# JNANASUDHA NEET-2019 QUESTION PAPER AND SOLUTION

1. The speed of a swimmer in still water is $20ms^{-1}$.The speed of river water is $10ms^{-1}$ and is flowing due east .If he is standing on the south bank and wishes to cross the river along the shortest path ,The angle at which he should make his strokes w.r.t. north is given by :

   a. $30^0$ west
   b. $0^0$
   c. $60^0$ west
   d. $45^0$ west

   **ANS : 1**

   **SOLUTION :** $\sin\theta = \dfrac{v_{ra}}{v_{sw}} = \dfrac{10}{20} = \dfrac{1}{2} \Rightarrow \theta = 30°$
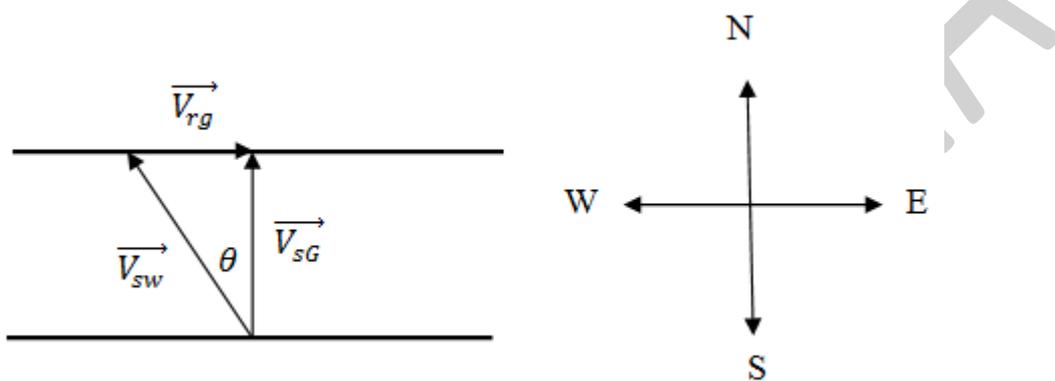
   

2. In an experiment, the percentage of error occurred in the measurement of physical quantities A,B, C and D are 1%, 2%, 3%, and 4% respectively. Then the maximum percentage of error in the measurement X, where $X=A^2B^{1/2}/C^{1/3}D^3$ ,will be:

   a. (3/13)%
   b. 16%
   c. -10%
   d. 10%

   **ANS : 2**

   **SOLUTION :** $\dfrac{\Delta x}{x} = \dfrac{2\Delta A}{A} + \dfrac{1}{2}\dfrac{\Delta B}{B} + \dfrac{1}{3}\dfrac{\Delta C}{C} + 3\dfrac{\Delta D}{D}$

   $\therefore \Rightarrow 16\%$

3. In total internal reflection when the angle of incidence is equal to the critical angle for the pair of media in contact, what will be the angle of refraction?

   a. $180^0$
   b. $0^0$
   c. equal to angle of incidence
   d. $90^0$

   **ANS : 4**

   **SOLUTION :** If Angle of incidence is critical angle then angle of refraction is 90°

4. A block of mass $10kg$ is in contact against the inner wall of a hollow cylindrical drum of radius $1m$. The coefficient of friction between the block and the inner wall of the cylinder is 0.1. The minimum angular velocity needed for the cylinder to keep the block stationary when the cylinder is vertical and rotating about its axis will be: ($g = 10m/s^2$)

   a. $\sqrt{10}\ rad/s$

   b. $\frac{10}{2\pi}\ rad/s$

   c. $10\ rad/s$

   d. $10\pi\ rad/s$

   **ANS : 3**
   **SOLUTION :** If the block is at rest
   $$f = \mu N = mg = N = \frac{mg}{\mu} = m\omega^2 R$$
   $$\omega = \sqrt{\frac{g}{\mu R}} = 10 \text{rad/s}$$
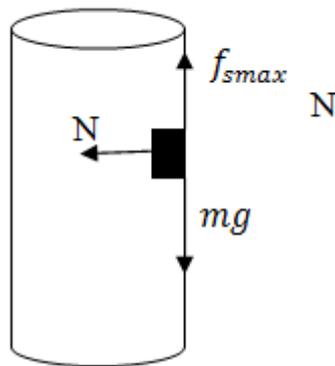


5. For a p-type semiconductor, which of the following statements is true?
   a. Electrons are the majority carriers and trivalent atoms are the dopants
   b. Holes are the majority carriers and trivalent atoms are the dopants
   c. Holes are the majority carriers and pentavalent atoms are the dopants
   d. Electrons are the majority carriers and pentavalent atoms are the dopants
   **ANS : 2**
   **SOLUTION :** Kinetic energy is directly proportional to the temperature

6. The total energy of an electron in an atom in an orbit is -3.4 eV. Its kinetic and potential energies are ,respectively :
   a. -3.4 eV, -3.4 eV
   b. -3.4eV , -6.8eV
   c. 3.4 eV , -6.8eV
   d. 3.4eV, 3.4eV
   **ANS : 3**
   **SOLUTION :**
   $E_n = -3.4eV, K = +3.4eV, U = -6.8eV$

7. A copper rod of 88cm and an aluminium rod of unknown length have their increase in length independent of increase in temperature .The length of aluminium rod is:
($\alpha_{cu}$=1.7× $10^{-5}K^{-1}$ and $\alpha_{Al}$ =2.2× $10^{-5}K^{-1}$)
   a. 6.8cm
   b. 113.9cm
   c. 88cm
   d. 68cm
   **ANS : 4**
   **SOLUTION :** $\alpha_1 l_1 = \alpha_2 l_2 => l_2 = \frac{\alpha_1 l_1}{\alpha_2} = 68cm$

8. A small hole of area of cross section $2mm^2$ is present near the bottom of a fully filled open tank of height 2m .Taking g =$10ms^{-2}$ ,the rate of flow of water through the open hole would be nearly :
   a. 12.6× $10^{-6}m^3s^{-1}$
   b. 8.9× $10^{-6}m^3s^{-1}$
   c. 2.23× $10^{-6}m^3s^{-1}$
   d. 6.4× $10^{-6}m^3s^{-1}$
   **ANS : 1**
   **SOLUTION :** Volume rate of flow is
   $$\Rightarrow AV = A\sqrt{2gh} = 2 \times 10^{-6} \times \sqrt{2 \times 10 \times 2} = 12.6 \times 10^{-6}m^3/s$$

9. When a block of mass M is suspended by a long wire of length L, the length of the wire becomes (L+1) .The elastic potential energy stored in the extended wire is :
   a. Mgl
   b. MgL
   c. $\frac{1}{2}Mgl$
   d. $\frac{1}{2}MgL$
   **ANS : 3**
   **SOLUTION :** Elastic potential energy U $= \frac{1}{2} \times$ stress $\times$ strain $\times$ volume
   $$U = \frac{Mgl}{2}$$

10. Two particles A and B are moving in uniform circular motion in concentric circles of radii $r_A$ and $r_B$ with speed $v_A$ and $v_B$ respectively. Their time period of rotation is the same. The ratio of angular speed of A to that of B will be
    a. $r_A$:$r_B$
    b. $v_A$:$v_B$
    c. $r_B$:$r_A$
    d. 1:1
    **ANS : 4**
    **SOLUTION :** $T = \frac{2\pi r}{v} = \frac{2\pi}{\omega}$
    $$\frac{T_A}{T_B} = 1 => \frac{\omega_B}{\omega_A}$$

11. A parallel plate capacitor of capacitance $20\mu F$ is being charged by a voltage source whose potential is changing at the rate of 3v/s .The conduction current through the connecting wire, and the displacement current through the plates of the capacitor, would be ,respectively :

   a. zero, $60\mu A$
   b. $60\mu A$, $60\mu A$
   c. $60\mu A$, zero
   d. zero, zero

   **ANS : 2**

   **SOLUTION :** $i_d = \varepsilon_0 \dfrac{d(EA)}{dt} = \dfrac{dQ}{dt} = i$

   Also $i_d = C\dfrac{dV}{dt} = 20 \times 3 = 60\mu A$

12. A 800 turn coil of effective area 0.05 $m^2$ is kept perpendicular to a magnetic field $5 \times 10^{-5}$ T .When the plane of the coil is rotated by $90^0$ around any of its coplanar axis in 0.1s ,the emf induced in the coil will be :

   a. 2V
   b. 0.2V
   c. $2 \times 10^{-3}$V
   d. 0.02$V$

   **ANS : 4**

   **SOLUTION :** $\varepsilon = \dfrac{d\varphi_B}{dt} = \dfrac{NBAd\ (\cos\theta)}{dt} = 0.02$V

13. The unit of thermal conductivity is:

   a. $JmK^{-1}$
   b. $Jm^{-1}K^{-1}$
   c. $WmK^{-1}$
   d. $Wm^{-1}K^{-1}$

   **ANS : 4**

   **SOLUTION :** B is directly proportional to d if d < R and B inversly proportional d if d > R

14. The radius of circle ,the period of revolution , initial position and sense of revolution are indicated in the fig.
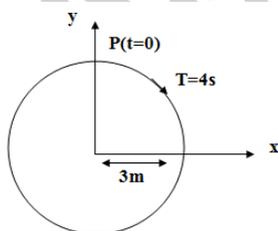


   y- projection of the radius vector of rotating particle P is :

   a. $y(t) = -3cos2\pi t$ , where y in m
   b. $y(t) = 4\sin\left(\dfrac{\pi t}{2}\right)$ , where y in m
   c. $y(t) = 3cos(\dfrac{3\pi t}{2})$ , where y in m
   d. $y(t) = 3\cos\left(\dfrac{\pi t}{2}\right)$ , where y in m

   **ANS : 4**

   **SOLUTION :** $\omega = \dfrac{2\pi}{T} = \dfrac{2\pi}{4} = \dfrac{\pi}{2}$ $\therefore y = 3\cos\omega t => 3cos(\dfrac{\pi t}{2})$

15. The displacement of a particle executing simple harmonic motion is given by
$y = A_0 + A \sin \omega t + B \cos \omega t$. Then the amplitude of its oscillation is given by:

a. $A_0 + \sqrt{A^2 + B^2}$

b. $\sqrt{A^2 + B^2}$

c. $\sqrt{A_0{}^2 + (A + B)^2}$

d. $A + B$

**ANS : 2**
**SOLUTION :** $y = A_0 + A\sin\omega t + B\cos\omega t$
$$y - A_0 = A\sin\omega t + B\cos\omega t$$
$$y = \sqrt{A^2 + B^2}$$

16. The correct Boolean operation represented by the circuit diagram drawn is:
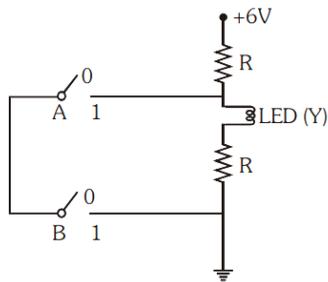


a. AND
b. OR
c. NAND
d. NOR

**ANS : 3**
**SOLUTION :** NAND GATE

| A | B | Y |
|---|---|---|
| 0 | 0 | 1 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 0 |

17. Six smaller bulbs are connected as shown in the figure with a DC source of emf E, and zero internal resistance .
The ratio of power consumption by the bulbs when
(i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing ,will be:
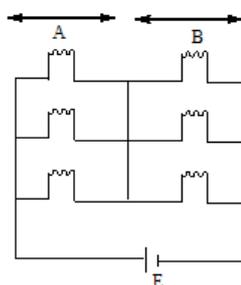
a. 4:9
b. 9:4
c. 1:2
d. 2:1

**ANS : 2**

**SOLUTION :** When all are glowing $R_{eq} = \dfrac{2R}{3}$

$$\text{Therefore} P_1 = \dfrac{E^2}{R_{eq}} = \dfrac{3E^2}{2R}$$

$$\text{In situation (ii) } R_{eq} = \dfrac{R}{2} + R = \dfrac{3R}{2}$$

$$\therefore P_2 = \dfrac{E^2}{3\frac{R}{2}} = \dfrac{2E^2}{3R} = \dfrac{P_1}{P_2} = \dfrac{9}{4}$$

18. A hollow metal sphere of R is uniformly charged. The electric field due to the sphere at a distance r from the centre:

   a. Increases as $r$ increases for $r < R$ and for $r > R$

   b. Zero as r increases for $r < R$, decreases as r increases for $r > R$

   c. Zero as r increases for $r < R$, increases as r increases for $r > R$

   d. Decreases as $r$ increases for $r < R$ and for $r > R$

   **ANS : 2**
   **SOLUTION :** Electric field inside the conductor is zero , outside the conductor elector field is inversely proportional to $R^2$

19. The work done to raise a mass $m$ from the surface of the earth to a height $h$, which is equal to the radius of the earth is:

   a. $mgR$
   b. $2mgR$
   c. $\dfrac{1}{2}mgR$
   d. $\dfrac{3}{2}mgR$

   **ANS : 3**
   **SOLUTION :** $W = U_f - U_i = -\dfrac{GMm}{2R} - \left(\dfrac{-GMm}{R}\right) = \dfrac{mgR}{2}$

20. An electron is accelerated through a potential difference of $10000\ V$. Its de-Broglie wavelength is, (nearly):$(m_e = 9 \times 10^{-31} kg)$
   a. $12.2 \times 10^{-13} m$
   b. $12.2 \times 10^{-12} m$
   c. $12.2 \times 10^{-14} m$
   d. $12.2 nm$

   **ANS : 2**
   **SOLUTION :** $\lambda = \dfrac{12.27}{\sqrt{V}} A^\circ = \dfrac{12.27}{\sqrt{10000}} = 12.27 \times 10^{-12} m$

21. In a double slit experiment, when light of wavelength 400nm was used ,the angular width of the first minima formed on a screen placed 1m away ,was found to be $0.2^0$ .What will be the angular width of the first minima ,if the entire experimental apparatus is immersed in water?($\mu_{water}$ =4/3)

    a.  $0.266^0$

    b.  $0.15^0$

    c.  $0.05^0$

    d.  $0.1^0$

**ANS : 2**

**SOLUTION :** $\theta_\omega = \dfrac{\theta_{air}}{n} = \dfrac{0.2}{\frac{4}{3}} = \dfrac{0.6}{4} = 0.15^0$

22. In the circuits shown below ,the reading of the voltmeters and the ammeters will be :



**Circuit 1**    **Circuit 2**
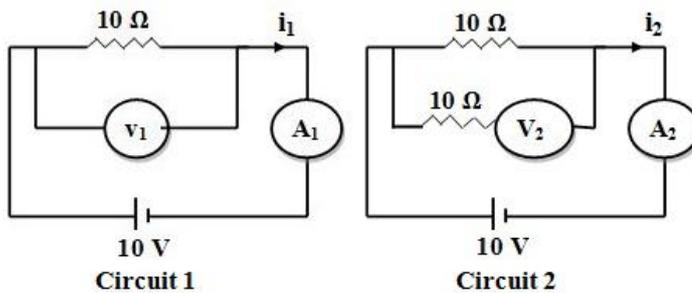
    a.  $V_2 > V_1$ and $i_1 = i_2$

    b.  $V_1 = V_2$ and $i_1 > i_2$

    c.  $V_1 = V_2$ and $i_1 = i_2$

    d.  $V_2 > V_1$ and $i_1 > i_2$

**ANS : 3**

**SOLUTION :** $i_1 = \dfrac{10}{10} = 1A$ , $V_1 = 10V$

$$i_2 = \dfrac{10}{10} = 1A , V_2 = 10V$$

$$\therefore V_1 = V_2 \text{ and } i_1 = i_2$$

23. A body weighs $200N$ on the surface of the earth. How much will it weigh half way down to the centre of earth?

    a.  $150N$

    b.  $200N$

    c.  $250N$

    d.  $100N$

**ANS : 4**

**SOLUTION :** $w = w_0 \left(1 - \dfrac{d}{R}\right) = 200(0.5) = 100N$

24. A cylindrical conductor of radius R is carrying a constant current. The plot of the magnitude of the magnetic field , B with the distance d from the centre of the conductor, is correctly represented by the figure:

a.



b.



c.



d.
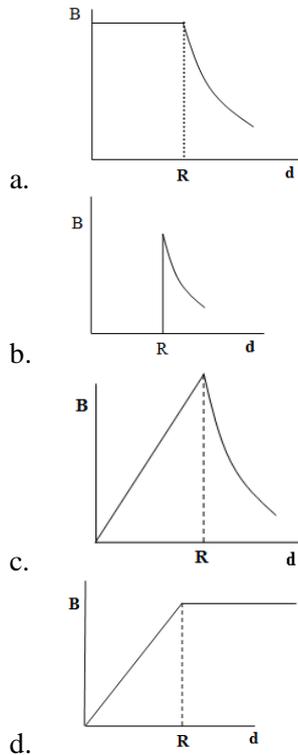


**ANS : 3**

> **SOLUTION :** In a cylindrical conductor magnetic field inside the conductor $B \propto r$
> Outside the conductor $B \propto \dfrac{1}{r}$

25. Ionized hydrogen atoms and $\alpha$-particles with same momenta enters perpendicular to a constant magnetic field, B. The ratio of their radii of their paths $r_H : r_\alpha$ will be:

   a. $2 : 1$

   b. $1 : 2$

   c. $4 : 1$

   d. $1 : 4$

   **ANS : 1**

   **SOLUTION : ** $r = \dfrac{mV}{qB}$

   $$\therefore \frac{r_H}{r_\alpha} = \frac{q_\alpha}{q_H} = 2$$

26. Which of the following acts as a circuit protection device?

   a. conductor
   b. inductor
   c. switch
   d. fuse

   **ANS : 4**

   **SOLUTION :** Fuse acts as a circuit protection device

27. Two parallel infinite line charges with linear charge densities $+\lambda C/m$ and $-\lambda C/m$ are placed at a distance of 2R in free space .What is the electric field midway between the two line charges?

    a. Zero

    b. $\dfrac{2\lambda}{\pi\epsilon_0 R}$N/C

    c. $\dfrac{\lambda}{\pi\epsilon_0 R}$N/C

    d. $\dfrac{\lambda}{2\pi\epsilon_0 R}$N/C

**ANS : 3**

**SOLUTION :** $E = \dfrac{2\lambda}{2\pi\epsilon_0 R} = \dfrac{\lambda}{\pi\epsilon_0 R}$

28. A disc of radius 2m and mass 100kg rolls on a horizontal floor .Its centre of mass has speed of 20cm/s .How much work is needed to stop it?

    a. 3J

    b. 30kJ

    c. 2J

    d. 1J

**ANS : 1**

**SOLUTION :** $w = \dfrac{1}{2}mV_{cm}^2\left(1 + \dfrac{k^2}{R^2}\right)$

$$\therefore w = \dfrac{3}{4} \times 100 \times 4 \times 10^{-2} = 3J$$

29. $\alpha$ −particle consists of :
    a. 2 protons and 2 neutrons only
    b. 2 electrons, 2 protons and 2 neutrons
    c. 2 electrons and 4 protons only
    d. 2 protons only

**ANS : 1**

**SOLUTION :** α particle consists of 2 protons and 2 neutrons

30. Two point charges A and B , having charges +Q and –Q respectively ,are placed at certain distance apart and force acting between them is F. If 25% charge of A is transferred to B , then force between the charges becomes:

    a. F

    b. $\dfrac{9F}{16}$

    c. $\dfrac{16F}{9}$

    d. $\dfrac{4F}{3}$

**ANS : 2**

**SOLUTION :** $F = K\dfrac{Q^2}{r^2}$

When 25% of change of A is transferred to B ,

$$Q_1 = \dfrac{3Q}{4} \qquad Q_2 = -Q + \dfrac{Q}{4} = \dfrac{-3Q}{4}$$

$$\therefore F' = K\dfrac{Q_1 Q_2}{r^2} = \dfrac{9}{16}F$$

31. Which colour of the light has the longest wavelength ?
    a. Red
    b. Blue
    c. Green
    d. Violet

**ANS : 1**

**SOLUTION :** Red has highest wavelength

32. When an object is shot from the bottom of a long smooth inclined plane kept at an angle $60^0$ with horizontal ,it can travel a distance $x_1$ along the plane .But when the inclination is decreased to $30^0$ and the same object is shot with the same velocity ,it can travel $x_2$ distance .Then $x_1 : x_2$ will be
    a. $1 : \sqrt{2}$
    b. $\sqrt{2} : 1$
    c. $1 : \sqrt{3}$
    d. $1 : 2\sqrt{3}$

**ANS : 3**

**SOLUTION :** $a = -g\sin\theta \quad V^2 = V_0^2 + 2a\Delta x$

$$0 = V_0^2 - 2g\sin\theta\Delta x$$

$$\therefore \Delta x = \frac{V_0^2}{2g\sin\theta} \implies \Delta x \propto \frac{1}{\sin\theta}$$

$$\therefore \frac{x_1}{x_2} = \frac{\sin\theta_2}{\sin\theta_1} = \frac{\sin 30^0}{\sin 60^0} = \frac{1}{2\frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}}$$

33. A particle moving with velocity $\vec{V}$ is acted by three forces shown by the vector triangle PQR . The velocity of the particle will :
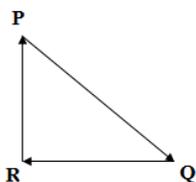


    a. Increase
    b. Decrease
    c. Remain constant
    d. Change according to the smallest force $\overrightarrow{QR}$

**ANS : 3**

**SOLUTION :** Since net force acting on the particle is zero the velocity remains constant

34. At a point A on the earth's surface the angle of dip, $\delta = +25^0$. At a point B on the earth's surface the angle of dip $\delta = -25^0$. We can interpret that:
    a. A and B are both located in thenorthern hemisphere
    b. A is located in the southern hemisphere and B is located in the northern hemisphere
    c. A is located in the northern hemisphere and B is located in the southern hemisphere
    d. A and B are both located in the southern hemisphere

**ANS : 3**

**SOLUTION :** A is located in the northern hemisphere and B is located in the southern hemisphere.

35. A force F=20+10y acts on a particle in y-direction where F is in newton and y in meter. Work done by this force to move the particle from y=0 to y=1m is
    a. 30J
    b. 5J
    c. 25J
    d. 20J

    **ANS : 3**
    **SOLUTION :** $w = \int_0^1 (20 + 10y)d_y = 20 \times 1 + 10 \times \frac{1}{2} = 25J$

36. A mass m is attached to a thin wire and whirled in a vertical circle. The wire is most likely to break when :
    a. The mass is at the highest point
    b. The wire is horizontal
    c. The mass is at the lowest point
    d. Inclined at an angle of $60^0$ from vertical
    **ANS : 3**
    **SOLUTION :** Tension is maximum at the lowest point.

37. A solid cylinder of mass 2kg and radius 4cm is rotating about its axis at the rate of 3rpm . The torque required to stop after $2\pi$ revolution is
    a. $2\times 10^{-6}$Nm
    b. $2\times 10^{-3}$Nm
    c. $12\times 10^{-4}$Nm
    d. $2\times 10^{+6}$Nm

    **ANS : 1**
    **SOLUTION :** $\Delta\theta = 2\pi \times 2\pi = 4\pi^2$
    $$\omega_0 = 3\text{rpm} = \frac{3\times 2\pi}{60} = \frac{\pi}{10} \text{ and } \omega = 0$$
    $$\alpha = -\frac{\omega_0^2}{2\alpha} = -0.0025$$
    $$\therefore \tau = I\alpha = \frac{MR^2\alpha}{2} = \frac{2\times 16\times 10^{-4}}{2} \times 0.0025 = 2 \times 10^{-6} \text{ Nm}$$

38. In which of the following devices, the eddy current effect is not used?
    a. Induction furnace
    b. Magnetic braking in train
    c. Electromagnet
    d. Electric heater

    **ANS : 3**
    **SOLUTION :** Eddy current effect is not used in electro magnet

39. Body A of mass $4m$ moving with speed $u$ collides with another body B of mass $2m$, at rest. The collision is head-on and elastic in nature. After the collision the fraction of energy lost by the colliding body A is:

    a. $\frac{1}{9}$
    b. $\frac{8}{9}$
    c. $\frac{4}{9}$
    d. $\frac{5}{9}$

**ANS : 2**

**SOLUTION :** $K_i = \frac{1}{2}m_A V_A^2$

$$= \frac{1}{2} \times 4m \times x^2 = 2mu^2$$

$$= K_f = \frac{2mu^2}{9}$$

$$= \Delta K \Longrightarrow K - \frac{K}{9} = \frac{8K}{9}$$

40. Average velocity of a particle executing SHM in one complete vibration is:
    a. $A\omega/2$
    b. $A\omega$
    c. $A\omega^2/2$
    d. Zero

    **ANS : 4**

    **SOLUTION :** $V = V_m \sin\omega t \Longrightarrow V_{av} = 0$

41. Pick the wrong answer in the context with rainbow.
    a. When the light rays undergo two internal reflections in a water drop, a secondary rainbow is formed
    b. The order of colours is reversed in the secondary rainbow.
    c. An observer can see a rainbow when his front is towards the sun.
    d. Rainbow is a combined effect of dispersion, refraction and reflection of sunlight.

    **ANS : 3**

    **SOLUTION :** The wrong statement is option 3

42. Two similar thin equi-convex lenses, of focal length $f$ each, are kept co-axially in contact with each other such that the focal length of the combination is $F_1$. When the space between the two lenses is filled with glycerin(*which has the same refractive index*($\mu = 1.5$ *as that of glass* then the equivalent focal length is *F2.*The ratio *F1:F2* will be:
    a. $2:1$
    b. $1:2$
    c. $2:3$
    d. $3:4$

    **ANS : 2**

    **SOLUTION :** $\frac{1}{F_1} = \frac{1}{f} + \frac{1}{f} = \frac{2}{f} \Longrightarrow F_1 = \frac{f}{2}$ and f=R

    When filled with glycerine

    $$\frac{1}{f'} = (\mu - 1)\left[\frac{2}{R}\right] = \frac{1}{R} \quad \therefore f' = f$$

    $$\therefore \frac{1}{F_2} = \frac{1}{f} - \frac{1}{f} + \frac{1}{f} = \frac{1}{f} \Longrightarrow F_2 = f$$

    $$\therefore F_1 : F_2 = 1:2$$

43. A soap bubble, having radius of $1 mm$, is blown from a detergent solution having a surface tension of $2.5 \times 10^{-2} N/m$. The pressure inside the bubble equals at a $Z_0$ below the free surface of water in a container. Taking $g = 10 \, m/s^2$, density of water $10^3 kg/m^3$, the value of $Z_0$ is:

   a. $100 cm$
   b. $10 cm$
   c. $1 cm$
   d. $0.5 cm$

**ANS : 3**

**SOLUTION :** $P = P_0 + \rho gh$

$$P_0 + \frac{4T}{r} = P_0 + \rho g Z_0$$

$$Z_0 = \frac{4T}{\rho g r} = \frac{4 \times 2.5 \times 10^{-2}}{10^4 \times 10^{-3}} = 10 \times 10^{-3} = 1 \text{ cm}$$

44. In which of the following processes, heat is neither absorbed nor released by a system?

   a. Isothermal
   b. Adiabatic
   c. Isobaric
   d. Isochoric

**ANS : 2**

**SOLUTION :** If heat is neither absorbed nor released then the process is adiabatic

45. Increase in temperature of a gas filled in a container would lead to :

   a. Increase in its mass
   b. Increase in its kinetic energy
   c. Decrease in its pressure
   d. Decrease in intermolecular distance

**ANS : 2**

**SOLUTION :** Kinetic energy $\propto$ Temperature

46. Match the Xenon compounds in column I with the structure in column II and assign the correct code :

| Column I | Column II |
|---|---|
| (a) $XeF_4$ | (i) Pyramidal |
| (b) $XeF_6$ | (ii) Square planar |
| (c) $XeOF_4$ | (iii) Distorted tetrahedral |
| (d) $XeO_3$ | (iv) Square pyramidal |

   a. (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)
   b. (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)
   c. (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)
   d. (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)

**ANS : 2**

**SOLUTION :** $XeF_4$ - Square planar

          $XeF_6$ - Distorted tetrahedral

          $XeOF_4$ - Square pyramidal

          $XeO_3$ – Pyramidal

47. Which is the correct thermal stability order for $H_2E$ (E=O,S,Se,Te and Po)?
   a. $H_2S < H_2O < H_2Se < H_2Te < H_2Po$
   b. $H_2O < H_2S < H_2Se < H_2Te < H_2Po$
   c. $H_2Po < H_2Te < H_2Se < H_2S < H_2O$
   d. $H_2Se < H_2Te < H_2Po < H_2O < H_2S$

   **ANS : 3**
   **SOLUTION :** The H-E bond dissociation enthalpy decreases down the group

48. Among the following the correct reaction that proceeds through an electrophilic substitution is:

   a.
   

   b.
   

   c.
   

   d.
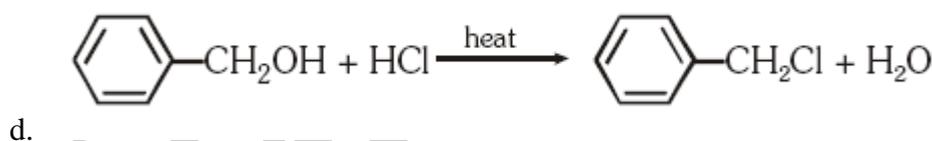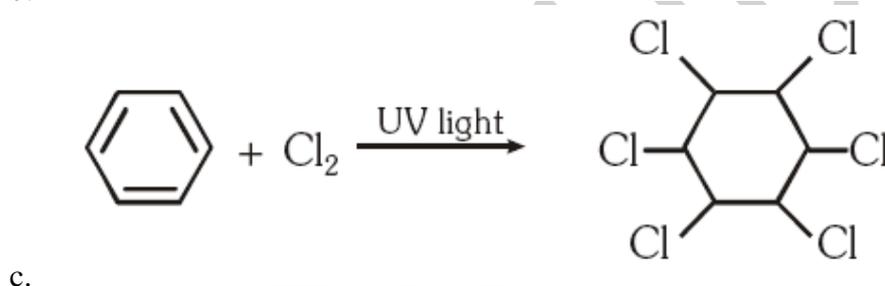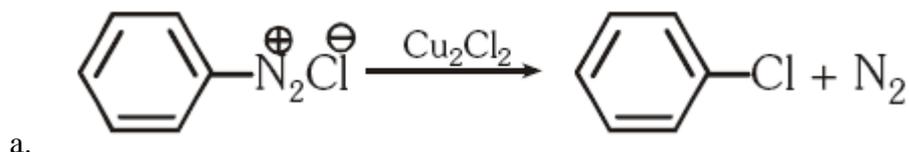   

   **ANS : 2**
   **SOLUTION :** (a)-Displacement reaction
   (b)-Chlorination of benzene is an example for electrophilic substitution reaction.
   (c)-Addition reaction
   (d)-Nucleophilic substitution reaction

49. Enzyme that utilize ATP in phosphate transfer require an alkaline earth metal (M) as the cofactor. M is
   a. Be
   b. Mg
   c. Ca
   d. Sr

   **ANS : 2**
   **SOLUTION :** Mg

50. Which of the following reaction are disproportionation reaction
    (1) $2\,Cu^+ \rightarrow Cu^{+2} + Cu^0$
    (2) $3\,MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$
    (3) $2KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$
    (4) $2MnO_4^- + 3\,Mn^{2+} + 2\,H_2O \rightarrow 5MnO_2 + 4H$
       Select the correct option from the following
    a. (1) and (2) only
    b. (1), (2) and (3)
    c. (1), (3) and (4)
    d. (1) and (4) only

    **ANS : 1**
    **SOLUTION :** $2Cu^+ \rightarrow Cu^{+2} + Cu^0$
    $3\,MnO_4^{-2} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$
    In a and b, for the same element oxidation number increases and decreases

51. The method used to remove temporary hardness of water is
    a. Calgon's method
    b. Clark's method
    c. Ion-exchange method
    d. Synthetic resin method
       **ANS : 2**
       **SOLUTION :** Clark's method

52. For the chemical reaction
    $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$. The correct option is
    a. $-\dfrac{1}{3}\dfrac{d[H_2]}{dt} = -\dfrac{1}{2}\dfrac{d[NH_3]}{dt}$
    b. $-\dfrac{d[N_2]}{dt} = 2\dfrac{d[NH_3]}{dt}$
    c. $-\dfrac{d[N_2]}{dt} = \dfrac{1}{2}\dfrac{d[NH_3]}{dt}$
    d. $3\dfrac{d[H_2]}{dt} = 2\dfrac{d[NH_3]}{dt}$
    **ANS : 3**
    **SOLUTION :** $-\dfrac{d[N_2]}{dt} = \dfrac{1}{2}\dfrac{d[NH_3]}{dt}$

53. For the second period elements the correct increasing order of first ionisation enthalpy is
    a. Li < Be < B < C < N < O< F < Ne
    b. Li < B < Be < C < O < N < F < Ne
    c. Li < B < Be < C < N < O < F < Ne
    d. Li < Be < B < C < O < N < F < Ne

    **ANS : 2**
    **SOLUTION :** Li (520kJmol$^{-1}$) < B (801 kJmol$^{-1}$) < Be (899 kJmol$^{-1}$) < C (1086 kJmol$^{-1}$) < O( 1314 kJmol$^{-1}$) < N (1402 kJmol$^{-1}$) < F (1681 kJmol$^{-1}$) < Ne( 2080 kJmol$^{-1}$)

54. For a cell involving one electron $E^0_{cell} = 0.59\ V$ at 298 K, the equilibrium constant for the cell reaction is

[Given that $\dfrac{2.303RT}{F} = 0.059V$ at T=298 K ]

a. $1.0 \times 10^2$
b. $1.0 \times 10^5$
c. $1.0 \times 10^{10}$
d. $1.0 \times 10^{30}$

**ANS : 3**

**SOLUTION :** $E^0_{cell} = \dfrac{0.059}{1} \times logK_c$ $logK_c = \dfrac{0.59}{0.059}$

$$logK_c = 10$$

$$K_c = 10^{10}$$

55. The manganate and permanganate ions are tetrahedral, due to :

a. The $\pi$ - bonding involves overlap of p-orbitals of oxygen with d-orbitals of manganese
b. There is no $\pi$ -bonding
c. The $\pi$ -bonding involves overlap of p-orbitals of oxygen with p-orbitals of manganese
d. The $\pi$ -bonding involves overlap of d-orbitals of oxygen with d-orbitals of manganese

**ANS : 1**

**SOLUTION :** The $\pi$-bonding involves overlap of p-orbitals of oxygen with d-orbitals of manganese

56. The number of moles of hydrogen molecules required to produce 20 moles of ammonia through Haber's process is;

a. 10
b. 20
c. 30
d. 40

**ANS : 3**

**SOLUTION :** $N_2 + 3H_2 \rightleftarrows 2NH_3$  $10N_2 + 30H_2 \rightleftarrows 20NH_3$
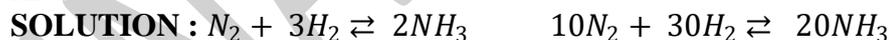
57. A gag at 350K and 15 bar has molar volume 20 percent smaller than that for an ideal gas under the same conditions. The correct option about the gas and its compressibility factor (Z) is:

a. Z > 1 and attractive forces are dominant
b. Z > 1 and repulsive forces are dominant
c. Z < 1 and attractive forces are dominant
d. Z <1 and repulsive forces are dominant

**ANS : 3**

**SOLUTION :** $\dfrac{PV}{RT} = Z$

$$Z = \dfrac{15}{20 \times 0.083 \times 350} = 0.025$$

Z < 1 and given that molar volume of the gas is 20% smaller than of an ideal gas which indicates attractive force is dominating.

58. Which will make basic buffer?
   a. 50 mL of 0.1M NaoH + 25 mL of 0.1M CH$_3$ COOH
   b. 100 mL of 0.1M CH$_3$ COOH+100 mL of 0.1M NaOH
   c. 100 mL of 0.1M HCL+200 mL of 0.1M NH$_4$OH
   d. 100 mL of 0.1M HCL+100 mL of 0.1M NaOH

   **ANS : 3**

   **SOLUTION :** Basic buffer is mixture of weak base and its salt with strong acid.

59. If the rate constant for a first order reaction is k, the time (t) required for the completion of 99% of the reaction is given by
   a. t=0.693/k
   b. t=6.909/k
   c. t=4.606/k
   d. t=2.303/k

   **ANS : 3**

   **SOLUTION :** $k = \dfrac{2.303}{t}\log\dfrac{[R]_0}{[R]}$

   $$t = \dfrac{2.303}{k}\log\dfrac{100}{100-99} = \dfrac{4.606}{k}$$

60. The major product of the following reaction is



   a. 

   b. 
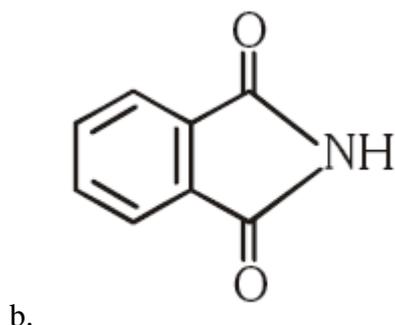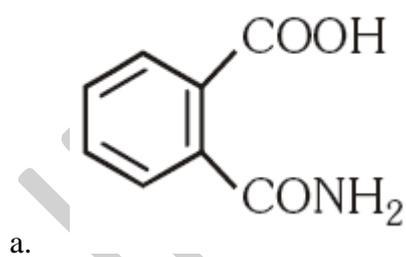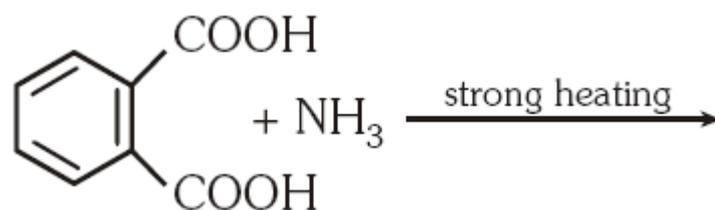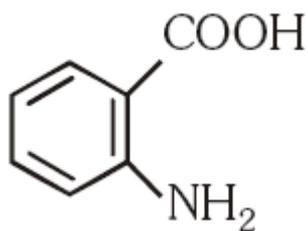
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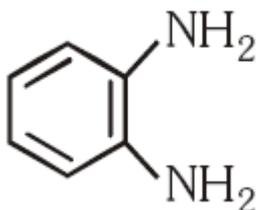


d.

**ANS : 2**



**SOLUTION :**

61. Conjugate base for Bronsted acids $H_2O$ and HF are:
    a. $OH^-$ and $H_2F^+$, respectively
    b. $H_3O^+$ and $F^-$, respectively
    c. $OH^-$ and $F^-$, respectively
    d. $H_3O^+$ and $H_2F^+$, respectively

    **ANS : 3**
    **SOLUTION :** Conjugate base of an acid is by the removal of $H^+$ ion.

62. Under the isothermal condition, a gas at 300K expands from 0.1L to 0.25L against a constant external pressure of 2 bar. The work done by the gas is:
    [given that 1L bar=100J]
        a.    -30J
        b.    5kJ
        c.    25J
        d.    30J

    **ANS : 1**
    **SOLUTION :** W= - PΔV
        = - 2(0.25- 0.1)
        = - 0.3 L bar
        Given 1L bar = 100 J
        0.3 L bar = -30 J

63. Which of the following species is NOT stable?
        a.    $[SiF_6]^{2-}$
        b.    $[GeCl_6]^{2-}$
        c.    $[Sn(OH)_6]^{2-}$
        d.    $[SiCl_6]^{2-}$

**ANS : 4**
**SOLUTION :** $[SiCl_6]^{-2}$ species is not stable because
6 large chloride ions cannot be accommodated around $Si^{+4}$ due to limitation of its size and interaction between lone pair of chloride ion and $Si^{4+}$ is not very strong.

64. Which mixture of the solution will lead to the formation of negatively charged colloidal $[AgI]I^-$ sol.?
    a. 50mL of 1M $AgNO_3$+50mL of 1.5M KI
    b. 50mL of 1M $AgNO_3$+50mL of 2M KI
    c. 50mL of 2M $AgNO_3$+50mL of 1.5M KI
    d. 50mL of 0.1M $AgNO_3$+50mL of 0.1M KI

    **ANS : 1**
    **SOLUTION :** (1)-50mL of 1M $AgNO_3$+50mL of 1.5M KI
    (2)-50mL of 1M $AgNO_3$+50mL of 2M KI
    Both are correct

65. Which one is malachite from the following?
    a. $CuFeS_2$
    b. $Cu(OH)_2$
    c. $Fe_3O_4$
    d. $CuCO_3 . Cu(OH)_2$

    **ANS : 4**
    **SOLUTION :** CuCO₃. Cu(OH)₂

66. Which of the following is **incorrect** statement?
    a. $PbF_4$ is covalent in nature
    b. $SiCl_4$ is easily hydrolysed
    c. $GeX_4$(X=F, Cl, Br, I) is more stable than $GeX_2$
    d. $SnF_4$ is ionic in nature

    **ANS : 1**
    **SOLUTION :** PbF₄ is ionic in nature

67. The non-essential amino acid among the following is:
    a. valine
    b. leucine
    c. alanine
    d. lysine

    **ANS : 3**
    **SOLUTION :** Alanine

68. Match the following:

| (a) pure nitrogen | (i) chlorine |
|---|---|
| (b) Haber process | (ii)Sulphuric acid |
| (c) Contact process | (iii) Ammonia |
| (d) Deacon's Process | (iv) Sodium azide and Barium azide |

Which of the following is the correct answer?
    a. (a)-(i) , (b)-(ii) , (c)-(iii) , (d)-(iv)
    b. (a)-(ii) , (b)-(iv) , (c)-(i) , (d)-(iii)
    c. (a)-(iii) , (b)-(iv) , (c)-(ii) , (d)-(i)
    d. (a)-(iv) , (b)-(iii) , (c)-(ii) , (d)-(i)

**SOLUTION :** Pure nitrogen  - Sodium azide, Barium azide

Habers process – Ammonia

Contact process – Sulphuric acid

Deacon's process – Chlorine

69. Among the following, the narrow spectrum antibiotic is:

a. penicillin G

b. ampicillin

c. amoxycillin

d. chloramphenicol

**ANS : 1**

**SOLUTION :** Penicillin G

70. Which of the following is an amphoteric hydroxide

a. $Sr(OH)_2$

b. $Ca\ (OH)_2$

c. $Mg\ (OH)_2$

d. $Be\ (OH)_2$

**ANS : 4**

**SOLUTION :** $Be(OH)_2 + 2OH^- \longrightarrow \underset{\text{(beryllate ion)}}{Be(OH)_4^{-2}}$

$Be(OH)_2 + 2HCl + 2H_2O \rightarrow [Be(OH)_4]Cl_2$

71. Which of the following diatomic molecular species has only $\pi$ bonds according to molecular orbital Theory?

a. $O_2$

b. $N_2$

c. $C_2$

d. $Be_2$

**ANS : 3**

**SOLUTION :** $C_2$ consists of both $\pi$ bonds because of the presence of 4 electrons in two pi molecular orbitals

72. An alkene "A" on reaction with $O_3$ and Zn-$H_2O$ gives propanone and ethanal  in equimolar ratio. Addition of HCl to alkene "A" gives "B" as the major product. The structure of product "B" is :

a.

$$Cl-CH_2-CH_2-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{CH}}$$

b.

$$H_3C-CH_2-\overset{\overset{\displaystyle CH_2Cl}{|}}{CH}-CH_3$$
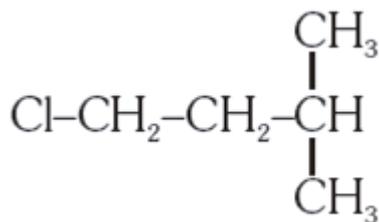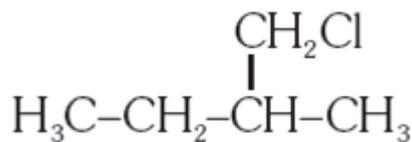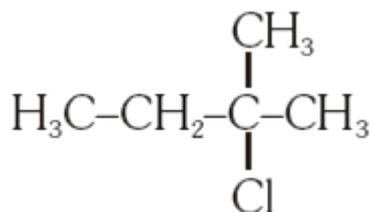
c.
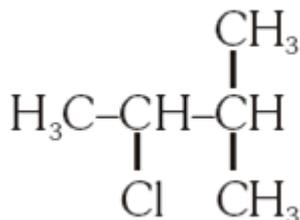


d.

**ANS : 3**
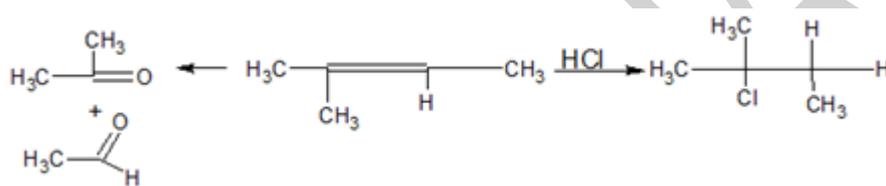
**SOLUTION:**



73. The biodegradable polymer is:
    a. Nylon-6,6
    b. Nylon-2-nylon 6
    c. Nylon-6
    d. Buna-S

    **ANS : 2**
    **SOLUTION :** Nylon-2-nylon-6 is an example for biodegradable polymer

74. The number of sigma ($\sigma$) and pi($\pi$) bonds in pent-2-en-4-yne is
    a. 10 $\sigma$ bonds and 3$\pi$ bonds
    b. 8 $\sigma$ bonds and 5$\pi$ bonds
    c. 11 $\sigma$ bonds and 2$\pi$ bonds
    d. 13 $\sigma$ bonds and no $\pi$ bonds
    **ANS : 1**
    **SOLUTION :** Pent-2-en-4-yne
    $$CH_3 - CH = CH - C \equiv CH$$
    Sigma bonds =10
    Pi bonds =3
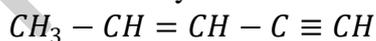
75. The **correct** order of the basic strength of methyl substituted amines in aqueous solution is
    a. $(CH_3)_2NH > CH_3NH_2 > (CH_3)_3N$
    b. $(CH_3)_3N > CH_3NH_2 > (CH_3)_2NH$
    c. $(CH_3)_3N > (CH_3)_2NH > CH_3NH_2$
    d. $CH_3NH_2 > (CH_3)_2N\,H > (CH_3)_3N$
    **ANS : 1**
    **SOLUTION :** Decreasing order of basic strength of methyl substituted amines in aqueous solution is
        $2^0$ amine > $1^0$ amine > $3^0$ amine
        Based on inductive effect, salvation effect and steric hindrance

76. What is the **correct** electronic configuration of the central atom in $K_4[Fe(CN)_6]$ based on crystal field theory?

a. $t_{2g}^4 \, e_g^2$

b. $t_{2g}^6 \, e_g^0$

c. $e^3 \, t_2^3$

d. $e^4 \, t_2^2$

**ANS : 2**

**SOLUTION :** $K_4 [Fe (CN)_6]$

$Fe^{+2}$ ; $3d^6$
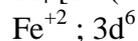
$CN^-$ is a strong ligand (Crystal field splitting energy greater than pairing energy ).

$t_{2g}^{\,6} \, e_g^{\,0}$

77. Among the following ,the one that is **not** a green house gas is

a. Nitrous oxide

b. methane

c. ozone

d. Sulphur dioxide

**ANS : 4**

**SOLUTION :** $SO_2$ is not a green house gas.

78. A compound is formed by cation C and anion A. The anions forms hexagonal close packed (hcp) lattice and the cations occupy 75% of octahedral voids. The formula of the compound is:

a. $C_2A_3$

b. $C_3A_2$

c. $C_3A_4$

d. $C_4A_3$

**ANS : 3**

**SOLUTION :** Cation : C

Anion : A

Anions form hexagonal close packed lattice. Cation occupies 75% octahedral voids.

C:A

0.75:1

3:4

$C_3A_4$

79. For an ideal solution, the **correct** options is:

a. $\Delta_{mix}S=0$ at constant T and P

b. $\Delta_{mix}V \neq 0$ at constant T and P

c. $\Delta_{mix}H=0$ at constant T and P

d. $\Delta_{mix}G=0$ at constant T and P

**ANS : 3**

**SOLUTION :** For an ideal solution

$\Delta_{mix} = \Delta_{mix} \ H = 0$ at constant T and P

80. The compound that is most difficult to protonate is:
   a. H-O-H
   b. $H_3C$-O-H
   c. $H_3C$-O-$CH_3$
   d. Ph-O-H

   **ANS : 4**

   **SOLUTION :** In phenol, $C_6H_5$- is an electron withdrawing group. Hence it is most difficult to protonate.

81. 4d, 5p, 5f and 6p orbitals are arranged in the order of decreasing energy. The correct option is:
   a. 5f>6p>5p>4d
   b. 6p>5f>5p>4d
   c. 6p>5f>4d>5p
   d. 5f>6p>4d>5p

   **ANS : 1**

   **SOLUTION :**

   | Orbit | 4d | 5p | 5f | 6p |
   |-------|------|------|------|------|
   | (n+l) | 4+2=6 | 5+1=6 | 5+3=8 | 6+1=7 |

   Among the orbitals having same (n+l) values the one having smaller n value has lower energy.

   5f > 6p > 5p > 4d

82. The mixture that forms maximum boiling azeotrope is:
   a. Water + Nitric acid
   b. Ethanol + Water
   c. Acetone + Carbon disulphide
   d. Heptane + Octane

   **ANS : 1**

   **SOLUTION :** Maximum boiling azeotrope is the one which shows negative deviation from ideal behaviour. Water + nitric acid

83. In which case change in entropy is negative?
   a. Evaporation of water
   b. Expansion of a gas at constant temperature
   c. Sublimation of solid to gas
   d. $2H_{(g)} \rightarrow H_{2(g)}$

   **ANS : 4**

   **SOLUTION :** $2H_{(g)} \rightarrow H_{2(g)}$

   Number of gaseous moles decreases. Hence entropy decreases (-ve)

84. pH of a saturated solution of $Ca(OH)_2$ is 9. The solubility product (Ksp) of $Ca(OH)_2$ is
   a. $0.5 \times 10^{-15}$
   b. $0.25 \times 10^{-10}$
   c. $0.125 \times 10^{-15}$
   d. $0.5 \times 10^{-10}$

   **ANS : 1**

**SOLUTION :** pH +pOH = 14

  pOH= 14-9=5

  pOH = - log [OH⁻]

  5= - log [OH⁻]

  $[OH^-] = 10^{-5}$

$$Ba(OH)_2 \leftrightarrows Ba^{+2} + 2OH^-$$
$$\phantom{Ba(OH)_2 \leftrightarrows} S \phantom{Ba^{+2} +} 2S$$

  S of $Ba^{+2} = 10^{-5}$

  S of OH⁻ = 0.5 X $10^{-5}$

  $K_{SP} = 4S^3$

  $K_{sp} = 4 \times (0.5 \times 10^{-5})^3$

  $K_{sp} = 0.5 \times 10^{-15}$

85. Which of the following series of transition in the spectrum of hydrogen atom falls in visible region?
 a. Lyman series
 b. Balmer series
 c. Paschen series
 d. Brackett series

**ANS : 2**
**SOLUTION :** Balmer series

86. Idendity the **incorrect** statement relelated to $PCl_5$ from the following:
 a. Three equatorial P-Cl bonds make an angle of 120° with each other.
 b. Two axial P-Cl bonds make an angle of 180° with each other.
 c. Axial P-Cl bonds are longer than equatorial P-Cl bonds
 d. P-$Cl_5$ bonds are non-reactive

**ANS : 4**
**SOLUTION :** $PCl_5$ molecule has trigonal bipyramidal geometry. As the axial bond pairs suffer more repulsive interactions from the equatorial bond pairs, therefore axial bonds have been found to be slightly longer and hence slightly weaker than the equatorial bonds; which makes $PCl_5$ molecules more reactive.

87. The most suitable reagent for the following conversion, is:

$$H_3C-C{\equiv}C-CH_3 \longrightarrow$$

cis-2-butene

 a. Na/liquid$NH_3$
 b. $H_2$, Pd/C, quinoline
 c. Zn/HCl
 d. $Hg^{2+}/H^+$, $H_2O$

**ANS : 2**

**SOLUTION :** Alkyne $\xrightarrow{Lindlars\ catalyst\ ,Pd \backslash c\ )}$ cis alkene

alkyne $\xrightarrow{Na,liquid\ NH_3}$ trans alkene

88. The structure of intermediate **A** in the following reaction is:



a.
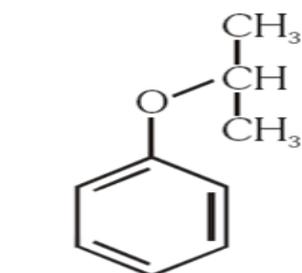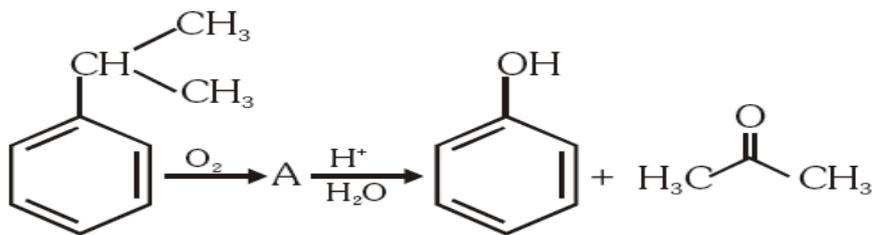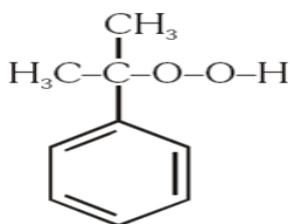


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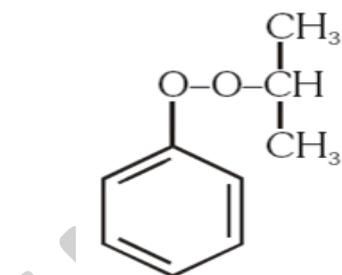


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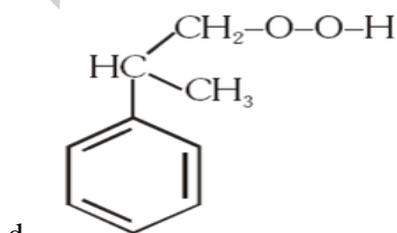


d.

**ANS : 2**

**SOLUTION :** Preparation of phenol from cumene process

89. For the cell reaction $2Fe^{3+}(aq) + 2I^-(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(aq)$ $E^-_{cell} = 0.24$V at 298K. The standard Gibbs energy $(\Delta_r G^o)$ of the cell reaction is:

[given that Faraday constant F=96500Cmol$^{-1}$]

    a.   -46.32kJmol$^{-1}$

    b.   -23.16kJmol$^{-1}$

    c.   46.32kJmol$^{-1}$

    d.   23.16kJmol$^{-1}$

**ANS : 1**

**SOLUTION :** $\Delta G^0 = - nFE^0_{cell}$

          $\Delta G^0 = - 2 \times 96500 \times 0.24$

          $= - 46. 32$kJmol$^{-1}$

90. The correct structure of tribromooctaoxide is:

a.
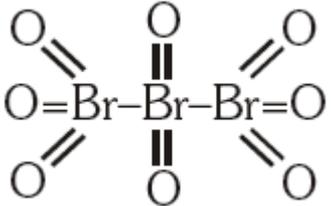

b.
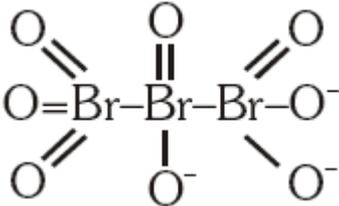

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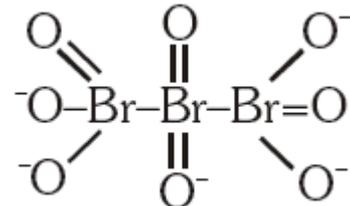

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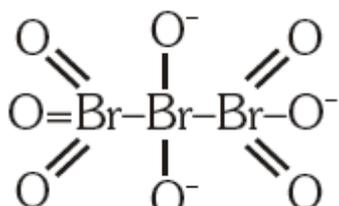

**ANS : 1**
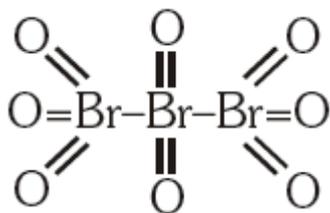


**SOLUTION :**

91. Thiobacillus is a group of bacteria helpful in carrying out
    a. Nitrogen fixation
    b. Chemoautotrophic fixation
    c. Nitrification
    d. Denitrification

    **ANS : 4**
    **SOLUTION :** Nitrate present in the soil is reduced to nitrogen by the process of denitrification. Denitrification is carried by bacteria Pseudomonas and Thiobacillus.

92. From evolutionary point of view, retention of the female gametophyte with developing embryo on the parent sporophyte for some time is first observed in
    a. Liverworts
    b. Mosses
    c. Pteridophytes
    d. Gymnosperms

    **ANS : 3**
    **SOLUTION :** From evolutionary point of view, retention of the female gametophyte with developing embryo on the parent sporophyte for some time is first observed in pteridophytes.

93. Which of the following is the most important cause for animals and plants being driven to extinction?
    a. Habitat loss and fragmentation
    b. Drought and floods
    c. Economic exploitation
    d. Alien species invasion

    **ANS : 1**
    **SOLUTION :** Habitat loss and fragmentation is the most important cause for animals and plants being driven to extinction.

94. Xylem translocates:
    a. Water only
    b. Water, mineral salts only
    c. Water, mineral salts and some organic nitrogen only
    d. Water, mineral salts, some organic nitrogen and hormones

    **ANS : 4**
    **SOLUTION :** Xylem translocateswater, minerals and some organic nitrogen & harmones.

95. Which of the following statements is correct?
    a. Cornea is an external, transparent and protective proteinaceous covering of the eye ball
    b. Cornea consists of dense connective tissue of elastin and can repair itself
    c. Cornea is convex, transparent layer which is highly vascularised
    d. Cornea consists of dense matrix of collagen and is the most sensitive portion of the eye.

    **ANS : 1**
    **SOLUTION :** Cornea is an external, transparent and protective proteinaceous covering of the eye ball.

96. Persistent nucellus in the seed is known as
    a. Chalaza
    b. Perisperm
    c. Hilum
    d. Tegmen

**ANS : 2**
**SOLUTION :** Persistent nucellus in the seed is known as perisperm

97. Extrusion of second polar body from egg nucleus occurs
    a. After entry of sperm but before fertilization
    b. After fertilization
    c. Before entry of sperm into ovum
    d. Simultaneously with first cleavage

**ANS : 1**
**SOLUTION :** The sperm entry stimulates the secondary oocyte to undergo meiotic II division, which produces the ovum and second polar body.

98. Select the correctly written scientific name of Mango which was first described by Carolus Linnaeus:
    a. *Mangiferaindica* Car. linn
    b. *Mangiferaindica* Linn
    c. *Mangiferaindica*
    d. *MangiferaIndica*

**ANS : 2**
**SOLUTION :** Name of the author appears after the specific epithet, i.e., at the end of the biological name and is written in an abbreviated form, e.g., Mangiferaindica Linn.
It indicates that this species was first described by Linnaeus.

99. Expressed Sequence Tags (ESTs) refers to;
    a. Genes expressed as RNA
    b. Polypeptide expression
    c. DNA polymorphism
    d. Novel DNA sequence

**ANS : 1**
**SOLUTION :** Expressed Sequence Tags (ESTs) includes identifying all the genes that are expressed as RNA.

100. Grass leaves curl inwards during very dry weather. Select the most appropriate reason from the following
    a. Closure of stomata
    b. Flaccidity of bulliform cells
    c. Shrinkage of air spaces in spongy mesophyll
    d. Tyloses in vessels

**ANS : 2**
**SOLUTION :** In grasses, certain adaxial epidermal cells along the veins modify themselves into large, empty, colourless cells. These are called bulliform cells. When the bulliform cells in the leaves have absorbed water and are turgid, the leaf surface is exposed. When they are flaccid due to water stress, they make the leaves curl inwards to minimise water loss.

101. Which of the following muscular disorders is inherited?
   a. Tetany
   b. Muscular dystrophy
   c. Myasthenia gravis
   d. Botulism
   **ANS : 2**
   **SOLUTION :** Duchene muscular dystrophy is a rare X-linked dominant genetic disorder with features like mental retardation, absence of teeth and cleft tongue.

102. Under which of the following conditions will there be no change in the reading frame of the following mRNA? 5'AACAGCGGUGCUAUU3'
   a. Insertion of G at $5^{th}$ position
   b. Deletion of G from $5^{th}$ position
   c. Insertion of A and G at $4^{th}$ and $5^{th}$ positions respectively
   d. Deletion of GGU from $7^{th}$, $8^{th}$ and $9^{th}$ positions
   **ANS : 4**
   **SOLUTION :** Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion. However, such mutations are referred to asframeshift insertion or deletion mutations. Insertion or deletion of three or its multiple bases insert or delete one or multiple codon hence one or multiple amino acids, and reading frame remains unaltered from that point onwards.

103. The shorter and longer arms of a submetacentric chromosome are referred to as
   a. 's' arm and 'l' arm respectively
   b. 'p' arm and 'q' arm respectively
   c. 'q' arm and 'p' arm respectively
   d. 'm' arm and 'n' arm respectively
   **ANS : 2**
   **SOLUTION :** The "p" comes from the French "petit" meaning small. All human chromosomesha 2 arms - the p (short) arm and the q (long) arm - that are separated from each other only by a prima constriction, the centromere, the point at which the chromosome is attached to the spindle during c division.

104. Select the correct option
   a. $8^{th}$, $9^{th}$ and $10^{th}$ pairs of ribs articulate directly with the sternum
   b. $11^{th}$ and $12^{th}$ pairs of ribs are connected to the sternum with the help of hyaline cartilage
   c. Each rib is a flat thin bonne and all the ribs are connected dorsally to the thoracic vertebrae and ventrally to the sternum
   d. There are 7 pairs of vertebrosternal, 3 pairs of vertebrochondral and 2 pairs of vertebral ribs.

   **ANS : 4**
   **SOLUTION :** There are 7 pairs of vertebrosternal, 3 pairs of vertebrochondral and 2 pairs of vertebral ribs.

105. Which of the following sexually transmitted diseases is not completely curable?
   a. Gonorrhoea
   b. Genital warts
   c. Genital herpes
   d. Chlamydiasis

   **ANS : 3**
   **SOLUTION :** Except for hepatitis-B, genital herpes and HIV infections, other diseases are completely curable if detected early and treated properly

106. Which of the following statements is not correct?
   a. Lysosomes have numerous hydrolytic enzymes
   b. The hydrolytic enzymes of lysosomes are active under acidic pH.
   c. Lysosomes are membrane bound structures
   d. Lysosomes are formed by the process of packaging in the endoplasmic reticulum

   **ANS : 4**
   **SOLUTION :** Lysosomes are formed by the process of packaging in the Golgi complex.

107. Which of the following equipments is essentially required for growing microbes on a large scale, for industrial production of enzymes?
   a. BOD incubator
   b. Sludge digester
   c. Industrial oven
   d. Bioreactor

   **ANS : 4**
   **SOLUTION :** Bioreactor is essentially required for growing microbes on a large scale, for industrial production of enzymes

108. Which one of the following is not a method of *in situ* conservation of biodiversity?
   a. Biosphere reserve
   b. Wildlife sanctuary
   c. Botanical garden
   d. Sacred grove

   **ANS : 3**
   **SOLUTION :** Botanical garden is a method of *ex situ* conservation of biodiversity.

109. Consider the following features:
   (a) Organ system level of organisation
   (b) Bilateral symmetry
   (c) True coelomates with segmentation of body
   Select the correct option of animal groups which possess all the above characteristics.
   a. Annelida, Arthropoda and Chordata
   b. Annelida, Arthropoda and Mollusca
   c. Arthropoda, Mollusca and Chordata
   d. Annelida, Mollusca and Chordata

   **ANS : 1**
   **SOLUTION :** Annelida, Arthropoda and Chordata shows all of the given characters.

110. The ciliated epithelial cells are required to move particles or mucus in a specific direction. In humans, these cells are mainly present in
   a. Bile duct and Bronchioles
   b. Fallopian tubes and Pancreatic duct
   c. Eustachian tube and Salivary duct
   d. Bronchioles and fallopian tubes

   **ANS : 4**
   **SOLUTION :** The ciliated epithelial cells are required to move particles or mucus in a specific direction.In humans, these cells are mainly present in bronchioles and fallopian tubes.

111. What is the site of perception of photoperiod necessary for induction of flowering in plants?
   a. Lateral buds
   b. Pulvinus
   c. shoot apex
   d. leaves
   **ANS : 4**
   **SOLUTION :** Leaves are the site of perception of photoperiod necessary for induction of flowering in plants

112. Match the Hominids with their correct brain size:

| (a) Homo habilis | (i) 900 cc |
|---|---|
| (b) Homo neanderthalensis | (ii) 1350 cc |
| (c) Homo erectus | (iii) 650-800 cc |
| (d) Homo sapiens | (iv) 1400 cc |

   a. a-(iii) b-(i) c-(iv) d-(ii)
   b. a-(iii) b-(ii) c-(i) d-(iv)
   c. a-(iii) b-(iv) c-(i) d-(ii)
   d. a-(iv) b-(iii) c-(i) d-(ii)
   **ANS : 3**
   **SOLUTION :** Homo habilis-650-800 cc , Homo neanderthalensis-1400 cc,Homo erectus-900 cc,Homo sapiens-1350 cc

113. In *Antirrhinum* (snapdragon), a red flower was crossed with a white flower and in $F_1$ generation, pink flowers were obtained. When pink flowers were selfed, the $F_2$ generation showed white, red and pink flowers. Choose the incorrect statement from the following
   a. This experiment does not follow the principle of dominance
   b. Pink colour in $F_1$ is due to incomplete dominance
   c. Ratio of $F_2$ is $\frac{1}{4}(red):\frac{2}{4}(pink):\frac{1}{4}(white)$
   d. Law of segregation does not apply in this experiment
   **ANS : 4**
   **SOLUTION :** Law of segregation does not apply in the given experiment

114. Which of these following methods is the most suitable for disposal of nuclear waste?
   a. Shoot the waste into space
   b. Burry the waste under Antarctic ice cover
   c. Dump the waste within rocks under deep ocean
   d. Bury the waste within rocks deep below the earth's surface
   **ANS : 4**
   **SOLUTION :** It has been recommended that storage of nuclear waste, after sufficient pre-treatment, should be done in suitably shielded containers buried within the rocks, about 500 m deep below the earth's surface.

115. Drug called 'Heroin' is synthesized by:
   a. Methylation of morphine
   b. Acetylation of morphine
   c. Glycosylation of morphine
   d. Nitration of morphine
   **ANS : 2**
   **SOLUTION :** The most notorious derivative of morphine is heroin. It is synthesised by acetylation of the two hydroxyl groups of morphine with acetyl chloride, hence its other names, diacetylmorphine or diamorphine.

116. Use of an artificial kidney during haemodialysis may result in:
    (a) Nitrogenous waste build- up in the body
    (b) Non- elimination of excess potassium
    (c) Reduced absorption of calcium ions in gastro- intestinal tract
    (d) Reduced RBC production
    Which of the following options is the appropriate?
    a. (a) and (b) are correct
    b. (b) and (c) are correct
    c. (c) and (d) are correct
    d. (a) and (d) are correct
    **ANS : 3**
    **SOLUTION :** Reduced absorption of calcium ions in gastro- intestinal tract
            Reduced RBC production

117. What is the genetic disorder in which an individual has an overall masculine development, gynaecomastia, and is sterile?
    a. Turner's syndrome
    b. Klinefelter's syndrome
    c. Edward syndrome
    d. Down's syndrome
    **ANS : 2**
    **SOLUTION** : Klinefelter'sSyndrome : This genetic disorder is also caused due to the presence of an additional copy of X-chromosome resulting into a karyotype of 47, XXY. Such an individual has overall masculine development , however, the feminine development (development of breast, i.e., Gynaecomastia) is also expressed. Such individuals are sterile.

118. Which of the following statement is incorrect?
    a. Morels and truffles are edible delicacies
    b. Claviceps is a source of many alkaloids and LSD
    c. Conidia are produced exogenously and ascospores endogenously
    d. Yeasts have filamentous bodies with long thread- like hyphae
    **ANS : 4**
    **SOLUTION :** Yeasts are unicellular fungi.

119. Which of the following ecological pyramids is generally inverted?
    a. Pyramid of numbers in grassland
    b. Pyramid of energy
    c. Pyramid of biomass in a forest
    d. Pyramid of biomass in a sea
    **ANS : 4**
    **SOLUTION :** Pyramid of biomass in a sea is generally inverted because the biomass of fishes far exceeds that of the phytoplankton.

120. Select the correct sequence for transport of sperm cells in male reproductive system.
    a. Testis →Epididymis → Vasa efferentia→ Rete testis → Inguinal canal → Urethra
    b. Seminiferous tubules→Rete testis → Vasa efferentia→ Epididymis→Vas deferens→Ejaculatory duct → Urethra → Urethral meatus
    c. Seminiferous tubules → Vasa efferentia→ Epididymis → Inguinal canal →Urethra
    d. Testis → Epididymis → Vasa efferentia→Vas deferens→ Ejaculatory duct → Inguinal canal → Urethra → Urethral meatus

**ANS : 2**

**SOLUTION :** Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens→ Ejaculatory duct → Urethra → Urethral meatus

121. Which of the following protocols did aim for reducing emission of chlorofluorocarbons into the atmosphere?
   a. Montreal protocol
   b. Kyoto protocol
   c. Gothenburg protocol
   d. Geneva protocol

   **ANS : 1**

   **SOLUTION :** Recognising the deleterious affects of ozone depletion, an international treaty, known as the Montreal Protocol, was signed at Montreal (Canada) in 1987 (effective in 1989) to control the emission of ozone depleting substances. Subsequently many more efforts have been made and protocols have laid down definite roadmaps, separately for developed and developing countries, for reducing the emission of CFCs and other ozone depleting chemicals.

122. The correct sequence of phases of cell cycle is
   a. $M \rightarrow G_1 \rightarrow G_2 \rightarrow S$
   b. $G_1 \rightarrow G_2 \rightarrow S \rightarrow M$
   c. $S \rightarrow G_1 \rightarrow G_2 \rightarrow M$
   d. $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$

   **ANS : 4**

   **SOLUTION :** The correct sequence of phases of cell cycle is $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$.

123. What is the fate of the male gametes discharged in the synergid?
   a. One fuses with the egg, other(s) degenerates in the synergid
   b. All fuses with the egg
   c. One fuses with the egg, other(s) fuses with synergid nucleus
   d. One fuses with the egg and other fuses with central cell nuclei

   **ANS : 4**

   **SOLUTION :** After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid. One of the male gametes moves towards the egg cell and fuses with its nucleus thus completing the syngamy. This results in the formation of a diploid cell, the zygote. The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus.

124. Which of the following pair of organelles does not contains DNA?
   a. Mitochondria and Lysosomes
   b. Chloroplast and Vacuoles
   c. Lysosomes and vacuoles
   d. Nuclear envelope and mitochondria

   **ANS : 3**

   **SOLUTION :** Nucleus, mitochondria and chloroplast contains DNA.

125. Which of the following glucose transporters is insulin- dependent?
   a. GLUT I
   b. GLUT II
   c. GLUT III
   d. GLUT IV

**ANS : 4**
**SOLUTION :** GLUT4 is insulin-dependent and is responsible for the majority of glucose transport into muscle and adipose cells in anabolic conditions.

126. Conversion of glucose to glucose-6-phosphate, the first irreversible reaction of glycolysis, is catalysed by:
  a. Aldolase
  b. Hexokinase
  c. Enolase
  d. Phosphofructokinase

**ANS : 2**
**SOLUTION :** Glucose and fructose are phosphorylated to give rise to glucose-6- phosphate by the activity of the enzyme hexokinase.

127. Variations caused by mutation, as proposed by Hugo de Vries, are :
  a. Random and directional
  b. Random and directionless
  c. Small and directional
  d. Small and directionless
  **ANS : 2**
  **SOLUTION :** In the first decade of twentieth century, Hugo deVries based on his work on evening primrose brought forth the idea of mutations – large difference arising suddenly in a population. He believed that it is mutation which causes evolution and not the minor variations (heritable) that Darwin talked about. Mutations are random and directionless while Darwinian variations are small and directional.

128. Which of the following statements regarding mitochondria is incorrect?
  a. Outer membrane is permeable to monomers of carbohydrates, fats and proteins
  b. Enzymes of electron transport are embedded in outer membrane
  c. Inner membrane is convoluted with infoldings
  d. Mitochondrial matrix contains single circular DNA molecule and ribosomes
  **ANS : 2**
  **SOLUTION :** Enzymes of electron transport are embedded in inner membrane of mitochondria

129. Select the correct sequence of organs in the alimentary canal of cockroach starting from mouth :
  a. Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum
  b. Pharynx → Oesophagus →Gizzard→Crop→ Ileum → Colon → Rectum
  c. Pharynx → Oesophagus → Gizzard → Ileum → Crop→ Colon → Rectum
  d. Pharynx → Oesophagus→ Ileum→ Crop→ Gizzard → Colon → Rectum
  **ANS : 1**
  **SOLUTION :** Pharynx → Oesophagus → Crop → Gizzard → Ileum → Colon → Rectum

130. Select the hormone- releasing Intra-Uterine Devices.
  a. Vaults, LNG-20
  b. Multiload 375, Progestasert
  c. Progestasert, LNG-20
  d. Lippes loop, Multiload 375
  **ANS : 3**
  **SOLUTION :** Hormone- releasing Intra-Uterine Devices are Progestasert, LNG-20

131. Concanavalin A is :
    a. An alkaloid
    b. An essential oil
    c. A lectin
    d. A pigment
    **ANS : 3**
    **SOLUTION :** Concanavalin A is a lectin a secondary metabolite.

132. DNA precipitation out of a mixture of biomolecules can be achieved by treatment with :
    a. Isopropanol
    b. Chilled ethanol
    c. Methanol at room temperature
    d. Chilled chloroform
    **ANS : 2**
    **SOLUTION :** DNA precipitation out of a mixture of biomolecules can be achieved by treatment with chilled ethanol.

133. Which of the following factors is responsible for the formation of concentrated urine?
    a. Low levels of antidiuretic hormone
    b. Maintaining hyperosmolarity towards inner medullary interstitium in the kidneys
    c. Secretion of erythropoietin by Juxtaglomerular complex
    d. Hydrostatic pressure during glomerular filtration
    **ANS : 2**
    **SOLUTION :** Maintaining hyperosmolarity towards inner medullary interstitium in the kidneysis responsible for the formation of concentrated urine.

134. What would be the heart rate of a person of the cardiac output is 5L, blood volume in the ventricles at the end of diastole is 100 mL and at the end of ventricular systole is 50 mL?
    a. 50 beats per minute
    b. 75 beats per minute
    c. 100 beats per minute
    d. 125 beats per minute
    **ANS : 3**
    **SOLUTION :** Cardiac output = heart rate × stroke volume
    Cardiac output = 5 L (5000 mL), stroke volume = EDV – ESV = 100 – 50 = 50 Ml
    5000 mL = heart rate × 50 mL
    Therefore, Heart rate = 100 beats/ min.

135. Select the incorrect statement.
    a. Inbreeding increases homozygosity
    b. Inbreeding is essential to evolve purelines in any animal
    c. Inbreeding selects harmful recessive genes that reduce fertility and productivity
    d. Inbreeding helps in accumulation of superior genes and elimination of undesirable genes

    **ANS : 3**
    **SOLUTION :** Inbreeding increases homozygosity. Thus inbreeding is necessary if we want to evolve a pureline in any animal. Inbreeding exposes harmful recessive genes that are eliminated by selection. It also helps in accumulation of superior genes and elimination of less desirable genes. Therefore, this approach, where there is selection at each step, increases the productivity of inbred population.

136. Match the following genes of the Lac operon with their respective products :

| (a) i gene | (i) $\beta$- galactosidase |
|---|---|
| (b) z gene | (ii) Permease |
| (c) a gene | (iii) Repressor |
| (d) y gene | (iv) Transacetylase |

   a.   (a) – (i), (b) – (iii), (c) – (ii), (d) – (iv)
   b.   (a) – (iii), (b) – (i), (c) – (ii), (d) – (iv)
   c.   (a) – (iii), (b) – (i), (c) – (iv), (d) – (ii)
   d.   (a) – (iii), (b) – (iv), (c) – (i), (d) – (ii)

**ANS : 3**

**SOLUTION :** The lac operon consists of one regulatory gene (thei gene – here the term i does not refer to inducer, rather it is derived from the word inhibitor) and three structural genes (z, y, and a). The i gene codes for the repressor of the lac operon. The z gene codes for beta-galactosidase ($\beta$-gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose. The y gene codes for permease, which increases permeability of the cell to $\beta$-galactosides. Thea gene encodes a transacetylase.

137. Which of the following features of genetic code does allow bacteria to produce human insulin by recombinant DNA technology?
   a.  Genetic code is not ambiguous
   b.  Genetic code is redundant
   c.  Genetic code is nearly universal
   d.  Genetic code is specific

**ANS : 3**

**SOLUTION :** The code is nearly universal: for example, from bacteria to human. So E. coli bacteria was used in the production of genetically engineered insulin.

138. Match the following

| (a)  Insulin | (i) Addison's disease |
|---|---|
| (b) Thyroxin | (ii)Diabetes insipidus |
| (c)Corticoids | (iii)Acromegaly |
| (d)Growth Hormone | (iv)Goitre |
|  | (v)Diabetes mellitus |

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

**ANS : 3**

**SOLUTION :** a-Insulin-( v)Diabetes mellitus
          b-Thyroxin- (iv)Goitre
          c-Corticoids- (i) Addison's disease
          d-Growth Hormone- (iii)Acromegaly

139. Colostrum, the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the new born infants because it contains:-
   a. Natural killer cells
   b. Monocytes
   c. Macrophages
   d. ImmunoglobulinA

**ANS : 4**
**SOLUTION :** Colostrum, the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the new born infants because it contains-ImmunoglobulinA

140. Placentation in which ovules develop on the inner wall of the ovary or in peripheral part, is:
   a. Basal
   b. Axile
   c. Parietal
   d. Free central

   **ANS : 3**
   **SOLUTION :** Placentation in which ovules develop on the inner wall of the ovary or in peripheral part, is- Parietal

141. Cells in $G_0$ phase
   a. Exit  the cell cycle
   b. Enter the cell cycle
   c. Suspend the cell cycle
   d. Terminate the cell cycle

   **ANS : 1**
   **SOLUTION :** The G0 phase is a period in the cell cycle in which cells exist in a quiescent state. G0 phase viewed as either an extended G1 phase, where the cell is neither dividing nor preparing to divide, or a distinct quiescent stage that occurs outside of the cell cycle

142. Respiratory quotient (RQ) value of tripalmitin is
   a. 0.9
   b. 0.7
   c. 0.07
   d. 0.09

   **ANS : 2**
   **SOLUTION :** When fats are the respiratory substrates, the value of R.Q. becomes less than one because the fats are poorer in oxygen in comparison to carbon and they require more $O_2$ for their oxidation. 0.7 (less than one)
   $$2C_{51}H_{98}O_6(Tripalmitin) + 145O_2 \rightarrow 102CO_2 + 98H_2O$$
   $$R.Q = Vol.of\ CO_2/Vol.of\ O_2 = \frac{102}{145} = 0.7(less\ than\ one)$$
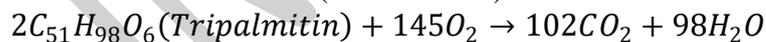
143. Select the correct group of bio control agents
   a. Bacillus thuringiensis, Tobacco Moasaic virus, Aphids
   b. Trichoderma, Baculovirus, Bacillus thuringiensis
   c. Oscillatoria, Rhizobium, Trichoderma
   d. Nostoc, Azospirillum,Nucleopolyherdrovirus

   **ANS : 2**
   **SOLUTION :** Trichoderma, Baculovirus, Bacillus thuringiensis  are group of bio control agents

144. Match the column- I with column- II:

| column- I | column- I I |
|---|---|
| (a)P-wave | (i)Depolarisation of ventricles |
| (b)QRS complex | (ii)Repolarisation of ventricles |
| (c)T-wave | (iii)Coronary ischemia |
| (d)Reduction in the size of T-wave | (iv) Depolarisation of atria |
| | (v) Repolarisation of atria |

a.  a-(iv)   b-(i) c-(ii) d-(iii)

b.  a-(iv)   b-(i) c-(ii) d-(v)

c.  a-(ii)   b-(i) c-(v) d-(iii)

d.  a-(ii)   b-(iii) c-(v) d-(iv)

**ANS : 1**
**SOLUTION :**      (a)P-wave-(iv) Depolarisation of atria
                    (b)QRS complex-(i)Depolarisation of ventricles
                    (c)T-wave-(ii)Repolarisation of ventricles
                    (d)Reduction in the size of T-wave-(iii)Coronary ischemia

145. Match the following structures with their respective location in organs:

| (a)Crypts of Lieberkuhn | (i)Pancreas |
|---|---|
| (b)Glison's capsule | (ii)Duodenum |
| (c)Islets of Langerhans | (iii)Small intestine |
| (d)Brunner's Glands | (iv) Liver |

a.  a-(iii)   b-(i) c-(ii) d-(iv)

b.  a-(ii)   b-(iv) c-(i) d-(iii)

c.  a-(iii)   b-(iv) c-(i) d-(ii)

d.  a-(iii)   b-(ii) c-(i) d-(iv)

**ANS : 3**
**SOLUTION :** (a) Crypts of Lieberkuhn-(iii) Small intestine
                    (b) Glison's capsule-(iv) Liver
                    (c) Islets of Langerhans-(i) Pancreas
                    (d) Brunner's Glands-(ii)Duodenum

146. Which of the following contraceptive method involve a role of hormone?
     a.   Lactational amenorrhea, Pills, Emergency contraceptives
     b.   Barrier method, Lactational amenorrhea,Pills
     c.   CuT, Pills, , Emergency contraceptives
     d.   Pills, , Emergency contraceptives, Barrier method

**ANS : 1**
**SOLUTION :** Lactational amenorrhea, Pills, Emergency contraceptives
Breast feeding delays the resumption of normal ovarian cycles by disrupting the pattern of pulsatile release of GnRH from the hypothalamus and hence LH from the pituitary. The plasma concentrations of FSH during lactation are sufficient to induce follicle growth, but the inadequate pulsatile LH signal results in a reduced estradiol production by these follicles. When follicle growth and estradiol secretion does increase to normal, lactation prevents the generation of a normal preovulatory LH surge and follicles either fail to rupture, or become atretic or cystic. Only when lactation declines sufficiently to allow generation of a normal preovulatory LH surge to occur will ovulation take place with the formation of a corpus luteum of variable normality.

Thus lactation delays the resumption of normal ovarian cyclicity by disrupting but not totally inhibiting, the normal pattern of release of GnRH by the hypothalamus.

Pills, Emergency contraceptives -contain two types of hormones, estrogen and progestin, which are commonly found in daily oral contraceptives.

147. Due to increasing air-borne allergens  and  pollutants, many people in urban area suffering form respiratory disorder causing wheezing due to
    a. Benign growth on mucus lining of cavity
    b. Inflammation of Bronchi and bronchioles
    c. Proliferation of fibrous tissues and damage of the alveolar walls.
    d. Reduction in the secretion of surfactants by  pneumocytes

    **ANS : 2**

    **SOLUTION :** Due to increasing air-borne allergens  and  pollutants, many people in urban area suffering form respiratory disorder causing wheezing due to Inflammation of Bronchi and bronchioles .

148.  A gene locus has two alleles A, a. If the frequency of dominant allele A is 0.4,then what will be the frequency of homozygous dominant ,heterozygous and  homozygous recessive individual  population?
    a. 0.36(AA);0.48(Aa);0.16(aa)
    b. 0.16(AA);0.24 (Aa);0.36(aa)
    c. 0.16(AA);0.48 (Aa);0.36(aa)
    d. 0.16(AA);0.36 (Aa);0.48(aa)

    **ANS : 3**
    **SOLUTION :** The frequency of dominant allele A is 0.4
    The frequency of the "A" allele. Since p = 0.4, and p + q = 1, then p = 0.6
    The frequency of the "AA" genotype. $P^2$=0.16
    The frequencies of the genotypes "AA" and "Aa." The frequency of AA is equal to $p^2$, and the frequency of Aa is equal to 2pq. So, using the information above, the frequency of AA is 16% (i.e. $p^2$ is 0.4 x 0.4 = 0.16) and Aa is 48% (2pq = 2 x 0.4 x 0.6 = 0.48).

    The frequency of the "a" allele. The frequency of aa is 36%, which means that $q^2$ = 0.36, by definition. If $q^2$ = 0.36, then q = 0.6, again by definition. Since q equals the frequency of the a allele, then the frequency is 60%.

149.   How does steroid hormone influence the cellular activities  ?
    a. Changing the permeability of the cell membrane
    b. Binding to DNA and forming a gene-hormone complex
    c. Activating cyclic AMP located on the cell membrane
    d. Using aquaporine channels as second messenger

    **ANS : 2**
    **SOLUTION :** The steroid hormones pass through the plasma membrane of a target cell and adhere to intracellular receptors residing in the cytoplasm or in the nucleus. In the nucleus, the hormone-receptor complex binds to a DNA sequence called a hormone response element (HRE), which triggers gene transcription and translation.

150. In some plants ,the female gamete develops into embryo without fertilisation.
This  phenomenon is known as
a. Autogamy
b. Parthenocarpy
c. Syngamy
d. Parthenogenesis
   **ANS :**
   **SOLUTION :** In some plants ,the female gamete develops into embryo without fertilisation.
   This  phenomenon is known as Parthenogenisis.

151. Which of the following statements regarding post –fertilisation development in
flowering plants is incorrect?
a. Ovary develops into fruit
b. Zygote develops into embryo
c. Central cell develops into endosperm
d. Ovules develop into embryo sac
**ANS : 4**
**SOLUTION :** After fertilization occurs, each ovule develops into a seed. Each seed contains
a tiny, undeveloped plant called an embryo. The ovary surrounding the ovules develops into a
fruit that contains one or more seeds

152. Match the following  organisms with products they produce:

| (a)  Lactobacillus | (i) Cheese |
| --- | --- |
| (b) Saccharomyces cervisiae | (ii)Curd |
| (c)Aspergillus niger | (iii)Citric acid |
| (d)Acetobacter aceti | (iv)Bread |
|  | (v)Acetic acid |

a.   a-(ii),  b-(iv), c-(v), d-(iii)
b.   a- (ii), b-(iv), c-(iii), d-(v)
c.   a- (iii), b-(iv), c-(v), d- (i)
d.   a- (ii), b-(i), c-(iii), d- (v)
**ANS : 2**
**SOLUTION :** a-Lactobacillus-(ii)Curd
 b-Saccharomyces cervisiae-(iv)Bread
 c-Aspergillus niger-(iii)Citric acid
 d-Acetobacter aceti-(v)Acetic acid

153.Tidal Volume and Expiratory Reserve Volume of an athlete is 500 mL and 1000mL
respectively .What will be his Expiratory Capacity if the Residual Volume is 1200mL?
a.   1500mL
b.   1700mL
c.   2200mL
d.   2700Ml
**ANS : 1**
**SOLUTION :** Expiratory Capacity-(TV+ERV)= 1500Ml

154. Purines found both in DNA and RNA are
a. Adenine and thymine
b. Adenine and guanine
c. Guanine and cytosine
d. Cytosine and thymine

**ANS : 2**
**SOLUTION :** Purines found both in DNA and RNA are Adenine and guanine

155. The frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes was explained by :
    a. T.H.Morgan
    b. Gregor J.Mendle
    c. Alfred Sturtevant
    d. Sutton boveri
    **ANS : 3**
    **SOLUTION :** The frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes was explained by Alfred Sturtevant

156. The concept of "Omnis cellula –ecellula" regarding cell division was first proposed by:
    a. Rodulf Virchow
    b. Theodore Schwann
    c. Schleiden
    d. Aristotle
    **ANS : 1**
    **SOLUTION :** The concept of "Omnis cellula –ecellula" regarding cell division was first proposed by Rodulf Virchow

157. Phloem in gymnosperms lack:
    a. Albuminous cells and sieve cells
    b. Sieve tubes only
    c. Companion cells only
    d. Both Sieve tubes and Companion cells
    **ANS : 4**
    **SOLUTION :** Phloem in gymnosperms lack Both Sieve tubes and Companion cells

158. Match the following organisms with their respective charecteristics:

| (a) Pila | (i) Flame cells |
| --- | --- |
| (b) Bombyx | (ii)Comb plates |
| (c)Pleurobrachia | (iii)radula |
| (d)Taenia | (iv)Malpighian tubules |

    a. a-(iii)  b-(ii) c-(i) d-(iv)
    b. a- (iii) ,b-(iv) ,c-(ii) ,d-(i)
    c. a- (ii) ,b-(iv) ,c-(iii) ,d- (i)
    d. a- (iii) ,b-(ii) ,c-(iv) ,d- (i)
    **ANS : 2**
    **SOLUTION :** a-Pila-(iii)radula
    b-Bombyx-(iv)Malpighian tubules
    c-Pleurobrachia-(ii)Comb plates
    d-Taenia-(i) Flame cells

159. It takes very long time for pineapple plants to produce flowers .Which combination of hormones can be applied to artificially induced flowering in pineapple plants throughout the year to increase yield?
    a. Auxin and Ethylene
    b. Gibberellin and Cytokinin
    c. Gibberellin and Abscisic acid
    d. Cytokinin and Abscisic acid

**ANS : 1**

**SOLUTION :** It takes very long time for pineapple plants to produce flowers . Auxine and Ethylene combination of hormones can be applied to artificially induced flowering in pineapple plants throughout the year to increase yield?

160. Which of the following pairs of gases is mainly responsible for green house effect?
    a. Ozone and Ammonia
    b. Oxygen and Nitrogen
    c. Nitrogen and Sulphur dioxide
    d. Carbon dioxide and methane

    **ANS : 4**

    **SOLUTION :** Carbon dioxide 60% and methane20% pairs of gases is mainly responsible for green house effect.

161. Which of the following true for golden rice?
    a. It is vitamin A enriched, with a gene from daffodil.
    b. It is a peat resistant, with a gene from *Bacillus thuringiensis*
    c. It is a drought tolerant, developed using *Agrobacterium* vector.
    d. It has yellow grains, because of a gene introduced from a primitive variety of rice.

    **ANS : 1**

    **SOLUTION :** The International Rice Research Institute (IRRI) and its national research partners have developed Golden Rice to complement existing interventions to address vitamin A deficiency (VAD). VAD is a serious public health problem affecting millions of children and pregnant women globally.

162. Which of the following immune responses is responsible for rejection of kidney graft?
    a. Auto immune response
    b. Humoral immune response
    c. Inflammatory immune response
    d. Cell-mediated immune response

    **ANS : 4**

    **SOLUTION** : The second type is called cell-mediated immune response or cell-mediated immunity (CMI). The T-lymphocytes mediate CMI. Very often, when some human organs like heart, eye, liver, kidney fail to function satisfactorily, transplatation is the only remedy to enable the patient to
    live a normal life. Then a search begins – to find a suitable donor. Grafts from just any source – an animal, another primate, or any human beings cannot be made since the grafts would be rejected sooner or later. Tissue matching, blood group matching are essential before undertaking any graft/transplant and even after this the patient has to take immuno–suppresants all his/her life. The body is able to differentiate 'self ' and 'nonself' and the cell-mediated immune response is responsible for the graft rejection.

163. Which of the statements given is not true about formation of about formation of Annual Rings in trees?
    a. Annual ring is a combination of spring wood and autumn wood produced in a year
    b. Differential activity of cambium causes light and dark bands of tissue – early and late wood respectively.
    c. Activity of cambium depends upon variation in climate.
    d. Annual rings are not prominent in trees of temperate region.

**ANS : 4**
**SOLTION :** The activity of cambium is under the control of many physiological and environmental factors. In temperate regions, the climatic conditions are not uniform through the year. In the spring season, cambium is very active and produces a large number of xylary elements having vessels with wider cavities. The wood formed during this season is called spring wood or early wood. In winter, the cambium is less active and forms fewer xylary elements that have narrow vessels, and this wood is called autumn wood or late wood.

164. What is the direction of movement of sugars in phloem?
    a. Non-multidirectional
    b. Upward
    c. Downward
    d. Bi-directional

    **ANS : 4**
    **SOLUTION :** Since the source-sink relationship is variable, the direction of movement in the phloem can be upwards or downwards, i.e., bi-directional. This contrasts with that of the xylem where the movement is always unidirectional, i.e., upwards. Hence, unlike one-way flow of water in transpiration, food in phloem sap can be transported in any required direction so long as there is a source of sugar and a sink able to use, store or remove the sugar.

165. Polyblend, a fine powder of recycled modified plastic, has proved to be a good material for
    a. Making plastic sacks
    b. Use as a fertilizer
    c. Construction of roads
    d. Making tubes and pipes

    **ANS : 3**
    **SOLUTION :** Ahmed Khan, aged 57 years old, has been producing plastic sacks for 20 years. About 8 years ago, he realised that plastic waste was a real problem. Polyblend, a fine powder of recycled modified plastic, was developed then by his company. This mixture is mixed with the bitumen that is used to lay roads. In collaboration with R.V.College of Engineering and the Bangalore City Corporation, Ahmed Khan proved that blends of Polyblend and bitumen, when used to lay roads, enhanced the bitumen's water repellant properties, and helped to increase road life by a factor of three.

166. What map unit (Centimorgan ) is adopted in the construction of genetic maps?
    a. A unit of distance between two expressed genes, representing 10% cross over.
    b. A unit of distance between two expressed genes, representing 100% cross over.
    c. A unit of distance between genes on chromosomes representing 1% cross over
    d. A unit of distance between  genes on chromosomes representing 50% cross over

    **ANS : 3**
    **SOLUTION :** The analysis with more and more genes  we can build up linkage maps of entire chromosomes. In linkage maps, you may see distances expressed as centimorgans or map units rather than recombination frequencies. Luckily, there's a direct relationship among these values: a 1% recombination frequency is equivalent to 1 centimorgan or 1 map unit.

167. Consider the following statements

A.Coenzyme or metal ion that is tightly linked to enzyme protein is called prosthetic group.

B.A complete catalytic active enzyme with its bound prosthetic group is called apoenzyme.

Select the **correct** option.
   a. Both A and B are correct.
   b. A is true but B is false.
   c. Both A and B are false.
   d. A is false but B is true.

**ANS : 3**

**SOLUTION :** Prosthetic groups are organic compounds and are distinguished from other cofactors in that they are tightly bound to the apoenzyme. For example, in peroxidase and catalase, which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.

Co-enzymes are also organic compounds but their association with the apoenzyme is only transient, usually occurring during the course of catalysis.

A biochemically active compound formed by the combination of an enzyme with a coenzyme.

168. Which of the following can be used as a biocontrol agent in the treatment of plant diseases?
   a. *Trichoderma*
   b. *Chlorella*
   c. *Anabaena*
   d. *Lactobacillus*

**ANS : 1**

**SOLUTION :** A biological control being developed for use in the treatment of plant disease is the fungus *Trichoderma. Trichoderma* species are free-living fungi that are very common in the root ecosystems. They are effective biocontrol agents of several plant pathogens.

169. Pinus seed cannot germinate and establish without fungal association . This is because
   a. Its embryo is immature.
   b. It has obligate association with mycorrhiza
   c. It has very hard seed coat.
   d. Its seeds contain inhibitors that prevent germination.

**ANS : 2**

**SOLUTION :** Some plants have additional structures associated with them that help in water (and mineral) absorption. A mycorrhiza is a symbiotic association of a fungus with a root system. The fungal filaments form a network around the young root or they penetrate the root cells. The hyphae have a very large surface area that absorb mineral ions and water from the soil from a much larger volume of soil that perhaps a root cannot do. The fungus provides minerals and water to the roots, in turn the roots provide sugars and N-containing compounds to them mycorrhizae. Some plants have an obligate association with the mycorrhizae. For example, *Pinus* seeds cannot germinate and establish without the presence of mycorrhizae.

170. Which of the following is a commercial blood cholesterol lowering agent?
   a. Cyclosporine A
   b. Statin
   c. Streptokinase
   d. Lipases

   **ANS : 2**
   **SOLUTION :** Statins produced by the yeast *Monascus purpureus* have been commercialised as blood-cholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol

171. Identify the **correct** pair representing the causative agent of typhoid fever and the confirmatory test for typhoid.
   a. *Plasmodium vivax/*UTI test
   b. *Streptococcus pneumonia/* Widal test
   c. *Salmonella typhi/*Anthrone test
   d. *Salmonella typhi/*Widal test

   **ANS : 4**
   **SOLUTION :** *Salmonella typhi* is a pathogenic bacterium which causes typhoid fever in human beings. Typhoid fever could be confirmed by Widal test.

172. Match Column I with Column II

| Column – I | Column – II |
|---|---|
| a) Saprophyte | i) Symbiotic association of fungi with plant roots |
| b) Parasite | ii) Decomposition of dead organic material |
| c) Lichens | iii) Living on living plants or animals |
| d) Mycorrhiza | iv) Symbiotic association of algae and fungi |

   Choose the correct answer from the options given below.
   a.  a – (i)       b – (ii)       c – (iii)       d – (iv)
   b.  a – (iii)     b – (ii)       c – (i)         d – (iv)
   c.  a – (ii)      b – (i)        c – (iii)       d – (iv)
   d.  a – (ii)      b – (iii)      c – (iv)        d – (i)

   **ANS : 4**
   **SOLUTION :** a) Saprophyte

173. In a species ,the weight of new born ranges from 2to 5 Kg.97% of the newborn with an average weight between 3 to 3.3 Kg survive where as 99% of the infants born with weights from 2 to 2.5 Kg or 4.5 to  Kg die. Which type of selection process is taking place ?
   a. Directional selection
   b. Stabilizing Selection
   c. Disruptive Selection
   d. Cyclical Selection

   **ANS : 2**
   **SOLUTION :** Natural selection can lead to stabilisation (in which more individuals acquire mean character value)

174. Following statements describe the characteristics of the enzyme Restriction endonuclease .Identify the incorrect statement
    a. The enzyme cuts DNA molecule at identified position within the DNA
    b. The enzyme binds DNA at specific sites and cuts only one of the two strands
    c. The enzyme cuts the sugar –phosphate backbone at specific sites on each strand.
    d. The enzyme recognizes a specific palindromic nucleotide sequence in the DNA

    **ANS : 2**
    **SOLUTION :** Restriction endonuclease cuts both the strands of DNA in a specific site.

175. Select the incorrect statement
    a. Male fruit fly is heterogametic
    b. In male grasshoppers ,50% of sperms have no sex –chromosome.
    c. In domesticated fowls ,sex of the progeny depends on the type of sperm rather than egg
    d. Human males have one of their sex-chromosome much shorter than the other

    **ANS : 3**
    **SOLUTION :** In birds, the females are heterogametic not the males. Sex of the progeny depends on the type of egg rather than sperms.

176. Which of the following statements is incorrect ?
    a. Viroids lack a protein coat
    b. Viruses are obligate parasites
    c. Infective constituent in viruses is the protein coat
    d. Prions consist of abnormally folded proteins

    **ANS : 3**
    **SOLUTION :** In viruses the genetic materials are infective constituent not the protein.

177.  Identify the cells whose secretion protects the lining of gastro-intestinal tract from various enzymes
    a. Chief Cells
    b. Goblet Cells
    c. Oxyntic Cells
    d. Duodenal Cells

    **ANS : 2**
    **SOLUTION :** Goblet cells secreting mucus which protects gastro-intestinal tract from various enzymes.

178. The earth Summit held in Rio de Janeiro in 1992 was called :
    a. To reduce $CO_2$ emissions and global warming
    b. For conservation of biodiversity and sustainable utilization of its benefits
    c. To assess threat posed to native species by invasive weed species
    d. For immediate steps to discontinue use of CFCs that were damaging the ozone layer

    **ANS : 2**
    **SOLUTION :** Biodiversity knows no political boundaries and its conservation is therefore a collective responsibility of all nations. The historic Convention on Biological Diversity ('The Earth Summit') held in Rio de Janeiro in 1992, called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilisation of its benefits

179. What triggers activation of protoxin to active Bt toxin of *Bacillus thuringiensis* in boll worm
   a. Body temperature
   b. Moist surface of midgut
   c. Alkaline pH of gut
   d. Acedic pH of stomach

   **ANS : 3**
   **SOLUTION :** Actually, the Bt toxin protein exist as inactive *protoxins* but once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals. The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

180. Which part of the brain is responsible for thermoregulation
   a. Cerebrum
   b. Hypothalamus
   c. Corpus callosum
   d. Medulla oblongata

   **ANS : 2**
   **SOLUTION :** The hypothalamus contains a number of centres which control body temperature(thermoregulation), urge for eating and drinking.

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***