

MOTION

Student's Solution Copy [CODE - 27377]

NEET PATTERN TEST Brahmastra Major Test-02

13th NEET - Phase 13

KOTA

Date: 16-Mar-2025

Duration: 3 Hours

Max Marks: 720

Physics - Section A

1. Answer: 1

Sol:

Given :-

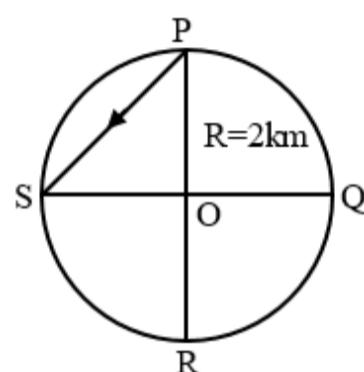
From the given equation

$\lambda = 50 \text{ cm} \rightarrow \text{at end position} \rightarrow \text{antinode}$
 $(x = 0)$

Distance between A \rightarrow N $\Rightarrow \frac{\lambda}{4}$
 $\Rightarrow x = \frac{50}{4} = 12.5 \text{ cm}$

2. Answer: 3

Sol:



The displacement is given by

$$\begin{aligned} PS &= \sqrt{(OS)^2 + (OP)^2} \\ &= \sqrt{2^2 + 2^2} \\ &= \sqrt{8} \text{ km} \end{aligned}$$

3. Answer: 2

Sol:

$$\begin{aligned} B &= \frac{\mu_0 ni}{2} = \frac{(4\pi \times 10^{-7}) \times 800 \times 1.6}{2} \\ &= 8 \times 10^{-4} \text{ T} \end{aligned}$$

4. Answer: 3

Sol:

$$\begin{aligned} \text{Torque } \tau &= pE \sin \theta \\ \Rightarrow 9 \times 10^{-26} \text{ Nm} &= p(10^4 \text{ N/C}) (\sin 30^\circ) \\ \therefore p &= 1.8 \times 10^{-29} \text{ C-m} \end{aligned}$$

5. Answer: 3

Sol:

$$\begin{aligned} F &= T \times 2\pi r \\ &= 0.07 \times 2 \times 3.14 \times 4.5 \times 10^{-2} = 19.8 \text{ mN} \end{aligned}$$

6. Answer: 4

Sol:

According to Wein's law,

$$\begin{aligned} \lambda_m T &= b \\ \lambda_m &= \frac{b}{T} = \frac{2.80 \times 10^6}{2800} = 1000 \text{ nm} \end{aligned}$$

Hence, U_2 is maximum

i.e. $U_2 > U_1$

7. Answer: 2

8. Answer: 2

Sol:

x magnetic field increasing therefore induced current will be anticlockwise

Sol:

$$\frac{\lambda}{4} = 20 \text{ cm}$$

$$\therefore \lambda = 80 \text{ cm}$$

9. Answer: 3

Sol:

Given :

$$\mu = 0.2$$

$$R = 50 \text{ m}$$

$$\text{As we know } f_s = \frac{mv^2}{r}$$

For maximum speed in safe turning

$$f_s = f_{\max} = \mu mg$$

$$v_{\max} (\text{for safe turning}) = \sqrt{\mu rg}$$

$$= \sqrt{0.2 \times 50 \times 10} = 10 \text{ m/s}$$

11. Answer: 1

Sol:

From the formula of Young's modulus, we get

$$Y = \frac{FI}{A\Delta l}$$

on rearranging and multiply by A, we get

$$\text{so, } F = \frac{YA^2 \Delta l}{Al} = \frac{YA^2 \Delta l}{V}$$

where, $Al = V = \text{Volume of wire}$

Since, it is given that the volume of both the wire is same
hence, $F \propto A^2$

$$\frac{F'}{F} = \frac{(3A)^2}{A^2} = 9$$

or $F' = 9F$

13. Answer: 3

Sol:

Beat frequency $f_b = (f_2 - f_1)$

$$= |256 - 250| = 6$$

Hz

Time from one maxima to minima.

$$T' = \frac{T_b}{2} = \frac{1}{2f_b} = \frac{1}{12} \text{ sec.}$$

15. Answer: 2

Sol:

At $t = 1 \text{ s}$, $I = 2 + 3 \times 1 = 5 \text{ A}$ and

$$|e| = L \frac{di}{dt} = 9 \times 10^{-3}$$

$$\Rightarrow L \times \frac{d}{dt} (2 + 3t) = 9 \times 10^{-3}$$

$\Rightarrow L = 3 \times 10^{-3} \text{ H}$ and

$$u = \frac{1}{2} LI^2 = \frac{3 \times 10^{-3}}{2} (5)^2 = 37.5 \text{ mJ}$$

10. Answer: 3

Sol:

$$V_A - V_B = -E \cdot [r_A - r_B] =$$

$$-E \cdot [(2\hat{i} + 3\hat{j}) - (5\hat{i} + 7\hat{j})]$$

$$= (9 + 16) \text{ volt} = 25 \text{ V}$$

12. Answer: 2

Sol:

$$\text{mean free path} = \left(\lambda = \frac{1}{\sqrt{2}\pi n d^2} \right)$$

$$\lambda_1 = \frac{1}{\sqrt{2}\pi n_1 d_1^2}$$

$$\lambda_2 = \frac{1}{\sqrt{2}\pi n_2 d_2^2}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{n_2 d_2^2}{n_1 d_1^2}$$

$$\frac{n_1}{n_2} = \frac{3}{5}$$

$$\frac{n_2}{n_1} = \frac{5}{3}$$

$$\frac{d_1}{d_2} = \frac{4}{5}$$

$$\Rightarrow \frac{d_2}{d_1} = \frac{5}{4}$$

$$\frac{\lambda_1}{\lambda_2} = \frac{3}{5} \times \frac{5}{4} \times \frac{5}{4} = \frac{15}{16}$$

$$\lambda_1 : \lambda_2 = 15 : 16$$

14. Answer: 1

Sol:

$$a = \frac{(m_1 - m_2)g}{m_1 + m_2} = \frac{g}{8}$$

$$8m_1 - 8m_2 = m_1 + m_2$$

$$7m_1 = 9m_2$$

$$\frac{m_1}{m_2} = \frac{9}{7}$$

16. Answer: 1

Sol:

Let P be a particle of mass m situated midway between the centres of the earth and the moon.

The potential energy of particle P due to earth is

$$U_1 = \frac{-GM_1 m}{r}$$

$$U_1 = \frac{-2GM_1 m}{d}$$

and due to Moon is

$$U_2 = \frac{-2GM_2 m}{d}$$

If the particle P is projected with a velocity v, its kinetic energy is

$$K = \frac{1}{2}mv^2$$

Therefore, the total initial energy of the particle is

$$E_1 = U_1 + U_2 + KE_1$$

$$E_1 = \frac{-2Gm(M_1+M_2)}{d} + \frac{1}{2}mv^2$$

If the particle is to escape to infinity, its total energy should be greater than or equal to zero.

So, the minimum velocity required is given by

$$E_1 = \frac{-2Gm(M_1+M_2)}{d} + \frac{1}{2}mv^2 = 0$$

so

$$v = 2 \left[\frac{G(M_1+M_2)}{d} \right]^{\frac{1}{2}}$$

17. Answer: 3**18. Answer: 2****Sol:**

$$\begin{aligned} I_P &= I_1 + I_2 + 2\sqrt{I_1 I_2} \cos\theta \\ &= I + 4I + 2\sqrt{4I^2} \times \cos 120^\circ = 3I \end{aligned}$$

Sol:

$$\Delta Q = nC_p \Delta T = n \left(\frac{f}{2} + 1 \right) R \Delta T$$

$$= n \left(\frac{5}{2} + 1 \right) R \Delta T$$

$$= n \left(\frac{7}{2} \right) R \Delta T$$

Given, $\Delta Q = 735$

$$\Rightarrow n \left(\frac{7}{2} \right) R \Delta T = 735$$

$$\Rightarrow nR \Delta T = 735 \times \frac{2}{7}$$

$$\text{Also, } \Delta U = \frac{f}{2} nR \Delta T$$

$$= \frac{5}{2} nR \Delta T$$

$$= \frac{5}{2} \times 735 \times \frac{2}{7}$$

$$= 525 \text{ J}$$

19. Answer: 1

Sol:

$$N \propto \frac{1}{I}$$

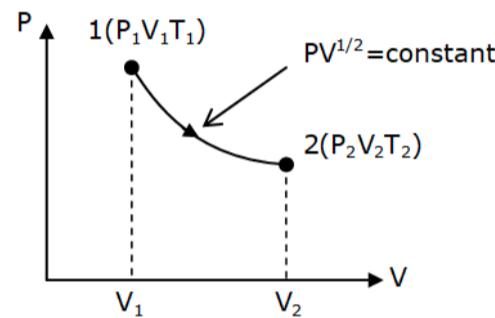
$$\frac{N_1}{N_2} = \frac{I_2}{I_1}$$

$$\frac{50}{200} = \frac{I_2}{4}$$

$$I_2 = 1 \text{ A}$$

20. Answer: 4

Sol:



From the P-V diagram,

$$\text{Given, } PV^{\frac{1}{2}} = \text{Constant} \quad \dots \dots (1)$$

We know that, $PV = nRT$

$$\text{or, } P \propto \frac{T}{V}$$

Put it in equation (1),

$$\frac{T}{V} \times V^{\frac{1}{2}} = \text{Constant}$$

$$\Rightarrow TV^{-\frac{1}{2}} = \text{Constant}$$

$$\Rightarrow T \propto \sqrt{V}$$

$$\text{So, } \frac{T_2}{T_1} = \sqrt{\frac{V_2}{V_1}}$$

$$\Rightarrow \frac{T_2}{T_1} = \sqrt{\frac{2V_1}{V_1}}$$

$$\therefore \frac{T_2}{T_1} = \sqrt{2}$$

21. Answer: 1

Sol:

Slipping starts when

$$\tan \theta = \mu_s$$

where,

θ = angle of inclination

μ_s = coefficient of static friction

$$\Rightarrow \mu_s = \tan 45^\circ$$

$$\mu_s = 1$$

22. Answer: 4

Sol:

Both (Assertion) and (Reason) are correct and (Reason) is the correct explanation of (Assertion).

23. Answer: 1**Sol:**

$$\frac{dw}{dt} = 10$$

$$F = u \frac{dw}{dt}$$

$$ma = u \frac{dw}{dt}$$

$$5000 \times 10 = u(10)$$

$$u = \frac{5000 \times 10}{10}$$

$$= 5000 \text{ m/s}$$

24. Answer: 3**Sol:**

Given

Work function of Cs, $\phi_{Cs} = 1.9 \text{ eV}$ Work function of Li, $\phi_{Li} = 2.5 \text{ eV}$ Wavelength of incident light, $\lambda = 550 \text{ nm}$

As we know energy of photon is given by,

$$E_{ph} = \frac{1240}{\lambda(\text{nm})} = \frac{1240}{550 \text{ nm}} = 2.25 \text{ eV}$$

As we know photoelectric effect is possible when energy of photon is greater than the work function and here,

$$E_{ph} > \phi_{Cs}$$

$$E_{ph} < \phi_{Li}$$

So the photoelectric effect is possible for Cs only.

25. Answer: 3**Sol:**

$$\text{Range} = H_{\max}$$

$$\frac{u^2 \sin 2\theta}{g} = \frac{u^2 \sin^2 \theta}{2g}$$

$$4 \sin \theta \cos \theta = \sin^2 \theta$$

$$\tan \theta = 4$$

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

26. Answer: 1**Sol:**

Time period is given by

$$t = \frac{2\pi r}{\nu}$$

$$\text{Here, } r = \left(\frac{\pi}{2}\right) \text{ cm} = \frac{\pi}{2} \times 10^{-2} \text{ m and } \nu = 6 \times 10^5 \text{ m/s}$$

So, electric current,

$$i = \frac{e\nu}{2\pi r}$$

$$= \frac{1.6 \times 10^{-19} \times 6 \times 10^5}{2\pi \times \frac{\pi}{2} \times 10^{-2}}$$

$$= 9.7 \times 10^{-13} \text{ A}$$

27. Answer: 4**Sol:**

Given :

$$\text{Depth} = 200 \text{ m}$$

$$\frac{\Delta V}{V} = \frac{0.1}{100} = 10^{-3}$$

$$\text{density} = 1 \times 10^3$$

$$g = 10$$

$$\beta = \frac{\Delta P}{\Delta V/V} = \frac{hg\rho}{\Delta V/V}$$

$$\Rightarrow \beta = 200 \times 10 \times 10^3 \times 1000 = 2 \times 10^9$$

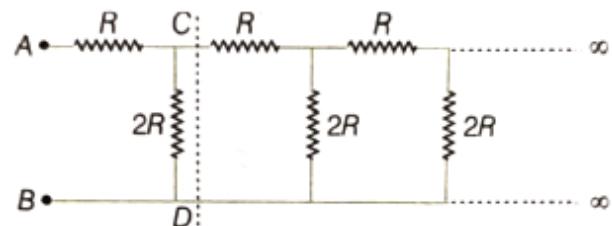
28. Answer: 3**Sol:**

$$\vec{r}_{cm} = \frac{M(0\hat{i} + 0\hat{j}) - \frac{M}{16}(3R\hat{i} + 0\hat{j}) - \frac{M}{16}(0\hat{i} + 3R\hat{j})}{M - \frac{M}{16} - \frac{M}{16}}$$

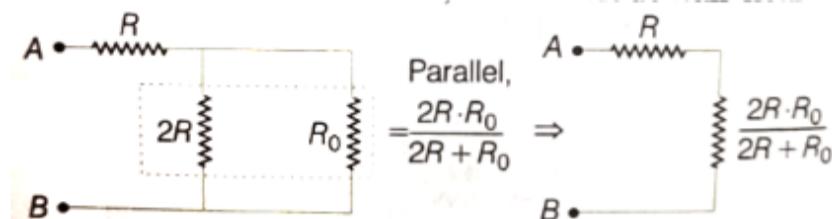
$$\vec{r}_{cm} = \frac{-3R(\hat{i} + \hat{j})}{14}$$

29. Answer: 1**30. Answer: 2**

Sol:



Here, we have infinite pairs of R and $2R$. Suppose, the equivalent resistance is R_0 between C and D, i.e. excluding one pair near AB (since, pairs are infinite, equivalent resistance will remain same, if we include pair near AB).



$$\Rightarrow R_{eq} = R_0 = R + \frac{2RR_0}{2R+R_0}$$

$$(R_0 - R)(2R + R_0) = 2RR_0$$

$$2RR_0 - 2R^2 + R_0^2 - RR_0 = 2RR_0$$

$$R_0^2 - RR_0 - 2R^2 = 0$$

$$R_0 = \frac{R \pm \sqrt{R^2 + 8R^2}}{2} = \frac{R \pm 3R}{2} = 2R \text{ or } -R$$

Equivalent resistance between A and B
= $2R$ (\because equivalent resistance cannot be negative)

31. Answer: 3

Sol:

Polytropic process $PV^{-1} = \text{constant}$ ($N = -1$)

$$C = C_v + \frac{R}{1-N}$$

33. Answer: 2

Sol:

Resistance between A and D,

As we can see from the circuit, 1Ω and 2Ω are in series,

$$R_1 = 1 + 3 = 4\Omega$$

Now, R_1 and 5Ω are in parallel, R_2
 $= \frac{4 \times 5}{4+5} = \frac{20}{9}\Omega$

Now, R_2 and 6Ω are in parallel, $R_3 = 20/9 + 6 = \frac{74}{9}\Omega$

Now, R_3 and 2Ω are in parallel,

$$R_4 = \frac{\frac{74}{9} \times 2}{\left(\frac{74}{9} + 2\right)} = \frac{37}{23}\Omega$$

35. Answer: 2

Sol:

By theory

Sol:

$$i = \frac{e}{T} = \frac{ev_n}{2\pi r_n}$$

but $r_n \propto n^2$ & $V_n \propto n^{-1}$

$$\therefore B = \frac{\mu_0 i}{2r_n}$$

$$B = \frac{\mu_0}{2} \times \frac{n^{-1}}{n^2 \times n^2}$$

$$B \propto n^{-5}$$

32. Answer: 2

Sol:

$$I_{xx} = \frac{MR^2}{4} + 2 \left[\frac{MR^2}{4} + MR^2 \right]$$

$$= \frac{MR^2}{4} + \frac{5}{2}MR^2 = \frac{11}{4}MR^2$$

34. Answer: 2

Sol:

From mirror formula

$$\text{similarly, } \frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{-f} = \frac{1}{v_1} + \frac{1}{-3/2f} \Rightarrow v_1 = -3f$$

$$\Rightarrow \frac{1}{-f} = \frac{1}{-2f} + \frac{1}{v_2} \Rightarrow v_2 = -2f$$

So length of image, $L_i = |-3f + 2f| = f$

36. Answer: 2

Sol:

Using COAM

$$I_1 \omega_i = (I_1 + I_2) \omega_f$$

$$\Rightarrow \omega_f = \frac{I_1 \omega_i}{I_1 + I_2}$$

37. Answer: 4

Sol:

Here,

$$C_{13} = C_1 + C_3 = 9 + 9 = 18 \mu F$$

$$C_{2-13} = \frac{C_2 \cdot C_{13}}{C_2 + C_{13}} = \frac{9 \times 18}{9+18} = 6 \mu F$$

Equivalent capacitance between the point A and B,

$$C_{eq} = C_{2-13} + C_4 = 6 + 9 = 15 \mu F$$

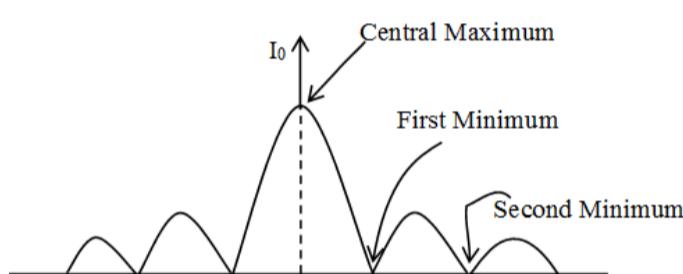
39. Answer: 4

Sol:

$$\frac{1}{5}, \frac{3}{5}$$

41. Answer: 4

Sol:



$$\text{Given as : } \lambda = 600 \text{ nm} \Rightarrow 600 \times 10^{-9} \text{ m}$$

$$a = 1 \text{ mm} = 10^{-3} \text{ m}$$

$$D = 2 \text{ m}$$

Distance between the first dark fringes on either side of the central bright fringe is also the width of central maxima.

$$\text{Width of central maxima} = \frac{2\lambda D}{a}$$

$$= \frac{2 \times 2 \times 6 \times 10^{-7}}{1 \times 10^{-3}} \Rightarrow 24 \times 10^{-4} \text{ m}$$

$$\Rightarrow 2.4 \text{ mm}$$

43. Answer: 3

Sol:

At junction, a potential barrier/depletion layer is formed, with N-side at higher potential and P-side at lower potential. Therefore there is an electric field at the junction directed from the N-side to P-side.

38. Answer: 1

Sol:

$$\sin C = 1/\mu$$

$$\sin 45^\circ = 1/\mu \Rightarrow \mu = \sqrt{2}$$

$$\therefore v = \frac{\text{light speed in vacuum}}{\mu}$$

$$= \frac{3 \times 10^8}{\sqrt{2}} \text{ m/s} = 2.12 \times 10^8 \text{ m/s}$$

40. Answer: 2

Sol:

$$E_{(ev)} = \frac{hc}{\lambda_{(\text{nm})}}$$

42. Answer: 1

Sol:

Minimum inaccuracy in the measurement of distance by Vernier callipers = vernier constant

$$= 1 \text{ MSD} - 1 \text{ SD} = 1 \text{ MSD} - \frac{49}{50} \text{ MSD} = \frac{1}{50} \text{ MSD}$$

$$= \frac{1}{50} \times 0.5 \text{ mm} = 0.01 \text{ mm}$$

44. Answer: 2

Sol:

By theory

$$n_1 \lambda_1 = (2n_2 - 1) \lambda_2 / 2$$

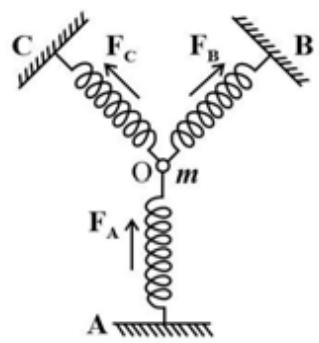
$$3 \lambda_1 = (2 \times 5 - 1) \lambda_2 / 2$$

$$3 \lambda_1 = \frac{9 \lambda_2}{2}$$

$$2 \lambda_1 = 3 \lambda_2$$

45. Answer: 2

Sol:



When the particle of mass m at O is pushed by y in the direction of A, the spring A will be compressed by y while spring B and C will be stretched by $y' = y \cos 45^\circ$. So that the total restoring force on the mass m along OA.

$$F_{\text{net}} = F_A + F_B \cos 45^\circ$$

$$+ F_C \cos 45^\circ = ky +$$

$$2ky' \cos 45^\circ = ky +$$

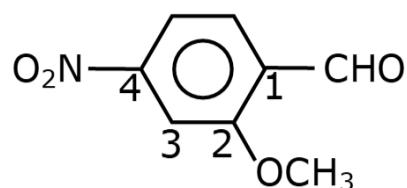
$$2k(y \cos 45^\circ) \cos 45^\circ = 2ky$$

Also $F_{\text{net}} = k'y$

$$\Rightarrow k'y = 2ky$$

$$\Rightarrow k' = 2k$$

$$T = 2\pi \sqrt{\frac{m}{k'}} = 2\pi \sqrt{\frac{m}{2k}}$$

46. Answer: 1**Sol:**

Lowest set of locant rule

2-Methoxy-4-nitro benzenecarbaldehyde

47. Answer: 2**Sol:**

$$0.1 \text{ mole of } \text{XY}_2 = 10 \text{ g}$$

$$1 \text{ mole of } \text{XY}_2 = 100 \text{ g}$$

$$\text{X} + 2\text{Y} = 100 \text{ g} \dots\dots\dots (1)$$

$$0.05 \text{ mole of } \text{X}_3\text{Y}_2 = 9 \text{ g}$$

$$1 \text{ mole of } \text{X}_3\text{Y}_3 = \frac{9}{0.05} \times 1 = 180 \text{ g}$$

$$3\text{X} + 2\text{Y} = 180 \dots\dots\dots (2)$$

Equation (2) – Equation (1)

$$3\text{X} + 2\text{Y} = 180$$

$$\text{X} + 2\text{Y} = 100$$

$$\underline{\quad - \quad}$$

$$2\text{X} = 80$$

$$\text{X} = 40$$

From equation (1)

$$\text{X} + 2\text{Y} = 100$$

$$40 + 2\text{Y} = 100$$

$$\text{Y} = 30$$

49. Answer: 1**Sol:**

Formation of a Solution from two components can be considered as addition of enthalpy pure solvent + pure solute & enthalpy of separated solvent and solute molecules.

$$\Delta H_{\text{soln}} = \Delta H_1 + \Delta H_2 + \Delta H_3$$

51. Answer: 3**48. Answer: 3****Sol:**

This system is insulated then heat will not be exchangeable so

$$q = 0$$

$$\text{From } \text{FLT} = U = q + w$$

$$U = 0 + w$$

$$U = w$$

When we stirred then temperature is increases then internal energy will also increases then

$$\Delta U > 0$$

50. Answer: 2**Sol:**

Maximum covalency of N cannot exceed 4 because of absence of vacant d-orbitals

52. Answer: 4**Sol:**

ΔH neutralisation will be maximum in case of SA vs SB

Sol:

(a) Heisenberg's uncertainty principle for simultaneous measurements of energy and time. In equation form, $\Delta E \cdot \Delta t \geq \frac{h}{4\pi}$

(b) Half-filled and fully-filled orbitals are more stable due to symmetry and exchange energy.

(c) In case of hydrogen like atoms, energy depends on the principal quantum number only.

Hence, 2s-orbital will have energy equal to 2p-orbital.

(d) de-Broglie wave equation $\lambda = \frac{h}{mv}$

53. Answer: 3**Sol:**

We know that

$$\Delta T_b = K_f \times m$$

$$\Delta T_b = K_f \times \frac{W_s \times 1000}{M_s \times W_{\text{Solvent}}}$$

$$\left\{ \therefore m = \frac{W_s \times 1000}{M_s \times W_{\text{Solvent}}} \right\}$$

Given

$$\Delta T_b = 0.3^\circ\text{C}$$

$$W_s = 10 \text{ gm} ; M_s = 100 \text{ gram mol}^{-1}$$

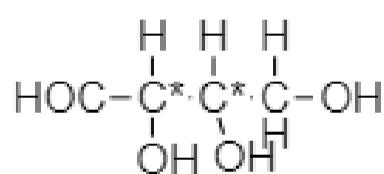
$$W_{\text{Solvent}} = 100 \text{ gm}$$

$$\Delta T_b = \frac{K_f \times W_s \times 1000}{M_s \times W_{\text{Solvent}}}$$

$$K_f = \frac{\Delta T_b \times M_s \times W_{\text{Solvent}}}{K_f \times W_s \times 1000}$$

$$K_f = \frac{0.3 \times 100 \times 100}{10 \times 1000}$$

$$K_f = 0.3 \text{ K kg mol}^{-1}$$

55. Answer: 3**Sol:**

The molecule is unsymmetrical & there are 2 chiral centers.

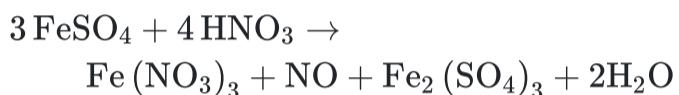
$$\text{So, } (n) = 2$$

$$\text{No. of optically active isomers} = 2^n = 2^2 = 4$$

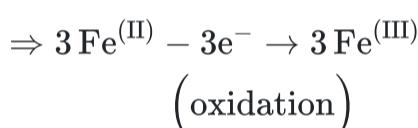
57. Answer: 1**54. Answer: 3****Sol:**

Before adding the reagents of group III, the solution is heated with some conc. HNO_3 in order to oxidize Fe^{+2} to Fe^{+3} .

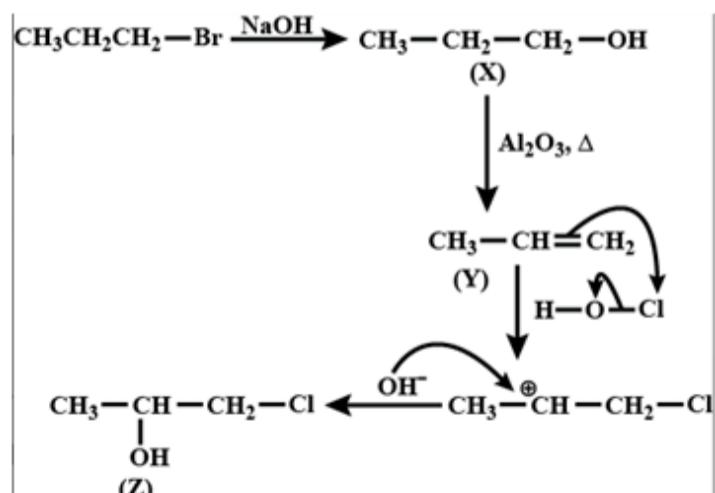
The reaction can be given as-



Here,



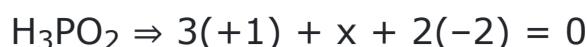
This is done to oxidise $\text{Fe}^{+2} \rightarrow \text{Fe}^{+3}$ otherwise Fe^{+3} is not completely precipitated as Fe(OH)_2 as ferrous hydroxide is more soluble in water than Fe(OH)_3 .

56. Answer: 2**Sol:****58. Answer: 4****Sol:**

$$t_{100\%} = \frac{\alpha}{k} = \frac{1}{0.6} \text{ min} = 100 \text{ sec.}$$

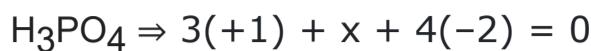
Reaction will be finish in 100 sec so concentration of B will reach maximum value 1M after 100 sec.

Sol:



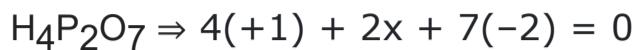
$$3 + x - 4 = 0$$

$$x = +1$$



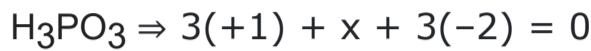
$$3 + x - 8 = 0$$

$$x = +5$$



$$4 + 2x - 14 = 0$$

$$x = +5$$



$$3 + x - 6 = 0$$

$$x = +3$$

59. Answer: 2

Sol:

$$\Delta T_b \propto$$

$$0.1 \text{ m KCl}$$

$$i=1+(n-1)\alpha$$

$$\alpha=1 \text{ for salt}$$

$$n=2$$

$$i=2$$

$$0.1 \text{ m K}_2\text{CO}_3$$

$$i=1+(n-1)\alpha$$

$$n=3$$

$$\alpha=1$$

$$i=3$$

$$\Delta T_b \propto i m$$

So option (C) & (D) has low concentration that's why $\Delta T_b \downarrow$ boiling point is low comparatively from (A) & (B) concentration is same but (B) option (van't Hoff factor) is greater that's why having highest boiling point

61. Answer: 2

Sol:

$$\frac{(t_{1/2})_1}{(t_{1/2})_2} = \left(\frac{a_2}{a_1}\right)^{n-1}$$

$$\frac{75}{150} = \left(\frac{2}{1}\right)^{n-1}$$

$$\Rightarrow 2^{-1} = 2^{n-1}$$

$$-1 = n - 1$$

$$\Rightarrow n = 0$$

So it is zero order reaction.

63. Answer: 1

60. Answer: 3

Sol:



According to Effective Atomic Number (EAN) Rule central atom tends to achieve nearest noble gas configuration (or) 18 electrons in its outer shell

$$\text{EAN} = (\text{Atomic number of central metal atom } (Z) - \text{Oxidation number}) (\text{Coordination number} \times 2)$$

EAN number of CrO_6 is found as 36, and is known to be stable.

Substituting the known values in the formula

$$36 = 24 - 0 + 2x$$

$$x = 6$$

62. Answer: 4

Sol:

All the above are correct statements

Sol:

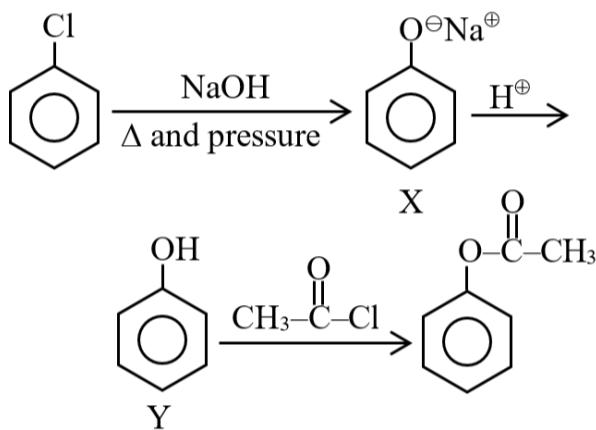
The boiling point of any liquid depends on the intermolecular force of attraction. Stronger the force of attraction, higher will be the boiling point.

The order of boiling point in hydrides of group 16 elements is as follows:



The boiling of water is highest due to the presence of H-bonding which is more strong than Vander Waal force of attraction. In H_2S , H_2Se and H_2Te . There is no H-bonding, therefore boiling point depends on an Vander Waal force which is directly proportional to the molecular weight of molecules. Hence, the boiling point of H_2O is maximum and that of H_2S is minimum.

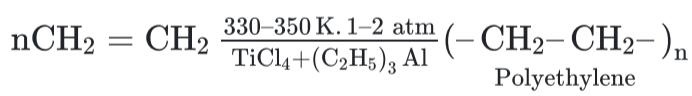
65. Answer: 3

Sol:

67. Answer: 2

Sol:

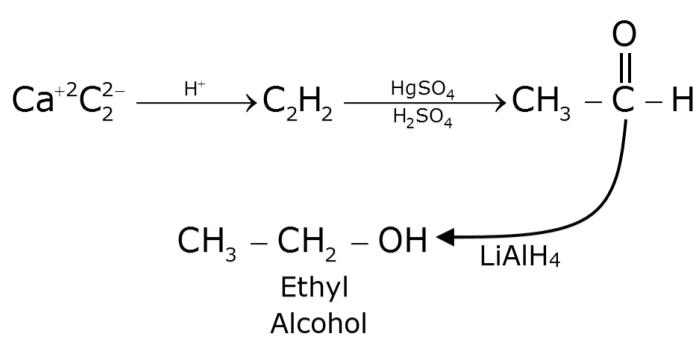
Ziegler-Natta catalyst is an organometallic compound containing titanium. It is TiCl_4 and $(\text{C}_2\text{H}_5)_3\text{Al}$. It is used in the preparation of polyethylene.



69. Answer: 1

Sol:

All involve reactions follow as;



66. Answer: 1

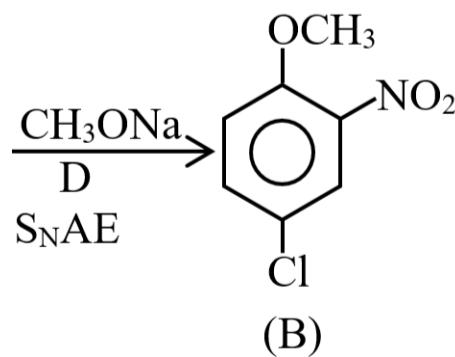
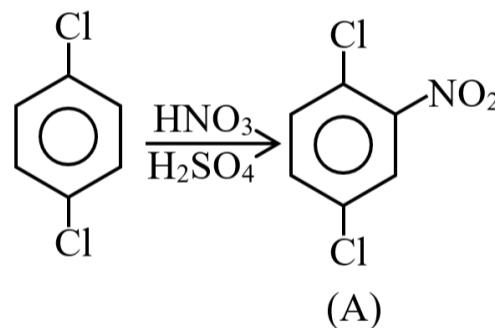
Sol:

$$\lambda_{eq}^\infty \text{ BaCl}_2 = \lambda_{eq}^\infty(\text{Ba}^{2+}) + \lambda_{eq}^\infty(\text{Cl}^-)$$

$$\lambda_{eq}^\infty (\text{BaCl}_2) = 63.5 + 76$$

$$\lambda_{eq}^\infty (\text{BaCl}_2) = 139.5 \Omega^{-1} \text{ Cm}^2 \text{ eq}^{-1}$$

68. Answer: 2

Sol:

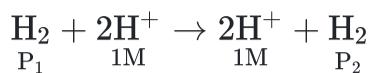
70. Answer: 3

Sol:

They are sp^3 hybridised but due to lone pair they are bent molecule.

Sol:

cell reaction



$$E_{\text{cell}} = 0 - \frac{0.0591}{2} \log \left[\frac{P_2 \times 1}{P_1 \times 1} \right] > 0$$

$$\Rightarrow \log \left(\frac{P_2}{P_1} \right) < 0$$

$$\Rightarrow \frac{P_2}{P_1} < 1 \Rightarrow P_2 < P_1$$

71. Answer: 1

Sol:

$$\text{pOH} = 13$$

$$\text{pH} = 1$$

73. Answer: 4

Sol:

The conjugate base of a strong acid is weaker while the conjugate base of a weak acid is stronger.

Hence, the correct order of strength of bases is -



here, CH_3CH_2^- is the conjugate base for ethane and $\text{CH} \equiv \text{C}^-$ is the conjugate base for ethyne, and HCOO^- is the conjugate base of stronger acid.

Since stronger acid gives a weaker base and, ethyne has more s-character than ethane, so, ethyne is more acidic and hence, its conjugate base will be less basic.

Therefore, the conjugate base of ethane is CH_3CH_2^- the most basic anion.

75. Answer: 1

72. Answer: 3

Sol:

If the molecule has zero dipole moment then the only possibility for MX_3 should be sp^2 hybridized only.

74. Answer: 2

Sol:

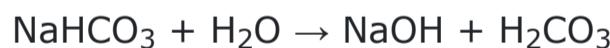
NaCl and KCl are salts of a strong acid with a strong base. They do not undergo hydrolysis in an aqueous solution. Their aqueous solutions are neutral.

Sodium carbonate and bicarbonate are the salts of a weak acid with a strong base. Thus their solution is basic in nature.

Now dissociation of one molecule of sodium bicarbonate gives one molecule of sodium hydroxide and one molecule of carbonic acid.

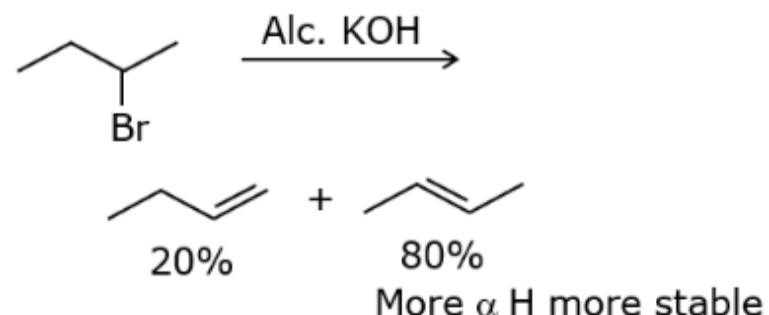
On the other hand, the dissociation of one molecule of sodium carbonate gives two molecules of sodium hydroxide and one molecule of carbonic acid.

Hence, sodium carbonate is more basic.



76. Answer: 4

Sol:



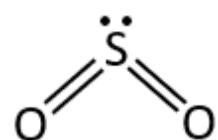
Sol:

Steric number l.p. + σ bond

$$= 1 + 2$$

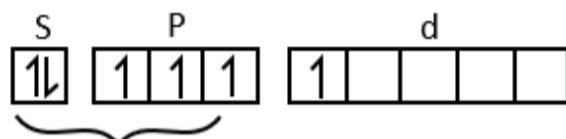
$$= 3$$

Hybridisation = sp^2



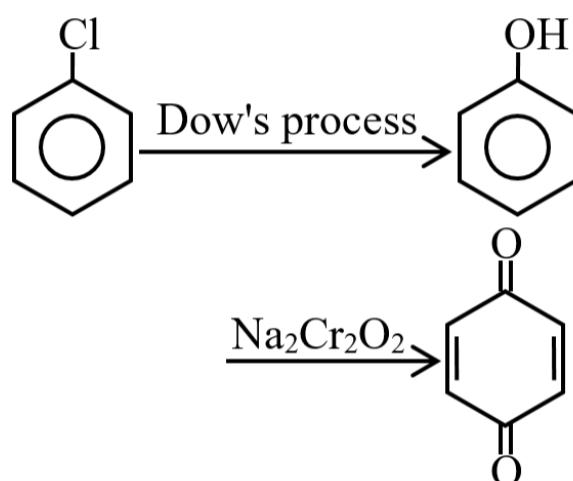
Bent structure

$$s \rightarrow 3s^2 \ 3p^4$$



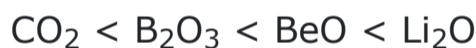
77. Answer: 3

Sol:



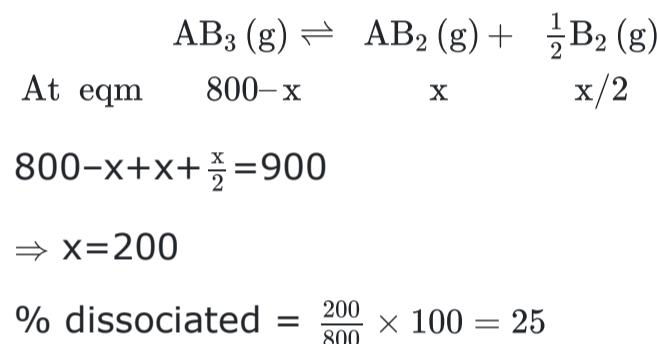
79. Answer: 4

Sol:



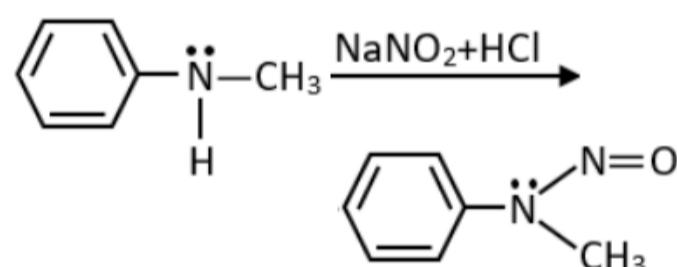
78. Answer: 3

Sol:



80. Answer: 1

Sol:



81. Answer: 1

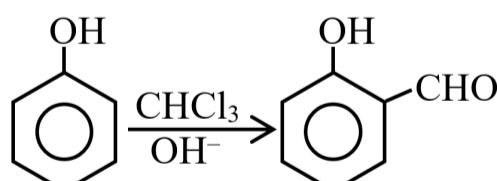
Sol:

A metalloid is a chemical element with properties that are intermediate between those of metals and nonmetals.

Metalloids = B, Si, As, Te, At, Sb, Ge

82. Answer: 3

Sol:



(Riemer-Tiemann reaction)

83. Answer: 2

84. Answer: 1

Sol:

- (A) Europium (Eu) \rightarrow [Xe] 4f⁷ 5d⁰ 6s² \rightarrow
Half filled (+2)
- (B) Praseodymium (Pr) \rightarrow [Xe] 4f³ 5d⁰ 6s²
 \rightarrow (+2, +3, +4, +5)
- (C) Ytterbium(Yb) \rightarrow [Xe] 4f¹⁴ 5d⁰ 6s² \rightarrow
Full filled (+2)
- (D) Lutetium (Lu) \rightarrow [Xe] 4f¹⁴ 5d¹ 6s² \rightarrow
Full filled (+3, +2)

85. Answer: 3

Sol:

Co, Mn belongs to ivth group

Conditions of 2nd group form ppt of sulphide if H₂S is supplied in the presence of HCl

Bi is belongs to 2nd group

87. Answer: 3

Sol:

Steam distillation is applied when the one compound is steam volatile and it is insoluble form a layer with water and can be separated by separation funnel

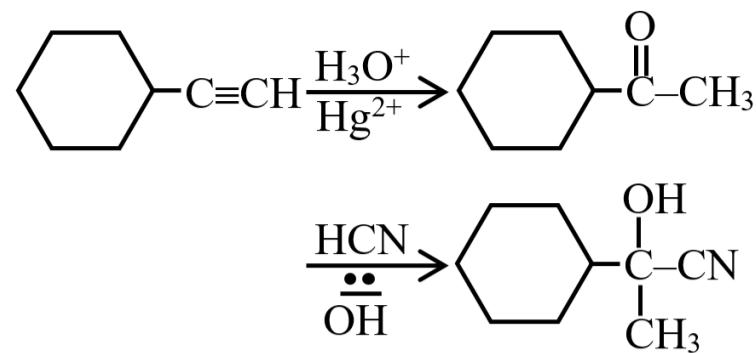
89. Answer: 4

Sol:

Water has strong intermolecular hydrogen bonding between the molecules.

Large amount of energy is required to break this hydrogen bonding. Hence water molecules will have high boiling point.

Sol:



86. Answer: 3

Sol:

Percent ionic character \propto difference in electronegativity

88. Answer: 2

Sol:

Since Nitrogen has smallest size and greatest electronegativity in the family, it may gain three electrons and attain noble gas configuration, forming nitride N³⁻ ions.

As we move down in the group electronegativity decreases thereby introducing new e⁻ is less feasible.

Hence, the correct increasing order of their tendency of the given elements to form M³⁻ ion is Bi < Sb < As < P < N.

90. Answer: 4

Sol:

For SN=5 lone pair are present at equatorial position because this arrangement minimise overall repulsion in the molecule

91. Answer: 3

Sol:

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92. Answer: 2

Sol:

The larynx (voice box) is part of the respiratory system that holds the vocal cords. It is responsible for producing voice, helping us swallow and breathe. The trachea, also called the windpipe, is a tube that connects the pharynx and larynx to the lungs, allowing the passage of air. The epiglottis is a flexible flap at the superior end of the larynx in the throat. It acts as a switch between the larynx and the oesophagus to permit air to enter the airway to the lungs and food to pass into the gastrointestinal tract. The alveoli are tiny air sacs within the lungs where the exchange of oxygen and carbon dioxide takes place. The pleural fluid of pleural space reduces friction on the lung surface. The pleural fluid is secreted by visceral (inside) pleura.

93. Answer: 1

Sol:

There are different levels of organisation-

Cellular level- Cells are arranged as loose cell aggregates and division of labour occurs among cells (Tissues absent). E.g. **Porifera**. Therefore **A=s**

Protoplasmic Level- Acellular body performs all biological activities except **protozoan**. Therefore **B=q**

Tissue level - Cells of a group performing the same function are arranged into tissues (Organs absent). E.g. **Cnideria, Ctenophora**. Therefore **C=p**

Organ system level- In higher animals, organs further organise to form organ systems e.g. Aschelminthes to **Chordata**. Therefore **D=r**

95. Answer: 3

Sol:

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

	Column-I		Column-II
a. Planaria	(iv)	Regeneration	
b. Protonema of moss	(iii)	Fragmentation	
c. Amoeba	(ii)	Binary fission	
d. Fungi	(i)	Spores	

96. Answer: 2

Sol:

A **biological phenomenon** in which an organism resembles another organism is called **mimicry**. Its advantages include:

1. It serves as a **defensive** measure.
2. Less risk from **predators**

So, the correct option is "**mimicry**."

97. Answer: 4

Sol:

If both Assertion & Reason are false.

98. Answer: 1

Sol:

11th NCERT Page No.- 225 & 226

99. Answer: 4**Sol:**

Onions and garlic belong to the family i.e. Allium cepa is included in the liliaceae family. It is a characteristic representative of monocotyledonous plants.

Cucumber belongs to the Cucurbitaceae family.

Grass belongs to the Gramineae family.

Sunflower belongs to the Compositae family.

Hence, the correct answer is **liliaceae**.

100. Answer: 4**Sol:****Incorrect statement**

4. The chemosensitive area is not highly sensitive to O_2 and Na^+ ions. Instead, it is primarily sensitive to changes in the partial pressure of carbon dioxide (PCO_2) and the pH (acid-base balance) of the cerebrospinal fluid (CSF). It is responsible for detecting these changes in the blood and cerebrospinal fluid and plays a crucial role in regulating respiration to maintain appropriate levels of CO_2 and pH in the body.

Correct statement

1. Respiratory rhythm center is primarily responsible for the regulation of respiration.

This is correct. The respiratory rhythm center, located in the brainstem, sets the basic rhythm of breathing and controls the rate and depth of respiration.

2. Pneumotaxic center can moderate the functions of the respiratory rhythm center.

This is correct. The pneumotaxic center, also located in the brainstem, modulates and fine-tunes the activities of the respiratory rhythm center. It helps to regulate the inspiratory and expiratory durations during breathing.

3. A chemosensitive area is situated adjacent to the rhythm center.

This is correct. The chemosensitive area, specifically the central chemoreceptors, is located near the respiratory rhythm center in the brainstem. It senses changes in the PCO_2 and pH levels in the cerebrospinal fluid and influences the respiratory rhythm accordingly.

101. Answer: 4**Sol:**

(ii) (iii) (v)

11th NCERT Page No. 40, 41 (Phylum porifera)

103. Answer: 2**Sol:**

Diptera is an order, belongs to class insecta.

Primate is an Order.

Arthropoda is a Division.

Angiospermae is a Division.

102. Answer: 1**Sol:**

Class 12th NCERT Page No. 37

104. Answer: 1**Sol:**

Class 12th NCERT Page No. 231

105. Answer: 4**Sol:**

The Calvin cycle proceeds in three stages- **carboxylation, reduction** and **regeneration**.

Reduction involve **utilisation of 2 molecules of ATP** for phosphorylation and **two of NADPH** for reduction per CO₂ molecule fixed. The **fixation of six molecules of CO₂** and 6 turns of the cycle are required for the formation of one molecule of glucose from the pathway.

107. Answer: 1**Sol:**

A floral formula is a symbolic representation of different floral parts, their numbers, arrangement pattern and how they are related. The general floral formula of Solanaceae family is as follows:

$\oplus \text{♀}^\text{♂} \text{K}_{(5)} \text{C}_{(5)} \text{A}_5 \text{G}_{(2)}$ the symbols represent

\oplus	Actinomorphic (radial symmetry)
$\text{♀}^\text{♂}$	Bisexual
K ₍₅₎	Calyx – 5 sepals, gamosepalous (united)
C ₍₅₎	Corolla – 5 petals, gamopetalous
A ₅	Androecium – 5 stamens, polyandrous (free), epipetalous (attached to petals)
G ₍₂₎	Gynoecium – bicarpellary, syncarpous (united), superior ovary

109. Answer: 4**Sol:**

11th NCERT Page No. 47-48

111. Answer: 2**Sol:**

Gonyaulax found in red tides contain photosynthetic pigments that vary in color from brown to red. These organisms undergo such rapid multiplication that they make the sea appear red.

113. Answer: 3**106. Answer: 4****108. Answer: 1****Sol:**

Both A and B antigens on RBC but no antibodies in the plasma.

110. Answer: 3**Sol:**

Spermatogenesis starts when the hypothalamus releases a concentration of gonadotrophin-releasing hormone that induces the release of pituitary luteinizing hormone and follicle stimulating hormone.

112. Answer: 2**Sol:**

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114. Answer: 2**Sol:**

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Sol:

Complex-I = FMN-NADH₂" dehydrogenase
Complex-II = CoQ-FADH₂" dehydrogenase
Complex-III = Cyto. a-cyto.a₃
Complex IV refers to cytochrome c oxidase complex containing cytochromes a and a₃, and two copper centres.
(complex V) = ATP synthase.

115. Answer: 3

Sol:

(A) Radial Vascular Bundle (Found in Roots)

- Xylem and phloem are arranged in separate radii.
- This arrangement is characteristic of **roots** (both monocots and dicots).
- The image shows a **hexarch xylem**, which is common in **monocot roots**

(B) Closed Conjoint Vascular Bundle (Found in Monocot Stem)

- Xylem and phloem are on the **same radius** but **no cambium** is present (closed vascular bundle).
- This is characteristic of **monocot stems**, which lack secondary growth.

(C) Open Conjoint Vascular Bundle (Found in Dicot Stem)

- Xylem and phloem are on the **same radius** (conjoint).
- A **cambium layer** is present between xylem and phloem, making it an **open vascular bundle** (allows secondary growth).
- This is a feature of **dicot stems**.

Thus, the correct labeling is: A - Root, B - Monocot Stem, C - Dicot Stem

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117. Answer: 1

116. Answer: 3

Sol:

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118. Answer: 2

Sol:

I. **Correct** - Arteries are the blood vessels which carry blood away from the heart. In comparison to veins, arteries have narrow lumen and more muscular thick walls to bear the pressure of pumping action of heart.

II. **Incorrect** - In acute chest pain, no enough oxygen is reaching the heart muscle.

III. **Incorrect** - An individual with blood group AB has both antigen A and B but no antibodies. So, they can receive the blood of any group.

IV. **Correct** - Calcium ions play an important part in the blood clotting, the increased calcium concentrate which helps in the activation of proteins in platelets which is essential for the clotting of blood.

Sol:

Cnidoblasts are used for **anchorage, defence, and the capture of prey**.

A **comb** plate is a large, flat organelle formed by the fusion of many cilia. Vertical rows of comb plates form the motile appendages of ctenophores, which help in **locomotion**.

The **proboscis gland** collects waste from blood and passes it into the coelom of the proboscis, from where it is excreted through the proboscis pore in the anterior region of the proboscis. It helps with **excretion processes**.

Members of the phylum **Mollusca** have a file-like **rasping organ** called a **radula** in their mouth that helps in feeding.

The **statocyst** is responsible for **balance** and such reactions as rising to the surface of the water or sinking.

11th NCERT Page No.: 50, 51, 53

119. Answer: 4**Sol:**

Effective and popular method is the use of Intra Uterine Devices (IUDs). These devices are inserted by doctors or expert nurses in the uterus through vagina. These Intra Uterine Devices are presently available as the non-medicated IUDs (e.g., Lippes loop), copper releasing IUDs (CuT, Cu7, Multiload 375) and the hormone releasing IUDs (Progestasert, LNG-20) (Figure 4.2). IUDs increase phagocytosis of sperms within the uterus and the Cu ions released suppress sperm motility and the fertilising capacity of sperms. The hormone releasing IUDs, in addition, make the uterus unsuitable for implantation and the cervix hostile to the sperms. IUDs are ideal contraceptives for the females who want to delay pregnancy and/or space children. It is one of most widely accepted methods of contraception in India.

121. Answer: 4**Sol:**

Drosera, Utricularia, Nepenthes are the example of insectivorous plants and they feed on insects for fulfilling their nutritional needs.

These insectivorous plants shows both autotrophic and heterotrophic mode of nutrition.

Hence, the correct answer is option "4".

123. Answer: 2**120. Answer: 3****Sol:**

Chlamydomonas and Chlorella both belongs to the protista kingdom because these are unicellular and eukaryotic organisms.

Protista have a well-defined cell wall and membrane bound nucleus.

122. Answer: 1**Sol:**

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124. Answer: 2

Sol:

Only 2 is true

Class 11th NCERT Page No. 72, 73, 74

Sol:

Urea is produced in the liver as a waste product of protein metabolism (through the **urea cycle**). The **hepatic vein** carries **blood away from the liver**, transporting **maximum urea** to the heart before being filtered by the kidneys.

Analysis of Options:-

Hepatic Portal Vein

- This vein carries **nutrient-rich blood from the intestines to the liver**, but **not much urea**.

Hepatic Vein

- Carries **urea-rich blood from the liver** to the heart → **Correct answer**.

Dorsal Aorta

- Distributes **oxygenated blood** from the heart to the body, but urea concentration is **lower than in the hepatic vein**.

Renal Vein

- Carries **filtered (clean) blood away from the kidneys**, meaning **less urea** than the hepatic vein.

125. Answer: 4**Sol:**

Stratified epithelium consists of two or more cell layers.

On the basis of presence of keratin protein in the outer most cells this epithelium is of two types -

Non Keratinized Stratified squamous epithelium - If Keratin protein is absent. Examples - moist surface of **buccal cavity, pharynx**, oesophagus etc.

Keratinized Stratified squamous epithelium - If keratin protein is present. Eg. - Dry surface of skin (Epidermis of skin, Nails, etc).

Stratified Cuboidal epithelium are found in female urethra.

Stratified Columnar epithelium are found in Uterus ,larynx

Transitional epithelium are found in ureter, urinary bladder etc.

127. Answer: 3**Sol:**

1-a, 2-c, 3-d, 4-b

129. Answer: 2**Sol:**

11 ncert page no 158 /159

126. Answer: 3**Sol:**

Class 12th New NCERT Page No. 113

128. Answer: 3**Sol:**

Class 12th NCERT Page No. 243 & 249

130. Answer: 3**Sol:**

Class XIth NCERT Page No. 242, 243

131. Answer: 3**Sol:**

Industrial melanism is an example of natural selection. Industrial melanism is an adaptation where the moths living in the industrial areas developed melanin pigments to match their body to the soot-covered surroundings.

These melanic forms are mainly distributed in and around large industrial cities, where the environment has been altered by the pollution of the atmosphere; and is manifested by the appearance of the dark colour of the lichen covered tree trunks, on which the moths rest during the day time.

The peppered moth exists in 2 strains: light and dark. In the past, the bark of the trees was covered by the whitish lichens, so white moths escaped unnoticed from predatory birds.

After industrialization barks got covered by smoke, so the white moths were selectively picked up by birds. But the black moths escape unnoticed so they managed to survive in more population of black moths and less population of white moths.

133. Answer: 1**Sol:**

Urine is a liquid by-product of metabolism in humans and in many other animals. Urine flows from the kidneys through the ureters to the urinary bladder. Urination results in urine being excreted from the body through the urethra.

An adult human excretes, on an average, 1 to 1.5 litres of urine per day. The urine formed is a light yellow coloured watery fluid which is slightly acidic (pH-6.0) and has a characteristic odour. On an average, 25-30 gm of urea is excreted out per day.

135. Answer: 3**Sol:**

consists of a foot, a stalk and a capsule

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137. Answer: 1**132. Answer: 1****Sol:**

A dominant allele produces a dominant physical character in individuals who have one copy of the allele, which can come from just one parent. A recessive allele produces a recessive phenotype in the individual who have two copies of the allele, one from each parent.

According to Law of dominance, in the heterozygous organisms/hybrid, only one character is expressed, second character is not expressed. Expressed character is called dominant character and one not expressed is called recessive character.

Codominance occurs when two alleles of the same gene are present in a living thing, and both alleles are expressed separately in different parts of an organism. Instead of one trait being **dominant** over the other, both traits appear.

Epistatic gene is a **gene** that determines whether or not a trait will be expressed.

134. Answer: 2**Sol:**

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136. Answer: 3**Sol:**

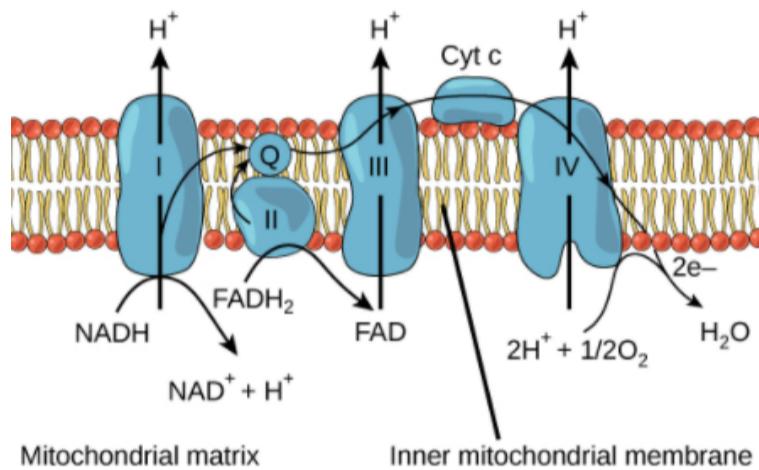
Class 12th NCERT Page No. 249

138. Answer: 2

Sol:

The ETC makes sure under normal conditions that the mitochondrial inter-membrane space holds more H⁺ ions than the matrix thus creating an electrochemical proton gradient the potential energy of which drives ATP synthesis. More hydrogen = lower potential hydrogen(pH)= more acidic. Therefore the pH of matrix increases while that of inter membrane decreases.

Intermembrane space

**139. Answer: 1****Sol:**

Gregor Mendel, conducted **hybridisation experiments** on **garden peas** for seven years (1856-1863) and proposed the laws of inheritance in living organisms.

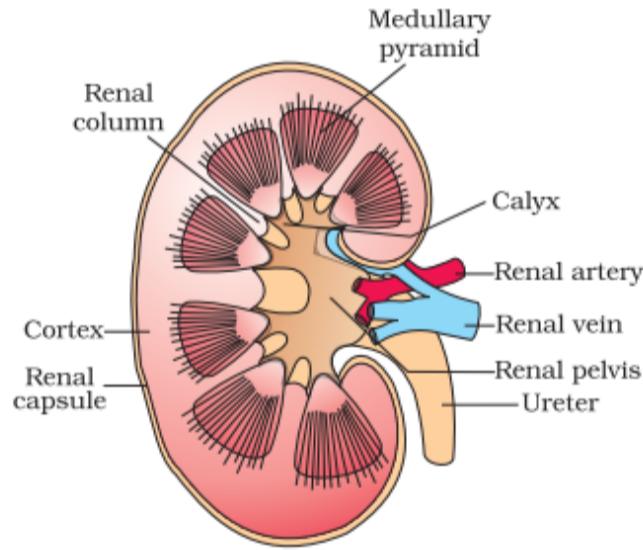
Mendel conducted **artificial pollination** experiments using several **true-breeding pea lines**. A truebreeding line is one that, having undergone continuous self-pollination, shows the **stable trait inheritance** and expression for several generations.

Sol:

Relaxin is a protein hormone secreted by placenta. It dilates the cervix and aids in childbirth. Thyroxine is secreted from thyroid gland. It stimulates the consumption of oxygen by metabolically active tissues and also increases the oxidation of glucose in tissues. Progesterone is a steroid female sex hormone which is also known as pregnancy hormone. It maintains the inner lining of uterus which aids in implantation of embryo in the uterus. Glucocorticoid hormones are secreted from adrenal cortex and regulate carbohydrate metabolism , storage of glycogen and increase reabsorption of sodium and water from the renal tubules.

140. Answer: 2**Sol:**

Inside the kidney, the cortical region extends in between the medullary pyramids as renal columns are called column of Bertini.



While, other given statements are correct statements.

141. Answer: 2**Sol:**

Both (A) and (R) are true but (R) is not the correct explanation of (A).

143. Answer: 3**142. Answer: 4****Sol:**

all of these

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144. Answer: 4

Sol:

Decomposers are organisms that break down organic matter (dead plants and animals) into simpler inorganic substances like carbon dioxide, water, and nutrients, which can be reused by producers (plants).

Sol:

Increase in growth per unit time is called as growth rate. The growth rate may be arithmetic or geometrical. Arithmetic Growth is a type of growth in which the rate of growth is constant and increase in growth occurs in arithmetic progression-- 2, 4, 6, 8, 10,12.

Meristematic cells at the growing point divide in such a fashion that one daughter cell remains meristematic while the other grows and differentiates. the process continues. Mathematically, arithmetic growth is expressed as

$L_t = L_0 + rt$; where L_t = length after time t , L_0 = length at the beginning, and r = growth rate. On plotting growth against time, a linear graph is obtained.

So, the correct answer is 'All statements are correct.'

145. Answer: 4**Sol:**

Turner's syndrome is the chromosomal abnormality in females. In this condition, a person has 44 autosomes but one X chromosome is missing and thus called as a 45X condition. The missing chromosome affects the development of the body. It is characterized by the delayed puberty, infertility due to loss of ovarian function and learning disabilities.

146. Answer: 3**Sol:**

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147. Answer: 4**Sol:**

Both (1) and (2)

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148. Answer: 1**Sol:**

The **decomposers are heterotrophic organisms**, mostly **bacteria and fungi**, which live on dead organic matter, or **detritus**. They release different enzymes from their bodies into **dead and decaying plant and animal** remains and break them down into simpler substances like minerals, which are **added to the soil**. These substances enrich the soil and help the producers grow. So, if **decomposers** are removed from the ecosystem, the complete mineral cycle will be **stopped**.

149. Answer: 4**Sol:**

Column I	Column II
Natural auxin	IBA
Synthetic auxin	NAA
Stress hormone	ABA
Zeatin	Cytokinin

150. Answer: 2**Sol:**

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151. Answer: 3**152. Answer: 2**

Sol:

A single phenotypic character governed by more than one pair of genes is called polygenic or quantitative character. Polygenic or quantitative character shows continuous variation.

examples of quantitative inheritance	Examples of qualitative inheritance
Cob length in Maize,	
Kernel colour in wheat,	
Human intelligence,	
Skin colour in human beings,	Seed shape, seed color,
Height in human beings and several plants	seed form
Milk yield in animals,	The coat colour of the animal
Yield of crop plants including size, shape and number of seeds or fruits per plant.	

153. Answer: 2**Sol:**

Citric acid is produced by fungus *Aspergillus niger*. Acetic acid is obtained from *Acetobacter aceti* (a bacterium); *Clostridium butylicum* (a bacterium) produces butyric acid and *Lactobacillus* (a bacterium) produces lactic acid.

155. Answer: 1**Sol:**

In drawing or analyzing a pedigree, there are certain standard symbols that are used. Pedigree Analysis is a tabular representation of a family history by taking a particular disease or character into consideration. An unfilled circle is used to represent a normal female, an unfilled square to represent a normal male and a diamond to represent a normal individual of unknown gender.

Possession of the character (affected male or female) under study is shown by a solid or blackened symbol, and absence is shown by an open or clear symbol.

157. Answer: 2**Sol:**

Cannabinoids are a group of chemicals which interact with cannabinoid receptors present principally in the brain. Natural **cannabinoids** are obtained from the inflorescences of the plant *Cannabis sativa*.

Heroin commonly called **smack** is chemically diacetylmorphine which is a **white, odourless, bitter crystalline compound**. This is obtained by acetylation of morphine which is extracted from the latex of poppy plant *Papaver somniferum*.

154. Answer: 3**Sol:**

The In-situ conservation method is the conservation method in the natural ecosystem or habitat. Examples are: Sacred groves, National park, Biosphere, Hotspots, Wildlife sanctuary, etc.

The Ex-situ conservation method is carried out in man-made habitats and ecosystems. Examples are Aquarium, botanical garden, cryopreservation, DNA banks, Seed banks, Zoological garden, etc.

Hence, the correct answer is option "3".

156. Answer: 2**Sol:**

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158. Answer: 4

Sol:

Some extreme estimates range from 20 to 50 million, but a more conservative and scientifically sound estimate made by Robert May places the global species diversity at about 7 million. Although India has only 2.4 per cent of the world's land area, its share of the global species diversity is an impressive 8.1 per cent.

Biodiversity is the shortened form of two words "biological" and "diversity". It refers to all the variety of life that can be found on Earth (plants, animals, fungi and micro-organisms) as well as to the communities that they form and the habitats in which they live.

159. Answer: 1**Sol:**

Down stream

The operator sequence is the regulatory sequence of structural gene

Sol:

When the pollen grain is mature it contains two cells, the vegetative cell and generative cell. The vegetative cell is bigger, has abundant food reserve and a large irregularly shaped nucleus. The generative cell is small and floats in the cytoplasm of the vegetative cell. The mature embryo sac contains seven cells and eight nuclei.

160. Answer: 1**Sol:**

Hind II was the first discovered restriction endonuclease enzyme. It has been isolated from *Haemophilus influenzae* Rd. It cuts DNA molecules at a particular point by recognising a specific sequence of six base pairs.

161. Answer: 2**Sol:**

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162. Answer: 4**Sol:**

Not all aquatic plants use water for pollination. In a majority of aquatic plants such as water hyacinth and water lily, the flowers emerge above the level of water and are pollinated by insects or wind as in most of the land plants.

163. Answer: 4**Sol:**

Given structure is of flagella and it is not associated with gene transfer by conjugation tube.

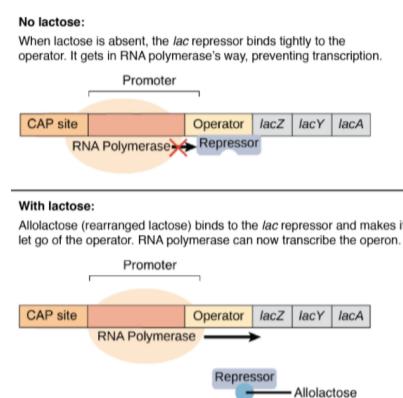
164. Answer: 3

Sol:

The **lac operon** is an operon, or group of genes with a single promoter that encode proteins that allow the bacteria to use lactose as an energy source.

The activity of the promoter that controls the expression of the lac operon is regulated by two different proteins.

One of the proteins prevents the RNA polymerase from transcribing (**negative control**), the other enhances the binding of RNA polymerase to the promoter (**positive control**).



Change in the lac repressor is caused by the small molecule allolactose(**inducer**), an isomer (rearranged version) of lactose.

A small molecule that regulates expression of a gene or operon.

Catabolic operons such as lac (which produces the enzymes that digest lactose) are induced to be transcribed when a substance to be catabolized enters the cell ie controls catabolic pathway.

In **feedback repression** end product binds with DNA of the gene that encode the enzyme and prevents synthesis of enzyme. Whereas Lac operon is an example of **inducible circuit**.

165. Answer: 4

Sol:

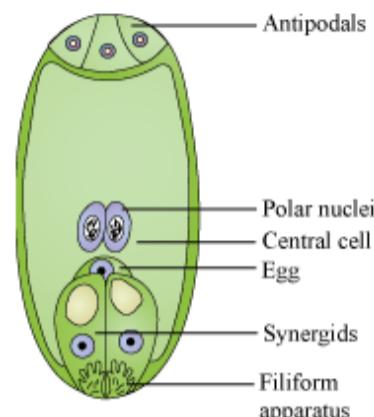
Biolistics mainly includes bombardment of tiny particles coated with DNA into living cells and is a commonly used method for genetic transformation of plants when either cells/tissues or intracellular organelles are impermeable to foreign DNA.

166. Answer: 2

Sol:

Filiform apparatus is defined as the prolongation of the synergids beyond the summit of the embryo sac.

The function of the filiform apparatus is that it helps in leading the pollen tubes in the synergids. This is an important process during fertilization in the angiosperms.

**167. Answer: 3****Sol:**

The gene for producing insulin is present in everybody's cell. But these genes are expressed in particular cells (beta cells of the pancreas). The genes are inactive or turned off in other cells.

DNA is made up of nucleotides. Each nucleotide consists of a nitrogen base, five-carbon sugar, and phosphate molecule.

Centromere is the region of the chromosome where two sister chromatids linked. It is found in all animal cells and plants. It is the region where microtubules are attached to the kinetochore.

Nucleosome is made up of the segment of DNA, histone protein core (histone octamer).

169. Answer: 3**Sol:**

Cilia and flagella are projections from the cell. They are made up of microtubules, as shown in this cartoon and are covered by an extension of the plasma membrane. They are motile and designed either to move the cell itself or to move substances over or around the cell.

168. Answer: 4**Sol:**

In the EcoRI, Eco represents the bacterial species from which it is isolated ie *Escherichia coli* and R represents the strain of the bacteria.

Hence, the correct answer is option "4".

170. Answer: 1**Sol:**

Transcription is the process of copying genetic information from one strand of DNA into RNA.

The pre-mRNA is processed to form a mature mRNA molecule that can be translated to build the protein molecule (polypeptide) encoded by the original gene.

A repressor protein binds to the gene's promoter region to stop the production of enzymes.

An operon consists of an operator, promoter, regulator, and structural gene.

171. Answer: 3**172. Answer: 4**

Sol:

The most commonly used bioreactor in biotechnology labs is the stirring type bioreactor.

Stirred-tank bioreactor is usually cylindrical or with a curved base to facilitate the mixing of the reaction contents / nutrients. The stirrer facilitates even mixing and oxygen availability throughout the bioreactor.

173. Answer: 2**Sol:**

The nucleolus is the distinct structure present in the nucleus of eukaryotic cells. Primarily, it participates in assembling the ribosomes, alteration of transfer RNA and sensing cellular stress. The nucleolus is composed of RNA and proteins, which form around specific chromosomal regions.

175. Answer: 1**Sol:**

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Sol:

Mitosis is the process of cell division wherein the chromosomes replicate and get equally distributed into two daughter cells. The chromosome number in each daughter cell is equal to that in the parent cell, i.e., diploid. Hence, mitosis is known as equational division.

174. Answer: 3**Sol:**

Transgenic mice are being used to test the safety of the polio vaccine. If successful and found to be reliable, they could replace the use of monkeys to test the safety of batches of the vaccine.

176. Answer: 1**Sol:**

Severe combined immunodeficiency (SCID) is a life-threatening syndrome of **recurrent infections, diarrhea, dermatitis, and failure to thrive** that is caused by a deficiency of the **enzyme adenosine deaminase (ADA)**.

ADA-SCID patients can be cured by **HLA-matched sibling donor bone marrow transplantation**.

Alternative transplantation strategies as well as enzyme replacement are being tested in those patients who do not have a suitable matched **sibling** donor. Replacement therapy with **PEG-ADA** has resulted in **improvements** in growth, a variable increase in the number of **peripheral blood lymphocytes**, and a decrease in the **incidence of severe infections**.

177. Answer: 4**Sol:**

Diakinesis is the final stage of **Prophase I** in meiosis, characterized by:

Terminalisation of chiasmata: The chiasmata (points where homologous chromosomes are joined) move toward the ends of the chromosomes.

Chromosomes are fully condensed: The chromosomes reach their maximum condensation, making them clearly visible.

Meiotic spindle assembled: The spindle fibers form and prepare to attach to the chromosomes for separation.

178. Answer: 4**Sol:**

Column I	Column II
(a) First transgenic cow	(iii) Rosie
(b) Safety test of polio vaccine	(iv) Transgenic mice
(c) Resistance from nematode	(i) m-RNA silencing
(d) Vitamin 'A' enriched crop	(ii) Rice

179. Answer: 1**Sol:**

Golgi body and ER are reformed at **Telophase** stage.

Anaphase is characterized by events such as spindle poles moving apart, splitting of centromere and separation of chromatids and movement of chromosomes to opposite poles.

180. Answer: 1**Sol:**

Transgenic animals that produce useful biological products can be created by the introduction of the **portion of DNA (or genes)** that codes for a particular product, such as human protein (**a-1-antitrypsin**) used to treat **emphysema**.

Rosie produced human **protein-enriched milk** (2.4 grammes per litre).

ELISA is an **enzyme-linked immunosorbent assay**. This test is used for the detection of antibodies.

ROP is a protein responsible for the coding of proteins involved in **plasmid replication**.