Resonance
Educating for better tomorrow

QUESTIONS & SOLUTIONS OF AIPMT-2010 (MAINS) TEST PAPER

Duration : 3 Hours **Max. Marks : 480**

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

IMPORTANT INSTRUCTIONS

1. The Test Booklet consists of one paper containing **120** objective type questions (four options with single correct answer) from Physics, Chemistry and Biology (Botany & Zoology).

2. There are three parts in the question paper (Physics, Chemistry and Biology (Botany & Zoology)). The distribution of marks subjectwise in each part is as under for each correct response.

3. **Scoring and Negative Marking** : **Each question carries 4 marks. For each incorrect response one mark will be deducted from the total score.** No deduction from the total score will, however, be made if no response is indicated for a question in the Answer Sheet. The candidates are advised not to attempt such question in the Answer Sheet, if they are not sure of the correct response. **More than one answer indicated against a question will be deemed as incorrect response and will be negatively marked.**

Part A — PHYSICS (120 marks) – 30 Questions

Part B — CHEMISTRY (120 marks) – 30 Questions

Part C — BIOLOGY (240 marks) – 60 Questions

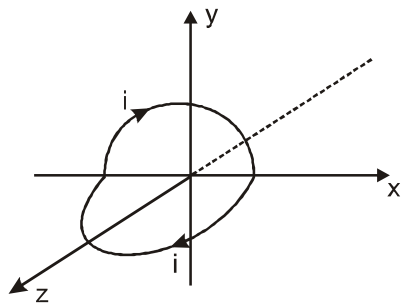
PART- A (PHYSICS)

1. A current loop consists of two identical semicircular parts each of radius R, one lying in the x-y plane and the other in x-z plane. If the current in the loop is i. The resultant magnetic field due to the two semicircular parts at their common centre is

(1) $\frac{\mu_0 i}{2\sqrt{2}R}$ (2) $\frac{\mu_0 i}{2R}$ (3) $\frac{\mu_0 i}{4R}$ (4) $\frac{\mu_0 i}{\sqrt{2}R}$

Ans. (1)

Sol. The loop mentioned in the question must look like one as shown in the figure.



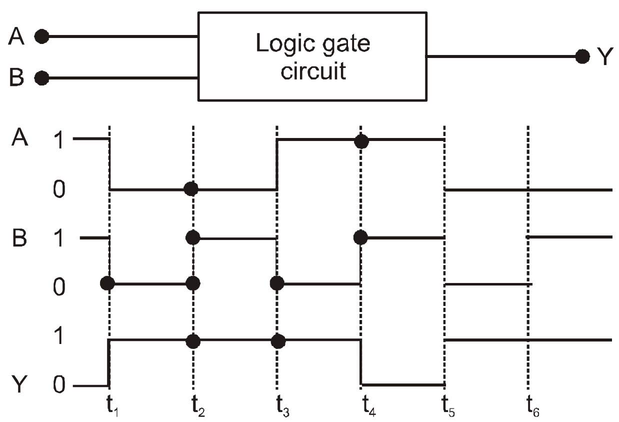
Magnetic field at the centre due to semicircular loop lying in x-y plane, $B_{xy} = \frac{1}{2}\left(\frac{\mu_0 i}{2R}\right)$ negative z direction

Similarly field due to loop in x–z plane, $B_{xz} = \frac{1}{2}\left(\frac{\mu_0 i}{2R}\right)$ in negative y direction.

∴ Magnitude of resultant magnetic field,

$$B = \sqrt{B_{xy}^2 + B_{xz}^2} = \sqrt{\left(\frac{\mu_0 i}{4R}\right)^2 + \left(\frac{\mu_0 i}{4R}\right)^2} = \frac{\mu_0 i}{4R}\sqrt{2} = \frac{\mu_0 i}{2\sqrt{2}R}$$

2. Two following figure shows a logic gate circuit with two inputs A and B and the output Y. the voltage wave forms of A, B and Y are as given.



The logic gate is

(1) NOR gate (2) OR gate (3) AND gate (4) NAND gate

Ans. (4)

Sol. It is clear from given logic circuit, that output Y is low when both the inputs are high, otherwise it is high. Thus logic circuit is NAND gate.

A	B	Y
1	1	0
0	0	1
0	1	1
1	0	1

3. Two parallel metal plates having charges +Q and –Q face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will

(1) become zero (2) increase (3) decrease (4) remains same

Ans. (3)

Sol. Electric field between two parallel plates placed in vacuum is given by

$$E = \frac{\sigma}{\varepsilon_0}$$

In a medium of dielectric constant K, $E' = \frac{\sigma}{\varepsilon_0 K}$ For kerosene oil K > 1 $\Rightarrow$ E' = E

4. The electric field at a distance $\frac{3R}{2}$ from the centre of a charged conducting spherical shell of radius R is E. The electric field at a distance $\frac{R}{2}$ from the centre of the sphere is

(1) zero (2) E (3) $\frac{E}{2}$ (4) $\frac{E}{3}$

Ans. (1)

Sol. Electric field insided charged conductor is always zero.

5. A student measures the distance traversed in free fall of abody, initially at rest, in a given time. He uses this data to estimate g, the acceleration due to gravity. If the maximum percentage errors in measurement of the distance and the time are e_1 and e_2 respectively, the percentage error in the estimation of g is

(1) $e_2 - e_1$ (2) $e_1 + 2e_2$ (3) $e_1 + e_2$ (4) $e_1 - 2e_2$

Ans. (2)

Sol. From the relation

$$h = ut + \frac{1}{2}gt^2$$

$$h = \frac{1}{2}gt^2 \quad \Rightarrow \quad g = \frac{2h}{t^2} \quad (\because \text{ body initially at rest})$$

Taking natural logarithm on both sides, we get

$\ell ng = \ell n\, h - 2\ell n\, t$

Differentiating, $\frac{\Delta g}{g} = \frac{\Delta h}{h} - 2\frac{\Delta t}{t}$

For maximum permissible error,

or $\left(\frac{\Delta g}{g}\times 100\right)=\left(\frac{\Delta h}{h}\times 100\right)+2\times\left(\frac{\Delta t}{t}\times 100\right)$

According to problem

$\frac{\Delta h}{h}\times 100 = e_1$ and $\frac{\Delta t}{t}\times 100 = e_2$

Therefore, $\left(\frac{\Delta g}{g}\times 100\right) = e_1 + 2e_2$

6. When monochromatic radiation of intensity I falls on a metal surface, the number of photoelectrons and their maximum kinetic energy are N and T respectively. If the intensity of radiation is 2I, the number of emitted electrons and their maximum kinetic energy are respectively

(1) N and 2T (2) 2N and T (3) 2N and 2T (4) N and T

Ans. (2)

Sol. The number of photoelectrons ejected is directly proportional to the intensity of incident light. Maximum kinetic energy is independent of intensity of incident light but depends upon the frequency of light. Hence option (2) is correct.

7. The electric field of an electromagnetic wave in free space is given by $\vec{E}=10\cos(10^7 t + kx)\hat{j}$ V/m, where t and x are in seconds and metres respectively. It can be iferred that

(i) the wavelength λ is 188.4 m. (ii) the wave number k is 0.33 rad/m

(iii) the wave amplitude is 10 V/m (iv) the wave is propagating along +x direction

Which one of the following pairs of statements is correct ?

(1) (iii) and (iv) (2) (i) and (ii) (3) (ii) and (iii) (4) (i) and (iii)

Ans. (4)

Sol. As given E = $10\cos(10^7 t + kx)$

Comparing it with standard equation of e.m. wave,

$E = E_0\cos(\omega t + kx)$

Amplitude E_0 =10V/m and $\omega = 10^7$ rad/s

$\because c = \nu\lambda = \frac{\omega\lambda}{2\pi}$ or $\lambda = \frac{2\pi c}{\omega} = \frac{2\pi\times 3\times 10^8}{10^7}$ = 188.4 m

Also

$c=\frac{\omega}{k}$ or $k=\frac{\omega}{c}=\frac{10^7}{3\times 10^8}$ = 0.033

The wave is propagating along y direction.

8. The speed of light in media M_1 and M_2 are 1.5×10^8 m/s and 2.0×10^8 m/s respectively. A ray of light enters from medium M_1 to M_2 at an incidence angle i. If the ray suffers total internal reflection, the value of i is

(1) Equal to $\sin^{-1}\left(\frac{2}{3}\right)$ (2) Equal to or less than $\sin^{-1}\left(\frac{3}{5}\right)$

(3) Equal to or greater than $\sin^{-1}\left(\frac{3}{4}\right)$ (4) Less than $\sin^{-1}\left(\frac{2}{3}\right)$

Ans. (3)

Sol. Refractive index for medium M_1 is

$$\mu_1 = \frac{c}{v_1} = \frac{3\times10^8}{1.5\times10^8} = 2$$

Refractive index for medium M_2 is

$$\mu_2 = \frac{c}{v_2} = \frac{3\times10^8}{2.0\times10^8} = \frac{3}{2}$$

For total internal reflection

sini ≥ sinC

where i = angle of incidence

C = critical angle

But $\sin C = \frac{\mu_2}{\mu_1}$

$$\sin i \geq \frac{\mu_2}{\mu_1} \geq \frac{3/2}{2} \quad \Rightarrow \; i > \sin^{-1}\left(\frac{3}{4}\right)$$

9. A ray of light is incident on a 60° prism at the minimum deviation position. The angle of refraction at the first face (i.e., incident face) of the prism is

(1) zero (2) 30° (3) 45° (4) 60°

Ans. (2)

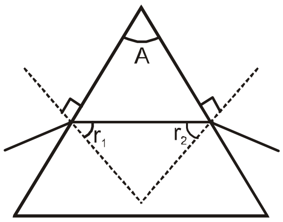
Sol. Angle of prism, $A = r_1 + r_2$

For minimum deviation

$r_1 = r_2 = r \quad \therefore \; A = 2r$

Given, A = 60°

Hence, $r = \frac{A}{2} = \frac{60°}{2} = 30°$



10. For transistor action

(1) Base, emitter and collector regions should have similar size and doping concentrations.

(2) The base region must be very thin and lightly doped.

(3) The emitter-base junction is forward biased and base-collector junction is reverse biased

(4) Both the emitter-base junction as well as the base-collector junction are forward biased

(1) (4) and (1) (2) (1) and (2) (3) (2) and (3) (4) (3) and (4)

Ans. (3)

11. The additional kinetic energy to be provided to a satellite of mass m revolving around a planet of mass M, to transfer it from a circular orbit of radius R_1 to another of radius R_2 ($R_2 > R_1$) is

(1) $GmM\left(\frac{1}{R_1^2} - \frac{1}{R_2^2}\right)$ (2) $GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ (3) $2GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ (4) $\frac{1}{2}GmM\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

Ans. (4)

Sol. $$KE = \left(-\frac{GMm}{2R_2}\right) - \left(-\frac{GMm}{2R_1}\right)$$

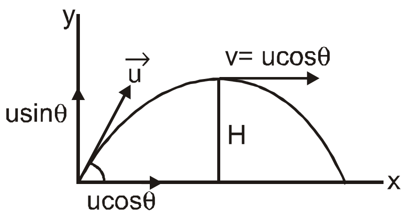
$$KE = \frac{GMm}{2}\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

12. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is

(1) 60° (2) 15° (3) 45° (4) 60°

Ans. (1)

Sol. Let v be velocity of a projectile at maximum height H



$v = u\cos\theta$

According to given problem, $v = \frac{u}{2}$

$\therefore \frac{u}{2} = u\cos\theta \Rightarrow \cos\theta = \frac{1}{2}$

$\Rightarrow \theta = 60°$

13. From a circular disc of radius R and mass 9M, a small disc of mass M and radius $\frac{R}{3}$ is removed concentrically.

The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through its centre is

(1) $\frac{40}{9}MR^2$ (2) MR^2 (3) $4MR^2$ (4) $\frac{4}{9}MR^2$

Ans. (1)

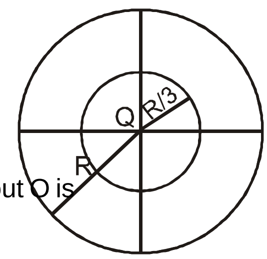
Sol. Mass of the disc = 9M

Mass of removed portion of disc = M

The moment of inertia of the complete disc about an axis passing through its centre O and perpendicular to its plane is

$$I_1 = \frac{9}{2}MR^2$$

Now, the moment of inertia of the disc with removed portion



$$I_2 = \frac{1}{2}M\left(\frac{R}{3}\right)^2 = \frac{1}{18}MR^2$$

Therefore, moment of inertia of the remaining portion of disc about O is

$$I = I_1 - I_2$$

$$= 9\frac{MR^2}{2} - \frac{MR^2}{18} = \frac{40MR^2}{9}$$

14. A particle moves in x-y plane according to rule x = asinωt and y = acosωt. The particle follows

(1) an elliptical path (2) a circular path

(3) a parabolic path (4) a straight line path inclined equally to x and y-axes

Ans. (2)

Sol. $x = a\sin\omega t$ or $\frac{x}{a} = \sin\omega t$ ...(i)

$y = a\cos\omega t$ or $\frac{y}{a} = \cos\omega t$ ...(ii)

Squaring and adding, we get

$\frac{x^2}{a^2} + \frac{y^2}{a^2} = 1$ $(\because \cos^2\omega t + \sin^2\omega t = 1)$

or $x^2 + y^2 = a^2$

This is the equation of a circle. Hence particle follows a circular path

15. A closely wound solenoid of 2000 turns and area of cross-section 1.5×10^{-4} m^2 carries a current of 2.0 A. It is suspended through its centre and perpendicular to its length, allowing it to turn in a horizontal plane in a uniform magnetic field 5×10^{-2} tesla making an angle of 30° with the axis of the solenoid. The torque on the solenoid will be

(1) 3×10^{-3} N m (2) 1.5×10^{-3} N m (3) 1.5×10^{-2} N m (4) 3×10^{-2} N m

Ans. (3)

Sol. Magnetic moment of the loop.

$M = NIA = 2000 \times 2 \times 1.5 \times 10^{-4} = 0.6$ J/T

torque $\tau = MB\sin 30°$

$= 0.6 \times 5 \times 10^{-2} \times \frac{1}{2}$

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

16. The decay constant of a radio isotope is λ. If A_1 and A_2 are its activities at times t_1 and t_2 respectively, the number of nuclei which have decayed during the time $(t_1 - t_2)$

(1) $A_1t_1 - A_2t_2$ (2) $A_1 - A_2$ (3) $(A_1 - A_2)/\lambda$ (4) $\lambda(A_1 - A_2)$

Ans. (3)

Sol. $A_1 = \lambda N_1$ at time t_1

$A_2 = \lambda N_2$ at time t_2

Therefore, number of nuclei decayed during time interval $(t_1 - t_2)$ is

$N_1 - N_2 = \frac{[A_1 - A_2]}{\lambda}$

17. A particle having a mass of 10^{-2} kg carries a charge of 5×10^{-8} C. The particle is given an initial horizontal velocity of 10^5 ms^{-1} in the presence of electric field $\vec{E}$ and magnetic field $\vec{B}$. To keep the particle moving in a horizontal direction, it is necessary that

(i) $\vec{B}$ should be perpendicular to the direction of velocity and $\vec{E}$ should be along the direction of velocity

(ii) Both $\vec{B}$ and $\vec{E}$ should be along the direction of velocity

(iii) Both $\vec{B}$ and $\vec{E}$ are mutually perpendicular and perpendicular to the direction of velocity.

(iv) $\vec{B}$ should be along the direction of velocity and $\vec{E}$ should be perpendicular to the direction of velocity

Which one of the following pairs of statements is possible

(1) (i) and (iii) (2) (iii) and (iv) (3) (ii) and (iii) (4) (ii) and (iv)

Ans. (3)

18. The binding energy per nucleon in deuterium and helium nuclei are 1.1 MeV and 7.0 MeV, respectively. When two deuterium nuclei fuse to form a helium nucleus the energy released in the fusion is

(1) 23.6 MeV (2) 2.2 MeV (3) 28.0 MeV (4) 30.2 MeV

Ans. (1)

Sol. ${}_1H^2 + {}_1H^2 \rightarrow {}_2He^4 + \Delta E$

The binding energy per nucleon of a deuteron = 1.1 MeV

$\therefore$ Total binding energy = 2 × 1.1 = 2.2 MeV

The binding energy per nucleon of a helium nuclei = 7 MeV

$\therefore$ Total binding energy = 4 × 7 = 28 MeV

$\therefore$ Hence, energy released

$\Delta E = (28 - 2 \times 2.2) = 23.6$ MeV

19. The electron in the hydrogen atom jumps from excited state (n = 3) to its ground state (n = 1) and the photons thus emitted irradiate a photosensitive material. If the work function of the material is 5.1 eV, the stopping potential is estimated to be (the energy of the electron in n^th^ state $E_n = -\frac{13.6}{n^2}$ eV)

(1) 5.1 V (2) 12.1 V (3) 17.2 V (4) 7V

Ans. (4)

Sol. Energy released when electron in the atom jumps from excited state (n = 3) to ground state (n = 1) is

$$E = h\nu = E_3 - E_1 = \frac{-13.6}{3^2} - \left(\frac{-13.6}{1^2}\right) = \frac{-13.6}{9} + 13.6 = 12.1 \text{ eV}$$

Therefore, stopping potential

$eV_0 = h\nu - \phi_0$

$= 12.1 - 5.1$ [$\because$ work function $\phi_0 = 5.1$]

$V_0 = 7V$

20. If c_p and c_v denote the specific heats (per unit mass) of an ideal gas of molecular weight M where R is the molecular weight constant, then

(1) $c_p - c_v = R/M^2$ (2) $c_p - c_v = R$ (3) $c_p - c_v = R/M$ (4) $c_p - c_v = MR$

Ans. (3)

Sol. Let C_V and C_P be molar specific heats of the ideal gas at constant volume and constant pressure, respectively, then

$C_P = Mc_p$ and $C_V = Mc_v$

$\because$ $C_P - C_V = R$ $\therefore$ $Mc_p - Mc_v = R$

$\Rightarrow$ $c_p - c_v = R/M$

21. A condenser of capacity C is charged to a potential difference of V_1. The plates of the condenser are then connected to an ideal inductor of inductance L. The current through the inductor when the potential difference across the condenser reduces to V_2 is

(1) $\left(\frac{C(V_1 - V_2)^2}{L}\right)^{\frac{1}{2}}$ (2) $\frac{C(V_1^2 - V_2^2)}{L}$ (3) $\frac{C(V_1^2 + V_2^2)}{L}$ (4) $\left(\frac{C(V_1^2 - V_2^2)}{L}\right)^{\frac{1}{2}}$

Ans. (4)

Sol. In case of oscillatory discharge of a capacitor through an inductor, charge at instant t is given by

$q = q_0 \cos\omega t$

where $\omega = \frac{1}{\sqrt{LC}}$

$$\therefore \ \cos\omega t = \frac{q}{q_0} = \frac{CV_2}{CV_1} = \frac{V_2}{V_1} \quad (\because\ q = CV) \ldots(i)$$

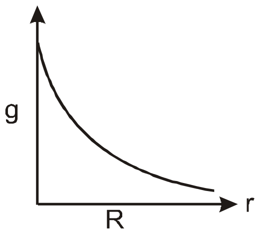
Current through the inductor

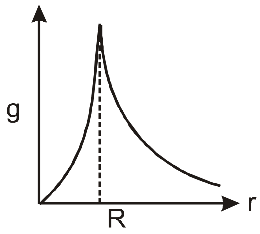
$$I = \frac{dq}{dt} = \frac{d(q_0 \cos\omega t)}{dt} = -q_0\omega\sin\omega t$$

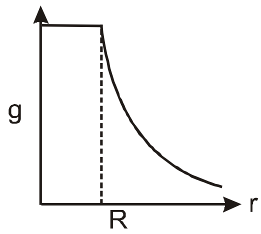
$$|I| = CV_1 \frac{1}{\sqrt{LC}} \left[1 - \cos^2\omega t\right]^{1/2}$$

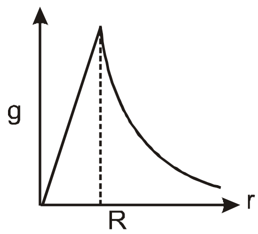
$$= V_1\sqrt{\frac{C}{L}}\left[1-\left(\frac{V_2}{V_1}\right)^2\right]^{1/2} = \left[\frac{C(V_1^2 - V_2^2)}{L}\right]^{1/2} \quad \text{(using (i))}$$

22. The dependence of acceleration due to gravity g on the distance r from the centre of the earth, assumed to be a sphere of radius R of uniform density is as shown in figures below. The correct figure is.

(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. The acceleration due to gravity at a depth d below surface of earth is

$$g' = \frac{GM}{R^2}\left(1-\frac{d}{R}\right) = g\left(1-\frac{d}{R}\right)$$

$$g' = 0 \text{ at } d = R$$

i.e., acceleration due to gravity is zero at the centre of earth .
Thus, the variation in value g with r is
for, r > R,

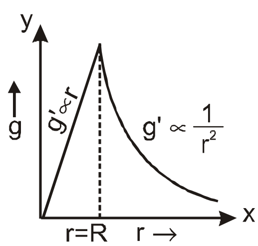
$$g' = \frac{g}{\left(1+\frac{h}{R}\right)^2} = \frac{gR^2}{r^2} \quad \Rightarrow g' \propto \frac{1}{r^2}$$

Here, $R + h = r$

For $r < R,\ g' = g\left(1-\frac{d}{R}\right) = \frac{gr}{R}$

Here, $R - d = r \ \Rightarrow\ g' \propto r$

Therefore, the variation of g with distance from centre of the earth will be as shown in the figure.



23. A solid cylinder and a hollow cylinder, both of the same mass and same external diameter are relaeased from the same height at the same time on an inclined plane. Both roll down without slipping. Which one will reach the bottom first ?

(1) Both together only when angle of inclination of plane is 45°

(2) Both together

(3) Hollow cylinder

(4) Solid cylinder

Ans. (4)

Sol. time taken to reach the bottom of inclined plane

$$t = \sqrt{\frac{2\ell\left(1+\frac{K^2}{R^2}\right)}{g\sin\theta}}$$

Here, ℓ is length of incline plane

For solid cylinder $K^2 = \frac{R^2}{2}$

For hollow cylinder = $K^2 = R^2$

Hence, solid cylinder will reach the bottom first.

24. The thermo e.m.f. E in volts of a certain thermocouple is found to vary with temperature difference θ in °C between the two junctions according to the relation

$$E = 30\theta - \frac{\theta^2}{15}$$

The neutral temperature for the thermo-couple will be

(1) 450°C (2) 400°C (3) 225°C (4) 30°C

Ans. (3)

Sol. As given $E = 30\theta - \frac{\theta^2}{15}$

$$\frac{dE}{d\theta} = 0$$

$$\frac{dE}{d\theta} = 30 - \frac{2\theta}{15} = 0 \quad \text{or} \quad 30 = 2\frac{\theta}{15}$$

$$\Rightarrow \theta = \frac{15\times 30}{2} = 225°C$$

25. (i) Centre of gravity (C.G.) of a body is the point at which the weight of the body acts

(ii) Centre of mass coincides with the centre of gravity if the earth is assumed to have infinitely large radius

(iii) To evaluate the gravitational field intensity due to any body at an external point, the entire mass of the body can be considered to be concentrated at its C.G.

(iv) The radius of gyration of any body rotating about an axis is the length of the perpendicular dropped from the C.G. of the body to the axis.

Which one of the following pairs of statements is correct ?

(1) (iv) and (i) (2) (i) and (ii) (3) (ii) and (iii) (4) (iii) and (iv)

Ans. (1)

26. The magnetic moment of a diamagnetic atom is

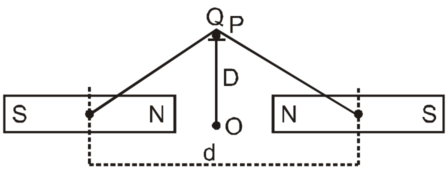
(1) much greater than one (2) one

(3) between zero and one (4) equal to zero

Ans. (4)

Sol. The magnetic momentum of a diamagnetic atom is equal to zero.

27. Two identical bar magnets are fixed with their centres at a distance d apart. a stationary charge Q is placed at P in between the gap of the two magnets at a distance D from the centre O as shown in the figure



The force on the charge Q is

(1) Zero (2) directed along OP

(3) directed along PO (4) directed perpendicular to the plane of paper

Ans. (1)

Sol. Magnetic field due to bar magnets exerts force on moving charges only. Since the charge is at rest, zero force acts on it.

28. A particle of mass M, starting from rest, undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is

(1) $\frac{MV^2}{T}$ (2) $\frac{1}{2}\frac{MV^2}{T^2}$ (3) $\frac{MV^2}{T^2}$ (4) $\frac{1}{2}\frac{MV^2}{T}$

Ans. (4)

Sol. Power delivered in time T is

$$P = F.V. = MaV$$

or $$P = MV\frac{dV}{dT} \Rightarrow PdT = MVdV$$

$\Rightarrow$ $$PT = \frac{MV^2}{2} \text{ or } P = \frac{1}{2}\frac{MV^2}{T}$$

29. A thin circular ring of mass M and radius r is rotating about its axis with constant angular velocity ω. Two objects each of mass m are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with angular velocity given by

(1) $\frac{(M+2m)\omega}{2m}$ (2) $\frac{2M\omega}{M+2m}$ (3) $\frac{(M+2m)\omega}{M}$ (4) $\frac{M\omega}{M+2m}$

Ans. (4)

Sol. As no external toruqe is acting about the axis, angular momentum of system remains conserved.

$$I_1\omega_1 = I_2\omega_2$$

$\Rightarrow$ $$\omega_2 = \frac{I_1\omega_1}{I_2} = \frac{Mr^2\omega}{(M+2m)r^2} = \frac{M\omega}{(M+2m)}$$

30. A monoatomic gas at pressure P_1 and volume V_1 is compressed adiabatically to $\frac{1}{8}$th of its original volume. What is the final pressure of the gas

(1) $64P_1$ (2) P_1 (3) $16P_1$ (4) $32P_1$

Ans. (4)

Sol. Ideal gas equation, for an adiabatic process is

PV^{γ} = constant or $P_1V_1^{\gamma} = P_2V_2^{\gamma}$

For monoatomic gas $\gamma = \frac{5}{3}$

$$\therefore \quad P_1V_1^{5/3} = P_2\left(\frac{V_1}{8}\right)^{5/3}$$

$$\Rightarrow \quad P_2 = P_1 \times (2)^5 = 32P_1$$

PART- B (CHEMISTRY)

31. Among the elements Ca, Mg, P and Cl, the order of increasing atomic radii is :

(1) Mg < Ca < Cl < P (2) Cl < P < Mg < Ca

(3) P < Cl < Ca < Mg (4) Ca < Mg < P < Cl

Ans. (2)

Sol. The atomic radii decreases on moving from left to right in a period, thus order of sizes for Cl, P and Mg is Cl < P < Mg. Down the group size increases. Thus overall order is : Cl < P < Mg < Ca.

32. The reaction,

$$2A_{(g)} + B_{(g)} \rightleftharpoons 3C_{(g)} + D_{(g)}$$

is begun with the concentrations of A and B both at an initial value of 1.00 M. When equilibrium is reached, the concentration of D is measured and found to be 0.25 M. The value for the equilibrium constant for this reaction is given by the expression :

(1) $[(0.75)^3 (0.25)] \div [(1.00)^2 (1.00)]$ (2) $[(0.75)^3 (0.25)] \div [(0.50)^2 (0.75)]$

(3) $[(0.75)^3 (0.25)] \div [(0.50)^2 (0.25)]$ (2) $[(0.75)^3 (0.25)] \div [(0.75)^2 (0.25)]$

Ans. (2)

Sol.

	$2A_{(g)}$ +	$B_{(g)}$ $\rightleftharpoons$	$3C_{(g)}$ +	$D_{(g)}$
Initial moles :	1	1	0	0
Moles of eq. :	1 – (2 × 0.25)	1 – 0.25	3 × 0.25	0.25
	= 0.5	= 0.75	= 0.75	= 0.75

Equilibrium constant,

$$K = \frac{[C]^3[D]}{[A]^2[B]}$$

$$\Rightarrow \quad K = \frac{(0.75)^3(0.25)}{(0.5)^2(0.75)}$$

33. Which of the following expressions correctly represents the equivalent conductance at infinite dilution of $Al_2(SO_4)_3$. Given that $\overset{\circ}{\Lambda}_{Al^{3+}}$ and $\overset{\circ}{\Lambda}_{SO_4^{2-}}$ are the equivalent conductances at infinite dilution of the respective ions?

(1) $2\overset{\circ}{\Lambda}_{Al^{3+}} + 3\overset{\circ}{\Lambda}_{SO_4^{2-}}$ (2) $\overset{\circ}{\Lambda}_{Al^{3+}} + \overset{\circ}{\Lambda}_{SO_4^{2-}}$

(3) $(\overset{\circ}{\Lambda}_{Al^{3+}} + 3\overset{\circ}{\Lambda}_{SO_4^{2-}}) \times 6$ (4) $\frac{1}{3}\overset{\circ}{\Lambda}_{Al^{3+}} + \frac{1}{2}\overset{\circ}{\Lambda}_{SO_4^{2-}}$

Ans. (2)

Sol. At infinite dilution, when dissociation is complete, each ion makes a definite contribution towards molar conductance of the electrolyte irrespective of the nature of the other ion with which it is associated.

Hence $\overset{\circ}{\Lambda}_{Al_2(SO_4)_3} = \overset{\circ}{\Lambda}_{Al^{3+}} + \overset{\circ}{\Lambda}_{SO_4^{2-}}$

34. The pressure exerted by 6.0 g of methane gas in a 0.03 m^3 vessel at 129° C is (Atomic masses) : C = 12.01, H = 1.01 and R = 8.314 J K^{-1} mol^{-1}) :

(1) 215216 Pa (2) 13409 Pa (3) 41648 Pa (4) 31684 Pa

Ans. (3)

Sol. Given, mass of CH_4, w = 6 g
Volume of CH_4, V = 0.03 m^3
T = 129°C = 129 + 273 = 402 K
R = 8.3114 J K^{-1} mol^{-1}
Molecular mass of CH_4, M = 12.01 + 4 × 1.01 = 16.05

$$PV = nRT = \frac{w}{M}RT$$

$$\therefore \quad P = \frac{w}{M}\frac{RT}{V} = \frac{6}{16.05} \times \frac{8.314 \times 402}{0.03}$$

= 41647.7 Pa ≈ 41648 Pa

35. Match List I (Equations) with List II (Types of processes) and select the correct option.

	List I **Equations**		**List II** **Types of process**
(a)	$K_p > Q$	(i)	Non-spontaneous
(b)	$\Delta G° < RT \ln Q$	(ii)	Equilibrium
(c)	$K_p = Q$	(iii)	Spontaneous and endothermic
(d)	$T > \frac{\Delta H}{\Delta S}$	(iv)	Spontaneous

(1) a - (i), b - (ii), c - (iii), d - (iv) (2) a - (iii), b - (iv), c - (ii), d - (i)
(3) a - (iv), (b -(i), c - (ii), d - (iii) (4) a - (ii), b - (i), c - (iv), d - (iii)

Ans. (3)

Sol. When $K_p > Q$, rate of forward reaction > rate of backward reaction.
∴ Reaction is sontaneous.
When $\Delta G° < RT \ln Q$, $\Delta G°$ is positive, reverse reaction is feasible, thus reaction is non-spontaneous.
When $K_p = Q$, rate of forward reaction = rate of backward reaction
∴ Reaction is in equilibrium.
When $T\Delta S > \Delta H$, ΔG will be negative only when ΔH = + ve.

36. Among the following four compounds :

(i) Phenol (ii) Methyl phenol (iii) Meta-nitrophenol (iv) Para-nitrophenol

The acidity order is :

(1) (iv) > (iii) > (i) > (ii) (2) (iii) > (iv) > (i) > (ii) (3) (i) > (iv) > (iii) > (ii) (4) (ii) > (i) > (iii) > (iv)

Ans. (1)

Sol. In phenols, the presence of electron releasing groups decreases the acidity, whereas presence of electron withdrawing groups increase the acidity, compared to phenol. Among the meta and para-nitrophenols, the latter is more acidic as the present of – NO_2 group at para position stabilises the phenoxide ion to a greater extent than when it is present at meta position. Thus, correct order of acidity is :

Para-nitrophenol > meta-nitrophenol > phenol > methyl phenol

(iv) (iii) (i) (ii)

37. Among the following which one has the highest cation to anion size ratio?

(1) CsI (2) CsF (3) LiF (4) NaF

Ans. (2)

Sol. The order of size of given cations is

$Li^+ < Na^+ < Cs^+$

and the order of size of given anions is

$I^- > F^-$

Thus, when the cation is large and anion is smallest, the cation to anion size ratio is maximum.

Hence, cation to anion size ratio is maximum for CsF.

38. Three moles of an ideal gas expanded spontaneously into vacuum. The work done will be :

(1) Infinite (2) 3 Joules (3) 9 Joules (4) Zero

Ans. (4)

Sol. Since the ideal gas expands spontaneously into vacuum, $P_{ext} = 0$, hence work done is also zero.

39. Which of the following species is not electrophilic in nature?

(1) $\overset{\oplus}{Cl}$ (2) BH_3 (3) $H_3\overset{\oplus}{O}$ (4) $\overset{\oplus}{N}O_2$

Ans. (3)

Sol. Electrophiles are electron deficient species. Among the given, $H_3O^{\oplus}$ has lone pair of electrons for donation, thus it is not electron deficient and hence, does not behave like an electrophile.

40. A 0.66 kg ball is moving with a speed of 100 m/s. The associated wavelength will be : ($h = 6.6 \times 10^{-34}$ Js)

(1) 6.6×10^{-32} m (2) 6.6×10^{-34} m (3) 1.0×10^{-35} m (4) 1.0×10^{-32} m

Ans. (3)

Sol According to de-Broglie equation, $\lambda = \frac{h}{mv}$

Given, $h = 6.6 \times 10^{-34}$ J s

$m = 0.66$ kg

$v = 100$ m s^{-1}

$\therefore \quad \lambda = \frac{6.6 \times 10^{-34}}{0.66 \times 100} = 1 \times 10^{-35}$ m

41. Consider the following relations for emf of an electrochemical cell :

(i) EMF of cell = (Oxidation potential of anode) – (Reduction potential of cathode)

(ii) EMF of cell = (Oxidation potential of anode) + (Reduction potential of cathode)

(iii) EMF of cell = (Reduction potential of anode) + (Reduction potential of cathode)

(iv) EMF of cell = (Oxidation potential of anode) – (Oxidation potential of cathode)

Which of the above relations are correct

(1) (iii) and (i) (2) (i) and (ii) (3) (iii) and (iv) (4) (ii) and (iv)

Ans. (4)

Sol. EMF of a cell = Reduction potential of cathode – Reduction potential of anode
= Reduction potential of cathode + Oxidation potential of anode
= Oxidation potential of anode – Oxidation potential of cathode.

42. In which of the following molecules, the central atom does not have sp^3 hybridization?

(1) CH_4 (2) SF_4 (3) BF^-_4 (4) NH^+_4

Ans. (2)

Sol. For neutral molecules,
No. of electron pairs = No. of atoms bonded to it + 1/2 [Gp. no of central atom – Valency of central atom]

$\therefore$ For CH_4, no. of e^- pairs = $4+\frac{1}{2}[4-4]$ = 4 (sp^3 hybridisation)

For SF_4, no. of e^- pairs = $4+\frac{1}{2}[6-4]$ = 5 (sp^3 d hybridisation)

For ions,
No. of electron pairs = No. of atoms bonded to it + 1/2 [Gp. no. of central atom – Valency of central atom ± No. of electrons]

$\therefore$ For BF_4^-, no. e^- pairs = $4+\frac{1}{2}[3-4+1]$ = 4 (sp^3 hybridisation)

For NH^+_4, no. of e^- pairs = $4+\frac{1}{2}[5-4-1]$ = 4 (sp^3 hybridisation)

43. For vaporization of water at 1 atmospheric pressure, the values of ΔH and ΔS are 40.63 kJ mol^{-1} and 108.8 JK^{-1} mol^{-1}, respectively. The temperature when Gibb's energy change (ΔG) for this transformation will be zero, is :

(1) 273.4 K (2) 393.4 K (3) 373.4 K (4) 293.4 K

Ans. (3)

Sol. According to Gibb's equation, $\Delta G = \Delta H - T\Delta S$ when $\Delta G = 0$, $\Delta H = T\Delta S$

Given, ΔH = 40.63 kJ mol^{-1} = 40.63×10^3 J mol^{-1}
ΔS = 108.8 J K^{-1} mol^{-1}

$\therefore$ $T = \frac{\Delta H}{\Delta S} = \frac{40.63 \times 10^3}{108.8}$ = 373.43 K.

44. Match List I (substances) with List II (processes) employed in the manufacture of the substances and select the correct option :

	List I (Substances)		**List II (Processes)**
(a)	Sulphuric acid	(i)	Haber's process
(b)	Steel	(ii)	Bessemer's process
(c)	Sodium hydroxide	(iii)	Leblanc process
(d)	Ammonia	(iv)	Contact process

(1) a - (i), b- (iv), c- (ii), d- (iii) (2) a- (i), b- (ii), c- (iii), d- (iv)
(3) a - (iv), b - (iii), c - (ii), d - (i) (4) a- (iv), b - (ii), c - (iii), d - (i)

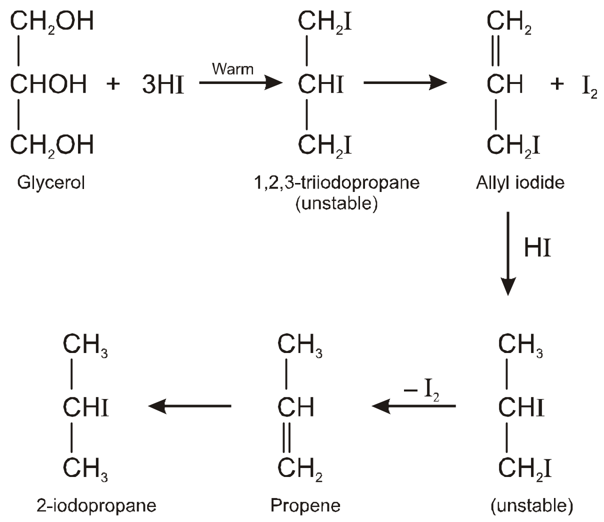
Ans. (4)

45. When glycerol is treated with excess of HI, it produces :

(1) 2-iodopropane (2) allyl iodide (3) propene (4) glycerol triiodide

Ans. (1)

Sol.



46. Some statements about heavy water are given below :
(i) Heavy water is used as a moderator in nuclear reactors.
(ii) Heavy water is more associated than ordinary water.
(iii) Heavy water is more effective solvent than ordinary water.
Which of the above statements are correct?
(1) (i) and (ii) (2) (i), (ii) and (iii) (3) (ii) and (iii) (4) (i) and (iii)

Ans. (1)

Sol. Heavy water is used for slowing down the speed of neutrons in nuclear reactors, hence used as moderators. Boiling point of heavy water is greater (374.42 K) than that of ordinary water (373 K), hence heaver water is more associated. Dielectric constant of ordinary water is greater than that of heavy water, hence ordinary water is a better solvent.

47. The compound A on heating gives a colourless gas and a residue that is dissolved in water to obtain B. Excess of CO_2 is bubbled through aqueous solution of B, C is formed which is recovered in the solid form. Solid C on gentle heating gives back A. The compound A is :
(1) $CaCO_3$ (2) Na_2CO_3 (3) K_2CO_3 (4) $CaSO_4.2H_2O$

Ans. (1)

Sol. The reactions can be summarised as follows

$$A \xrightarrow{\Delta} \text{colourless gas + residue}$$

$$\text{Residue} + H_2O \longrightarrow B \xrightarrow{\text{excess } CO_2} C \xrightarrow{\Delta} A$$

This is possible only when A is $CaCO_3$. The reactions are as follows :

$$\underset{(A)}{CaCO_3} \xrightarrow{\Delta} \underset{\text{(colourless gas)}}{CO_2} + \underset{\text{(residue)}}{CaO}$$

$$CaO + H_2O \longrightarrow \underset{(B)}{Ca(OH)_2} \xrightarrow[\text{(excess)}]{CO_2} \underset{(C)}{Ca(HCO_3)_2} \xrightarrow{\Delta} \underset{(A)}{CaCO_3}$$

48. Match the compounds given in List I with their characteristic reactions given in List II. Select the correct option.

List I (Compounds)		**List II (Reactions)**	
(a)	$CH_3(CH_2)_3NH_2$	(i)	Alkaline hydrolysis
(b)	$CH_3C\equiv CH$	(ii)	With KOH (alcohol) and $CHCl_3$ produces bad smell
(c)	$CH_3CH_2COOCH_3$	(iii)	Gives white ppt. with ammoniacal $AgNO_3$
(d)	$CH_3CH\,(OH)CH_3$	(iv)	With Lucas reagent cloudiness appears after 5 minutes

(1) a-(ii), b - (i), c - (iv), d- (iii)
(2) a - (iii), b - (ii), c - (i), d - (iv)
(3) a - (ii), b - (iii), c - (i), d - (iv)
(4) a - (iv), b - (ii), c - (iii), d - (i)

Ans. **(3)**

Sol. $\underset{\text{1° Amine}}{CH_3CH_2CH_2CH_2NH_2} \xrightarrow[CHCl_3]{KOH(alc.)} \underset{\text{Bad smell}}{CH_3CH_2CH_2CH_2NC} + 3\,KCl + 3\,H_2O$

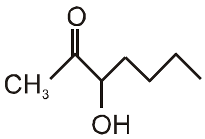
$CH_3C\equiv CH + \text{Amm. } AgNO_3 \longrightarrow \underset{\text{White ppt.}}{CH_3C\equiv \bar{C}Ag^+} + HNO_3$

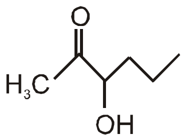
$CH_3CH_2COOCH_3 + NaOH \xrightarrow{Heat} CH_3CH_2COONa + CH_3OH$

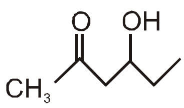
$\underset{\text{2° Alcohol}}{CH_3CH(OH)CH_3} + \text{Conc. HCl} \xrightarrow{\text{anhy. } ZnCl_2} CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3 + H_2O$

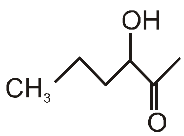
cloudiness
appears in 5 minutes

49. Which one of the following compounds will be most readily dehydrated?

(1) 

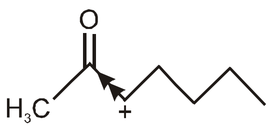
(2) 

(3) 

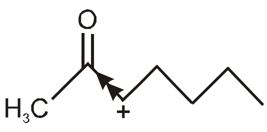
(4) 

Ans. **(3)**

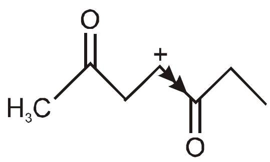
Sol. (3) : The ease of dehydration of the given compounds can be explained on the basis of the stability of the carbocation formed. In case of options (1), (2) and (4), a secondary carbocation is formed but the presence of an electron withdrawing > C = O group adjacent to the positively charged carbon, intensifies the charge and hence destabilies the species.



(a)

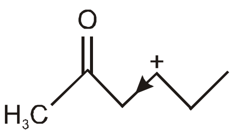


(b)



(c)

However, in case of option (c), a secondary carbocation is formed, but the electron withdrawing > C = O group is present away, as a farther result, the effect of this group is diminished and hence the carbocation is relatively more stable.



(c)
(more stable)

50. The rate of reaction

$2\,NO + Cl_2 \longrightarrow 2\,NOCl$ is given by the rate equation rate = $k[NO]^2\,[Cl]_2$. The value the rate of constant can be increased by :

(1) increasing the temperature (2) increasing the concentration of NO

(3) increasing the concentration of the Cl_2 (4) doing all of above

Ans. (1)

Sol. Rate constant is independent of the initial concentration of the reactants. It has a constant value at fixed temperature. Hence the value of rate constant can be increased by increasing the temperature.

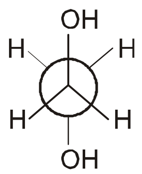
51. Which of the following complexes is not expected to exhibit isomerism?

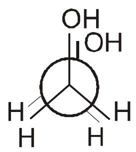
(1) $[Ni\,(NH_3)_4\,(H_2O)_2]^{2+}$ (2) $[Pt\,(NH_3)_2Cl_2]$ (3) $[Ni(NH_3)_2Cl_2]$ (4) $[Ni(en)_3]^{2+}$

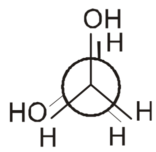
Ans. (3)

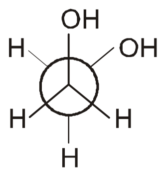
Sol. $[Ni(NH_3)_2Cl_2]$ has tetrahedral geometry and thus, deos not exhibit isomerism due to presence of symmetry elements.

52. Which of the following conformers for ethylene glycol is most stable?

(1) 

(2) 

(3) 

(4) 

Ans. (4)

Sol. The conformation (4) is most stable because of intermolecular H - bonding.

53. The IUPAC name of the compound $CH_3CH = CHC \equiv CH$ is :

(1) Pent-4-yn-2-ene (2) Pent-3-en-1-yne (3) Pent-2-en-4-yne (4) Pent-1-yn-3-ene

Ans. (2)

Sol. $\overset{5}{C}H_3\overset{4}{C}H = \overset{3}{C}H\overset{2}{C} \equiv \overset{1}{C}H$

Pent-3-en-1-yne

Fact : If a molecule contains both carbon-carbon double or triple bonds, the two are treated at par in seeking the lowest number combination. However, if the sum of numbers turns out to be the same starting from either of the carbon chain, then lowest number is given to the $C = C$ double bond.

54. Which of the following oxidation states is the most common among the lanthanoids?

(1) 4 (2) 2 (3) 5 (4) 3

Ans. (4)

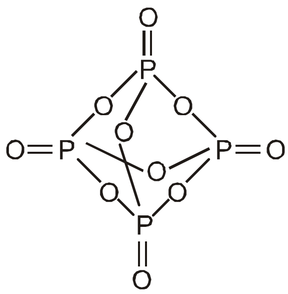
Sol. The common stable oxidation state of all the lanthanoids is + 3. The oxidation state of + 2 and + 4 are also exhibited by some of the elements. These oxidation states are only stable in those cases where stable 4f°, $4f^7$ or $4f^{14}$ configuration are achieved.

55. How many bridging oxygen atoms are present in P_4O_{10}?

(1) 6 (2) 4 (3) 2 (4) 5

Ans. (1)

Sol. P_4O_{10} has the following structure :



Thus, the number of bridging oxygen atoms = 6.

56. Some of the properties of the two species, NO_3^- and H_3O^+ are described below. Which one of them is correct?

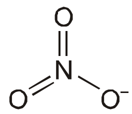
(1) Dissimilar in hybridization for the central atom with different structures
(2) Isostructural with same hybridization for the central atom
(3) Isostructural with different hybridization for the central atom
(4) Similar in hybridiation for the central atom with different structures

Ans. (1)

Sol. In $NO^-{}_3$,

$$H = \frac{1}{2}[5+0-0+1] = 3$$

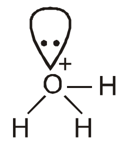
Thus, in $NO^-{}_3$, the central atom is sp^2 hybridised and it has trigonal planar geometry.



In H_3O^+,

$$H = \frac{1}{2}[6+3-1+0] = 4$$

Thus, O is sp^3 hybridised in H_3O^+ and H_3O^+ has pyramidal geometry due to the presence of one lone pair of electrons.



57. The following two reactions are known

$Fe_2O_{3(s)} + 3CO_{(g)} \longrightarrow 2Fe_{(s)} + 3CO_{2(g)}$; $\Delta H = -26.8$ kJ

$FeO_{(s)} + CO_{(g)} \longrightarrow Fe_{(s)} + CO_{2(g)}$; $\Delta H = -16.5$ kJ

The value of ΔH for the following reaction

$Fe_2O_{3(s)} + CO_{(g)} \longrightarrow 2FeO_{(s)} + CO_{2(g)}$ is :

(1) + 10.3 kJ (2) – 43.3 kJ (3) – 10.3 kJ (4) + 6.2 kJ

Ans. (4)

Sol. Given

(I) $Fe_2O_3(s) + 3CO(g) \longrightarrow 3Fe(s) + 3CO_2(g)$; $\Delta H = -26.8$ kJ

(II) $FeO(s) + CO(g) \longrightarrow Fe(s) + CO_2(g)$; $\Delta H = -16.5$ kJ

On multiplying equation (II) with 2, we get

(III) $2FeO(s) + 2CO(g) \longrightarrow 2Fe(s) + 2CO_2(g)$; $\Delta H = -33$ kJ

On substracting equation (IIII) from, I we get

$Fe_2O_3(s) + CO(g) \longrightarrow 2FeO(s) + CO_2(g)$; $\Delta H = -26.8 - (-33) = +6.2$ kJ

58. Following compounds are given

(i) CH_3CH_2OH (ii) CH_3COCH_3 (iii) $CH_3 - \underset{\underset{CH_3}{|}}{CHOH}$ (iv) CH_3OH

Which of the above compound (s), on being warmed with iodine solution and NaOH, will give iodoform?

(1) (i), (iii) and (iv) (2) Only (ii) (3) (i), (ii) and (iii) (4) (i) and (ii)

Ans. (3)

Sol. Compounds having either $CH_3\overset{\overset{O}{||}}{C}-$ group or CH_3CHOH – group, give iodoform when warmed with I_2 and NaOH.

Thus,

$$CH_3\underset{\underset{H}{|}}{C}HOH,\ CH_3-\overset{\overset{O}{||}}{C}-CH_3,\ CH_3-\underset{\underset{CH_3}{|}}{CHOH}$$

give iodoform when warmed with I_2 and NaOH, (Remember, NaOI oxidises CH_3CH_2OH to CH_3CHO, thus it gives positive iodoform test.)

59. Fructose reduces Tollen's reagent due to :

(1) Asymmetric carbons

(2) Primary alcoholic groups

(3) Secondary alcoholic group

(4) Enolisation of fructose followed by conversion to aldehyde by base

Ans. (4)

Sol. In aqueous solution, fructose is enolised and then converted into aldehyde in basic medium. All aldehydes generally reduce Tollen's reagent, thus fructose also reduces Tollen's reagent.

60. In the following reaction,

$C_6H_5CH_2Br \xrightarrow[2.H_3O^+]{1.MgEther} X$, the product 'X' is :

(1) $C_6H_5CH_2OCH_2C_6H_5$ (2) $C_6H_5CH_2OH$

(3) $C_6H_5CH_3$ (4) $C_6H_5CH_2CH_2C_6H_5$

Ans. (3)

Sol. $$C_6H_5CH_2Br \xrightarrow{\text{Mg, ether}} \underset{\text{Grignard reagent}}{C_6H_5CH_2MgBr} \xrightarrow{H_3O^+/H^+} \underset{\text{toluene}}{C_6H_5CH_3} + Mg\begin{matrix}Br\\OH\end{matrix}$$

Cornea is the transparent anterior portion of the outer coat of the vertebrate eye covering the iris and the pupil. It is avascular as it lacks lymphatic and blood vessels.

PART- C (BIOLOGY)

61. Which one of the following is manoecious

(1) Date palm (2) Marchantia (3) Cyas (4) Pinus

Ans. (4)

62. Jaundice is disorder of

(1) Circulatory system (2) Excretory system

(3) Skin and eyes (4) Digestive system

Ans. (4)

63. Given below are four statements (A-D) each with one or two blanks. Select the option which correctly fills up the blanks in two.

Statements :

(A) Wings of butterfly and birds look alike and are the results of ..... (i)....., evolution

(B) Miller showed that CH_4, H_2, NH_3 and .... (i) ..., when exposed to electric discharge in a flask resulted in formation of ...... (ii).....

(C) Vermiform appendix is a ...... (i)..... organ and an ...... (ii).... evidence of evolution.

(D) According to Darwin evolution took place due to ...... (i).... and ....(ii)..... of the fittest.

Options :

(1) (C) – (i) vestigial, (ii) anatomical, (D) (i) mutations (ii) multiplication

(2) (D) – (i) small variation, (ii) survival, (A) – (i) convergent

(3) (A) – (i) convergent, (B) – (i) oxygen, (ii) nucleosides

(4) (B) – (i) water vapour, (ii) amino acids, (C) – (i) rudimentary (ii) anatomical

Ans. (2)

64. In eukaryotic cell transcription, RNA splicaing and RNA capping take place inside the

(1) ER (2) Ribosomes (3) Nucleus (4) Dictyosomes

Ans. (3)

65. Select the correct matching of a hormone, its source and function.

	Hormone	Source	Function
1	Prolactin	Posterior pituitary	Regulates growth of mammary glands and milk formation in females
2	Vasopression	Posterior pituitary	Increases loss of water through urine
3	Norepinephrine	Adrenal medulla	Increases heart beat, rate of respiration and alertness
4	Glucagon	Beta-cells of lslets of langerhans	Stimulates glycogenolysis

Ans. (3)

66. A cross in which an organism showing a dominant phenotype crosed with the recessive parent in order to know its genotype is called

(1) Dihybrid cross (2) Monohybrid cross (3) Back cross (4) Test cross

Ans. (4)

67. A person suffering from a disease caused by Plasmodium, experinces recurring chill and fever at the time when

(1) The microgametocytes and megagametocytes are being destoryed by the WBCs.

(2) The sporozoites released from RBCs are being rapidly killed and broken down inside spleen.

(3) The trophyzoitges reach maximum growth and give out certain toxins

(4) The parasite after its rapid multiplicaiton inside RBCs ruptures them, releasing the stage to enter fresh RBCs.

Ans. (3)

68. Select the correct combination of the statements (a-d) regarding the characteristics of certain organisms.

(a) Methanogens are archaebacteria which produce methane in marshy areas

(b) Notoc is a filamentous blue-green alga which fixes atmospheric nitrogen

(c) Chemosynthetic autotrophic bacteria synthesize cellulose form glucose

(d) Mycoplasma lack a cell wall and can survive wihout oxygen.

The correct statemetns are

(1) (a), (b), (d) (2) (b), (c) (3) (a), (b), (c) (4) (b), (c), (d)

Ans. (1)

69. Read the following four statements, A, B, C and D and select the right option having both correct statements.

Statement :

(A) Z scheme of light reaction takes place in presence of PSI only

(B) Only PSI is functional in cyclic photophosphorylaiton.

(C) Cyclic photophosphorylation results into synthesis of ATP and $NADPH_2$

(D) Stroma lamellae lack PSII as well as NADP.

Options :

(1) C and D (2) B and D (3) A and B (4) B and C

Ans. (2)

70. Which one of the following lechniques is safest for the detection of cancers

(1) Histopathological studies (2) Magnetic resonance imaging (MRI)

(3) Radiography (X-ray) (4) Computed tomography (CT)

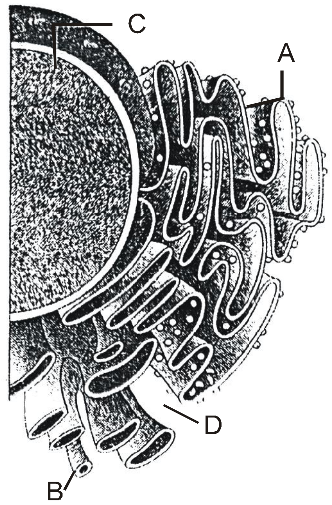
Ans. (2)

71. Select the answer with correct matching of the structure, its location and function.

	Structure	Location	Function
1	Blind spot	Near the place Where optic nerve leaves the eye	Rods and cones are present but inactive here
2	Eustachian tube	Anterior part of internal ear	Equalizes air pressure on either sides of tympanic membrane
3	Cerebellum	Mid brain	Controls respiration and ganieie
4	Hypothalamus	Fore brain	Controls Body temperature, urge for eating and drinking

Ans. (4)

72. Identify the components labelled A, B, C and D in the diagram below from the list (i) to (viii) given with.



Components :

(i) Cristae of mitochondria

(ii) Inner membrane of mitochondria

(iii) Cytoplasm

(iv) Smooth endoplasmic reticulum

(v) Rough endoplasmic reticulum

(vi) Mitochondrial matrix

(vii) Cell vacuole

(viii) Nucleus

The correct components are

	A	B	C	D
(1)	(v)	(i)	(iii)	(ii)
(2)	(v)	(iv)	(viii)	(iii)
(3)	(i)	(iv)	(viii)	(vi)
(4)	(vi)	(v)	(iv)	(vii)

Ans. (2)

73. Signals from fully developed foetus and placenta ultimately lead to parturition which requires the release of

(1) Ralaxin from placenta
(2) Estrogen from placenta
(3) Oxytocin from maternal pituitary
(4) Oxytocin from foetal pituitary

Ans. (3)

74. Consider the following four statements A, B, C and D select the right option for two correct statements.

Statements :

(A) In vexillary aestivation, the large posteior petal is called-standard, two lateral ones are wings and two small anteior petals are termed keel.

(B) The floral formula for Litiaceae is ⊕⚥ $P_{3+3}\, A_{3+3}\, G_{\underline{3}}$

(C) In pea flower the stamens are monadelphous

(D) The floral formula for Solanaceae is ⊕⚥ $K_{(5)} C_{(3)}\, G_{\underline{(2)}}$

The Correct statements are

(1) (C) and (D)
(2) (A) and (C)
(3) (A) and (B)
(4) (B) and (C)

Ans. (1)

75. The most apparent change during the evloutionary history of Homo sapiens is traced in

(1) Remarkable increase in the brains size (2) Loss of body hair
(3) Walking upright (4) Shortening of the jaws

Ans. (1)

76. Transport of food material in higher plants takes place through

(1) Sieve elements (2) Companion cells (3) Transfusion cells (4) Tracheids

Ans. (1)

77. Crocodile and Penguin are similar to Whale and Dogfish in which one of the following fetures

(1) Have gill slits at some stage
(2) Possess a solid single stranded central nerovous system
(3) Lay eggs and guard them till they hatch
(4) Possess bony skeleton.

Ans. (1)

78. The Indian Rhinoceros is a natural inhabitant of which one of the Indian states

(1) Assam (2) Uttarakhand (3) Uttar Pradesh (4) Himachal Pradesh

Ans. (1)

79. In Antirrhinum two plants with pink flowers were hybridized. The F1 plants produced red, pink and white flowers in the proportion of 1 red, 2 pink and 1 white. What could be the genotype of the two plants used for hybridization? Red flower colour is determined by RR, and white by rr genes.

(1) rr (2) rrr (3) RR (4) Rr

Ans. (4)

80. Fastest distribution of some injectible material / medicine and with no risk of any kind can be achieved by injecting it into the

(1) Lymph vessels (2) Muscles (3) Arteries (4) Veins

Ans. (4)

81. Which one of the following is most appropriately defined

(1) Parasite is an organism which always lives inside the body of other organism and may kill it.
(2) Host is an organism which provides food to another organism.
(3) Amensalism is a relationship in which one species is benefited where as the other is unaffected.
(4) Predator is an organism that catches and kills other organism for for food.

Ans. (4)

82. Kranz anatomy is one of the characteristics of the leaves of

(1) Mustard (2) Potato (3) Wheat (4) Sugarcane

Ans. (4)

83. The fruit fly Drosophila melanogaster was found to be very suitbable for experimental verification of chromosomal theory of inheritance by Morgan and his colleagues because

(1) It completes life cycle in about two weeks
(2) It reproduces parthenogenetically
(3) A single mating produces two young flies
(4) Smaller female is easily recognisable from larger male

Ans. (1)

84. Leguminous plants are able to fix atmospheric nitrogen through the process of symbiotic nitrogen fixation. Which one of the following statements is not correct during this process of nitrogen fixation

(1) Nitrogenase is insensitive to oxygen

(2) Leghaemoglobin scavenges oxygen and is pinkish in colour

(3) Nodules act as sites nitrogen fixation

(4) The enzyme nitrogenase catalyses the conversion of atmospheric N_2 to NH_3

Ans. (1)

85. Which one of the following can not be used for preparation of vaccines against plague

(1) Heat-Killed suspensions of virulent bacteria

(2) Formalin-inactivated suspensions of virulent bacteria

(3) Avirulent live baeteria

(4) Synthetic capsular polysaccharide material

Ans. (1)

86. One of the commonly used plant growth hormone in tea plantations is

(1) Indole-3-acetic acid (2) Ethylene (3) Abscisic acid (4) Zeatin

Ans. (1)

87. The haemoglobin content per 100 ml of blood of a normal healthy adult is

(1) 12 - 16 g (2) 5 - 11 g (3) 25 -30 g (4) 17 - 20 g

Ans. (1)

88. Black (stem) rust of wheat is caused by

(1) Xanthomonas oryzae (2) Alternaria solani (3) Ustilago nuda (4) Puccinia graminis

Ans. (4)

89. In human female the blastocyst

(1) Gets implanted in endometrium by the trophoblast cells

(2) Forms placenta even before implantation

(3) Gets implanted into uterus 3 days after ovulation

(4) gets nutrition from uterine endometrial secretion only after implantation

Ans. (1)

90. Which of the following are used in gene cloning

(1) Plamids (2) Nucleoids (3) Lomasomes (4) Mesosomes

Ans. (1)

91. ABO blood grouping is controlled by gene I which has three alleles and show co-dominance. There are six genotypes. How many phenotypes in all are possible

(1) Five (2) Six (3) Three (4) Four

92. Given below are four statements (a-d) regarding human blood circulatory system

(a) Arteries are thick-walled and have narrow lumen as compared to veins

(b) Angina is acute chest pain when the blood ciruclation of the brain is reduced

(c) Persons with blood group AB can donate blood to any person with any blood group under ABO system

(d) Calcium ions play a very important role in blood clotting

Which two of the above statements are correct

(1) (c) and (d) (2) (a) and (d) (3) (a) and (b) (4) (b) and (c)

Ans. (2)

93. Vegetative propagation in Pistia occurs by

(1) Sucker (2) Stolen (3) Offset (4) Runner

Ans. (3)

94. Which one of the following pairs of structure is correctly matched with their correct description

	Structures		Description
1	Premolars and molars	–	20 in all and 3-rooted
2	Tibia and fibula	–	Both form parts of knee joint
3	Cartilage and cornea	–	No blood supply but do require oxygen for respiratory need
4	Shoulder joint and elbow joint	–	Ball and socket type of joint

Ans. (3)

95. Secretions from which one of the following are rich in fructose, calcium and some enzymes

(1) Salivary glands (2) Male accessory glands

(3) Liver (4) Pancreas

Ans. (2)

96. When domestic sewage mixes with river water

(1) The river water is still suitable for drinking as impurities only about 0.1%

(2) Small animals like rats will die after drinking river water

(3) The increased microbial activity releases micro-nutrients such as iron

(4) The increased microbial activity uses up dissolved oxygen

Ans. (4)

97. Three of the following statements about enzymes are correct and one is wrong which one is wrong

(1) Most enzymes are proteins but some are lipids

(2) Enzymes require optimum pH for maximal activity

(3) Enzymes are denatured at high temperatures but in certain exceptional organisms they are effective even at tempreatures 80°- 90°C

(4) Enzymes are highly specific

Ans. (1)

98. Root development is promoted by

(1) Ethylene (2) Abscisic acid (3) Auxin (4) Gibberellin

Ans. (3)

99. In which one of the following organisms its excretory organs are **correctly** stated

(1) Frog – Kidneys, skin and buccal epithelium

(2) Humans – Kidneys, sebaceous glands and tear glands

(3) Earthworm – Pharyngeal, integumentary and septal nephridia

(4) Cockroach – Malpighian tubules and enteric caeca

Ans. (3)

100. If for some reason the pariental cells of the gut epithelium become partially nonfunctional, what is likely to happen.

(1) Proteins will not be adequately hydrolysed by pepsin into proteoses and peptones

(2) The pancreatic enzymes and specially the trypsin and lipase will not work efficiently

(3) The pH of stomach will fall abruptly

(4) Steapsin will be more effective

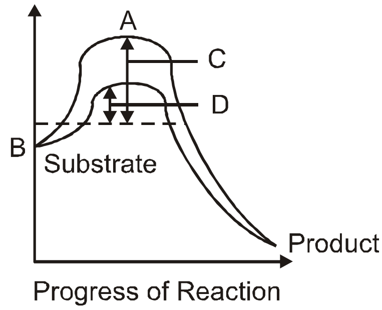
Ans. (1)

101. Which one of the following is now being commercially produced by biotechnological procedures

(1) Insulin (2) Nicotine (3) Morphine (4) Quinine

Ans. (1)

102. The figure given below shows the conversion of a substrate into produced by an enzyme. In which one of the four option (1-4) the components of reaction labelled as A, B, C and D are identitied correctly.



Options :

	A	B	C	D
1	Activation energy with enzyme	Transition state	Activation energy without enzyme	Potential energy
2	Potential energy	Transition state	Activation energy with enzyme	Activation energy without enzyme
3	Transition state	Potential energy	Activation energy without enzyme	Activation energy with enzyme
4	Potential energy	Transition state	Activation energy with enzyme	Activation energy without enzyme

Ans. (3)

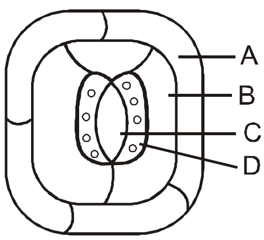
103. An eleborate network of filamentous proteinaceous structures present in the cytoplasm which helps in the maintenance of cell shape is called.

(1) Cytoskeleton (2) Thylakoid

(3) Endosplasmic Reticulum (4) Plasmalemma

Ans. (1)

104. Given below is the diagram of a stomatal apparatus. In which of the folloiwng all the four parts Labelled as A, B, C and D are correctly identified.



	A	B	C	D
1	Epidermal cell	Subsidiary cell	Stomatal aperture	Guard cell
2	Subsidiary cell	Epidermal cell	Guard cell	Stomatal aperture
3	Guard cell	Stomatal aperture	Subsidiary cell	Epidermal cell
4	Epidermal cell	Guard cell	Stomatal aperture	Subsidiary cell

Ans. (1)

105. Which one of the following statements about the particular entity is true.

(1) DNA consists of a core of eight histones

(2) Centromere is found in animal cells, which produces aster during cell division

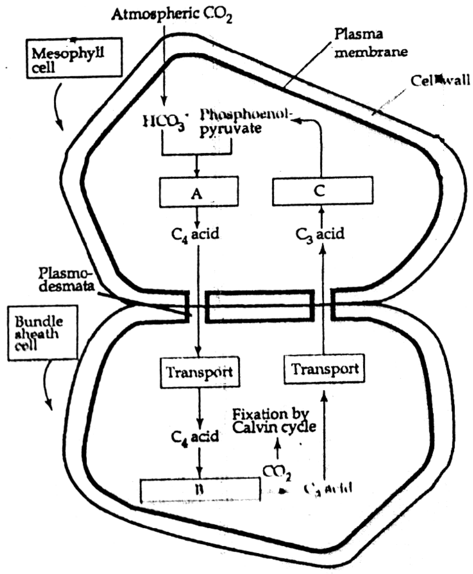
(3) The gene for producing insulin is present in every body cell

(4) Nucleosome is formed of nucleotides

Ans. (3)

106. Study the pathway given below

In which of the following options correct words for all the three blanks A, B and C are indicated.



	A	B	C
1	Carboxylation	Decarboxylation	Reduction
2	Decarboxylaiton	Reduction	Regeneration
3	Fixation	Transamination	Regeneration
4	Fixation	Decrboxylaiton	Regeneration

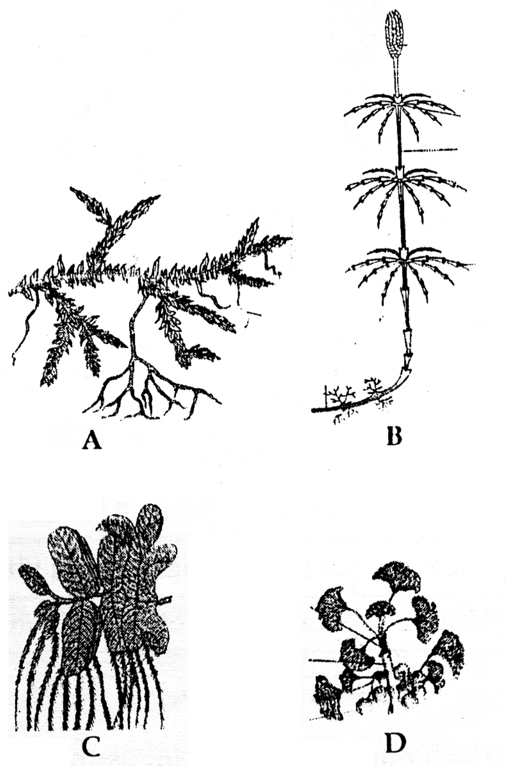
Ans. (4)

107. Which one of the following is a xerophytic plant in which the stem is modified into a flat, green and succulent structure

(1) Acacia (2) Opuntia (3) Casuarina (4) Hydrilla

Ans. (2)

108. Examine the figures A, B, C and D. In which one of the four options all the items, A, B, C and D are correct



Options:

Opn.	A	B	C	D
1	Funaria	Adinatum	Salvinia	Riccia
2	Chara	Marchantia	Fucus	Pinus
3	Equisetum	Ginkgo	Selaginella	Lycopodium
4	Selaginella	Equisetum	Salvinia	Ginkgo

Ans. **(4)**

109. The lac operon consists of

(1) Three regulatory genes and three structural genes

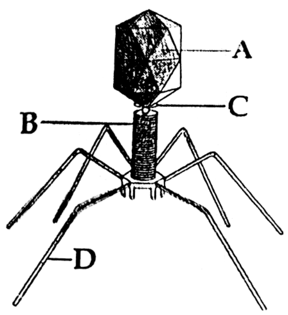
(2) Four regulatory genes only

(3) One regulatory gene and three structural genes

(4) Two regulatory genes and two structural genes

Ans. **(3)**

110. Given below is the diagram of a bacteriophage. In which one of the options all the four parts A, B, C and D are correct.



Options :

	A	B	C	D
1	Collar	Tail fibres	Head	Sheath
2	Tail fibres	Head	Sheath	Collar
3	Sheath	Collar	Head	Tail fibres
4	Head	Sheath	Collar	Tail fibres

Ans. (4)

111. Which one of the following is the the correct description of a certain part of a normal human skeleton

(1) Glenoid cavity is a depression to which the thigh bone articulates

(2) Parietal bone and the temporal bone of the skull are joined by fibrous joint

(3) First vertebra is axis which articulates with the occipital condyles

(4) The 9th and 10th pairs of ribs are called the floating ribs

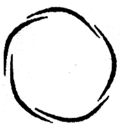
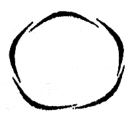
Ans. (2)

112. An example of endomycorrhiza is

(1) Rhizobium (2) Nostoc (3) Glomus (4) Agaricus

Ans. (3)

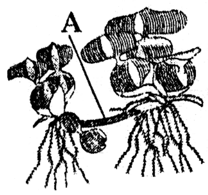
113. Aestivation of petals in the flower of cotton is correctly shown is

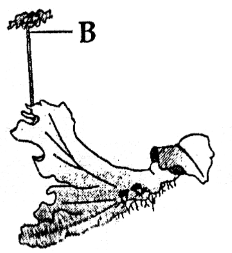
(1)  (2)  (3)  (4) 

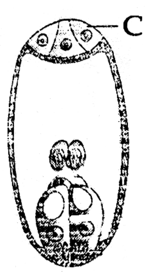
Ans. (1)

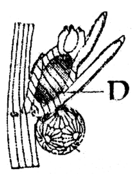
114. Examine the figures (A-D) given below and select the right option out of 1-4, in which all the four structures A, B, C and D are identified correctly.

Structures :







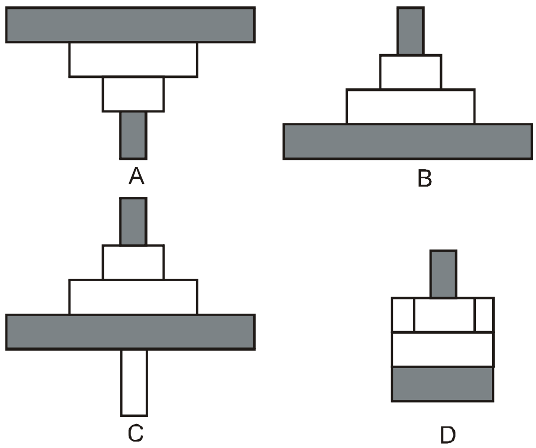


Options :

	A	B	C	D
1	Sucker	Seta	Megaspore mother cell	Gemma cup
2	Rhizome	Sporangiophore	Polar cell	Globule
3	Runner	Archegoniophore	Synergid	Antheridium
4	Offset	Antheridiophore	Antipodals	Oogonium

Ans. **(4)**

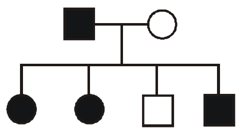
115. Which of the following representations shows the pyramid of number in a forest ecosystem



(1) C (2) D (3) A (4) B

Ans. **(4)**

116. Study the pedigree chart of a certain family given below and select the correct conclusion which can be drawn for the character.



(1) The male parent is homozygous dominant
(2) The female parent is heterozygous
(3) The parents could not have had a normal daughter for this character
(4) The trait under study could not be colour-blindness.

Ans. **(4)**

117. The correct floral formula of soyabean is

(1) % ⚥ $K_{(5)}C_{1+2+(2)}A_{1+(9)}G_{\underline{1}}$ (2) % ⚥ $K_{(5)}C_{1+(2)+2}A_{(9)+1}G_{\bar{1}}$

(3) % ⚥ $K_{(5)}C_{1+(2)+2}A_{(9)+1}G_{\underline{1}}$ (4) % ⚥ $K_{(5)}C_{1+2+(2)}A_{(9)+1}G_{\underline{1}}$

Ans. **(1)**

118. The 3'-5' phosphodiester linkages inside a polynucleotide chain serve to join
(1) One nitrogenous base with pentose sugar (2) One DNA strand with the other DNA strand
(3) One nucleoside with another nucleoside (4) One nucleotide with another nucleotide

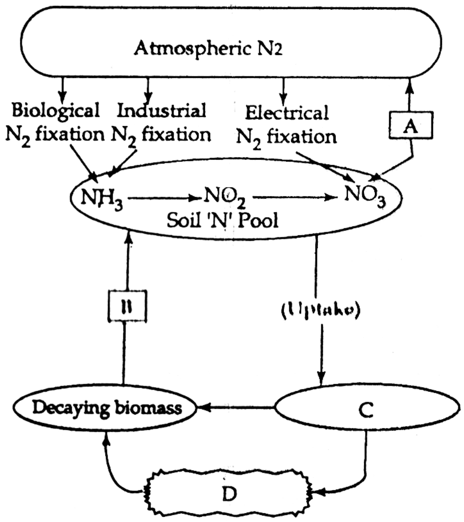
Ans. **(4)**

119. In genetic engineering, a DNA segment (gene) of interest, is transferred to the host cell through a vector. Consider the following four agents (A-D) in this regard and select the correct option about which one or more of these can be used as a vector/vectors:
(A) a bacterium (B) plasmid (C) plasmodium (D) bacteriophage

Options :
(1) (B) and (D) only (2) (A), (B) and (D) only (3) (A) only (4) (A) and (C) only

Ans. **(1)**

120. Study the cycle shown below and select the option which gives correct words for all the four blanks A, B, C and D.



Options :

	A	B	C	D
1	Denitrification	Nitrificaiton	Plants	Animals
2	Nitrification	Ammonification	Animals	Plants
3	Denitrification	Ammonification	Plants	Animals
4	Nitrification	Denitrification	Animals	Plants

Ans. **(3)**