Jupiter Academy

Subjects : Physics , Chemistry , Biology

Full mock test 02

(Solutions)

Total Marks : 720

Physics

1. What is the relative decrease in focal length of a lens for an increase in optical power by 0.1 D from 2.5D ? ['D' stands for dioptre]

A) 0.01 **B)** 0.04 **C)** 0.40 **D)** 0.1

Solution : (Correct Answer: B)

$P = \frac{1}{f}$

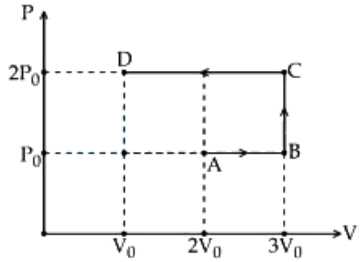
So $P_1 = \frac{1}{F_1} \Rightarrow F_1 = \frac{1}{2.5}$

Next $F_2 = \frac{1}{2.6}$

$\left|\frac{\Delta F}{F_1}\right| = \frac{|F_2 - F_1|}{F_1} = \left|\frac{F_2}{F_1} - 1\right|$

$\Rightarrow \left|\frac{\Delta F}{F_1}\right| = \left|\frac{2.5}{2.6} - 1\right| = \frac{0.1}{2.6} \approx 0.04$

2.

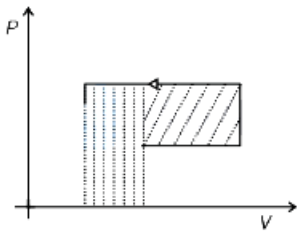


Using the given $\mathrm{P-V}$ diagram, the work done by an ideal gas along the path ABCD is :

A) $3\mathrm{P}_0\ \mathrm{V}_0$ **B)** $-4\mathrm{P}_0\ \mathrm{V}_0$

C) $-3\mathrm{P}_0\ \mathrm{V}_0$ **D)** $4\mathrm{P}_0\ \mathrm{V}_0$

Solution : (Correct Answer: C)



Area under graph will be magnitude of graph and being counterclockwise graph it would be negative

$\text{Area } = 2P_0 \times V_0 + P_0V_0 = 3P_0V_0$

$\mathrm{W} = -3P_0V_0$

3. The ground state energy of hydrogen atom is $-13.6\ eV$. What is the potential energy of the electron in this state.....eV

A) 0 **B)** -27.2

C) 1 **D)** 2

Solution : (Correct Answer: B)

(b) $P.E. = 2 \times \text{Total energy} = 2 \times (-13.6) = -27.2\,\text{eV}$

4. Which of the following is used to produce radio waves of constant amplitude

A) Oscillator **B)** FET

C) Rectifier **D)** Amplifier

Solution : (Correct Answer: A)

(a)Oscillator can produce radio waves of constant amplitude.

5. The half life of the isotope $_{11}Na^{24}$ is $15\ hrs$. How much time does it take for $\frac{7}{8}th$ of a sample of this isotope to decay.....hrs

A) 75 **B)** 65 **C)** 55 **D)** 45

Solution : (Correct Answer: D)

(d) Undecayed isotope$= 1 - \frac{7}{8} = \frac{1}{8}$

$\therefore \frac{N}{N_0} = \left(\frac{1}{2}\right)^{t/T}$

$\Rightarrow \left(\frac{1}{8}\right) = \left(\frac{1}{2}\right)^{t/15}$

$\Rightarrow \frac{t}{15} = 3$

or $t = 45\ hours$

6. Light of frequency $4v_0$ is incident on the metal of the threshold frequency v_0. The maximum kinetic energy of the emitted photoelectrons is

A) $3\,h\nu_0$ **B)** $2\,h\nu_0$

C) $\frac{3}{2}\,h\nu_0$ **D)** $\frac{1}{2}h\nu_0$

Solution : (Correct Answer: A)

(a) $E = h\nu_0 + K_{\max}$

$\Rightarrow h(4\nu_0) = h\nu_0 + K_{\max}$

$\Rightarrow K_{\max} = 3\,h\nu_0.$

7. Imagine a Young's double slit interference experiment performed with waves associated with fast moving electrons produced from an electron gun. The distance between successive maxima will decrease maximum if

A) the accelerating voltage in the electron gun is decreased

B) the accelerating voltage is increased and the distance of the screen from the slits is decreased

C) the distance of the screen from the slits is increased.

D) the distance between the slits is decreased.

Solution : (Correct Answer: B)

8. When EM wave propagates through vacuum then

A) $E-$ field leads $B-$ field

B) $E-$ field lags $B-$ field

C) $E-$ field and $B-$ field are in the same phase

D) Energy is stored only in $E-$ field

Solution : (Correct Answer: C)

In vacuum E and B are in the same in phase EM waves.

9. A series $R-C$ combination is connected to an AC voltage of angular frequency $\omega = 500\ radian/s$. If the impedance of the $R-C$ circuit is $R\sqrt{1.25}$, the time constant (in millisecond) of the circuit is

A) 5 B) 6 C) 4 D) 8

Solution : (Correct Answer: C)

Given : $\omega = 500\ radian/s$

Let the capacitance of the capacitor be C.

Thus resistance of capacitor $X_C = \frac{1}{\omega C} = \frac{1}{500C}$

Impedance of the circuit $Z = R\sqrt{1.25}$

Using $Z^2 = R^2 + X_C^2$

$\therefore 1.25R^2 = R^2 + \frac{1}{(500)^2C^2}$

Or $0.25R^2 = \frac{1}{.25\times10^6C^2}$

$\Rightarrow R^2C^2 = \frac{10^{-6}}{(0.25)^2}$

We get time constant of the circuit $RC = \frac{10^{-3}}{0.25}$

$= 0.004s = 4\ ms$

10. The magnetic flux through a circuit carrying a current of $2.0\ A$ is $0.8\ weber$. If the current reduces to $1.5\ A$ in $0.1\ s$, the induced emf be.....V

A) 2 B) 4 C) 8 D) none of the above

Solution : (Correct Answer: A)

flux corresponds to $2\ A$ is $= 0.8\ weber$

flux corresponds to $1.5\ A$ is $= 0.6\ weber$

$|e| = \frac{\Delta\phi}{\Delta t} = \frac{0.2}{0.1} = 2.0\ V$

11. Two short magnets with their axes horizontal and perpendicular to the magnetic meridian are placed with their centres $40\ cm$ east and $50\ cm$ west of magnetic needle. If the needle remains undeflected, the ratio of their magnetic moments $M_1 : M_2$ is

A) $4:5$ B) $16:25$

C) $64:125$ D) $2:\sqrt{5}$

Solution : (Correct Answer: C)

(c)For null deflection $\frac{M_1}{M_2} = \left(\frac{d_1}{d_2}\right)^3 = \left(\frac{40}{50}\right)^3 = \frac{64}{125}$

12. If a proton is projected in a direction perpendicular to a uniform magnetic field with velocity v and an electron is projected along the lines of force, what will happen to proton and electron

A) The electron will travel along a circle with constant speed and the proton will move along a straight line

B) Proton will move in a circle with constant speed and there will be no effect on the motion of electron

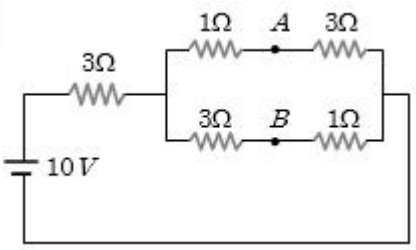
C) There will not be any effect on the motion of electron and proton

D) The electron and proton both will follow the path of a parabola

Solution : (Correct Answer: B)

(b) Maximum force will act on proton so it will move on a circular path. Force on electron will be zero because it is moving parallel to the field.

13. A battery of $e.m.f.\ 10\ V$ is connected to resistance as shown in figure. The potential difference $V_A - V_B$ between the points A and B is V



A) -2 B) 2 C) 5 D) $\frac{20}{11}$

Solution : (Correct Answer: B)

$R_{eq} = 5\,\Omega$, Current $i = \frac{10}{5} = 2\ A$ and current in each branch = $1\ A$

Potential difference between C and A,

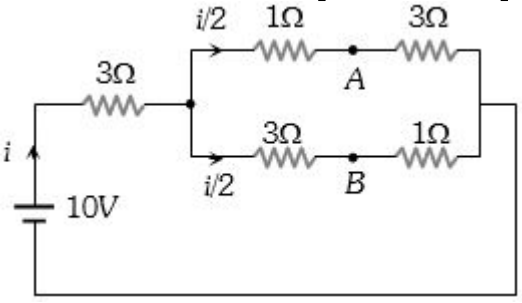
$V_C - V_A = 1\times1 = 1\ V$ .....(i)

Potential difference between C and B,

$V_C - V_B = 1\times3 = 3\ V$.....$(ii)$

On solving (i) and (ii) $V_A - V_B = 2\ volt$

Shot Trick : $(V_A - V_B) = \frac{i}{2}(R_2 - R_1) = \frac{2}{2}(3-1) = 2\,V$



14. Consider the combination of 2 capacitors C_1 and C_2, with $C_2 > C_1$, when connected in parallel, the equivalent capacitance is $\frac{15}{4}$ time the equivalent capacitance of the same connected in series. Calculate the ratio of capacitors, $\frac{C_2}{C_1}$

A) $\frac{15}{11}$ **B)** $\frac{111}{80}$
C) $\frac{29}{15}$ **D)** None of these

Solution : (Correct Answer: D)

When connected in parallel $C_{eq} = C_1 + C_2$

When in series

$C'_{eq} = \frac{C_1 C_2}{C_1 + C_2}$

$C_1 + C_2 = \frac{15}{4}\left(\frac{C_1 C_2}{C_1 + C_2}\right)$

$4\,(C_1 + C_2)^2 = 15 C_1 C_2$

$4{C_1}^2 + 4C_2^2 - 7C_1 C_2 = 0$

dividing by ${C_1}^2$

$4\left(\frac{C_2}{C_1}\right)^2 - \frac{7C_2}{C_1} + 4 = 0$

Let $\frac{C_2}{C_1} = x$

$4x^2 - 7x + 4 = 0$

$b^2 - 4ac = 49 - 64 < 0$

No solution exits981-s782

15. The radius of two metallic spheres A and B are r_1 and r_2 respectively $(r_1 > r_2)$. They are connected by a thin wire and the system is given a certain charge. The charge will be greater

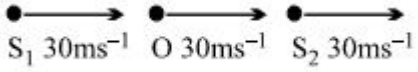
A) On the surface of the sphere B
B) On the surface of the sphere A
C) Equal on both
D) Zero on both

Solution : (Correct Answer: B)

(b) After connection of wire, potential becomes equal

$\frac{Q_1}{r_1} = \frac{Q_2}{r_2} \Longrightarrow \frac{Q_1}{Q_2} = \frac{r_1}{r_2}$ when $r_1 > r_2$, then $Q_1 > Q_2$

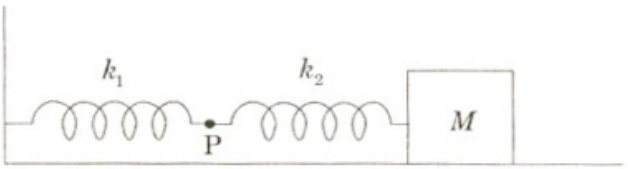
16. Consider two sound sources S_1 and s_2 having same frequency $100\ \ Hz$ and the observer O located between them as shown in the fig. All the three are moving with same velocity in same direction. The beat frequency of the observer is .... Hz



A) 50 **B)** 5 **C)** 0 **D)** 2.5

Solution : (Correct Answer: C)

17. The mass M shown in the figure oscillates in simple harmonic motion with amplitude A. The amplitude of the point P is



A) $\frac{k_1 A}{k_2}$ **B)** $\frac{k_2 A}{k_1}$
C) $\frac{k_1 A}{k_1 + k_2}$ **D)** $\frac{k_2 A}{k_1 + k_2}$

Solution : (Correct Answer: D)

$F = k_1 x_1$ and $F = k_2 x_2$

tehn $A = x_1 + x_2 = F\left(\frac{1}{k_1} + \frac{1}{k_2}\right)$

$F = \frac{k_1 k_2}{k_1 + k_2} A$

So the amplitude of the point is $x_1 = \frac{F}{k_1} = \frac{k_2}{k_1 + k_2} A$

18. Initially a gas of diatomic molecules is contained in a cylinder of volume V_1 at a pressure P_1 and temperature $250\ K$. Assuming that 25% of the molecules get dissociated causing a change in number of moles. The pressure of the resulting gas at temperature $2000\ K$, when contained in a volume $2V_1$ is given by P_2. The ratio $\frac{P_2}{P_1}$ is.

A) 5 **B)** 10 **C)** 13 **D)** 9

Solution : (Correct Answer: A)

$PV = nRT$

$P_1 V_1 = nR \times 250$

$P_2\,(2V_1) = \frac{5n}{4} R \times 2000$

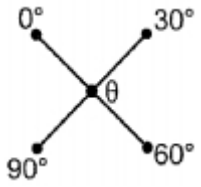
Divide

$\frac{P_1}{2P_2} = \frac{4 \times 250}{5 \times 2000}$

$\frac{P_1}{P_2} = \frac{1}{5}$

$\frac{P_2}{P_1} = 5$

19. Four rods of same material and having the same cross section and length have been joined, as shown. The temperature of the junction of four rods will be ..... $^{\circ}C$



A) 20 **B)** 30 **C)** 45 **D)** 60

Solution : (Correct Answer: C)

Incoming heat = outgoing heat

$(90^{\circ}-\theta)+(60^{\circ}-\theta)=\theta-30^{\circ}+\theta-0^{\circ}$

$180^{\circ}=4\theta$

$45^{\circ}C=\theta$

20. On heating a liquid of coefficient of cubical expansion γ in a container having coefficient of linear expansion $\gamma/3$, the level of liquid in the container will

A) Rise
B) Fall
C) Will remain almost stationary
D) It is difficult to say

Solution : (Correct Answer: C)

(c) As coefficient of cubical expansion of liquid equals coefficient of cubical expansion of vessel, the level of liquid will not change on heating.

21. $5\,g$ of ice at $0^{\circ}C$ is dropped in a beaker containing $20\,g$ of water at $40^{\circ}C$. The final temperature will be..... ^{o}C

A) 32 **B)** 16 **C)** 8 **D)** 24

Solution : (Correct Answer: B)

(b) For water and ice mixing $\theta_{\text{mix}}=\frac{m_W\theta_W-\frac{m_i L_i}{c_W}}{m_i+m_W}$

$=\frac{20\times40-\frac{5\times80}{1}}{5+20}=16^{\circ}C$

22. A capillary tube is immersed vertically in water and the height of the water column is x. When this arrangement is taken into a mine of depth d, the height of the water column is y. If R is the radius of earth, the ratio $\frac{x}{y}$ is

A) $\left(1-\frac{d}{R}\right)$ **B)** $\left(1-\frac{2d}{R}\right)$
C) $\left(\frac{R-d}{R+d}\right)$ **D)** $\left(\frac{R+d}{R-d}\right)$

Solution : (Correct Answer: A)

Acceleration due to gravity changes with the depth,

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

$pressure,\ P=\rho gh$

$Hence\ ratio,\ \frac{x}{y}\ is\ \left(1-\frac{d}{R}\right)$

23. A drop of water breaks into two droplets of equal size. In this process, which of the following statement is correct

A) The sum of temperature of the two droplets together is equal to the original temperature of the drop
B) The sum of masses of the two droplets is equal to the original mass of the drop
C) The sum of the radii of two droplets is equal to the radius of the original drop
D) The sum of the surface areas of the two droplets is equal to the surface area of the original drop

Solution : (Correct Answer: B)

When a drop of water breaks into two droplets, the total mass of the system remains the same, that is, sum of masses of the two droplets is equal to the mass of the original drop.

Hence $\rho\times\frac{4}{3}\pi R^3=2\times\rho\times\frac{4}{3}\pi r^3$

$\Rightarrow R=2^{1/3}r$

Hence the surface area is in the ratio $\frac{R^2}{r^2}=2^{2/3}$

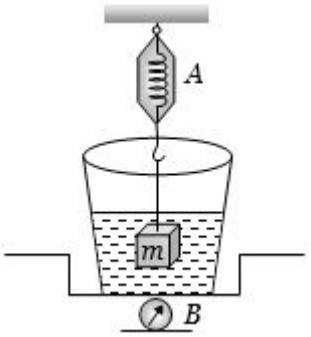
24. If the atmospheric pressure is P_a, then the pressure P at depth h below the surface of liquid of density ρ open to the atmosphere is

A) $p_a-\frac{\rho gh}{2}$ **B)** $p_a-\rho gh$
C) P_a **D)** $p_a+\rho gh$

Solution : (Correct Answer: D)

$P=P_a+\rho gh$

25. The spring balance A reads $2\ kg$ with a block m suspended from it. A balance B reads $5\ kg$ when a beaker filled with liquid is put on the pan of the balance. The two balances are now so arranged that the hanging mass is inside the liquid as shown in figure. In this situation



A) The balance A will read more than $2\,kg$
B) The balance B will read more than $5\,kg$
C) The balance A will read less than $2\,kg$ and B will read more than $5\,kg$
D) Both (b) and (c)

Solution : (Correct Answer: D)

Force of upthrust will be there on mass m shown in figure, so A weighs less than $2\,kg$. Balance will show sum of load of beaker and reaction of upthrust so it reads more than $5\,kg$.

26. In a wire of length L, the increase in its length is l. If the length is reduced to half, the increase in its length will be

A) l
B) $2l$
C) $\frac{l}{2}$
D) None of the above

Solution : (Correct Answer: C)

(c) $l \propto L$ i.e. if length is reduced to half then increase in length will be $\frac{l}{2}$.

27. In steel, the Young's modulus and the strain at the breaking point are $2 \times 10^{11}\ Nm^{-2}$ and 0.15 respectively. The stress at the breaking point for steel is therefore

A) $1.33 \times 10^{11}\,Nm^{-2}$
B) $1.33 \times 10^{12}\,Nm^{-2}$
C) $7.5 \times 10^{-13}\,Nm^{-2}$
D) $3 \times 10^{10}\,Nm^{-2}$

Solution : (Correct Answer: D)

(d) Breaking stress $=$ strain $\times$ Young's modulus

$= 0.15 \times 2{\times}^{11} = 3 \times 10^{10}\ Nm^{-2}$

28. $Assertion$: Space rocket are usually launched in the equatorial line from west to east

$Reason$: The acceleration due to gravity is minimum at the equator.

A) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
B) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
C) If the Assertion is correct but Reason is incorrect.
D) If both the Assertion and Reason are incorrect.

Solution : (Correct Answer: B)

Space rocket are usually launched from west to east to take the advantage of rotation of earth.

Also $g' = g - \omega^2 R \cos^2 \lambda$, at equator $\lambda = 0$, and so $\cos \lambda = 1$, and g' is least

29. In case of an orbiting satellite, if the radius of orbit is decreased

A) Its kinetic energy decreases
B) Its potential energy increases
C) Both (A) and (B) are correct
D) Both (A) and (B) are wrong

Solution : (Correct Answer: D)

$\mathrm{KE} = \frac{\mathrm{GMm}}{2\mathrm{r}}; \mathrm{PE} = -\frac{\mathrm{GMm}}{\mathrm{r}}; \mathrm{E} = -\frac{\mathrm{GMm}}{2\mathrm{r}}$

If r is decreased, K will increase, but PE and E will decrease

30. The densities of two solid spheres A and B of the same radii R vary with radial distance r as $\rho_A(r) = k\left(\frac{r}{R}\right)$ and $\rho_B(r) = k\left(\frac{r}{R}\right)^5$, respectively, where k is a constant. The moments of inertia of the individual spheres about axes passing through their centres are I_A and I_B, respectively. If $\frac{I_B}{I_A} = \frac{n}{10}$, the value of n is

A) 5
B) 6
C) 7
D) 8

Solution : (Correct Answer: B)

$I = \int \frac{2}{3}\rho 4\pi r^2 r^2 dr$

$I_A \propto \int (r)\left(r^2\right)\left(r^2\right) dr$

$I_B \propto \int \left(r^5\right)\left(r^2\right)\left(r^2\right) dr$

$\therefore \frac{I_B}{I_A} = \frac{6}{10}$

31. Two rotating bodies A and B of masses m and $2\ m$ with moments of inertia I_A and $I_B (I_B > I_A)$ have equal kinetic energy of rotation. If L_A and L_B be their angular momenta respectively, then

A) $L_B > L_A$
B) $L_A > L_B$
C) $L_A = \frac{L_B}{2}$
D) $L_A = 2L_B$

Solution : (Correct Answer: A)

Here, $m_A = m, m_B = 2m$

Both bodies A and B have equal kinetic energy of rotation

$k_A = k_B \Rightarrow \frac{1}{2} I_A \omega_A^2 = \frac{1}{2} I_B \omega_B^2$

$\Rightarrow \frac{\omega_A^2}{\omega_B^2} = \frac{I_B}{I_A} \ldots (i)$

Ratio of angular momenta,

$\frac{L_A}{L_B} = \frac{I_A \omega_A}{I_B \omega_B} = \frac{I_A}{I_B} \times \sqrt{\frac{I_B}{I_A}}$ ....(i)

$= \sqrt{\frac{I_A}{I_B}} < 1 (I_B > I_A$

$L_B > L_A$

32. KE acquired by a mass m in travelling a certain distance d, starting from rest, under the action of a constant force F is ....

A) Directly proportional to $\sqrt{m}$
B) Directly proportional to m
C) Directly proportional to $\frac{1}{m}$
D) None of these

Solution : (Correct Answer: D)

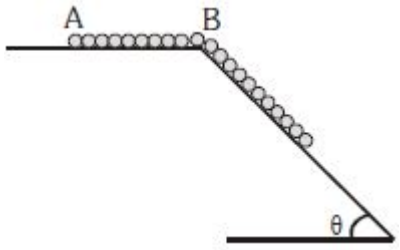
(d)

$F.d = \Delta K$

$F.d = K_f$

K is independent of mass here.

33. A chain of length L and mass m is placed upon a smooth surface. The length of BA is $L - b$. Calculate the velocity of the chain when its end reaches B.



A) $\sqrt{\frac{2g\sin\theta}{L}(L^2-b^2)}$

B) $2\sqrt{\frac{g\sin\theta}{L}(L^2-b^2)}$

C) $\sqrt{\frac{g\sin\theta}{L}(L^2-b^2)}$

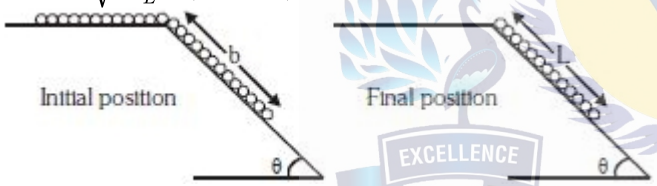
D) $\sqrt{\frac{g\sin\theta}{2L}(L^2-b^2)}$

Solution : (Correct Answer: C)

Loss in PE = gain in KE

$\Rightarrow \mathrm{mg}\left(\frac{\mathrm{L}}{2}\sin\theta\right) - \left(\frac{\mathrm{m}}{\mathrm{L}}\mathrm{b}\right)\mathrm{g}\left(\frac{\mathrm{b}}{2}\sin\theta\right) = \frac{1}{2}\mathrm{mv}^2$

$\Rightarrow v = \sqrt{\frac{g\sin\theta}{L}(L^2-b^2)}$



34. Maximum value of static friction is called

A) Limiting friction

B) Rolling friction

C) Normal reaction

D) Coefficient of friction

Solution : (Correct Answer: A)

(a) Let a heavy wooden box be placed on a hoor, it being pushed by a person. The static frictional force developed between the wooden box and floor balances the force applied in pushing the box. Iftwo persons try to push it the box does not move as the static frictional force increases in order to balance the force ofpushing it: If the pushing force is furce is further increased, at one stage, the static \&ic tional force reaches a maximum value at which it cannot increase any further. This maximum value of static frictional force is called limiting Eiction. If the applied force on the wooden box is more than limiting friction, then the box starts moving.

35. A mass is supported on a frictionless horizontal surface. It is attached to a string and rotates about a fixed centre at an angular velocity ω_0. If the length of the string and angular velocity are doubled, the tension in the string which was initially T_0 is now

A) T_0 B) $T_0/2$

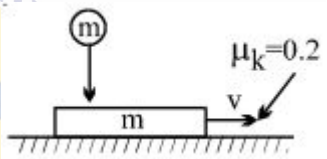
C) $4T_0$ D) $8T_0$

Solution : (Correct Answer: D)

(d) Tension in the string $T_0 = mR\omega_0^2$

In the second case $T = m(2R)(4\omega_0^2) = 8mR\omega_0^2 = 8T_0$

36. A ball of mass m falls vertically from a height h and collides with a block of equal mass m moving horizontally with a velocity v on a surface. The coefficient of kinetic friction between the block and the surface is 0.2, while the coefficient of restitution e between the ball and the block is 0.5. There is no friction acting between the ball and the block. The velocity of the block decreases by



A) 0 B) $0.1\sqrt{2gh}$

C) $0.3\sqrt{2gh}$ D) can't be said

Solution : (Correct Answer: D)

By using change in impulse formula $\Delta p = F\Delta t$

$= \frac{3}{2}m\sqrt{2gh}$

where as on black

$\mu F\Delta t = mv - mv^1$

$0.2 \times \frac{3}{2}\sqrt{2gh} \times m = m(v - v^1)$

$\therefore (v - v^1) = 0.3\sqrt{2gh}$

37. A body, under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of $1\ m/s^2$ The mass of this body must be

A) $15\,kg$ B) $20\,kg$

C) $10\sqrt{2}\,kg$ D) $2\sqrt{10}\,kg$

Solution : (Correct Answer: C)

$\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$

$\left|\vec{F}\right| = \sqrt{36+64+100} = \sqrt{200}N = 10\sqrt{2}\,N.$

$Acceleration,\ a = 1\,m/s^{-2}$

$\therefore\ Mass,\ M = \frac{10\sqrt{2}}{1} = 10\sqrt{2}kg.$

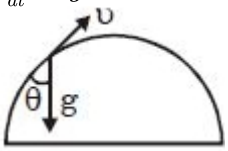
38. In projectile motion, the modulus of rate of change of velocity

A) is constant

B) first increases then decreases
C) first decreases then increases
D) None of the above

Solution : (Correct Answer: A)

$\frac{dv}{dt} = g =$ constant



39. A particle is moving on a circular path with constant speed, then its acceleration will be

A) Zero
B) External radial acceleration
C) Internal radial acceleration
D) Constant acceleration

Solution : (Correct Answer: C)

(c)In uniform circular motion, acceleration causes due to change in direction and is directed radially towards centre.

40. If a particle of mass m is moving with constant velocity v parallel to $X-$axis in $x-y$ plane as shown in fig. Its angular momentum with respect to origin at any time t will be

A) $mvb\,\hat{k}$ B) $-mvb\,\hat{k}$ C) $mvb\,\hat{i}$ D) $mv\,\hat{i}$

Solution : (Correct Answer: B)

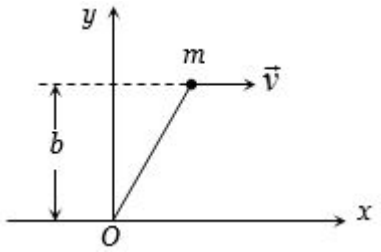
We know that, Angular momentum $\vec{L} = \vec{r} \times \vec{p}$ in terms of omponent becomes

$$\vec{L} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ x & y & z \\ p_x & p_y & p_z \end{vmatrix}$$

As motion is in x-y plane ($z = 0$ and $P_z = 0$), so $\vec{L} = \vec{k}\,(xp_y - yp_x)$

Here $x = vt, y = b, p_x = m\,v$ and $p_y = 0$

$\therefore \vec{L} = \vec{k}\,[vt \times 0 - b\,mv] = -mvb\,\hat{k}$



41. Three concurrent forces of the same magnitude are in equilibrium. What is the angle between the forces Also name the triangle formed by the forces as sides

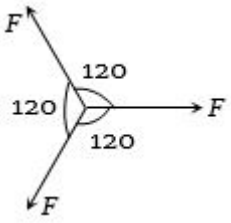
A) $120°$ equilateral triangle
B) $60°$ equilateral triangle
C) $120°, 30°, 30°$ an isosceles triangle
D) $120°$ an obtuse angled triangle

Solution : (Correct Answer: A)

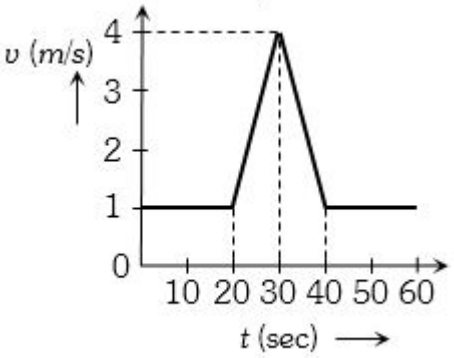
In N forces of equal magnitude works on a single point and their resultant is zero then angle between any two forces is given

$\theta = \frac{360}{N} = \frac{360}{3} = 120°$

If these three vectors are represented by three sides of triangle then they form equilateral triangle



42. Velocity-time $(v-t)$ graph for a moving object is shown in the figure. Total displacement of the object during the time interval when there is non-zero acceleration and retardation is.....m



A) 60 B) 50 C) 30 D) 40

Solution : (Correct Answer: B)

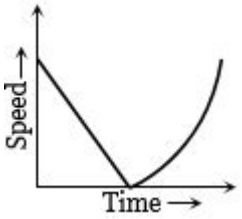
Between time interval $20\,sec$ to $40\,sec$, there is non-zero acceleration and retardation. Hence distance travelled during this interval

= Area between time interval $20\,sec$ to $40\,sec$

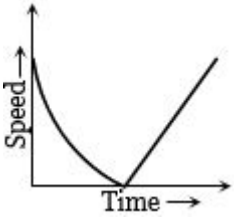
= $\frac{1}{2} \times 20 \times 3 + 20 \times 1 = 30 + 20 = 50\,m.$

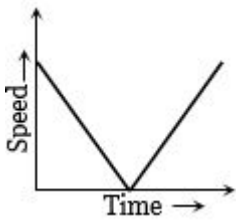
43. A ball is thrown vertically upwards. Which of the following plots represents the speed-time graph of the ball during its height if the air resistance is not ignored

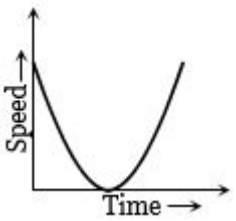
A)



B)



C) 

D) 

Solution : (Correct Answer: C)

For upward motion

Effective acceleration $= -(g + a)$

and for downward motion

Effective acceleration $= (g - a)$

But both are constants. So the slope of speed-time graph will be constant.

44. If time (t), velocity (u), and angular momentum (I) are taken as the fundamental units. Then the dimension of mass (m) in terms of t, u and I is

A) $[t^{-1}u^{-2}I^{1}]$
B) $[t^{1}u^{2}I^{-1}]$
C) $[t^{-2}u^{-1}I^{1}]$
D) $[t^{-1}u^{1}I^{-2}]$

Solution : (Correct Answer: A)

$m \propto t^a v^b \ell^c$

$m \propto [T]^a [LT^{-1}]^b [ML^2T^{-1}]^c$

$M^1L^0T^0 = M^c L^{b+2c} T^{a-b-c}$

comparing powers

$v = 1, b = -2, a = -1$

$m \propto t^{-1}v^{-2}\ell^1$

45. A body travels uniformly a distance of $(13.8 \pm 0.2)m$ in a time $(4.0 \pm 0.3)s$. Its velocity with error limits and percentage error is

A) $(4.0 \pm 0.31), \pm 8\%$ **B)** $(3.5 \pm 0.31), \pm 9\%$
C) $(5.0 \pm 0.37), \pm 9\%$ **D)** $(3.8 \pm 0.34), \pm 7\%$

Solution : (Correct Answer: B)

$s = (13.8 \pm 0.2)m$

$t = (4.0 \pm 0.3)s$

$V = \frac{s}{t} = \frac{13.8}{4.0} = 3.45\ ms^{-1} = 3.5\ ms^{-1}$

$\frac{\Delta v}{v} = \pm \left(\frac{\Delta s}{s} + \frac{\Delta t}{t}\right) = \pm \left(\frac{0.2}{13.8} + \frac{0.3}{4.0}\right)$

$= \pm \left(\frac{0.8 + 4.14}{13.8 \times 4.0}\right) = \pm \frac{4.49}{13.8 \times 4.0} = \pm 0.0895$

$\Delta v = \pm 0.0895 \times v = \pm 0.0895 \times 3.45 = \pm 0.3087 = \pm 0.31$

$v = (3.5 \pm 0.31)\ ms^{-1}$

$\frac{\Delta v}{v} \times 100 = \pm 0.0895 \times 100 = \pm 8.95\% = \pm 9\%$

Chemistry

46. When hemiacetals react with one more molecule of alcohol, what type of compound is formed?

A) Alkoxyalcohol **B)** Hemiacetal **C)** Acetal **D)** Ketal

Solution : (Correct Answer: C)

When hemiacetals react with one more molecule of alcohol, they form acetals.

47. What is the electrical conductivity of low-density polythene (LDP)?

A) Good conductor of electricity
B) Excellent conductor of electricity
C) Poor conductor of electricity
D) Non-conductor of electricity

Solution : (Correct Answer: C)

Low-density polythene (LDP) is a poor conductor of electricity.

48. How is the configuration of a compound related to the letters 'D' and 'L'?

A) It indicates the optical activity of the compound.
B) It specifies the number of asymmetric carbon atoms.
C) It refers to the relative configuration compared to glyceraldehyde.
D) It denotes the absolute configuration of the compound.

Solution : (Correct Answer: C)

'D' and 'L' indicate the relative configuration of a compound compared to a known compound, glyceraldehyde.

49. What is a common use of the reaction of primary aliphatic amines with nitrous acid?

A) Formation of diazonium salts
B) Synthesis of aromatic compounds
C) Estimation of amino acids and proteins
D) Production of alcohols

Solution : (Correct Answer: C)

The quantitative evolution of nitrogen gas in the reaction of primary aliphatic amines with nitrous acid is used in the estimation of amino acids and proteins.

50. What is the product formed when a primary alcohol is oxidised using PCC (pyridinium chlorochromate)?

A) Carboxylic acid **B)** Ketone
C) Aldehyde **D)** Alkene

Solution : (Correct Answer: C)

When a primary alcohol is oxidised using PCC, it typically forms an aldehyde.

51. What is the result of β-elimination?

A) Formation of a halogen atom
B) Formation of an alkene
C) Formation of an alkane
D) Formation of a hydrogen atom

Solution : (Correct Answer: C)
Chelate ligands have a higher denticity due to their ability to use multiple donor atoms.

52. In a coordination compound, what is collectively termed the coordination sphere?

A) The central atom/ion and the ligands attached to it
B) The ionisable groups
C) The counter ions
D) The central atom/ion alone

Solution : (Correct Answer: A)
The coordination sphere in a coordination compound includes the central atom/ion and the ligands attached to it.

53. What is the color of Ni2+ when it is in the 3d8 state?

A) Green **B)** Blue **C)** Pink **D)** Yellow

Solution : (Correct Answer: A)
Ni2+ in the 3d8 state is green.

54. Which halogen is known for its blue-violet color?

A) Chlorine **B)** Fluorine **C)** Bromine **D)** Iodine

Solution : (Correct Answer: D)
Iodine is known for its blue-violet color.**

55. Why are only p-orbital electrons involved in bonding for some elements in the group 13?

A) Due to their high ionization enthalpies
B) Due to the poor shielding effect of intervening d and f orbitals
C) Due to their low melting points
D) Due to their low electronegativity

Solution : (Correct Answer: B)
Down the group, due to poor shielding effect of intervening d and f orbitals, the increased effective nuclear charge holds ns electrons tightly (responsible for inert pair effect) and thereby, restricting their participation in bonding. As a result of this, only p-orbital electron may be involved in bonding.

56. Which compound leads to the formation of blister copper?

A) FeO **B)** SO_2 **C)** Cu_2O **D)** Cu_2S

Solution : (Correct Answer: B)
The evolution of SO_2 during the process results in the blistered appearance, giving rise to blister copper.

57. What is the role of surface particles in adsorption?

A) They possess balanced forces.
B) They possess unbalanced or residual attractive forces.
C) They lack attractive forces.
D) They are surrounded by atoms or molecules of their kind.

Solution : (Correct Answer: B)
The paragraph states that on the surface, particles possess unbalanced or residual attractive forces.

58. What does the peak of the curve in the kinetic energy distribution represent?

A) The minimum kinetic energy
B) The maximum kinetic energy
C) The average kinetic energy
D) The total kinetic energy

Solution : (Correct Answer: B)
The peak of the curve corresponds to the most probable kinetic energy, which is the kinetic energy of the maximum fraction of molecules.

59. What does the standard electrode potential of lithium metal indicate about its reactivity?

A) It is highly reducing.
B) It is ly reducing.
C) It is ly oxidizing
D) It is highly oxidizing.

Solution : (Correct Answer: A)
Lithium has the lowest electrode potential indicating that lithium ion is the weakest oxidising agent while lithium metal is the most powerful reducing agent in an aqueous solution.

60. What are two solutions with the same osmotic pressure at a given temperature called?

A) Hypertonic solutions
B) Hypotonic solutions
C) Isotonic solutions
D) Normal saline solutions

Solution : (Correct Answer: C)
The paragraph states that two solutions with the same osmotic pressure at a given temperature are called isotonic solutions.

61. Which of the following substances is an example of a diamagnetic material?

A) Iron (Fe) B) Oxygen (O_2)
C) Water (H_2O) D) Copper (Cu)

Solution : (Correct Answer: C)

Water (H_2O) is an example of a diamagnetic substance.

62. What is the primary reason for the differences in properties between crystalline and amorphous solids?

A) Their color
B) Their mass
C) The arrangement of constituent particles
D) Their density

Solution : (Correct Answer: C)

The primary reason for the differences in properties between crystalline and amorphous solids is the arrangement of their constituent particles, as mentioned in the paragraph.

63. What are the primary sources of water pollution?

A) Industrial and municipal discharge pipes
B) Agricultural runoff and storm-water drainage
C) Acid rain and pollution-free sources
D) Non-point sources and point sources

Solution : (Correct Answer: A)

The primary sources of water pollution are industrial and municipal discharge pipes, which are examples of point source pollution.

64. Atmospheric pollution is generally studied in which two layers?

A) Troposphere and Mesosphere
B) Stratosphere and Thermosphere
C) Troposphere and Stratosphere
D) Mesosphere and Thermosphere

Solution : (Correct Answer: C)

Atmospheric pollution is primarily studied in the troposphere and stratosphere.

65. Which halogenation reaction is typically not used for practical synthesis due to its low reactivity?

A) Chlorination B) Bromination
C) Iodination D) Fluorination

Solution : (Correct Answer: C)

Iodination is not commonly used for practical synthesis due to its low reactivity compared to other halogenation reactions.

66. What is the order of reactivity of halogens towards alkanes?

A) $F_2 > Cl_2 > Br_2 > I_2$
B) $I_2 > Br_2 > Cl_2 > F_2$
C) $Cl_2 > F_2 > Br_2 > I_2$
D) $Br2 > I_2 > Cl_2 > F_2$

Solution : (Correct Answer: A)

The reactivity of halogens towards alkanes follows the order: Fluorine (F_2) > Chlorine (Cl_2) > Bromine (Br_2) > Iodine (I_2).

67. What does the solvent used in paper chromatography rise up due to in the paper strip?

A) Capillary action B) Boiling point
C) Gravity D) Magnetic force

Solution : (Correct Answer: A)

The solvent used in paper chromatography rises up the paper strip due to capillary action.

68. What is the name for benzene when it is considered as a substituent?

A) Phenyl B) Benzyl C) Benzoyl D) Phenol

Solution : (Correct Answer: A)

The paragraph states that the name for benzene as a substituent is phenyl (C_6H_5-).

69. What is the primary color observed in solutions of alkaline earth metals in liquid ammonia?

A) Red B) Blue C) Yellow D) Green

Solution : (Correct Answer: B)

The primary color observed in solutions of alkaline earth metals in liquid ammonia is blue, which may appear deep blue-black.

70. What happens to the paramagnetic nature of alkali metal solutions in liquid ammonia when they stand for some time?

A) It remains paramagnetic.
B) It becomes diamagnetic.
C) It becomes non-magnetic.
D) It becomes ferromagnetic.

Solution : (Correct Answer: B)

Paramagnetic alkali metal solutions in liquid ammonia become diamagnetic when they stand for some time.

71. What is the result of treating hard water with washing soda?

A) The water becomes acidic.
B) The hardness of the water increases.
C) The water becomes soft.
D) The water becomes more saline.

Solution : (Correct Answer: C)

Treating hard water with washing soda results in the removal of permanent hardness, making the water soft.

72. What is the name of the mixture of CO and H_2 produced by the reaction of steam on hydrocarbons or coke at high temperatures?

A) Carbon gas **B)** Hydrocarbon gas
C) Synthesis gas (syngas) **D)** Methane gas

Solution : (Correct Answer: C)

The mixture of CO and H_2 produced by the reaction of steam on hydrocarbons or coke at high temperatures is called synthesis gas (syngas).

73. Which substance oxidizes the indicator diphenylamine to produce an intense blue color in titrations?

A) Mn2+ **B)** Fe3+ **C)** MnO4- **D)** Cr_2O_72-

Solution : (Correct Answer: D)

Cr_2O_72- oxidizes the indicator diphenylamine to produce an intense blue color.

74. What is the reducing agent in the given reaction, 2 Na (s) + H_2 (g) → 2 NaH (s)?

A) NaH **B)** H_2 **C)** Na **D)** None of the above

Solution : (Correct Answer: C)

In the given reaction, sodium (Na) is oxidized from its elemental form (Na) to form sodium ions (Na^+). The substance that undergoes oxidation is the reducing agent, so sodium (Na) is the reducing agent in this reaction.

75. How does water's dielectric constant affect the electrostatic interactions between ions in a substance like sodium chloride?

A) It has no effect on electrostatic interactions.
B) It increases the electrostatic interactions.
C) It decreases the electrostatic interactions.
D) It facilitates the ions to move freely in the solution.

Solution : (Correct Answer: D)

The paragraph explains that water, with its high dielectric constant, facilitates the ions in substances like sodium chloride to move freely in the solution by reducing electrostatic interactions.

76. What is the defining characteristic of an acid in the Lewis concept?

A) It donates an electron pair.
B) It accepts an electron pair.
C) It provides a proton.
D) It provides a hydroxide ion.

Solution : (Correct Answer: B)

In the Lewis concept, an acid is defined as a species that accepts an electron pair.

77. What is the key role of a catalyst in a chemical reaction?

A) To change the reactants into products
B) To increase the equilibrium constant
C) To decrease the activation energy for the reverse reaction
D) To provide a new low energy pathway for the reaction

Solution : (Correct Answer: D)

The primary role of a catalyst is to make available a new low energy pathway for the conversion of reactants to products, as mentioned in the paragraph.

78. At what temperature and pressure are ice and water in equilibrium?

A) 0°C and atmospheric pressure
B) 100°C and atmospheric pressure
C) 273 K and atmospheric pressure
D) 0 K and vacuum conditions

Solution : (Correct Answer: C)

Ice and water are in equilibrium at 273 K and atmospheric pressure.

79. What is the enthalpy change for the ionization of sodium atoms (Na) to form sodium ions (Na+), given the equation: Na(g) → Na+(g) + e–; Δ_iH = 496 kJ mol–1?

A) –496 kJ mol–1 **B)** +496 kJ mol–1
C) +108.4 kJ mol–1 **D)** –108.4 kJ mol–1

Solution : (Correct Answer: B)

The enthalpy change for the ionization of sodium atoms to form sodium ions is +496 kJ mol–1, as indicated by the given equation.

80. In an exothermic reaction, how does ΔH relate to the surroundings?

A) ΔH absorbs heat from the surroundings.
B) ΔH releases heat to the surroundings.
C) ΔH remains constant with the surroundings.
D) ΔH is unrelated to the surroundings.

Solution : (Correct Answer: B)

In an exothermic reaction, ΔH is negative, indicating that heat is released from the system to

the surroundings, making option B the correct choice.

81. Under normal conditions, how do the densities of liquids compare to gases?

A) Liquids are less dense than gases.
B) Liquids are denser than gases.
C) Liquids and gases have the same density.
D) The densities of liquids and gases vary widely.

Solution : (Correct Answer: B)
Under normal conditions, liquids are denser than gases.

82. In 1811, which scientist attempted to combine the conclusions of Dalton's atomic theory and Gay Lussac's law of combining volumes to propose a new law?

A) Robert Boyle B) Charles
C) Amedeo Avogadro D) Joseph Gay Lussac

Solution : (Correct Answer: C)
In 1811, the Italian scientist Amedeo Avogadro tried to combine Dalton's atomic theory and Gay Lussac's law to propose a new law, which is now known as Avogadro's law.

83. What does the ψ_{MO} represent in the equation $\psi MO = \psi_A + \psi_B$?

A) A mathematical constant
B) Molecular orbitals
C) The Schrödinger wave equation
D) The linear combination of atomic orbitals

Solution : (Correct Answer: B)
In the equation $\psi_{MO} = \psi_A + \psi_B$, ψ_{MO} represents molecular orbitals formed bythe linear combination of atomic orbitals.

84. What is the general principle for selecting the lowest energy Lewis structure?

A) The one with the largest formal charges on the atoms.
B) The one with the smallest formal charges on the atoms.
C) The one with the most atoms.
D) The one with the fewest lone pairs.

Solution : (Correct Answer: B)
Generally, the lowest energy structure is the one with the smallest formal charges on the atoms.

85. Which elements are bordering the line and running diagonally across the Periodic Table?

A) Sodium, potassium, and calcium
B) Silicon, germanium, arsenic, antimony, and tellurium
C) Oxygen, nitrogen, and fluorine
D) Iron, nickel, and cobalt

Solution : (Correct Answer: B)
silicon, germanium, arsenic, antimony, and tellurium as elements bordering the line and running diagonally across the Periodic Table.

86. What is the maximum covalency of the first member of each group?

A) 2 B) 4 C) 6 D) 9

Solution : (Correct Answer: B)
The maximum covalency of the first member of each group is 4.

87. How many p orbitals are there in a given subshell?

A) One B) Two C) Three D) Four

Solution : (Correct Answer: C)
In a given subshell, there are three p orbitals, designated as $2p_x$, $2p_y$, and $2p_z$, with mutually perpendicular axes.

88. How many subshells are there in the third principal shell (n = 3)?

A) One B) Two C) Three D) Four

Solution : (Correct Answer: C)
In the third principal shell (n = 3), there are three sub-shells corresponding to the values of l (azimuthal quantum number) 0, 1, and 2.

89. Why is it necessary to consider the existence of isotopes and their relative abundances when calculating the average atomic mass of an element?

A) To determine the most common isotope
B) To identify the heaviest isotope
C) To account for variations in atomic mass within the element
D) To simplify the calculation process

Solution : (Correct Answer: C)
Considering the existence of isotopes and their relative abundances is necessary to calculate the average atomic mass of an element, as it accounts for variations in atomic mass within the element.

90. What did Antoine Lavoisier conclude from his experimental studies of combustion reactions?

A) Matter can be created but not destroyed
B) There is a net change in mass during chemical changes
C) Matter can neither be created nor destroyed

D) Mass changes in all physical changes but not in chemical changes

Solution : (Correct Answer: C)

Antoine Lavoisier concluded that matter can neither be created nor destroyed based on his studies of combustion reactions.

Biology - (Zoology)

91. What is the function of a mammal's external ears or pinnae?

A) To produce milk
B) To hear
C) To see
D) To swim

Solution : (Correct Answer: B)

External ears or pinnae in mammals are used for hearing, not for producing milk, seeing or swimming.

92. How do amphibians respire?

A) By lungs only
B) By gills only
C) Through skin only
D) By gills, lungs and through skin

Solution : (Correct Answer: D)

Amphibians have the ability to respire through gills, lungs and through skin.

93. What are the paired appendages of Vertebrates?

A) Fins
B) Limbs
C) Both A) and B)
D) None of the above

Solution : (Correct Answer: C)

Vertebrates have paired appendages which may be fins or limbs, Fish have fins and Tetrapods have limbs.

94. What is the level of organization in cnidarians?

A) Cellular
B) Tissue
C) Organ
D) None of the above

Solution : (Correct Answer: B)

Cnidarians exhibit tissue level of organization and are diploblastic.

95. What is the effect of Bacillus thuringiensis on insect larvae?

A) It leaves them unharmed
B) It enhances their growth
C) It makes them more resistant to attack
D) It kills them

Solution : (Correct Answer: D)

When Bacillus thuringiensis is eaten by insect larvae, the toxin is released in their gut and kills them.

96. These microbes consume the major part of the organic matter in the effluent, significantly reducing the BOD of the effluent.
What is the BOD test?

A) A measure of the rate of uptake of oxygen by micro-organisms in a sample of water
B) A measure of the organic matter present in the water
C) A measure of the pollution potential of waste water
D) A measure of the physical removal of particles

Solution : (Correct Answer: A)

The BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water and, thus, indirectly, BOD is a measure of the organic matter present in the water.

97. What was the first antibiotic discovered?

A) Penicillin
B) Streptomycin
C) Tetracycline
D) Erythromycin

Solution : (Correct Answer: A)

Penicillin was the first antibiotic to be discovered.

98. What type of immunity is responsible for the rejection of grafts?

A) Humoral immunity
B) Cell-mediated immunity
C) Active immunity
D) Passive immunity

Solution : (Correct Answer: B)

The body is able to differentiate 'self' and 'nonself' and the cell-mediated immune response is responsible for the rejection of grafts.

99. What do certain sportspersons misuse to enhance their performance?

A) Narcotic analgesics, anabolic steroids, diuretics and certain hormones
B) Infected blood
C) Sexual contact
D) Sharing of infected needles and syringes

Solution : (Correct Answer: A)

Certain sportspersons (mis)use narcotic analgesics, anabolic steroids, diuretics and certain hormones in sports to increase muscle strength and bulk and to promote aggressiveness and as a result increase athletic performance.

100. What is the life cycle of Plasmodium dependent on?

A) One host - human
B) One host - mosquitoes

C) Two hosts - human and mosquitoes
D) None of the above

Solution : (Correct Answer: C)

The life cycle of Plasmodium is dependent on two hosts - human and mosquitoes.

101. What did the first mammals resemble?

A) Shrews B) Fish C) Birds D) Reptiles

Solution : (Correct Answer: A)

The first mammals were like shrews and their fossils are small sized.

102. What is the term used to describe similarities in the structure of different animals that indicate a common ancestor?

A) Convergent evolution
B) Divergent evolution
C) Adaptive evolution
D) Homology

Solution : (Correct Answer: D)

Homology refers to similarities in the structure of different animals that indicate a common ancestor.

103. What is the main focus of the study of Evolutionary Biology?

A) The evolution of the earth
B) The evolution of the stars
C) The evolution of the universe
D) The history of life forms on earth

Solution : (Correct Answer: D)

Evolutionary Biology is the study of the history of life forms on earth.

104. What is a recessive allele?

A) An allele that is modified and produces no enzyme
B) An allele that produces the same phenotype as the unmodified allele
C) An allele that produces a non:functional enzyme
D) Both A) and C)

Solution : (Correct Answer: D)

A recessive allele can be one that produces a non:functional enzyme or produces no enzyme at all, resulting in a non:expressed phenotype.

105. Thalassemia can be classified according to which chain of the haemoglobin molecule is affected. Which of the following is not a type of Thalassemia?

A) α Thalassemia B) β Thalassemia
C) δ Thalassemia D) γ Thalassemia

Solution : (Correct Answer: C)

Thalassemia can be classified according to which chain of the haemoglobin molecule is affecteD) α Thalassemia and β Thalassemia are two common types of Thalassemia. δ Thalassemia and γ Thalassemia are not types of Thalassemia.

106. Which of the following genotypic symbols represents dominant yellow seed colour?

A) R B) r C) Y D) y

Solution : (Correct Answer: C)

The genotypic symbol Y represents dominant yellow seed colour.

107. What is the function of cervical caps, diaphragms and vaults in barrier methods of contraception?

A) To block the entry of sperms
B) To increase contraceptive efficiency
C) To protect the user from contracting STIs and AIDS
D) To cover the male penis

Solution : (Correct Answer: A)

The cervical caps, diaphragms, and vaults are made of rubber and are inserted into the female reproductive tract to cover the cervix during coitus. They prevent conception by blocking the entry of sperms through the cervix.

108. What is the role of ART in assisting infertile couples to have children?

A) Correction of disorders
B) Special techniques
C) Both A and B
D) None of the above

Solution : (Correct Answer: B)

Where correction of infertility disorders is not possible, couples could be assisted to have children through certain special techniques commonly known as assisted reproductive technologies (ART).

109. What is amniocentesis used for in the medical field?

A) To determine the survivability of the foetus
B) To detect the presence of certain genetic disorders
C) To check for the sex of the foetus
D) To test for maternal diseases

Solution : (Correct Answer: B)

Amniocentesis is used to analyse the fetal cells and dissolved substances in the amniotic fluid of the developing foetus. The procedure is used to test for the presence of certain genetic disorders such as, down syndrome, haemoplilia, sickle:cell anemia,

etC) and to determine the survivability of the foetus.

110. Can the hymen be torn during activities like horseback riding, cycling, etc ?

A) No **B)** Sometimes **C)** Rarely **D)** Yes

Solution : (Correct Answer: D)

The hymen can be torn by a sudden fall or jolt, insertion of a vaginal tampon, and active participation in some sports like horseback riding, cycling, etc.

111. What is the purpose of the zona pellucida formed around the secondary oocyte?

A) To protect the secondary oocyte
B) To facilitate fertilization
C) To facilitate meiosis
D) None of the above

Solution : (Correct Answer: B)

The secondary oocyte forms a new membrane called zona pellucida surrounding it, which helps in the process of fertilization.

112. What are the regions in the testis that contain immunologically competent cells?

A) Interstitial spaces
B) Seminiferous tubules
C) Testicular lobules
D) Olfactory epithelium

Solution : (Correct Answer: A)

The regions in the testis that contain immunologically competent cells are Interstitial spaces.

113. What is the purpose of a synaptic cleft?

A) To separate pre- and post-synaptic neurons
B) To increase the efficiency of impulse transmission
C) To regulate the release of neurotransmitters
D) To allow for direct current flow between neurons

Solution : (Correct Answer: A)

A synaptic cleft separates the membranes of pre- and post-synaptic neurons, allowing for the transmission of a nerve impulse from one neuron to another.

114. What is the function of the limbic system in the brain?

A) Involved in the regulation of sexual behavior
B) Expression of emotional reactions
C) Controls body temperature, urge for eating and drinking
D) All of the above

Solution : (Correct Answer: D)

The limbic system, along with the hypothalamus, is involved in the regulation of sexual behavior, expression of emotional reactions, and motivation.

115. What is the difference between myelinated and nonmyelinated nerve fibres?

A) Myelinated nerve fibres have a myelin sheath while nonmyelinated do not
B) Nonmyelinated nerve fibres have a myelin sheath while myelinated do not
C) Both myelinated and nonmyelinated nerve fibres have a myelin sheath
D) Both myelinated and nonmyelinated nerve fibres do not have a myelin sheath

Solution : (Correct Answer: A)

Myelinated nerve fibres are enveloped with Schwann cells, which form a myelin sheath around the axon. Nonmyelinated nerve fibres are enclosed by a Schwann cell that does not form a myelin sheath around the axon.

116. What is involved in the amoeboid movement of cells in the human body?

A) Pseudopodia **B)** Microfilaments
C) Both A) and B) **D)** None of the above

Solution : (Correct Answer: C)

The amoeboid movement of cells in the human body is affected by pseudopodia formed by the streaming of protoplasm and cytoskeletal elements like microfilaments are also involved in this movement.

117. How many bones are present in the wrist?

A) 5 **B)** 6 **C)** 7 **D)** 8

Solution : (Correct Answer: D)

There are 8 wrist bones (carpals) in the human body.

118. What is the mechanism of muscle contraction?

A) Sliding filament theory
B) Contraction by release of neurotransmitter
C) Binding of calcium ions to troponin
D) Shortening of the sarcomere

Solution : (Correct Answer: A)

The mechanism of muscle contraction is best explained by the sliding filament theory, which states that contraction of a muscle fiber takes place by the sliding of the thin filaments over the thick filaments.

119. What is the function of tropomyosin in the actin filament?

A) To activate the binding sites for myosin on actin filaments
B) To mask the active binding sites for myosin on actin filaments
C) To run close to the "F" actins throughout its length
D) To regulate the interaction between "F" actins and troponin

Solution : (Correct Answer: C)

Two filaments of tropomyosin run close to the "F" actins throughout its length.

120. What is the function of juxta glomerular apparatus (JGA)?

A) To regulate the glomerular blood flow
B) To release renin
C) To stimulate the glomerular filtration rate
D) All of the above

Solution : (Correct Answer: D)

JGA has a built-in mechanism for regulation of GFR. It can release renin in response to a fall in GFR, which can stimulate the glomerular blood flow and the GFR back to normal.

121. What is the process by which the kidneys regulate glomerular filtration rate?

A) reabsorption
B) ultrafiltration
C) juxta glomerular apparatus (JGA)
D) secretion

Solution : (Correct Answer: C)

The kidneys have built-in mechanisms for the regulation of glomerular filtration rate.

122. What is Bowman's capsule?

A) A Malpighian corpuscle
B) A distal convoluted tubule
C) A double walled capsule enclosing the glomerulus
D) Henle's loop

Solution : (Correct Answer: C)

The Bowman's capsule is a double walled capsule enclosing the glomerulus to form Malpighian or renal corpuscle.

123. How is ammonia produced from metabolism excreted from ureotelic animals?

A) Directly through the skin
B) As uric acid in the form of pellet or paste
C) Through the kidneys after conversion into urea in the liver
D) As solid waste

Solution : (Correct Answer: C)

Ammonia produced by metabolism is converted into urea in the liver and excreted through the kidneys.

124. How are human blood grouped based on surface antigens on RBCs?

A) By the presence or absence of antigen A
B) By the presence or absence of antigen B
C) By the presence or absence of antigen A and B
D) By the presence or absence of Rh factor

Solution : (Correct Answer: C)

Human blood is grouped into A, B, AB and O systems based on the presence or absence of two surface antigens, A, B on the RBCs.

125. What type of valve guards the opening between the left atrium and left ventricle in the human heart?

A) Bicuspid valve **B)** Tricuspid valve
C) Septal valve **D)** Aortic valve

Solution : (Correct Answer: A)

The opening between the left atrium and the left ventricle in the human heart is guarded by a bicuspid or mitral valve.

126. What is the thin, muscular wall called that separates the right and left atria in the human heart?

A) Inter-atrial membrane
B) Inter-ventricular septum
C) Atrio-ventricular septum
D) Cardiac wall

Solution : (Correct Answer: A)

The thin, muscular wall that separates the right and left atria in the human heart is called the inter-atrial septum.

127. What initiates the mechanism of coagulation?

A) Platelets **B)** Tissues
C) Thrombin **D)** Calcium ions

Solution : (Correct Answer: A)

An injury or trauma stimulates the platelets in the blood to release certain factors which activate the mechanism of coagulation.

128. What is the effect of the contraction of diaphragm on the thoracic chamber?

A) It decreases the volume of the thoracic chamber

B) It increases the volume of the thoracic chamber
C) It has no effect on the volume of the thoracic chamber
D) It increases the pressure in the thoracic chamber

Solution : (Correct Answer: B)

The contraction of the diaphragm increases the volume of the thoracic chamber in the antero-posterior axis.

129. What is oxyhaemoglobin?

A) A dissolved form of oxygen
B) A form of O_2 that is bound with haemoglobin in a reversible manner
C) A form of CO_2 that is bound with haemoglobin in a reversible manner
D) A dissolved form of CO_2

Solution : (Correct Answer: B)

Oxyhaemoglobin is a form of O_2 that is bound with haemoglobin in a reversible manner.

130. What is represented by pO_2?

A) Pressure of CO_2 B) Pressure of O_2
C) Pressure of N_2 D) Pressure of He

Solution : (Correct Answer: B)

The pressure contributed by an individual gas in a mixture of gases is called partial pressure and is represented as pO_2 for oxygen.

131. What type of respiratory system do mammals have?

A) Simple diffusion system over their entire body surface
B) A network of tubes
C) Gills
D) A well-developed respiratory system

Solution : (Correct Answer: D)

Mammals have a well-developed respiratory system, which includes lungs and other respiratory structures.

132. What is the general colour of the dorsal side of a frog's body?

A) Olive green B) Bright yellow C) Brown D) Black

Solution : (Correct Answer: A)

The dorsal side of a frog's body is generally olive green with dark irregular spots.

133. What is the main function of the sensory papillae in a frog?

A) Hearing B) Smelling C) Touching D) Tasting

Solution : (Correct Answer: C)

The sensory papillae in a frog are organs of touch, which allow the frog to sense its environment through its skin.

134. What is the main function of the excretory system in frogs?

A) To produce eggs or sperm
B) To eliminate nitrogenous wastes
C) To digest food
D) To circulate oxygen throughout the body

Solution : (Correct Answer: B)

The excretory system in frogs is responsible for removing nitrogenous wastes, such as urea, from the body.

135. What are the three types of blood cells found in frogs?

A) RBCs, WBCs, and platelets
B) Haemoglobin, leucocytes, and platelets
C) Erythrocytes, lymphocytes, and thrombocytes
D) Haemoglobin, erythrocytes, and leukocytes

Solution : (Correct Answer: A)

The blood cells in frogs are RBC (red blood cells) or erythrocytes, (white blood cells) or leukocytes and platelets.

Biology - (Botany)

136. What is the main source of fascination for humans regarding the diversity of life on Earth?

A) The number of species
B) The variety of organisms
C) The study of evolution
D) The habitats of each species

Solution : (Correct Answer: B)

The rich variety of living organisms on Earth never ceases to amaze and fascinate humans.

137. What is the name given to the four major causes of biodiversity loss?

A) The Good Quartet
B) The Evil Quartet
C) The Neutral Quartet
D) The Beneficent Quartet

Solution : (Correct Answer: B)

The four major causes of biodiversity loss are referred to as the "Evil Quartet".

138. What is the purpose of expressing the biomass of a species in terms of fresh or dry weight?

A) To compare the biomass of different species

B) To compare the biomass of the same species in different areas
C) To compare the biomass of the same species at different times
D) All of the above

Solution : (Correct Answer: D)

The biomass of a species is expressed in terms of fresh or dry weight to compare the biomass of different species, the same species in different areas, or the same species at different times.

139. What is the energy used for in various energy-requiring processes of the organisms?

A) The energy released by oxidation in respiration
B) The carbon skeleton produced during respiration
C) The energy trapped in ATP
D) The energy contained in respiratory substrates

Solution : (Correct Answer: C)

The energy trapped in ATP is used in various energy-requiring processes of the organisms.

140. What is the best way to describe the outcome of interspecific interactions?

A) Beneficial interaction
B) Detrimental interaction
C) Neutral interaction
D) All of the above

Solution : (Correct Answer: D)

Interspecific interactions could be beneficial, detrimental or neutral to one of the species or both.

141. What is the intrinsic rate of natural increase (r) in the logistic growth model?

A) The maximum number of individuals that a habitat can support
B) The maximum number of births per capita
C) The maximum number of deaths per capita
D) The per capita increase or decrease in the population density during a unit time period

Solution : (Correct Answer: D)

The intrinsic rate of natural increase (r) in the logistic growth model is the per capita increase or decrease in the population density during a unit time perioD) This parameter is used to assess the impact of biotic or abiotic factors on population growth.

142. What is the function of restriction enzymes in the purification process of DNA?

A) To remove RNA
B) To remove proteins
C) To cut the DNA
D) To add ethanol

Solution : (Correct Answer: C)

The function of restriction enzymes in the purification process of DNA is to cut the DNA into smaller fragments, but it is necessary to have the DNA in pure form and free from other macro-molecules before using these enzymes.

143. What are the genes encoding resistance to antibiotics commonly considered as useful selectable markers for E. coli?

A) Ampicillin
B) Chloramphenicol
C) Tetracycline
D) All of the above

Solution : (Correct Answer: D)

Genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline or kanamycin, etc are considered useful selectable markers for E. coli.

144. What is the result of the RNAi mechanism in the transgenic host plant?

A) The parasite survives
B) The host plant is protected from the parasite
C) The mRNA of the nematode is silenced
D) The transgenic host is expressing specific interfering RNA

Solution : (Correct Answer: B)

The result of the RNAi mechanism in the transgenic host plant is that the parasite cannot survive, as the specific mRNA of the nematode is silenced. This protects the transgenic host plant from the parasite.

145. Are recombinant therapeutics commonly associated with unwanted immunological responses?

A) Yes
B) No
C) Sometimes
D) Rarely

Solution : (Correct Answer: B)

The recombinant therapeutics do not induce unwanted immunological responses, unlike similar products isolated from non-human sources.

146. Why is RNA better for the transmission of genetic information?

A) RNA is more stable than DNA
B) RNA directly codes for the synthesis of proteins
C) RNA has a shorter life span than DNA
D) DNA depends on RNA for synthesis of proteins

Solution : (Correct Answer: B)

RNA is better for the transmission of genetic information because it directly codes for the

synthesis of proteins.

147. What is the length of DNA double helix in a typical mammalian cell?

A) Approximately 10^{-6} m
B) Approximately 0.34 nm
C) Approximately 2.2 metres
D) Approximately 6.6×10^9 bp

Solution : (Correct Answer: C)

The length of DNA double helix in a typical mammalian cell is approximately 2.2 metres (by multiplying the total number of bp with distance between two consecutive bp, that is, 6.6×10^9 bp $\times$ $0.34 \times 10^{\wedge -9}$ m/bp).

148. What are the two nuclei situated below the egg apparatus in the large central cell?

A) Antipodals **B)** Polar nuclei
C) Synergids **D)** Egg cells

Solution : (Correct Answer: B)

The two nuclei situated below the egg apparatus are called polar nuclei.

149. What is the main component of the inner wall of the pollen grain called the intine?

A) Sporopollenin **B)** Cellulose
C) Pectin **D)** Pectocellulose

Solution : (Correct Answer: D)

The intine layer of the pollen grain is mainly composed of pectin and cellulose (together called pectocellulose).

150. What are the extrinsic factors that control Plant Growth and Development?

A) Light and temperature
B) Soil type and humidity
C) Fertilisers and water
D) None of the above

Solution : (Correct Answer: A)

Many of the extrinsic factors such as temperature and light, control Plant Growth and Development via PGR.

151. What is the first phase of growth according to the paragraph?

A) Maturation **B)** Elongation
C) Meristematic **D)** Proximal

Solution : (Correct Answer: C)

The first phase of growth, according to the paragraph, is the meristematic phase, which is represented by the constantly dividing cells at the root apex and the shoot apex.

152. What is F_o component of ATP synthase (complex V)?

A) A peripheral membrane protein complex that contains the site for oxidation of NADH
B) A peripheral membrane protein complex that contains the site for synthesis of ATP from ADP and inorganic phosphate
C) An integral membrane protein complex that forms the channel through which protons cross the inner membrane
D) An integral membrane protein complex that forms the channel for transport of electrons from one carrier to another

Solution : (Correct Answer: C)

The F_o component of ATP synthase (complex V) is an integral membrane protein complex that forms the channel through which protons cross the inner membrane.

153. What are facultative anaerobes?

A) Organisms that can live in both aerobic and anaerobic conditions
B) Organisms that can only live in anaerobic conditions
C) Organisms that live in an atmosphere that lacks oxygen
D) Organisms that can only live in aerobic conditions

Solution : (Correct Answer: A)

Facultative anaerobes are organisms that can live in both aerobic and anaerobic conditions.

154. What is the purpose of ATP and NADPH in the biosynthetic phase of photosynthesis?

A) To synthesize food, more accurately, sugars
B) To produce O_2
C) To activate the Calvin cycle
D) To produce CO_2

Solution : (Correct Answer: A)

The biosynthetic phase of photosynthesis depends on the products of the light reaction, i.e., ATP and NADPH, besides CO_2 and H_2O, to drive the processes leading to the synthesis of food, more accurately, sugars.

155. Can the Calvin cycle occur in all photosynthetic plants?

A) Yes **B)** No
C) Only in C_3 plants **D)** Only in C_4 plants

Solution : (Correct Answer: A)

The Calvin pathway occurs in all photosynthetic plants, regardless of whether they have C_3 or C_4 (or

any other) pathways.

156. What is the saturation level for C_4 plants with regard to CO_2 concentration?

A) 360 μlL^{-1} **B)** 450 μlL^{-1}
C) 500 μlL^{-1} **D)** 600 μlL^{-1}

Solution : (Correct Answer: A)

C_4 plants show saturation at about 360 μlL^{-1}

157. What is the composition of ribosomes?

A) Proteins and lipids
B) Proteins and carbohydrates
C) RNA and proteins
D) DNA and lipids

Solution : (Correct Answer: C)

Ribosomes are composed of ribonucleic acid (RNA) and proteins.

158. What are cilia and flagella?

A) hair-like outgrowths of the cell membrane
B) small structures that work like oars
C) responsible for cell movement
D) All of the above

Solution : (Correct Answer: D)

Cilia and flagella are hair-like outgrowths of the cell membrane. Cilia are small structures that work like oars, causing the movement of either the cell or the surrounding fluid. Flagella are comparatively longer and responsible for cell movement. The prokaryotic bacteria also possess flagella but these are structurally different from that of the eukaryotic flagella.

159. How do fimbriae differ from flagella?

A) Fimbriae are small bristle-like fibres and flagella are thin filamentous extensions from the cell wall.
B) Fimbriae are thin filamentous extensions from the cell wall and flagella are small bristle-like fibres.
C) Fimbriae are pili and flagella are fimbriae.
D) Fimbriae and flagella are the same structure.

Solution : (Correct Answer: A)

Fimbriae are small bristle-like fibres sprouting out of the cell while flagella are thin filamentous extensions from the cell wall. They play different roles in the bacteria's survival and reproduction.

160. What is the R group in proteinaceous amino acids?

A) A hydrogen **B)** A methyl group
C) Hydroxy methyl **D)** All of the above

Solution : (Correct Answer: D)

The R group in proteinaceous amino acids could be a hydrogen (the amino acid is called glycine), a methyl group (alanine), hydroxy methyl (serine).

161. What is the difference between an exothermic and an endothermic reaction?

A) Exothermic reactions are energy requiring, while endothermic reactions are spontaneous
B) Endothermic reactions are energy requiring, while exothermic reactions are spontaneous
C) Both exothermic and endothermic reactions are spontaneous
D) Both exothermic and endothermic reactions are energy requiring

Solution : (Correct Answer: B)

If the potential energy of the product is lower than that of the substrate, the reaction is exothermic and spontaneous.

162. What is cellulose?

A) A variant of starch
B) A storehouse of energy in animal tissues
C) A polymer of fructose
D) A polymeric polysaccharide consisting of only one type of monosaccharide (glucose)

Solution : (Correct Answer: D)

Cellulose is described as a polymeric polysaccharide consisting of only one type of monosaccharide, i.e. glucose.

163. What happens to the centriole during the S phase in animal cells?

A) It remains unchanged
B) It undergoes mitosis
C) It duplicates
D) It undergoes DNA replication

Solution : (Correct Answer: C)

Centriole duplicates during S phase.

164. What is the metaphase plate?

A) The point of attachment of spindle fibres to the chromosomes
B) The point where the chromosomes align along the spindle equator
C) The point where the chromatids are separated
D) The point where the centromeres are located

Solution : (Correct Answer: B)

The metaphase plate is the plane of alignment of the chromosomes during metaphase, where they are moved to the spindle equator and aligned along it through the attachment of spindle fibres to the kinetochores.

165. How does cell growth occur during the cell cycle?

A) By the formation of new cells
B) By the division of existing cells
C) By the duplication of DNA
D) By the synthesis of new cell components

Solution : (Correct Answer: D)

The sequence of events by which a cell duplicates its genome, synthesizes the other constituents of the cell and eventually divides into two daughter cells is termed cell cycle.

166. What is the innermost layer of the cortex in a young dicotyledonous stem?

A) Epidermis B) Hypodermis
C) Endodermis D) Cortex

Solution : (Correct Answer: C)

The innermost layer of the cortex in a young dicotyledonous stem is called the endodermis.

167. What type of cells surround the vascular bundles in a leaf?

A) Epidermal cells
B) Mesophyll cells
C) Bundle sheath cells
D) Palisade parenchyma cells

Solution : (Correct Answer: C)

The vascular bundles in a leaf are surrounded by a layer of thick-walled bundle sheath cells

168. What are the main components of the epidermal tissue system?

A) Epidermal cells B) Stomata
C) Epidermal appendages D) All of the above

Solution : (Correct Answer: D)

The epidermal tissue system is made up of epidermal cells, stomata, and the epidermal appendages, which include trichomes and hairs. All three components work together to protect the plant and regulate water loss through the stomata.

169. What is the term used to describe the arrangement of veins in the lamina of a leaf?

A) Venation B) Reticulate C) Parallel D) Network

Solution : (Correct Answer: A)

The arrangement of veins in the lamina of a leaf is referred to as venation. This encompasses both reticulate and parallel venation.

170. What is imbricate aestivation?

A) When the margins of sepals or petals overlap one another but not in any particular direction
B) When sepals or petals overlap one another in a particular direction
C) When sepals or petals just touch one another at the margin, without overlapping
D) When one margin of the appendage overlaps that of the next one and so on

Solution : (Correct Answer: A)

Imbricate aestivation refers to a situation where the margins of the sepals or petals overlap one another, but not in any particular direction.

171. What is the function of the cells in the region of meristematic activity in a plant root?

A) To absorb water and minerals
B) To protect the tender apex of the root
C) To divide repeatedly
D) To promote root hair formation

Solution : (Correct Answer: C)

The cells of the region of meristematic activity in a plant root divide repeatedly.

172. How does the sporophyte stage in mosses compare to that in liverworts?

A) More elaborate B) Less elaborate
C) The same D) None of the above

Solution : (Correct Answer: A)

The sporophyte in mosses is more elaborate than that in liverworts.

173. Which part of the ovule develops into the female gametophyte?

A) Microsporangia B) Megasporangia
C) Nucellus D) Megaspore mother cell

Solution : (Correct Answer: D)

The megaspore mother cell divides meiotically to form four megaspores, one of which enclosed within the megasporangium develops into a multicellular female gametophyte.

174. What is the main component of the cell wall of green algae?

A) Cellulose B) Pectin C) Laminin D) Chitin

Solution : (Correct Answer: A)

The cell wall of green algae is made of an inner layer of cellulose and an outer layer of pectose.

175. What are the sexual spores produced by basidiomycetes called?

A) Zoospores B) Conidia
C) Sporangiospores D) Basidiospores

Solution : (Correct Answer: D)

Sexual spores produced by basidiomycetes are called basidiospores.

176. What are bacteriophages?

A) Viruses that infect plants
B) Viruses that infect animals
C) Viruses that infect bacteria
D) None of the above

Solution : (Correct Answer: C)

Bacterial viruses or bacteriophages (viruses that infect the bacteria) are usually double stranded DNA viruses.

177. What is the difference between the reproductive events in males and females?

A) Sperm formation occurs even in old men, but formation of ovum ceases in women around the age of fifty years.
B) Formation of gametes occurs only in males.
C) Transfer of sperms occurs only in females.
D) Delivery of the baby occurs only in males.

Solution : (Correct Answer: A)

There are remarkable differences between the reproductive events in males and females, for example, sperm formation continues even in old men, but formation of ovum ceases in women around the age of fifty years.

178. What is the scope of systematics?

A) Identification and nomenclature
B) Identification, nomenclature, and classification
C) Identification and classification
D) Nomenclature and classification

Solution : (Correct Answer: B)

The scope of systematics was later enlarged to include identification, nomenclature, and classification.

179. Which category is the highest in the classification system of animals?

A) Phylum Chordata **B)** Kingdom Animalia
C) Order Primata **D)** Class Mammalia

Solution : (Correct Answer: B)

All animals belonging to various phyla are assigned to the highest category called Kingdom Animalia in the classification system of animals.

180. What is the term used to describe the number and types of organisms present on Earth?

A) Biodiversity **B)** Forest exploration
C) Potted plants **D)** Species count

Solution : (Correct Answer: A)

Biodiversity is the number and types of organisms present on Earth.