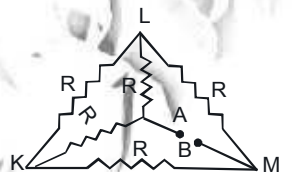


AIIMS 2017

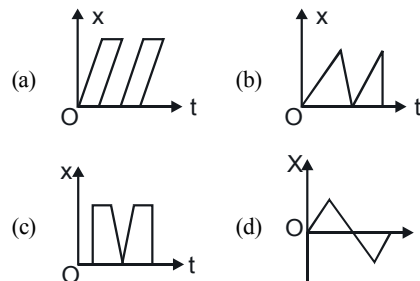
PHYSICS

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° with the vertical and rebound at 60° with the vertical. Assume contact to be smooth, the coefficient of restitution is
- (a) $e = \frac{1}{\sqrt{3}}$ (b) $e = \frac{1}{3}$
(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) 5R
(c) 3R (d) 6R
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 / second²
(b) 1800 degree / second²

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) $K/\rho P$ (b) $P/\rho K$
(c) $\rho P/K$ (d) $\rho K/P$
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 ${}^2_1\text{H}$ and ${}^4_2\text{He}$ respectively are 1.1 MeV and 7.1 MeV. The energy released in MeV when two ${}^2_1\text{H}$ nuclei fuse to form ${}^4_2\text{He}$ 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 $V = \frac{A\sqrt{x}}{x+B}$ where

A and B are constants. The dimensions of AB are

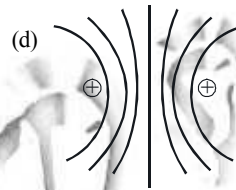
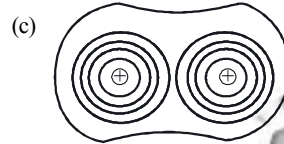
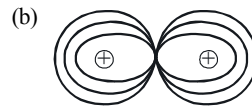
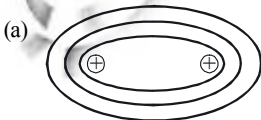
- (a) $[M^1 L^{5/2} T^{-2}]$
(b) $[M^1 L^2 T^{-2}]$
(c) $[M^{3/2} L^{5/2} T^{-2}]$
(d) $[M^1 L^{7/2} T^{-2}]$
83. A light ray falls on a rectangular glass slab as shown. The index of refraction of the glass, if total internal reflection is to occur at the vertical face, is

- (a) $\sqrt{3}/2$
(b) $\frac{(\sqrt{3}+1)}{2}$
(c) $\frac{(\sqrt{2}+1)}{2}$
(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

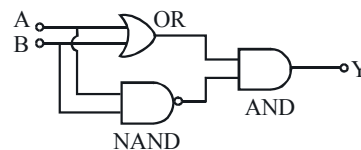
74. Which of the following figure shows the correct equipotential surfaces of a system of two positive charges?



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) $y = 0.1 \sin\left(\pm 4t + \frac{\pi}{4}\right)$
(b) $y = 0.2 \sin\left(\pm 4t + \frac{\pi}{4}\right)$
(c) $y = 0.1 \sin\left(\pm 2t + \frac{\pi}{4}\right)$
(d) $y = 0.2 \sin\left(\pm 2t + \frac{\pi}{4}\right)$

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) $3\mu_0/2\pi$

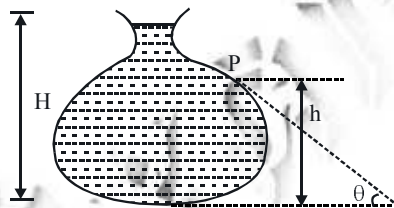
70. A small block of mass m is kept on a rough inclined surface of inclination θ fixed in an elevator. The elevator goes up with a uniform velocity v and the block does not slide on the wedge. The work done by the force of friction on the block in time t as seen by the observer on the inclined plane 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 $3/4^{\text{th}}$ 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 $\frac{1}{\epsilon_0}$ times the total charge placed near the closed surface.

- (b) the total electric flux through a closed surface

is $\frac{1}{\epsilon_0}$ times the total charge enclosed by the closed surface.

- (c) the total electric flux through an open surface

is $\frac{1}{\epsilon_0}$ times the total charge placed near the open surface.

- (d) the line integral of electric field around the

boundary of an open surface is $\frac{1}{\epsilon_0}$ times the

total charge placed near the open surface.

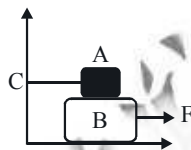
18. A current carrying coil is subjected to a uniform magnetic field. The coil will orient so that its plane

- (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

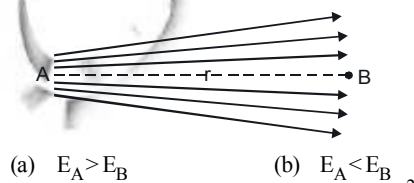
90. Block A of weight 100 kg rests on a block B and is tied with horizontal string to the wall at C. Block B is of 200 kg. The coefficient of friction between A and B is 0.25 and that between B and surface is $\frac{1}{3}$. The horizontal force F necessary to move the block B should be ($g = 10 \text{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

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

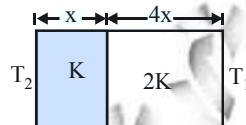


129. In an A.C. circuit, the current flowing in inductance is $I = 5 \sin(100t - \pi/2)$ amperes and the potential difference is $V = 200 \sin(100t)$ volts. The power consumption is equal to
 (a) 1000 watt (b) 40 watt
 (c) 20 watt (d) Zero

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



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 $\left(\frac{A(T_2 - T_1)K}{x}\right) f$ with f equal to



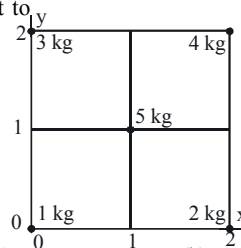
- (a) 1 (b) $\frac{1}{2}$
 (c) $\frac{2}{3}$ (d) $\frac{1}{3}$

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

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

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

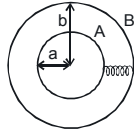
54. Five masses are placed in a plane as shown in figure. The coordinates of the centre of mass are nearest to



- (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) $4\pi\epsilon_0 \frac{ab}{b-a}$
 (b) $4\pi\epsilon_0(a+b)$
 (c) $4\pi\epsilon_0 b$
 (d) $4\pi\epsilon_0 a$



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 $\frac{4}{3}f$.
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 :** Kirchhoff's junction 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 deceleration.

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 convert 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 understanding 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 4.29 \AA . The radius of sodium atom is approximately : [2017]

- (a) 5.72 \AA (b) 0.93 \AA
(c) 1.86 \AA (d) 3.22 \AA

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) $3 \rightarrow 2$

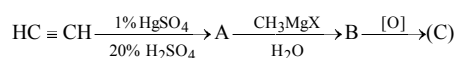
109. The ether that undergoes electrophilic substitution reactions is [2017]

- (a) $\text{CH}_3\text{OC}_2\text{H}_5$ (b) $\text{C}_6\text{H}_5\text{OCH}_3$
(c) CH_3OCH_3 (d) $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$

62. Aldol condensation will not be observed in [2017]

- (a) chloral
(b) phenylacetaldehyde
(c) hexanal
(d) nitromethane

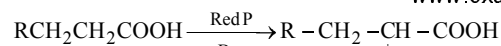
84. The end product (C) in the following sequence of reactions is [2017]



- (a) acetic acid (b) isopropyl alcohol
(c) acetone (d) ethanol

37. The reaction

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- (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) enantiomers
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

$$\text{Phenol} \xrightarrow{\text{NaOH}} (\text{A}) \xrightarrow[140]{\text{CO}_2 + \text{HCl}} (\text{B}), \text{ here B is}$$
 [2017]
 (a) benzaldehyde (b) chlorobenzene
 (c) benzoic acid (d) salicylic acid
39. The molar heat capacity of water at constant pressure is $75 \text{ JK}^{-1} \text{ mol}^{-1}$. When 1 kJ 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 $\Delta_f H^\circ$ for $\text{CO}_2(\text{g})$, $\text{CO}(\text{g})$ and $\text{H}_2\text{O}(\text{g})$ are -393.5, -110.5 and -241.8 kJ/mol respectively, the standard enthalpy change (in kJ) for the reaction $\text{CO}_2(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{H}_2\text{O}(\text{g})$ is: [2017]
 (a) 524.1 (b) 41.2
 (c) -262.5 (d) -41.2
21. For the following reaction in gaseous phase

$$\text{CO}(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}), K_p / K_c \text{ is}$$
 [2017]
39. Which of the following relation represents correct relation between standard electrode potential and equilibrium constant? [2017]
 I. $\log K = \frac{nFE^\circ}{2.303 RT}$
 II. $K = e^{\frac{nFE^\circ}{RT}}$
 III. $\log K = \frac{-nFE^\circ}{2.303 RT}$
 IV. $\log K = 0.4342 \frac{-nFE^\circ}{RT}$
 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 $\text{Mg}(\text{OH})_2$ is 1.0×10^{-11} . At which pH, will Mg^{2+} ions start precipitating in the form of $\text{Mg}(\text{OH})_2$ from a solution of 0.001 M Mg^{2+} ions? [2017]
 (a) 9 (b) 10
 (c) 11 (d) 8
67. In the given reaction

$$\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_3 \xrightarrow{\text{X}}$$

$$\text{CH}_3\text{CH}_2\text{COOH} + \text{CH}_3\text{COOH}$$
 The X is [2017]
 (a) $\text{C}_2\text{H}_5\text{ONa}$
 (b) Conc. $\text{HCl} + \text{Anhy. ZnCl}_2$
 (c) Anh. AlCl_3
 (d) $\text{KMnO}_4/\text{OH}^-$
128. The strongest ortho - para and strongest meta - directing groups respectively are [2017]
 (a) $-\text{NO}_2$ and $-\text{NH}_2$
 (b) $-\text{CONH}_2$ and $-\text{NH}_2$
 (c) $-\text{NH}_2$ and $-\text{CONH}_2$
 (d) $-\text{NH}_2$ and $-\text{NO}_2$
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 occurring in basic medium [2017]
 $2\text{MnO}_4^- (\text{aq}) + \text{Br}^- (\text{aq}) \longrightarrow$
 $2\text{MnO}_2 (\text{s}) + \text{BrO}_3^- (\text{aq})$
 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 2 H^+ ions on right side
 (d) Both (a) and (b)
19. On the basis of the following E° values, the strongest oxidizing agent is : [2017]
 $[\text{Fe}(\text{CN})_6]^{4-} \rightarrow [\text{Fe}(\text{CN})_6]^{3-} + \text{e}^-; E^\circ = -0.35 \text{ V}$
 $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-; E^\circ = -0.77 \text{ V}$
 (a) $[\text{Fe}(\text{CN})_6]^{4-}$ (b) Fe^{2+}
 (c) Fe^{3+} (d) $[\text{Fe}(\text{CN})_6]^{3-}$
35. Consider the following cell reaction: [2017]
 $2\text{Fe} (\text{s}) + \text{O}_2 (\text{g}) + 4\text{H}^+ (\text{aq}) \rightarrow$
 $2\text{Fe}^{2+} (\text{aq}) + 2\text{H}_2\text{O} (\text{l}); E^\circ = 1.67 \text{ V}$
 At $[\text{Fe}^{2+}] = 10^{-3} \text{ M}$, $p(\text{O}_2) = 0.1 \text{ atm}$ and $\text{pH} = 3$, 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 peroxyacids of sulphur? [2017]
 (a) H_2SO_5 and $\text{H}_2\text{S}_2\text{O}_8$
 (b) H_2SO_5 and $\text{H}_2\text{S}_2\text{O}_7$
 (c) $\text{H}_2\text{S}_2\text{O}_7$ and $\text{H}_2\text{S}_2\text{O}_8$
 (d) $\text{H}_2\text{S}_2\text{O}_6$ and $\text{H}_2\text{S}_2\text{O}_7$
35. For d block elements the first ionization potential is of the order [2017]
 (a) $\text{Zn} > \text{Fe} > \text{Cu} > \text{Cr}$
 (b) $\text{Sc} = \text{Ti} < \text{V} = \text{Cr}$
 (c) $\text{Zn} < \text{Cu} < \text{Ni} < \text{Co}$
 (d) $\text{V} > \text{Cr} > \text{Mn} > \text{Fe}$
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(ethylenediamine)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 $0.512 \text{ K kg mol}^{-1}$ 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) $(\text{C}_6\text{H}_5)_2\dot{\text{C}}\text{H} < (\text{C}_6\text{H}_5)_3\dot{\text{C}} < (\text{CH}_3)_3\dot{\text{C}} < (\text{CH}_3)_2\dot{\text{C}}\text{H}$
 (b) $(\text{CH}_3)_2\dot{\text{C}}\text{H} < (\text{CH}_3)_3\dot{\text{C}} < (\text{C}_6\text{H}_5)_2\dot{\text{C}}\text{H} < (\text{C}_6\text{H}_5)_3\dot{\text{C}}$
 (c) $(\text{CH}_3)_2\dot{\text{C}}\text{H} < (\text{CH}_3)_3\dot{\text{C}} < (\text{C}_6\text{H}_5)_2\dot{\text{C}}\text{H} < (\text{C}_6\text{H}_5)_3\dot{\text{C}}$
 (d) $(\text{C}_6\text{H}_5)_3\dot{\text{C}} < (\text{C}_6\text{H}_5)_2\dot{\text{C}}\text{H} < (\text{CH}_3)_3\dot{\text{C}} < (\text{CH}_3)_2\dot{\text{C}}\text{H}$

48. $2\text{CuFeS}_2 + \text{O}_2 \longrightarrow \text{Cu}_2\text{S} + 2\text{FeS} + \text{SO}_2$
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) $\text{C}_6\text{H}_5\text{N}^+ \equiv \text{NCl}^-$ (ii) $\text{C}_6\text{H}_5\text{N}^+ \equiv \text{N}$
(iii) C_6H_5 (iv) $\text{C}_6\text{H}_5\text{Cl}$
(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 $\text{K}_2\text{Cr}_2\text{O}_7$ 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. **Assertion :** Aniline does not undergo Friedel-Crafts reaction. [2017]

Reason : $-\text{NH}_2$ 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 :** $[\text{Fe}(\text{CN})_6]^{3-}$ is weakly paramagnetic while $[\text{Fe}(\text{CN})_6]^{4-}$ is diamagnetic. [2017]

Reason : $[\text{Fe}(\text{CN})_6]^{3-}$ has +3 oxidation state while $[\text{Fe}(\text{CN})_6]^{4-}$ 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]

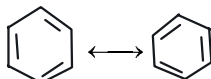
Reason : Above critical temperature, the molecular speed is high and intermolecular attractions cannot hold the molecules together

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 $\text{N}(\text{CH}_3)_3$. [2017]

Reason : NF_3 ionizes to give F^- ions in aqueous solution.

114. Assertion : $\text{S}_{\text{N}}2$ reaction of an optically active aryl halide with an aqueous solution of KOH always gives an alcohol with opposite sign of rotation. [2017]

Reason : $\text{S}_{\text{N}}2$ 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

- A. Family
- B. Kingdom
- C. Order
- D. Species
- E. Genus

Column-II

- I. *tuberosum*
- II. Polymoniales
- III. *Solanum*
- IV. Plantae
- 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 from the options given below.

Column-I (Organism) structures)

- A. Cockroach
- B. Cat fish
- C. Earthworm
- D. *Balanoglossus*
- E. Flatworm

Column-II (Excretory structures)

- I. Nephridia
- II. Malpighian tubules
- III. Kidneys
- IV. Flame cells
- 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 Mouth with radula	Mollusca
(b)	Asterias	(ii) Spiny skinned Water vascular system	Echinodermata
(c)	Sycon	(iii) Pore bearing Canal system	Porifera
(d)	Periplaneta	(iv) Jointed appendages Chitinous exoskeleton	Arthropoda

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

- base-sugar-phosphate.
- base-sugar-OH.
- (base-sugar-phosphate)_n.
- sugar-phosphate.

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

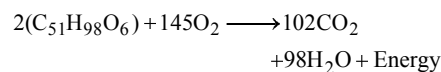
Column I

Column II

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

- A – I; B – II; C – III; D – IV
- A – II; B – III; C – IV; D – I
- A – IV; B – III; C – II; D – I
- A – III; B – I; C – IV; D – II

34 Refer the given equation and answer the



The R.Q of above reaction is

- 1
- 0.7
- 1.45
- 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.

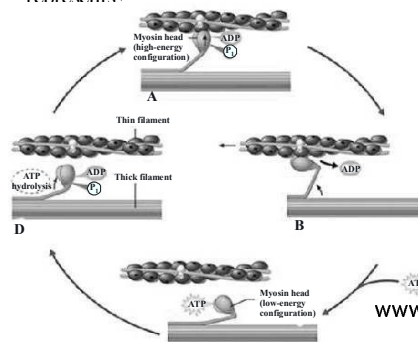
74. In a practical test, a student has to identify the organisms in which syngamy does not occur. In those organisms the female gamete undergoes development to form new organisms without fertilization. This phenomenon is called "X". Identify the organisms and the phenomenon "X".

- Frog, Parthenogenesis
- Lizards, Gametogenesis
- Rotifers, Embryogenesis
- 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.

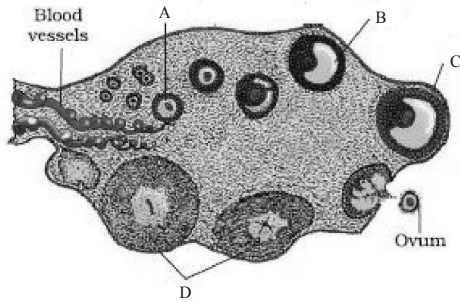
74. The given figure represents the cross bridge cycle in skeletal muscle. What does the step B in the figure represents?



(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 upto 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

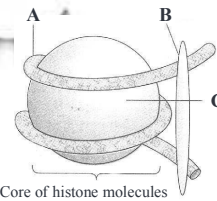
50. **Assertion :** In humans, the gamete contributed by the male determines whether the child produced will be male or female.

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.



- (a) A – DNA; B – H₁ histone; C – Histone octamer
(b) A – H₁ histone; B – DNA; C – Histone octamer
(c) A – Histone octamer; B – RNA; C – H₁ histone
(d) A – RNA; B – H₁ 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.
- Random Mating
 - Sexual Reproduction
 - Non-overlapping Generations
 - Occurrence of Natural Selection
 - 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.
- Habitat loss and fragmentation
 - Co-extinction
 - Over-exploitation
 - 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 biomass.
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 www.extramrce.com outside the seminiferous tubule called interstitial

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. www.exampnrace.com
Reticulate 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 acetaldehyde 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

SOLUTION – AIMS 2017

PHYSICS

107. (d) $K_{\max} = \frac{hc}{\lambda} - W = \frac{hc}{\lambda} - 5.01 =$
 $\frac{12375}{\lambda (\text{in } \text{\AA})} - 5.01$
 $= \frac{12375}{2000} - 5.01 = 6.1875 - 5.01 =$
 $1.1775 \approx 1.2 \text{ V}$

53. (b) Components of velocity before and after collision parallel to the plane are equal, So
 $v \sin 60^\circ = u \sin 30^\circ \dots\dots(1)$
 Components of velocity normal to the plane are related to each other
 $v \cos 60^\circ = e u (\cos 30^\circ) \dots\dots(2)$
 $\Rightarrow \cot 60^\circ = e \cot 30^\circ \Rightarrow e = \frac{\cos 60^\circ}{\cot 30^\circ}$

$$\Rightarrow e = \frac{1}{\sqrt{3}} \Rightarrow e = \frac{1}{3}$$

146. (c) No. of electrons reaching the collector,
 $n_C = \frac{96}{100} \times 10^{10} = 0.96 \times 10^{10}$

$$\text{Emitter current, } I_E = \frac{n_E \times e}{t}$$

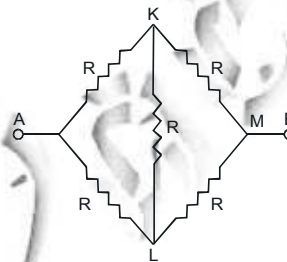
$$\text{Collector current, } I_C = \frac{n_C \times e}{t}$$

\therefore Current transfer ratio,

$$\alpha = \frac{I_C}{I_E} = \frac{n_C}{n_E} = \frac{0.96 \times 10^{10}}{10^{10}} = 0.96$$

122. (a) The equivalent circuit is shown in fig. Since the Wheatstone's bridge is balanced, therefore no current will flow through the arm KL. Equivalent resistance between AKM = $R + R = 2R$
 Equivalent resistance between A I M = $R +$

equivalent resistance between A and B is given by



$$\frac{1}{R'} = \frac{1}{2R} + \frac{1}{2R} = \frac{2}{2R} = \frac{1}{R}$$

i.e., $R' = R$

62. (d) $\alpha = \frac{\omega_2 - \omega_1}{t_2 - t_1}$

$$\omega_1 = \frac{2\pi \times 1200}{60} = 40\pi ;$$

$$\omega_2 = \frac{2\pi \times 4500}{60} = 150\pi$$

$$\alpha = \frac{110\pi}{10} \text{ rad/sec}^2$$

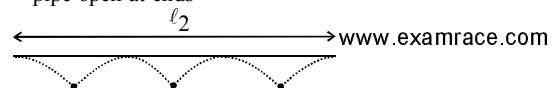
Now, π radian = 180°

$$\therefore 1 \text{ rad} = \frac{180}{\pi} \text{ degree}$$

$$\therefore \alpha = \frac{11\pi \times 180}{\pi} \text{ degree/sec}^2$$

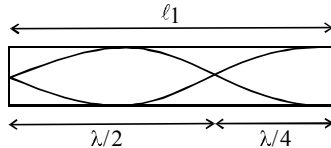
$$= 1980 \text{ degree/sec}^2$$

55. (a) For 3rd harmonic/2nd over tone of organ pipe open at ends



$$\Rightarrow n_2 = \frac{3v}{2\ell_2}$$

For 1st overtone of organ pipe open at one end



$$\Rightarrow n_1 = \frac{3v}{4\ell_1}$$

$$\text{Given } n_1 = n_2 \Rightarrow \frac{3v}{2\ell_2} = \frac{3v}{4\ell_1} \text{ or } \frac{\ell_1}{\ell_2} = \frac{1}{2}$$

5. (a) $K = \frac{p}{\Delta V/V}$ or $\frac{\Delta V}{V} = \frac{p}{K}$;
Also $\rho = \frac{M}{V}$ and $\rho' = \frac{M}{V - \Delta V}$;
 $\therefore \frac{\rho'}{\rho} = \frac{V}{(V - \Delta V)} = \frac{1}{(1 - \Delta V/V)} = \left(1 - \frac{\Delta V}{V}\right)^{-1}$

$$\approx \left(1 + \frac{\Delta V}{V}\right) = 1 + \frac{p}{K} \text{ or } \frac{\rho'}{\rho} - 1 = \frac{p}{K}$$

or $\rho' - \rho = \frac{\rho p}{K} \quad (\because \Delta V \ll V)$

102. (a) $e = \frac{-d\phi}{dt} = \frac{-d}{dt}(6t^2 - 5t + 1) = -12t + 5$
 $e = -12(0.25) + 5 = 2 \text{ volt}$

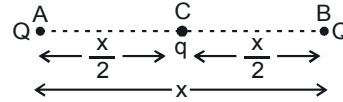
$$i = \frac{e}{R} = \frac{2}{10} = 0.2 \text{ A}$$

4. (d) is not possible, because at a particular time t , displacement cannot have two values.

39. (c) The chemical reaction of process is $2^2_1\text{H} \rightarrow ^4_2\text{He}$

$$\text{Energy released} = 4 \times (7.1) - 4(1.1) = 24 \text{ eV}$$

119. (d) Let q charge is situated at the mid position of the line AB. The distance between AB is x . A and B be the positions of charges Q and Q respectively.



$$\text{Let } AC = \frac{x}{2}, BC = \frac{x}{2}$$

The force on A due to charge q at C,

$$\vec{F}_{CA} = \frac{1}{4\pi\epsilon_0} \cdot \frac{Qq}{(x/2)^2} \text{ along } \vec{AC}$$

The force on A due to charge Q at B

$$\vec{F}_{AB} = \frac{1}{4\pi\epsilon_0} \cdot \frac{Q^2}{x^2} \text{ along } \vec{BA}$$

The system is in equilibrium, then two oppositely directed force must be equal, i.e., total force on A is equal to zero.

$$\vec{F}_{CA} + \vec{F}_{AB} = 0 \Rightarrow \vec{F}_{CA} = -\vec{F}_{AB}$$

$$\frac{1}{4\pi\epsilon_0} \cdot \frac{4Q \cdot q}{x^2} = \frac{-1}{4\pi\epsilon_0} \cdot \frac{Q^2}{x^2}$$

$$\Rightarrow q = -\frac{Q}{4}$$

35. (d) $B = x = [L]; A\sqrt{x} = Vx; A = V\sqrt{x}$

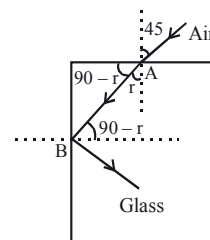
$$= ML^2 T^{-2} L^{1/2} = ML^{5/2} T^{-2}$$

$$AB = (ML^{5/2} T^{-2})(L) = [M^1 L^{7/2} T^{-2}]$$

83. (a) For point A, $a\mu_g = \frac{\sin 45^\circ}{\sin r}$

$$\Rightarrow \sin r = \frac{1}{\sqrt{2} a\mu_g}$$

for point B, $\sin(90 - r) = g\mu_a$
($90 - r$) is critical angle.



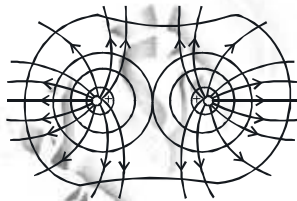
Nurturing Ambitions

$$\begin{aligned}\therefore \cos r &= \frac{\mu_a}{\mu_g} = \frac{1}{\mu_g} \\ \Rightarrow \mu_g &= \frac{1}{\cos r} \\ &= \frac{1}{\sqrt{1 - \sin^2 r}} = \frac{1}{\sqrt{1 - \frac{1}{\mu_g^2}}} \\ \Rightarrow \mu_g^2 &= \frac{1}{1 - \frac{1}{\mu_g^2}} = \frac{\mu_g^2}{\mu_g^2 - 1} \\ \Rightarrow 2\mu_g^2 - 1 &= 2 \Rightarrow \mu_g = \sqrt{\frac{3}{2}}\end{aligned}$$

77. (a) Since water does not fall down, therefore the velocity of revolution should be just sufficient to provide centripetal acceleration at the top of vertical circle. So,

$$v = \sqrt{gr} = \sqrt{\{10 \times (1.6)\}} = \sqrt{16} = 4 \text{ m/sec.}$$

74. (c) Equipotential surfaces are normal to the electric field lines. The following figure shows the equipotential surfaces along with electric field lines for a system of two positive charges.



58. (a) The displacement of a particle in S.H.M. is given by
 $y = a \sin(\omega t + \phi)$

$$\text{velocity} = \frac{dy}{dt} = \omega a \cos(\omega t + \phi)$$

The velocity is maximum when the particle passes through the mean position i.e.,

$$\left(\frac{dy}{dt}\right)_{\max} = \omega a$$

The kinetic energy at this instant is given by

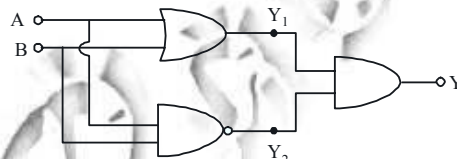
$$\frac{1}{2} m \left(\frac{dy}{dt}\right)_{\max}^2 = \frac{1}{2} m \omega^2 a^2 = 8 \times 10^{-3} \text{ joule}$$

$$\text{or } \frac{1}{2} \times (0.1) \omega^2 \times (0.1)^2 = 8 \times 10^{-3}$$

Solving we get $\omega = \pm 4$

Substituting the values of a , ω and ϕ in the equation of S.H.M., we get
 $y = 0.1 \sin(\pm 4t + \pi/4) \text{ metre.}$

99. (b)



$$Y_1 = A + B, Y_2 = \overline{A} \cdot \overline{B}$$

$$Y = (A + B) \cdot \overline{A} \cdot \overline{B} = A \cdot \overline{A} + A \cdot \overline{B} + B \cdot \overline{A} + B \cdot \overline{B}$$

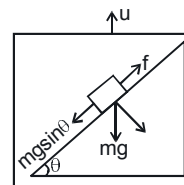
$$= 0 + A \cdot \overline{B} + B \cdot \overline{A} + 0 = A \cdot \overline{B} + B \cdot \overline{A}$$

This expression is for XOR

18. (c) $B = \frac{\mu_0}{4\pi} \frac{2i_2}{(r/2)} - \frac{\mu_0}{4\pi} \frac{2i_1}{(r/2)} = \frac{\mu_0}{4\pi} \frac{4}{r} (i_2 - i_1)$

$$= \frac{\mu_0}{4\pi} \frac{4}{5} (5 - 2.5) = \frac{\mu_0}{2\pi}$$

70. (a) Since block does not slide on wedge so displacement is zero & hence work done by force is zero.



123. (d) The distance between the first dark fringe on either side of the central bright fringe
 = width of central maximum

$$\begin{aligned}&= \frac{2D\lambda}{a} = \frac{2 \times 2 \times 600 \times 10^{-9}}{10^{-3}} \\ &= 2.4 \times 10^{-3} \text{ m} = 2.4 \text{ mm}\end{aligned}$$

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51. (c) Pressure is proportional to depth from the free surface and is same in all directions.

47. (b)

114. (d) $[Y] = \frac{[X]}{[Z^2]} = \frac{M^{-1}L^{-2}T^4A^2}{M^2T^{-4}A^{-2}}$

$$= M^{-3}L^{-2}Q^4T^4 \quad \left(\because A = \frac{Q}{T} \right)$$

66. (b) Effective half life is calculated as

$$\frac{1}{T} = \frac{1}{T_1} + \frac{1}{T_2}$$

$$\frac{1}{T} = \frac{1}{16} + \frac{1}{48} \Rightarrow T = 12 \text{ years}$$

Time in which $\frac{3}{4}$ will decay is 2 half lives = 24 years

41. (d) Angle of dip, $\delta = 45^\circ$

$$\therefore \tan \delta' = \frac{\tan \delta}{\cos \theta} = \frac{\tan 45^\circ}{\cos 30^\circ} = \frac{1}{\sqrt{3}/2} = \frac{2}{\sqrt{3}}$$

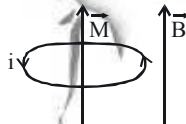
$$\therefore \text{Real dip } \delta' = \tan^{-1} (2/\sqrt{3})$$

50. (b) Gauss's law is applicable only for closed surface and for the charge placed inside it not near it.

$$\text{Total electric flux, } \phi_e = \frac{1}{\epsilon_0} Q$$

18. (d) $\vec{\tau} = (\vec{M} \times \vec{B})$, where $|\vec{M}| = iA$
 $= MB \sin \theta$

where θ is angle between Magnetic moment & \vec{B} . For $\theta = 0$ $\vec{\tau} = 0$ & coil is in stable equilibrium. Hence plane of coil must be perpendicular to magnetic field.



33. (a) In vacuum velocity of all EM waves are same but their wavelengths are different.

28. (a) In adiabatic process

$$\Delta Q = 0$$

$$\therefore \Delta W = -\Delta U$$

90. (d) F_f = Force of friction between B and A

$$= \mu_1 m_1 g$$

$$= 0.25 \times 100 \times 9.8 = 250 \text{ newton}$$

$$= \mu_2 m_2 g = \mu_2 (\text{mass of A and B}) g$$

$$= \frac{1}{3} (100 + 200) g = \frac{300}{3} g = 100 g \text{ newton}$$

$$\therefore F = F_1 + F_2$$

$$= 25 g + 100 g = 125 g = 125 \times 10 \text{ N}$$

$$\therefore F = 1250 \text{ N}$$

129. (d) Power, $P = I_{r.m.s} \times V_{r.m.s} \times \cos \phi$

In the given problem, the phase difference between voltage and current is $\pi/2$. Hence

$$P = I_{r.m.s} \times V_{r.m.s} \times \cos(\pi/2) = 0.$$

1. (a) Figure indicates the presence of some positive charge to the left of A.

$$\therefore E_A > E_B (\because r_A < r_B)$$

65. (d) For slab in series, we have

$$R_{eq} = R_1 + R_2 = \frac{x}{KA} + \frac{4x}{2KA} = \frac{3x}{KA}$$

Now, in a steady state rate of heat transfer through the slab is given by

$$\frac{dQ}{dt} = \frac{T_2 - T_1}{R_{eq}} = \frac{(T_2 - T_1)}{3x} KA \quad \dots(i)$$

$$\text{Given } \frac{dQ}{dt} = \left(\frac{A(T_2 - T_1)K}{x} \right) f \quad \dots(ii)$$

Comparing (i) and (ii), we get $f = 1/3$

37. (a) For Bracket series

$$\frac{1}{\lambda_{\max}} = R \left[\frac{1}{4^2} - \frac{1}{5^2} \right] = \frac{9}{25 \times 16} R$$

$$\text{and } \frac{1}{\lambda_{\min}} = R \left[\frac{1}{4^2} - \frac{1}{\infty^2} \right] = \frac{R}{16} \Rightarrow \frac{\lambda_{\max}}{\lambda_{\min}} = \frac{25}{9}$$

41. (a)

$$54. (c) X_{C.M.} = \frac{1 \times 0 + 2 \times 2 + 3 \times 0 + 4 \times 2 + 5 \times 1}{1 + 2 + 3 + 4 + 5}$$

$$= \frac{4 + 8 + 5}{15} = \frac{17}{15} = 1.1$$

$$Y_{C.M.} = \frac{1 \times 0 + 2 \times 0 + 3 \times 2 + 4 \times 2 + 5 \times 1}{1 + 2 + 3 + 4 + 5}$$

$$= \frac{6 + 8 + 5}{15} = 1.3$$

Nurturing Ambitions

29. (c) All the charge given to inner sphere will pass on to the outer one. So capacitance that of outer one is $4\pi \epsilon_0 b$.

30. (c) $\lambda = \frac{h}{\sqrt{2mE}}$ so $h \propto \frac{1}{\sqrt{m}}$

Since $m_\alpha > m_n > m_p > m_e$
so de-Broglie wavelength in increasing order will be

$$\lambda_\alpha, \lambda_n, \lambda_p, \lambda_e$$

54. (c) $C_{v_{\text{mix}}} = \frac{n_1 C_{v1} + n_2 C_{v2}}{n_1 + n_2}$

$$\Rightarrow \frac{13R}{6} = \frac{n_1 C_{v1} + 2n_1 C_{v2}}{n_1 + 2n_1} \quad \left[\because \frac{n_1}{n_2} = \frac{1}{2} \right]$$

$$\Rightarrow \frac{13R}{2} = C_{v1} + 2C_{v2}$$

Possible values are,

$$C_{v1} = \frac{3R}{2}, C_{v2} = \frac{5R}{2}$$

\therefore Gases are monatomic (like He) and diatomic (like N_2)

39. (d) We can combine two prisms in such a way
(i) deviation is zero but dispersion not
(ii) dispersion is zero but deviation is not.
But in any situation both deviation & dispersion can not be zero simultaneously.

ASSERTION - REASON TYPE QUESTIONS

96. (d) $f_w = f \frac{\left(\frac{a\mu_g}{a\mu_w} - 1\right)}{\left(\frac{a\mu_g}{a\mu_w} - 1\right)} = f \frac{\left(\frac{3}{2} - 1\right)}{\left(\frac{3/2}{4/3} - 1\right)} = 4f$

90. (d) Pressure of water reduces when it comes from wide pipe to narrow pipe. According to equation of continuity, $av = \text{constant}$. As the water flows from wider tube to narrow tube, its velocity increases. According to Bernoulli principle, where velocity is large pressure is less.

117. (c) Amplitude of oscillation for a forced damped

$$\text{oscillatory is } A = \frac{F_0 / m}{\sqrt{(\omega^2 - \omega_0^2)^2 + (b\omega / m)^2}}$$

where b is constant related to the strength of the resistive force, $\omega_0 = \sqrt{k/m}$ is natural frequency of undamped oscillator ($b=0$)

When the frequency of driving force (ω) $\approx \omega_0$, then amplitude A is very larger.

For $\omega < \omega_0$ or $\omega > \omega_0$, the amplitude decreases.

103. (a)

102. (b)

114. (b) Study of junction diode characteristics shows that the junction diode offers a low resistance path, when forward biased and high resistance path when reverse biased. This feature of the junction diode enables it to be used as a rectifier.

86. (d) Ampere's circuital law can be derived from Biot-Savart law and is not independent of Biot-Savart law.

111. (d)

95. (d) Large eddy currents are produced in non-laminated iron core of the transformer by the induced emf, as the resistance of bulk iron core is very small. By using thin iron sheets as core the resistance is increased. Laminating the core substantially reduces the eddy currents. Eddy current heats up the core of the transformer. More the eddy currents greater is the loss of energy and the efficiency goes down.

77. (a)

116. (a) Carnot cycle has maximum efficiency.

82. (a) Lenz's law (that the direction of induced emf is always such as to oppose the change that cause it) is direct consequence of the law of conservation of energy.

90. (d) Law of conservation of linear momentum is correct when no external force acts. When bullet is fired from a rifle then both should possess equal momentum.

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$$p = mv \quad \text{or} \quad p^2$$

of bullet because $E \propto 1/m$

104. (d)

94. (a)

70. (a) Work done

$$= \frac{1}{2} \times \text{Stress} \times \text{Strain} = \frac{1}{2} \times Y \times (\text{Strain})^2.$$

Since, elasticity of steel is more than copper, hence more work has to be done in order to stretch the steel.

107. (b) Electromagnets are magnets, which can be turned on and off by switching the current on and off.

As the material in electromagnets is subjected to cyclic changes (magnification and demagnetisation), the hysteresis loss of the material must be small. The material should attain high value of I and B with low value of magnetising field intensity H . As soft iron has small coercivity, so it is a best choice for this purpose.

86. (a) In real gas, intermolecular force exist. Work has to be done in changing the distance between the molecules. Therefore, internal energy of real gas is sum of internal kinetic and internal potential energy which are function of temperature and volume respectively. Also change in internal energy of a system depends only on initial and final states of the system.

69. (a) de-Broglie wavelength associated with gas molecules varies as $1/\sqrt{T}$

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

111. (b) intensity, $I = \frac{1}{2} \rho \omega^2 A^2 v$

\therefore Intensity depend upon amplitude, frequency as well as velocity of wave.

$$\text{Also } I_1 = I_2$$

CHEMISTRY

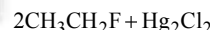
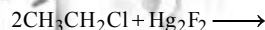
5. (c) In bcc the atoms touch along body diagonal

$$\therefore 2r + 2r = \sqrt{3}a$$

$$\therefore r = \frac{\sqrt{3}a}{4} = \frac{\sqrt{3} \times 4.29}{4} = 1.857 \text{ \AA}$$

8. (a) Phenelzine is an antidepressant, while others are antacids.

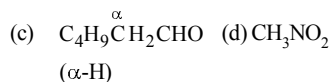
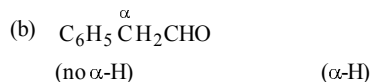
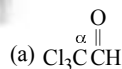
21. (b) Alkyl fluorides are more conveniently prepared by heating suitable chloro- or bromo-alkanes with organic fluorides such as AsF_3 , SbF_3 , CoF_2 , AgF , Hg_2F_2 etc. This reaction is called Swarts reaction.



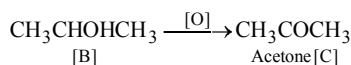
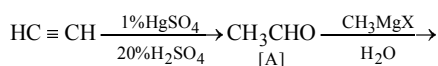
20. (a) The lines falling in the visible region comprise Balmer series. Hence the third line would be $n_1=2$, $n_2=5$ i.e. $5 \rightarrow 2$.

109. (b)

62. (a) only those compounds which have α -H give Aldol condensation



84. (c)



37. (b)

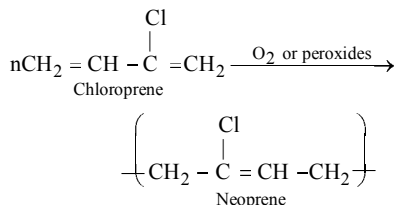
24. (a) Since glycerol has three -OH groups, it can have three acyl (similar or different) groups.

23. (c) Anomers are those diastereomers that differ

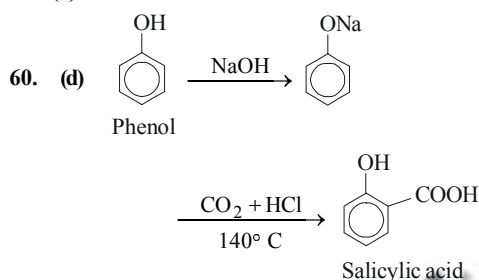
Nurturing Ambitions

glucose differ in configuration at C-1 atom so they are anomers.

6. (d) Neoprene is an addition polymer of isoprene.



17. (c)



39. (c) Given $C_p = 75 \text{ JK}^{-1} \text{ mol}^{-1}$
 $n = \frac{100}{18} \text{ mole}$ $Q = 1000 \text{ J } \Delta T = ?$

$$Q = nC_p \Delta T \Rightarrow \Delta T = \frac{1000 \times 18}{100 \times 75} = 2.4 \text{ K}$$

51. (b) $\Delta H = \sum [\Delta H_f^\circ \text{ products}] - \sum [\Delta H_f^\circ \text{ reactants}]$

$$\Delta H^\circ = [\Delta H_f^\circ (\text{CO})(\text{g}) + \Delta H_f^\circ (\text{H}_2\text{O})(\text{g})] - [\Delta H_f^\circ (\text{CO}_2)(\text{g}) + \Delta H_f^\circ (\text{H}_2)(\text{g})]$$

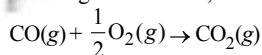
$$= [-110.5 + (-241.8)] - [-393.5 + 0]$$

$$= 41.2$$

21. (b) For a gaseous phase reaction K_p and K_c are related as

$$K_p = K_c (RT)^{\Delta n_g}$$

For the given reaction,



$$\therefore K_p = K_c (RT)^{-\frac{1}{2}}$$

$$\text{or } \frac{K_p}{K_c} = (RT)^{-\frac{1}{2}}$$

39. (c) $\Delta G = -2.303 RT \log K$
 $-nFE^\circ = -2.303 RT \log K$
 $\log K = \frac{nFE^\circ(I)}{2.303 RT}$
 $= 0.4342 \frac{nFE^\circ}{RT}$ (i)

$$\ln K = \frac{nFE^\circ}{RT}$$

$$K = e^{\frac{-nFE^\circ}{RT}}$$

..... (ii)

115. (b) $\text{Mg}(\text{OH})_2 \rightleftharpoons \text{Mg}^{++} + 2\text{OH}^-$

$$K_{sp} = [\text{Mg}^{++}][\text{OH}^-]^2$$

$$1.0 \times 10^{-11} = 10^{-3} \times [\text{OH}^-]^2$$

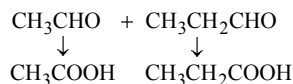
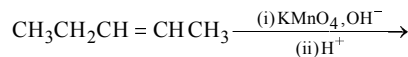
$$[\text{OH}^-] = \sqrt{\frac{10^{-11}}{10^{-3}}} = 10^{-4}$$

$$\therefore \text{pOH} = 4$$

$$\therefore \text{pH} + \text{pOH} = 14$$

$$\therefore \text{pH} = 10$$

67. (d) A doubly bonded carbon atom having an alkyl group is oxidised to aldehyde which is further oxidised to carboxylic acid.



128. (d)

99. (b) Given $N_1 = 10\text{N}$, $V_1 = 10 \text{ ml}$, $N_2 = 0.1\text{N}$, $V_2 = ?$

$$N_1V_1 = N_2V_2$$

$$\text{or } 10 \times 10 = 0.1 \times V_2$$

$$\text{or } V_2 = \frac{10 \times 10}{0.1}, V_2 = 1000 \text{ ml}$$

Volume of water to be added

$$= V_2 - V_1 = 1000 - 10 = 990 \text{ ml}$$

$$10 = 990 \text{ ml.}$$

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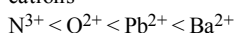
183. (a) Hybridisation of carbon in CH_3^+ is sp^2 and in CH_4 its hybridisation is sp^3

192. (d) According to Fajan's rule :

$$\text{Covalent character} \propto \frac{1}{\text{size of cation}}$$

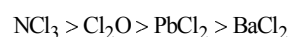
$$\propto \text{size of anion}$$

Among the given species order of size of cations



order of size of anions $\text{O}^{2-} > \text{Cl}^-$.

Hence the order of covalent character is

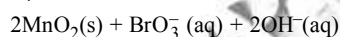
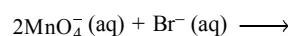


BaCl_2 is least covalent in nature.

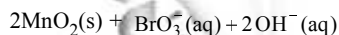
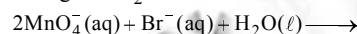
4. (a) According to the law of triads the atomic wt of the middle element is arithmetic mean of I and III.

$$\text{At wt of Br} = \frac{\text{At wt of Cl} + \text{At wt of I}}{2}$$

57. (d) Since reaction is occurring in basic medium therefore 2OH^- are added on right side.



Now, hydrogen atoms can be balanced by adding one H_2O molecule to the left side



19. (c) From the given data we find Fe^{3+} is strongest oxidising agent. More the positive value of E° , more is the tendency to get oxidized. Thus correct option is (c).

35. (d) Here $n = 4$, and $[\text{H}^+] = 10^{-3}$ (as $\text{pH} = 3$)
Applying Nernst equation

$$E = E^\circ - \frac{0.059}{n} \log \frac{[\text{Fe}^{2+}]^2}{[\text{H}^+]^4 (\text{PO}_2)}$$

$$= 1.67 - \frac{0.059}{4} \log \frac{(10^{-3})^2}{(10^{-3})^4 \times 0.1}$$

$$= 1.67 - \frac{0.059}{4} \log 10^7$$

$$= 1.67 - 0.103 = 1.567$$

101. (c) Electrodialysis involves movement of ions towards oppositely charged electrodes.

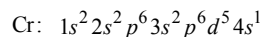
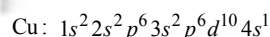
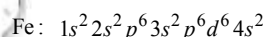
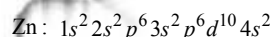
Urea being a covalent compound does not dissociate to give ions and hence it cannot be removed by electrodialysis. However all the other given compounds are ionic which can undergo dissociation to give oppositely charged ions and thus can be separated.

27. (b)

19. (a) NF_5 does not exist because N does not form pentahalides due to the absence of d-orbital in its valence shell. While P, As and Sb form pentahalides of the general formula MX_5 (where, M = P, As and Sb) due to the presence of vacant d-orbitals in their respective valence shell.

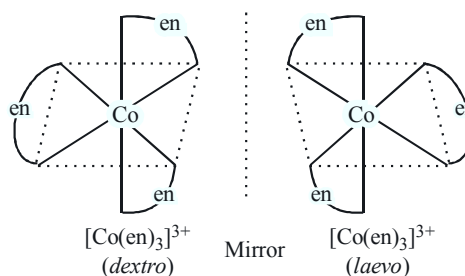
125. (a) Both have peroxy linkage

35. (a) The ionisation energies increase with increase in atomic number. However, the trend is irregular among some d-block elements. On the basis of electronic configuration, the



IE_1 follows the order : $\text{Zn} > \text{Fe} > \text{Cu} > \text{Cr}$

57. (d) The optical isomers are pair of molecules which are non superimposable mirror images of each other.



The two optically active isomers are collectively called enantiomers.

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107. (b) As $\Delta T_f = K_f \cdot m$
 $\Delta T_b = K_b \cdot m$

Hence, we have $m = \frac{\Delta T_f}{K_f} = \frac{\Delta T_b}{K_b}$

or $\Delta T_f = \Delta T_b \frac{K_f}{K_b}$

$\Rightarrow [\Delta T_b = 100.18 - 100 = 0.18^\circ\text{C}]$

$= 0.18 \times \frac{1.86}{0.512} = 0.654^\circ\text{C}$

As the Freezing Point of pure water is 0°C ,

$\Delta T_f = 0 - T_f$

$0.654 = 0 - T_f$

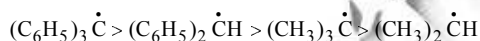
$\therefore T_f = -0.654$

Thus the freezing point of solution will be -0.654°C .

44. (c) $n = \frac{PV}{RT} = \frac{m}{M}$

$m = \frac{MPV}{RT} = \frac{34 \times 2 \times 100}{0.082 \times 293} = 282.68\text{gm}$

85. (b) The order of stability of free radicals



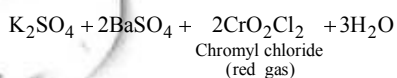
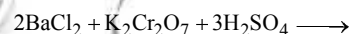
The stabilisation of first two is due to resonance and last two is due to inductive effect.

48. (b)

85. (a)



16. (b) The reagent is BaCl_2 which imparts green colour to flame. BaCl_2 forms chromyl chloride (which is red in colour), when treated with $\text{K}_2\text{Cr}_2\text{O}_7$ and conc. H_2SO_4 .



ASSERTION / REASON

133. (d) Assertion is false but Reason is true. The enthalpy of chemisorption is of the order of

101. (b) Both assertion and reason are true but reason is not the correct explanation of assertion. Non fusible mass present in ore in mixing with suitable flux are fused which are then reduced by coke to give free metal.

247. (a)

107. (a)

123. (c) Equal moles of different substances contain same number of constituent particles but equal weights of different substances do not contain the same number of constituent particles.

89. (b) Both Assertion and Reason are true but reason is not the correct explanation of assertion. Greater the number of negative atoms present in the oxy-acid make the acid stronger. In general, the strengths of acids that have general formula $(\text{HO})_m\text{ZO}_n$ can be related to the value of n . As the value of n increases, acidic character also increases. The negative atoms draw electrons away from the Z-atom and make it more positive. The Z-atom, therefore, becomes more effective in withdrawing electron density away from the oxygen atom that bonded to hydrogen. In turn, the electrons of $\text{H}-\text{O}$ bond are drawn more strongly away from the H-atom. The net effect makes it easier from the proton release and increases the acid a strength.

108. (a) Lithium carbonate is unstable to heat; lithium being very small in size polarises a large CO_3^{2-} ion leading to the formation of more stable Li_2O and CO_2 .

154. (b) Both Assertion and Reason are true but Reason is not the correct explanation of statement-1. $[\text{Fe}(\text{CN})_6]^{3-}$ is weakly paramagnetic as it has unpaired electrons while $[\text{Fe}(\text{CN})_6]^{2-}$ has no unpaired electron. \therefore It is diamagnetic.

150. (b)

115. (a)

172. (a) It is fact that aniline is better nucleophile than anilium ion. Anilium ion contain +ve charge, which reduces the tendency to donate lone pair of electron. $\text{C}_6\text{H}_5\text{NH}_2$

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171. (c) Benzene has a uniform C – C bond distance of 139 pm, a value intermediate between the C – C single. (154 pm) and C = C double (134 pm) bonds.

125. (a) Zinc metal which has a more negative electrode potential than iron will provide electrons in preference of the iron, and therefore corrodes first. Only when all the zinc has been oxidised, the iron start to rust.

118. (c) Atomic radius of gallium is less than that of aluminium.

140. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

$$\text{Radius, } r_n = \frac{n^2 h^2}{4\pi e^2 m Z} = \frac{n^2}{Z} \times 0.529 \text{ \AA} \cdot r_n$$

For first orbit of H-atom

$$n = 1$$

$$r_1 = \frac{(1)^2}{1} \times 0.529 \text{ \AA} = 0.529 \text{ \AA}$$

153. (c) It is correct statement that NF_3 is a weaker ligand than $\text{N}(\text{CH}_3)_3$, the reason is that fluorine is highly electronegative therefore, it will draw electrons from nitrogen atom. Hence, the lone pair of nitrogen atom cannot be ligated. While $\text{N}(\text{CH}_3)_3$ is a strong ligand because CH_3 is electron releasing group.

114. (d) **Assertion** is false, because aryl halides do not undergo nucleophilic substitution under ordinary conditions. This is due to resonance, because of which the carbon–chlorine bond acquires partial double bond character, hence it becomes shorter and stronger and thus cannot be replaced by nucleophiles. However **Reason** is true.

152. (b) The magnetic moments are lesser than the fact that 5f electrons of actinides are less effectively shielded which results in quenching of orbital contribution.

107. (a) A small quantity of sedative produces a feeling of relaxation, calmness and drowsiness.

107. (b) Vulcanisation is a process of treating natural rubber with sulphur or some compounds of sulphur under heat so as to

67. (b) A - V; B - IV; C - II; D - I; E - III

34. (d) In chlorophyceae, the stored food material is starch and the major pigments are chlorophyll- *a* and *b*. In phaeophyceae, laminarian is the stored food and major pigments are chlorophyll *a*, *c* and *fucoxanthin*.

58. (d)

65. (a) Molluscs are soft bodied animals. Their body is unsegmented with a distinct head, muscular foot and visceral hump. In *Pila*, the buccal cavity contains a rasping organ, the radula with transverse rows of teeth.

In the following questions, a statement of Assertion is followed by a statement of Reason.

(a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.

(b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

47. (c) In a DNA molecule, A-T rich parts melt before G-C rich parts because there are two H-bond between A and T whereas in between G and C, there are three H-bond.

83. (a) Nucleotides are the building blocks of nucleic acid. Each nucleotide consists of three parts: a sugar (ribose for RNA and deoxyribose for DNA), a phosphate, and a nitrogenous base.

44. (c) A – IV, B – III, C – II, D – I

Metaphase –

Chromosomes are moved to spindle fibre.

Anaphase –

Centromere splits and chromatids move apart.

Zygotene –

Pairing between homologous chromosomes takes place.

Pachytene –

C crossing between homologous chromosomes occurs.

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34. (b) The ratio of the volume of CO_2 liberated to the volume of oxygen absorbed per molecule during respiration is called Respiratory Quotient (RQ). The value of RQ indicates the types of respiratory substrate.

$$\text{RQ} = \frac{\text{Volume of } \text{CO}_2 \text{ evolved}}{\text{Volume of } \text{O}_2 \text{ consumed}}$$

$$\text{RQ} = \frac{102}{145} = 0.7$$

In the following questions, a statement of Assertion is followed by a statement of Reason.

- (a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

74. (a)

In the following questions, a statement of Assertion is followed by a statement of Reason.

- (a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
(b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

71. (b) Hind brain consists of cerebellum located dorsally to medulla oblongata and pons varolii. It contains centres for maintenance of posture and equilibrium of the body and for the muscle tone. All activities of the cerebellum are involuntary but may involve learning in their early stages.

74. (d) Parthenogenesis is a form of reproduction in which an unfertilized egg develops into a new individual, occurring commonly among insects and certain other arthropods.

In the following questions, a statement of Assertion is followed by a statement of Reason

Reason is the correct explanation of the Assertion.

- (b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

47. (a) Male gamete (n) + secondary nucleus (2n) = primary endosperm nucleus which develops into endosperm (3n)
Endosperm is the reserve food used by developing embryo.

74. (b) Step A: Attachment of myosin head to actin forming cross bridge.

Step B: Release of phosphate. Myosin changes shape to pull actin.

Step C: Attachment of new ATP to myosin head. The cross bridge detaches.

Step D: Splitting of ATP into ADP and Pi. Myosin cocks into its high energy conformation.

91. (c) Oogonia are called as gamete mother cell. Corpus luteum is formed as a temporary endocrine structure after the ovulation. It is involved in the production of relatively high levels of progesterone and moderate levels of estradiol and inhibin A to maintain pregnancy. A large number of primary follicles degenerate during the phase from birth to puberty.

53. (d) ICSI (Intracytoplasmic sperm injection) - Formation of embryo by directly injecting sperm into the ovum

IUI (intrauterine insemination) - Artificial introduction of semen into the vagina or uterus

IUT (Intra uterine transfer) - Transfer of embryo with more than 8 blastomeres into the uterus

GIFT (Gamete intra fallopian transfer) - Transfer of ovum collected from a donor into the fallopian tube where fertilization occurs

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ZIFT (Zygote intra fallopian transfer) -

upto 8 blastomeres) into a fallopian tube.

In the following questions, a statement of Assertion is followed by a statement of Reason.

- (a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
 (b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
 (c) If Assertion is true but Reason is false.
 (d) If both Assertion and Reason are false.
50. (c) In human, the gamete contributed by the male determines whether the child produced will be male or female. Sex in humans is a polygenic trait depending upon cumulative effect of some genes present on Y-chromosome. Only sex in human is amonogenic trait.

In the following questions, a statement of Assertion is followed by a statement of Reason.

- (a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.
 (b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.
 (c) If Assertion is true but Reason is false.
 (d) If both Assertion and Reason are false.
52. (a) In eukaryotes, the replication and transcription takes place in the nucleus. mRNA came out from the nucleus through the nuclear pore. In cytoplasm, translation occurs. In prokaryote, there is no nuclear membrane, so replication, transcription and translation all occur in the cytoplasm.
64. (a) Nucleosome is a structural unit of a eukaryotic chromosome which consists of a length of DNA coiled around a core of histones and are thought to be present only during interphase of cell cycle. In the given figure of nucleosome structure, the parts marked as A, B and C are respectively DNA, H1 histones and histone octamer.
59. (a) A-III, B-IV, C-I, D-V, E-II
 UUU —

UCU—
 CCC—
 AUG

Serine
 Proline
 — Methionine

89. (a) Occurrence of natural selection and small size of population do not meet for a population to reach Hardy-Weinberg Equilibrium. For Hardy-Weinberg equilibrium to be reached, natural selection should not be occurring. If populations are undergoing natural selection at the locus under consideration, allele frequencies will be changing in a specific direction and continuously, Hardy-Weinberg Equilibrium predicts that allele frequencies will stay constant. It assumes that population size is very large.
47. (a) Somatic embryos are non-zygotic embryo like structures that develop into from any type of tissue in plant tissue culture.
51. (b) An important technique of tissue culture, somatic hybridization results in the production of somatic hybrid plants. Two different plant varieties each with a desirable character can be made to undergo protoplast fusion, which further can be grown into a new plant.
42. (a) BOD is the method of determining the amount of oxygen required by microorganisms to decompose the waste present in the water supply. It is a measure of organic matter present in the water. If the quantity of organic wastes in the water supply is high then the number of decomposing bacteria present in the water will also be high. As a result, BOD value will increase.
33. (b) Selectable marker selectively permitting the growth of the transformants.
41. (d) Biodiversity refers to the variety found in biota from genetic make-up of plants and animals to cultural diversity. The main cause of the loss of biodiversity can be attributed to the influence of human beings on the world's ecosystem. The important factors

- over exploitation of resources, pollution, exotic species, co-extinction, alien species invasion, intensive agriculture and forestry.
43. (a) Communities with higher number of species are more stable as it can resist occasional disturbances. A stable community should show less variation in productivity from year to year and resistant towards by alien species.
8. (a) The Govt. of India through a new auto fuel policy has laid out a roadmap to cut down the vehicular pollution in Indian cities. For example, Euro II norms stipulate that sulphur be controlled at 350 ppm in diesel and 150 ppm in petrol.
43. (b) Eutrophication is a natural process which literally means well nourished or enriched. It is a natural state in many lakes and ponds which have a rich supply of nutrients. Eutrophication becomes excessive, when abnormally high amount of nutrient from sewage, fertilizers, animal wastage and detergent, enter streams and lakes causing excessive growth or blooms of microorganisms. With increasing eutrophication, the diversity of the phytoplankton community of a lake increases and the lake finally becomes dominated by blue - green algae.
37. (d) When food is made available automatically the next higher level of organism in the hierarchy should increase. This is because when the forest cover got depleted it led to the increase in the number of endangered species. If the deer population is more, it automatically leads to an increase in the tiger population.
53. (b) A group of individuals resembling each other in morphological, physiological, biochemical and behavioural characters constitute a species. Such individuals can breed among themselves but cannot breed with members other than their own to produce fertile offsprings. New species are formed mainly due to reproductive isolation.
46. (a) Alternative markers have been developed that can differentiate recombinants from chromogenic substrate. The plasmid in the bacteria, lacking an insert produces blue coloured colonies, while those plasmids with an insert do not produce any colour due to insertional inactivation of the enzyme, β -galactosidase.
87. (b) Artificially acquired passive immunity results when antibodies or lymphocytes that have been produced outside the host are introduced into a host. This type of immunity is immediate short lived, lasting only a few weeks to a few months. An example is bone marrow transplant given to a patient with genetic immunodeficiency.
71. (c) Leydig cells, also known as interstitial cells, are found adjacent to the seminiferous tubules in the testicle. They produce testosterone in the presence of luteinizing hormone (LH).
53. (a) Painful inflammation of the synovial membrane of the joints results in stiffening of joints and painful movement. Uric acid accumulation in the joints can lead to painful movement of joint.
48. (b) Auxin delays abscission of young leaves and fruits. Its effect is through non-formation of abscission zone below a leaf or fruit. Abscission zone cuts off nutrients and water supply. However, auxin promotes the abscission of mature or older leaves and fruits.
56. (b)
56. (a) The water vascular system is a unique organ system that functions in locomotion, feeding, respiration and excretion. Ambulacral canal is connected to outside through external tube feet. Hydraulic pressure of fluid and contraction of muscle of tube feet make possible movement of Echinoderm.
49. (a) *Nostoc* is a cyanobacterium. Cyanobacteria are gram (-) ve prokaryotes which perform oxygenic photosynthesis like plants. Cyanobacteria can be unicellular (e.g. *spirulina*), colonial. (e.g. *Nostoc*), or filamentous (e.g. *Oscillatoria*)

17. (b) Thorn is a stiff, sharp-pointed woody projection on the stem or other part of a plant. Thorns are found in many plants such as *Citrus*, *Bougainvillea*. They protect plants from grazing animals.
74. (d) The skeleton of Cro-Magnon was almost identical to the modern man.
76. (c) Before transferring on the culture medium, the explant is first of all disinfected by surface sterilization using clorx water, sodium or calcium hypochlorite solution or methiolate. Too much care must be taken in this operation so that the cells do not die.
2. (b) Coccidiosis is a protozoan disease.
26. (b) Trichoderma is a free-living saprophytic fungi that most commonly lives on dead organic matter in the soil and rhizosphere (root ecosystem). It inhibits pathogens through release of gliotoxin, viridin, gliovirin and trichodermin like substances.
34. (c) In Urn Shaped pyramid the individuals below the reproductive age are fewer in number than the individuals of reproductive age.
56. (d) Net primary productivity (NPP) is the biomass or storage of energy by green plants. It is equal to the gross primary productivity minus loss due to respiration. The productivity generally increases from polar regions toward the tropics, because of the increasing sunlight and temperature.
22. (a) Yeast being a unicellular fungus does not show filamentous nature. It is a microscopic fungus consisting of a single oval cell that reproduces by budding.
24. (c) Virus is a small infectious agent that replicates only inside the living cells of other organisms. Viruses can infect all types of life forms, from animals and plants to microorganisms, including bacteria and archaea. Viruses can pass through bacterial proof filters as they are smaller than bacteria.
46. (b) Cyanobacteria are photosynthetic (containing a blue photosynthetic pigment) autotrophs. They are prokaryotic and represent the earliest known form of life on the Earth.
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 leaves. It can be found in the leaves of maple trees, oak trees and rose bushes. In parallel venation veins are arranged parallel to each other.
20. (a) The first formed primary xylem elements are called protoxylem and the later formed primary xylem is called metaxylem. In stems, the protoxylem lies towards the centre (pith) and the metaxylem lies towards the periphery of the organ. This type of primary xylem is called endarch.
25. (d) Both the sexes of cockroach have anal cerci which are jointed structures. But in the male, in addition, there is a paired unjointed needle-like anal style, which serve to distinguish between the male and the female.
32. (d) Frog has different types of sense organs like organs of touch (sensory papillae), taste (taste buds), smell (nasal epithelium), vision (eyes) and hearing (tympanum with internal ears).
22. (d) Except the first, the last and clitellar segment in each segment bear a ring of tiny curved, chitinous structure known as setae. Setae helps in locomotion and copulation.
35. (c) Statements (iv) and (v) are not correct.
- (iv) Xylem is associated with the translocation of mainly water, mineral salts, some organic nitrogen and hormones from roots to the aerial parts of the plants.
- (v) Phloem translocates a variety of organic and inorganic solutes mainly from the leaves to other parts of the plants.
76. (a) Alcoholic fermentation is a process in which molecules such as glucose etc. are converted into cellular energy and thereby

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produce ethanol and carbon dioxide as metabolic waste products. During alcoholic fermentation, NAD^+ is produced when acetaldehyde is reduced to ethanol.

64. (d) Milk protein can be digested by pepsin and chymotrypsin.
43. (b) The human immunodeficiency virus is a lentivirus that causes the acquired immunodeficiency syndrome, a condition in humans in which progressive failure of the immune system allows life-threatening opportunistic infections and cancers to thrive. HIV has a protein coat and a genetic material which is single stranded RNA.
122. (d) Yellow fever and dengue are viral diseases, and they are transmitted by mosquitoes.
24. (c) Basmati rice was patented by a US company even though the highest number of varieties of this rice is found in India.
16. (c) ADH (or vasopressin) is secreted by posterior pituitary gland. It acts on kidney tubule and blood capillaries and concentrates the urine by promoting the reabsorption of water and salts into the cortical collecting ducts.