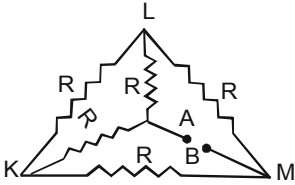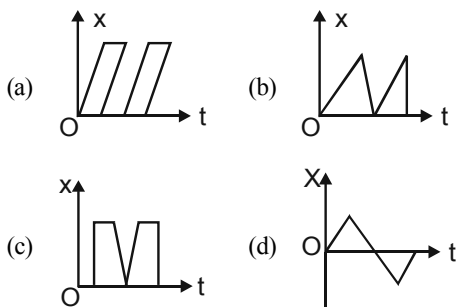# AIIMS 2017

PHYSICS

107. The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface, having work function 5.01 eV, when ultraviolet light of 200 nm falls on it, must be
(a) 2.4 V
(b) −1.2 V
(c) −2.4 V
(d) 1.2 V

53. Hail storms are observed to strike the surface of the frozen lake at 30^0 with the vertical and rebound at 60^0 with the vertical. Assume contact to be smooth, the coefficient of restitution is
(a) $e = \dfrac{1}{\sqrt{3}}$
(b) $e = \dfrac{1}{3}$
(c) $e = \sqrt{3}$
(d) $e = 3$

146. In a npn transistor 10^{10} electrons enter the emitter in 10^{-6} s. 4% of the electrons are lost in the base. The current transfer ratio will be
(a) 0.98
(b) 0.97
(c) 0.96
(d) 0.94

122. Each of the resistance in the network shown in fig. is equal to R. The resistance between the terminals A and B is

(a) R
(b) 5 R
(c) 3 R
(d) 6 R

62. The wheel of a car is rotating at the rate of 1200 revolutions per minute. On pressing the accelerator for 10 seconds it starts rotating at 4500 revolutions per minute. The angular acceleration of the wheel is
(a) 30 radian / second^2
(b) 1880 degrees/ second^2

55. An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is
(a) 1 : 2
(b) 4 : 1
(c) 8 : 3
(d) 3 : 8

5. The normal density of gold is ρ and its bulk modulus is K. The increase in density of a lump of gold when a pressure P is applied uniformly on all sides is
(a) K/ρ P
(b) P/ρ K
(c) ρ P/K
(d) ρ K/P

102. Magnetic flux ϕ in weber in a closed circuit of resistance 10Ω varies with time ϕ (sec) as $f = 6t^2 - 5t + 1$. The magnitude of induced current at t = 0.25 s is
(a) 0.2 A
(b) 0.6 A
(c) 1.2 A
(d) 0.8 A

4. Which of the following displacement (X) time graphs is not possible?

39. The binding energy per nucleon for $_1^2 H$ and $_2^4 He$ respectively are 1.1 MeV and 7.1 MeV. The energy released in MeV when two $_1^2 H$ nuclei fuse to form $_2^4 He$ is
(a) 4.4
(b) 8.2

119. If a charge q is placed at the centre of the line joining two equal charges Q such that the system is in equilibrium then the value of q is
(a) Q/2
(b) –Q/2
(c) Q/4
(d) –Q/4

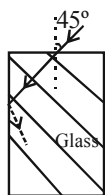**35.** The potential energy of a particle varies with distance x from a fixed origin as $V = \dfrac{A\sqrt{x}}{x+B}$ where A and B are constants. The dimensions of AB are

(a) $[M^1 L^{5/2} T^{-2}]$

(b) $[M^1 L^2 T^{-2}]$

(c) $[M^{3/2} L^{5/2} T^{-2}]$

(d) $[M^1 L^{7/2} T^{-2}]$

83. A light ray falls on a rectangular glass slab as shown. The index of refraction of the glass, if total internal reflection is to occur at the vertical face, is

(a) $\sqrt{3/2}$

(b) $\dfrac{(\sqrt{3}+1)}{2}$

(c) $\dfrac{(\sqrt{2}+1)}{2}$

(d) $\sqrt{5}/2$

77. A bucket tied at the end of a 1.6 m long string is whirled in a vertical circle with constant speed. What should be the minimum speed so that the water from the bucket does not spill when the bucket is at the highest position?
(a) 4 m/sec
(b) 6.25 m/sec
(c) 16 m/sec
(d) None of the above

74. Which of the following figure shows the correct equipotential surfaces of a system of two positive charges?

(a)

(b)

(c)

(d)
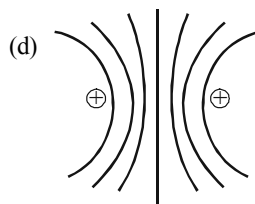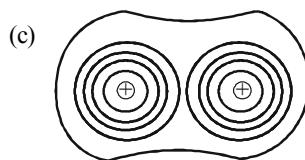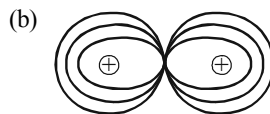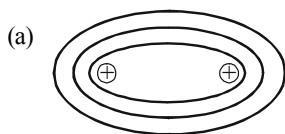
58. A point particle of mass 0.1 kg is executing S.H.M. of amplitude of 0.1 m. When the particle passes through the mean position, its kinetic energy is 8×10^{-3} Joule. Obtain the equation of motion of this particle if this initial phase of oscillation is 45°.

(a) $y = 0.1\sin\left(\pm 4t + \dfrac{\pi}{4}\right)$

(b) $y = 0.2\sin\left(\pm 4t + \dfrac{\pi}{4}\right)$

(c) $y = 0.1\sin\left(\pm 2t + \dfrac{\pi}{4}\right)$

(d) $y = 0.2\sin\left(\pm 2t + \dfrac{\pi}{4}\right)$

99. The following configuration of gate is equivalent to
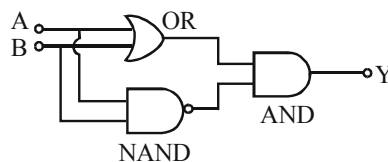
(a) NAND gate
(b) XOR gate
(c) OR gate
(d) NOR gate

18. Two long parallel wires P and Q are held

direction, then the magnetic field at a point half-way between the wires is

(a) $\mu_0/17$ (b) $\sqrt{3}\,\mu_0/2\pi$

(c) $\mu_0/2\pi$ (d) $3\mu_0/2\pi$

70. A small block of mass m is kept on a rough inclined surface of inclination θ fixed in an elevator. The elevator goes up with a uniform velocity v and the block does not slide on the wedge. The work done by the force of friction on the block in time t as seen by the observer on the inclined p lane will be

(a) zero (b) $mgvt\cos^2\theta$

(c) $mgvt\sin^2\theta$ (d) $mgvt\sin 2\theta$

123. A beam of light of wavelength 600 nm from a distance source falls on a single slit 1 mm wide and a resulting diffraction pattern is observed on a screen 2m away. The distance between the first dark fringes on either side of central bright fringe is

(a) 1.2 cm (b) 1.2 mm

(c) 2.4 cm (d) 2.4 mm

51. Figure here shows the vertical cross section of a vessel filled with a liquid of density ρ. The normal thrust per unit area on the walls of the vessel at the point P, as shown, will be
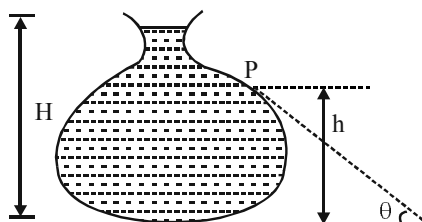
(a) $h\rho g$
(b) $H\rho g$
(c) $(H-h)\,\rho g$
(d) $(H-h)\,\rho g\cos\theta$

47. If in the experiment of Wheatstone's bridge, the positions of cells and galvanometer are interchanged, then balance point will

(a) change
(b) remain unchanged
(c) depend on the internal resistance of cell and resistance of galvanometer
(d) None of these

114. In the equation $X = 3YZ^2$, X and Z are dimensions of capacitance and magnetic induction respectively. In MKSQ system, the dimensional formula for Y is

(a) $[M^{-3}\,L^{-2}\,T^{-2}\,Q^{-4}]$
(b) $[M\,L^{-2}]$
(c) $[M^{-3}\,L^{-2}\,Q^4\,T^8]$
(d) $[M^{-3}\,L^{-2}\,Q^4\,T^4]$

66. Half lives for α and β emission of a radioactive material are 16 years and 48 years respectively. When material decays giving α and β emission simultaneously, time in which $3/4^{th}$ material decays is

(a) 29 years (b) 24 years
(c) 64 years (d) 12 years

41. If a magnet is suspended at angle 30° to the magnetic meridian, the dip needle makes an angle of 45° with the horizontal. The real dip is

(a) $\tan^{-1}(\sqrt{3/2})$

(b) $\tan^{-1}(\sqrt{3})$

(c) $\tan^{-1}(\sqrt{3}/2)$

(d) $\tan^{-1}(2/\sqrt{3})$

50. Gauss's law states that
(a) the total electric flux through a closed surface
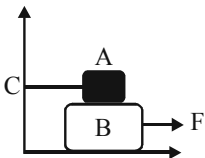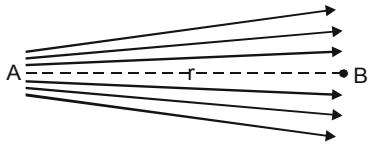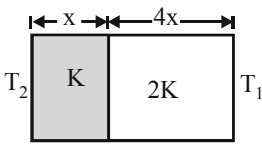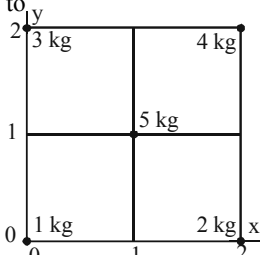
is $\dfrac{1}{\varepsilon_0}$ times the total charge placed near the closed surface.
(b) the total electric flux through a closed surface

is $\dfrac{1}{\varepsilon_0}$ times the total charge enclosed by the closed surface.
(c) the total electric flux through an open surface

is $\dfrac{1}{\varepsilon_0}$ times the total charge placed near the open surface.
(d) the line integral of electric field around the

boundary of an open surface is $\dfrac{1}{\varepsilon_0}$ times the

total charge placed near the open surface.

18. A current carrying coil is subjected to a uniform magnetic field. The coil will orient so that its plane

(b) inclined at any arbitrary angle to the magnetic field
(c) parallel to the magnetic field
(d) perpendicular to magnetic field

33. Radio waves and visible light in vacuum have
(a) same velocity but different wavelength
(b) continuous emission spectrum
(c) band absorption spectrum
(d) line emission spectrum

28. The work done in which of the following processes is equal to the internal energy of the system?
(a) Adiabatic process
(b) Isothermal process
(c) Isochoric process
(d) None of these

90. Block A of weight 100 kg rests on a block B and is tied with horizontal string to the wall at C. Block B is of 200 kg. The coefficient of friction between A and B is 0.25 and that between B and surface is $\dfrac{1}{3}$. The horizontal force F necessary to move the block B should be ($g = 10$ m/s^2)

(a) 1050 N
(b) 1450 N
(c) 1050 N
(d) 1250 N

129. In an A.C. circuit, the current flowing in inductance is $I = 5\sin(100\,t - \pi/2)$ amperes and the potential difference is $V = 200\sin(100\,t)$ volts. The power consumption is equal to
(a) 1000 watt
(b) 40 watt
(c) 20 watt
(d) Zero

1. Figure shows the electric lines of force emerging from a charged body. If the electric field at A and B are E_A and E_B respectively and if the displacement between A and B is r, then

(a) $E_A > E_B$
(b) $E_A < E_B$

65. The temperature of the two outer surfaces of a composite slab consisting of two materials having coefficient of thermal conductivity K and **2K and thickness** x and $4x$ respectively are T_2 and T_1 ($T_2 > T_1$). The rate of heat transfer through the slab, in a steady state is $\left(\dfrac{A(T_2 - T_1)K}{x}\right) f$ with f equal to

(a) 1
(b) 1/2
(c) 2/3
(d) 1/3

37. The ratio of the longest to shortest wavelengths in Brackett series of hydrogen spectra is

(a) $\dfrac{25}{9}$
(b) $\dfrac{17}{6}$
(c) $\dfrac{9}{5}$
(d) $\dfrac{4}{3}$

41. Curie temperature is the temperature above which
(a) a ferromagnetic material becomes paramagenetic
(b) a paramagnetic material becomes diamagnetic
(c) a ferromagnetic material becomes diamagnetic
(d) a paramagnetic meterial becomes ferromagnetic

54. Five masses are placed in a plane as shown in figure. The coordinates of the centre of mass are nearest to

(a) 1.2, 1.4
(b) 1.3, 1.1
(c) 1.1, 1.3
(d) 1.0, 1.0

29. Two spherical conductors A and B of radii a and b (b>a) are placed concentrically in air. The two

(a) $4\pi\varepsilon_0 \dfrac{ab}{b-a}$

(b) $4\pi\varepsilon_0(a+b)$

(c) $4\pi\varepsilon_0 b$

(d) $4\pi\varepsilon_0 a$
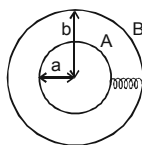
30. The magnitude of the de-Broglie wavelength (λ) of electron (e), proton (p), neutron (n) and α-particle (α) all having the same energy of 1 MeV, in the increasing order will follow the sequence

(a) $\lambda_e, \lambda_p, \lambda_n, \lambda_\alpha$ (b) $\lambda_e, \lambda_n, \lambda_p, \lambda_\alpha$

(c) $\lambda_\alpha, \lambda_n, \lambda_p, \lambda_e$ (d) $\lambda_p, \lambda_e, \lambda_\alpha, \lambda_n$

54. The molar heat capacities of a mixture of two gases at constant volume is $13R/6$. The ratio of number of moles of the first gas to the second is 1 : 2. The respective gases may be

(a) O_2 and N_2 (b) He and Ne

(c) He and N_2 (d) N_2 and He

39. By properly combining two prisms made of different materials, it is not possible to have

(a) dispersion without average deviation

(b) deviation without dispersion

(c) both dispersion and average deviation

(d) neither dispersion nor average deviation

ASSERTION - REASON TYPE QUESTIONS

Directions : Each of these questions contains two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

(c) Assertion is correct, reason is incorrect

(d) Assertion is incorrect, reason is correct.

96. **Assertion :** When a convex lens ($\mu_g = 3/2$) of focal length f is dipped in water, its focal length becomes $\dfrac{4}{3}f$.

Reason : The focal length of convex lens in water becomes $4f$.

90. **Assertion:** The pressure of water reduces when it flows from a narrow pipe to a wider pipe.

proportionately.

117. **Assertion :** Resonance is special case of forced vibration in which the natural frequency of vibration of the body is the same as the impressed frequency of external periodic force and the amplitude of forced vibration is maximum

Reason : The amplitude of forced vibrations of a body increases with an increase in the frequency of the externally impressed periodic force.

103. **Assertion :** Kirchoff's juction rule can be applied to a junction of several lines or a point in a line.

Reason : When steady current is flowing, there is no accumulation of charges at any junction or at any point in a line.

102. **Assertion :** When a sphere is rolls on a horizontal table it slows down and eventually stops.

Reason : When the sphere rolls on the table, both the sphere and the surface deform near the contact. As a result, the normal force does not pass through the centre and provide an angular declaration.

114. **Assertion :** When two semi conductor of p and n type are brought in contact, they form p-n junction which act like a rectifier.

Reason : A rectifier is used to convent alternating current into direct current.

86. **Assertion:** Ampere's circuital law is independent of Biot-Savart's law.

Reason: Ampere's circuital law can be derived from the Biot-savart's law.

111. **STATEMENT-1 :** Mechanical energy is the sum of macroscopic kinetic & potential energies.

STATEMENT-2 : Mechanical energy is that part of total energy which always remain conserved.

95. **Assertion :** A laminated core is used in transformers to increase eddy currents.

Reason: The efficiency of a transformer increases with increase in eddy currents.

77. **Assertion:** In the measurement of physical quantities direct and indirect methods are used.

Reason : The accuracy and precision of measuring instruments along with errors in measurements should be taken into account, while expressing the result.

116. **Assertion :** The Carnot cycle is useful in understandsing the performance of heat engines.
Reason : The Carnot cycle provides a way of determining the maximum possible efficiency achievable with reservoirs of given temperatures.

82. **Assertion :** Lenz's law violates the principle of conservation of energy.
Reason : Induced emf always opposes the change in magnetic flux responsible for its production.

90. **Assertion :** A bullet is fired from a rifle. If the rifle recoils freely, the kinetic energy of rifle is more than that of the bullet.
Reason : In case of rifle bullet system, the law of conservation of momentum violates.

104. **Assertion :** Orbital velocity of a satellite is greater than its escape velocity.
Reason : Orbit of a satellite is within the gravitational field of earth whereas escaping is beyond the gravitational field of earth.

94. **Assertion :** In the absence of an external electric field, the dipole moment per unit volume of a polar dielectric is zero.
Reason : The dipoles of a polar dielectric are randomly oriented.

70. **Assertion :** Identical springs of steel and copper are equally stretched. More work will be done on the steel spring
Reason : Steel is more elastic than copper.

107. **Assertion :** Electromagnets are made of soft iron.
Reason : Coercivity of soft iron is small.

86. **Assertion :** The internal energy of a real gas is function of both, temperature and volume.
Reason : Internal kinetic energy depends on temperature and internal potential energy depends on volume.

69. **Statement (1 :** The de-Broglie wavelength of a molecule (in a sample of ideal gas) varies inversely as the square root of absolute temperature.
Statement (2 : The rms velocity of a molecule (in a sample of ideal gas) depends on temperature.

111. **Assertion :** Two longitudinal waves given by equations $-y_1(x, t) = 2a \sin(\omega t - kx)$ and $y_2(x, t) = a \sin(2\omega t - 2kx)$ will have equal intensity.
Reason : Intensity of waves of given frequency in same medium is proportional to square of

CHEMISTRY

5. Sodium metal crystallizes in a body centred cubic lattice with a unit cell edge of 4.29Å. The radius of sodium atom is approximately : *[2017]*
   (a) 5.72Å   (b) 0.93Å
   (c) 1.86Å   (d) 3.22Å

8. Which of the following compounds is not an antacid ? *[2017]*
   (a) Phenelzine
   (b) Ranitidine
   (c) Aluminium hydroxide
   (d) Cimetidine

21. The synthesis of alkyl fluorides is best accomplished by : *[2017]*
   (a) Finkelstein reaction
   (b) Swarts reaction
   (c) Free radical fluorination
   (d) Sandmeyer's reaction

20. In Bohr series of lines of hydrogen spectrum, the third line from the red end corresponds to which one of the following inter-orbit jumps of the electron for Bohr orbits in an atom of hydrogen *[2017]*
   (a) $5 \rightarrow 2$ (b) $4 \rightarrow 1$
   (c) $2 \rightarrow 5$ (d) $3 \rightarrow 2$

109. The ether that undergoes electrophilic substitution reactions is *[2017]*
   (a) $CH_3OC_2H_5$ (b) $C_6H_5OCH_3$
   (c) CH_3OCH_3 (d) $C_2H_5OC_2H_5$

62. Aldol condensation will not be observed in
   (a) chloral *[2017]*
   (b) phenylacetaldehyde
   (c) hexanal
   (d) nitromethane

84. The end product (C) in the following sequence of reactions is *[2017]*

$$HC \equiv CH \xrightarrow[20\% \ H_2SO_4]{1\% \ HgSO_4} A \xrightarrow[H_2O]{CH_3MgX} B \xrightarrow{[O]} (C)$$
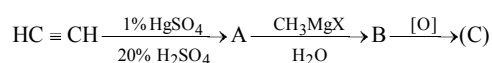
   (a) acetic acid   (b) isopropyl alcohol
   (c) acetone   (d) ethanol

37. The reaction

$$RCH_2CH_2COOH \xrightarrow[Br]{Red P} R-CH_2-CH-COOH$$

(a) Reimer-Tiemann reaction
(b) Hell-volhard Zelinsky reaction
(c) Cannizzaro reaction
(d) Sandmeyer reaction

24. A triglyceride can have how many different acyl groups? *[2017]*
(a) 3   (b) 2
(c) 1   (d) 4

23. α - D-(+)-glucose and β-D-(+)-glucose are *[2017]*
(a) conformers   (b) epimers
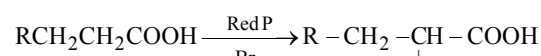(c) anomers   (d) enatiomers

6. Which one of the following is not a condensation polymer ? *[2017]*
(a) Melamine   (b) Glyptal
(c) Dacron   (d) Neoprene

17. Teflon and neoprene are *[2017]*
(a) copolymers
(b) condensation polymers
(c) homopolymers
(d) monomers

60. In the reaction

Phenol $\xrightarrow{\text{NaOH}}$ (A) $\xrightarrow{\frac{CO_2 + HCl}{140}}$ (B), here B is *[2017]*
(a) benzaldehyde   (b) chlorobenzene
(c) benzoic acid   (d) salicylic acid

39. The molar heat capacity of water at constant pressure is $75\ JK^{-1}\ mol^{-1}$. When 1kJ of heat is supplied to 100 g of water, which is free to expand, the increase in temperature of water is *[2017]*
(a) 6.6 K   (b) 1.2 K
(c) 2.4 K   (d) 4.8 K

51. The $\Delta_f H°$ for $CO_2(g)$, $CO(g)$ and $H_2O(g)$ are $-393.5, -110.5$ and -241.8 kJ/mol respectively, the standard enthalpy change (in kJ) for the reaction $CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$ is : *[2017]*
(a) 524.1   (b) 41.2
(c) -262.5 (d) -41.2

21. For the following reaction in gaseous phase

$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$, K_p / K_c is *[2017]*

39. Which of the following relation represents correct relation between standard electrode potential and equilibrium constant? *[2017]*
I. $\log K = \dfrac{nFE°}{2.303\ RT}$
II. $K = e^{\frac{nFE}{RT}}$
III. $\log K = \dfrac{-nFE°}{2.303\ RT}$
IV. $\log K = 0.4342\dfrac{-nFE°}{RT}$
Choose the correct statement(s).
(a) I, II and III are correct
(b) II and III are correct
(c) I, II and IV are correct
(d) I and IV are correct

115. At 25°C, the solubility product of $Mg(OH)_2$ is 1.0×10^{-11}. At which pH, will Mg^{2+} ions start precipitating in the form of $Mg(OH)_2$ from a solution of 0.001 M Mg^{2+} ions? *[2017]*
(a) 9   (b) 10
(c) 11   (d) 8

67. In the given reaction

$CH_3CH_2CH = CHCH_3 \xrightarrow{X}$
$\quad\quad\quad CH_3CH_2COOH + CH_3COOH$

The X is *[2017]*
(a) C_2H_5ONa
(b) Conc. HCl + Anhy.$ZnCl_2$
(c) Anh. $AlCl_3$
(d) $KMnO_4/OH^-$

128. The strongest ortho - para and strongest meta - directing groups respectively are *[2017]*
(a) $-NO_2$ and $-NH_2$
(b) $-CONH_2$ and $-NH_2$
(c) $-NH_2$ and $-CONH_2$
(d) $-NH_2$ and $-NO_2$

99. Volume of water needed to mix with 10 mL 10N HNO_3 to get 0.1 N HNO_3 is : *[2017]*
(a) 1000 mL   (b) 990 mL
(c) 1010 mL   (d) 10 mL

183. Hybridisation states of C in CH_3^+ and CH_4 are *[2017]*
(a) sp^2 & sp^3 (b) sp^3 & sp^2
(c) sp^2 & sp^2 (d) sp^3 & sp^3

192. Which of the following substances has the least covalent character ? *[2017]*
(a) Cl_2O (b) NCl_3
(c) $PbCl_2$ (d) $BaCl_2$

4. The law of triads is applicable to a group of *[2017]*
(a) Cl, Br, I (b) C, N, O
(c) Na, K, Rb (d) H, O, N

57. Consider the following reaction occuring in basic medium *[2017]*

$$2MnO_4^-(aq) + Br^-(aq) \longrightarrow$$
$$2MnO_2(s) + BrO_3^-(aq)$$

How the above reaction can be balanced further?
(a) By adding 2 OH^- ions on right side
(b) By adding one H_2O molecule to left side
(c) By adding $2H^+$ ions on right side
(d) Both (a) and (b)

19. On the basis of the following $E°$ values, the strongest oxidizing agent is : *[2017]*

$[Fe(CN)_6]^{4-} \rightarrow [Fe(CN)_6]^{3-} + e^-; E° = -0.35 V$
$Fe^{2+} \rightarrow Fe^{3+} + e^-; \qquad E° = -0.77 V$

(a) $[Fe(CN)_6]^{4-}$ (b) Fe^{2+}
(c) Fe^{3+} (d) $[Fe(CN)_6]^{3-}$

35. Consider the following cell reaction: *[2017]*

$$2Fe(s) + O_2(g) + 4H^+(aq) \rightarrow$$
$$2Fe^{2+}(aq) + 2H_2O(l); E° = 1.67V$$

At $[Fe^{2+}] = 10^{-3} M, p(O_2) = 0.1$ atm and pH = 3, the cell potential at 25°C is
(a) 1.47 V   (b) 1.77 V
(c) 1.87 V   (d) 1.57 V

101. Which one of the following impurities present in colloidal solution cannot be removed by electrodialysis? *[2017]*
(a) Sodium chloride
(b) Potassium sulphate
(c) Urea
(d) Calcium chloride

27. In the Victor-Meyer's test, the colour given by 1°, 2° and 3° alcohols are respectively. *[2017]*
(a) red, colourless, blue
(b) red, blue, colourless

19. Which of the following fluorides does not exist? *[2017]*
(a) NF_5 (b) PF_5
(c) AsF_5 (d) SbF_5

125. Which of the following are peroxoacids of sulphur? *[2017]*
(a) H_2SO_5 and $H_2S_2O_8$
(b) H_2SO_5 and $H_2S_2O_7$
(c) $H_2S_2O_7$ and $H_2S_2O_8$
(d) $H_2S_2O_6$ and $H_2S_2O_7$

35. For d block elements the first ionization potential is of the order *[2017]*
(a) $Zn > Fe > Cu > Cr$
(b) $Sc = Ti < V = Cr$
(c) $Zn < Cu < Ni < Co$
(d) $V > Cr > Mn > Fe$

57. Which of the following coordination compounds would exhibit optical isomerism? *[2017]*
(a) pentamminenitrocobalt(III) iodide
(b) diamminedichloroplatinum(II)
(c) trans-dicyanobis (ethylenediamine) chromium (III) chloride
(d) tris-(ethylendiamine) cobalt (III) bromide

107. A solution of urea (mol. mass 56 g mol^{-1}) boils at 100.18°C at the atmospheric pressure. If K_f and K_b for water are 1.86 and 0.512 K kg mol^{-1} respectively, the above solution will freeze at *[2017]*
(a) 0.654°C   (b) −0.654°C
(c) 6.54°C   (d) −6.54°C

44. Pure hydrogen sulphide is stored in a tank of 100 litre capacity at 20°C and 2 atm pressure. The mass of the gas will be *[2017]*
(a) 34 g   (b) 340 g
(c) 282.68 g   (d) 28.24 g

85. The increasing order of stability of the following free radicals is *[2017]*
(a) $(C_6H_5)_2\overset{\bullet}{C}H < (C_6H_5)_3\overset{\bullet}{C} < (CH_3)_3\overset{\bullet}{C} < (CH_3)_2\overset{\bullet}{C}H$
(b) $(CH_3)_2\overset{\bullet}{C}H < (CH_3)_3\overset{\bullet}{C} < (C_6H_5)_2\overset{\bullet}{C}H < (C_6H_5)_3\overset{\bullet}{C}$
(c) $(CH_3)_2\overset{\bullet}{C}H < (CH_3)_3\overset{\bullet}{C} < (C_6H_5)_2\overset{\bullet}{C}H < (C_6H_5)_3\overset{\bullet}{C}$
(d) $(C_6H_5)_3\overset{\bullet}{C} < (C_6H_5)_2\overset{\bullet}{C}H < (CH_3)_3\overset{\bullet}{C} <$

48. $2CuFeS_2 + O_2 \longrightarrow Cu_2S + 2FeS + SO_2$
Which process of metallurgy of copper is represented by above equation? *[2017]*
(a) Concentration   (b) Roasting
(c) Reduction   (d) Purification

85. Which of the following are intermediates in Sandmeyer reaction ? *[2017]*
(i) $C_6H_5N^+ \equiv NCl^-$ (ii) $C_6H_5N^+ \equiv N$
(iii) $\overset{\bullet}{C}_6H_5$ (iv) C_6H_5Cl
(a) (ii) and (iii)   (b) (i) and (iv)
(c) (ii) and (iv)   (d) (i) and (ii)

53. When zeolite (hydrated sodium aluminium silicate) is treated with hard water the sodium ions are exchanged with *[2017]*
(a) H^+ ions   (b) Ca^{2+} ions
(c) SO_4^{2-} ions   (d) OH^- ions

16. A laboratory reagent imparts green colour to the flame. On heating with solid $K_2Cr_2O_7$ and conc. H_2SO_4 it evolves a red gas. Identify the reagent *[2017]*
(a) $CaCl_2$ (b) $BaCl_2$
(c) $CuCl_2$ (d) None of these

ASSERTION / REASON

Directions : Each of these questions contain two statements, Assertion and Reason. Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select one of the codes (a), (b), (c) and (d) given below.

(a) Assertion is correct, reason is correct; reason is a correct explanation for assertion.

(b) Assertion is correct, reason is correct; reason is not a correct explanation for assertion

(c) Assertion is correct, reason is incorrect

(d) Assertion is incorrect, reason is correct.

133. Assertion : The enthalpy of physisorption is greater than chemisorption. *[2017]*
Reason : Molecules of adsorbate and adsorbent are held by van der Waal's forces in physisorption and by chemical bonds in chemisorption.

Reason : The phenomenon in which ore is mixed with suitable flux and coke is heated to fusion is known as smelting.

247. Assertion : Both rhombic and monoclinic sulphur exist as S_8 but oxygen exists as O_2. *[2017]*
Reason : Oxygen forms $p\pi - p\pi$ multiple bond due to small size and small bond length but $p\pi - p\pi$ bonding is not possible in sulphur.

107. Assertoin : Aniline does not undergo Friedel-Crafts reaction. *[2017]*
Reason : $-NH_2$ group of aniline reacts with $AlCl_3$ (Lewis acid) to give acid-base reaction.

123. Assertion : Equal moles of different substances contain same number of constituent particles. *[2017]*
Reason : Equal weights of different substances contain the same number of constituent particles.

89. Assertion : $HClO_4$ is a stronger acid than $HClO_3$. *[2017]*
Reason : Oxidation state of Cl in $HClO_4$ is $+VII$ and in $HClO_3 +V$.

108. Assertion : Lithium carbonate is not so stable to heat. *[2017]*
Reason : Lithium being very small in size polarizes large CO_3^{2-} ion leading to the formation of more stable Li_2O and CO_2

154. Assertion : $[Fe(CN)_6]^{3-}$ is weakly paramagnetic while $[Fe(CN)_6]^{4-}$ is diamagnetic. *[2017]*
Reason : $[Fe(CN)_6]^{3-}$ has $+3$ oxidation state while $[Fe(CN)_6]^{4-}$ has $+2$ oxidation state.

150. Assertion : If one component of a solution obeys Raoult's law over a certain range of composition, the other component will not obey Henry's law in that range. *[2017]*
Reason : Raoult's law is a special case of Henry's law.

115. Assertion : Gases do not liquefy above their critical temperature, even on applying high pressure. *[2017]*
Reason : Above critical temperature, the molecular speed is high and intermolecular attractions cannot hold the molecules together

172. Assertion : Aniline is better nucleophile than anilium ion. *[2017]*
Reason : Anilium ion have +ve charge.

171. Assertion : Benzene exhibit two different bond lengths, due to $C - C$ single and $C = C$ double bonds. *[2017]*
Reason : Actual structure of benzene is a hybrid of following two structures.
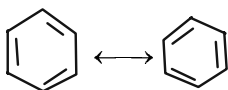
125. Assertion : Galvanised iron does not rust. *[2017]*
Reason : Zinc has a more negative electrode potential than iron.

118. Assertion : Atomic radius of gallium is higher than that of aluminium *[2017]*
Reason : The presence of additional *d*-electron offer poor screening effect for the outer electrons from increased nuclear charge. *[2017]*

140. Assertion : The radius of the first orbit of hydrogen atom is 0.529Å. *[2017]*
Reason : Radius of each circular orbit (r_n) - 0.529Å (n^2/Z), where n = 1, 2, 3 and Z = atomic number.

153. Assertion : NF_3 is a weaker ligand than $N(CH_3)_3$. *[2017]*
Reason : NF_3 ionizes to give F^- ions in aqueous solution.

114. Assertion : S_N2 reaction of an optically active aryl halide with an aqueous solution of KOH always gives an alcohol with opposite sign of rotation. *[2017]*
Reason : S_N2 reactions always proceed with inversion of configuration.

152. Assertion : Magnetic moment values of actinides are lesser than the theoretically predicted values. *[2017]*
Reason : Actinide elements are strongly paramagnetic.

107. Assertion : Sedatives are given to patients who are mentally agitated and violent. *[2017]*
Reason : Sedatives are used to suppress the activities of central nervous system. *[2017]*

107. Assertion : In vulcanisation of rubber, sulphur cross links are introduced. *[2017]*

BIOLOGY

67. Match column I with column II and choose the correct option.

	Column-I		Column-II
A.	Family	I.	*tuberosum*
B.	Kingdom	II.	Polymoniales
C.	Order	III.	*Solanum*
D.	Species	IV.	Plantae
E.	Genus	V.	Solanaceae

(a) A – IV; B – III; C – V; D – II; E – I
(b) A – V; B – IV; C – II; D – I; E – III
(c) A – IV; B – V; C – II; D – I; E – III
(d) A – V; B – III; C – II; D – I; E – IV

34. Consider the following statements regarding the major pigments and stored food in the different groups of algae and choose the correct option

(i) In chlorophyceae, the stored food material is starch and the major pigments are chlorophyll-*a* and *d*.

(ii) In phaeophyceae, laminarian is the stored food and major pigments are chlorophyll-*a* and *b*.

(iii) In rhodophyceae, floridean starch is the stored food and the major pigments are chlorophyll-*a*, *d* and phycoerythrin.

(a) (i) is correct, but (ii) and (iii) are incorrect
(b) (i) and (ii) are correct, but (iii) is incorrect
(c) (i) and (iii) are correct, but (ii) is incorrect
(d) (iii) is correct, but (i) and (ii) are incorrect

58. Column-I contains organisms and column-II contains their excretory structures. Choose the correct match form the options given below.

	Column- I (Organism)		Column -II (Excretory structures)
A.	Cockroach	I.	Nephridia
B.	Cat fish	II.	Malpighian tubules
C.	Earthworm	III.	Kidneys
D.	*Balanoglossus*	IV.	Flame cells
E.	Flatworm	V.	Proboscis gland

(a) A – I; B – III; C – II; D – IV; E – V
(b) A – III; B – I; C – II; D – V; E – IV
(c) A – II; B – I; C – III; D – V; E – IV
(d) A – II; B – III; C – I; D – V; E – IV

65. In which one of the following the genus name.

	Genus name	Two characters	Phylum
(a)	Pila	(i) Body segmented	Mollusca
		Mouth with radula	
(b)	Asterias	(ii) Spiny skinned	Echinodermata
		Water vascular system	
(c)	Sycon	(iii) Pore bearing	Porifera
		Canal system	
(d)	Periplaneta	(iv) Jointed appendages	Arthropoda
		Chitinous exoskeleton	

47. Assertion : In a DNA molecule, A–T rich parts melt before G–C rich parts.
Reason: In between A and T there are three H–bond, whereas in between G and C there are two H-bonds.

83. Nucleotides are building blocks of nucleic acids. Each nucleotide is a composite molecule formed by
(a) base-sugar-phosphate.
(b) base-sugar-OH.
(c) (base-sugar-phosphate)$_n$.
(d) sugar-phosphate.

44. Match the description (given in column I) with correct stage of prophase I (given column II) and choose the correct option.

	Column I		Column II
A.	Chromosomes are moved to spindle equator	I.	Pachytene
B.	Centromere splits and chromatids move apart	II.	Zygotene
C.	Pairing between homologous chromosomes takes place	III.	Anaphase
D.	Crossing between homologous chromosomes	IV.	Metaphase

(a) A – I; B – II; C – III; D – IV
(b) A – II; B – III; C – IV; D – I
(c) A – IV; B – III; C – II; D – I
(d) A – III; B – I; C – IV; D – II

34. Refer the given equation and answer the

$$2(C_{51}H_{98}O_6) + 145O_2 \longrightarrow 102CO_2$$
$$+ 98H_2O + Energy$$
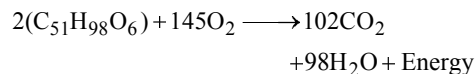
The R.Q of above reaction is
(a) 1
(b) 0.7
(c) 1.45
(d) 1.62

74. Assertion : Water and electrolytes are almost fully absorbed in the large intestine.
Reason : In large intestine, haustral contractions (slow segmenting movements) roll the forming faeces over and over, causing absorption of water and electrolytes.

71. Assertion : A cerebellum is related with skillful voluntary movement and involuntary activity like body balance, equilibrium *etc*.
Reason : It is part of hind brain and it is situated behind the pons.

74. In a practical test, a student has to identify the organisms in which syngamy does not occur. In those organisms the female gamete undergoes development to form new organisms without fertilization. This phenomenon is called "X".
Identify the organisms and the phenomenon "X".
(a) Frog, Parthenogenesis
(b) Lizards, Gametogenesis
(c) Rotifers, Embryogenesis
(d) Honeybee, Parthenogenesis

47. Assertion : Endosperm is a nutritive tissue and it is triploid.
Reason: Endosperm is formed by fusion of secondary nucleus to second male gamete. It is used by developing embryo.

74. The given figure represents the cross bridge cycle in skeletal muscle. What does the step B in the figure represents?
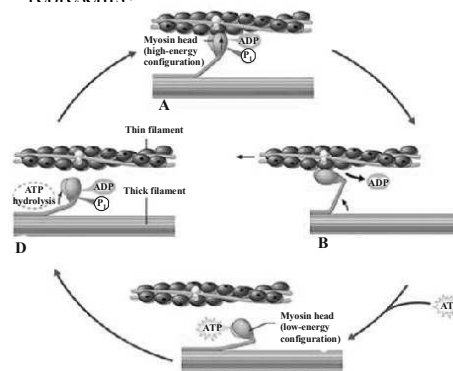
(a) Attachment of myosin head to actin forming

(c) Attachment of new ATP to myosin head. The cross bridge detaches.

(d) Splitting of ATP into ADP and Pi. Myosin cocks into its high energy conformation.

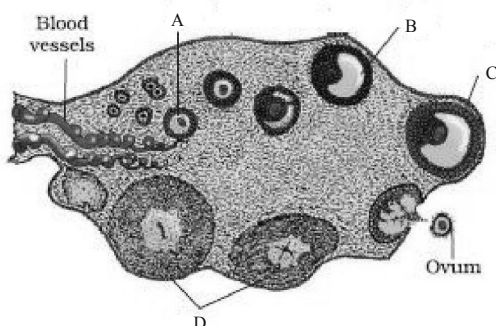**91.** The figure given below shows the sectional view of ovary. Select the option which gives correct identification of marked structure (A to D) and its feature.

(a) A: Primary follicle, it is also called gamete mother cell.

(b) B: Corpus luteum, it cannot be formed and added after birth.

(c) C: Graafian follicle, mature follicle which ruptures to release secondary oocyte.

(d) D: Tertiary follicle, a large number of this follicle degenerates during the phase from birth to puberty.

53. Select the correct match of the techniques given in column I with its feature given in column II.

	Column I		Column II
A.	ICSI	I	Artificially introduction of semen into the vagina or uterus.
B.	IUI	II	Transfer of ovum collected from a donor into the fallopian tube where fertilization occur
C.	IUT	III	Formation of embryo by directly injecting sperm into the
D.	GIFT	IV	Transfer of the zygote or early embryo (with up to 8 blastomeres) into a fallopian tube.
E.	ZIFT	V	Transfer of embryo with more

(a) A – V; B – IV; C – I; D – III; E – IV

(b) A – I; B – II; C – III; D – IV; E – V

(c) A – III; B – V; C – II; D – IV; E – I

(d) A – III; B – I; C – V; D – II; E – IV

50. Assertion : In humans, the gamete contributed by the male determines whether the child produced will be male or female.

Reason : Sex in humans is a polygenic trait depending upon a cumulative effect of some genes on X-chromosome and some on Y-chromosome.

52. Assertion : Replication and transcription occur in the nucleus but translation takes place in the cytoplasm.

Reason : mRNA is transferred from the nucleus into cytoplasm where ribosomes and amino acids are available for protein synthesis.

64. The given figure shows the structure of nucleosome with their parts labelled as A, B & C. Identify A, B and C.

Core of histone molecules
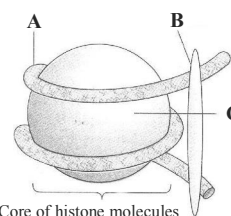
(a) A – DNA; B – H_1 histone; C – Histone octamer

(b) A – H_1 histone; B – DNA; C – Histone octamer

(c) A – Histone octamer; B – RNA; C – H_1 histone

(d) A – RNA; B – H_1 histone; C – Histone octamer

59. Match the codons given in column I with their respective amino acids given in column II and choose the correct answer.

Column -I (Codons)		Column -II (Amino acids)	
A	UUU	I.	Serine
B	GGG	II.	Methionine
C	UCU	III.	Phenylalanine
D	CCC	IV	Glycine

(a) A – III; B – IV; C – I; D – V; E – II
(b) A – III; B – I; C – IV; D – V; E – II
(c) A – III; B – IV; C – V; D – I; E – II
(d) A – II; B – IV; C – I; D – V; E – III

89. According to Hardy-Weinberg principle, allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences. It makes several assumptions which were given below.

i. Random Mating
ii. Sexual Reproduction
iii. Non-overlapping Generations
iv. Occurrence of Natural Selection
v. Small size of population

Identify two assumptions which do not meet for a population to reach Hardy-Weinberg Equilibrium?

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

47. Assertion : Somatic embryos can be induced from any cell in plant tissue culture.
Reason : Any living plant cell is capable of differentiating into somatic embryos.

51. Assertion : A major advantage of tissue culture is protoplast fusion.
Reason : A hybrid is formed by the fusion of naked protoplasts of two plants.

42. Which one of the following statement regarding BOD is true?
(a) The greater the BOD of waste water, more is its polluting potential.
(b) The greater the BOD of waste water, less is its polluting potential.
(c) The lesser the BOD of waste water, more is its polluting potential.
(d) The lesser the BOD of waste water, less is its polluting potential.

33. Which of the following statement is not correct about cloning vector ?
(a) 'Ori' is a sequence responsible for controlling the copy number of the linked DNA.
(b) Selectable marker selectively permitting the growth of the non-transformants.
(c) In order to link the alien DNA, the vector needs to have single *recognition site* for the commonly used restriction enzymes.

41. Biodiversity loss occurs due to the reasons given below.
(i) Habitat loss and fragmentation
(ii) Co-extinction
(iii) Over-exploitation
(iv) Alien species invasion
Identify the correct reasons.
(a) (i) and (ii)
(b) (i), (ii) and (iii)
(c) (ii), (iii) and (iv)
(d) (i), (ii), (iii) and (iv)

43. Assertion: Communities that comprise of more species tend to be more stable.
Reason: A higher number of species results in less animal variation in total biomoss.

8. Euro II norms stipulate that sulphur be controlled at _____ ppm in diesel and _____ ppm in petrol.
(a) 350; 150
(b) 150; 350
(c) 350; 250
(d) 150; 250

43. Assertion : Eutrophication shows increase in productivity in water.
Reason : With increasing eutrophication, the diversity of the phytoplankton increases.

37. Assertion : In a food chain, members of successive higher levels are fewer in number.
Reason : Number of organisms at any trophic level depends upon the availability of organisms which serve as food at the lower level.

53. Assertion : Species are groups of potentially interbreeding natural populations which are isolated from other such groups.
Reason : Distinctive morphological characters are displayed due to reproductive isolation.

46. Assertion : Insertion of recombinant DNA within the coding sequence of β-galactosidase results in colourless colonies.
Reason : Presence of insert results in inactivation of enzyme β-galactosidase known as insertional inactivation.

87. Assertion: Artificially acquired passive immunity results when antibodies or lymphocytes produced outside the host are introduced into a host.
Reason: A bone marrow transplant given to a patient with genetic immunodeficiency is an example of artificially acquired passive immunity.

71. Assertion : Interstitial cell is present in the region outside the seminiferous tubule called interstitial spaces.

53. Assertion : Inflammation of a skeletal joint may immobilize the movements of the joint. **Reason :** Uric acid crystals in the joint cavity and ossification of articular cartilage lead to this.

48. Assertion : Auxins help to prevent fruit and leaf drop at early stages.

Reason : Auxins promote the abscission of older mature leaves and fruits.

56. Assertion : The squamous epithelium is made of a single thin layer of flattened cells with irregular boundaries.

Reason : They are found in walls of blood vessels and air sacs of wings.

56. Assertion : Ambulacral system plays a major role in locomotion of echinoderm.

Reason : Hydraulic pressure of fluid and contraction of muscle of tube feet make possible movement of echinoderm.

49. Assertion : TMV is a virus which causes mosaic disease.

Reason : TMV has RNA as genetic material.

17. Which of the following is a modified stem for the protection of plants from browsing animals?
(a) Tendrils   (b) Thorns
(c) Rhizome   (d) Tuber

74. Which of the following was most similar to modern man?
(a) Java man   (b) Neanderthal man
(c) Homo habilis   (d) Cro-Magnon man

76. Explant is required to be disinfected before placing in culture. This is done by
(a) autoclaving
(b) ultra-violet rays
(c) clorax or hypochlorite
(d) X-rays

2. Which of the following is a viral disease of poultry birds?
(a) Anthrax   (b) Ranikhet
(c) Coccidiosis   (d) None of these

26. The free-living fungus Trichoderma can be used for
(a) killing insects
(b) biological control of plant diseases
(c) controlling butterfly caterpillars
(d) producing antibiotics

34. In Urn shaped age pyramid of the population the trend of growth is

56. Arrange the following ecosystems in increasing order of mean NPP (Tonnes / ha / year)
A. Tropical deciduous forest
B. Temperate coniferous forest
C. Tropical rain forest
D. Temperate deciduous forest
(a) B < A < D < C
(b) D < B < A < C
(c) A < C < D < B
(d) B < D < A < C

22. Fungi are filamentous with the exception of "X" which is unicellular. Identify X.
(a) Yeast   (b) Albugo
(c) Mucor   (d) Lichen

24. Which of the following statements is not correct for viruses?
(a) Viruses are obligate parasites.
(b) Viruses can multiply only when they are inside the living cells.
(c) Viruses cannot pass through bacterial filters.
(d) Viruses are made up of protein and DNA or RNA (never both DNA and RNA).

46. Which of the following statements regarding cyanobacteria is incorrect?
(a) It is also called blue green algae.
(b) They are chemosynthetic autotrophs.
(c) It forms blooms in polluted water bodies.
(d) It is unicellular, colonial or filamentous, marine or terrestrial bacteria.

21. Leaves of dicotyledonous plants possess _____ venation, while _____ venation is the characteristic of most monocotyledons.
(a) reticulate and parallel
(b) parallel and reticulate
(c) reticulate and perpendicular
(d) obliquely and parallel

21. (a) Leaves of dicotyledonous plants possess reticulate venation while parallel venation is the characteristics of most monocotyledonous. In reticulate venation, the main veins of leaf form numerous irregular branches and as a result a net like arrangements is formed. Reticulated venation is the most common vein formation in

20. In stems, the protoxylem lies towards the _____ and the metaxylem lies towards the _____ of the organ.
    (a) centre; periphery
    (b) periphery; centre
    (c) periphery; periphery
    (d) centre; centre

25. Male cockroach can be identified from the female by the presence of
    (a) long antennae
    (b) wingless body
    (c) elongated abdomen
    (d) anal styles

32. The sensory papillae in frogs are associated with
    (a) smell   (b) hearing
    (c) respiration   (d) touch

22. In earthworms setae are present in all segments except
    (a) first and the last segments
    (b) first segment and the clitellum
    (c) first segment
    (d) clitellum and last segments

35. Which of the following statements is/are not incorrect?
    (i) Water and minerals, and food are generally moved by a mass or bulk flow system.
    (ii) Bulk flow can be achieved either through a positive hydrostatic pressure gradient or a negative hydrostatic pressure gradient.
    (iii) The bulk movement of substances through the conducting tissues of plants is called translocation.
    (iv) Xylem translocates organic and inorganic solutes, mainly from roots to the aerial parts of the plants.
    (v) Phloem translocates water, mineral salts, some organic nitrogen and hormones, from the leaves to other parts of the plants.

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

76. In alcoholic fermentation, NAD$^+$ is produced during the
    (a) reduction of acetyldehyde to ethanol.
    (b) oxidation of glucose.
    (c) oxidation of pyruvate to acetyl coA.
    (d) hydrolysis of ATP to ADP.

64. Which of the following statement is true ?
    (a) Pepsin cannot digest casein.
    (b) Trypsin can digest collagen.
    (c) Pepsin cannot digest collagen.
    (d) Chymotrypsin can digest casein.

43. Human immuno deficiency virus (HIV) has a protein coat and a genetic material which is
    (a) Single stranded DNA.
    (b) Single stranded RNA.
    (c) Double stranded RNA.
    (d) Double stranded DNA.

122. Which one of the following pairs of diseases is viral as well as transmitted by mosquitoes?
    (a) Elephantiasis and dengue
    (b) Yellow fever and sleeping sickness
    (c) Encephalitis and sleeping sickness
    (d) Yellow fever and dengue

24. Which variety of rice was patented by a U.S. company even though the highest number of varieties of this rice is found in India ?
    (a) Sharbati Sonara   (b) Co-667
    (c) Basmati   (d) Lerma Roja

16. Which of the following hormone acts upon the renal tubule and blood capillaries ?
    (a) Glucagon   (b) Aldosterone
    (c) Vasopressin   (d) Glucocorticoids