

## Questions with Solutions

Time: 3 Hours

Total Marks: 720

**General Instructions:**

1. The test is of **3 hours** duration.
2. The Test Paper contains **180** questions. There are **three** parts in the question paper consisting of **Physics and Chemistry** having **45** questions each and **Biology** with **90 questions**.
3. Each question carries **4 marks**. For each correct response, the candidate will get **4 marks**. For each incorrect response, **1 mark** will be deducted from the total scores. The maximum marks are **720**.
4. Out of the four options given for each question, only one option is the correct answer. If more than one response is marked in any question, it will be treated as wrong response and marked up for wrong response will be deducted.
5. No deduction from the total score will be made if no response is indicated for an item in the answer box.
6. Use of Electronic/Manual Calculator is prohibited.

**PHYSICS**

**Q 1. The damping force on an oscillator is directly proportional to the velocity. The unit of the constant of proportionality are:-**

- Option A       $\text{kg s}^{-1}$   
 Option B       $\text{kg s}$   
 Option C       $\text{kg m s}^{-1}$   
 Option D       $\text{kg m s}^{-2}$

**Correct Option A**

**Solution:**

Damping force  $\propto$  velocity

$$\therefore F = kv$$

$$\text{Unit of } k = \text{Unit of } F / \text{Unit of } v = \frac{\text{kg ms}^{-2}}{\text{ms}^{-1}} = \text{kg s}^{-1}$$

Hence unit of  $k$  is  $\text{kg s}^{-1}$

**Q 2. The motion of a particle along a straight line is described by equation  $x = 8 + 12t - t^3$  where  $x$  is in metre and  $t$  in second. The retardation of the particle when its velocity becomes zero is:-**

- Option A       $6 \text{ ms}^{-2}$   
 Option B       $12 \text{ ms}^{-2}$   
 Option C       $24 \text{ ms}^{-2}$   
 Option D      zero

**Correct Option B****Solution:**

$$v = \frac{dx}{dt} = 0 + 12 - 3t^2 = 0 \Rightarrow t = 2s$$

At  $t = 2s$ ,

$$\text{Retardation} = -\frac{dv}{dt} = -(-6t) = 12m/s^2$$

**Q 3. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is:-**

Option A  $\theta = \tan^{-1}(2)$

Option B  $\theta = 45^\circ$

Option C  $\theta = \tan^{-1}\left(\frac{1}{4}\right)$

Option D  $\theta = \tan^{-1}(4)$

**Correct Option D****Solution:**

$$R = H_{\max} \Rightarrow \frac{2u^2 \sin \theta \cos \theta}{g} = \frac{u^2 \sin^2 \theta}{2g}$$

$$\Rightarrow \tan \theta = 4 \Rightarrow \theta = \tan^{-1}(4)$$

**Q 4. A particle has initial velocity  $(2\vec{i} + 3\vec{j})$  and acceleration  $(0.3\vec{i} + 0.2\vec{j})$ . The magnitude of velocity after 10 second will be:**

Option A 5 units

Option B 9 units

Option C  $9\sqrt{2}$  units

Option D  $5\sqrt{2}$  units

**Correct Option D****Solution:**

$$\vec{v} = \vec{u} + \vec{a}t = (2\hat{i} + 3\hat{j}) + (0.3\hat{i} + 0.2\hat{j})(10) = 5\hat{i} + 5\hat{j}$$

$$\text{Hence } |\vec{v}| = \sqrt{5^2 + 5^2} = \sqrt{5^2(1+1)} = 5\sqrt{2} \text{ units}$$

**Q 5. A car of mass 1000 kg negotiates a banked curve of radius 90m on a frictionless road. If the banking angle is  $45^\circ$ , the speed of the car is:**

Option A 5ms<sup>-1</sup>

Option B 10ms<sup>-1</sup>

Option C 20ms<sup>-1</sup>

Option D 30ms<sup>-1</sup>

**Correct Option D**

**Solution:**

$$\text{Speed of car, } v = \sqrt{Rg \tan \theta}$$

$$\therefore v = \sqrt{(90)(10)(\tan 45^\circ)}$$

$$\therefore v = \sqrt{900} = 30 \text{ m/s}$$

**Q 6. A solid cylinder of mass 3 kg is rolling on a horizontal surface with velocity 4 ms<sup>-1</sup>. It collides with a horizontal spring of force constant 200 Nm<sup>-1</sup>. The maximum compression produced in the spring will be:**

Option A 0.7 m

Option B 0.2 m

Option C 0.5 m

Option D 0.6 m

**Correct Option D**

**Solution:** From work energy theorem

$$\frac{1}{2} kx^2 = \frac{1}{2} mv^2 \left( 1 + \frac{K^2}{R^2} \right)$$

$$\Rightarrow \frac{1}{2} (200) x^2 = \frac{1}{2} \times 3 \times 4^2 \left( 1 + \frac{1}{2} \right)$$

$$\Rightarrow 100 x^2 = 36 \Rightarrow x = 0.6 \text{ m}$$

**Q 7. The potential energy of a particle in a force field is:  $U = \frac{A}{r^2} - \frac{B}{r}$  where A and B are positive constants and r is the distance of particle from the centre of the field. For stable equilibrium, the distance of the particles is:**

Option A A/B

Option B B/A

Option C B/2A

Option D 2A/B

**Correct Option D**

**Solution:**

$$F = -\frac{dU}{dr} = -\frac{2A}{r^3} + \frac{B}{r^2} = 0 \Rightarrow r = \frac{2A}{B}$$

$$\text{At } r = \frac{2A}{B}, \frac{d^2U}{dr^2} = +ve \text{ so stable equilibrium}$$

**Q 8. Two spheres A and B of masses  $m_1$  and  $m_2$  respectively collide. A is at rest initially and B is moving with velocity v along x-axis. After collision B has a velocity v/2 in a direction perpendicular to the original direction. The mass A moves after collision in the direction.**

Option A  $\theta = \tan^{-1} (1/2)$  to the x-axis

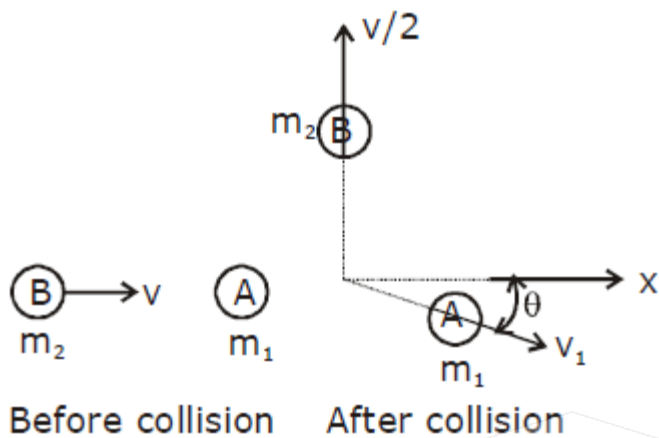
Option B  $\theta = \tan^{-1} (-1/2)$  to the x-axis

Option C same as that of B

Option D opposite to that of B

**Correct Option B**

**Solution:**



In x- direction  $m_2 v = m_1 v_1 \cos \theta$  ....(i)

In y- direction = 0  $m_2 v/2 - m_1 v_1 \sin \theta$  ....(ii)

Form above equation  $\tan \theta = - \frac{1}{2}$

**Q 9. Two persons of masses 55 kg and 665 kg respectively, are at the opposite ends of a boat. The length of the boat is 3.0 m and weight 100 kg. The 55 kg man walks up to the 65 kg man and sits with him. If the boat is in still water the centre of mass of the system shifts by:**

- Option A      zero
- Option B      0.75 m
- Option C      3.0 m
- Option D      2.3 m

**Correct Option A**

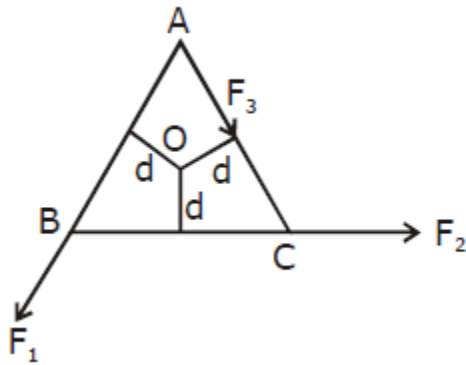
**Solution:** Net external force is equal to zero so there is no displacement of centre of mass of the system. Thus, centre of mass remains unchanged.

**Q 10. ABC is an equilateral triangle with O as its centre.  $\vec{F}_1, \vec{F}_2$  and  $\vec{F}_3$  represent three forces acting along the sides AB BC and AC respectively. If the total torque about O is zero then the magnitude of  $\vec{F}_3$  is:**

- Option A       $\frac{F_1 + F_2}{2}$
- Option B       $2(F_1 + F_2)$
- Option C       $F_1 + F_2$
- Option D       $F_1 - F_2$

**Correct Option C**

**Solution:**



$$\sum \tau = 0 \Rightarrow (F_1 + F_2) d = F_3 d \Rightarrow F_3 = F_1 + F_2$$

**Q 11. When a mass is rotating in a plane about a fixed point, its angular momentum is directed along:-**

- Option A the radius
- Option B the tangent to the orbit
- Option C a line perpendicular to the plane of rotation.
- Option D the line making an angle of  $45^\circ$  to the plane of rotation.

**Correct Option C**

**Solution:** Angular momentum will be along the axis of rotation which is perpendicular to the plane of motion.

**Q 12. A spherical planet has a mass  $M_p$  and Diameter  $D_p$ . A particle of mass  $m$  falling freely near the surface of this planet will experience an acceleration due to gravity, equal to:-**

- Option A  $GM_p/D_p^2$
- Option B  $4GM_p m/D_p^2$
- Option C  $4GM_p/D_p^2$
- Option D  $GM_p/D_p^2$

**Correct Option C**

**Solution:**

$$g = \frac{GM}{R^2} = \frac{GM_p}{\left(\frac{D_p}{2}\right)^2} = \frac{4GM_p}{D_p^2}$$

**Q 13. A geostationary satellite is orbiting the earth at a height of  $5R$  above that surface of the earth,  $R$  being the radius of the earth. The time period of another satellite in hours at a height of  $2R$  from the surface of the earth is:-**

- Option A  $6\sqrt{2}$
- Option B 6
- Option C 5
- Option D 10

**Correct Option A**

**Solution:** Time period  $T \propto r^{3/2}$

$$\frac{T_2}{T_1} = \left(\frac{r_2}{r_1}\right)^{3/2} \Rightarrow T_2 = (24 \text{ hrs.}) \left(\frac{3R}{6R}\right) = 6\sqrt{2} \text{ h}$$

**Q 14. The height at which the weight of a body becomes 1/16<sup>th</sup>, its weight on the surface of earth (radius R), is:-**

- Option A      3R  
 Option B      4R  
 Option C      5R  
 Option D      15R

**Correct Option A**

**Solution:**

$$mg_h = \frac{mg}{\left(1 + \frac{h}{R}\right)^2} \Rightarrow \frac{ng}{16} = \frac{mg}{\left(1 + \frac{h}{r}\right)^2} \Rightarrow h = 3R$$

**Q 15. Two sources of sound placed close to each other, are emitting progressive waves given by**

$$y_1 = 4 \sin 600 \pi t \text{ and } y_2 = 5 \sin 608 \pi t$$

**An observer located near these two sources ratiion sound will near.**

- Option A      8 beats per sound with intensity ratio 81 : 1 between waxing and waning  
 Option B      4 beats per sound with intensity ratio 81 : 1 between waxing and waning  
 Option C      4 beats per sound with intensity ratio 25 ; 16 between waxing and waning  
 Option D      8 beats per sound with intensity ratio 25 : 16 between waxing and waning

**Correct Option B**

**Solution:**

$$\text{Number of beats} = \frac{608\pi}{2\pi} - \frac{600\pi}{2\pi}$$

$$= 304 - 300 = 4$$

$$\text{and } \frac{I_{\max}}{I_{\min}} = \left(\frac{a_1 + a_2}{a_1 - a_2}\right)^2 = \left(\frac{4 + 5}{4 - 5}\right)^2 = 81$$

**Q 16. When a string is divided into three segments of length  $\ell_1$ ,  $\ell_2$  and  $\ell_3$  the fundamental frequencies of these three segments are  $V_1$ ,  $V_2$  and  $V_3$  respectively. The original fundamental frequency (V) of the string is:**

- Option A       $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$   
 Option B       $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{v_2} + \frac{2}{v_3}$   
 Option C       $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$   
 Option D       $v = v_1 + v_2 + v_3$

**Correct Option A**

**Solution:**

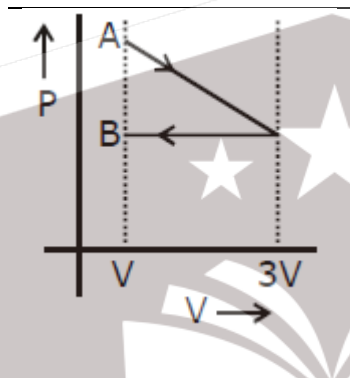
Fundamental frequency  $V \propto \frac{1}{l}$

$\therefore V_1 \propto \frac{1}{l_1}, v_2 \propto \frac{1}{l_2}$  and  $v_3 \propto \frac{1}{l_3}$

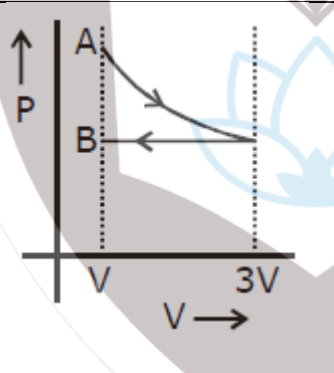
Also  $l_1 + l_2 + l_3 = l$  so  $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$

**Q 17. One mole of an ideal gas goes from an initial state A to final state B via two processes. It first undergoes isothermal expansion from volume  $V$  to  $3V$  and then its volume is reduced from  $3V$  to  $V$  at constant pressure. The correct P-V diagram representing the two processes is:**

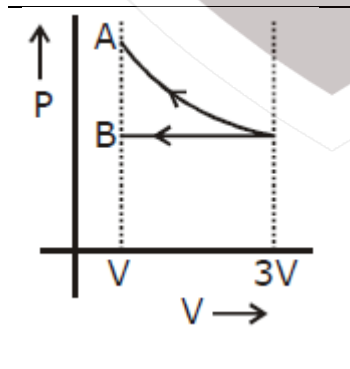
Option A



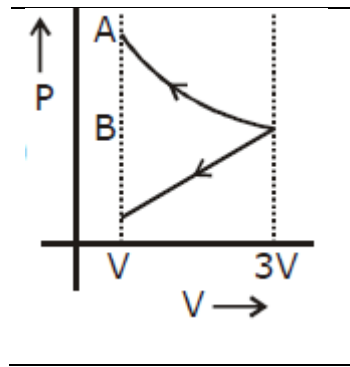
Option B



Option C



Option D



### Correct Option B

**Solution:** A process in which the pressure remain constant is isobaric process.

And

$$PV = nRT$$

As  $P = \text{constant}$

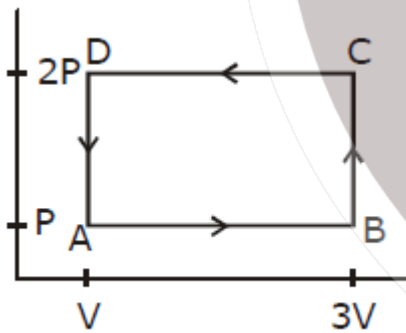
$$V \propto T$$

$$\therefore \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

1<sup>st</sup> process is  $V \rightarrow 3V$  (Isothermal)

2<sup>nd</sup> process is  $3V \rightarrow V$  (isobaric)

**Q 18.** A thermodynamic system is taken through the cycle ABCD as shown in figure. Heat rejected by the during the cycle is;-



Option A  $\frac{1}{2}PV$

Option B  $PV$

Option C  $2PV$

Option D  $4PV$

### Correct Option C

**Solution:**

In cyclic process  $\Delta U = 0$

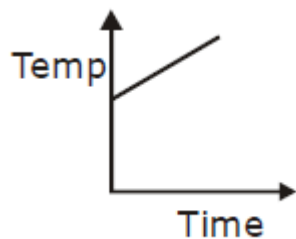
$$\text{So } Q = W = - (2P - P) (3V - V) = - 2PV$$

Heat rejected by gas =  $2PV$

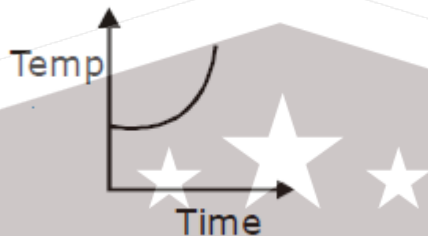


**Q 19. Liquid oxygen at 50 K is heated to 300 K at constant pressure of 1 atm. The rate of heating is constant. Which one of the following graphs represents the variation of temperature with time?**

Option A



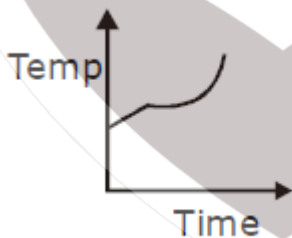
Option B



Option C



Option D



**Correct Option C**

**Solution:**

While heating at initial, temperature will increase and then as there will be change of state from liquid to gas the temperature will remain constant.

**Q 20. If the radius of a star is  $r$  and it acts as a black body, what would be the temperature of the star, in which the rate of energy production is  $Q$ ?**

Option A  $(4\pi R^2 Q / \sigma)^{1/4}$

Option B  $(Q / 4\pi R^2 \sigma)^{1/4}$

Option C  $Q / 4\pi R^2 \sigma$

Option D  $(Q / 4\pi R^2 \sigma)^{-1/2}$

( $\sigma$  stands for Stefan's constant.)

**Correct Option B**

**Solution:**

$$\frac{Q}{A} = \sigma T^4 \Rightarrow T = \left( \frac{Q}{4\sigma\pi R^2} \right)^{1/4}$$

**Q 21. A coil of resistance  $400\Omega$  is placed in a magnetic field. If the magnetic flux  $\phi$  (Wb) linked with the coil varies with time  $t$  (sec) as**

$$\Phi = 50t^2 + 4$$

**The current in the coil at  $t = 2$  s is:**

Option A 2A

Option B 1A

Option C 0.5A

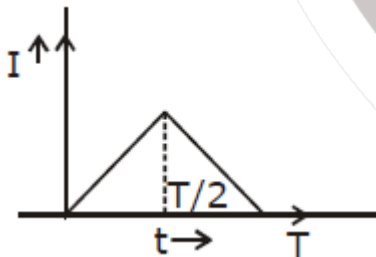
Option D 0.1A

**Correct Option C**

**Solution:**

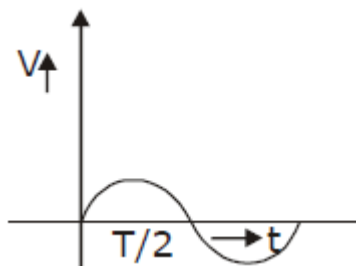
$$i = \frac{d\phi / dt}{R} = \frac{100t}{400} = \frac{200}{400} = 0.5 \text{ A}$$

**Q 22. The current ( $I$ ) in the inductance is varying with time according to the plot shown in figure.**

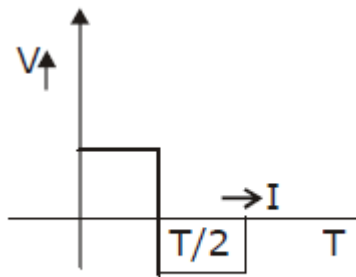


**Which one of the following is the correct variation of voltage with time in the coil?**

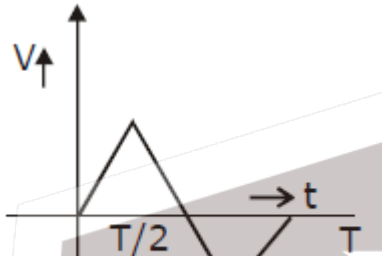
Option A



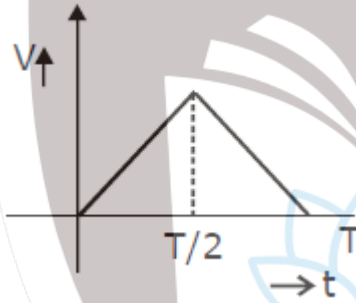
Option B



Option C



Option D



**Correct Option B**

**Solution: Voltage across inductor  $V = L \frac{dI}{dt}$**

$\frac{dI}{dt}$  – slope of graph

for  $0 < t < T/2$  - Slope is positive and constant

for  $T/2 < t < T$  - Slope is negative and constant

**Q 23.** In a electrical circuit R, L, C and a.c voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and the current in the circuit is  $\pi/3$ . If instead, C is removed from the circuit the phase difference is again  $\pi/3$ . The power factor of the circuit is:

- Option A      1  
 Option B       $\sqrt{3} / 2$   
 Option C       $\frac{1}{2}$   
 Option D       $\frac{1}{\sqrt{2}}$

**Correct Option A**

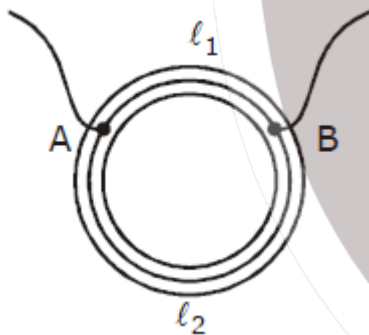
**Solution:**

$$\tan \phi_1 = \frac{X_L}{R}, \tan \phi_2 = \frac{X_C}{R}$$

$$\text{But } \tan \phi_1 = \tan \phi_2$$

$$\text{So } X_C = X_L$$

**Q 24.** A ring is made of a wire having a resistance  $R_0 = 12\Omega$ . Find the points A and B as shown in the figure at which a current carrying conductor should be connected so that the resistance R of the sub circuit between these point is equal to  $8/3 \Omega$ .



- Option A       $\frac{l_1}{l_2} = \frac{3}{8}$   
 Option B       $\frac{l_1}{l_2} = \frac{1}{2}$   
 Option C       $\frac{l_1}{l_2} = \frac{5}{8}$   
 Option D       $\frac{l_1}{l_2} = \frac{1}{3}$

**Correct Option B**

**Solution:**

$$\frac{R_1 R_2}{R_1 + R_2} = \frac{8}{3} \text{ \& } R_1 + R_2 = 12 \Rightarrow R_1 R_2 = 32$$

$$\Rightarrow R_1 - R_2 = \sqrt{(R_1 + R_2)^2 - 4R_1 R_2}$$

$$= \sqrt{12^2 - 4 \times 32} = 4 \Omega$$

So,  $R_1 = 4 \Omega$  and  $R_2 = 8 \Omega$

$$\text{Hence, } \frac{l_1}{l_2} = \frac{4}{8} = \frac{1}{2}$$

**Q 25. If voltage across a bulb rated 220 Volt 100 what drops by 2.8 % of its rated value, the percentage of the rated value by which the power would decrease is**

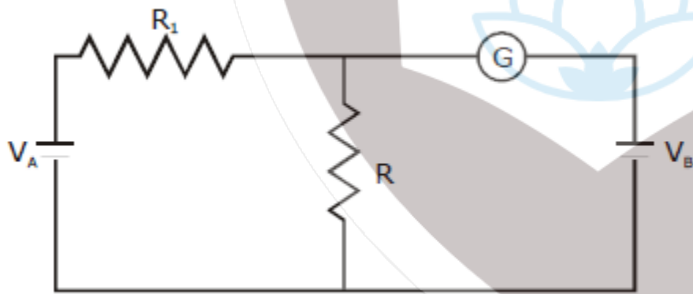
- Option A 5%
- Option B 10%
- Option C 20%
- Option D 2.5%

**Correct Option A**

**Solution:**

$$P \propto V^2 \text{ So } \frac{\Delta P}{P} = 2 \frac{\Delta V}{V} = 5\%$$

**Q 26. In the circuit shown the cells A and B have negligible resistances. For  $V_A = 12V$ ,  $R_1 = 500 \Omega$  and  $R = 100 \Omega$  the galvanometer (G) shows to deflection. The value of  $V_B$  is**



- Option A 12V
- Option B 6V
- Option C 4V
- Option D 2V

**Correct Option D**

**Solution:**

$V_B$  = Potential drop across R

$$\Rightarrow V_B = \left( \frac{R}{R_1 + R} \right) V_A = \left( \frac{100}{100 + 500} \right) (12)$$

$$= 2V$$

**Q 27. The electric field associated with an EM wave in vacuum is given by  $\vec{E} = \vec{i}40 \cos (kz - 6 \times 10^8t)$ , where  $E < z$  and  $t$  are in volt/m, meter and seconds respectively. The value of wave vector  $k$  is:**

- Option A  $6\text{m}^{-1}$
- Option B  $3\text{m}^{-1}$
- Option C  $2\text{m}^{-1}$
- Option D  $0.5\text{m}^{-1}$

**Correct Option C**

**Solution:**

$$\text{Wave factor } k = \frac{\omega}{v} = \frac{6 \times 10^8}{3 \times 10^8} = 2\text{ m}^{-1}$$

**Q 28. What is the flux through a cube of side 'a' if a point charge of  $q$  is at one of its corner?**

- Option A  $\frac{q}{\epsilon_0}$
- Option B  $\frac{q}{2\epsilon_0} 6a^2$
- Option C  $\frac{2q}{\epsilon_0}$
- Option D  $\frac{q}{8\epsilon_0}$

**Correct Option D**

**Solution:**

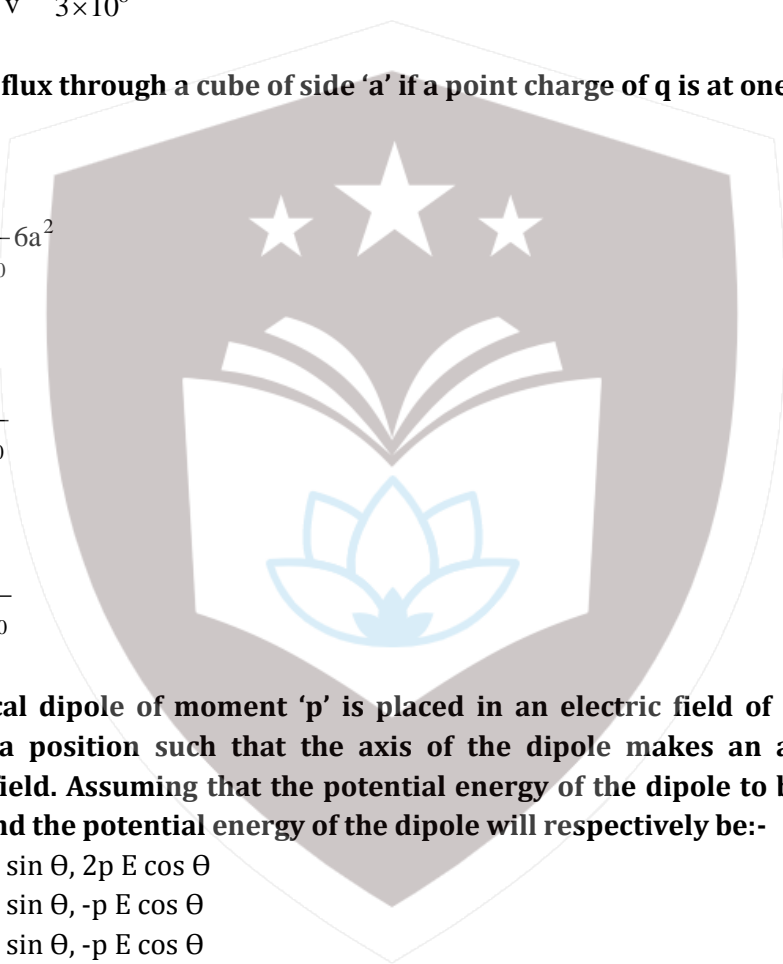
$$\text{Flux} = \frac{1}{8} \left( \frac{q}{\epsilon_0} \right) = \frac{q}{8\epsilon_0}$$

**Q 29. An electrical dipole of moment 'p' is placed in an electric field of intensity 'E'. The dipole acquires a position such that the axis of the dipole makes an angle  $\theta$  with the direction of the field. Assuming that the potential energy of the dipole to be zero when  $\theta = 90^\circ$ , the torque and the potential energy of the dipole will respectively be:-**

- Option A  $p E \sin \theta, 2p E \cos \theta$
- Option B  $p E \sin \theta, -p E \cos \theta$
- Option C  $p E \sin \theta, -p E \cos \theta$
- Option D  $p E \sin \theta, -2p E \cos \theta$

**Correct Option C**

**Solution:**  $\vec{\tau} = \vec{P} \times \vec{E}$  &  $U = -\vec{p} \cdot \vec{E}$



**Q 30. Four point charges  $-Q$ ,  $-q$ ,  $2q$  and  $2Q$  are placed, one at each corner of the square. The relation between  $Q$  and  $q$  for which the potential at the centre of the square is zero is:**

Option A  $Q = q$

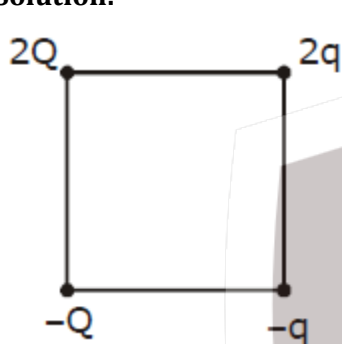
Option B  $Q = \frac{1}{q}$

Option C  $Q = -q$

Option D  $Q = -\frac{1}{q}$

**Correct Option C**

**Solution:**



Distances from charges are equal so at centre  $\mu \sum \text{charge}$

So  $-Q - q + 2q + 2Q = 0$

Thus,  $Q = -q$

**Q 31. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It:**

Option A will stay in north-south direction only

Option B will stay in east-west direction only

Option C will become rigid showing no movement

Option D will stay in any position

**Correct Option D**

**Solution:** There is no horizontal component of earth's magnetic field at geomagnetic pole as compass needle is allowed to move in horizontal plane taken at geomagnetic pole. Thus, it will stay in any position as horizontal component of the earth's magnetic field becomes zero at geomagnetic pole.

**Q 32. A millivoltmeter of 25 milli volt range is to be converted into an ammeter of 25 ampere range. The value (in ohm) of necessary shunts will be:**

Option A  $1 \Omega$

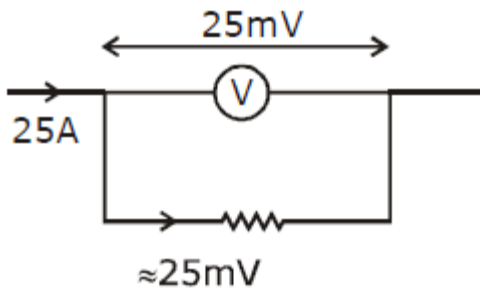
Option B  $0.05 \Omega$

Option C  $0.001 \Omega$

Option D  $0.01 \Omega$

**Correct Option C**

**Solution:**



$$\text{Shunt resistance} = \frac{25 \times 10^{-3}}{25}$$
$$= 10^{-3} \Omega = 0.001 \Omega$$

**Q 33. Two similar coils of radius R are lying concentrically with their planes at right angles to each other. The currents flowing in them are I and 2I respectively. The resultant magnetic field induction at the centre will be:**

Option A  $\frac{\mu_0 I}{2R}$

Option B  $\frac{\mu_0 I}{R}$

Option C  $\frac{\sqrt{5}\mu_0 I}{2R}$

Option D  $\frac{3\mu_0 I}{2R}$

**Correct Option C**

**Solution:**

$$B = \sqrt{B_1^2 + B_2^2} = \sqrt{\left(\frac{\mu_0 I}{2R}\right)^2 + \left(\frac{\mu_0 2I}{2R}\right)^2} = \frac{\sqrt{5}\mu_0 I}{2R}$$

**Q 34. Alternating electric field of frequency  $\nu$ , is applied across the dees (radius = R) of a cyclotron that is being used to accelerate protons (mass = m). The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton beam, produced by it, are given by:**

Option A  $B = \frac{2\pi m \nu}{e}$  and  $K = 2m\pi^2 \nu^2 R^2$

Option B  $B = \frac{m \nu}{e}$  and  $K = m^2 \pi \nu R^2$

Option C  $B = \frac{m \nu}{e}$  and  $K = 2m\pi^2 \nu^2 R^2$

Option D  $B = \frac{2\pi m \nu}{e}$  and  $K = m^2 \pi \nu R^2$

**Correct Option A**



**Solution:**

$$\frac{mv^2}{R} = qVB \Rightarrow R = \frac{mv}{qB}$$

$$\text{So } y = \frac{1}{T} = \frac{v}{2\pi R} = \frac{qB}{2\pi m} \Rightarrow B = \frac{2\pi mv}{e}$$

$$\begin{aligned} \text{kinetic energy } K &= \frac{1}{2}mv^2 = \frac{1}{2}m(2\pi Rv)^2 \\ &= 2\pi^2mv^2R^2 \end{aligned}$$

**Q 35. The magnifying power of a telescope is 9. When it is adjusted for parallel rays the distance between the objective and eyepiece is 20 cm. The focal length of lenses are:**

- Option A 18 cm, 2 cm
- Option B 11 cm, 9 cm
- Option C 10 cm, 10 cm
- Option D 15 cm, 5 cm

**Correct Option A**

**Solution:** magnifying power  $m = \frac{f_0}{f_e} = 9$  &  $L = f_0 + f_e = 20$

By solving we get,

$$f_e = 2 \text{ cm}$$

$$\text{and } f_0 = 18 \text{ cm}$$

**Q 36. A ray of light is incident at an angle of incidence, I, on one face of a prism of angle A (assumed to be small) and emerges normally from the opposite face. If the refractive index of the prism is  $\mu$ , the angle of incident I, is nearly equal to:**

- Option A  $A/\mu$
- Option B  $A/2\mu$
- Option C  $\mu A$
- Option D  $\frac{\mu A}{2}$

**Correct Option C**

**Solution:**

$$\text{Here } r_2 = 0 \text{ so } r_1 = A$$

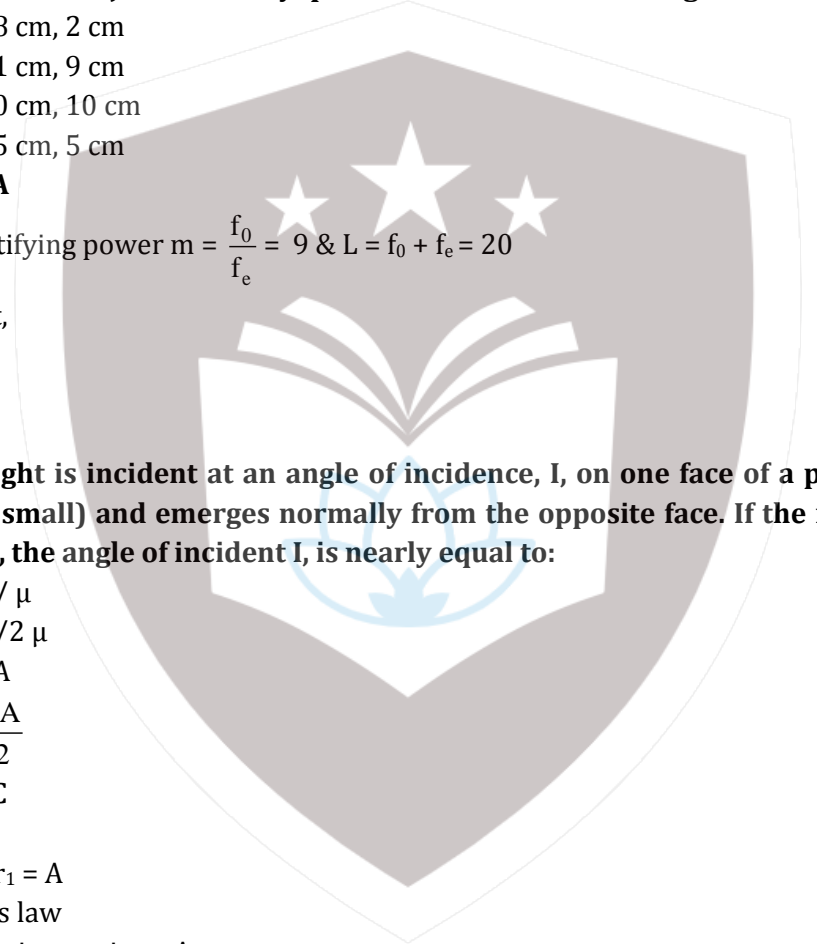
By using Snell's law

$$1 \times \sin i_1 = \mu \times \sin r_1 \Rightarrow i_1 = \mu A$$

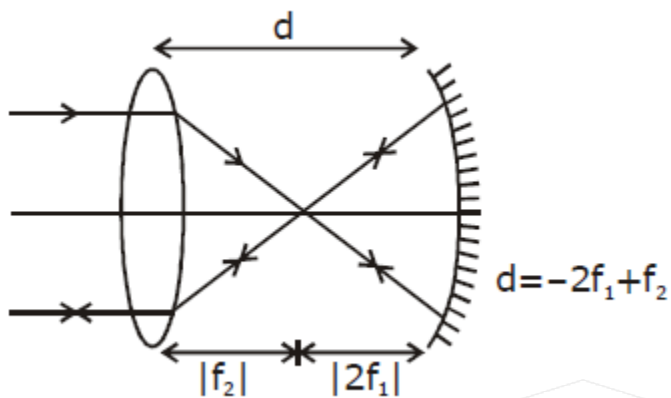
**Q 37. A concave mirror of focal length 'f<sub>1</sub>' is placed at a distance of 'd' from a convex lens of focal length 'f<sub>2</sub>'. A beam of light coming from infinity and falling on this convex lens-concave lens-concave mirror combination returns to infinity. The distance 'd' must be:**

- Option A  $2f_1 + f_2$
- Option B  $-2f_1 + f_2$
- Option C  $f_1 + f_2$
- Option D  $-f_1 + f_2$

**Correct Option B**



**Solution:**



**Q 38. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index.**

- Option A greater than that of glass
- Option B less than that of glass
- Option C equal to that of glass
- Option D less than one

**Correct Option C**

**Solution:**

$$P = \frac{1}{f} = \left( \frac{\mu_g}{\mu_\ell} - 1 \right) \left( \frac{1}{R_1} - \frac{1}{R_2} \right) = 0$$

$$\Rightarrow \mu_\ell = \mu_g$$

**Q 39. An  $\alpha$ -particle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m<sup>2</sup>. The de Broglie wavelength associated with the particle will be:**

- Option A  $\text{\AA}$
- Option B 0.01  $\text{\AA}$
- Option C 1  $\text{\AA}$
- Option D 0.01  $\text{\AA}$

**Correct Option B**

**Solution:**

$$\begin{aligned} \lambda &= \frac{h}{p} = \frac{h}{mv} = \frac{h}{qBR} \\ &= \frac{6.6 \times 10^{-34}}{2 \times 1.6 \times 10^{-19} \times 0.25 \times 0.83 \times 10^{-2}} \\ &= 1 \times 10^{-12} \text{ m, } = 0.01 \text{ \AA} \end{aligned}$$

**Q 40. Monochromatic radiation emitted when electron on hydrogen atom jumps from first excited to the ground state irradiates a photosensitive material. The stopping potential is measured to be 3.57V. The threshold frequency of the material is:**

- Option A  $1.6 \times 10^{15}$  Hz
- Option B  $2.5 \times 10^{15}$  Hz
- Option C  $4 \times 10^{15}$  Hz
- Option D  $5 \times 10^{15}$  Hz

**Correct Option A**

**Solution:**

$$\begin{aligned} \text{Work function } \phi &= h\nu - eV_0 \\ &= 10.2 - 3.57 = 6.63 \text{ eV} \end{aligned}$$

$$\begin{aligned} \text{Threshold frequency} &= \frac{6.63 \times 1.6 \times 10^{19}}{6.63 \times 10^{-34}} \\ &= 1.6 \times 10^{15} \text{ Hz} \end{aligned}$$

**Q 41. A 200 W sodium street lamp emits yellow light of wavelength  $0.6 \mu\text{m}$ . Assuming it to be 25% efficient converting electrical energy to light, the number of photon of yellow light it emits per second is:-**

- Option A  $62 \times 10^{15}$  Hz
- Option B  $3 \times 10^{19}$  Hz
- Option C  $1.5 \times 10^{20}$
- Option D  $6 \times 10^{18}$

**Correct Option C**

**Solution:**

Number of photons per second

$$\begin{aligned} &= \frac{\text{Power}}{\text{Energy of photon}} \\ &= \frac{200 \times \frac{25}{100}}{\frac{6.6 \times 10^{-34} \times 3 \times 10^8}{0.6 \times 10^{-5}}} = 1.5 \times 10^{20} \end{aligned}$$

**Q 42. Electron in hydrogen atom first jumps from third excited state to seconds excited state and then from second excited to the first excited state. The ration of the wavelengths  $\lambda_1: \lambda_2$  emitted in the two cases:**

- Option A 27/5
- Option B 20/7
- Option C 7/5
- Option D 27/20

**Correct Option B**

**Solution:**

$$\frac{\lambda_1}{\lambda_2} = \frac{\left(\frac{1}{2^2} - \frac{1}{3^2}\right)}{\left(\frac{2}{3^2} - \frac{1}{4^2}\right)} = \frac{\frac{1}{4} - \frac{1}{9}}{\frac{1}{9} - \frac{1}{16}} = \frac{\frac{5}{36}}{\frac{7}{144}} = \frac{20}{7}$$

$$\text{as } \frac{1}{\lambda} \propto \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

**Q 43. An electron of stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired as a result of photon emission will be:**

Option A  $\frac{25m}{24hR}$

Option B  $\frac{24m}{25hR}$

Option C  $\frac{24hR}{25m}$

Option D  $\frac{25hR}{24m}$

(m is the mass of the electron, R, Rydberg constant and h Planck's constant)

**Correct Option C**

**Solution:**

$$\text{Energy of photon} = \frac{hc}{\lambda} = hcR \left(\frac{1}{1^2} - \frac{1}{5^2}\right) = \frac{24hcR}{25}$$

$$\text{Momentum of photon} = \frac{E}{c} = \frac{24hR}{25}$$

= Momentum of atom

$$\text{Velocity of atom} = \frac{24hR}{25m}$$

Where m = mass of atom.

**Q 44. If the nuclear radius of  $^{27}\text{Al}$  is 3.6 Fermi, the approximate nuclear radius of  $^{64}\text{Cu}$  in Fermi is:**

Option A 4.8

Option B 3.6

Option C 2.4

Option D 1.2

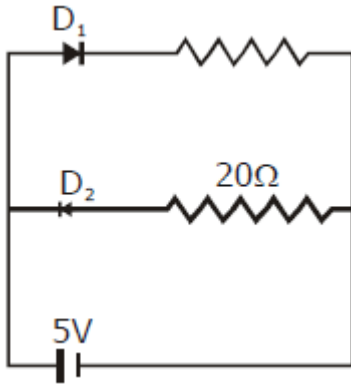
**Correct Option A**

**Solution:**

$$R \propto A^{1/3} \Rightarrow \frac{R_{\text{Cu}}}{R_{\text{Al}}} = \left(\frac{64}{27}\right)^{1/3} = \left(\frac{4^3}{3^3}\right)^{1/3} = \frac{4}{3}$$

$$\Rightarrow R_{\text{Cu}} = \frac{4}{3} \times 3.6 = 4.8 \text{ fermi}$$

**Q 45.** Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is:-



- Option A 0
- Option B 0.5 a
- Option C 0.75 a
- Option D zero

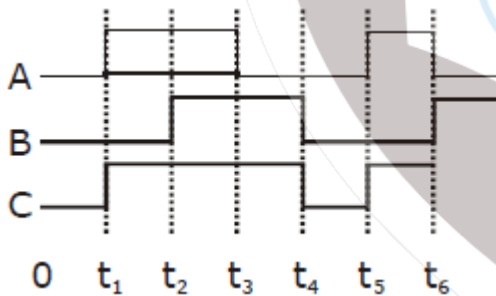
**Correct Option B**

**Solution:**

$$m_A = \frac{40}{2^{t/20}} \text{ and } m_B = \frac{160}{2^{t/10}} \Rightarrow 2^{\frac{t}{10} - \frac{t}{20}} = 4 = 2^2$$

$$\Rightarrow 2^{\frac{t}{10}} = 2^2 \Rightarrow t = 40 \text{ s}$$

**Q 47.** The figure shown a logic circuit two inputs A and B and the output C. The voltage wave forms across circuit gate is:



- Option A AND gate
- Option B NAND gate
- Option C OR gate
- Option D NOR gate

**Correct Option C**

**Solution:** The logic gate is OR gate.

**Q 48. In a CE transistor amplifier, the audio signal voltage across the collector resistance of  $2k\Omega$  is 2V. If the base resistance is  $1k\Omega$  and the current amplification of the transistor is 100, the input signal voltage is:-**

- Option A 1 mV
- Option B 10mV
- Option C 0.1 V
- Option D 1.0 V

**Correct Option B**

**Solution:**

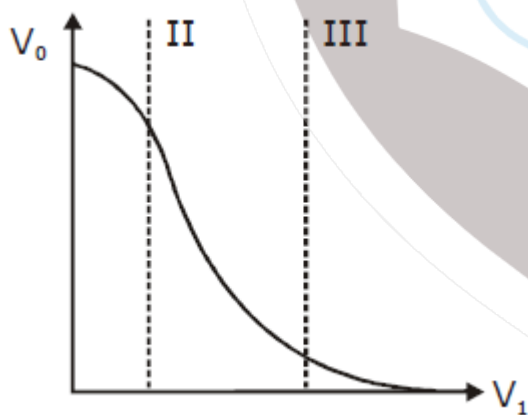
**Q 49. C and Si both have same lattice structure, having 4 bonding electrons in each. However, C is insulator whereas Si is intrinsic semiconductor. This is because:**

- Option A The four bonding electron in the case of C lie in the second orbit, whereas in the case of Si they lie in the third
- Option B The four bonding electron in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit.
- Option C In case of C the valance band is not completely filled at absolute zero temperature.
- Option D In case of C the conduction band is partly filled even at absolute zero temperature

**Correct Option a**

**Solution:**

**Q 50. Transfer characteristics (output voltage ( $V_0$ ) vs Input voltage ( $V_i$ ) for a base biased transistor in CE configuration is as shown in the figure. For using transistor as a switch, it is used.**



- Option A in region II
- Option B in region I
- Option C in region III
- Option D both in region (I) and (III)

**Correct Option D**

**Solution:**

# CHEMISTRY

**Q 1. In a zero-order reaction for every 10° rise of temperature, the rate is doubled. If the temperature is increased from 10°C to 100°C, the rate of the reaction will become:**

- Option A 64 times
- Option B 128 times
- Option C 256 times
- Option D 512 times

**Correct Option D**

**Solution:**

For 10° rise in temperature, rate of reaction will become =  $2^{\frac{\Delta T}{10}}$  times

$$= 2^{\left(\frac{100-10}{10}\right)}$$
$$= 2^9 = 512 \text{ times}$$

**Q 2. Which one of the following pairs is isostructural (i.e. having the same shape and hybridization)?**

- Option A [NF<sub>3</sub> and BF<sub>3</sub>]
- Option B [BF<sub>4</sub><sup>-</sup> and NH<sub>4</sub><sup>+</sup>]
- Option C [BCl<sub>3</sub> and BrCl<sub>3</sub>]
- Option D [NH<sub>3</sub> and NO<sub>3</sub><sup>-</sup>]

**Correct Option B**

**Solution:**

NF<sub>3</sub>- Pyramidal, BF<sub>3</sub>-Trigonal planar

BF<sub>4</sub><sup>-</sup>- Tetrahedral, NH<sub>4</sub><sup>+</sup>- Tetrahedral

BCl<sub>3</sub>- Trigonal planar, BrCl<sub>3</sub>- T Shape

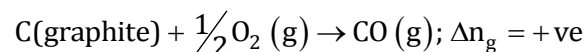
NH<sub>3</sub>- Pyramidal, NO<sub>3</sub><sup>-</sup>- Trigonal planar

**Q 3. In which of the following reactions, standard reaction entropy change (ΔS°) is positive and standard Gibb's energy change (ΔG°) decreases sharply with increasing temperature?**

- Option A  $\text{Mg (s)} + \frac{1}{2} \text{O}_2 \text{ (g)} \rightarrow \text{MgO (s)}$
- Option B  $\frac{1}{2} \text{C (graphite)} + \frac{1}{2} \text{O}_2 \text{ (g)} \rightarrow \frac{1}{2} \text{CO}_2 \text{ (g)}$
- Option C  $\text{C (graphite)} + \frac{1}{2} \text{O}_2 \text{ (g)} \rightarrow \text{CO (g)}$
- Option D  $\text{CO (g)} + \frac{1}{2} \text{O}_2 \text{ (g)} \rightarrow \text{CO}_2 \text{ (g)}$

**Correct option C**

**Solution:**



When number of gaseous moles increases then randomness increases.

⇒ ΔS° = +ve

**Q 4. In a reaction  $A + B \rightarrow \text{Product}$ , rate is doubled when the concentration of B is doubled and rate increased by a factor of 8 when the concentration of both the reactants (A and B) are doubled, rate law for the reaction can be written as:**

- Option A      Rate =  $k [A] [B]$   
 Option B      Rate =  $[A]^2 [B]$   
 Option C      Rate =  $k [A] [B]^2$   
 Option D      Rate =  $k [A]^2 [B]^2$

**Correct Option B**

**Solution:**

$$\text{Let } r = k[A]^m [B]^n \dots\dots\dots(1)$$

$$r_1 = k[A]^m [2B]^n \dots\dots\dots(2)$$

$$r_2 = k[2A]^m [2B]^n \dots\dots\dots(3)$$

$$\frac{r_1}{r_2} = 2 \text{ and } \frac{r_2}{r} = 8 \text{ (given) } \dots\dots\dots(4)$$

From equation(1),(2),(3) and (4)

$$r = k[A]^2 [B]^1$$

$$\therefore \text{rate law } \Rightarrow \text{rate} = K [A]^2 [B]$$

**Q 5. Limiting molar conductivity of  $\text{NH}_4\text{OH}$  (i.e.  $\Lambda^\circ(\text{NH}_4\text{OH})$ ) is equal to :**

Option A       $\Lambda_m^\circ(\text{NH}_4\text{OH}) + \Lambda_m^\circ(\text{NH}_4\text{Cl}) - \Lambda_m^\circ(\text{HCl})$

Option B       $\Lambda_m^\circ(\text{NH}_4\text{Cl}) + \Lambda_m^\circ(\text{NaOH}) - \Lambda_m^\circ(\text{NaCl})$

Option C       $\Lambda_m^\circ(\text{NH}_4\text{Cl}) + \Lambda_m^\circ(\text{NaCl}) - \Lambda_m^\circ(\text{NaOH})$

Option D       $\Lambda_m^\circ(\text{NaOH}) + \Lambda_m^\circ(\text{NaCl}) - \Lambda_m^\circ(\text{NH}_4\text{Cl})$

**Correct Option B**

**Solution:**

According to Kohlrausch's Law

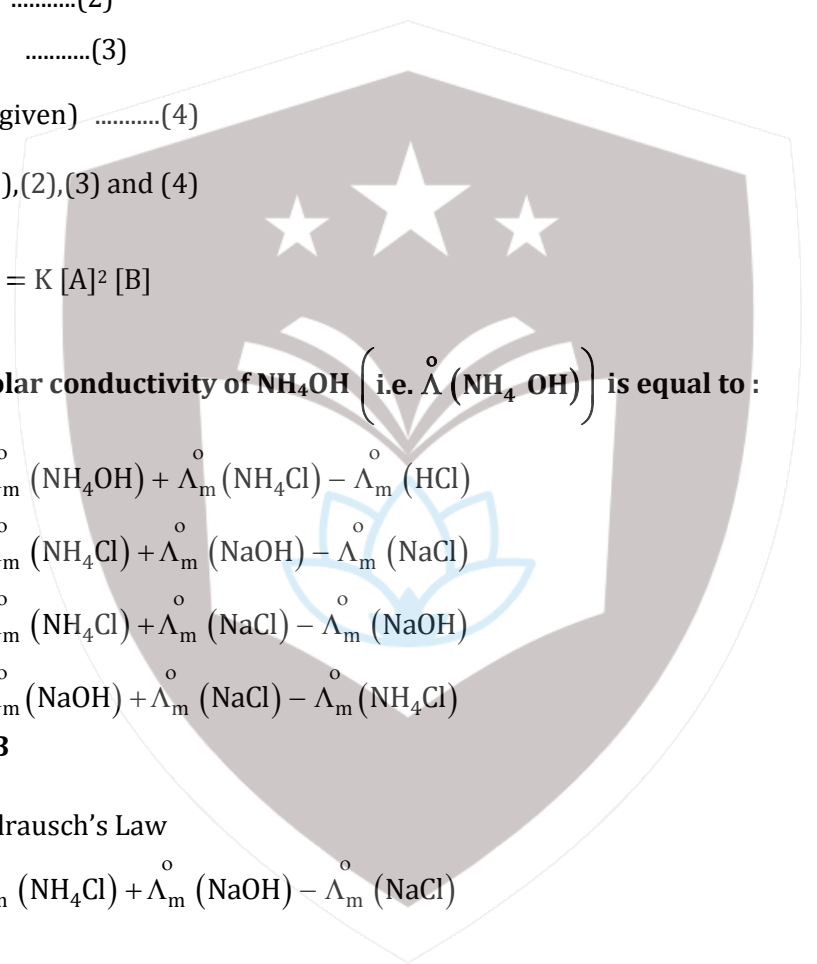
$$\Lambda_m^\circ(\text{NH}_4\text{OH}) = \Lambda_m^\circ(\text{NH}_4\text{Cl}) + \Lambda_m^\circ(\text{NaOH}) - \Lambda_m^\circ(\text{NaCl})$$

**Q 6. Which of the following species contains three bond pairs and one lone pair around the central atom?**

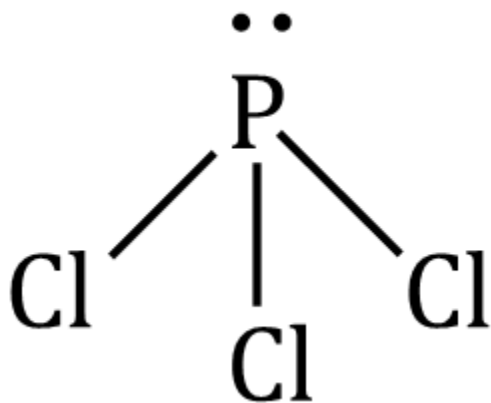
- Option A       $\text{NH}_4^-$   
 Option B       $\text{PCl}_3$   
 Option C       $\text{H}_2\text{O}$   
 Option D       $\text{BF}_3$

**Correct Option B**

**Solution:**  $\text{PCl}_3$  has 3 bond pairs and one lone pair around the central atom in its pyramidal shape.







**Q 7. Buffer solutions have constant acidity and alkalinity because:**

- Option A they have large excess of  $H^+$  or  $OH^-$  ions
- Option B they have fixed value of pH
- Option C these give unionized acid or base on reaction with added acid or alkali
- Option D acids and alkalies in these solutions are shielded from attack by other ions

**Correct Option C**

**Solution:** Buffer solutions have constant acidity and alkalinity because they react with added acid or base to maintain constant pH.

**Q 8. In Freundlich Adsorption isotherm, the value of  $1/n$  is:**

- Option A 1 in case of physical adsorption
- Option B 1 in case of chemisorption
- Option C between 0 and 1 in all cases
- Option D between 2 and 4 in all cases

**Correct Option C**

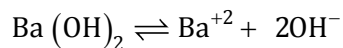
**Solution:** Value of  $\frac{1}{n}$  is in between 0 to 1 in all adsorptions.

**Q 9. pH of a saturated solution of  $Ba(OH)_2$  is 12. The value of solubility product ( $K_{sp}$ ) of  $Ba(OH)_2$  is:**

- Option A  $4.0 \times 10^{-6}$
- Option B  $5.0 \times 10^{-6}$
- Option C  $3.3 \times 10^{-7}$
- Option D  $5.0 \times 10^{-7}$

**Correct Option D**

**Solution:**



$$p^{\text{H}} = 12 \Rightarrow p^{\text{OH}} = 14 - 12 = 2$$

$$[\text{OH}^-] = 10^{-2} \text{ M} = 2S$$

$$\therefore S = \frac{10^{-2} \text{ M}}{2}$$

Now for  $\text{Ba}(\text{OH})_2$   $K_{\text{sp}} = 4S^3$

$$= 4 \left( \frac{10^{-2}}{2} \right)^3 = 5 \times 10^{-7}$$

**Q 10. When  $\text{Cl}_2$  gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chloride changes from:**

Option A zero to -1 and zero to +3

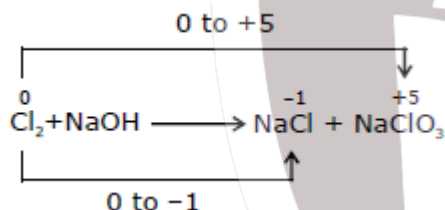
Option B zero to +1 and zero to -3

Option C zero to +1 and zero to -5

Option D zero to -1 and zero to +5

**Correct Option D**

**Solution:**



**Q 11. Which one of the following statements is incorrect about enzyme catalysis?**

Option A Enzymes are denatured by ultraviolet rays and at high temperature

Option B Enzymes are least reactive at optimum temperature

Option C Enzymes are mostly proteinous in nature

Option D Enzyme action is specific

**Correct Option B**

**Solution:** Enzymes are most reactive at optimum temperature and are mostly inactive outside that range.

**Q 12.  $P_A$  and  $P_B$  are the vapour pressure of pure liquid components, A and B, respectively of an ideal binary solution. If  $X_A$  represents the mole fraction of components A, the total pressure of the solution will be:**

Option A  $P_B + X_A (P_B - P_A)$

Option B  $P_B + X_A (P_A - P_B)$

Option C  $P_A + X_B (P_B - P_A)$

Option D  $P_A + X_A (P_B - P_A)$

**Correct Option B**

**Solution:**

$$\begin{aligned} P_T &= P_A X_A + P_B X_B \\ &= P_A X_A + P_B (1 - X_A) \end{aligned}$$

$$= P_A X_A + P_B - P_B X_A$$

$$P_T = P_B + X_A (P_A - P_B)$$

**Q 13. The protecting power of lyophilic colloidal sol is expressed in terms of:**

- Option A Critical micelle concentration
- Option B Oxidation number
- Option C Coagulation value
- Option D Gold number

**Correct Option D**

**Solution:** Lyophobic sols are unstable so they are re-stabilised by adding some lyophilic colloids which protect them from precipitation. Thus, lyophilic colloids are called protecting colloids. The protecting power of lyophilic colloidal sol is expressed in terms of Gold Number.

**Q 14. Maximum number of electrons in a subshell with  $\ell = 3$  and  $n=4$  is:**

- Option A 10
- Option B 12
- Option C 14
- Option D 16

**Correct Option C**

**Solution:**  $n = 4, \ell = 3$  corresponds to f subshell and f maximum electrons in f subshell =14.

**Q 15. 50mL of each gas A of gas B takes 150 and 200 seconds respectively for effusing through a pin hole under the similar condition If molecular mass of gas B is 36, the molecular mass of gas A will be**

- Option A 32
- Option B 20.25
- Option C 96
- Option D 128

**Correct Option B**

**Solution:**

According to Graham's diffusion law

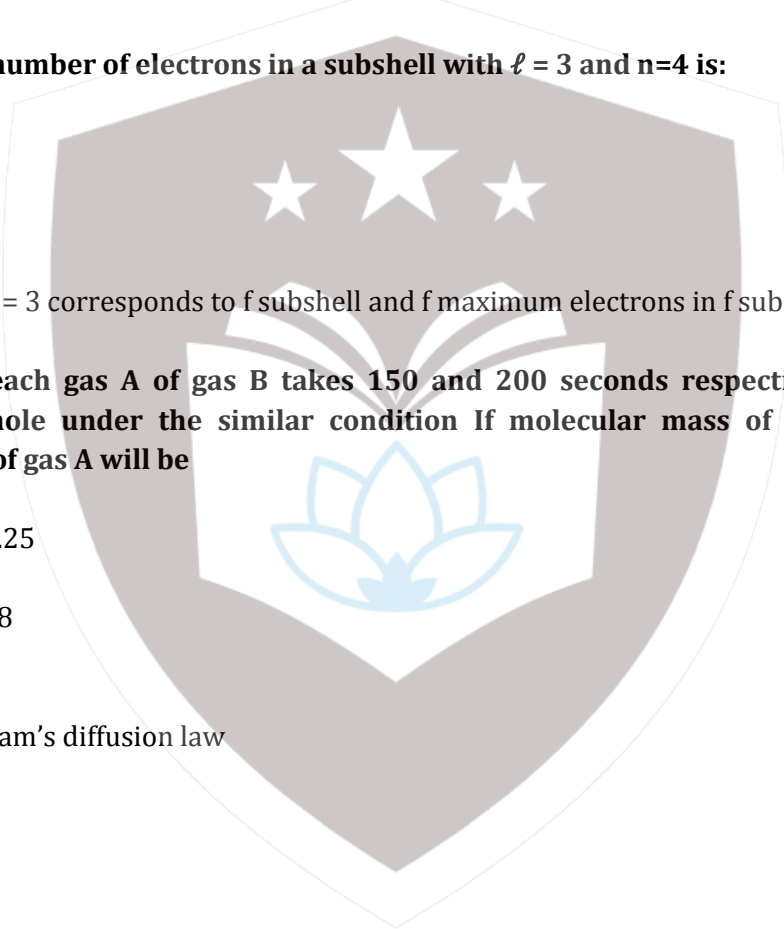
$$\frac{r_B}{r_A} = \sqrt{\frac{M_A}{M_B}}$$

$$\frac{50}{200} = \sqrt{\frac{M_A}{36}}$$

$$\frac{1}{4} = \sqrt{\frac{M_A}{36}}$$

$$\frac{1}{4} = \frac{\sqrt{M_A}}{6}$$

$$M_A = 20.25$$

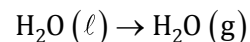


**Q 16. Standard enthalpy of vapourisation  $\Delta_{\text{vap}}H^\ominus$  for water at  $100^\circ\text{C}$  is  $40.66\text{ kJ mol}^{-1}$ . The internal energy of vaporization of water at  $100^\circ\text{C}$  (in  $\text{kJ mol}^{-1}$ ) is**

- Option A -43.76
- Option B +40.66
- Option C +37.56
- Option D -43.76

**Correct Option C**

**Solution:**



$$\Delta H = \Delta E + \Delta n_g RT$$

$$40.66 = \Delta E + \frac{1 \times 8.314}{1000} \times 373$$

$$\Delta E = 37.56\text{ kJ mol}^{-1}$$

**Q 17. The number of octahedral void (s) per atom present in a cubic-close-packed structure is:**

- Option A 2
- Option B 4
- Option C 1
- Option D 3

**Correct Option C**

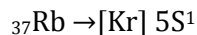
**Solution:** In cubic closed packed structure each atom forms one octahedral void so number of octahedral voids is equal to number of atoms.

**Q 18. The correct set of four quantum numbers for the valence electron of rubidium atom ( $Z = 37$ ) is:-**

- Option A 5, 0, 0,  $+1/2$
- Option B 5, 1, 0,  $+1/2$
- Option C 5, 1, 1,  $+1/2$
- Option D 6, 0, 0,  $+1/2$

**Correct Option A**

**Solution:**



$$n = 5, \ell = 0, m = 0, S = +\frac{1}{2}$$

**Q 19. A metal crystallizes with a face-centered cubic lattice. The edge of the unit cell is 408pm. The diameter of the metal atom is:**

- Option A 144 pm
- Option B 204 pm
- Option C 288 pm
- Option D 408 pm

**Correct Option C**

**Solution:**

$$\begin{aligned}\text{Diameter } (2r) &= \frac{a}{\sqrt{2}} = \frac{408}{1.414} \\ &= 288 \text{ pm}\end{aligned}$$

**Q 20. The enthalpy of fusion of water is 1.435 kcal/mol. The molar entropy change for the melting of ice at 0° C is:**

- Option A      5.260 cal/(mol K)  
Option B      0.526 cal/(mol K)  
Option C      10.52 cal/(mol K)  
Option D      21.04 cal/(mol K)

**Correct Option A**

**Solution:**

$$\begin{aligned}\Delta S &= \frac{\Delta H}{T} \\ &= \frac{1.435 \times 1000}{273} \text{ cal mol}^{-1} \text{ K}^{-1} \\ \Delta S &= 5.260 \text{ cal mol}^{-1} \text{ K}^{-1}\end{aligned}$$

**Q 21. In which of the following compounds, nitrogen exhibits highest oxidation state?**

- Option A      N<sub>3</sub>H  
Option B      NH<sub>2</sub>OH  
Option C      N<sub>2</sub>H<sub>4</sub>  
Option D      NH<sub>3</sub>

**Correct Option A**

**Solution:**

- (1) N<sub>3</sub>H → O.N. of N =  $-\frac{1}{3}$   
(2) NH<sub>2</sub>OH → O.N. of N = -1  
(3) N<sub>2</sub>H<sub>4</sub> → O.N. of N = -2  
(4) NH<sub>3</sub> → O.N. of N = -3

**Q 22. Aluminium is extracted from alumina (Al<sub>2</sub>O<sub>3</sub>) by electrolysis of a molten mixture of:**

- Option A      Al<sub>2</sub>O<sub>3</sub> + Na<sub>3</sub>AlF<sub>6</sub> + CaF<sub>2</sub>  
Option B      Al<sub>2</sub>O<sub>3</sub> + KF + Na<sub>3</sub>AlF<sub>6</sub>  
Option C      Al<sub>2</sub>O<sub>3</sub> + HF + NaAlF<sub>4</sub>  
Option D      Al<sub>2</sub>O<sub>3</sub> + CaF<sub>2</sub> + NaAlF<sub>4</sub>

**Correct Option A**

**Solution:**

Na<sub>3</sub>AlF<sub>6</sub> to increase conductivity  
CaF<sub>2</sub> to decrease m.p. ] are added

**Q 23. Which of the statements is not true?**

- Option A  $K_2Cr_2O_7$  solution in acidic medium is orange  
 Option B  $K_2Cr_2O_7$  solution becomes yellow on increasing the pH beyond 7  
 Option C On passing  $H_2S$  through acidified  $K_2Cr_2O_7$  solution, a milky colour is observed  
 Option D  $Na_2Cr_2O_7$  is preferred over  $K_2Cr_2O_7$  in volumetric analysis

**Correct Option D**

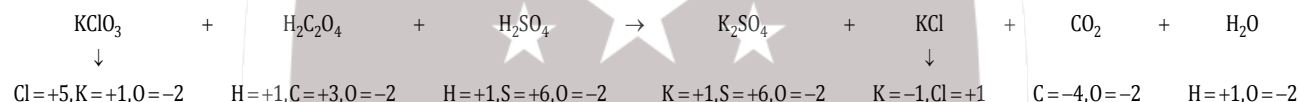
**Solution:** Because  $Na_2Cr_2O_7$  is hygroscopic hence it is given less priority as compared to  $K_2Cr_2O_7$ .

**Q 24. A mixture of potassium chlorate, oxalic acid and sulphuric acid is heated. During the reaction which element undergoes maximum change in the oxidation number?**

- Option A Cl  
 Option B C  
 Option C S  
 Option D H

**Correct Option A**

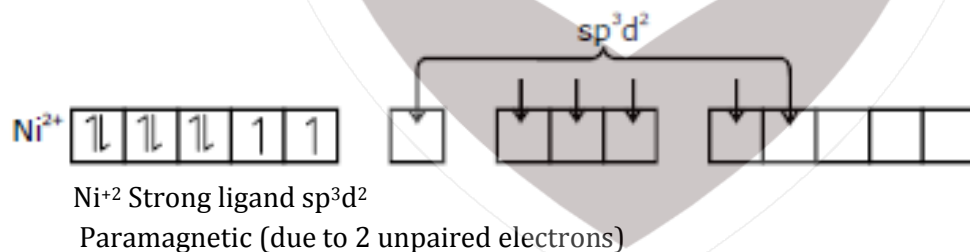
**Solution:**

**Q 25. Which one of the following is an outer orbitals complex and exhibits paramagnetic behavior?**

- Option A  $[Cr(NH_3)_6]^{3+}$   
 Option B  $[Co(NH_3)_6]^{3+}$   
 Option C  $[Ni(NH_3)_6]^{2+}$   
 Option D  $[Zn(NH_3)_6]^{2+}$

**Correct Option C**

**Solution:**  $[Ni(NH_3)_6]^{2+}$

**Q 26. The ease of adsorption of the hydrated alkali metal ions on an ion-exchange resins follows the order:**

- Option A  $K^+ < Na^+ < Rb^+ < Li^+$   
 Option B  $Na^+ < Li^+ < K^+ < Rb^+$   
 Option C  $Li^+ < K^+ < Na^+ < Rb^+$   
 Option D  $Rb^+ < K^+ < Na^+ < Li^+$

**Correct Option D**

**Solution:** Both physical and chemical adsorption depends on surface area (surface area  $\propto$  rate of Adsorption)

$Li^+_{(aq)}$  has maximum surface area.

So order will be-  $Rb^+ < K^+ < Na^+ < Li^+$

**Q 27. Equimolar solutions of the following substances were prepared separately. Which one of these will record the highest pH value?**

- Option A      LiCl  
Option B      BeCl<sub>2</sub>  
Option C      BaCl<sub>2</sub>  
Option D      AlCl<sub>3</sub>

**Correct Option C**

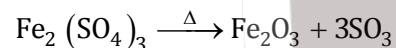
**Solution:** BaCl<sub>2</sub> is made up of a strong acid HCl and strong base Ba(OH)<sub>2</sub>. So its aqueous solution is neutral. All other salts are made up of strong acid and weak base so their pH is less than 7.

**Q 28. Sulphur trioxide can be obtained by which of the following reaction:**

- Option A       $S + H_2 SO_4 \xrightarrow{\Delta}$   
Option B       $H_2SO_4 + PCl_5 \xrightarrow{\Delta}$   
Option C       $CaSO_4 + C \xrightarrow{\Delta}$   
Option D       $Fe_2 (SO_4)_3 \xrightarrow{\Delta}$

**Correct Option D**

**Solution:**



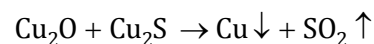
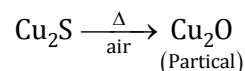
SO<sub>3</sub> is obtained by heating Fe<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>.

**Q 29. In the extraction of copper from its sulphide ore, the metal is finally obtained by the reduction of cuprous oxide with:**

- Option A      Iron sulphide (FeS)  
Option B      Carbon monoxide (CO)  
Option C      Copper (I) sulphide (Cu<sub>2</sub>S)  
Option D      Sulphur dioxide (SO<sub>2</sub>)

**Correct Option C**

**Solution:**



**Q 30. Identify the wrong statement in the following:**

- Option A      Atomic radius of the elements increase as one moves down the first group of the periodic table  
Option B      Atomic radius of the elements decrease as one moves across from left to right in the 2<sup>nd</sup> period of the periodic table  
Option C      Amongst isoelectronic species, smaller the positive charge on the cation, smaller is the ionic radius  
Option D      Amongst isoelectronic species, greater the negative charge on the anion, larger is the ionic radius

**Correct Option C**

**Solution:**

$$+ve \text{ charge} \propto \frac{1}{\text{Ionic radius}}$$

So smaller the positive charge on cation, larger is the ionic radius.

**Q 31. Which of the following statements is not valid for oxoacids phosphorus?**

- Option A All oxoacids contain tetrahedral four coordinated phosphorus  
Option B All oxoacids contain atleast one P = O unit and one P – OH group  
Option C Orthophosphoric acid is used in the manufacture of triple superphosphate  
Option D Hypophosphorous acid is a diprotic acid

**Correct Option D**

**Solution:** Hypophosphorous acid  $\text{H}_3\text{PO}_2$  is a monoprotic acid. It has one –OH group attached to it.

**Q 32. Identify the alloy containing a non-metal as a constituent in it.**

- Option A Bell metal  
Option B Bronze  
Option C Invar  
Option D Steel

**Correct Option D**

**Solution:** Steel- Fe + C (Non metal) + other metals

**Q 33. The pair of species with the same bond order is:**

- Option A NO, CO  
Option B  $\text{N}_2$ ,  $\text{O}_2$   
Option C  $\text{O}_2^{2-}$ ,  $\text{B}_2$   
Option D  $\text{O}_2^+$ ,  $\text{NO}^+$

**Correct Option C**

**Solution:**

According to Molecular Orbital Theory-

$$\text{O}_2^{2-} \text{ B.O.} = 1.0$$

$$\text{B}_2 \text{ B.O.} = 1.0$$

**Q 34. Bond order of 1.5 is shown by:**

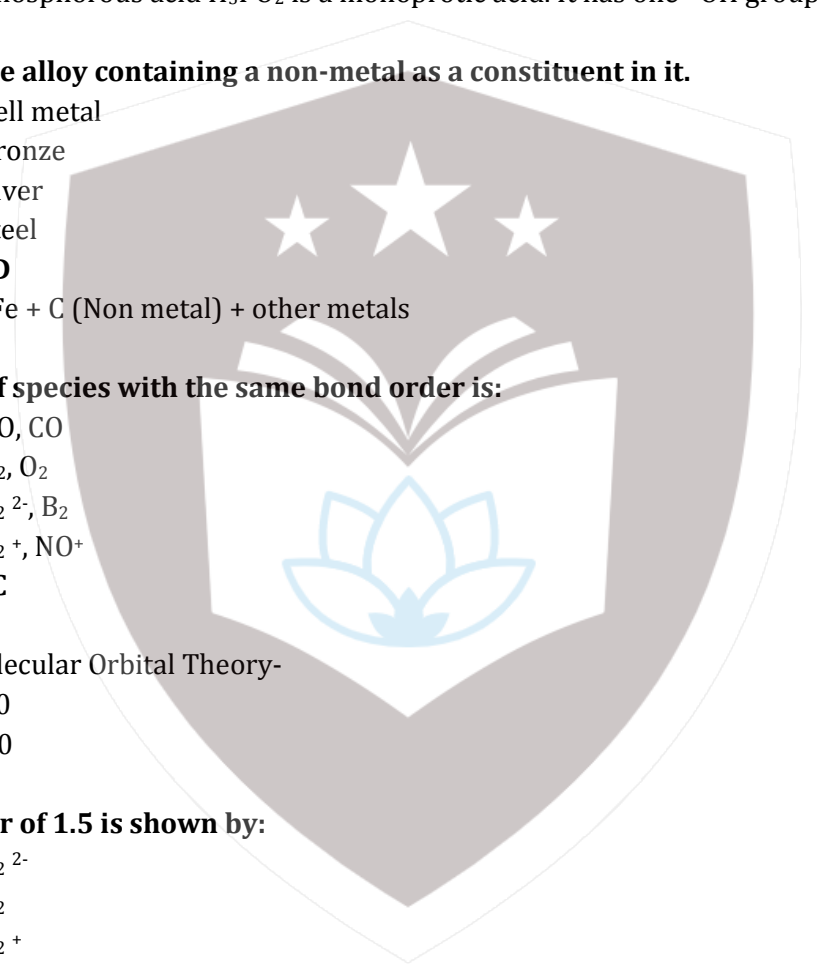
- Option A  $\text{O}_2^{2-}$   
Option B  $\text{O}_2$   
Option C  $\text{O}_2^+$   
Option D  $\text{O}_2^-$

**Correct Option D**

**Solution:**

According to MOT

$$\text{O}_2^{-1} \text{ B.O.} = 1.5$$





**Q 35. Which one of the following is a mineral of iron?**

- Option A Pyrolusite
- Option B Magnetite
- Option C malachite
- Option D Cassiterite

**Correct Option B**

**Solution:** Magnetite-  $\text{Fe}_3\text{O}_4$  is a mineral of iron.

**Q 36. Which one of the alkali metals, forms only the normal oxide,  $\text{M}_2\text{O}$  heating in air?**

- Option A Li
- Option B Na
- Option C Rb
- Option D K

**Correct Option A**

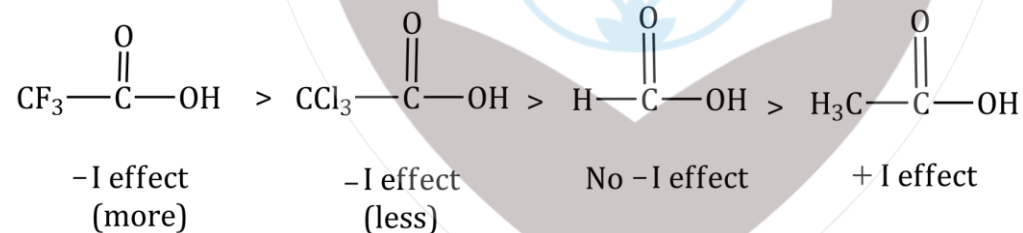
**Solution:** On strong heating only Li gives normal oxide while other alkali metals gives peroxide or super oxide.

**Q 37. The correct order of decreasing acid strength of trichloacetic acid (A), trifluoroacetic acid (B), Acetic acid (C) and formic acid (D) is:**

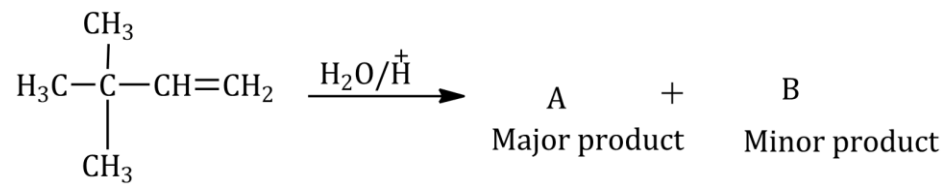
- Option A  $\text{A} > \text{B} > \text{C} > \text{D}$
- Option B  $\text{A} > \text{C} > \text{B} > \text{D}$
- Option C  $\text{B} > \text{A} > \text{D} > \text{C}$
- Option D  $\text{B} > \text{D} > \text{C} > \text{A}$

**Correct Option C**

**Solution:**

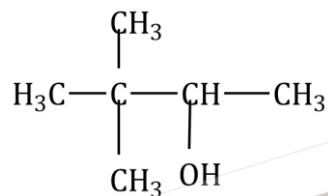


**Q 38. In the following reactions:**

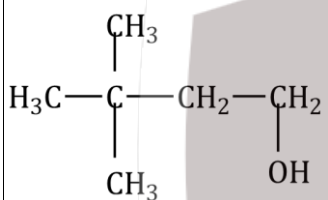


**The major products is :-**

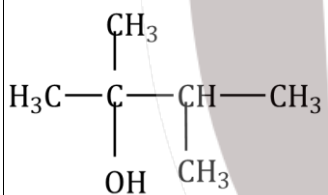
Option A



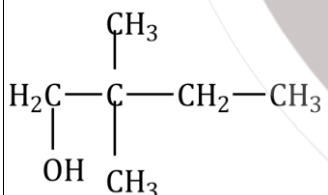
Option B



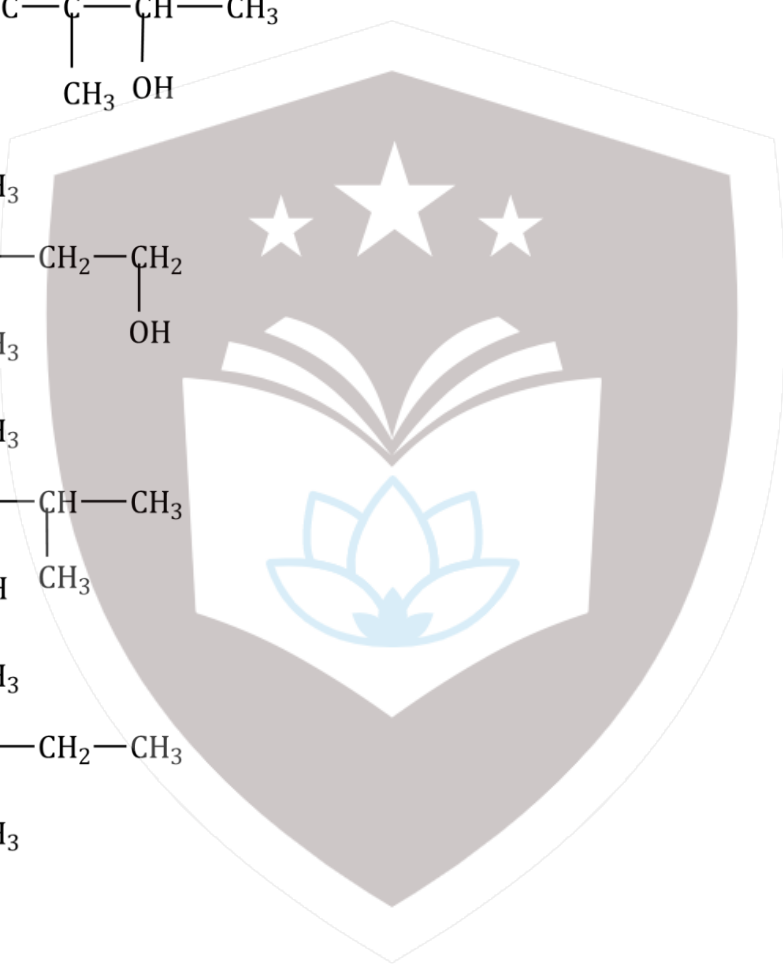
Option C



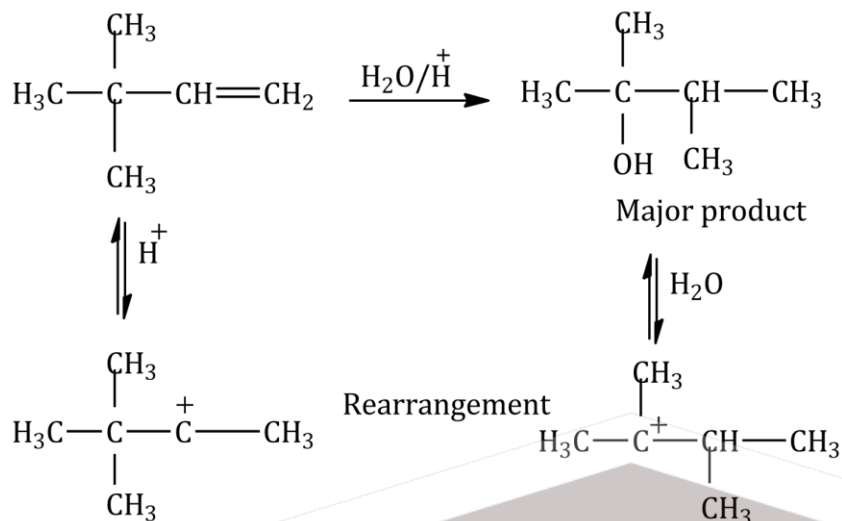
Option D



**Correct Option C**

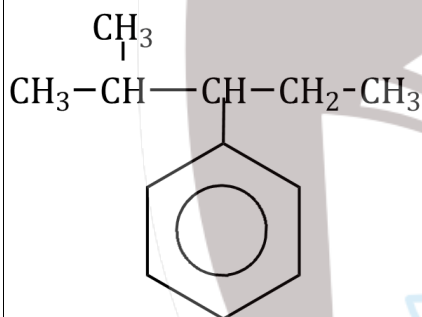


**Solution:**



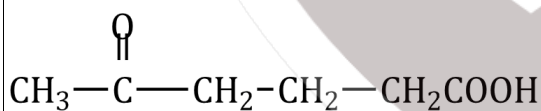
**Q 39. Which nomenclature is not according to IUPAC system?**

Option A



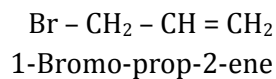
2-methyl-3-phenylpentan

Option B

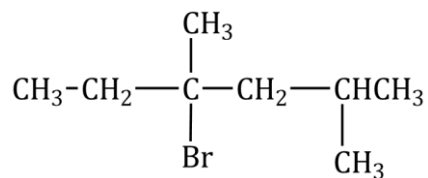


5-Oxohexanoic acid

Option C



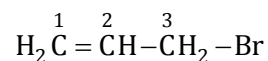
Option D



4-bromo-2,4-dimethylhexane

**Correct Option C**

**Solution:**



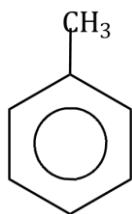
Correct IUPAC name is 3-Bromoprop-1-ene since double bond is given priority over a substituent (-Br)

**Q 40. Among the following compounds the one that is most reactive towards electrophilic nitration is:**

- Option A Toluene
- Option B Benzene
- Option C Benzoic Acid
- Option D Nitrobenzene

**Correct Option A**

**Solution:**



Toluene

Electron releasing effect (+H -effect) of -CH<sub>3</sub> group increase reactivity of benzene ring for electrophilic substitution reaction.

**Q 41. Deficiency of vitamin B<sub>1</sub> causes the disease**

- Option A Cheiosis
- Option B Sterility
- Option C Convulsion
- Option D Beri-Beri

**Correct Option D**

**Solution:** Beri-Beri disease is caused by deficiency of vitamin B<sub>1</sub>.

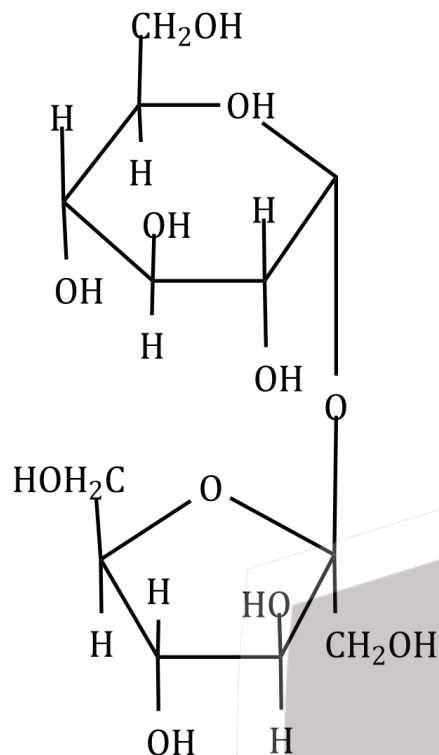
**Q 42. Which one of the following sets of monoseccharides forms sucrose?**

- Option A  $\beta$ - D- Glucopyranose and  $\alpha$ - D- Fructofuranose
- Option B  $\alpha$ - D- Glucopyranose and  $\beta$ - D- Fructofuranose
- Option C  $\alpha$ - D- Galactopyranose and  $\alpha$ - D- glucopyranose
- Option D  $\alpha$ - D- fructofuranose

**Correct Option D**

**Solution:**

Sucrose is a disaccharide of  $\alpha$ -D-Glycopyranase and  $\beta$ -D-frictofuranase



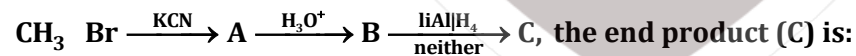
**Q 43. Which one of the following statements regarding photochemical smog is not correct?**

- Option A Photochemical smog is formed through photochemical reaction involving solar energy
- Option B Photochemical smog does not cause irritation in eyes and throat.
- Option C Carbon monoxide does not play any role on photochemical smog formation
- Option D Photochemical smog is an oxidising agent in character

**Correct Option B**

**Solution:** Photochemical smog cause irritation in eyes and throat, headache, chest pain, cough, difficulty in breathing.

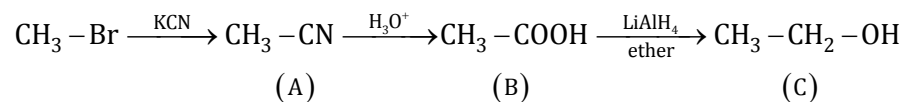
**Q 44. In the following sequence of reactions**



- Option A Acetaldehyde
- Option B Ethyl alcohol
- Option C Acetone
- Option D Methane

**Correct Option B**

**Solution:**



(C) is  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$  (Ethyl alcohol)

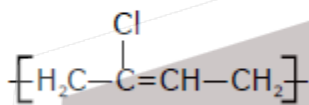
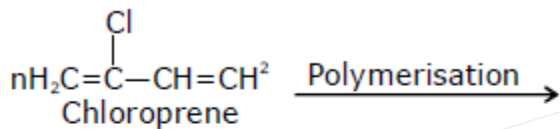
**Q 45. Which one of the following is not a condensation polymer?**

- Option A Dacron
- Option B Neoprene
- Option C Melamine
- Option D Glyptal

**Correct Option B**

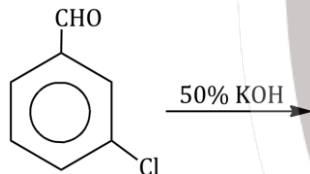
**Solution:**

Neoprene is an example of addition polymer.

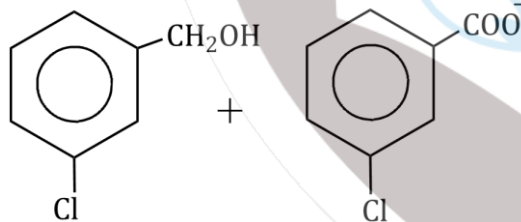


Neoprene  
(a synthetic rubber)

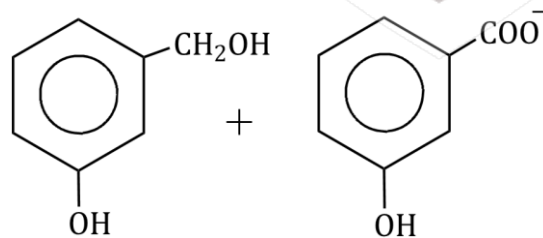
**Q 46. Predict the products in the given reaction:**



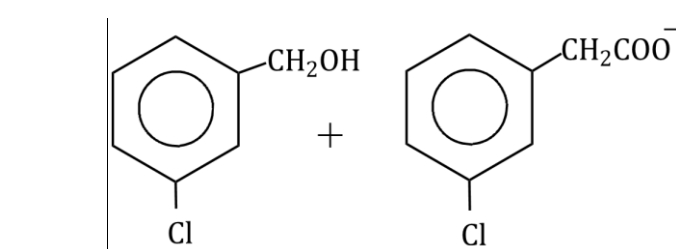
Option A



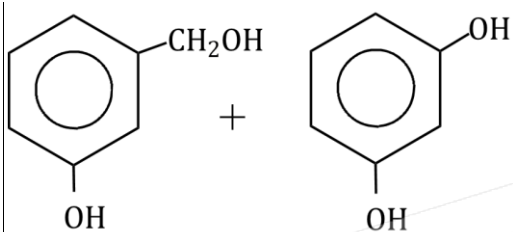
Option B



Option C

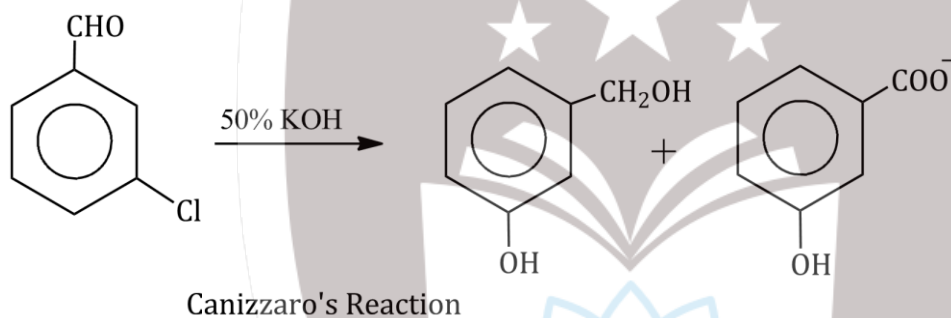


Option D



**Correct Option A**

**Solution:**

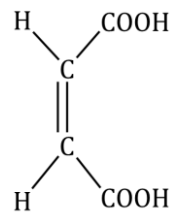


**Q 47. Which of the following acids does not exhibit optical isomerism?**

- Option A Lactic acid
- Option B Tartaric acid
- Option C Maleic acid
- Option D  $\alpha$ - amino acids

**Correct Option C**

**Solution:**



Maleic acid

**Q 48.  $\text{CH}_3\text{CHO}$  and  $\text{C}_6\text{H}_5\text{CHO}$  can be distinguished chemically by:**

- Option A Tollen's reagent test
- Option B Fehling solution test
- Option C Benedict test
- Option D Iodoform test

**Correct Option D**

**Solution:** By iodoform test-

$\text{CH}_3\text{CHO}$  gives positive iodoform test while

$\text{C}_6\text{H}_5\text{CHO}$  does not give positive iodoform test,

**Q 49. Which of the following statements is false?**

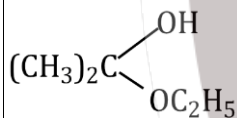
- Option A The repeat unit in natural rubber is isoprene
- Option B Both starch and cellulose are polymers of glucose
- Option C Artificial silk is derived from cellulose
- Option D Nylon-66 is an example of elastomer

**Correct Option D**

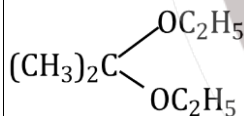
**Solution:** Nylon-66 an example of fibre.

**Q 50. Acetone is treated with excess of ethanol in the presence of hydrochloric acid. The product obtained is:**

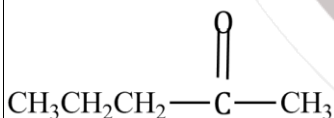
Option A



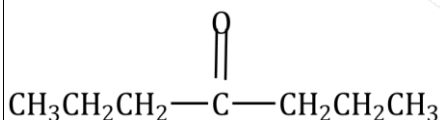
Option B



Option C

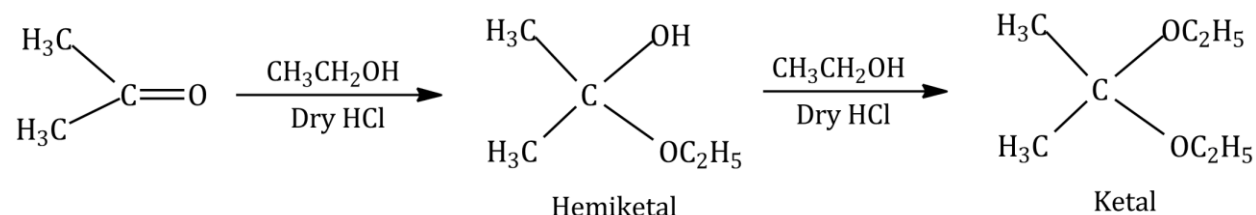


Option D



**Correct Option B**

**Solution:**



In excess of  $\text{C}_2\text{H}_5\text{OH}$  final product will be ketal.



# BIOLOGY

**Q 1. *Cycas* and *Adiantum* resemble each other in having:**

- Option A Cambium
- Option B Vessels
- Option C Seeds
- Option D Motile sperms

**Correct option D**

**Solution:** All pteridophytes have bi-flagellated or multi-flagellated sperms. Hence, *Cycas* and *Adiantum* resemble each other in having motile sperms.

**Q 2. Gymnosperms are also called soft wood spermatophytes because they lack:**

- Option A Thick-walled tracheids
- Option B Xylem fibres
- Option C Cambium
- Option D Phloem fibres

**Correct option B**

**Solution:** Gymnosperms lack xylem fibres, so they are called soft wood spermatophytes.

**Q 3. Maximum nutritional diversity is found in the group:**

- Option A Monera
- Option B Plantae
- Option C Fungi
- Option D Animalia

**Correct option A**

**Solution:** Some bacteria are autotrophic, either photosynthetic autotrophic or chemosynthetic autotrophic. A vast majority of bacteria are heterotrophs. Hence, the organisms of Kingdom Monera show maximum nutritional diversity.

**Q 4. Which one of the following is common to multicellular fungi, filamentous algae and protonema of mosses?**

- Option A Mode of nutrition
- Option B Multiplication by fragmentation
- Option C Diplontic life cycle
- Option D Members of Kingdom Plantae

**Correct option B**

**Solution:** Multicellular fungi, filamentous algae and secondary protonema all reproduce by fragmentation. Hence, it is a common feature among all three.

**Q 5. Which statements is wrong for viruses?**

- Option A They have the ability to synthesise nucleic acids and proteins.
- Option B Antibiotics have no effect on them.
- Option C All are parasites.
- Option D All of them have helical symmetry.

**Correct option D**

**Solution:** All viruses do not have helical symmetry. Rod shaped viruses have helical symmetry and spherical shaped viruses have icosahedral symmetry.

**Q 6. Which one of the following is a correct statement?**

- Option A Antheridiophores and archegoniophores are present in pteridophytes.
- Option B Origin of seed habit can be traced in pteridophytes.
- Option C Pteridophyte gametophyte has a peritoneal and leafy stage.
- Option D In gymnosperms female gametophyte is free living.

**Correct option B**

**Solution:** In pteridophytes, the development of zygotes into young embryos takes place within the female gametophytes. This event is a precursor to the seed habit which is considered as an important step in evolution.

**Q 7. Nuclear membrane is absent in:**

- Option A *Volvox*
- Option B *Penicillium*
- Option C *Nostoc*
- Option D *Agaricus*

**Correct option C**

**Solution:** *Nostoc* is a prokaryotic eubacteria which lacks membrane bound cell organelles and a well-developed nucleus and nuclear membrane that surrounds the nucleus.

**Q 8. During gamete formation, the enzyme recombinase participates during:**

- Option A Prophase-I
- Option B Prophase-II
- Option C Metaphase-I
- Option D Anaphase-II

**Correct option A**

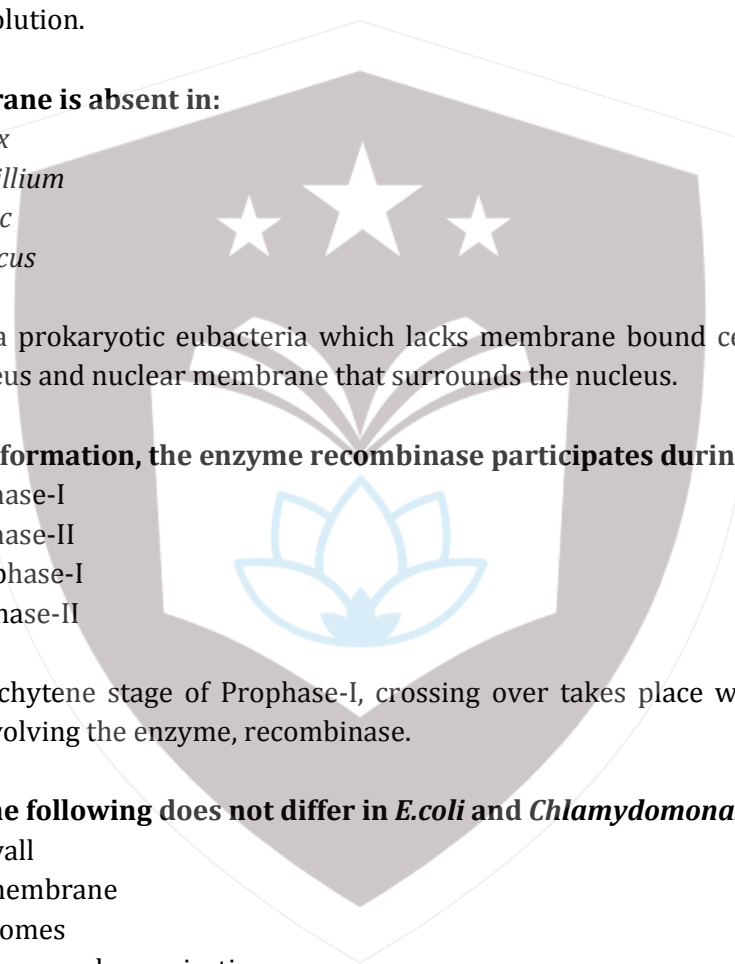
**Solution:** During pachytene stage of Prophase-I, crossing over takes place which is an enzyme-mediated process involving the enzyme, recombinase.

**Q 9. Which one of the following does not differ in *E.coli* and *Chlamydomonas*?**

- Option A Cell wall
- Option B Cell membrane
- Option C Ribosomes
- Option D Chromosomal organisation

**Correct option B**

**Solution:** Cell membrane of prokaryotes is similar in structure to eukaryotes. Hence, the cell membrane of *E.coli* and *Chlamydomonas* does not differ.



**Q 10. PCR and Restriction Fragment Length Polymorphism are the methods for:-**

- Option A DNA sequencing
- Option B Genetic fingerprinting
- Option C Study of enzymes
- Option D Genetic transformation

**Correct option B**

**Solution:** In DNA/genetic fingerprinting, the DNA is amplified by making several copies of it using PCR (Polymerase Chain Reaction). DNA molecules are cleaved at specific sites with the help of restriction endonucleases for the purpose of restriction fragment length analysis.

**Q 11. Removal of RNA polymerase III from nucleoplasm will affect the synthesis of:**

- Option A m-RNA
- Option B r-RNA
- Option C t-RNA
- Option D hn-RNA

**Correct option C**

**Solution:** The enzyme RNA polymerase III is responsible for the transcription of t-RNA. Hence, its removal from the nucleoplasm will affect the synthesis of t-RNA.

**Q 12. Evolution of different species in a given area starting from a point and spreading to other geographical area is known as:**

- Option A Migration
- Option B Divergent evolution
- Option C Adaptive radiation
- Option D Natural selection

**Correct option C**

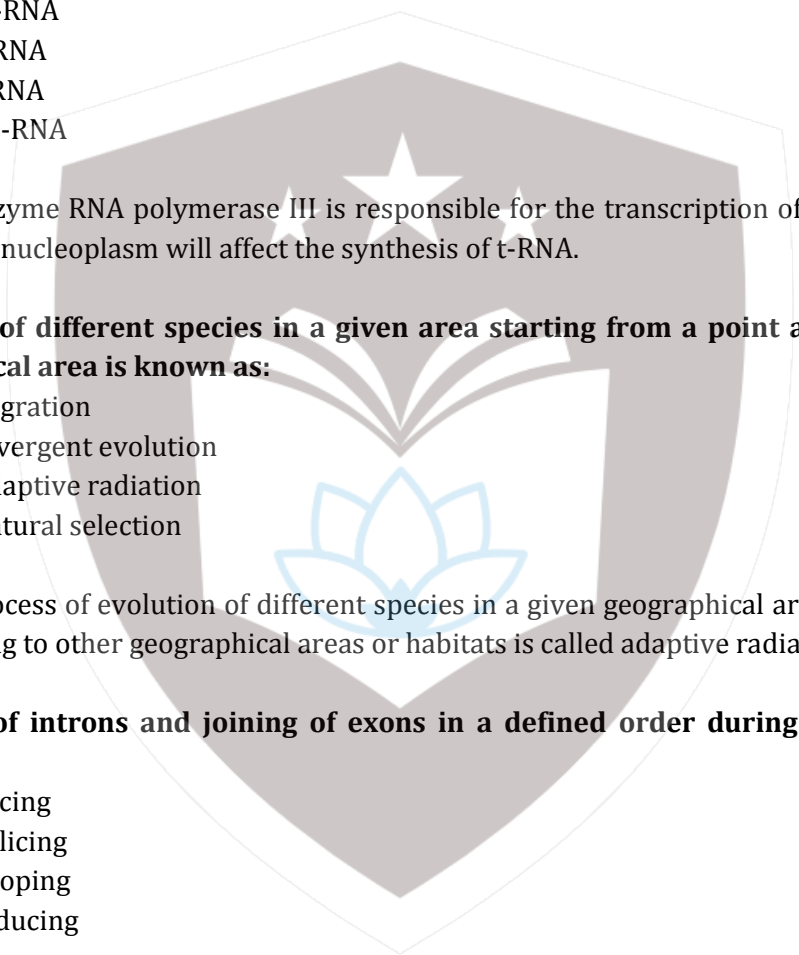
**Solution:** The process of evolution of different species in a given geographical area starting from a point and radiating to other geographical areas or habitats is called adaptive radiation.

**Q 13. Removal of introns and joining of exons in a defined order during transcription is called:**

- Option A Slicing
- Option B Splicing
- Option C Looping
- Option D Inducing

**Correct option B**

**Solution:** Splicing is the process in which the introns are removed and exons are joined in a defined order during transcription.



**Q 14. Which one of the following is not a part of the transcription unit in DNA?**

- Option A A promoter
- Option B The structural gene
- Option C The inducer
- Option D A terminator

**Correct option C**

**Solution:** A transcription unit in DNA is defined primarily by three regions in the DNA:

- i. A promoter
- ii. The structural gene
- iii. A terminator

The inducer is a part of lac operon.

**Q 15. An organic substance that can withstand environmental extreme and cannot be degraded by any enzymes is:**

- Option A Lignin
- Option B Cellulose
- Option C Cuticle
- Option D Sporopollenin

**Correct option D**

**Solution:** The exine of pollen grain is made up of sporopollenin which is one of the most resistant organic material known that can withstand high temperatures and strong acids and alkalis and no enzyme can degrade it.

**Q 16. Best defined function of manganese in green plants is:**

- Option A Nitrogen fixation
- Option B Water absorption
- Option C Photolysis of water
- Option D Calvin cycle

**Correct option C**

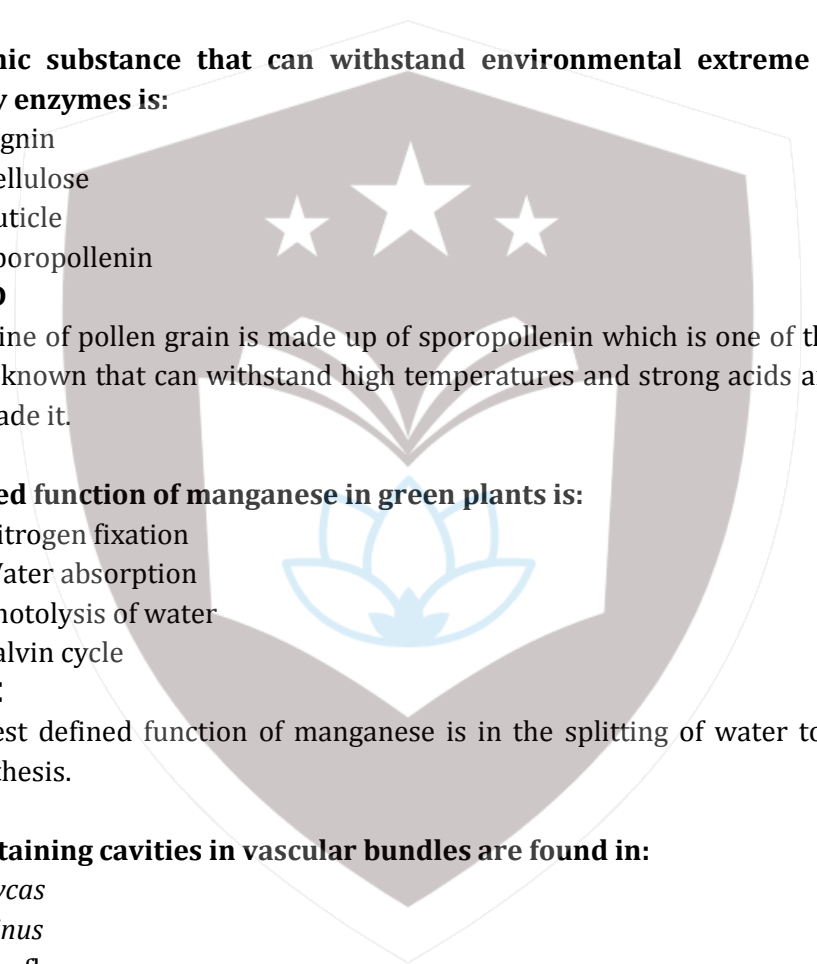
**Solution:** The best defined function of manganese is in the splitting of water to liberate oxygen during photosynthesis.

**Q 17. Water containing cavities in vascular bundles are found in:**

- Option A *Cycas*
- Option B *Pinus*
- Option C Sunflower
- Option D Maize

**Correct option D**

**Solution:** In monocotyledons like maize, there are water-containing cavities within the vascular bundles.



**Q 18. Closed vascular bundles lack:**

- Option A Cambium
- Option B Pith
- Option C Ground tissue
- Option D Conjunctive tissues

**Correct option A**

**Solution:** In monocotyledons, the vascular bundles have no cambium present in them. Since they do not form secondary tissues, they are referred to as closed vascular bundles.

**Q 19. Placentation in tomato and lemon is:**

- Option A Marginal
- Option B Axile
- Option C Parietal
- Option D Free central

**Correct option B**

**Solution:** When the placenta is axial and the ovules are attached to it in a multilocular ovary, the placentation is said to be axile. It occurs in tomato and lemon.

**Q 20. Companion cells are closely associated with**

- Option A Trichomes
- Option B Guard cells
- Option C Sieve elements
- Option D Vessel elements

**Correct option C**

**Solution:** Sieve tube elements are long, tube-like structures, arranged longitudinally and are associated with the companion cells.

**Q 21. Vexillary aestivation is a characteristic of the family:-**

- Option A Solanaceae
- Option B Brassicaceae
- Option C Fabaceae
- Option D Asteraceae

**Correct option C**

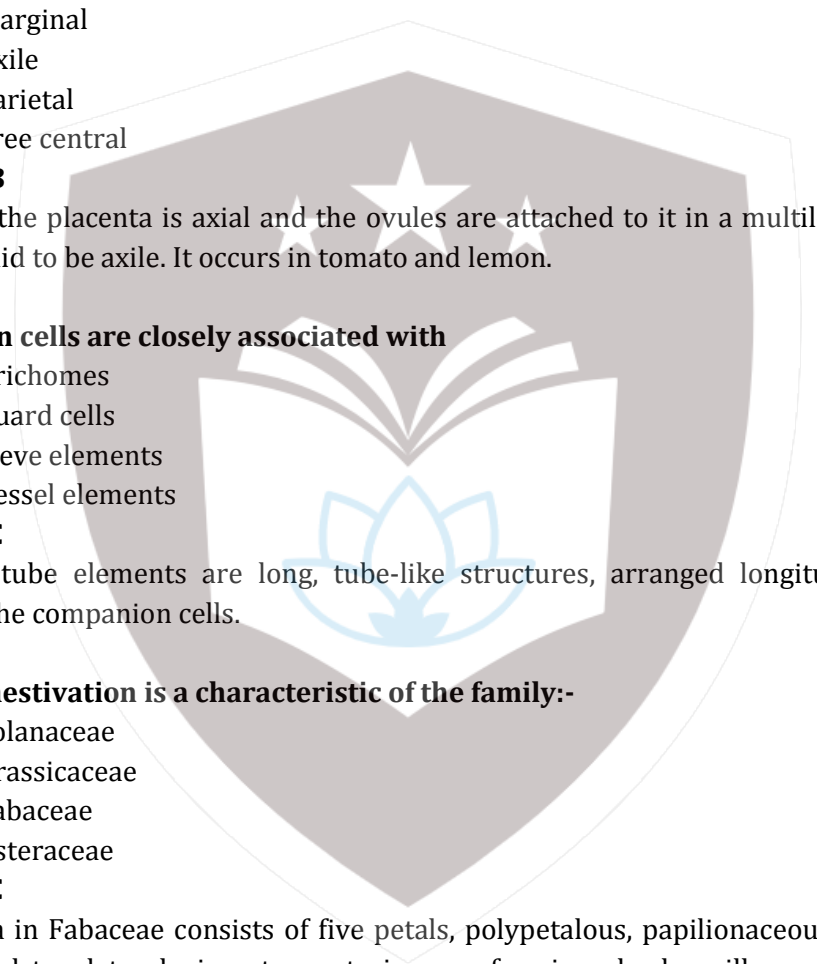
**Solution:** Corolla in Fabaceae consists of five petals, polypetalous, papilionaceous, consisting of a posterior standard, two lateral wings, two anterior ones forming a keel, vexillary aestivation.

**Q 22. Phyllode is present in:**

- Option A Australian *Acacia*
- Option B *Opuntia*
- Option C *Asparagus*
- Option D *Euphorbia*

**Correct option A**

**Solution:** Phyllode is a modification of leaf in which lamina is absent and the petiole becomes flattened and performs the function of food synthesis. It is present in Australian *Acacia*.



**Q 23. The common bottle cork is a product of:-**

- Option A Xylem
- Option B Vascular cambium
- Option C Dermatogen
- Option D Phellogen

**Correct option D**

**Solution:** Cork cambium or phellogen develops usually in the cortex region. Phellogen is a couple of layers thick. It is made of narrow, thin-walled and nearly rectangular cells. Phellogen cuts off cells on both sides. The outer cells differentiate into cork or phellem while the inner cells differentiate into secondary cortex or phelloderm.

**Q 24. Which one of the following is a wrong statement?**

- Option A Phosphorus is a constituent of cell membranes, certain nucleic acids and all proteins.
- Option B *Nitrosomonas* and *Nitrobacter* are chemoautotrophs.
- Option C *Anabaena* and *Nostoc* are capable of fixing nitrogen in free-living state also.
- Option D Root nodule forming nitrogen fixers live as aerobes under free-living conditions.

**Correct option A**

**Solution:** Phosphorus is a constituent of cell membranes, certain proteins, all nucleic acids and nucleotides, and is required for all phosphorylation reactions.

**Q 25. How many plants in the list given below have composite fruits that develop from an inflorescence?**

**Walnut, poppy, radish, fig, pineapple, apple, tomato, mulberry**

- Option A Two
- Option B Three
- Option C Four
- Option D Five

**Correct option B**

**Solution:** Fig, pineapple and mulberry develop from an inflorescence. Hence, out of the given list, three plants develop from an inflorescence.

**Q 26. Cymose inflorescence is present in:-**

- Option A *Trifolium*
- Option B *Brassica*
- Option C *Solanum*
- Option D *Sesbania*

**Correct option C**

**Solution:** In cymose type of inflorescence, the main axis terminates in a flower, hence is limited in growth. The flowers are borne in a basipetal order. It occurs in *Solanum*.

**Q 27. Which one of the following is correctly matched?**

- Option A Potassium - Readily immobilisation
- Option B Bakane of rice seedlings - F. Skoog
- Option C Passive transport of nutrients - ATP
- Option D Apoplast - Plasmodesmata

**Correct option A**

**Solution:** Active transport of nutrients requires ATP. Symplast includes translocation through plasmodesmata. Bakane disease of rice was found by Hori (1918) to be caused due to *Gibberella fujikuroi*. None of the options is correct. If the statement reads as 'potassium readily mobilisation' instead of 'potassium readily immobilisation'.

**Q 28. A process that marks important difference between C<sub>3</sub> and C<sub>4</sub> plants is:-**

- Option A Photosynthesis
- Option B Photorespiration
- Option C Transpiration
- Option D Glycolysis

**Correct option B**

**Solution:** C<sub>4</sub> plants lack a process called photorespiration whereas it occurs in C<sub>3</sub> plants which marks an important difference between C<sub>3</sub> and C<sub>4</sub> plants.

**Q 29. The correct sequence of cell organelles during photorespiration is:**

- Option A Chloroplast – Peroxisome – Mitochondria
- Option B Chloroplast – Vacuole – Peroxisome
- Option C Chloroplast – Golgi bodies – Mitochondria
- Option D Chloroplast – Rough endoplasmic reticulum – Dictyosomes

**Correct option A**

**Solution:** Chloroplast – Peroxisome – Mitochondria is the correct sequence for the cell organelles involved in photorespiration.

**Q 30. The coconut water and the edible part of coconut are equivalent to:-**

- Option A Mesocarp
- Option B Embryo
- Option C Endosperm
- Option D Endocarp

**Correct option C**

**Solution:** The edible part of coconut is white oily endosperm which contains a watery fluid called 'milk of coconut'.

**Q 31. The gynoecium consist of many free pistils in flowers of:-**

- Option A Papaver
- Option B *Michelia*
- Option C *Aloe*
- Option D Tomato

**Correct option B**

**Solution:** In *Michelia*, the gynoecium of the flower consists of many free pistils (multicarpellary).



**Q 32. Which one of the following is correctly matched?**

- Option A *Chlamydomonas* - Conidia
- Option B Yeast - Zoospores
- Option C Onion - Bulb
- Option D Ginger - Sucker

**Correct option C**

**Solution:** Onion is a bulb which is short, modified, underground stem surrounded by usually fleshy modified leaves that contain stored food for the shoot.

**Q 33. Both, autogamy and geitonogamy are prevented in:-**

- Option A Castor
- Option B Maize
- Option C Papaya
- Option D Cucumber

**Correct option C**

**Solution:** In several species such as papaya, male and female flowers are present on different plants. This condition prevents both autogamy and geitonogamy.

**Q 34. Even in absence of pollinating agents seed-setting is assured in:-**

- Option A *Salvia*
- Option B Fig
- Option C *Commellina*
- Option D *Zostera*

**Correct option C**

**Solution:** *Commellina* produces two types of flowers – chasmogamous flowers which are similar to flowers of other species with exposed anthers and stigma, and cleistogamous flowers which do not open at all. Cleistogamous flowers are autogamous as there is no chance of cross-pollen landing on the stigma. Hence, they produce assured seed-set even in the absence of pollinators.

**Q 35. Which one of the following areas in India, is a hot spot of biodiversity?**

- Option A Sunderbans
- Option B Western Ghats
- Option C Eastern Ghats
- Option D Gangetic plain

**Correct option B**

**Solution:** Three hotspots that cover our country's exceptionally high biodiversity regions are Western Ghats and Sri Lanka, Indo-Burma and Himalaya.

**Q 36. Which one of the following is not a functional unit of ecosystem:-**

- Option A Productivity
- Option B Stratification
- Option C Energy flow
- Option D Decomposition

**Correct option B**



**Solution:** Vertical distribution of different species occupying different levels is called stratification. The trophic level represents a functional unit of ecosystem and not a species. Hence, stratification is not a functional unit of ecosystem.

**Q 37. The upright pyramid of number is absent in:-**

- Option A Lake
- Option B Grassland
- Option C Pond
- Option D Forest

**Correct option D**

**Solution:** In lake, grassland and pond ecosystems, all the pyramids, of number, of energy and biomass are upright, i.e., producers are more in number and biomass than the herbivores, and herbivores are more in number and biomass than the carnivores. But in forest, the number of insects feeding on a big tree are more in number than the trees, the number of small birds depending on the insects are even more in number and so on. Hence, in forest ecosystem, the pyramid of number is inverted.

**Q 38. Which one of the following is not a gaseous biogeochemical cycle in ecosystem?**

- Option A Nitrogen cycle
- Option B Carbon cycle
- Option C Oxygen cycle
- Option D Phosphorus cycle

**Correct option D**

**Solution:** Phosphorus cycle is a sedimentary cycle. The main reservoir pool is the lithosphere.

**Q 39. Which one of the following is a wrong statement?**

- Option A Greenhouse effect is a natural phenomenon.
- Option B Eutrophication is a natural phenomenon in freshwater bodies.
- Option C Most of the forests have been lost in tropical areas.
- Option D Ozone in upper part of the atmosphere is harmful to animals.

**Correct option D**

**Solution:** Ozone in upper part of the atmosphere prevents the UV rays from reaching the surface of the Earth and hence protects everything on earth, including plants, animals and human beings.

**Q 40. The highest number of species in the world is represented by:-**

- Option A Algae
- Option B Lichens
- Option C Fungi
- Option D Mosses

**Correct option C**

**Solution:** Fungi represent the highest number of species in the world. Taxonomists have reported around 100000 species of fungi.

**Q 41. Yeast is used in the production of:**

- Option A Bread and beer
- Option B Cheese and butter
- Option C Citric acid and lactic acid

Option D Lipase and pectinase

**Correct option A**

**Solution:** *Saccharomyces cerevisiae* commonly called brewer's yeast is used for bread making and fermenting malted cereals like beer.

**Q 42. Which one of the following microbes forms symbiotic association with plants and helps them in their nutrition?**

Option A *Glomus*

Option B *Trichoderma*

Option C *Azotobacter*

Option D *Aspergillus*

**Correct option A**

**Solution:** Many members of the genus *Glomus* form mycorrhiza which are the fungal associations. They absorb phosphorus from the soil and pass it on to the plant.

**Q 43. A single strand of nucleic acid tagged with a radioactive molecule is called:**

Option A Plasmid

Option B Probe

Option C Vector

Option D Selectable marker

**Correct option B**

**Solution:** A single stranded DNA or RNA, tagged with a radioactive molecule is called a probe.

**Q 44. A patient brought to a hospital with myocardial infarction is normally immediately given:**

Option A Cyclosporin-A

Option B Statins

Option C Penicillin

Option D Streptokinase

**Correct option D**

**Solution:** Streptokinase produced by the bacterium *Streptococcus* is modified by genetic engineering and is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to a heart attack.

**Q 45. A nitrogen fixing microbe associated with *Azolla* in rice-fields is:**

Option A *Frankia*

Option B *Tolypothrix*

Option C *Spirulina*

Option D *Anabaena*

**Correct option D**

**Solution:** *Azolla* is a small, fast growing aquatic fern which carries cyanobacterium (*Anabaena-Azollae*) in the leaf cavities. The *Azolla* leaves degrade in the rice-fields and prove as an excellent biofertiliser for rice.

**Q 46. Which one is true statement regarding DNA polymerase used in PCR?**

- Option A It is isolated from a virus.
- Option B It remains active at high temperature.
- Option C It is used to ligate introduced DNA in recipient cells.
- Option D It serves as a selectable marker.

**Correct option B**

**Solution:** DNA polymerase is a thermostable enzyme which remains active during the high temperature induced denaturation of double stranded DNA.

**Q 47. Consumption of which one of the following foods can prevent the kind of blindness associated with vitamin 'A' deficiency?**

- Option A Golden rice
- Option B Bt-brinjal
- Option C Flavr Savr tomato
- Option D Canolla

**Correct option A**

**Solution:** Golden rice is rich in vitamin A. Hence, consumption of golden rice can prevent night blindness.

**Q 48. Which one of the following is a case of wrong matching?**

- Option A Micropropagation – In vitro production of plants in large numbers
- Option B Callus – Unorganised mass of cells produced in tissue culture
- Option C Somatic hybridisation – Fusion of two diverse cells
- Option D Vector DNA – Site for t-RNA synthesis

**Correct option D**

**Solution:** Vector DNA is a small piece of DNA into which a foreign DNA fragment can be inserted for cloning purposes. Hence, vector DNA is not a site for t-RNA synthesis.

**Q 49. Which part would be most suitable for raising virus free plants for micropropagation?**

- Option A Meristem
- Option B Node
- Option C Bark
- Option D Vascular tissue

**Correct option A**

**Solution:** The meristem (apical and axillary) is free of virus. Hence, one can remove the meristem and grow it in vitro to obtain virus-free plants.

**Q 50. For transformation micro-particles coated with DNA to be bombarded with gene are made up of:**

- Option A Silicon or platinum
- Option B Gold or tungsten
- Option C Silver or platinum
- Option D Platinum or zinc

**Correct option B**

**Solution:** For transformation, the cells are bombarded with high velocity micro-particles of gold or tungsten. This method is known as biolistics or gene gun.

**Q 51. The cyanobacteria are also referred to as:**

- Option A Slime moulds
- Option B Blue green algae
- Option C Protists
- Option D Golden algae

**Correct option B**

**Solution:** The cyanobacteria are also referred to as blue green algae.

**Q 52. Which one single organism or a pair of organisms is correctly assigned to its/their named taxonomic group?**

- Option A Yeast used in making bread and beer is a fungus.
- Option B *Nostoc* and *Anabaena* are examples of protists.
- Option C *Paramoecium* and *Plasmodium* belong to the same kingdom as that of *Penicilium*.
- Option D Lichen is a composite organism formed from the symbiotic associated of an algae and a protozoan.

**Correct option A**

**Solution:** Yeast used in making bread and beer is a single celled fungus.

**Q 53. In which one of the following, the genus name, its two characters and its phylum are not correctly matched, whereas the remaining three are correct?**

	Genus name	Two characters	Phylum
Option A	<i>Sycon</i>	(a) Pore bearing (b) Canal system	Porifera
Option B	<i>Periplaneta</i>	(a) Jointed appendages (b) Chitinous exoskeleton	Arthropoda
Option C	<i>Pila</i>	(a) Body segmented (b) Mouth with radula	Mollusca
Option D	<i>Asterias</i>	(a) Spiny skinned (b) Water vascular system	Echinodermata

**Correct option C**

**Solution:** *Pila* belongs to Phylum Mollusca. Its body is not segmented and its mouth contains a file-like rasping organ for feeding, called radula.

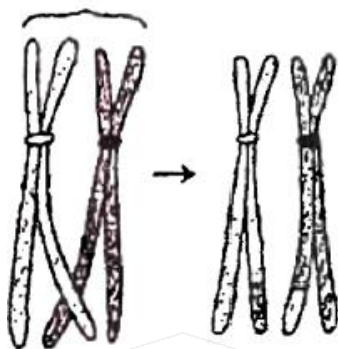
**Q 54. Select the correct statement from the following regarding cell membrane:**

- Option A Lipids are arranged in a bilayer with polar heads towards the inner part.
- Option B Fluid mosaic model of cell membrane was proposed by Singer and Nicolson.
- Option C  $\text{Na}^+$  and  $\text{K}^+$  ions move across cell membrane by passive transport.
- Option D Proteins make up 60 to 70% of the cell membrane.

**Correct option B**

**Solution:** Fluid mosaic model of cell membrane was proposed by Singer and Nicolson in 1972.

**Q 55.** Given below is the representation of a certain event at a particular stage of a type of cell division. Which is this stage?



- Option A Prophase of mitosis
- Option B Both prophase and metaphase of mitosis
- Option C Prophase I during meiosis
- Option D Prophase II during meiosis

**Correct option C**

**Solution:** The given image shows the second stage of prophase I called zygotene in which the chromosomes start pairing together (synapsis). Such paired chromosomes are called homologous chromosomes.

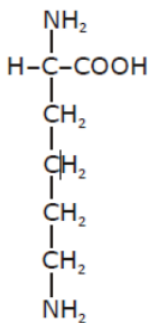
**Q 56.** Which one out of A -D given below correctly represents structural formula of the basic amino acid?

A	B	C	D
$  \begin{array}{c}  \text{NH}_2 \\    \\  \text{H}-\text{C}-\text{COOH} \\    \\  \text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{C} \\  // \quad \backslash \\  \text{O} \quad \text{OH}  \end{array}  $	$  \begin{array}{c}  \text{NH}_2 \\    \\  \text{H}-\text{C}-\text{COOH} \\    \\  \text{CH}_2 \\    \\  \text{OH}  \end{array}  $	$  \begin{array}{c}  \text{CH}_2\text{OH} \\    \\  \text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{NH}_2  \end{array}  $	$  \begin{array}{c}  \text{NH}_2 \\    \\  \text{H}-\text{C}-\text{COOH} \\    \\  \text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{CH}_2 \\    \\  \text{NH}_2  \end{array}  $

- Option A A
- Option B B
- Option C C
- Option D D

**Correct option D**

**Solution:** The below structure represents the structure of lysine which is a basic amino acid.



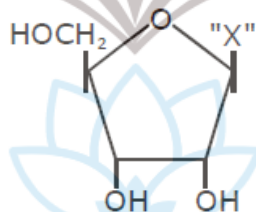
**Q 57. What is true about ribosomes?**

- Option A These are found only in eukaryotic cells.  
 Option B These are self-splicing introns of some RNAs.  
 Option C The prokaryotic ribosomes are 80s where 's' stands for sedimentation coefficient.  
 Option D These are composed of ribonucleic acid and proteins.

**Correct option D**

**Solution:** Ribosomes are composed of ribonucleic acid (RNA) and proteins and are not surrounded by any membrane.

**Q 58. Given below is the diagrammatic representation of one of the categories of small molecular weight organic compound in the living tissues. Identify the category shown and the one blank component "X" in it:**



	Category	Component
Option A	Nucleotide	Adenine
Option B	Nucleoside	Uracil
Option C	Cholesterol	Guanine
Option D	Amino acid	NH <sub>2</sub>

**Correct option B**

**Solution:** Category is nucleoside and the component 'X' is Uracil.

**Q 59. Ribosomal RNA is actively synthesised in:**

- Option A Nucleoplasm  
 Option B Ribosomes  
 Option C Lysosomes  
 Option D Nucleolus

**Correct option D**

**Solution:** Nucleolus is the site for active ribosomal RNA synthesis.

**Q 60. F<sub>2</sub> generation in a Mendelian cross showed that both genotypic and phenotypic ratios are same as 1 : 2 : 1. It represents a case of:**

- Option A Monohybrid cross with complete dominance
- Option B Monohybrid cross with incomplete dominance
- Option C Co-dominance
- Option D Dihybrid cross

**Correct option B**

**Solution:** Monohybrid cross is a cross where two forms of a single trait are brought together. Incomplete dominance occurs when the hybrid produced does not resemble either of the parents. Hence, F<sub>2</sub> generation in a Mendelian cross that showed both genotypic and phenotypic ratios as 1 : 2 : 1 represents monohybrid cross and incomplete dominance.

**Q 61. What was the most significant trend in the evolution of modern man (*Homo sapiens*) from his ancestors?**

- Option A Increasing cranial capacity
- Option B Upright posture
- Option C Shortening of jaws
- Option D Binocular vision

**Correct Option A**

**Solution:** The trend in the evolution of modern man (*Homo sapiens*) from his ancestors is increasing brain capacity. *Homo sapiens* evolved from *Neanderthal* man, have large sized brain (1500 cc).

**Q 62. If one strand of DNA has the nitrogenous base sequence as ATCTG, what would be the complementary RNA strand sequence?**

- Option A AACTG
- Option B ATCGU
- Option C TTAGU
- Option D UAGAC

**Correct Option D**

**Solution:** In RNA, adenine combines with uracil, thymine combines with adenine, cytosine combines with guanine and guanine combines with cytosine. Hence, the complementary RNA strand sequence with the given base sequence would be UAGAC.

**Q 63. Which one of the following options gives one correct example each of convergent evolution and divergent evolution?**

	<b>Convergent evolution</b>	<b>Divergent evolution</b>
Option A	Bones of forelimbs of vertebrates	Wings of butterfly and birds
Option B	Thorns of <i>Bougainvillea</i> and tendrils of <i>Cucurbita</i>	Eyes of octopus and mammals
Option C	Eyes of octopus and mammals	Bones of forelimbs of vertebrates
Option D	Thorns of <i>Bougainvillea</i> and tendrils of <i>Cucurbita</i>	Wings of butterflies and birds

**Correct Option C**



**Solution:** Eyes of octopus and mammals are an example of convergent evolution as they perform the same function but differ in their origin and structure that is, they have arisen in the evolutionary process through adaptation in different organisms to a similar mode of life.

Bones of forelimbs of vertebrates are an example of divergent evolution as these are similar in structure and origin but dissimilar in function.

**Q 64. A normal visioned man whose father was colour-blind marries a woman who had a colour blind mother and a normal father. They have their first child as a daughter. What are the chances that this child would be colour blind?**

- Option A 25 %
- Option B 50 %
- Option C 100 %
- Option D Zero percent

**Correct Option D**

**Solution:** Colour blindness is an autosomal recessive disorder present on X chromosome. Thus, a man whose father was colour blind will be normal (XY), marries a woman who had a colour blind mother and normal father, i.e. the woman will be a carrier ( $XX^c$ ).

When the carrier woman marries a normal man, then 50% of their sons would be colour blind and 50% would be normal. Also, 50% of their daughters would be carriers and 50% would be normal.

<b>Parents....</b>	<b>Husband</b>	<b>X</b>	<b>Wife</b>
<b>Genes....</b>	XY	X	$X^cX$
<b>Gametes.....</b>	X, Y	X	$X^c, X$

	<b>X</b>	<b>Y</b>
<b><math>X^c</math></b>	<b><math>X^cX</math></b>	<b><math>X^cY</math></b>
<b>X</b>	<b>XX</b>	<b>XY</b>

Hence, the probability of the female child being colour blind ( $X^cX^c$ ) would be 0%.

**Q 65. Select the correct statement regarding the specific disorder of muscular or skeletal system:**

- Option A Myasthenia gravis - autoimmune disorder which inhibits sliding of myosin filaments
- Option B Gout - inflammation of joint due to extra deposition of calcium
- Option C Muscular dystrophy - age related shortening of muscles
- Option D Osteoporosis - decreases in bone mass and higher chances of fractures with advancing age

**Correct Option D**

**Solution:** Osteoporosis is an age-related disorder characterised by decreased bone mass and increased chances of fractures.



**Q 66. A certain road accident patient with unknown blood group needs immediate blood transfusion. His one doctor friend at once offers his blood. What was the blood group of the donor?**

- Option A Blood group O
- Option B Blood group A
- Option C Blood group B
- Option D Blood group AB

**Correct Option A**

**Solution:** Type O blood group is a universal donor and hence, a person with Type O blood group can offer blood for blood donation without delay.

**Q 67. The maximum amount of electrolytes and water (70-80 percent) from the glomerular filtrate is reabsorbed in which part of the nephron?**

- Option A Proximal convoluted tubule
- Option B Descending limb of loop of Henle
- Option C Ascending limb of loop of Henle
- Option D Distal convoluted tubule

**Correct Option A**

**Solution:** Proximal convoluted tubule (PCT) is lined by simple cuboidal brush border epithelium which increases the surface area for reabsorption. All of the essential nutrients, and 70-80 per cent of electrolytes and water are reabsorbed by PCT.

**Q 68. The human hind brain comprises of three parts, one of which is?**

- Option A Cerebellum
- Option B Hypothalamus
- Option C Spinal cord
- Option D Corpus callosum

**Correct Option A**

**Solution:** The hindbrain comprises pons, cerebellum and medulla.

**Q 69. Which one of the following pairs of hormones are the example of those that can easily pass through the cell membrane of the target cell and bind to a receptor inside it (mostly in the nucleus)?**

- Option A Somatostatin, oxytocin
- Option B Cortisol, testosterone
- Option C Insulin, glucagon
- Option D Thyroxine, insulin

**Correct Option B**

**Solution:** Hormone receptors present on the cell membrane of the target cells are called membrane-bound receptors and the receptors present inside the target cell are called intracellular receptors. Cortisol and testosterone can bind to intracellular receptors.

**Q 70. The Leydig cells as found in the human body are the secretory source of:**

- Option A      Glucagon
- Option B      Androgens
- Option C      Progesterone
- Option D      Intestinal mucus

**Correct Option B**

**Solution:** Leydig cells synthesise and secrete testicular hormones called androgens.

**Q 71. Selected the correct statement from the ones given below with respect to *Periplaneta americana*:**

- Option A      There are 16 very long Malpighian tubules present at the junctions of midgut and hindgut.
- Option B      Grinding of food is carried out only by the mouth parts.
- Option C      Nervous system located dorsally, consists of segmentally arranged ganglia joined by a pair of longitudinal connectives.
- Option D      Males bear a pair of short thread-like anal styles.

**Correct Option D**

**Solution:** In *Periplaneta americana*, the males bear a pair of short, thread-like anal styles which are absent in females.

**Q 72. Anxiety and eating spicy food together in an otherwise normal human, may lead to:**

- Option A      Diarrhoea
- Option B      Vomiting
- Option C      Indigestion
- Option D      Jaundice

**Correct Option C**

**Solution:** Inadequate enzyme secretion, anxiety, food poisoning, over eating, and eating spicy food leads to indigestion.

**Q 73. Which one of the following is the correct statement for respiration in humans?**

- Option A      Workers in grinding and stone-breaking industries may suffer, from lung fibrosis.
- Option B      About 90% of carbon dioxide ( $\text{CO}_2$ ) is carried by haemoglobin as carbamino hemoglobin.
- Option C      Cigarette smoking may lead to inflammation of bronchi.
- Option D      Neural signals from pneumotaxic centre in pons region of brain can increase the duration of inspiration.

**Correct Option A**

**Solution:** In certain industries, especially those involving grinding or stone-breaking, so much dust is produced that the defense mechanism of the body cannot fully cope with the situation. Thus, long exposure of dust can give rise to inflammation leading to lung fibrosis.

**Q 74. What is correct to say about the hormone action in human?**

- Option A In females, FSH first binds with specific receptors on the ovarian cell membrane.  
Option B FSH stimulates the secretion of estrogen and progesterone.  
Option C Glucagon is secreted by the cells of Islets of Langerhans and stimulates glycogenolysis.  
Option D Secretion of thymosin is stimulated with ageing.

**Correct Option A**

**Solution:** Hormones produce their effects on target tissues by binding to specific proteins called hormone receptors located in the target tissues only. Hormone receptors present on the cell membrane of the target cells are called membrane-bound receptors. Binding of a hormone to its receptor leads to the formation of a hormone-receptor complex. Some pituitary hormones like FSH bind with membrane bound receptors.

**Q 75. *Pheretima* and its close relatives derive nourishment from:**

- Option A Soli insects  
Option B Small pieces of fresh fallen leaves of maize, etc.  
Option C Sugarcane rots  
Option D Decaying fallen leaves and soil organic matter

**Correct Option D**

**Solution:** The food of *Pheretima* commonly known as earthworm is decaying leaves and organic matter mixed with soil. Hence, its nourishment comprises of decaying fallen leaves and soil organic matter.

**Q 76. Compared to those of humans, the erythrocytes in frog are:**

- Option A Very much smaller and fewer  
Option B Nucleated and without haemoglobin  
Option C Without nucleus but with haemoglobin  
Option D Nucleated and with haemoglobin

**Correct Option D**

**Solution:** RBC's in frog are nucleated and contain a red-coloured pigment called haemoglobin.

**Q 77. Which one is the most abundant protein in the animal world?**

- Option A Collagen  
Option B Insulin  
Option C Trypsin  
Option D Haemoglobin

**Correct Option A**

**Solution:** Collagen is the most abundant protein in animal world.

**Q 78. Which part of the human ear plays no role in hearing as such but is otherwise very much required?**

- Option A Vestibular apparatus  
Option B Ear ossicles  
Option C Eustachian tube  
Option D Organ of Corti

**Correct Option A**

**Solution:** Vestibular apparatus plays no role in hearing. However, it is influenced by gravity and movements, and helps in maintaining balance of the body and posture.

**Q 79. A person entering an empty room suddenly finds a snake right in front on opening the door. Which one of the following is likely to happen in his neurohormonal control system?**

- Option A Hypothalamus activates the parasympathetic division of brain.
- Option B Sympathetic nervous system is activated releasing epinephrine and nor-epinephrine from adrenal cortex.
- Option C Sympathetic nervous system is activated releasing epinephrine and nor-epinephrine from adrenal medulla.
- Option D Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse.

**Correct Option C**

**Solution:** Sympathetic nervous system is activated releasing epinephrine and nor-epinephrine from adrenal medulla in response to stress of any kind and during emergency situations.

**Q 80. In a normal pregnant woman, the amount of total gonadotropin activity was assessed. The result expected was:**

- Option A High levels of FSH and LH in uterus to stimulate endometrial thickening.
- Option B High levels of circulating HCG to stimulate estrogen and progesterone synthesis.
- Option C High levels of circulating FSH and LH in the uterus to stimulate implantation of the embryo.
- Option D High levels of circulating HCG to stimulate endometrial thickening.

**Correct Option B**

**Solution:** Human chorionic gonadotropin (HCG) stimulates the ovaries to secrete progesterone and estrogen for maintaining pregnancy.

**Q 81. The test-tube baby programme employs which one of the following techniques?**

- Option A Gamete Intra Fallopian Transfer (GIFT)
- Option B Zygote Intra Fallopian Transfer (ZIFT)
- Option C Intra Cytoplasmic Sperm Injection (ICSI)
- Option D Intra Uterine Insemination (IUI)

**Correct Option B**

**Solution:** The test-tube baby programme employs zygote intra fallopian transfer (ZIFT) in which the zygote or early embryos (with upto 8 blastomeres) are transferred into the fallopian tube.

**Q 82. Signals for parturition originate from:**

- Option A Placenta only
- Option B Fully developed foetus only
- Option C Both placenta as well as fully developed foetus
- Option D Oxytocin released from maternal pituitary

**Correct Option C**

**Solution:** The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.

**Q 83. Which one of the following statements is false with respect to viability of mammalian sperm?**

- Option A Viability of sperm is determine by its motility.
- Option B Sperms must be concentrated in a thick suspension.
- Option C Sperm is viable for only upto 24 hours.
- Option D Survival of sperm depends on the pH of the medium and is more active in alkaline medium.

**Correct Option C**

**Solution:** Mammalian sperm is viable upto 24–48 hours.

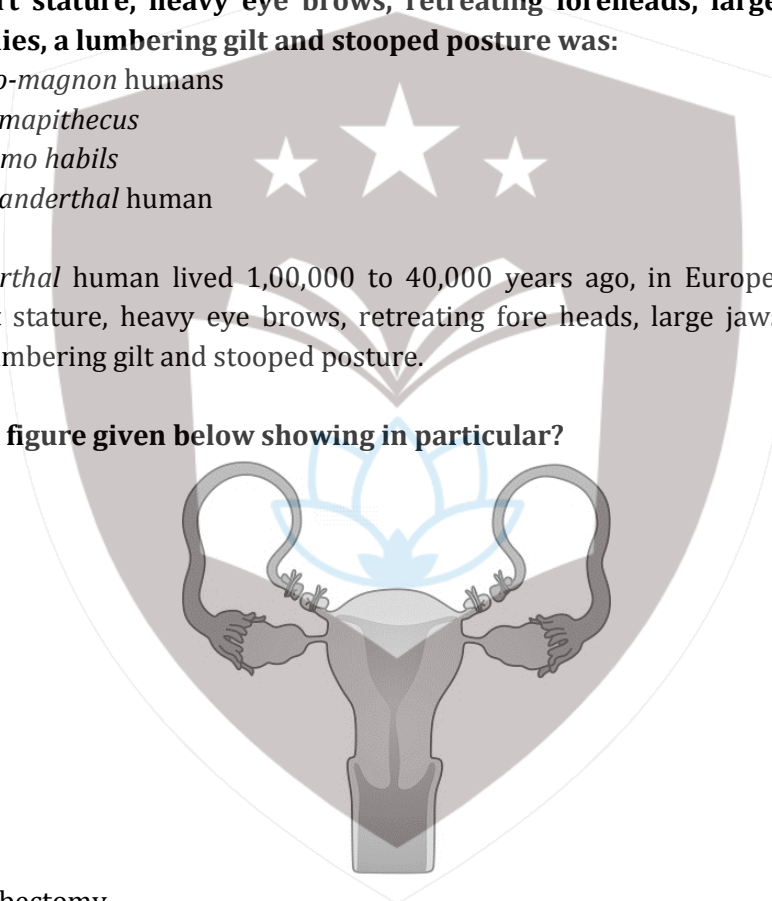
**Q 84. The extinct human who lived 1,00,000 to 40,000 years ago, in Europe, Asia and parts of Africa, with short stature, heavy eye brows, retreating foreheads, large jaws with heavy teeth, stocky bodies, a lumbering gait and stooped posture was:**

- Option A *Cro-magnon* humans
- Option B *Ramapithecus*
- Option C *Homo habilis*
- Option D *Neanderthal* human

**Correct Option D**

**Solution:** *Neanderthal* human lived 1,00,000 to 40,000 years ago, in Europe, Asia and parts of Africa, with short stature, heavy eye brows, retreating fore heads, large jaws with heavy teeth, stocky bodies, a lumbering gait and stooped posture.

**Q 85. What is the figure given below showing in particular?**



- Option A Tubectomy
- Option B Vasectomy
- Option C Ovarian cancer
- Option D Uterine cancer

**Correct Option A**

**Solution:** In tubectomy, a small part of the fallopian tube is removed or tied up through a small incision in the abdomen or through vagina.

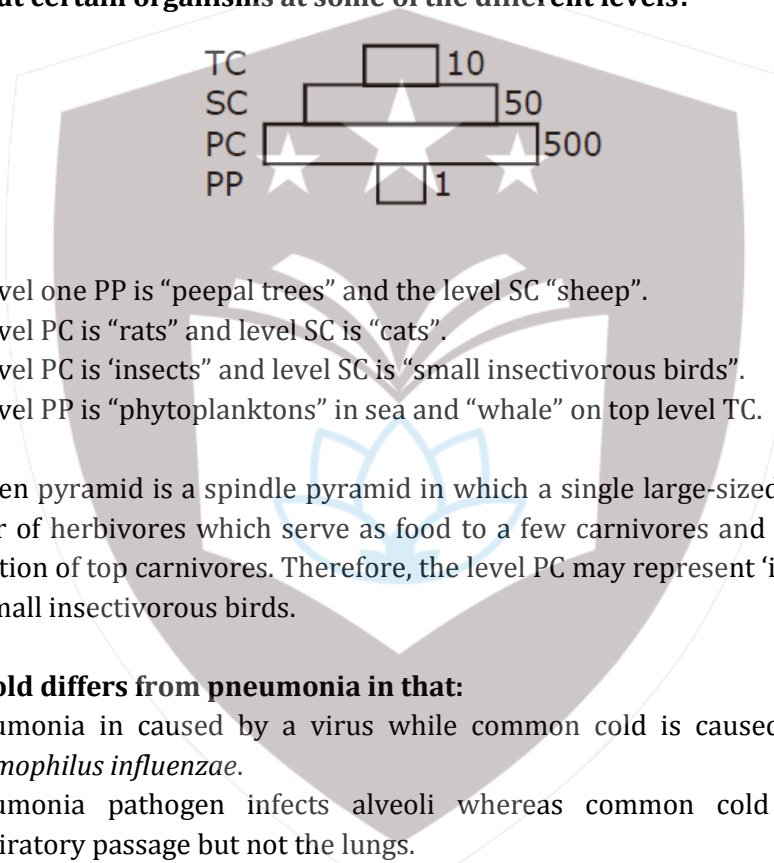
**Q 86. In an area where DDT had been used extensively the population of birds declined significantly because**

- Option A Cobras were feeding exclusively on birds.
- Option B Many of the eggs laid by birds did not hatch.
- Option C Birds stopped laying eggs.
- Option D Earthworms in the area got eradicated.

**Correct Option B**

**Solution:** High concentrations of DDT disturb calcium metabolism in birds, which causes thinning of eggshell and their premature breaking, eventually causing decline in bird populations.

**Q 87. Given below is an imaginary pyramid of numbers. What could be one of the possibilities about certain organisms at some of the different levels?**



- Option A Level one PP is “peepal trees” and the level SC “sheep”.
- Option B Level PC is “rats” and level SC is “cats”.
- Option C Level PC is ‘insects” and level SC is “small insectivorous birds”.
- Option D Level PP is “phytoplanktons” in sea and “whale” on top level TC.

**Correct Option C**

**Solution:** The given pyramid is a spindle pyramid in which a single large-sized tree provides food to a large number of herbivores which serve as food to a few carnivores and ultimately eaten by very small population of top carnivores. Therefore, the level PC may represent ‘insects” and level SC may represent “small insectivorous birds.

**Q 88. Common cold differs from pneumonia in that:**

- Option A Pneumonia is caused by a virus while common cold is caused by the bacterium *Haemophilus influenzae*.
- Option B Pneumonia pathogen infects alveoli whereas common cold affects nose and respiratory passage but not the lungs.
- Option C Pneumonia is a communicable disease whereas common cold is a nutritional deficiency disease.
- Option D Pneumonia can be prevented by a live attenuated bacterial vaccine whereas common cold has no effective vaccine.

**Correct Option B**

**Solution:** Pneumonia pathogen infects alveoli whereas common cold affects nose and respiratory passage but not the lungs,

**Q 89. Identify the possible link “A” in the following food chain:**

**Plant → Insect → Frog → “A” → Eagle**

- Option A      Cobra
- Option B      Parrot
- Option C      Rabbit
- Option D      Wolf

**Correct Option A**

**Solution:** In the given food chain, frog can be eaten by cobra but not by a parrot or a rabbit or a wolf.

**Q 90. Which one of the following is an example of carrying out biological control of pests/diseases using microbes?**

- Option A      Bt-cotton to increases cotton yield.
- Option B      Lady bird beetle against aphids in mustard.
- Option C      *Trichoderma sp.* against certain plant pathogens.
- Option D      Nucleopolyhedrovirus against white rust in *Brassica*.

**Correct Option C**

**Solution:** A biological control that is being developed for use in the treatment of plant disease caused by plant pathogens is the fungus *Trichoderma sp.*

**Q 91. Widal Test is carried out to test:**

- Option A      HIV/AIDS
- Option B      Typhoid fever
- Option C      Malaria
- Option D      Diabetes mellitus

**Correct Option B**

**Solution:** Typhoid fever can be confirmed by Widal test.

**Q 92. Cirrhosis of liver is caused by the chronic intake of:**

- Option A      Tobacco (Chewing)
- Option B      Cocaine
- Option C      Opium
- Option D      Alcohol

**Correct Option D**

**Solution:** The chronic use of drugs and alcohol damages nervous system and causes liver cirrhosis.

**Q 93. Which one of the following in not a property of cancerous cells whereas the remaining three are?**

- Option A      They divide in an uncontrolled manner.
- Option B      They show contact inhibition.
- Option C      They compete with normal cells for vital nutrients.
- Option D      They do not remain confined in the area of formation.

**Correct Option B**

**Solution:** Normal cells show a property called contact inhibition by the virtue of which contact with other cells inhibits their uncontrolled growth.



**Q 94. Motile zygote of *Plasmodium* occurs in:**

- Option A Human RBCs
- Option B Human liver
- Option C Gut of female *Anopheles*
- Option D Salivary glands of *Anopheles*

**Correct Option C**

**Solution:** The motile zygote called ookinete or vermicle is elongated, worm-like stage that occurs in the gut of female *Anopheles*.

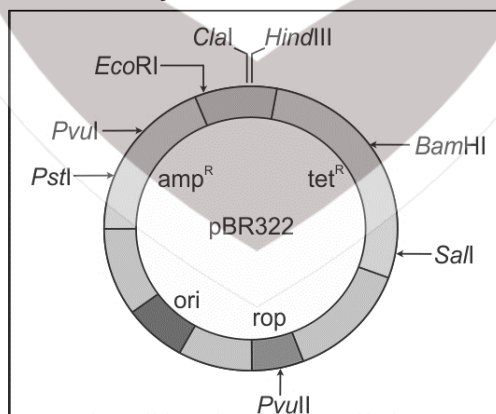
**Q 95. In which one of the following options the two example are correctly matched with their particular type of immunity?**

	Examples	Type of Immunity
Option A	Saliva in mouth and tears in eyes	Physical barriers
Option B	Mucus coating of epithelium lining the urinogenital tract and HCl in stomach	Physiological barriers
Option C	Polymorphonuclear leukocytes and monocytes	Cellular barriers
Option D	Anti-tetanus and anti-snake bite injections	Active immunity

**Correct Option C**

**Solution:** The body's internal defence is carried out by cellular barriers which includes white blood cells, macrophages, inflammatory reactions, fever and complement system.

**Q 96. The figure below is the diagrammatic representation of the *E.coli* vector pBR 322. Which one of the given options correctly identifies its certain component(s)?**



- Option A Hind III, *EcoRI* - selectable markers
- Option B ampR, tetR - antibiotic resistance genes
- Option C ori - original restriction enzyme
- Option D rop - reduced osmotic pressure

**Correct Option B**

**Solution:** *E.coli* cloning vector pBR322 showing restriction sites ampR and tetR are antibiotic resistance genes.



**Q 97. Measuring Biochemical Oxygen Demand (BOD) is a method used for:**

- Option A Measuring the activity of *Saccharomyces cerevisiae* in producing curd on a commercial scale.
- Option B Working out the efficiency of RBCs about their capacity to carry oxygen.
- Option C Estimating the amount of organic matter in sewage water.
- Option D Working out the efficiency of oil driven automobile engines.

**Correct Option C**

**Solution:** Biochemical Oxygen Demand (BOD) is a method used to estimate the amount of organic matter in sewage water.

**Q 98. The most abundant prokaryotes helpful to humans in making curd from milk and in production of antibiotics are the ones categorised as:**

- Option A Chemosynthetic autotrophs
- Option B Heterotrophic bacteria
- Option C Cyanobacteria
- Option D Archaeobacteria

**Correct Option B**

**Solution:** *Lactobacilli* bacteria grow in milk and convert it to curd. *Staphylococci* bacteria are used for the production of antibiotic. Both of these bacteria are examples of heterotrophic bacteria.

**Q 99. People who have migrated from plains to an area adjoining Rohtang pass about six months back:**

- Option A Suffer from altitude sickness with symptoms like nausea, fatigue, etc.
- Option B Have the usual RBC count but their haemoglobin has very high binding affinity to  $O_2$
- Option C Have more RBCs and their haemoglobin has a lower binding affinity to  $O_2$ .
- Option D Are not physically fit to play games like football.

**Correct Option C**

**Solution:** Moving up the hill causes a decrease in  $pO_2$  and total atmospheric pressure which stimulates the JG-cells of kidney to secrete erythropoietin hormone that increases the number of RBCs (polycythemia) to compensate the supply of  $O_2$ . The primary factor responsible for binding is  $pO_2$  decrease at higher altitudes and hence, haemoglobin has lower binding affinity to  $O_2$  at high altitude.

**Q 100. *Monascus purpureus* is a yeast used commercially in the production of:**

- Option A Citric acid
- Option B Blood cholesterol lowering statins
- Option C Ethanol
- Option D Streptokinase for removing clots from blood vessels

**Correct Option B**

**Solution:** Statins produced by the yeast *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents. They act by competitively inhibiting the enzyme responsible for the synthesis of cholesterol.