



Student's Solution Copy [Code - 27131]

NEET PATTERN TEST Brahmastra Semi Major Test-03

13th NEET - Phase 12

KOTA

Date: 02-Feb-2025

Duration: 3 Hours

Max Marks: 720

Physics - Section A

1.

Answer: 2

Sol:

$$q_1 = 20 \text{ unit}$$

$$q_1 = 20 \text{ unit}$$

$$q_1 = -30 \text{ unit}$$

From conservation of charge

$$20 + (-30) = -10 \text{ unit}$$

Final charge on both $5\mu\text{C}$ each.

$$F \propto q_1 q_2$$

$$\frac{F_1}{F_2} = \frac{(20)(30)}{(5)(5)} = \frac{24}{1}$$

4.

Answer: 4

Sol:

$$R = -30\text{cm} \Rightarrow f = -15\text{cm}$$

$$O = +2.5\text{cm}, u = -10\text{cm}$$

$$\text{By mirror formula } \frac{1}{-15} = \frac{1}{v}$$

$$\Rightarrow \frac{1}{(+2.5)} = -\frac{30}{(-10)} \Rightarrow I = +7.5\text{cm}$$

2.

Answer: 3

Sol:

$$u = +0.2 \text{ v} = -0.5$$

$$\Rightarrow \frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{-0.5} + \frac{1}{0.2} = \frac{1}{f} \Rightarrow f = \frac{1}{3}\text{m}$$

$$f = 66.67\text{cm.}$$

3.

Answer: 2

Sol:

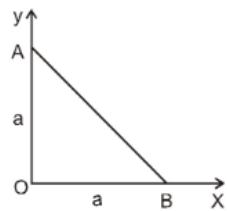
According to the question, $eE = mg \Rightarrow E = \frac{mg}{e}$

5.

Answer: 1

Sol:

The work done in carrying a test charge consists in product of difference of potential at points A and B and value of test charge.



Potential at A

$$V_A = \frac{1}{4\pi\epsilon_0} \frac{q}{a}$$

Potential at B

$$V_B = \frac{1}{4\pi\epsilon_0} \frac{q}{a}$$

Thus, work done in carrying a test charge - Q from A to B

$$w = (V_A - V_B)(-Q) = 0$$

6.

Answer: 1

Sol:

By using the relation,

$$\text{Electric field intensity, } E = - \frac{dV}{dr}$$

where,

potential difference = V

distance = r

From the graph,

the distance, r = 5 cm

potential, V = 2.5 V

Electric field intensity,

$$E = - \frac{(0-5)}{(6-4)}$$

$$E = - \frac{(-5)}{2}$$

$$E = 2.5 \text{ V/cm}$$

7.

Answer: 3

Sol:

$$\pi/4$$

8.

Answer: 1

Sol:

The electric field from the electric potential equation is derived as

$$E = - \frac{dV}{dr}$$

$$E_x = - \frac{\partial V}{\partial x} = -4$$

$$E_y = - \frac{\partial V}{\partial y} = -9$$

$$E_z = - \frac{\partial V}{\partial z} = 3$$

$$\vec{E} = E_x \hat{i} + E_y \hat{j} + E_z \hat{k} = -4 \hat{i} - 9 \hat{j} + 3 \hat{k}$$

$$\vec{E} = E_x \hat{i} + E_y \hat{j} + E_z \hat{k}$$

$$= -4 \hat{i} - 9 \hat{j} + 3 \hat{k}$$

9.

Answer: 1

Sol:

Given, A = δ_m

$$\mu = \frac{\sin \left(\frac{A + \delta_m}{2} \right)}{\sin \frac{A}{2}} ;$$

$$\sqrt{3} = \frac{\sin A}{\sin \frac{A}{2}} = \frac{2 \sin \frac{A}{2} \cos \frac{A}{2}}{\sin \frac{A}{2}}$$

$$\frac{\sqrt{3}}{2} = \cos \frac{A}{2}$$

$$A = 2 \cos^{-1} \left(\frac{\sqrt{3}}{2} \right)$$

$$A = 2 \times 30^\circ$$

$$= 60^\circ$$

10.

Answer: 3

Sol:

$$E = \frac{1}{4\pi\epsilon_0} \cdot \frac{Qr}{R^3} \Rightarrow E \propto \frac{1}{R^3}$$

11.

Answer: 2

Sol:

When it pass through A intensity become $\frac{I_0}{2}$

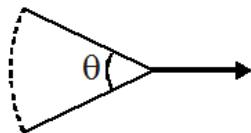
Now When it pass through B intensity become

$$I = \frac{I_0}{2} \cos^2 \theta$$

12.

Answer: 1

Sol:



Field due to charged arc at the centre = $\frac{2k\lambda}{R} \sin \frac{\theta}{2}$

Field due to remaining part at the centre will be equal and opposite to the field due to removed part.

$$E = \frac{2k\lambda}{R} \cdot \sin \frac{\theta}{2}$$

$$\frac{2k\lambda}{R} \left(\frac{\theta}{2} \right)$$

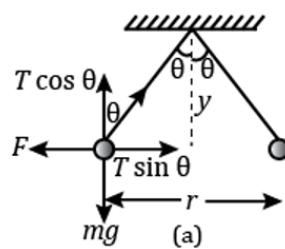
$$E = \frac{k\lambda}{R} \theta = \frac{K}{R} \cdot \frac{Q}{2\pi R} \cdot \frac{d}{R}$$

$$E = \frac{KQd}{2\pi R^3}$$

13.

Answer: 1

Sol:



Let 'm' be the mass of each ball and 'q' be the charge on each ball. Force of repulsion $F = \frac{Kq^2}{r^2}$

In equilibrium, $T \cos \theta = mg \dots \dots \dots (1)$

$T \sin \theta = F \dots \dots \dots (2)$

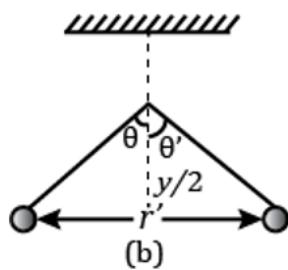
From equation (1) and (2) we get

$$\tan \theta = \frac{F}{mg} = \frac{Kq^2}{r^2 mg} \dots \dots \dots (3)$$

$$\text{And by geometry } \tan \theta = \frac{\left(\frac{r}{2}\right)}{y} \dots \dots \dots (4)$$

By equation (3) and (4), Before repulsion

$$\tan \theta = \frac{\left(\frac{r}{2}\right)}{y} = \frac{Kq^2}{r^2 mg}$$



$$\text{After repulsion } \tan \theta = \frac{\left(\frac{r'}{2}\right)}{\left(\frac{y}{2}\right)} = \frac{Kq^2}{r'^2 mg} \dots \dots \dots (5)$$

By equation (4) and (5) we have $r' = \frac{r}{\sqrt[3]{2}}$

14.

Answer: 3

Sol:

Given incident angle $i = 45^\circ$

angle of deviation, $D = i - r$

$$15^\circ = 45^\circ - r \Rightarrow r = 30^\circ$$

now, by snell's law

$$n_1 \sin i = n_2 \sin r$$

$$1 \sin 45^\circ = \mu \sin 30^\circ$$

$$\frac{1}{\sqrt{2}} = \mu \frac{1}{2}$$

$$\mu = \sqrt{2} = 1.414$$

15.

Answer: 2

Sol:

flux emitted from the surface S_2

$$\phi = \frac{q_{in}}{\epsilon_0} = \frac{q_2 + q_3}{\epsilon_0} = \frac{2 \times 10^{-6} + 3 \times 10^{-6}}{\epsilon_0}$$

$$\Rightarrow \phi = -36\pi \times 10^3 N \cdot m^2/C$$

16.

Answer: 3

Sol:

$$\text{Given : } \frac{I_{\max}}{I_{\min}} = \frac{25}{1}$$

$$\left[\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}} \right]^2 = \frac{25}{1}$$

$$\frac{\sqrt{I_1} + \sqrt{I_2}}{\sqrt{I_1} - \sqrt{I_2}} = \frac{5}{1}$$

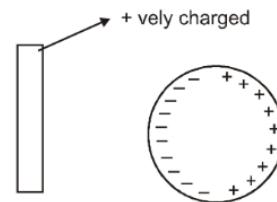
$$4\sqrt{I_1} = 6\sqrt{I_2}$$

$$\Rightarrow \frac{I_1}{I_2} = \frac{9}{4}$$

17.

Answer: 1

Sol:



Since distance between plate and -ve charge is less than that between plate and +ve charge, electric force acts on object towards plate.

18.

Answer: 1

Sol:

$$V = \frac{C}{\mu}$$

$$\text{So, } \frac{v_1}{v_2} = \frac{\mu_2}{\mu_1} = \frac{\lambda_1}{\lambda_2}$$

$$\text{Hence, } \frac{\mu_2}{\mu_1} = \frac{3500}{7000} = \frac{1}{2}$$

$$\text{Now, critical angle, } \theta = \sin^{-1} \left(\frac{\mu_2}{\mu_1} \right) \Rightarrow \theta \sin^{-1} \left(\frac{1}{2} \right)$$

$$\Rightarrow \theta = 30^\circ$$

19.

Answer: 1

Sol:

The quantity of charge passing through any cross-section per second is nothing but the current flowing in the conductor.

As given, the current is a steady current, which means the current is uniform throughout the cross-section. Hence it is independent of the Area of the cross-section.

20.

Answer: 1

Sol:

$$\frac{1}{f} = (\mu - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$$

$$\frac{1}{4} = (1.4 - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \quad \dots(1)$$

$$\frac{1}{f} = (1.6 - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \quad \dots(2)$$

$$\frac{1}{2} \Rightarrow f = -12.8$$

21.

Answer: 2

Sol:

Given:

$$J = \frac{J_0}{r^2}$$

$$r_i = a$$

$$r_0 = 2a$$

$$\therefore \text{current density } J = \frac{I}{dA}$$

$$\text{OR } I = \int_{r_i}^{r_0} J dA$$

$$= \int_a^{2a} \frac{J_0}{r^2} 2\pi r dr$$

$$I = 2\pi J_0 [ln r]_a^{2a}$$

$$I = 2\pi J_0 \ln 2$$

22.

Answer: 4

Sol:

Given,

size of image = 1/4 size of object

$$m = \frac{v}{u} = \frac{1/4}{1} \Rightarrow m = 1/4 \Rightarrow \frac{1}{4} = \frac{v}{u} \Rightarrow v = \frac{u}{4}$$

$$m = \frac{v}{u} = \frac{1/4}{1} \Rightarrow m = 1/4$$

$$\Rightarrow \frac{1}{4} = \frac{v}{u}$$

$$\Rightarrow v = \frac{u}{4}$$

now use lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{4}{u} - \frac{1}{u} = \frac{1}{30} \Rightarrow \frac{4-1}{u} = \frac{1}{30}$$

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{4}{u} - \frac{1}{u} = \frac{1}{30}$$

$$\Rightarrow \frac{4-1}{u} = \frac{1}{30}$$

$$\Rightarrow u = 90 \text{ cm}$$

23.

Answer: 2

Sol:

Given :

$$R = 10\Omega$$

$$V = 20 \text{ volt}$$

$$t = 2 \text{ min.} = 2 \times 60 \text{ sec}$$

By Ohm's law

$$i = \frac{V}{R}$$

$$\therefore i = \frac{Q}{t}$$

$$\text{so } \Rightarrow Q = \frac{Vt}{R} = \frac{20 \times 2 \times 60}{10} = 240 \text{ C}$$

24.

Answer: 1

Sol:

$$I = \frac{10-4}{3} = 2A$$

Power given by 10V battery = EI = 6 × 2 = 12W

25.

Answer: 3

Sol:

$$P = \frac{V^2}{R_{eq}}$$

$V = 10$ volt

$$R_{eq} = \left(\frac{5R}{5+R} \right)$$

$P = 30W$

$$30 = \frac{(10)^2}{\left(\frac{5R}{5+R} \right)}$$

$$\frac{15R}{5+R} = 10$$

$$15R = 50 + 10R$$

$$5R = 50$$

$$R = 10\Omega$$

26.

Answer: 3

Sol:

Let the resistance of wire be equal to R . If the length is tripled and thickness is made $1/4$ then the new resistance will be $48 R$. Hence new balance length will be $48 L$.

27.

Answer: 1

Sol:

In 1st case,

$$I_1 = \frac{E}{R+G}$$

In 2nd case

$$I_2 = \frac{E}{R + \frac{SG}{S+G}}$$

for half deflection,

$$I_{2G} = \frac{1}{2} I_1$$

$$\frac{1}{2} \frac{E}{R+G} = \frac{E}{R + \frac{SG}{S+G}} \frac{S}{S+G}$$

$$\Rightarrow G = \frac{RS}{R-S}$$

$$G = \frac{10 \times 4}{10-4} = \frac{20}{3} \Omega$$

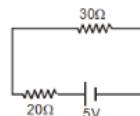
28.

Answer: 2

Sol:

Equivalent ckt is

$$I = \frac{5V}{(30+20)\Omega} = \frac{5}{50} A$$



29.

Answer: 1

Sol:

The initial energy stored in the first capacitor.

$$U_0 = \frac{1}{2} CV^2 = \frac{1}{2} \times 0.1 \times (10)^2 = 5.0 \text{ J}$$

When this capacitor is connected to the second uncharged capacitor, the charge distributes equally. This shows that the capacitance of the second capacitor is also C. The voltage across each capacitor will be $\frac{V}{2}$. If U be the energy stored in the two capacitors, then

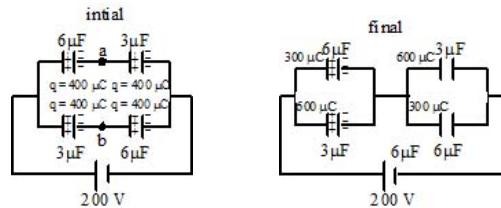
$$U = \frac{1}{2} C \left(\frac{V}{2}\right)^2 + \frac{1}{2} C \left(\frac{V}{2}\right)^2 = \frac{1}{4} CV^2 = 2.5 \text{ J}$$

$$\frac{U_0}{U} = \frac{5.0}{2.5} = \frac{2}{1}$$

30.

Answer: 1

Sol:



charge flown = 300 μC

31.

Answer: 3

Sol:

$$P = P_1 + P_2$$

$$P = -1 + 2 = + 1 \text{ D}$$

$$P = \frac{100}{f_{\text{cm}}} = 1 \Rightarrow f = 100 \text{ cm}$$

As focal length is positive the nature will be converging

32.

Answer: 2

Sol:

Power of the combination of lens

$$P = P_1 + P_2 = \left(\frac{1}{f_1}\right) + \left(\frac{1}{f_2}\right)$$

f_1 and f_2 are focal length (in meter)

$$P = \frac{1}{40/100} + \frac{1}{25/100} = 2.5 - 4 = -1.5 \text{ D}$$

33.

Answer: 1

Sol:

$$\frac{\omega_1}{\omega_2} = -\frac{f_1}{f_2}$$

34.

Answer: 1

Sol:

Magnifying power of a telescope

$$m = \frac{f_0}{f_e}$$

$$5 = \frac{f_0}{f_e}$$

$$f_0 = 5f_e$$

$$f_0 + f_e = 60$$

$$6f_e = 60$$

$$f_e = 10$$

The focal length of eye piece is $f_e = 10 \text{ cm}$

35.

Answer: 2

Sol:

$$\beta = \frac{\lambda D}{d}$$

$$\lambda = \frac{\beta d}{D}$$

put value and solve it

36.

Answer: 2

Sol:

$$n_1 \lambda_1 = n_2 \lambda_2$$

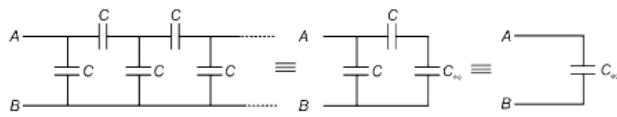
$$12 \times 600 = n_2 \times 400$$

$$n_2 = 18$$

37.

Answer: 2

Sol:



$$C_{eq} = C + \frac{C \cdot C_{eq}}{C + C_{eq}}$$

$$\Rightarrow (C + C_{eq}) C_{eq} = C^2 + C \cdot C_{eq} + C \cdot C_{eq}$$

$$\Rightarrow C_{eq}^2 - C \cdot C_{eq} - C^2 = 0$$

$$C_{eq} = \frac{C + \sqrt{C^2 + 4C^2}}{2} = \frac{C + \sqrt{5}C}{2}$$

$$C_{eq} = \frac{1 + \sqrt{5}}{2} C$$

38.

Answer: 1

Sol:

When oil is present

$$C = \frac{K \epsilon_0 A}{d} = \frac{2 \epsilon_0 A}{d}$$

When oil is removed.

$$C' = \frac{2 \epsilon_0 A}{d}$$

$$\therefore C' = C/2$$

$$\therefore (1)$$

39.

Answer: 3

Sol:

$Q = \text{Constant}$

New capacitance = KC (increases)

$$V' = \frac{V}{K} (\text{decreases})$$

$$U' = \frac{Q^2}{2KC} (\text{decreases})$$

$$E = \frac{Q}{A \epsilon_0} \Rightarrow E' = \frac{Q}{KA \epsilon_0} (\text{decreases})$$

40.

Answer: 2

Sol:

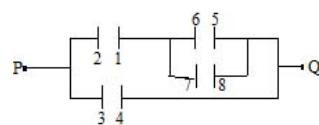
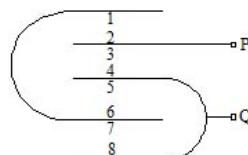
$$C_{eq} = \left(\frac{Er_1 + \epsilon r_2}{2} \right) C$$

$$= \left(\frac{4+6}{2} \right) (1 \mu F) = 5 \mu F$$

41.

Answer: 4

Sol:



$$\therefore C_{eq} = \frac{2C \times C}{2C + C} + C = \frac{5C}{3}$$

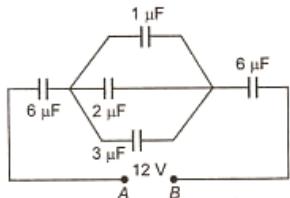
$$C_{eq} = \frac{5\epsilon_0 A}{3d}$$

42.

Answer: 3

Sol:

the given circuit is,



here, $1\mu\text{F}$, $2\mu\text{F}$ and $3\mu\text{F}$ capacitor are in parallel, so their equivalent capacitance is $6\mu\text{F}$

now, the three $6\mu\text{F}$ capacitor are in series,

$$\text{So, } \frac{1}{C} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} = \frac{1}{2}$$

hence, $C = 2\mu\text{F}$

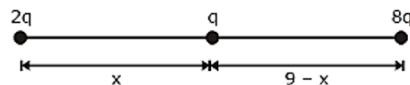
$$\text{So, } Q = CV = 2 \times 12 = 24\mu\text{C}$$

Hence, each $6\mu\text{F}$ capacitor has potential difference $= 24/6 = 4 \text{ V}$.

43.

Answer: 2

Sol:



For potential energy to be minimum the bigger charges should be farthest. Let x be the distance of q from $2q$. Then potential energy of the system shown in figure would be

$$U = K \left[\frac{(2q)(q)}{x} + \frac{(8q)(q)}{(9-x)} + \frac{(2q)(8q)}{9} \right]$$

$$\text{Here, } K = \frac{1}{4\pi\epsilon_0}$$

For U to be minimum $\frac{2}{x} + \frac{8}{9-x}$ shoule be minimum.

$$\frac{d}{dx} \left[\frac{2}{x} + \frac{8}{9-x} \right] = 0$$

$$\therefore \frac{-2}{x^2} + \frac{8}{(9-x)^2} = 0$$

$$\frac{x}{9-x} = \frac{1}{2}$$

or $x = 3 \text{ cm}$

i.e., distanc eof charge q from $2q$ should be 3 cm .

Electric field at q

$$E = \frac{K(2q)}{\left(3 \times 10^{-2}\right)^2} - \frac{K(8q)}{\left(6 \times 10^{-2}\right)^2} = 0$$

44.

Answer: 2

Sol:

$$\alpha = \frac{dR}{R_0 dT}$$

$$\therefore \Delta R = R_0 \times 2 \times 10^{-6} \left(\frac{T^2}{2} \right)_{100}^{200}$$

$$= R_0 \times 10^{-6} \times (200^2 - 100^2)$$

$$\frac{\Delta R}{R} = 3 \times 10^{-2}$$

$$\therefore \frac{\Delta R}{R} \times 100 = 3$$

45.

Answer: 4

Sol:

Given, capacitance of capacitor

$$C = 20 \text{ mF} = 20 \times 10^{-6} \text{ F}$$

$$\text{Rate of change of potential } \left(\frac{dV}{dt} \right) = 3 \text{ V/s}$$

$$\therefore q = CV$$

$$\text{or, } \frac{dq}{dt} = C \frac{dV}{dt}$$

$$\text{or, } i_C = 20 \times 10^{-6} \times 3 = 60 \times 10^{-6} \text{ A} = 60 \mu\text{A}$$

As we know that $i_d = i_c = 60 \mu\text{A}$

[Alternate Solution : we know that $i_d = i_c$ and the displacement current has finite value when potential difference across capacitor is changing]

Chemistry - Section A

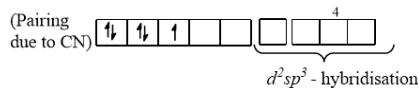
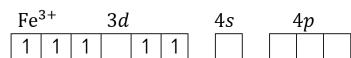
46.

Answer: 3

Sol:

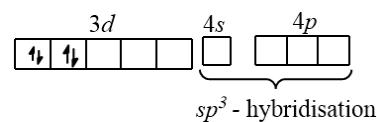
Diamagnetic substances have all paired electron.

$[\text{Fe}(\text{CN})_6]^{3-}$ Oxidation state of Fe=+3



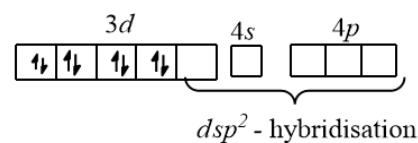
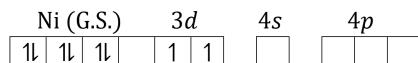
It has one unpaired electron and is paramagnetic.

$[\text{NiCl}_4]^{2-}$ Oxidation state of Ni=+2



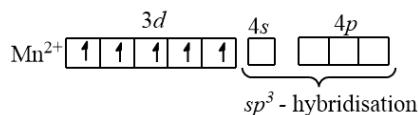
It has two unpaired electrons and is paramagnetic

$\text{Ni}(\text{CO})_4$ Oxidation state of Ni=0



It has no unpaired electron and is diamagnetic.

$[\text{MnCl}_4]^{2-}$ Oxidation state of Mn = +2



It is paramagnetic as it has five unpaired electrons.

47.

Answer: 2

Sol:

$$\pi = i c R T$$

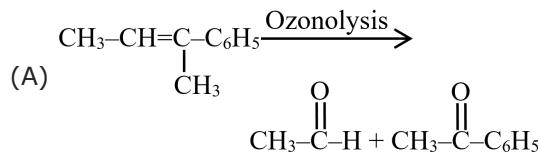
$$\pi \propto i$$

$$\frac{0.38}{0.16} = \frac{I_{\text{AB}_2}}{1} = i_{\text{AB}_2} = 2.37$$

48.

Answer: 4

Sol:



(B) Carbonyl group must have methyl group

49.

Answer: 4

Sol:

Henry law, is $p = K_H x$

x = mole fraction of dissolved gas

p = Partial pressure of gas

$$\therefore \log p = \log K_H + \log x$$

$$\log x = \log p - \log K_H$$

$$\Rightarrow y = mx - C$$

50.

Answer: 3

Sol:

$[\text{Co}(\text{NH}_3)_5 \text{ONO}]^{2+}$

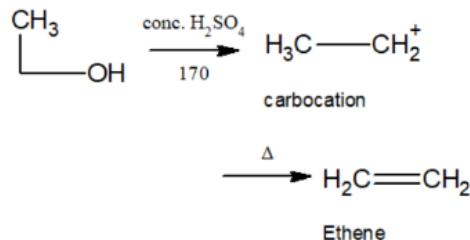
Pentaamminenitrito-Ocobalt (III) ion.

51.

Answer: 1

Sol:

A Dehydration of alcohol is a reaction in which alcohol reacts with protic acid to lose water molecules and form alkenes

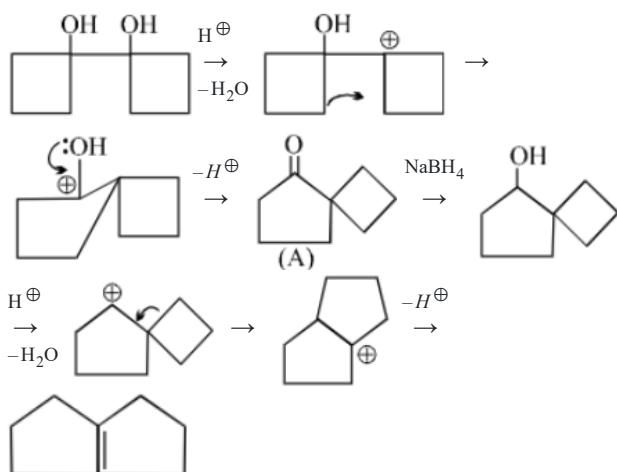


Major Product - Ethene

52.

Answer: 3

Sol:



53.

Answer: 1

Sol:

Molar conductivity of ionic compounds depend upon no. of ions furnished by complex therefore $[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$ will conduct most due to presence of 5 ions.

54.

Answer: 2

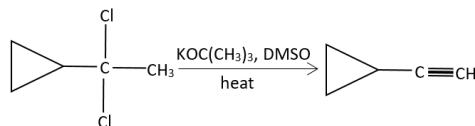
Sol:

Acetone and aniline mixture show negative deviation.

55.

Answer: 4

Sol:



Since base is bulky, we get Hoffmann's product as a major product.

56.

Answer: 2

Sol:

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

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

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

$$-1 = n - 1$$

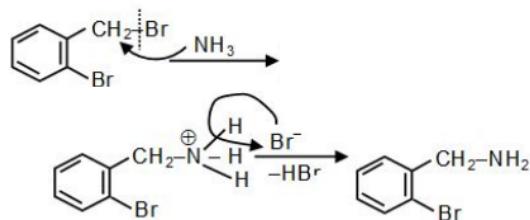
$$\Rightarrow n = 0$$

So it is zero order reaction.

57.

Answer: 1

Sol:



Because aromatic halides do not give S_N reaction in normal condition.

58.

Answer: 4

Sol:

$[\text{Ni}(\text{Cl})_4]^{2-}$ oxidation state of Ni is +2

So, configuration of $\text{Ni}^{2+} = 1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^8$

In Ni^{2+}	$3d$	$4s$	$4p$
$1\downarrow 1\downarrow 1\downarrow 1\downarrow 1\downarrow$	\square	$\square \square \square$	

In $[\text{NiCl}_4]^{2-}$	$1\downarrow 1\downarrow 1\downarrow 1\downarrow 1\downarrow$	$\times \times \times \times \times \times$
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sp^3 - hybridisation

Thus, due to sp^3 -hybridisation of Ni^{2+} in $[\text{NiCl}_4]^{2-}$, the shape of $[\text{NiCl}_4]^{2-}$ is tetrahedral.

59.

Answer: 1

Sol:

Examples of NCERT

- (1) Zero order
- (2) First order
- (3) First order
- (4) Pseudo First order

60.

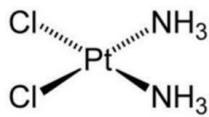
Answer: 1

Sol:

Organometallic compounds are those compounds in which metal atom is directly bonded with C-atom.

Organometallic compounds contain at least one bond between a carbon atom of an organic compound and a metal.

Cis-platin is not organometallic compound as it does not contain carbon-metal bond.



61.

Answer: 1

Sol:

$$t_{93.75} = \frac{2.303}{0.693} t_{1/2} \log \frac{100}{6.25}$$

$$t_{93.75} = \frac{2.303}{2.303 \times 0.3010} t_{1/2} \log 16$$

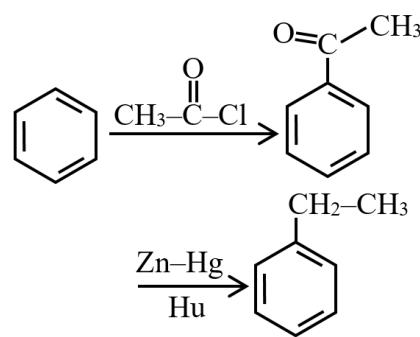
$$t_{93.75} = \frac{t_{1/2}}{0.3010} 4 \log_2$$

$$t_{93.75} = 4t_{1/2}$$

62.

Answer: 2

Sol:



63.

Answer: 2

Sol:

For depression in freezing point

$$\Delta T_f = \frac{1000 \times K_f \times w}{m \times W(H_2O)}$$

$$\Delta T_f = 9.3, w = 65, K_f = 1.86 \text{ m}_{\text{Glycol}} = 62$$

$$9.3 = \frac{1000 \times 1.86 \times 65}{62 \times W}$$

$$W_{\text{water}} = 209.67 \text{ g}$$

The mass of ice separated.

$$= 250 - 209.67 = 40.33 \text{ g}$$

64.

Answer: 4

Sol:

In this reaction intermediate free radical is highly unstable.

65.

Answer: 1

Sol:

$$\log \frac{K_2}{K_1} = \frac{E_a}{2.303R} \left(\frac{T_2 - T_1}{T_1 T_2} \right)$$

$$\log 2 = \frac{E_a}{2.303 \times 8.314} \times \frac{10}{298 \times 308}$$

$$E_a = 52.89 \text{ kJ}$$

66.

Answer: 3

Sol:

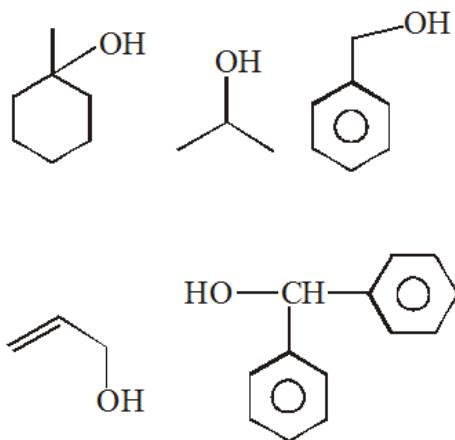
To give haloform reaction, carbonyl group must have methyl group.

67.

Answer: 4

Sol:

Lucas reagent is a solution of anhydrous zinc chloride in concentrated hydrochloric acid. This solution is used to classify alcohols of low molecular weight. The reaction is a substitution in which the chloride replaces a hydroxyl group with Lucas reagent. The alcohols react immediately as they form stable carbocations.



68.

Answer: 4

Sol:

Freezing point of solution $\propto \frac{1}{i}$

$[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3, i = 4$

$[\text{Co}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}, i = 3$

$[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}, i = 2$

$[\text{Co}(\text{H}_2\text{O})_3\text{Cl}_3] \cdot 3\text{H}_2\text{O}, i = 1$

69.

Answer: 3

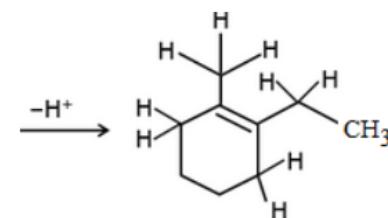
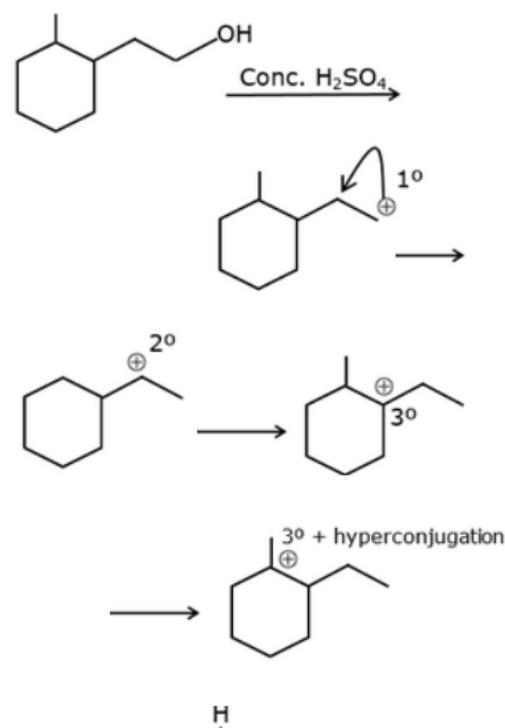
Sol:

$$m = \frac{X_A}{X_B} \times \frac{1000}{M_B} = \frac{0.25}{0.75} \times \frac{1000}{46} = 7.246 \text{ molal}$$

70.

Answer: 4

Sol:



9 α -H

Major

(a) 1,2-shift are possible = 3

(b) α -H are present in major product = 9

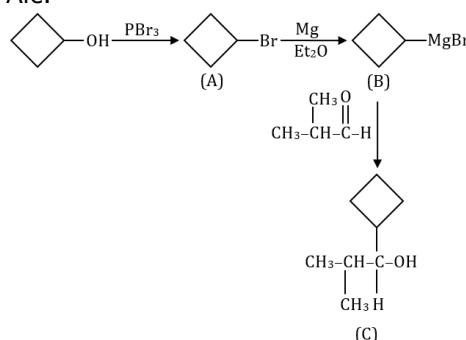
So the value of (a + b) = 12

71.

Answer: 4

Sol:

N.A.R. of G.R. with aldehyde give 2° Alc. not 3° Alc.



72.

Answer: 4

Sol:

$$\frac{P^{\circ} - P_S}{P^{\circ}} = \frac{n}{n+N} \approx \frac{n}{N} \approx \frac{w}{\text{MW}_{\text{solute}} \times N}$$

Method I

Solution has same amount of solvent, So P_S value depends only on molecular mass of solute. So, vapour pressure of solution $\propto \text{MW}_{\text{solute}}$

Method II

$$P_S = P_0 X_{\text{Solvent}} = P_0 \frac{N}{n+N}$$

$$\Rightarrow n \uparrow P_S \downarrow$$

n=moles of solute

73.

Answer: 3

Sol:

(I) For 1st order reaction, $\alpha = 1 - e^{-kt}$

At $t = 0$, $\alpha = 0$ and at t , $\alpha \rightarrow 1$

(II) $x = kt$ for zero order reaction

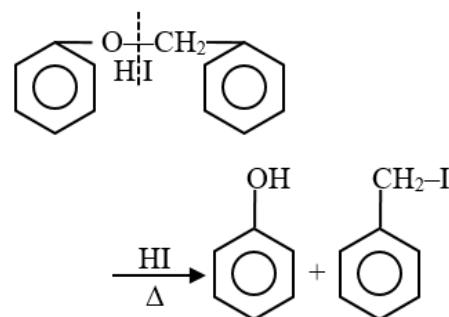
$$a_0 \alpha = kt \Rightarrow \alpha = \left(\frac{k}{a_0} \right) t$$

\therefore Straight line passing through origin.

74.

Answer: 2

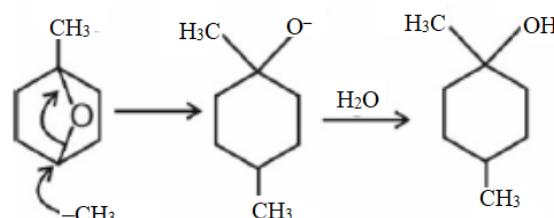
Sol:



75.

Answer: 1

Sol:



76.

Answer: 4

Sol:

β -D-glucos is more stable than α -D-glucose.

77.

Answer: 4

Sol:

Glucose does not react with pure HCN, Schiff's reagent NaHSO_3 as they cannot open the ring of cyclic glucose.

78.

Answer: 3

Sol:

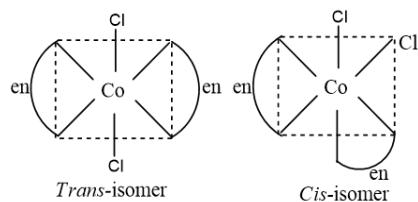
When hundreds or thousands of monosaccharides condense together, it will form polysaccharides. These are not sweet in taste hence they are called non-sugars.

79.

Answer: 2

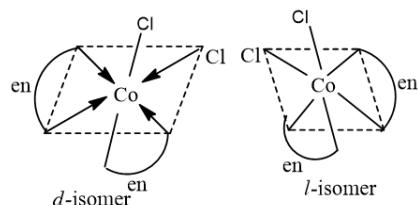
Sol:

In $[\text{Co}(\text{en})_2\text{Cl}_2]$, four isomers are possible, two geometrical isomers and two optical isomers.



Now, cis-isomer also show optical isomerism. Cis isomer exists in enantiomeric form as it is unsymmetrical.

Plane mirror



80.

Answer: 4

Sol:

HCl and H_2O mixture shows negative deviation

- ∴ They form maximum boiling azeotropic mixture
- ∴ Boiling point should be greater than 100°C

81.

Answer: 1

Sol:

$$Y_A = \frac{P_A^{\circ} X_A}{P_A^{\circ} X_A + P_B^{\circ} X_B} = \frac{800 \times \frac{3}{5}}{800 \times \frac{3}{5} + 500 \times \frac{2}{5}}$$

$$= \frac{800 \times 3}{800 \times 3 + 500 \times 2} = 0.7$$

82.

Answer: 1

Sol:

Let, Rate = $k[A]^x[B]^y$

$$\text{So, } 6.0 \times 10^{-3} = k[0.1]^x[0.1]^y \quad \dots\dots(1)$$

$$7.2 \times 10^{-2} = k[0.3]^x[0.1]^y \quad \dots\dots(2)$$

$$2.88 \times 10^{-1} = k[0.3]^x[0.9]^y \quad \dots\dots(3)$$

$$2.40 \times 10^{-2} = k[0.4]^x[0.1]^y \quad \dots\dots(4)$$

By 3 ÷ 2 ⇒

$$2^y = 4$$

$$\therefore y = 2$$

By 4 ÷ 1 ⇒

$$4^x = 4$$

$$\therefore x = 1$$

So, Rate = $k[A]^1[B]^2$

Order = 1 + 2 = 3

83.

Answer: 4

Sol:

Order of reaction may be zero, whole number or fraction number.

84.

Answer: 2

Sol:

Given ;

$$K_f = -1.86^\circ\text{C}/\text{m}$$

$$w_B = 5 \text{ gm}$$

$$M_{\text{Na}_2\text{SO}_4} = 142 \text{ gm/mol}$$

$$w_A = 45.0 \text{ gm}$$

$$\Delta T_f = 3.82^\circ\text{C}$$

$$i = ?$$

$$\because \Delta T_f = i \times K_f \times m$$

$$-3.82 = i \times (-1.86) \times \frac{5 \times 1000}{142 \times 45}$$

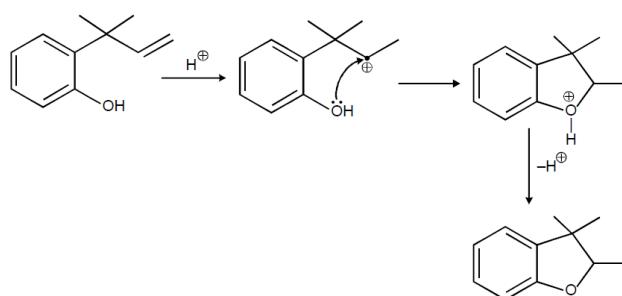
$$i = \frac{3.82 \times 142 \times 45}{1.86 \times 5 \times 1000}$$

$$i = 2.624 \approx 2.63$$

85.

Answer: 2

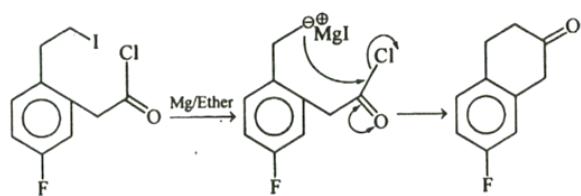
Sol:



86.

Answer: 2

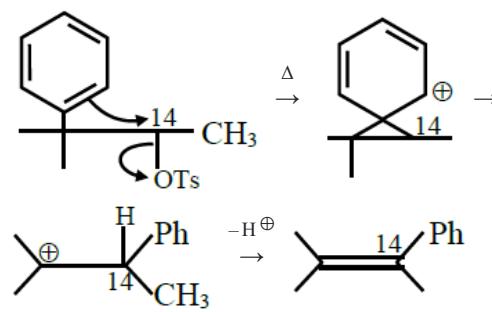
Sol:



87.

Answer: 3

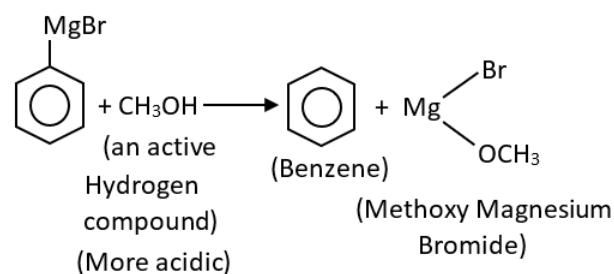
Sol:



88.

Answer: 1

Sol:

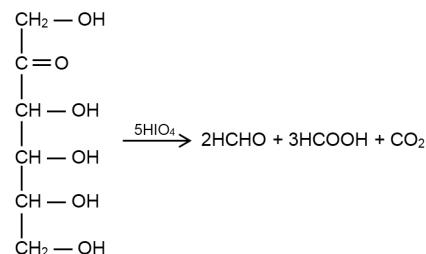


Both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.

89.

Answer: 1

Sol:



90.

Answer: 4

Sol:

Individual amino acids are different so they can be distinguished by their isoelectric point.

Amino acids contains amino ($-\text{NH}_2$) and carboxyl ($-\text{COOH}$) functional groups. Thus, for an amino acids, the isoelectric point is the average of pK_a values for the amine and the carboxyl group.

Biology - Section A

91.

Answer: 2

Sol:

When in case of normal allele it will form the same enzyme and will produce the same phenotypic trait, which means it will lead to the transformation of the substrate S.

But when the allele forms a nonfunctional enzyme or no enzyme the phenotype may be affected.

92.

Answer: 4

Sol:

A mature pollen grain contains two types of cells:
vegetative and generative cells

Vegetative cell is bigger, has abundant food reserve and a large irregular shaped nucleus.

The generative cell is small and floats in the cytoplasm of the vegetative cell. (it is spindle shaped with dense cytoplasm and a nucleus)

12 NCERT (PAGE 23)

93.

Answer: 4

Sol:

Statement "1" is incorrect as a cross between Aa X aa gives Aa.

On selfing Aa X Aa , we get AA, Aa, Aa, aa in the ratio of 3:1 in the F2 generation.

Statement "2" is incorrect as 3:1 explains the law of dominance.

Statement "3" is incorrect as law of dominance explains that in a monohybrid cross between the pair of contrasting traits, only one parental character will be expressed in the F1 generation, and both the parental characters will be expressed in the F2 generation.

Statement "4"

94.

Answer: 2

Sol:

Tapetum is the innermost one cell thick layer of the microsporangium wall. The cells of this layer are radially enlarged and store food.

The cells are multinucleated and provide nourishment to developing microspores or pollen grains.

95.

Answer: 4

Sol:

According to mendelian dihybrid cross,

The ratio of phenotype is : 9:3:3:1 The ratio of genotype is 1:2:2:2:4:1:2:1:1

Therefore, Homozygous for one and Heterozygous for other character - 8/16. In a dihybrid cross, this phenotype would result from the combination of two homozygous alleles for one trait and two heterozygous alleles for the other trait. The probability is 8/16 because there are 8 combinations that fulfill this condition (AABB, AABb, AaBB, AaBb, aaBB, aaBb, AAbb, aabb) out of a total of 16 possible combinations.

Recombinant phenotype - 6/16 The probability is 6/16 because there are 6 combinations (AABB, AABb, AaBB) out of 16 that give rise to recombinant genotypes.

F₁ like phenotype - 9/16 i.e. this phenotype is similar to the phenotypes of the parental generation. The probability is 9/16 because there are 9 combinations (AABB, AABb, AaBB, AaBb) out of 16 that result in F₁-like phenotypes.

Parental genotype - 2/16 i.e. there are 2 combinations (AaBb and aaBB) out of 16 that give rise to parental phenotypes.

96.

Answer: 1

Sol:

In western countries, a large number of pollen products in the form of tablets and syrups are available in the market. Pollen consumption has been claimed to increase the performance of athletes and race horses.

97.

Answer: 2

Sol:

In both incomplete dominance and codominance, both phenotypic and genotypic ratios are identical 1:2:1 in F₂ generation. In incomplete dominance, the phenotype of hybrid is intermediate between the two parents as both the alleles express themselves partially. However, in codominance, there is no intermediate expression as both the alleles express themselves equally.

Where the F₁ resembled either of the two parents (dominance) or was in-between (incomplete dominance). But, in the case of co-dominance the F₁ generation resembles both parents.

98.

Answer: 1

Sol:

The Ovule is attached to the placenta by means of a short stalk known as a funicle which is the point of adherence.

Hence, the correct answer is option "1".

99.

Answer: 2

Sol:

A polygenic trait is the one that is governed by more than one gene. Human skin colour is a polygenic trait governed by three pairs of genes where dominant allele of each gene express only a part of trait and the full trait is expressed only in presence of dominant alleles of all multiple genes, is called polygenic inheritance.

Skin color genes are present on autosomes and do not exhibit sex-linked inheritance. The presence of more than one allele for a gene is called multiple allelism; each gene for skin color has two alleles only.

Pleiotropy is the condition where a gene has its own independent effect but also modifies the expression of a completely different gene quantitatively.

100.

Answer: 2

Sol:

Micropyle is an opening for the entry of male gamete. It can be defined as the structure in seed plants that gives rise to and contains the female reproductive cells.

101.

Answer: 4

Sol:

Polygenic inheritance is when more than one gene controls a character. It is also known as quantitative inheritance where two or more different pair of alleles which have a cumulative effect on governing quantitative characters. When kernel colour in wheat is determined by two pairs of genes Aa and Bb. Genes A and B are dominant genes which determine the red colour whereas a and b are recessive alleles. Results of this polygenic inheritance is depicted.

Parents	RED AABB	X	WHITE aabb	
Gametes	AB		ab	
F ₁ Generation	MEDIUM AaBb			
Gametes	AB	Ab	aB	ab
AB	AABB RED	AABb DARK	AaBB DARK	AaBb MEDIUM
Ab	AABb DARK	AAbb MEDIUM	AaBb MEDIUM	Aabb LIGHT
aB	AaBB DARK	AaBb MEDIUM	aaBB MEDIUM	aaBb LIGHT
ab	AaBb MEDIUM	Aabb LIGHT	aaBb LIGHT	aabb WHITE

The ratio of 1: 4: 6: 4: 1.

(i) Red (extreme) – 1/16

(ii) Dark red – 4/16

(iii) Medium red – 6/16

(iv) Light red – 4/16

(v) White – 1/16

so, 1 red : 14 intermediate (non parental) : 1 white

the ratio will be 14/16.

102.

Answer: 2

Sol:

Nucellus is a diploid nutritive tissue in the ovule that contains the embryo sac. Nucellus is made up of parenchyma cells. Parenchyma cells are thin-walled living cells with intercellular spaces. The cells of the nucellus have abundant food material.

103.

Answer: 3

Sol:

Morgan coined the term linkage to describe the physical association of genes on a chromosome & the term recombination to describe the generation of non-parental gene combinations.

104.

Answer: 3

Sol:

Meiotic division forms 4 haploid megasporangia. Only one megasporangium divides mitotically to form embryo sac and the other three disappear or disintegrate.

105.

Answer: 4

Sol:

mother is carrier, father suffering from colourblindness

106.

Answer: 4

Sol:

Self pollination is a form of pollination that can occur when a flower has both stamen and a carpel in which the cultivar or species is self fertile and the stamens and the sticky stigma of the carpel contact each other in order to accomplish pollination.

It is prevented by: dichogamy, self-sterility and herkogamy. Dichogamy - having pistils and stamens that mature at different times, thus promoting cross-pollination rather than self pollination.

Herkogamy - common strategy employed by angiosperms to reduce sexual interference between male (anthers) and female (stigma) function.

107.

Answer: 1

Sol:

Among all the statements only incorrect option is "1".

In humans, a total of 23 pairs of chromosomes are present. Out of the 23 pairs, 22 pairs are the same in both (females and males).

Only 1 pair (Sex chromosome) is different.

In Males, the XY chromosome is present and In Females, the XX chromosome is present.

Hence, the correct option is "1" - Humans contain 23 pairs of autosomes.

108.

Answer: 4

Sol:

This disease is caused by the allele in recessive conditions. A person who is suffering from this disease is in a homozygous recessive condition.

The affected RBCs can block blood vessels. The black shaded figures show the affected population and those without color are the ones who are not affected.

Hence, the correct option is "4" - Sickle cell anemia.

109.

Answer: 1

Sol:

Failure of segregation of chromatids during cell division cycle results in gain or loss of chromosome is called aneuploidy. E.g. – Down Syndrome.

Chromosomal mutations can change the location as well as the number of genes on chromosomes.

Examples are:-

- 1) Down's syndrome or trisomy 21
- 2) Trisomy 13 or Patau syndrome
- 3) Chromosome 5 short arm partial deletion or Cri du chat syndrome.
- 4) Triple X syndrome.

Mendelian disorders are a group of genetic disorders which are characterized by alterations (mutations) in one gene.

Cystic fibrosis (CF) is a Mendelian “monogenic” recessive genetic disorder caused by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene

Hence, the correct option is "1" - I & III alone are correct.

110.

Answer: 2

Sol:

Since recombination frequency (crossing over) is directly proportional to the distance between genes.

Here 4 genes a, b, c and d have linear sequences a-c-b - d which depends on the gene present in the middle

gene frequency between genes a and c = 2% (Distance between a and c = 2 centimorgan)

gene frequency between genes b and c is =13%, (Distance between b and c = 13 centimorgan)

gene frequency between genes b and d =4%, (Distance between b and d = 4 centimorgan)

gene frequency between genes a and b =15%,(Distance between a and b = 15 centimorgan)

gene frequency between genes c and d= 17%. (Distance between c and d = 17 centimorgan)



111.

Answer: 4

Sol:

A polygene is a member of a group of non-epistatic genes that interact additively to influence a phenotypic trait, thus contributing to multiple-gene inheritance, a type of non-Mendelian inheritance, as opposed to single-gene inheritance, which is the core notion of Mendelian inheritance.

In the question, it is given that height is controlled by three pairs of genes (6 alleles).

According to the values, the maximum height given is 200 cm for AABBCC and the minimum height is 50cm for aabbcc.

The plant with genotype AaBbCc has 3 dominant alleles and hence the height of the plant would be:

Contribution of each polygene = (Maximum height - Minimum height)/No. of polygene = (200 - 50)/6 = 25cm

Contribution of dominant polygene in plant having genotype AaBbCc=25 x 3 = 75

Height of plant with genotype AaBbCc = Minimum height + Contribution of dominant polygene = 50 + 75 = 125 cm.

Hence, the correct option is "4" - 125cm.

112.

Answer: 1

Sol:

Nucleic acids are essential biomacromolecules of the living cells. They are polymer of nucleotides. Nucleotides comprises of three basic units nitrogenous base, pentose sugar and phosphate. There are two types of nitrogenous bases purines and pyrimidines. Adenine (A) and Guanine (G) are purines whereas Cytosine (C), Uracil (U) and Thymine (T) are pyrimidines. Erwin Chargaff proposed two rules which are termed as Chargaff's rules.

These are applicable for double helix DNA/RNA structure. First rule, in any double stranded DNA the number of guanine units equals the number of cytosine units and the number of adenine units equals the number of thymine units. Second rule, the composition of DNA varies from one species to another. Thus, in dsDNA/ dsRNA: 1.

The molar ratio of A to T equals to 1. Similarly the molar ratio of G to C equals to 1/2. The sum of purines (A and G) equals that of pyrimidines (C and T) 3. The percentage of C+G does not necessarily equal the percentage of A+T 4.

The ratio of G+C and A+T is constant for any species. Therefore the ratio that is generally constant for a given species is G+C/A+T as explained by Chargaff's laws.

Thus the right answer is option A.

113.

Answer: 1

Sol:

Alfred Hershey and Martha Chase (1952) worked with viruses that infect bacteria called bacteriophages.

Bacteria which was infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. DNA is therefore the genetic material that is passed from virus to bacteria.

114.

Answer: 3

Sol:

m-RNA	t-RNA	r-RNA
Have message for protein	Adapter RNA	Play catalytic role

There are three major types of RNAs : mRNA (messenger RNA), tRNA (transfer RNA), and rRNA (ribosomal RNA). All three RNAs are needed to synthesise a protein in a cell. The mRNA provides the template, tRNA brings aminoacids and reads the genetic code, and rRNAs play structural and catalytic role during translation.

115.

Answer: 4

Sol:

DNA replication always occur from 5 to 3 end in continuous manner on 3 to 5 end DNA and discontinuous manner on 5 to 3 end of DNA called okazaki fragment after the name of discover.

116.

Answer: 3

Sol:

RNA Polymerase is a multiprotein found in the nucleus of eukaryotes. RNA polymerase in the case of eukaryotes has three variations and each code for a different gene.

Protein coding is catalyzed by RNA polymerase II into mRNA which carries the information from the DNA to the protein synthesis site.

The role of RNA polymerase III is to transcribe the genes for tRNAs and for 5s rRNA which is the smallest species of ribosomal RNA.

Hence, the correct option is "3" - III, 5s

117.

Answer: 4

Sol:

UGG is a codon that codes for the amino acid tryptophan. UGA, UAA and UAG are codons that signal the termination of protein synthesis and do not code for any amino acids.

118.

Answer: 3

Sol:

One GTP is hydrolyzed to GDP as each successive amino acid-tRNA complex attaches to the A site of the ribosome.

A second GTP is broken down to GDP as the ribosome moves to each codon in the mRNA.

One ATP is hydrolyzed to AMP during amino acid activation.

Thus, the formation of each peptide bond uses 3 high energy molecules, one ATP and two GTP.

So, for single amino acids, it will be 1 ATP and 2 GTP.

119.

Answer: 3

Sol:

The lac operon consists of one regulatory gene (the i gene) and three structural genes (z, y, and a). The I gene codes for the repressor of the lac operon. The z gene codes for β -galactosidase, 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 β -galactosides.

120.

Answer: 4

Sol:

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

121.

Answer: 1

Sol:

The DNA fingerprinting involved

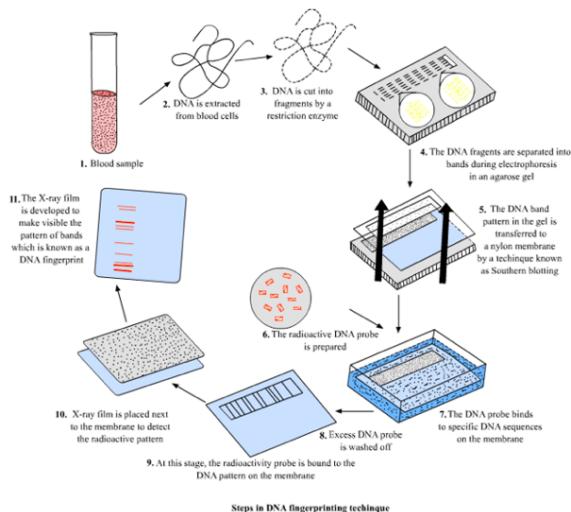
1. Isolation of DNA.
2. Digestion of DNA by restriction endonuclease.
3. Separation of DNA fragments by electrophoresis.
4. Transferring of separated DNA fragments to nitrocellulose or nylon membrane.
5. Hybridisation using labelled VNTR probe.
6. Detection of hybridised DNA fragments by autoradiography

According to these steps

A - restriction endonuclease B - Electrophoresis

C - Nitrocellulose and nylon D - Labelled VNTR probe

E - Autoradiography



122.

Answer: 1

Sol:

- According to human genome project, Chromosome 1 has most genes (2968).
- The human genome contains an estimated 30,000 genes.
- E. coli* that has only 4.6×10^6 bp (compare it with humans whose diploid content is 6.6×10^9 bp), completes the process of replication within 18 minutes; that means the average rate of polymerization has to be approximately 2000 bp per second.
- Chromosome Y has the fewest (231).

123.

Answer: 3

Sol:

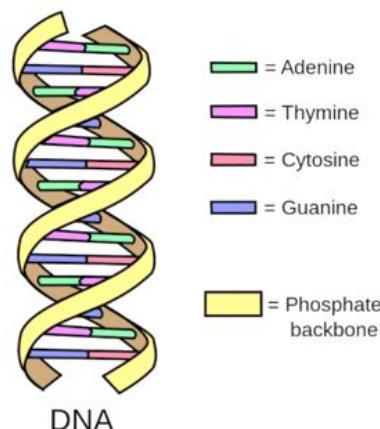
124.

Answer: 3

Sol:

Base pair refers to, two complementary nucleotides one of which is purine and the other is pyrimidine. Adenine always pairs with Thymine or vice versa and Guanine always pairs with Cytosine or vice versa. Hence 1 base pair has 2 nucleotides

i.e., 10,000 nitrogenous base pair will have $10,000 \times 2 = 20,000$ nucleotides.



125.

Answer: 2

Sol:

Pollination is the act of transferring pollen grains from the male anther of a flower to the female stigma. By pollination, male gamete i.e. pollen is brought in contact with the female gamete i.e. egg. In **Angiosperms**, male and female gametes are present in the flowers. Pollination occurs by means of wind, water, insects, birds etc. In **gymnosperms**, male and female gametes are present on separate plants in the form of cones. Pollens are usually carried away by the wind to the female cones. Hence, pollination process in angiosperm and gymnosperm perform as **anemophily**.

126.

Answer: 1

Sol:

Maize flowers undergo pollination with the help of wind. It is because their flowers are light in weight. This is called anemophily.

127.

Answer: 3

Sol:

Unisexual flowers only have either male or female flowers and do not have both stamens and carpels. Removing the anther from bisexual flowers without affecting the female reproductive part is known as emasculation. Bagging is a method of protecting an emasculated flower from unwanted pollen grains by covering it. Hence, emasculation or bagging is not required in unisexual flowers.

128.

Answer: 1

Sol:

Test cross: Crossing of F_1 individual with homozygous recessive progeny. It is used to determine whether F_1 progeny is homozygous or heterozygous.

Back cross: F_1 is crossed with one of the parents or genetically identical individual to the parent.

Reciprocal cross: Same parents are used in two different experiments. In one experiment, parent A is used as female, and B as male, and in the other A is used as male and B as female.

Out cross: It is the technique of crossing between different breeds with no common ancestors.

129.

Answer: 4

Sol:

Incomplete dominance: - According to Mendel's law of dominance, dominant character must be present in F_1 generation. But in some organisms, F_1 generation is different from the both parents. For example:

Flower colour in Mirabilis jalapa: Incomplete dominance was first discovered by Correns in *Mirabilis jalapa*. This plant is called as '4 O' clock plant 'or' Gul-e-Bans'. Three different types of plant are found in *Mirabilis* on the basis of flower colour, such as red, white and pink.

Flower colour in Antirrhinum majus:- Incomplete dominance is also seen in flower colour of this plant. This plant is also known as 'Snapdragon ' or 'Dog flower'. Incomplete dominance is found in this plant which is the same as *Mirabilis*.

Starch synthesis in the pea seed: It is controlled by a single gene which has 2 alleles - B and b. It is an example of incomplete dominance as far as the phenotype of grain size is considered. The BB alleles will produce starch grains that are big and bb will produce smaller starch grains.

130.

Answer: 2

Sol:

The ABO blood group system is a good example of multiple alleles because it involves three alleles: I^A , I^B , and i.

In a multiple allele, many alleles are present in a population for a character because an individual contains only two alleles.

131.

Answer: 4

Sol:

In pedigree analysis, dot in a circle represents the carrier individual for sex linked recessive. Half shaded circle and square are used to represent individuals heterozygous for autosomal recessive traits. Full shaded circle and square are used to represent affected individuals. A square with a diagonal line is used to represent death. So, the correct option is D.

132.

Answer: 4

Sol:

Klinefelter's Syndrome is genetic disorder which is 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.

133.**Answer:** 2**Sol:**

- a. DNA has a "Promoter site or initiation site" where transcription begins and a "Terminator site" where transcription stops. Sigma factor recognises the promoter or initiation site of DNA. With the help of sigma factor RNA polymerase enzyme attached to a specific site of DNA called "Promoter site".
- b. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA.
- c. In tailing, adenylate residues (200-300) are added at 3'-end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation.
- d. The DNA strand which has the polarity (5'→3') and the sequence same as RNA (except thymine at the place of uracil), is displaced during transcription. Strangely, this strand (which does not code for anything) is referred to as coding strand.

134.**Answer:** 2**Sol:**

Statement I :- The primary transcripts contain both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order.

Statement II :- In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3'-end in a template independent manner.

Hence, statement-I is correct but statement-II is incorrect.

135.**Answer:** 4**Sol:**

Deoxyribonucleoside triphosphates serve dual purposes. They serve as substrates i.e. nucleotides during replication and also provide energy for polymerization reaction by cleavage of high energy terminal phosphates bond or we say they provide energy for polymerisation reaction, the two terminal phosphates in a deoxynucleoside triphosphates are high-energy phosphates, same as in the case of ATP.

136.**Answer:** 2**Sol:**

Class 12th NCERT Page No. 31, 32

137.**Answer:** 3**Sol:**

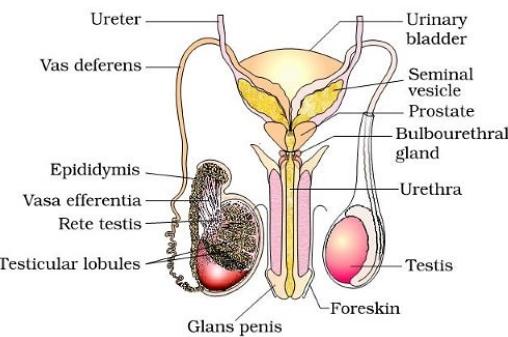
The exact composition of the early atmosphere was carbon dioxide, nitrogen gas, water vapour, hydrogen gas and compounds in which hydrogen atoms were bounded to the other light elements like Sulphur, nitrogen, carbon etc. producing hydrogen sulphide, ammonia and methane.

Such atmosphere is referred to as reducing atmosphere.

It has ample availability of hydrogen atoms and their electrons and predominance of molecules having less oxygen than hydrogen.

138.**Answer:** 1**Sol:**

The seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis. The epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder. It receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.



Diagrammatic view of male reproductive system
(part of testis is open to show inner details)

12 ncert page 43

139.

Answer: 1

Sol:

The idea of spontaneous generation is an obsolete theory that states that living organisms can originate from inanimate objects. Other common examples of spontaneous generation were that dust creates fleas, maggots arise from rotting meat, and bread or wheat left in a dark corner produces mice. The theory of spontaneous generation was hotly debated for hundreds of years. During this time, many experiments were conducted to both prove and disprove the theory. In 1668, Francesco Redi published the first set of experiments challenging spontaneous generation. In these experiments, he demonstrated that maggots arise from the eggs of flies rather than directly from rotting meat. He did so by taking several jars and placing raw meat inside of them. Half the jars he left open to the environment, and the other half, he covered with gauze. John Needham, however, was not convinced. He argued that Redi did not fully disprove the theory of spontaneous generation. Needham maintained that while spontaneous generation did not occur in larger organisms, for smaller organisms, it could still take place under the right circumstances. In 1745, he set out to prove this by boiling broth in a flask, leaving it open to cool and then sealing it. In several days' time, the broth was teeming with bacteria and mold. He claimed that this was proof of the existence of spontaneous generation for microorganisms.

140.

Answer: 2

Sol:

Female accessory ducts include oviducts (fallopian tube), uterus and vagina.

Clitoris is external genitalia it is not included in accessory ducts.

141.

Answer: 2

Sol:

Convergent evolution

Class 12th NCERT Page No.133

142.

Answer: 3

Sol:

12 ncert page 46

The edges of the infundibulum posses finger like projections called fimbriae.

The clitoris is a tiny finger like projection lies at the upper junction of two labia minora above the urethral opening.

143.

Answer: 4

Sol:

Variations among individuals are not important in natural selection

144.

Answer: 4

Sol:

Tertiary follicle changes into mature follicle or graffian follicle.

option (c) is correct but with respect to spermatogenesis not oogenesis.

In option (a) primary follicle surrounded by granulase cell layer is called secondary follicle.

In option (b) antrum is characteristic of tertiary follicle.

145.

Answer: 1

Sol:

Directional natural selection occurs when one extreme phenotype is favored over others, leading to a shift in the population's traits over time. The example of **DDT resistance in insects** is a classic case of directional selection. In this case, insects with genetic mutations that confer resistance to DDT (a pesticide) are more likely to survive and reproduce, leading to an increase in the frequency of resistant individuals in the population.

- **(B) Vestigial organ:** Vestigial organs are reduced or non-functional body parts. Their presence is not an example of directional selection but rather a result of evolutionary history.
- **(C) Survival of human babies with average body weight:** This is an example of **stabilizing selection**, not directional selection, where individuals with intermediate traits (like average body weight) are favored.
- **(D) None of these:** This is incorrect, as option A provides an example of directional natural selection.

146.

Answer: 2

Sol:

Class 12th NCERT Page No. 35

147.

Answer: 3

Sol:

NCERT Class 12th Page No. 128

148.

Answer: 1

Sol:

Statement I is true but Statement II is false

149.

Answer: 1

Sol:

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

150.

Answer: 1

Sol:

Both (A) and (R) are true and (R) is the correct explanation of (A).

151.

Answer: 1

Sol:

Extrusion of 2nd polar body of the egg nucleus occurs before the fusion of chromosomes (which occurs during the first mitotic division of the zygote). During oocyte-sperm fusion, the second polar body expulsion occurs and the cytoplasm contents of the sperm cell membrane (now fused with the oocyte membrane) pass into the oocyte cytoplasm.

152.

Answer: 3

Sol:

Neanderthal and Homo sapiens have a common ancestor, that most people think of as Homo heidelbergensis. However, since Neanderthal and Homo sapiens interbred, so another way to think of this is to simply say that we are both just a subspecies of Homo heidelbergensis. Australopithecus was an immediate ancestor of Homo erectus, the ancient form from which modern humans arose. Homo erectus, an ancestor to modern humans, arose at least 1.8 million years ago. Cro-Magnon man is the direct ancestor of the Homo sapiens. Cro-Magnon man's fossils have been found in Africa.

153.

Answer: 4

Sol:

presentation of various events during a menstrual cycle is as follows :-

Menstruation \Rightarrow Proliferative stage \Rightarrow Ovulation
 \Rightarrow Secretory Phase .

154.

Answer: 3

Sol:

The skull of baby chimpanzee is more like adult human skull. This fact is evident for the evolutionary pathway of human and chimpanzee. A shrew-like animal that snagged insects from ferns lining the shores of freshwater lakes 160 million years ago, might be one of the first "true" mammals to walk the Earth, back when the dinosaurs roamed, a new fossil suggests. Charles Darwin was influenced by Thomas Robert Malthus, a late-eighteenth century economist. Malthus wrote "Essay on the Principle of Population", which Darwin read and was inspired by. The central theme of Malthus' work was that population growth would always overpower food supply growth, creating perpetual states of hunger, disease and struggle. The natural, ever-present struggle for survival caught the attention of Darwin and he extended Malthus' principle to the evolutionary scheme.

155.

Answer: 1

Sol:

Class 12th NCERT Page No. 37

156.

Answer: 3

Sol:

First sign of a growing foetus is noticed by a heartbeat in the fifth week. By the end of 24 weeks (second trimester), the body is covered with fine hair, eye-lids separate and eye-lashes are formed.

Hence the correct answer is **1st movement of foetus during of 5th month of pregnancy.**

157.

Answer: 2

Sol:

hCG, hPL and relaxin, Explanation: Human chorionic gonadotropin (hCG), human placental lactogens (hCL) and relaxin are produced in human females only during pregnancy.

158.

Answer: 4

Sol:

It is necessary for maintaining the inner lining of the uterus known as the endometrium. This lining plays a vital role in carrying out the successful implantation of the embryo inside the mother's womb on the uterine wall.

This is achieved through the hormone progesterone secreted by the female reproductive system.

Hence, **the correct option is "4"- Progesterone.**

159.

Answer: 4

Sol:

Uterine contractions are induced by the hormone known as oxytocin. In turn, this stimulates the release of prostaglandins. That at last initiates the uterine contractions.

The process of delivering out baby after full growth is known as parturition.

Parturition is induced by the signals released through the developing fetus. This is known as fetal ejection reflex.

So, the correct option is "4" - Release of oxytocin from maternal pituitary.

160.

Answer: 4

Sol:

The process of parturition is generally a process in which the transformation of the myometrium occurs from a quiescent to a contractile state.

It requires progesterone withdrawal and estrogen activation.

In most mammals, the parturition is achieved by changes in circulating progesterone (decrease) and estrogen (increase).

Hence, the correct option is "4" - Progesterone hormone level decreases, and estrogen hormone level increases.

161.

Answer: 2

Sol:

A primary follicle is made up of a primary oocyte surrounded by a layer of granulosa cells. When more layers of granulosa cells are added to the primary follicle, it forms a **secondary follicle**. The secondary follicle also develops a covering, or a theca.

A cavity appears within the membrana granulosa. It is called the antrum. With the appearance of this cavity, the Tertiary follicle is formed. Presence of **antrum** (Follicular cavity) is character feature of **Tertiary follicle**.

The luteinizing hormone (LH) causes the Graafian follicle to rupture, which releases the secondary oocyte. This process is called **ovulation**.

162.

Answer: 2

Sol:

Class 12th NCERT Page No. 44

163.

Answer: 4

Sol:

b, c

164.

Answer: 3

Sol:

A copper-bearing IUD is the most effective form of emergency contraception available. The emergency contraceptive pill regimens recommended by WHO are ulipristal acetate, levonorgestrel, or combined oral contraceptives (COCs) consisting of ethynodiol diacetate plus levonorgestrel.

165.

Answer: 4

Sol:

166.

Answer: 1

Sol:

Assisted Reproductive Technologies (ARTs) are those techniques which assist childless couples to have children. Some of the ARTs include the following techniques. Test tube baby, GIFT, ICSI and artificial insemination. The later is applied when male partner fails to inseminate or suffer from oligospermia (low sperm count of semen). In artificial insemination, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI – intra-uterine insemination) of the female.

167.

Answer: 4

Sol:

When females cannot conceive then embryo transfer is done by using ZIFT and IUT techniques.

In this method ova from females & sperms from the male are collected and are induced in the laboratory under simulated conditions to form zygotes.

The zygote with up to 8 blastomeres is transferred into the fallopian tube through ZIFT (Zygote intrafallopian transfer) or embryos with more than 8 blastomeres are transferred into the uterus through IUT (Intrauterine transfusion).

168.

Answer: 3

Sol:

Three

Class 12th NCERT Page No. 134

169.

Answer: 1

Sol:

Convergent evolution : when different organisms independently evolve similar traits, then this type of evolution is known as convergent evolution.

Analogous structures are the result of convergent evolution - different structures evolving for the same function and hence having similarity.

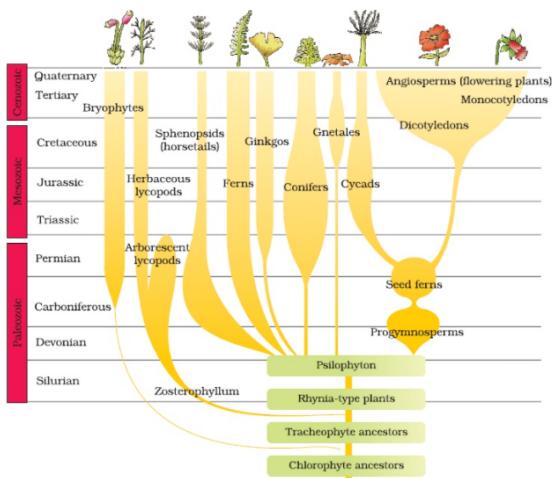
eg. Wing of birds and insects.

Other examples of analogy are the eye of the octopus and of mammals or the flippers of Penguins and Dolphins.

170.

Answer: 3

Sol:



Hence the **correct** option is **C**

171.

Answer: 2

Sol:

A reducing atmosphere is an atmospheric condition in which oxidation is prevented by removal of oxygen and other oxidizing gases or vapours, and which may contain actively reducing gases such as hydrogen, carbon monoxide, and gases such as hydrogen sulfide that would be oxidized by any present oxygen.

The primitive atmosphere of earth was reducing atmosphere with little or no oxygen but was rich in water vapour, carbon monoxide, carbon dioxide, nitrogen, and hydrogen. The ozone layer of present day atmosphere absorbs these UV and gamma rays.

172.

Answer: 2

Sol:

In human females, ovulation is the release of secondary oocytes from the ovary at about the 14th day of the menstrual cycle.

Both LH and FSH attain a peak level during this period. Rapid secretion of LH induces rupturing of fully developed Graafian follicles and thereby release of the ovum. LH surge is actually responsible for ovulation.

Estrogen hormone is associated with sexual development, menstrual cycle. The decrease in estrogen can cause bone disorders and other heart-related problems.

So, a decrease in estrogen is not related to human female ovulation.

173.

Answer: 2

Sol:

After the implantation of the blastocyst, the inner cell mass of the structure differentiates into endoderm, ectoderm and mesoderm.

174.

Answer: 2

Sol:

(iii) only

175.

Answer: 1

Sol:

12th NCERT Page No – 23, 37, 38

The fetal ejection reflex is a signal for parturition, or childbirth, that originates from the fully developed fetus and placenta. This reflex causes mild uterine contractions that trigger the release of oxytocin from the maternal pituitary.

Human chorionic gonadotropin (hCG) is a hormone produced by the placenta during pregnancy.

Colostrum is the first milk produced after giving birth and is rich in antibodies that help protect newborns from infectious pathogens.

Fimbriae are finger-like projections at the ends of fallopian tubes that collect the secondary oocyte (ovum) released from the ovary during ovulation.

176.

Answer: 2

Sol:

Prophase-I of meiotic division stage

177.

Answer: 1

Sol:

Statement I is correct but Statement II is false

178.

Answer: 3

Sol:

'Reproductive and Child Health Care (RCH) programme' deals with creating awareness among people about various reproduction related aspects and providing facilities and support for building up a reproductively healthy society.

Amniocentesis is basically used to test for the presence of certain genetic disorders such as Down's syndrome, haemophilia, etc., to determine the survivability of the foetus.

Amniocentesis is not a sex determination technique in India and is not a strategy of RCH.

179.

Answer: 3

Sol:

Multiload 375

180.

Answer: 2

Sol:

Class 12th NCERT Page No. 59

Declining population growth, also known as depopulation, is a reduction in the size of the human population. A rapid increase in mortality rate, maternal mortality rate (MMR) and infant mortality rate (IMR) are the possible reasons for the population decline.

While population growth increases due to lack of awareness about contraceptive methods and reduction in maternal mortality rate (MMR).