)

Digit	Name
0	nil
1	un
2	bi

$\therefore$ IUPAC name of the element with atomic number 120 is unbinilium.

13. (a) On moving from left to right in a period, atomic size and ionic size decreases.
So Mg > Al and $Mg^{2+} > Al^{3+}$

14. (b) Electron gain enthapies become more negative across a period and less negative down the group.

15. (a) Beryllium halides are covalent and soluble in organic solvents while rest are ionic in nature.

16. (a) Calcium is responsible for the neuromuscular function in the body.

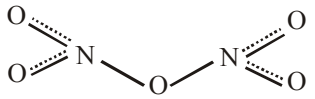
17. (c) Sodium salts give yellow colour in the flame test. Sodium sulphate on reaction with barium chloride, forms an insoluble white precipitate of barium sulphate.

18. (a) Hypophosphorus acid reduces silver nitrate to metallic silver.

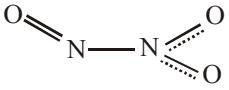
$$4AgNO_3 + 2H_2O + \underset{\text{Hypophosphorus acid}}{H_3PO_2} \longrightarrow 4Ag + 4HNO_3 + \underset{\text{orthophosphoric acid}}{H_3PO_4}$$

19. (e) Metal borides are able to absorb a large number of neutrons due to which these are used in nuclear industry as control rods and protective shields.

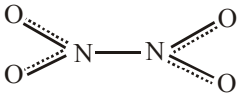
20. (c) N = N = O
Dinitrogen oxide



Dinitrogen pentaoxide



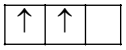
Dinitrogen trioxide



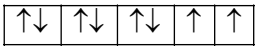
Dinitrogen tetraoxide

21. (d) As we move along a particular series, since the number of unpaired electrons increases, the melting points of the elements also increase. Although Mn has maximum number of unpaired electrons among given elements but its melting point value is low because metallic bonding in Mn is relatively weak.

22. (c) Electronic configuration of V: $[Ar]\,4s^2\,3d^3$
For V^{3+}: $[Ar]\,3d^2$

or 

i.e., 2 unpaired electrons
For Ni^{2+}: $[Ar]3d^8$

or 

i.e. 2 unpaired electrons
Therefore V^{3+} and Ni^{2+} have two unpaired electrons.
$Ti^{3+} \Rightarrow [Ar]3d^1$ (1 unpaired electron)
$Fe^{3+} \Rightarrow [Ar]3d^5$ (5 unpaired electrons)
$Cr^{3+} \Rightarrow [Ar]3d^3$ (3 unpaired electrons)
$Mn^{2+} \Rightarrow [Ar]3d^5$ (5 unpaired electrons).

23. (b) Neptunium (Np) and plutonium (Pu) show highest oxidation state of + 7

24. (a) Value of M^{2+}/M standard reduction potential becomes progressively less negative from Ti($E^\circ = -1.63$V) to Cu ($E^\circ = +0.34$V). Ti has the highest negative M^{2+}/M standard reduction potential value.

25. (d) $CuSO_4(s) + 5H_2O(l) \rightarrow CuSO_4.5H_2O(s)$

$$\Delta H = \Delta H_1 \text{ kJ mol}^{-1}$$

$CuSO_4.5H_2O(s) + aq \rightarrow CuSO_4(aq)$

$$\Delta H = \Delta H_2 = -11.7 \text{ kJ mol}^{-1}$$

According to Hess's law,
$\Delta H_1 + \Delta H_2 = -65.5 \text{ kJ mol}^{-1}$
$\Delta H_1 - 11.7 = -65.5$
$\Delta H_1 = -65.5 + 11.7 = -53.8 \text{ kJ mol}^{-1}$

26. (a) Given, $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

$\Delta_f H^\circ = -91.8 \text{ kJ mol}^{-1}$

Heat required to decompose 1 mole i.e.
$17 \text{ g } NH_3 = 91.8 \text{ kJ mol}^{-1}$
Heat required to decompose 34 g NH_3

$= \frac{91.8}{17} \times 34 = 2 \times 91.8 = 183.6 \text{ kJ mol}^{-1}$.

27. (N) None of the given option is correct.

$V_f = 25L, V_i = 2.5L$

$T = 300K, R = 8.2 \times 10^{-2}$ L atm K^{-1} mol^{-1}

For isothermal reversible expansion

$$W = -2.303\ nRT \log \frac{V_f}{V_i}$$

$$= -2.303 \times \frac{16}{32} \times 8.2 \times 10^{-2} \times 300 \log \frac{25}{2.5}$$

$$= -2.303 \times \frac{1}{2} \times 8.2 \times 10^{-2} \times 300$$

$= -28.32$ L atm.

28. (d) For reaction

$C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2O(g)$

$n_p > n_r$ (gaseous)

Therefore increase in pressure for production of 'syngas' by coal gasification favours backword reaction.

(i) $N_2(g) + 3H_2(g) \rightleftharpoons NH_3(g)\ (n_r > n_p)$
Increase in pressure will favour forward reaction.

(ii) $2HI(g) \rightleftharpoons H_2(g) + I_2(g)\ (n_r = n_p)$
Pressure has no effect on reaction.

(iii) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)\ (n_r > n_p)$
Increase in pressure will favour forward reaction

(iv) $3Fe(s) + 4H_2O(g) \rightleftharpoons Fe_3O_4(s) + 4H_2(g)$
Here $n_r = n_p$ (gaseous), so no effect of pressure.

29. (b) $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

$$K_c^1 = \frac{[NO]^2}{[N_2][O_2]} = \frac{\left(1.4 \times 10^{-3} M\right)^2}{\left(0.36 \times 10^{-3} M\right)\left(4.41 \times 10^{-3} M\right)}$$

$$= \frac{(1.4)^2}{0.36 \times 4.41}$$

For reaction,

$$NO(g) \rightleftharpoons \frac{1}{2} N_2(g) + \frac{1}{2} O_2(g)$$

$$K_c = \frac{[N_2]^{\frac{1}{2}}[O_2]^{\frac{1}{2}}}{[NO]} = \sqrt{\frac{1}{K_c^1}}$$

$$K_c = \sqrt{\frac{(0.36 \times 4.41)}{(1.4)^2}} = \frac{(0.36 \times 4.41)^{\frac{1}{2}}}{1.4} = 0.9$$

30. (a) $MX_2 \rightarrow \underset{s}{M^{2+}} + \underset{2s}{2X^-}$

$K_{sp} = [s]\,[2s]^2 = 4s^3$

Given, $K_{sp} = 4s^3 = 4 \times 10^{-12}$

$$s = \sqrt[3]{\frac{4 \times 10^{-12}}{4}} = 1 \times 10^{-4} M$$

$\therefore$ Concentration of M^{2+} ions $= 1 \times 10^{-4}$ M

31. (d) NH_2^- can act only as Bronsted base while H_2O, HSO_4^-, HCO_3^- and NH_3 can act both at Bronsted acid and base.

32. (a) Consider following association reaction,

	nA	$\rightleftharpoons$	$(A)_n$
Initial mole	1 mole		0
Associated change	$-\alpha$ mole		$+\alpha/n$ mole
Equilibrium mole	$(1-\alpha)$ mole		α/n mole

Total number of moles after association of 1 mole of A

$$= (1-\alpha) + (\alpha/n) \text{ mole}$$

Total no. of moles $= 1 - \alpha + \frac{\alpha}{n}$

van't Hoff factor (i)

$$= \frac{\text{Number of moles after association}}{\text{Normal number of mole taken}}$$

$$= \frac{1 - \alpha + \frac{\alpha}{n}}{1}$$

$$\therefore \text{ degree of association } \alpha = \frac{i-1}{\frac{1}{n} - 1} = \alpha = \frac{n(i-1)}{1-n}$$

33. (c) Dissociation of AB_2 is given as,

$AB_2 \rightarrow A^{2+} + 2B^-$

$i = 3$

Relative lowering of vapour pressure

$$\Rightarrow \frac{p^\circ - p_s}{p^\circ} = i \times \frac{n_2}{n_1 + n_2}$$

Here, $p^\circ = 100$ mm Hg

$n_1 = 99$ moles, $n_2 = 1$ mole

On substituting these values

$$\frac{100 - p_s}{100} = 3 \times \frac{1}{100}$$

$p_s = 97$ mm Hg

34. (e) Osmotic pressure is directly proportional to the number of particles in the solution. KCl will dissociate completely in the solution, while CH_3COOH and sucrose are weak electrolyte. Hence correct order will be :

$$KCl > CH_3COOH > \text{Sucrose}$$

35. (c) Among given elements only Iodine shows both positive and negative oxidation state.

36. (b) When reduction and oxidation takes place on same element of a compound, it is called disproportionation reaction.

In the reaction,

$P_4(s) + 3NaOH(aq) + 3H_2O(l) \rightarrow PH_3(g) + 3NaH_2PO_2(aq)$

P_4 is reduced to PH_3 and oxidised to NaH_2PO_2.

37. (c) Lower the standard reduction potential of a species, higher will be its reducing power.
Hence, the order of reducing power is Y > Z > X.

38. (d) Given, $a_0 = 80\% = 0.80$
$a_t = 8\% = 0.08$
t = 4606 second

$$k = \frac{2.303}{t}\log\frac{a_0}{a_t} = \frac{2.303}{4606}\log\frac{0.80}{0.08} = 5\times10^{-4}\,s^{-1}$$

39. (a) $2N_2O_5 \rightarrow 4NO_2 + O_2$

$$-\frac{1}{2}\frac{d[N_2O_5]}{dt} = \frac{1}{4}\frac{d[NO_2]}{dt}$$

$$-\frac{1}{2}\frac{[(2.0-2.4)]}{200} = \frac{1}{4}\frac{d[NO_2]}{dt}$$

$$\frac{d[NO_2]}{dt} = -\frac{1}{2}\times\frac{(-0.4)}{200}\times 4$$

$= 4\times10^{-3}$ mol L^{-1} min^{-1}.

40. (a) Concentration of reactant decreases from 0.6 M to 0.3 M in 30 minutes.
i.e. $t_{1/2}$ = 30 minutes
(as concentration decreases half of the initial value)
When concentration changes from 0.1 to 0.025 M

$$\text{i.e. } 0.1 \rightarrow \frac{0.1}{2} = 0.05 \rightarrow \frac{0.05}{2} = 0.025$$

This shows that time taken for the concentration to change from 0.1 to 0.025 M = $2t_{1/2}$
$= 2 \times 30 = 60$ min.

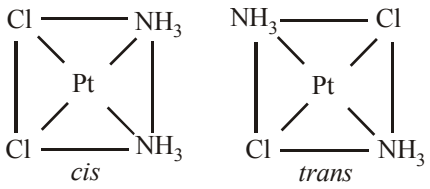
41. (b) Easily liquefiable gas i.e. gas with higher critical temperature adsorbed more easily.
Hence, order of adsorption will be.

$$H_2 < CH_4 < SO_2$$

42. (b) $CO(g) + H_2(g) \xrightarrow{Cu} \underset{\text{methanal}}{HCHO}$

43. (c) As physisorption involves no chemical reaction, no activation energy is required for the adsorption to occur.

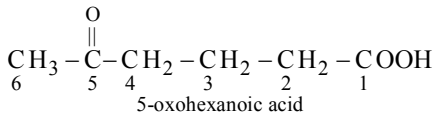
44. (d) $Pt(NH_3)_2Cl_2$ is a disubstituted complex and shows only *cis*-& *trans*-isomers



45. (a) Complexes having only one type of ligand are called homoleptic complexes.
In Tris (ethane-1, 2-diamine) cobalt (III) chloride only ethane-1, 2-diamine is present as ligand.

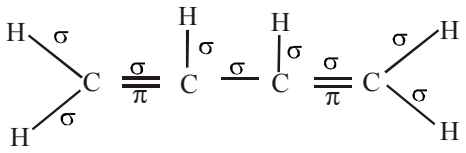
46. (e) Coordination number = 6
(As ethylene diamine is a bidentate ligand)
Oxidation Number :
$x + 2(-1) + 0 - 1 = 0$
$x - 3 = 0$
$x = 3$
Numer of d-electrons.
Electronic configuration of Co = [Ar] $3d^7 4s^2$
For Co^{3+} = [Ar]$3d^6$
$\therefore$ No. of d - electrons = 6

47. (e)



5-oxohexanoic acid

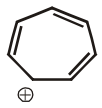
48. (a)



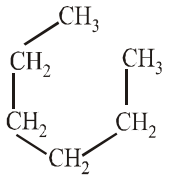
1, 3 - butadience

Number of σ bonds = 9, Number of π bonds = 2

49. (b) Cycloheptatrienyl cation is aromatic



50. (c)



$$\frac{Cr_2O_3, V_2O_5, Mo_2O_3 / Al_2O_3}{773K, 10-20\,atm}$$



Benzene

This process is called Aromatization.

51. (b) Buta-1,3-diene is not an isomer of 3-methylbut-1-yne

52. (d) As the *s*-character decreases from *sp* - to sp^2 - to sp^3 - carbon atoms (alkyne - *sp* hybridised, alkene-sp^2 hybridised, alkane - sp^3 hybridised),the acidic character of hydrocarbons decreases in the following order :
$CH \equiv CH > CH_2 = CH_2 > CH_3 - CH_3$,

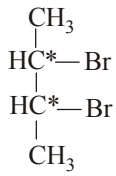
53. (d) $CH_3 - CH = CH - CH = CH - CH_3$
2, 4-hexadiene

$$\xrightarrow{\text{ozonolysis}} \underset{\text{ethanal}}{2CH_3CHO} + \underset{\text{ethanedial}}{OHC - CHO}$$

54. (d) Acid catalysed hydration of alkene is electrophilic addition

55. (e) Except benzene all other compounds contain deactivating groups $-COCH_3$, $-CN$, $-CHO$, $-COOH$. Therefore, benezene undergoes nitration reaction most readily.

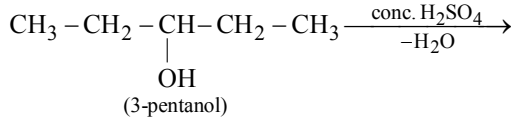
56. (d)



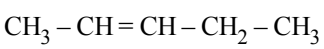
This is a symmetrical molecule.
Number of chiral carbon (n) = 2 (even number)
Number of *d* and *l* forms (a) $= 2^{(n-1)} = 2^{(2-1)} = 2$

Number of meso forms (m) $= 2^{\left(\frac{n}{2}-1\right)} = 2^{\left(\frac{2}{2}-1\right)} = 1$
Total number of optical isomers (a + m) = 2 + 1 = 3.

57. (e)



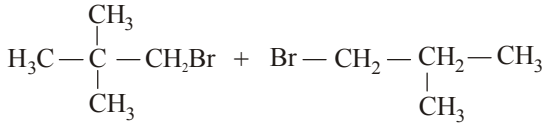
(3-pentanol)



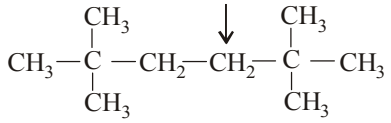
(2-pentene)

2-pentene shows cis-trans isomerism

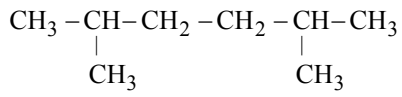
58. (b)



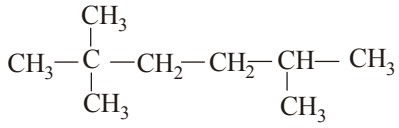
Neopentyl bromide isobutyl bromide



2, 2, 5,5 - tetramethyl hexane



2, 5-dimethyl hexane

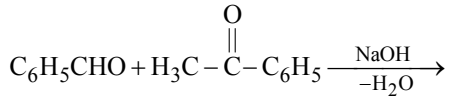


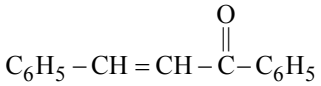
2,2,5-Trimethy hexane

59. (c) Neopentyl chloride does not readily undergo dehydrohalogenation

60. (d) Stephen's reaction is used to prepare aldehydes only.

61. (c)

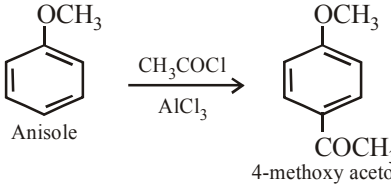




1, 3-diphenylprop-2-en-1-one

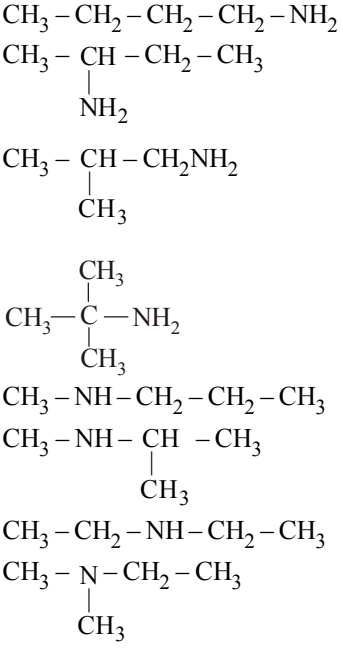
62. (c) Glutaric acid is pentane –1, 5– dioic acid
$HOOC-CH_2-CH_2-CH_2-COOH$

63. (c) Friedel-Crafts reaction



Anisole 4-methoxy acetophenone

64. (e) 8 structural isomers are possible for $C_4H_{11}N$ which are shown below:



65. (d) Ethylmethylamine is a secondary amine. It cannot be prepared by Gabriel phthalimide synthesis.
$CH_3CH_2NHCH_3$
Ethylmethyl amine

66. (d) Diethylamine is secondary amine. It gives an alkali insoluble product with p-toluenesulphonyl chloride

67. (c) Cyclohexylamine is most basic because there is no delocalisation of the lone pair of electrons on nitrogen in it.

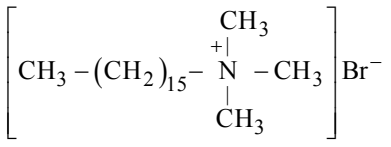
68. (d) Glucose does not react with $NaHSO_3$

69. (c) Vitamin B_1 is soluble in water. Vitamin A, D, E and K are fat soluble vitamins.

70. (e) Low density polythene is used in the manufacture of squeeze bottles

71. (d) The drug Tegamet is an antacid

72. (b) Cetyltrimethyl, ammonium bromide is a cationic detergent



73. (e) 1 astronomical unit $= 1.496 \times 10^{11}$m

74. (b) The speed in general $\geq$ the magnitude of velocity

75. (e) From displacement-time graph, it is clear that in equal intervals of time displacements are not equal infact, decreases and after 40s displacement constant i.e. the particle stops.

76. (b) Horizontal range $R = \frac{u^2 \sin 2\theta}{g}$

Range is same for angle of projection θ and $(90° - \theta)$

77. (e) Electric potential is a scalar quantity. Scalars have magnitude only and no direction.

78. (c) Motion with constant momentum along a straight line. According to Newton's second law rate of change of momentum is directly proportional to force applied.

79. (a) Newton's laws of motion are applicable only for inertial frames. All refrence frames present on surface of earth are supposed to be inertial frame of refrence.

80. (c) Kinetic energy is given by $k.E = \frac{p^2}{2m}$

$$\therefore \frac{p_1^2}{2m_1} = \frac{p_2^2}{2m_2}$$

$$\text{or } \frac{p_1}{p_2} = \sqrt{\frac{m_1}{m_2}}$$

81. (a) Energy of both bodies is given by

$KE_1 = F.S_1$

$KE_2 = F.S_2$

As force is equal

$$\therefore \frac{S_1}{S_2} = \frac{m_1 v_1^2}{m_2 v_2^2} = \frac{m_1}{m_2} = \frac{1}{2} \quad [\because v_1 = v_2]$$

82. (e) Ratio of M.I is

$$\frac{M_A r^2}{M_B (2r)^2} = \frac{I_A}{I_B}$$

$$\frac{I_A}{I_B} = \frac{1}{4} \quad [\because M_A = M_B]$$

$$\text{or, } I_A = \frac{I_B}{4}$$

83. (b) Moment of inertia is a tensor quantity.

84. (b) Orbital velocity of satellite is given by:

$$V_0 = \sqrt{\frac{GM_e}{R+h}}$$

85. (e) Gravitational potential energy is $\frac{-GMm}{R+h}$. Here negative sign shows that if 'h' increases the gravitational PE decreases and becomes zero at infinity.

86. (e) When stones are inside and float, water displacement $= V.p$

When inside water displacement is V only.

Then water level falls.

87. (d) As elongation produced is same, therefore

$$\frac{F}{\pi r_1^2} = \frac{f}{\pi r_2^2}$$

$$\frac{F}{f} = \frac{r_1^2}{r_2^2} = \frac{1}{4}.$$

88. (a) Terminal velocities of rain drops are proportional to square of their radii.

Terminal velocity of a body is given by

$$v_T = \frac{2R^2}{9\eta}(d - \sigma)g. \text{ or, } V \propto R^2$$

89. (c) By first law of thermodynamics $\Delta Q = \Delta U + \Delta W$

In adiabatic process $\Delta Q = 0$

$\therefore \Delta U = -W.$

90. (d) $\eta = \frac{W_{output}}{Heat_{input}} = \frac{w}{3w} = \frac{1}{3}$

$$\eta = 1 - \frac{Q_2}{Q_1} = \frac{1}{3}$$

$$\therefore \frac{Q_2}{Q_1} = \frac{2}{3}$$

91. (c) Pressure exerted by gas is given by:

$$P = \frac{1}{3}\rho C^2_{rms} \quad \text{...(i)}$$

$$\text{and } 2P = \frac{1}{3}PC'^2 \text{ rms} \quad \text{...(ii)}$$

Dividing eq^n (i) by (ii) we get

$$\frac{C_{rms}}{C'rms} = \frac{1}{\sqrt{2}}.$$

92. (b) The time period of pendulam is given by

$$T = 2\pi\frac{l}{g}$$

Acceleration due to gravity of earth is

$$g_e = \frac{GM}{R_e^2}$$

Value of 'g' on planet is

$$g_p = \frac{GM_p}{R_p^2} = \frac{G.2M}{4R^2} = \frac{g_e}{2}$$

$$\therefore T_p = 2\pi\sqrt{\frac{l.2}{g_e}} = \sqrt{2}T$$

$$\text{i.e. } T_p = 2\sqrt{2}$$

93. (e) In simple harmonic motion, frequency remains constant and else changes with time.

94. (b) Speed of sound $V_{solid} > V_{liquid} > V_{gas}$

Sound waves need a medium to travel cannot be polarized and not transverse in nature.

95. (b) As third harmonic frequency of both pipes are equal, so,

$$\frac{3v}{4l_c} = \frac{3v}{2l_0}$$

$$\frac{4l_c}{2l_0} = 1 \Rightarrow \frac{l_c}{l_0} = \frac{1}{2} \text{ or } 1:2$$

96. (b) Weight due to gravity is balanced by electric force. Therefore mg = qE

$$\Rightarrow q = \frac{mg}{E} = \frac{1.96\times10^{-15}\times10}{\left(\frac{400}{0.02}\right)}$$

$$= \frac{1.96\times10^{-14}}{2\times10^{4}} = 0.98\times10^{-18}$$

$$= 9.8\times10^{-19} \cong 6e.$$

97. (b) Let 'r' be the distance of point 'p' from centre of 'A'. Then as $\vec{E}$ is equal therefore,

$$\frac{Q_A}{r^2} = \frac{Q_B}{(10-r)^2}$$

$$\frac{9}{r^2} = \frac{4}{(10-r)^2}$$

$$\frac{3}{r} = \frac{2}{10-r} \Rightarrow r = 6m$$

98. (a) Charge is a scalar quantity.

99. (e) Current is the amount of charge crossing a unit area per unit time.

100. (b) By using the colour coding of carbon resistors for red code-2 multiplier - 100 for green and tolerance for silver is 10%.

101. (c) Reciprocal of resistance

$$\text{slope of graph} = \frac{I}{V} = \frac{1}{R}$$

102. (e) Permanent magnet – Loud speaker

103. (e) When the temperature of a magnetic material decreases, the magnetization remains the same in a diamagnetic material.

104. (c) Magnetic field at centre of coil is given by:

But here length of coil $l = 2\pi r$ If r' be radius of smaller coil then, $l = n2\pi r'$ or, $2\pi r = n2\pi r'$

$$B = \frac{\mu_0 i,}{2r}$$

$$\text{Now, } B' = \frac{\mu_0 ni}{2\frac{r}{n}} = n^2\frac{\mu_0 i}{2r} = n^2 B$$

$$\therefore \frac{B'}{B} = n^2$$

105. (a) According to Faraday's law of electromagnetic induction, Emf induced in circuit

$$e = \frac{\Delta\phi}{\Delta t}$$

$$\text{but } I = \frac{e}{R} = \frac{\Delta\phi}{\Delta t.R}$$

$$\text{and } Q = I.\ \Delta t = \frac{\Delta\phi}{R}$$

106. (d) For resonant frequency to remain same

$\sqrt{LC}$ = constant

LC = constant

As, $C \to 4C$

$$\therefore L \to \frac{L}{4}$$

107. (a) Eddy currents are due to changing magnetic field. These currents are also called foucault currents. The direction of eddy currents is given by Lenz's law.

108. (c) Ozone layer protects us from harmful effects of UV rays by absorbing it.

109. (d) Magnifying power

$$m = 1 + \frac{D}{f} = 1 + \frac{25}{10} = 3.5$$

110. (e) Except ultrasound all are EM waves which do not require a material medium to travel.

111. (a)

112. (c) As we know

$$\lambda \propto \frac{1}{\sqrt{V}}$$

$$\therefore \frac{1}{\sqrt{100}} : \frac{1}{\sqrt{200}} : \frac{1}{\sqrt{300}} = 1 : \frac{1}{\sqrt{2}} : \frac{1}{\sqrt{3}}$$

113. (a) No. of half life required to reduce material to safe level.

$2^n = 64 \Rightarrow n = 6$

$\therefore$ Minimum time required to work safely = $6\ T_{1/2}$

$= 6 \times 2 = 12$ hours.

114. (d) In atom bomb nuclear fission is found.

115. (d) Nuclear mass density is same for all nuclei.

116. (a) Boolean algebra of AND gate A.B = Y

117. (d) In p-type semiconductors acceptor level lies nearer to the valence band.

118. (b) At ionospheric layer, reflected frequency is 10 MHZ and transmitted frequency is 40 MHZ.

119. (b) In an amplitude modulated wave. side band frequency gap is twice that of the message signal.

120. (d) For satisfactory communication in Los mode maximum distance between the transmitter and receiver

$$d_{max} = \sqrt{2Rh_T} + \sqrt{2Rh_R}$$

$$\sqrt{2Rh_T} + \sqrt{2Rh_R} = 40\text{km}$$

$$\sqrt{2\times64\times10^5\times20} + \sqrt{2\times64\times10^5 h_R} = 40\times10^3$$

$$2\times8\times10^3 + \sqrt{2\times64\times10^5 h_R} = 40\times10^3$$

$$\Rightarrow h_R = 45\text{m}$$

Paper-II : Biology

1. (d) Ovule is attached to placenta by a slender stalk known as funicle. Small gap is left at the integuments at one end of the ovule, called micropyle.

2. (e) **3. (b)**

4. (a) Primary producers occupied first trophic level in an ecosystem. The energy formed by the green plants (producers) then flows through different trophic levels of ecosystem *i.e.*, primary, secondary and tertiary consumers.

5. (c) (a) - Partial regulators
(b) - Regulators
(c) - Conformers

1. Conformers

Majority of the animals (up to 99%) and nearly all plants, cannot maintain a constant internal environment. Their body temperature and osmotic concentration changes according to the surrounding conditions . Such animal and plants are called *Conformers*.

2. Regulators

Some animals maintain their homeostasis by physiological or behavioural means. All birds and mammals (Homeothermic or Warm blooded) and a few lower vertebrates and invertebrates can maintain constant body temperature and constant osmotic concentration regardless of the surrounding conditions. Such organisms are called *Regulators*.

3. Partial regulators

If the stressful condition are localized, the animals can '*escape in place*' and migrate to nearby region, having better environmental conditions. If the unfavourable conditions are for a shorter duration then the animals can '*escape in time*' and avoid those conditions suspending their activities. Such organisms are partial regulators.

6. (b) Phosphorus cycle is an example of sedimentary cycle. Pyramid of biomass of aquatic ecosystem is inverted. If decomposition leads to the formation of colloidal organic matter (humus), the process is called humification. Simple food chains are very rare in nature. This is because each organism may obtain food from more than one trophic level. Pyramid of energy is always **upright** because during the flow of energy from one trophic level to the next one. There always occurs a loss of energy.

7. (e) **Productivity** refers to the rate of biomass production *i.e.* the rate at which sunlight is captured by producers for the synthesis of energy rich organic compounds.

8. (b) Mammals from colder climate have shorter ears and limbs minimizing exposed surface area to minimize heat loss.

9. (b) Hydrarch succession takes place in wetter areas like ponds, lakes etc. In newly cooled lava primary succession occurs.

10. (c) **Bacteria can be transformed** in the following ways–

(i) By **microinjections** - where in DNA can be injected directly into the nucleus of cells to be transformed by using a micropipette. This technique was originally used in animal cells but has subsequently been applied to plant cells.

(ii) **Gene gun/biolistic guns -** Microscopic particles of gold or tungsten are coated with the DNA of interest & bombarded onto cells. This technique is known as biolistics.

11. (a) Bamboo species flower only once in their life time, generally after 50 - 100 years, produce large numbers of fruits and die.

12. (e) The proteins encoded by the genes cry I Ac and cry II Ab control the cotton bollworms, that of cry I Ab controls corn borer.

13. (b)

14. (b) The vast majority of bacteria do not synthesise their own food but depend on other organisms or on dead organic matter for food. Hence, they are heterotrophs.

15. (c)

16. (c) Cellulosic cell wall is present only in plant cell. Blue green algae come under eubacteria.

17. (a) In 1971, T. O. Diener discovered a new infectious agent that was smaller than viruses.

18. (e) **19. (b)**

20. (c) They do not grow in polluted areas.

21. (a) Rhizome in ginger store food and cucumber develops stem tendrils from axillary buds.

22. (c) (a) and (b) are correct. *Alstonia* leaves show whorled phyllotaxy. In Australian *Acacia*, the leaves are small and short-lived. The petioles in these plants expand, become green and synthesise food.

23. (a) Bryophytes include mosses and liver worts whereas the pteridophytes include horsetails and ferns.

24. (b) Heterospory is considered an important step in the development of seed habit.

25. (b) The gymnosperms are heterosporous. The male and female gametophytes do not have independent free living existance. Ovules are not enclosed by ovary, in gymnosperms. Pollengrains released from microsporangium. The diploid sporophyte is dominant.

26. (d) The anthers following meosis produces pollen grains. In an embryosac, the primary endosperm nucleus (PEN) is triploid.

27. (e) Ovary is tricarpellary in Liliaceae.

28. (a)

29. (b) Belladona is a medicinal plant.

30. (d)

31. (e) Suberin is present in casparian strips. Polyarch xylem bundles are the features of monocot root.

32. (e) Lenticels permit the exchange of gases between the outer atmosphere and the internal tissue of the stem. These occur in most woody trees.

33. (a)

34. (b) Parenchyma cell walls are made up of cellulose.

35. (c) In some bacteria (*e.g.*, *Bacillus subtilis*) the plasma membrane from certain invaginations or infoldings are called mesosomes in the cytoplasm. The mesosomes have various function, *viz.*, respiratory, secretory etc.

36. (d) **37. (b)**

38. (c) The given figure represents nucleic acid adenylic acid.

39. (b) Mitosis usually results in the production of diploid daughter cells with identical genetic compliment. A very significant contribution of mitosis is cell repair.

40. (e) The sequence of amino acids in a protein represents the primary structure. In proteins, only right handed helices are observed. Adult human haemoglobin consists of four subunits.

The left end of protein is N-terminal and right end of protein is C - terminal.

Proteins are heteropolymers containing strings of amino acids.

41. (d) Interphase consists of G_1 S and G_2.

Mitosis is divided into four stages :- Prophase, Metaphase Anaphase and Telophase.

42. (e)

43. (d) Curcumin and Vinblastine are secondary metabolites belong to drugs. Morphine and codeine belong to alkaloids and Abrin belongs to toxins.

44. (d) The process of loading at source produces a hypertonic condition in phloem.

45. (c) Pinus seeds cannot germinate without mycorrhiza.

46. (e) Melvin Calvin discovered PGA as first CO_2 fixation product in algal photosynthesis.

47. (a) **48. (a)**

49. (c) Plasmolysis occurs when water moves out of the cell. Cells shrink in hypertonic solution.

50. (b) FAD is an electron acceptor in TCA cycle during oxidation of succinic acid to malic acid.

51. (a) Maximum absorption of light by chlorophyll-a at blue and red regions.

52. (c)

53. (d) In glycolysis oxidation takes place when 3-phospho-glyceraldehyde is converted to 1, 3bisphosphoglycerate, where NAD is reduced to NADH

54. (d) Only ATP is produced during cyclic photophosphorylation but no NADPH + H^+. Both ATP and NADPH + H^+ are synthesised in Non-cyclic photophosphorylation.

55. (b) E. kurosawa - Gibberellin

Skoog and miller - Cytokinin

Cousins - Ethylene

F.W. Went - Auxin

Frederick T Addicott and his co-workers - Abscisic acid

56. (e) Abscisic acid stimulates closure of stomata and ethylene influences swelling of axis in dicot plants.

57. (e) The site of perception of light / dark duration is the leaf.

58. (a) Perisperm is the persistent nucellus in seed of pepper and beet.

59. (e)

60. (b) Megaspore mother cell is diploid. It undergoes meiosis to produce 4 haploid megaspores.

61. (c) A primary spermatocyte completes the first meiotic division (reduction division) leading to formation of 2 equal, haploid cells called secondary spermatocytes which have only 23 chromosomes each. Each secondary spermatocyte undergoes second meiotic division to produce two haploid spermatids.

62. (a) LNG - 20 and progestasert are the hormone producing intra uterine Devices (IUDs).

63. (e)

64. (c) Sacred grooves, Jaintia hills in Meghalaya.

65. (d) Cytokine barrier is interferon. Virus infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

66. (c) Ring worms are caused by fungi belonging to genera *Microsporum*, *Trichophyton* and *Epidermophyton*.

67. (e) B - lymphocytes mediates humoral immunity. Colostrum has abundant lgA antibodies.

68. (a) Bacterium *Bacillus thuringiensis* (Bt) is **used as microbial control agent** in order to control butterfly caterpillars. It is sprayed on plants like *Brassica* and fruit trees which are attacked by insect larvae. In the gut of larvae, Bt release toxin and insect larvae are killed. It kills only caterpillars, leaving all other insects unharmed.

69. (a) *Homo habilis* were first human - like being. The brain capacities were between 650 - 800 cc. They probably did not eat meat.

70. (d) **Oparin** proposed the idea of chemical evolution in 1923 and a similar idea was independently proposed by **Haldane** in 1928. The modern theory is, therefore, also known as oparin - Haldane theory.

71. (d) Tendrils of *Bougainvillea* and *Cucurbita* show homologous structures.

72. (b) Flame cells are specialized cells of platyhelminthes (flatworms) for excretion and osmoregulation.

73. (a) The adult echinoderms are radially symmetrical but larvae are bilaterally symmetrical. They are triploblastic and coelomate animals. Fertilization is usually external and indirect development is observed.

74. (d) All living members of the class Cyclostomata are ectoparasites on some fishes. They have a sucking and circular mouth without jaws.

75. (a)

76. (c) All the labelled options in (C) are correct for circulatory system of Earthworm.

77. (e) Prostomium is a wedge like structure to force open cracks in the soil, seen on the anterior end of earthworm.

78. (d) Maxillary palps are the part of cockroach mouth.

79. (d) Frogs are ureotelic and have olfactory lobes in the fore brain. Liver secretes bile that is stored in the gall bladder. They have both hepatic as well as renal portal system.

80. (b) Most of the cartilages in vertebrate embryos are replaced by bones in adults.

81. (b) Bones and blood are the specialized connective tissues.

82. (c) In a nucleic acid a phosphate moiety links the 3' - carbon of one sugar of one nucleotide to the 5' - carbon of the sugar of the succeeding nucleotide.

83. (a) The given binomial expansion is the F_2 - generation of monohybrid cross.

84. (d) Six genotypes and four phenotypes are there in ABO - blood group.

85. (c) In codominance, both the alleles of a gene are equally dominant i.e. the dominant character is not able to suppress the recessive character & thus both the characters appear side by side in F_1 hybrids. F_1 generation resembles both the parents. E.g., ABO blood group.

86. (a) Henking (1896), while working on Squash Bug (*Pyrrocoris*) and other insects traced a nuclear structure all through the spermatogenesis and observed that 50% of the sperms received this structure and other 50% did not. Henking called it **X-body** but could not explain its significance.

87. (b) Linkage is an association of closed packed genes in a chromosome.

88. (a) DNA strand coils right - handedly at a pitch (10 base pairs or 1 complete turn) of 3.4 nm. (34 Å)

89. (c) OH group in 2' - position of ribose sugar gives reactive nature of RNA.

90. (c) A structure formed by wrapping of negatively charged DNA around positively charged histone octamer.

91. (a) Every individual organism is unique. DNA sequences have some specific regions in DNA called repetitive DNA $\rightarrow$ which are short, stretch and repeated many times.

These short nucleotide repeats vary in number from person to person and are called **variable number of tandem repeat (VNTR)**. VNTR belongs to class of satellite DNA referred to as minisatellite. Size of VNTR varies from 1 to 20 bp.

92. (e)

93. (b) Experimental evidences of DNA replication is carried in *E.*coli.

94. (a) Process of copying genetic information from DNA to RNA is called **transcription**. At a time only one DNA strand is being transcribed into RNA. The strand of DNA with polarity 3' $\rightarrow$ 5' acts as **template strand** and the DNA strand with polarity 5' $\rightarrow$ 3' acts as **coding strand**.

e.g. 3' – ATGCATGCATGCATGC – 5' $\rightarrow$ template strand.

5' – TACGTACGTACGTACG – 3' $\rightarrow$ coding strand.

Transcription is carried out by **DNA dependent RNA polymerase**.

95. (d) **96. (e)** **97. (a)**

98. (e) The RNA polymerase II transcribes precursor of mRNA,the heterogenous nuclear RNA (hnRNA).

99. (b) Single gene mutation in DNA results change in mRNA and cause sickle - cell anaemia.

100. (a)

101. (b) Functional Residual Capacity is the volume of air that will remain in the lungs after a normal expiration. This includes Expiratory Reserve Volume (ERV) and Residual Volume (RV).

102. (c)

103. (c) Hypothalamus controls body temperature, urge of eating and drinking.

104. (b)

105. (c) Epiglottis is a cartilaginous flap of glottis.

106. (b) In amphibians and reptiles the left atrium receives oxygenated blood from the gills/lungs/skin and the right atrium gets the deoxygenated blood from other body parts. However, they get mixed up in the single ventricle which pumps out mixed blood (incomplete blood circulation).

107. (a)

108. (d) QRS complex initiates ventricular contraction.

109. (e) The ascending limb of Henle's loop is non-permeable to water.

110. (d)

111. (d) Prawns have green glands or antennal glands for excretion.

112. (c) **113. (d)**

114. (e) Muscles of the heart are striated, branched and involuntary.

115. (e) Multinucleated animal cells are known as syncytium.

116. (e) Cornea is the anterior part of sclera.

117. (d) Crista ampullaris possess hair cells.

118. (e) Pars intermedia secretes only one hormone called melanocyte stimulating hormone (MSH). Neurohypophysis (pars nervosa) also known as posterior pituitary, stores and releases two hormones called oxytocin and vasopressin which are actually synthesised by the hypothalamus and are transported axonally to neurohypophysis.

119. (d) Somatostatin from the hypothalamus inhibits the release of growth hormone from the pituitary.

120. (d)