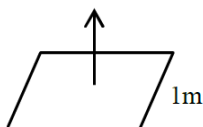


DETAILED SOLUTION NEET-2022

SECTION - A (PHYSICS)

1. (2)

$$B = 0.5 \text{ T}$$



Angle between \vec{B} & \vec{A} is zero

$$\begin{aligned} \phi &= B.A. \cos 0 \\ &= 0.5 \times (1) \times 1 \\ &= 0.5 \text{ Wb} \end{aligned}$$

2. (4)

$$n = \sqrt{\epsilon_r \mu_r}$$

$$n = \frac{c}{v} \Rightarrow v = \frac{c}{n}$$

$$v = \left(\frac{c}{\sqrt{\epsilon_r \mu_r}} \right)$$

3. (bonus)

Using the equation

$$eV = h\nu - \phi$$

$$\text{or } eV = h\nu - h\nu_{Th}$$

$$\frac{eV_s}{2} = \frac{h\nu}{2} - h\nu_{Th} \quad \dots(1)$$

$$eV_s = h\nu - h\nu_{Th} \quad \dots(2)$$

Data Incorrect

4. (2)

Initially speed is zero, then increases & after some time it becomes constant.

5. (3)

$$d\vec{B} = \frac{\mu_0 (I d\vec{\ell} \times \vec{r})}{4\pi r^3}$$

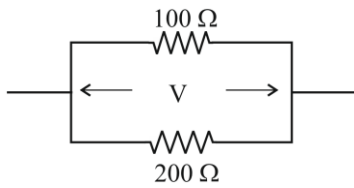
The expression for magnetic field depends on current carrying element $I d\vec{\ell}$, which is a vector quantity, therefore, statement-I is correct and statement-II is wrong.

6. (3)

For conductors α is (+ve)

For semiconductors α is (-ve)

7. (2)



$$P = \frac{V^2}{R} \Rightarrow P \propto \frac{1}{R}$$

$$\frac{P_1}{P_2} = \frac{R_2}{R_1} = \frac{200}{100} = \frac{2}{1}$$

$$= 2:1$$

8. (4)

In (a) & (c) circuits, both the junctions are in same biasing conditions so offers equal resistances.

9. (3)

Peak voltage is $\sqrt{2}$ times rms voltages in ac.

10. (4)

Slope of (x – t) graph, gives velocity

$$\frac{V_1}{V_2} = \frac{\tan \theta_1}{\tan \theta_2} = \frac{\tan 30^\circ}{\tan 45^\circ} = \frac{1}{\sqrt{3}}$$

11. (3)

Electric field is always perpendicular to equipotential surface.

12. (3)

$[MLT^{-2}A^{-2}]$ = Magnetic permeability

13. (1)

$$P = P_0 + \frac{4T}{R}$$

on expansion R increase, as a result, P decreases.

14. (1)

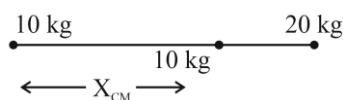
$$E = P \times t = 100 \times 10^3 \times 3600 \\ = 36 \times 10^7 \text{ J}$$

15. (3)

In half wave rectification

$$\Rightarrow f_{\text{output}} = 60 \text{ Hz}$$

16. (2)



$$X_{\text{CM}} = \frac{20 \times 10}{20 + 10} = \frac{20}{3} \text{ m}$$

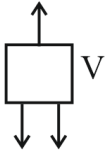
17. (4)

(a) Radio wave (ii) $\approx 102 \text{ m}$ (ii)

- (b) Microwave \approx (iii) 10.2 m (iii)
 (c) Infrared radiations \approx (iv) 10.4 m (iv)
 (d) X-ray (i) $\approx \text{\AA} = 10.10 \text{ m}$ (i)
 (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)

18. (3)

$$\begin{aligned} \Rightarrow T &= W + f \\ &= 20000 + 3000 \\ &= 23000 \text{ N} \end{aligned}$$



$$\begin{aligned} \Rightarrow \text{Power} &= Tv \\ &= 23000 \times 1.5 \\ &= 34500 \text{ watts} \end{aligned}$$

19. (4)

$$y = (n\lambda) \left(\frac{D}{d} \right)$$

$$n_1 \lambda_1 = n_2 \lambda_2$$

$$(8)(600 \text{ nm}) = n_2 (400 \text{ nm})$$

$$n_2 = 12$$

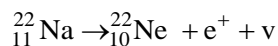
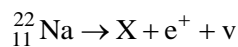
20. (2)

$$V = \frac{1}{4\pi\epsilon_0} \cdot \frac{Q}{R}$$

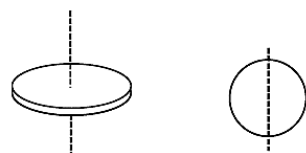
$$\therefore V \propto \frac{1}{R}$$

\therefore Potential is more on smaller sphere.

21. (3)



22. (2)



$$k = \sqrt{\frac{1}{m}}$$

$$\Rightarrow \frac{k_1}{k_2} = \sqrt{\frac{I_1}{I_2}} = \sqrt{\frac{mR^2/2}{mR^2/4}} = \sqrt{2} : 1$$

23. (4)

First excited state $\Rightarrow n = 2$

$$T_1 = 13.6 \frac{z^2}{n^2} = -\frac{13.6}{4} \text{ eV}$$

Second excited state $\Rightarrow n = 3$

$$T_2 = 13.6 \frac{z^2}{n^2} = -\frac{13.6}{9} \text{ eV}$$

$$T_1 : T_2 = \frac{1}{4} : \frac{1}{9} = 9 : 4$$

24. (3)

Because angle of incidence is Brewster's angle so that angle between reflected and refracted ray is 90°

$$\tan i_p = \mu = \sqrt{3}$$

$$i_p = 60^\circ = i$$

25. (4)

$$J = \sigma E \Rightarrow \frac{E}{\rho} = \frac{El}{RA} = \frac{10 \times 10 \times \pi}{10 \times 10^{-4}}$$

$$\Rightarrow 10^5 \text{ A/m}^2$$

26. (3)

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

$$P = \left(\frac{3}{2} - 1 \right) \left(\frac{1}{0.2} + \frac{1}{0.2} \right)$$

$$P = \frac{1}{2} \left(\frac{2}{0.2} \right) = \frac{10}{2} = +5D$$

27. (2)

$$B = \mu_0 ni = \mu_0 \frac{N}{\ell} i$$

$$\therefore B = 4\pi \times 10^{-7} \times \frac{100}{10^{-3}} \times 1 = 12.56 \times 10^{-2} \text{ T}$$

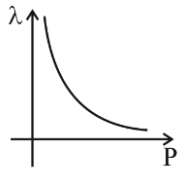
28. (2)

$$I_g = \frac{F}{m} = \frac{3}{60 \times 10^{-3}} = 50 \text{ N/kg}$$

29. (4)

$$\lambda = \frac{h}{p}$$

Graph will be hyperbolic



30. (3)

$$S_{nth} = u + \frac{a}{2}(2n-1)$$

$$S_{nth} \propto (2n-1)$$

$$= 1:3:5:7$$

31. (2)

$$\omega = \omega_0 + \alpha t$$

$$\alpha = \frac{\omega - \omega_0}{t}$$

$$= \frac{(3120 - 1200)}{16s} \text{ rpm}$$

$$= \frac{1920}{16} \times \frac{2\pi}{60} \text{ rad/s}^2$$

$$= 4\pi \text{ rad/s}^2$$

32. (2)

Adiabatic curve is more steeper than isothermal.

33. (3)

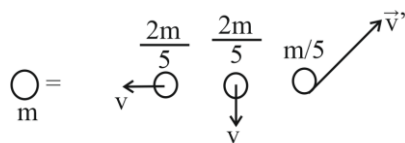
$$v \propto \sqrt{T}$$

$$\frac{v_i}{v_f} = \sqrt{\frac{T_i}{T_f}} = \frac{1}{\sqrt{2}}$$

34. (1)

Plane angle and solid angle are dimensionless but have units.

35. (3)



By conservation of momentum:

$$m(0) = \frac{2m}{5}(-v\hat{i}) + \frac{2m}{5}(-v\hat{j}) + \frac{m}{5}\vec{v}'$$

$$\Rightarrow \vec{v}' = 2v\hat{i} + 2v\hat{j}$$

$$\Rightarrow v' = \sqrt{(2v)^2 + (2v)^2}$$

$$= 2\sqrt{2}v$$

SECTION - B (PHYSICS)

36. (4)

$$\begin{aligned} \text{Area} &= \text{Length} \times \text{Breadth} \\ &= 55.3 \times 25 \\ &= 1382.5 \\ &= 14 \times 10^2 \end{aligned}$$

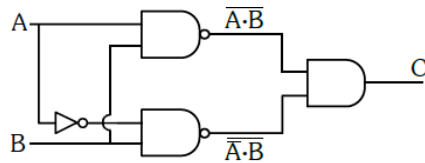
37. (3)

$$\begin{aligned} i_{\max} &= \frac{E_{\max}}{R} = \frac{NBA\omega}{R} \\ i_{\max} &= \frac{1000 \times 2 \times 10^{-5} \times \pi (10^2) \times 2}{12.56} \\ i_{\max} &= 1\text{A} \end{aligned}$$

38. (2)

$$\begin{aligned} E &= \frac{Kp}{r^3} \sqrt{1 + 3\cos^2 \theta} \\ \therefore E &\propto \frac{1}{r^3} \end{aligned}$$

39. (3)



$$C = \overline{A \cdot B} \cdot \overline{\overline{A} \cdot B}$$

Using De-Morgan Theorem

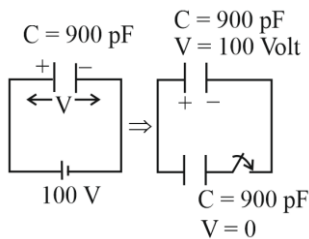
$$C = \overline{A \cdot B} \cdot \overline{\overline{A} \cdot B}$$

$$C = \overline{B(A + \overline{A})} = \overline{B}$$

Therefore

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

40. (3)



Common potential

$$V_c = \frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$$

$$= \frac{C \times 100 + C \times 0}{C + C}$$

$$= 50 \text{ Volt}$$

Electrostatic energy stored

$$= 2 \times \frac{1}{2} C V^2 = C V^2$$

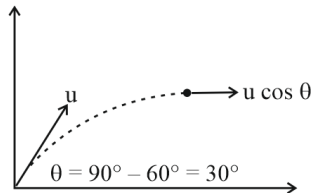
$$= 2.25 \times 10^{-6} \text{ J}$$

41. (2)

$$i_c = \sin^{-1} \left(\frac{3}{4} \right)$$

42. (2)

At highest point only horizontal component of velocity remains $\Rightarrow u_x = u \cos \theta$



$$u_x = u \cos \theta = 10 \cos 30^\circ$$

$$= 5\sqrt{3} \text{ ms}^{-1}$$

43. (2)

Resistance of P & Q should be approx. equal as it decreases error in experiment.

44. (3)

$$Y_{\text{copper}} < Y_{\text{steel}}$$

45. (2)

$$\omega = 100$$

$$v = \frac{\omega}{2\pi} = \frac{100}{2\pi} = \frac{50}{\pi} \text{ Hz}$$

Resonance frequency

$$v_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{10 \times 10 \times 10^{-6}}}$$

$$= \frac{50}{\pi} \text{ Hz}$$

46. (1)

$$(n)(1.1) = (n+1)$$

$$0.1(n) = 1$$

$$n = 10$$

$$\text{Required number of oscillation} = n + 1 = 10 + 1 = 11$$

47. (4)

$$\begin{aligned}
 V &= (\text{no. of moles})(22.4 \text{ litre}) \\
 &= \frac{\text{mass}}{\text{molar mass}} (22.4 \times 10^{-3} \text{ m}^3) \\
 &= \frac{4.5 \times 10^3}{18} \times 22.4 \times 10^{-3} \text{ m}^3 \\
 &= 5.6 \text{ m}^3
 \end{aligned}$$

48. (2)

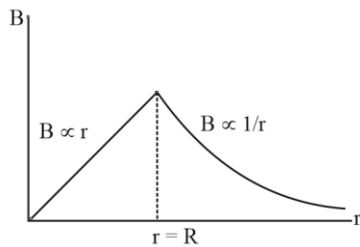
$$\text{Gravitational constant} = [M^{-1}L^3T^{-2}]$$

$$\text{Gravitational potential energy} = [ML^2T^{-2}]$$

$$\text{Gravitational potential} = [L^2T^{-2}]$$

$$\text{Gravitational intensity} = [LT^{-2}]$$

49. (3)



50. (3)

$$R = R_0 (A)^{1/3}$$

$$\frac{R_1}{R_2} = \left(\frac{125}{64} \right)^{1/3} = \frac{5}{4}$$

Section- A (CHEMISTRY)

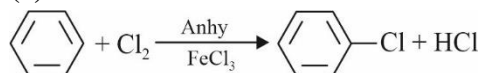
51. (2)

The oxidation state of K in KO_2 is (+1)

52. (1)

IUPAC name of element with atomic number 119 is ununennium.

53. (1)



54. (4)

Li is used in making batteries, liquid Na is a coolant in nuclear reactors. Cs is used in photoelectric cells and KOH as a base is used to absorb acidic oxides like CO_2 .

55. (3)

I – Cl bond is stronger than I-I bond due to additional electrostatic force between I and Cl.

56. (2)

Both statements are correct independently but the reason is not the correct reason of the assertion.

57. (4)

As compared to hydrocarbons of similar mass aldehydes and ketones will have greater dipole – dipole interactions.

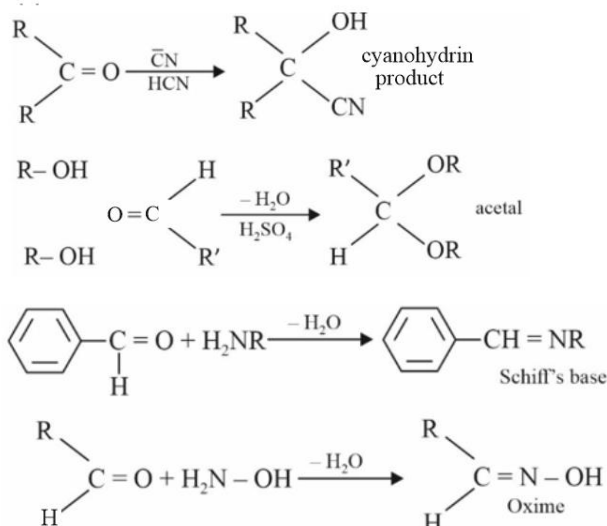
58. (3)

Carbon atoms in diamond are sp^3 hybridized and those in graphite are sp^2 hybridized

59. (2)

Cimetidine is an antacid. Seldane is an antihistaminic drug.

60. (4)

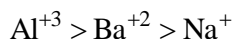


61. (3)

Aliphatic diazonium salts are not stable Aromatic diazonium salts exist at low temp of $0 - 4^\circ\text{C}$.

62. (3)

For the coagulation of a negative sol flocculating power is



But for coagulating a positive sol the flocculating power will be



63. (2)

The boiling point order is: $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{O}$

64. (2)

$$\text{Molality} = \frac{\text{moles of solute}}{\text{mass of solute(kgs)}} \Rightarrow 1 = \frac{0.5}{W(\text{kgs})}$$

$$W_{\text{solvent}} (\text{kgs}) = 0.5 = 500\text{g}$$

65. (4)

In diborane the boron atoms are sp^3 hybridized

66. (1)

MgH_2 is an ionic or saline hydride, GeH_4 is an electron precise hydride with 8 electrons around Ge, B_2H_6 is an electron deficient hydride and HF is electron rich.

67. (3)

Enantiomers are non-superimposable mirror images of each other.

68. (1)

$$\text{p}^{\text{H}} = \text{p}^{\text{ka}} + \log \frac{[\text{CH}_3\text{COONa}]}{[\text{CH}_3\text{COOH}]}$$

$$\text{p}^{\text{H}} = 4.57 + \log \frac{0.1}{0.01} = 5.57$$

69. (4)

$[\text{Ag}(\text{H}_2\text{O})_2]^+[\text{Ag}(\text{CN})_2]^-$ is called diaquasilver(I)dicyanidoargentate(I)

70. (4)

Cyclohepta-1, 3, 5-triene is not aromatic as one carbon is saturated (sp^3)

71. (3)

Kjehldahl's method does not work for heterocyclic and azo compounds.

72. (3)

Enzymes are proteins

73. (2)

Gadolinium has outer configuration of $[\text{Xe}]4f^7 5d^1 6s^2$

Its third ionization energy is low due to highly exchange energy and hence stability of the half-filled f-subshell.

74. (4)

$\text{O}_2^+(15)$ will have configuration $\sigma_{1s}^2 \sigma_{1s}^{*2} \sigma_{2s}^2 \sigma_{2s}^{*2} \sigma_{2p_x}^2 \left\{ \begin{array}{l} \pi_{2p_y}^2 \\ \pi_{2p_z}^2 \end{array} \right\} \left\{ \begin{array}{l} \pi_{2p_y}^{*1} \\ \pi_{2p_z}^{*1} \end{array} \right\}$. This ion is paramagnetic

75. (1)

$E_{\text{cell}}^0 = E_{\text{cathode}}^0 - E_{\text{anode}}^0 = (+1.510) - (1.229) = +0.287\text{V}$. As E_{cell}^0 is positive the cell will work

76. (2)

Maximum work is done in the case where area under the curve is maximum

77. (3)

At different positions $-\text{NO}_2$ affects acidic strength differently. The order of acidic strength is p-nitro phenol > o-nitrophenol > m-nitrophenol

78. (3)

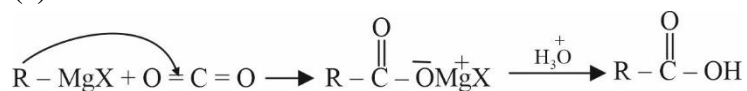
For a zero-order reaction Rate Vs conc graph will be straight line parallel to the x-axis

For a 1st order reaction $t_{\frac{1}{2}}$ vs concentration will again be a straight line parallel to x-axis.

79. (4)

Shapes of $d_{x^2-y^2}$ and d_{z^2} are not similar to each other.

80. (1)



81. (4)

Maximum lone pair – lone pair repulsions are there in XeF_2

82. (4)

$p_i = p_i \chi_i$ is not a correct form of Dalton's law of partial pressures

83. (4)

Thermosetting polymers such as Bakelite cannot be moulded again and are hence not reusable.

84. (2)

$$\text{Moles of HCl} = \frac{50}{1000} \times 0.5 = 0.025 \text{ moles}$$

$$\text{So, moles of CaCO}_3 \text{ used} = \frac{0.025}{2} = 0.0125 \text{ moles} = 1.25 \text{ g}$$

$$95\% (\text{Total mass of CaCO}_3) = 1.25 \text{ g}$$

$$\text{Total mass of CaCO}_3 = \frac{1.25}{0.95} = 1.32 \text{ g}$$

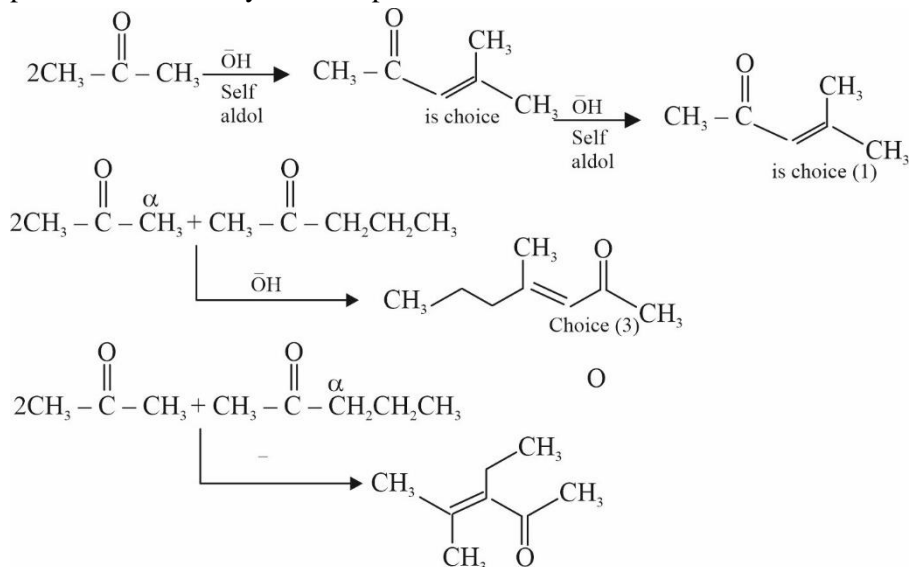
85. (4)

Silver will not be able to reduce Cu^{+2} to Cu.

Section- B (CHEMISTRY)

86. (2)

When acetone & 2-pentanone are added in a base for an aldol condensation reaction there are several possibilities that may arise for product formation.

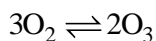


But structure in choice (2) is not possible. It will be possible with 3-pentanone.

87. (2)

$$k = \frac{2.303}{5} \log \frac{0.1}{0.001} = \frac{2.303 \times 2}{5} = \frac{4.606}{5} = 0.921 \text{ min}^{-1}$$

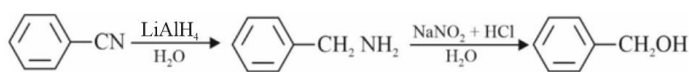
88. (1)



$$3 \times 10^{-59} = k_c = \frac{[\text{O}_3]^2}{[\text{O}_2]^3} = \frac{[\text{O}_3]^2}{[4 \times 10^{-2}]^3}$$

$$[\text{O}_3]^2 = 192 \times 10^{-65} \Rightarrow [\text{O}_3] = 4.38 \times 10^{-32}$$

89. (4)



90. (2)

Hematite: Fe_2O_3 Magnetite: Fe_3O_4 Calamine: ZnCO_3 Kaolinite: $[\text{Al}_2(\text{OH})_4\text{Si}_2\text{O}_5]$

91. (3)

Statement I is true but statement II is incorrect as 3°-alcohols are the most reactive and give immediate turbidity with Luca's reagent.

92. (3)

$$E_{\text{cell}} = 1.05 - \frac{0.059}{2} \log \frac{[\text{Ni}^{+2}]}{[\text{Ag}^+]^2}$$

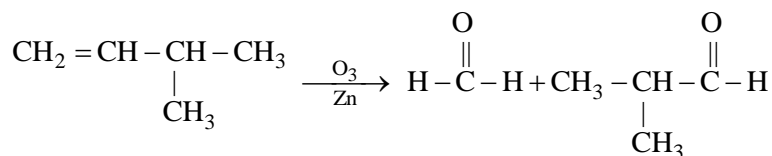
$$= 1.05 - \frac{0.059}{2} \log \frac{[10^{-3}]}{[10^{-3}]^2}$$

$$= 1.05 - \frac{0.059 \times 3}{2} = 1.05 - 0.0885 = 0.9615 \text{ volt}$$

PLEASE NOTE

There is a misprint in the question. The E_{cell}^0 is incorrectly given as 10.5 V. This should have been 1.05 volt.

93. (1)



Formaldehyde 2-methyl propanal

94. (1)

Oxidation state in neutral medium changes from +7 to +4 for MnO_4^- to MnO_2

95. (1)

$$\frac{a^3 \times d}{M} \times N_A = Z \Rightarrow \frac{(3.608 \times 10^{-8})^{3 \times 8.92}}{M} \times 6 \times 10^{23} = 4$$

$$M = \frac{46.96 \times 10^{-24} \times 8.92 \times 6.022 \times 10^{23}}{4} = 63 \text{ g/mole}$$

Closest answer is choice (1)

96. (4)

$$P = \frac{nRT}{V} = \frac{2 \times 0.0381 \times 300}{10} = 4.986 \text{ bar}$$

97. (1)

$$105.8 \times \frac{2}{4} = 52.9 \text{ pm} \Rightarrow r_{\text{Li}^{+2}} = 52.9 \times \frac{3^2}{3} = 158.7 \text{ pm}$$

98. (3)

More the number of strong field ligands in a complex greater the energy absorbed by a complex

99. (1)

The IUPAC name giving the lowest number to the functional group obeying the lowest set of local is

1-bromo-5-chloro-4-methylhexan-3-ol

100. (3)

Pollution due to oxides of sulphur gets enhanced due to hydrocarbons and oxidizing agents like O_3 & H_2O_2

SECTION - A (BIOLOGY: Botany)

101. (1)
When the small subunit of ribosome encounters an mRNA, the process of translation of the mRNA to protein begins. This process is followed by the binding of the larger subunit. t-RNA is activated by the addition of amino acid prior to the attachment of ribosome, in the first phase.
102. (3)
Electrostatic precipitators (ESPs) are very efficient devices which remove 99% of particulates present in the industrial and thermal plant exhausts.
103. (2)
Ulothrix is a member of Chlorophyceae (green algae), with reserve food material, starch. Mannitol is stored food material of Phaeophyceae (brown algae).
104. (3)
Hydrocolloids are water holding substances for eg. carrageen obtained from red algae (Rhodophyceae).
105. (3)
One of the species in predation gains benefit on the expense of the other. Predators help in maintaining species diversity in a community, by reducing the intensity of competition among competing prey species. If a predator is too efficient and overexploits its prey, then the prey might become extinct.
106. (1)
The primary CO₂ acceptor is a 3-carbon molecule, phosphoenol pyruvate (PEP) and is present in the mesophyll cells. Mesophyll cells of C₄ plants lack RuBisCO enzyme.
107. (2)
The microbe, *Frankia*, produces nitrogen fixing nodules on the roots of non-leguminous plants (e.g. *Alnus*)
108. (3)
Polymorphism in DNA sequence is the basis of genetic mapping of human genome as well as of DNA fingerprinting.
109. (4)
Plants follow different pathways in response to environment or phases of life to form different kinds of structures. This ability is called plasticity e.g. heterophylly in cotton, coriander and larkspur. In such plants, leaves of juvenile plant are different in a shape from those in mature plants. Maize does not show plasticity.
110. (3)
During glycolysis, total 4 ATPs are produced from one glucose molecule with a net gain of 2 ATPs.
111. (1)
In old trees, the greater part of secondary xylem is dark brown due to deposition of organic compounds like tannins, resins, oils, gums, aromatic substances and essential oils in the central or innermost layers of the stem. These substances make it hard, durable and resistant to the attacks of micro-organisms and insects.
112. (2)
When a flower can be divided into two similar halves only in one particular vertical plane, it is zygomorphic for e.g. pea, gulmohar, bean, Cassia. Mustard, Datura and Chilli show actinomorphic flowers.
113. (4)
Less than seven percent of the energy in glucose is released during lactic acid fermentation and not all of it is trapped as high energy bonds of ATP.

114. (2)
Ethylene is a gaseous plant hormone. It induces development of adventitious roots on various types of cutting. It promotes the development of lateral roots and growth of root hairs. Cytokinin helps to overcome the apical dominance. Auxin is used to kill dicot weeds. Gibberellin speeds up the malting process
115. (4)
Among the animals, insects, particularly bees are the dominant biotic pollinating agents.
116. (3)
Habitat loss and fragmentation, over exploitation, alien species invasion and co-extinction are causes for biodiversity loss.
117. (3)
Prophase I of meiosis I is a unique phase which involves recombination of genetic material between homologous chromosomes. This occurs in the pachytene stage where the non-sister chromatids of the homologous chromosomes cross-over and exchange of genetic material takes place. Recombination nodules are the sites at which the non-sister chromatids crossover.
118. (3)
Ethylene increases the number of female flowers and fruits in certain plants such as cucumber. Gibberellins are used to increase the size of fruits in some plants.
119. (2)
In-situ conservation means on site conservation i.e. when we conserve and protect the whole ecosystem, its biodiversity at all levels is protected. National parks are type of in-situ conservation.
Whereas, micropropagation, cryopreservation and in-vitro fertilisation are methods of ex-situ conservation.
120. (1)
Option (1) is the incorrect statement, as process of extraction of separated DNA strands from gel is called elution.
121. (2)
Heterochromatin is transcriptionally inactive. A typical nucleosome contains 200 bp of DNA helix. Euchromatin is the loosely packed chromatin region.
The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome. Histones are rich in basic amino acid residues lysine and arginine.
122. (2)
Manganese plays a major role in the splitting of water to liberate oxygen during photosynthesis. Magnesium activates several enzymes involved in photosynthesis and respiration. Boron is involved in pollen germination. Iron activates the catalase and some other enzymes.
123. (2)
Option (2) is the correct answer because both the statements are correct but the given reason is not the correct explanation. Polymerase chain reaction is used in DNA amplification.
Ampicillin resistance gene is a selectable marker that helps to check transformation by selection of transformants.
124. (3)
Pairing of homologous chromosomes is an essential feature of meiosis, acting to promote high levels of recombination and to ensure segregation of homologs.

125. (3)

The symplastic system is system of interconnected protoplasts. Neighbouring cells are connected through cytoplasmic strands that extend through plasmodesmata. The water travels through cell cytoplasm and plasmodesmata, hence the movement is relatively slower. Symplastic movement is aided by cytoplasmic streaming

126. (1)

Cleistogamous flowers does not open at all. In such flowers autogamy occurs. Lack of cross pollination is a disadvantage of cleistogamy.

127. (2)

The girdling experiment shows that phloem is the tissue responsible for translocation of food; and that transport takes place in one direction i.e. towards the root.

128. (3)

Grasshopper is an example of XO type of sex determination in which the males have only one X-chromosome besides the autosomes, whereas females have a pair of X-chromosomes.

129. (3*)

All the statements are correct regarding vascular bundles but none of the options with such combination is given.

130. (2)

- Vexillary aestivation and diadelphous stamens are the characteristic features of family Fabaceae.
- *Pisum sativum* (garden pea) belongs to family Fabaceae.
- *Allium cepa* (onion) and *Colchicum autumnale* (colchicine) belong to family Liliaceae.
- *Solanum nigrum* belongs to Solanaceae.

131. (3)

Decomposition is the process by which decomposers breakdown complex organic matter into inorganic substances.

The rate of decomposition is controlled by chemical composition of detritus and climatic factors. Decomposition is slower if detritus is rich in lignin and chitin and quicker, if detritus is rich in nitrogen and water soluble substances like sugars.

132. (3)

Axillary buds of stems get modified into woody, straight and pointed thorns. Thorns are found in many plants such as Citrus and Bougainvillea

133. (3)

Arthropods are covered with a tough, resilient integument or exoskeleton of chitin. Generally the exoskeleton will have thickened areas in which the chitin is reinforced or stiffened by materials such as minerals or hardened proteins.

134. (2)

Chemiosmosis requires a membrane, a proton pump, a proton gradient and ATP synthase. Energy is used to pump protons across a membrane to create a gradient or a high concentration of protons within the thylakoid lumen.

The NADP reductase enzyme is located on the stroma side of the membrane. Along with the electrons that come from the acceptor of electrons of PS I, protons are necessary for reduction of NADP^+ to $\text{NADPH}^+ \text{H}^+$. The process does not involve breaking of electron gradient.

135. (1)

Gregor J. Mendel, conducted hybridisation experiments on garden peas and selected 14 true breeding pea plant varieties (seven contrasting traits). Contrasting traits studied were smooth or wrinkled seeds, yellow or green seeds, inflated or constricted pods, green or yellow pods, tall or dwarf plants, violet or white flowers and axial or terminal flower positions.

SECTION - B (BIOLOGY: Botany)

136. (2)

Spirogyra is an alga. It shows haplontic life-cycle.

Fern is pteridophyte. The dominant phase of life-cycle is diploid sporophyte. Its gametophyte is called prothallus.

Funaria is a bryophyte. Its gametophyte is a leafy stage.

Cycas is a gymnosperm. The main plant body in gymnosperm is sporophyte. They have highly reduced gametophyte stage.

137. (2)

Spring wood is also called early wood. It is lighter in colour and has a lower density. The vessels are produced with the wider lumens to transport more water to meet the requirement by increased transpiring surface in spring season.

The spring and autumn wood appear as alternate concentric rings of light and dark colour forming annual rings.

138. (2)

Option (2) is the correct answer as a palindromic DNA sequence is a DNA sequence of base pairs that reads same on the two strands when orientation of reading is kept the same. Out of the four options, option (2) is the only palindromic sequence.

5'GAATTC3'

3'CTTAAG5'

139. (1)

In predation, one species is benefitted where as the other is harmed. It is (+ –) type of population interaction.

140. (3)

Closely located genes do not show independent assortment. Mendel's law of independent assortment holds good for those genes which are located on different chromosomes.

141. (3)

The given figure is of a false fruit. False fruit develops from other floral parts and thalamus alongwith the development of ovary wall.

142. (1)

The four types of chromosomes in animal cells are classified by the position of the centromere. These are:

1. Metacentric Chromosomes- These have the centromere in the center.
2. Submetacentric Chromosomes- These have the centromere slightly offset from the center leading to a slight asymmetry in the length of the two sections.
3. Acrocentric Chromosomes- These have a centromere which is severely offset from the center leading to one very long and one very short section.
4. Telocentric Chromosomes- These have the centromere at the very end of the chromosome. Humans do not possess telocentric chromosomes but they are found in other species such as mice.

143. (2)

If some solute is dissolved in pure water, the solution has lower free water and the concentration of water decreases, reducing its water potential. The magnitude of this lowering due to dissolution of a solute is called solute potential.

144. (3)

Phosphorus cycle is a sedimentary cycle. Reservoir pool of phosphorus in ecosystem is the earth's crust or lithosphere. Weathering of rocks accelerate phosphorus cycle.

145. (2)

Haemophilia is a X-linked recessive disorder. Thalassaemia is an autosomal recessive disorder. Sickle cell anaemia is an autosomal recessive disorder.

Myotonic dystrophy is an autosomal dominant disorder i.e. it occurs due to the presence of autosomal linked dominant trait.

146. (3)

Option (a) Lecithin (phosphatidylcholine) A phosphoglyceride containing the amino alcohol choline esterified to the phosphate group. It is the most abundant animal phospholipid (being a component of plasma membranes) and also occurs in higher plants, but rarely in microorganisms.

Option (b) A saturated fat is a type of fat in which the fatty acid chains have all single bonds. A fat known as a glyceride is made of two kinds of smaller molecules: a short glycerol backbone and fatty acids that each contain a long linear or branched chain of carbon (C) atoms.

Option (c) Oils have lower melting point (gingely oil) hence remain as oil in winters.

Option (d) Lipid is chemically defined as the substance which is insoluble in water and soluble in organic solvents like alcohol, ether, and chloroform and others. Lipid molecules are insoluble or sparingly soluble in water, but are readily soluble in organic solvents like ether, alcohol and benzene. Insolubility of lipids in water is due to the fact that the polar groups they contain are much smaller than their nonpolar portions.

Option (e) Monoglycerides may be obtained by: hydrolysis of triglycerides, glycerolysis of triglycerides or direct esterification of glycerol with fatty acids.

147. (2)

The large cells around the vascular bundles of C_4 plants form bundle sheath. These cells have large number of chloroplasts to perform calvin cycle.

148. (2)

Advantages of CNG

- (1) It is cheaper than diesel (2) It cannot be adulterated like diesel
(3) CNG burns more efficiently than diesel

149. (2)

Option (2) is the correct answer as the source of the complementary RNA for RNAi could be mobile genetic elements (transposons) that replicate via an RNA intermediate.

Option (3) is incorrect as autoradiography usually follows hybridisation.

Option (1) is incorrect because polymerase chain reaction is used to make copies of the DNA sample and does not need transposons.

Option (4) is incorrect because transposons are not required during gene sequencing.

150. (1)

Sequencing the whole set of genome that contained all the coding and non-coding sequences and later assigning different regions in the sequence with functions is called sequence annotation.

SECTION - A (BIOLOGY: Zoology)

151. (3)
Estrogen protects your bones. As a female undergoes menopause, her estrogen levels drop which can lead to decreased bone mass and increase the chances of fractures.
152. (3)
Maltose is a disaccharide whose molecular formula is $C_{12}H_{22}O_{11}$. Maltose also known as malt sugar, is a disaccharide formed from two units of glucose joined with an $\alpha(1\rightarrow4)$ glycosidic bond. In the isomer isomaltose, the two glucose molecules are joined with an $\alpha(1\rightarrow6)$ glycosidic bond.
153. (4)
The digestive tract of Aves has additional chambers in their digestive system as crop and Gizzard. Crop is concerned with storage of food grains. Gizzard is a masticatory organ in birds used to crush food grain.
154. (2)
Long protein fibers called microtubules extend from the centrioles in all possible directions, forming what is called a spindle. Some of the microtubules attach the poles to the chromosomes by connecting to protein complexes called kinetochores.
155. (3)
In prokaryotes, ribosomes can be found in the cytosol as well but they are free ribosomes not membrane bound. This protein-synthesizing organelle is the only organelle found in both prokaryotes and eukaryotes, asserting the fact that the ribosome is a trait that evolved early on, most likely present in the common ancestor of eukaryotes and prokaryotes.
156. (2)
Meiosis II begins with the 2 haploid cells where each chromosome is made up of two connected sister chromatids. DNA replication does NOT occur at the beginning of meiosis II. The sister chromatids are separated, producing 4 genetically different haploid cells.
157. (3)
Breeding crops with higher levels of vitamins and minerals, or higher protein and healthier fats is known as Biofortification.
Biomagnification refers to increase in concentration of the toxicant at successive trophic levels.
Bioremediation is the phenomenon of using biological organism to handle pollution.
158. (2)
The first pair of wings in the cockroach arise from the mesothorax and the second pair from the metathorax. Forewings are called tegmina. tegmina are opaque dark and leathery and they cover hind wings when at rest.
- 159 (1)
Fatty acid and glycerol are insoluble, hence cannot be absorbed into the blood. They are first incorporated into small droplets called micelles. Micelles move to intestinal mucosa, where they are reformed into very small protein coated globules called chylomicrons.
160. (3)
Spermiogenesis is transformation of spermatids into spermatozoa whereas spermiation is the release of the sperms from sertoli cells into the lumen of seminiferous tubule.
161. (1)
When we conserve and protect the whole ecosystem, its biodiversity at all levels is protected. This is *in-situ* or on site conservation strategy.

162. (3)

Mycoplasma are the smallest cells and are only 0.3 μm in length. So it can pass through less than 1 μm filter size. Mycoplasma lack cell wall.

163. (1)

Myotonic dystrophy (dystrophia myotonica [DM]) is an autosomal-dominant disorder, and myasthenia gravis (MG) is an autoimmune disease characterized by weakness of skeletal muscles.

Tetany usually is caused by low calcium levels, and hypoparathyroidism that causes low calcium levels also causes long term tetany.

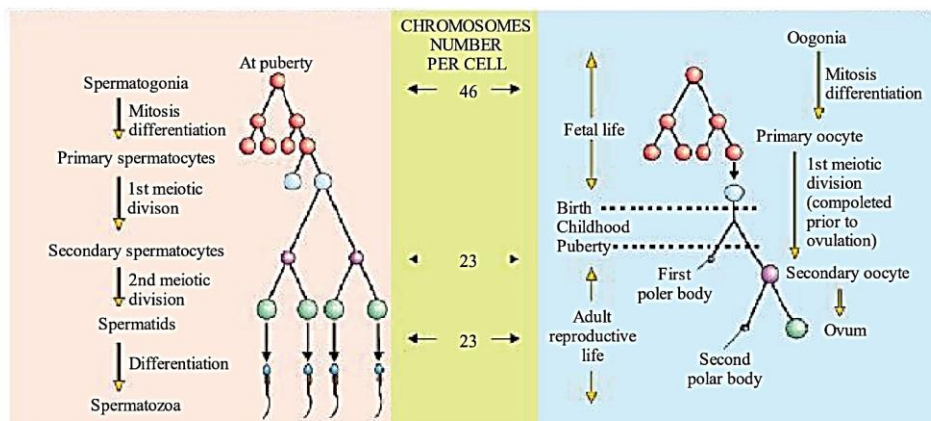
164. (3)

Rheumatoid arthritis, or RA, is an autoimmune and inflammatory disease, which means that our immune system attacks healthy cells in our body, causing inflammation (painful swelling) in the affected parts of the body. RA mainly attacks the joints, usually many joints at once.

165. (3)

As the product of 'i' gene binds with the operator region and blocks the transcription and translation of z, y and a genes. It's product is prevented from binding to the operator by attaching it with the inducer. As the inducer can now no more capable of binding with the repressor, thus, in all the cases, operator always gets attached with the repressor thereby preventing the transcription and transmission of z, y and a.

166. (4)



167. (2)

In tissues, the partial pressure of oxygen is low, so oxyhemoglobin dissociates into oxygen and hemoglobin. 100ml of oxygenated blood can deliver 5ml of oxygen to the tissues under normal conditions. 100ml of deoxygenated blood can deliver 4ml of carbon dioxide in the lungs.

168. (4)

Reptiles, birds, snails and insects excrete most of their waste nitrogen as uric acid in the form of pellet or paste with a minimum loss of water.

169. (4)

Saliva has various functions.

Cleaning effect of washing away food debris.

Makes swallowing food easier.

Antibacterial effect of fighting off bacteria entering the mouth.

Lubricating effect that protects mucous membranes.

pH buffering effect that prevents caries.

Effect of promoting remineralization of teeth.

Contains enzymes that begin chemical breakdown of starch(polysaccharide)

170. (2)

Directional selection occurs when individuals with traits on one side of the mean in their population survive better or reproduce more than those on the other. It has been demonstrated many times in natural populations, using both observational and experimental approaches.

171. (1)

Number of base pairs \times distance between 2 consecutive base pairs = Length of DNA molecule

$$x - 0.34 \times 10^{-9} \text{ m} = 1.1 \text{ m}$$

$$x = \frac{1.1}{0.3 \times 10^{-9}}$$

$$= 3.6 \times 10^9$$

$$\approx 3.3 \times 10^9 \text{ bp}$$

172. (4)

Neuroglia is the part of nervous tissue. Numerous cell types are found in connective tissue. Three of the most common are the fibroblast, macrophage, and mast cell. The types of connective tissue include loose connective tissue, adipose tissue, dense fibrous connective tissue, elastic connective tissue, cartilage, osseous tissue (bone), and blood.

173. (1)

The members of Vertebrata possess notochord during embryonic development. Thus, all vertebrates are chordates. However, the notochord gets replaced by a cartilaginous or bony vertebral column in the adult. Thus, all chordates are not vertebrates.

174. (1)

None of the options are matching with the language of the question

The correct ascending order of taxonomic categories in case of animals is

species \rightarrow genus \rightarrow family \rightarrow order \rightarrow class \rightarrow phylum \rightarrow kingdom

175. (1)

Cyclosporine A is widely produced by submerged fermentation of aerobic fungi identified as *Trichoderma polysporum*.

176. (1)

If 8 *Drosophila* in a laboratory population of 80 died during a week, the death rate in the population is

$$\frac{8}{80} = 0.1 \text{ individuals per } Drosophila \text{ per week.}$$

177. (4)

A clot or coagulum formed mainly of a network of threads called fibrins in which dead and damaged formed elements of blood are trapped. Fibrin are formed by the conversion of inactive fibrinogens in the plasma by the enzyme thrombin.

178. (2)

Vertebral column (spine) The vertebral column (spine or backbone) is a curved structure composed of bony vertebrae that are interconnected by cartilaginous intervertebral discs. It is part of the axial skeleton and extends from the base of the skull to the tip of the coccyx. The spinal cord runs through its center.

Cardiac muscle is made up of a type of muscle cells called cardiomyocytes. These muscle cells are connected to each other by an intercalated disc that helps them to act as a single functional organ.

So, the correct option is 'Cardiac muscles.'

179. (4)

The conducting zone consists of the nose, pharynx, larynx, trachea, bronchi, and bronchioles. These structures form a continuous passageway for air to move in and out of the lungs. The conducting part of the respiratory system serves to filter, warm and humidify air on its way to the lungs.

180. (3)

Lippes Loop intrauterine device was first introduced in 1962. It was a plastic double "S" loop, a trapezoidal shaped IUD that closely fit the contours of the uterine cavity, thereby reducing the incidence of expulsion. This IUD works mainly by enhancing phagocytosis of sperms.

Copper IUDs are 99.2% effective, while hormonal IUDs are successful 99.8% of the time. The chance of you getting pregnant is less than 1.

181. (4)

Option (4) is the correct answer as genetically engineered lymphocytes are not immortal cells and die after some time.

Option (3) is not the correct answer as the lymphocytes from patient's blood are grown in culture, outside the body but it is not the correct reason.

In option (2), if the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

182. (2)

Detritivores (eg. earthworm) break down detritus into smaller particles. This process is called fragmentation.

183. (1)

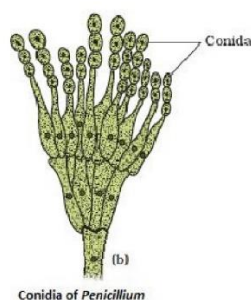
Option (1) is the correct answer because both the statements I and II are correct. Each restriction endonuclease recognises a specific palindromic nucleotide sequences in the DNA. It will bind to the DNA and cut each of the two strands of double helix at specific points. Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome site; but between the same two bases on the opposite strands. So both the statements I and II are correct.

184. (2)

Oogenesis is the differentiation of the ovum (egg cell) into a cell competent to further develop when fertilized. It is developed from the primary oocyte by maturation. Oogenesis is initiated in the embryonic stage.

185. (2)

Penicillium is a saprophytic fungus, com-monly known as blue or green mold. Asexual reproduction in *Penicillium* takes place by unicellular, uninucleate, non-motile spores, the conidia.



SECTION - B (BIOLOGY: Zoology)

186. (3)

Option (3) is the correct answer. Cloning vectors are the carriers of the desired gene in the host cell.

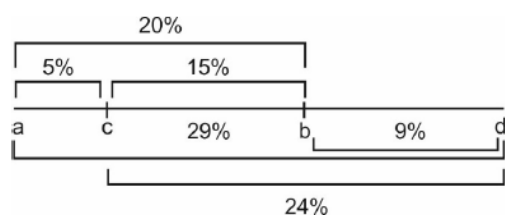
The features desirable in a cloning vector are: -

- Presence of origin of replication
- Presence of marker genes
- Presence of very few, preferably single recognition site for the commonly used restriction enzymes

187. (4)

1% recombination frequency = 1 centi Morgan

To place the genes on a linear chromosome, decreasing order of recombination frequency will be considered.



188. (4)

Glycogen is an easily mobilized storage form of glucose. Almost all of the glucose residues in glycogen are linked by glycosidic bonds. Glycogen synthesis requires an activated form of glucose.

The antibodies are γ -globulins. An antibody, also known as an immunoglobulin, is a large Y-shape protein produced by plasma cells that is used by the immune system to identify and neutralize foreign objects such as bacteria and viruses. The antibody recognizes a unique part of the foreign target, called an antigen

A steroid hormone is a steroid that acts as a hormone. Steroid hormones can be grouped into two classes: corticosteroids and sex steroids.

Thrombin catalyzes the conversion of fibrinogen—a soluble plasma protein—into long, sticky threads of insoluble fibrin. The fibrin threads form a mesh that traps platelets, blood cells, and plasma.

189. (4)

Electrical synapses transfer signals much faster than chemical synapses. While the speed of transmission in chemical synapses can take up to several milliseconds, the transmission at electrical synapses is nearly instantaneous.

190. (3)

During joint diastole stage, blood enters the respective auricles through veins. Blood is filled into the right and the left atria, as a result of this filling, the atrioventricular valves open allowing blood flow from the atria into ventricles hence there is a 2/3rd filling of ventricles.

Tricuspid & bicuspid valves are open during joint diastole and atrial systole as blood flows to the ventricles. During ventricular systole the bicuspid and tricuspid valves close and semilunar valves open to let blood flow through the pulmonary artery and aorta from the right and left ventricles, respectively.

191. (1)

The majority of the respiratory tree, from the nasal cavity to the bronchi, is lined by pseudostratified columnar ciliated epithelium. The bronchioles are lined by simple columnar to the cuboidal epithelium, and the alveoli possess a lining of thin squamous epithelium that allows for gas exchange

Tendons are dense connective tissues that connect muscle to bone. Tendons transmit forces generated by muscles to move joints.

Goblet cells are modified epithelial cells that secrete mucus on the surface of mucous membranes of organs, particularly those of the lower digestive tract and airways. Histologically, they are mucous merocrine exocrine glands.

192. (4)

In Penguins the wings are modified into flippers, while in Dolphins the flippers are modified fins. Hence, are an example of convergent evolution (Analogous organs).

193. (1)

Slime moulds are classified under kingdom Protista.

Mycoplasma lack cell wall.

Bacteria can be autotrophic as well as heterotrophic.

194. (2)

Lactational Amenorrhea is the absence of menstruation in lactating mothers. It is a period of temporary infertility or postpartum infertility. During the period of complete breastfeeding, the chances of conceiving are almost negligible.

Small doses of either progestogens or progesterone-estrogen combinations are used in the form of tablets by females called oral pills. Pills inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent or retard entry of sperms inside female genital tract.

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

195. (3)

From 10 parent E.coli cells

1st generation

^{15}N containing 10 cells $\xrightarrow{20 \text{ mins}}$ 20 cells (all hybrid)
 $^{15}\text{N} - ^{14}\text{N}$

2nd generation

20 cells (hybrid) $\xrightarrow{20 \text{ mins}}$ 40 cells $\begin{cases} 20 \text{ cells hybrid } ^{15}\text{N} - ^{14}\text{N} \\ 20 \text{ cells with } ^{14}\text{N} \end{cases}$

3rd generation

40 cells (20 cells hybrid + 20 ^{14}N containing cells) $\xrightarrow{20 \text{ min}}$ 20 ^{14}N containing cells + 20 hybrid and 40 ^{14}N containing cells

Therefore, after 60 minutes, 60 E.coli cells will have DNA totally free from ^{15}N .

196. (4)

Acquired immunity is also called specific immunity because it attacks to a specific antigen previously encountered. Its hallmarks are its ability to learn, adapt, and remember. Acquired immunity takes time to develop after first exposure to a new antigen.

Anamnestic response: renewed rapid production of an antibody following second or later contact with the provoking antigen or with related antigens.

197. (2)

Option (1) is the correct answer as genetically engineered insulin has A-peptide and B-peptide chains of insulin which are produced separately in E.coli, then they are extracted and combined by creating disulphide bond between them.

Statement (a) is incorrect as genetically engineered insulin does not have an extra stretch of C-peptide.

Statement (c) is incorrect as insulin obtained from cattles and pigs is not genetically engineered insulin.

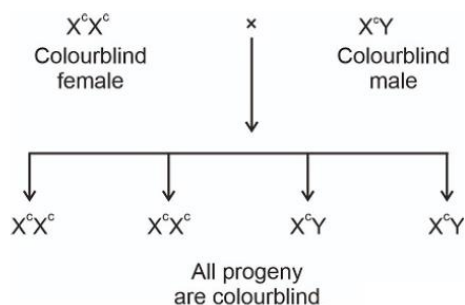
Statement (d) is incorrect because conversion of pro-insulin to insulin is not required during production of insulin by genetic engineering as A-peptide and B-peptide chains are produced separately.

Statement (e) is incorrect as allergic reactions to insulin are mostly seen when the insulin is obtained from animals.

Scrubbers are ideal for gaseous pollutant. ESPs also are not very efficient for removal of PM of very small sizes such as PM 2.5 μm .

198. (4)

If mother of man is colourblind, then man will also be colourblind as colour blindness is a X-linked recessive trait and shows criss-cross inheritance.



199. (2)

Parathyroid hormone regulates calcium levels in your blood by affecting the following parts of your body: Bones: Parathyroid hormone stimulates the release of small amounts of calcium from your bones into your bloodstream. At the kidneys, PTH increases calcium reabsorption and blocks phosphate reabsorption from the tubules. PTH also acts at the kidneys to stimulate the formation of vitamin D.

200. (2)

Scrubbers are air pollution control devices that use liquid to remove particulate matter or gases from an industrial exhaust or flue gas stream. This atomized liquid (typically water) entrains particles and pollutant gases in order to effectively wash them out of the gas flow.