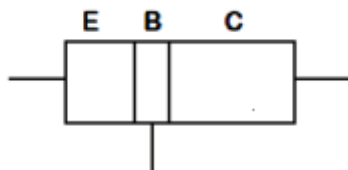


PHYSICS

1. (b)



As we know, for Bi-polar junction transistor

The length of each section of transistor is in order as shown above,

i.e., $L_C > L_E > L_B$

and doping profile is Emitter > Collector > Base

Whereas, for transistor action Base-emitter junction is forward biased and Base-collector junction is reversed biased.

Hence from this we can conclude that, for transistor action the base region must be very thin and lightly doped.

2. (d)

For a conducting sphere the electric field outside will be given as

$$E = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$$

$$= \frac{9 \times 10^9 \times 3.2 \times 10^{-7}}{225 \times 10^{-4}}$$

$$= 0.128 \times 10^6$$

$$= 1.28 \times 10^5 \text{ N/C}$$

3. (c)

As we know,

The limit of resolving power is given as

$$\theta_R = 1.22 \frac{\lambda}{d}; \lambda = 600 \times 10^{-9} \text{ m}, d = 2 \text{ m}$$

$$= \frac{1.22 \times 600 \times 10^{-9}}{2}$$

$$\theta = 3.66 \times 10^{-7} \text{ rad}$$

4. (b)

$$\text{Stress} = \frac{\text{Force}}{\text{Area}}$$

$$= \frac{[MLT^{-2}]}{L^2}$$

$$= [ML^{-1}T^{-2}]$$

5. (a)

Least count of screw gauge

$$= \frac{\text{Pitch}}{\text{Number of divisions on circular scale}}$$

$$0.01 \text{ mm} = \frac{\text{Pitch}}{50}$$

$$\text{Pitch} = 0.5 \text{ mm}$$

6. (a)

For the given case, the acceleration of given system will be expressed as

$$a = \frac{(m_1 - m_2)g}{(m_1 + m_2)}; \text{ where } m_1 > m_2$$

$$a = \frac{(6 - 4)g}{6 + 4}$$

$$a = \frac{g}{5}$$

7. (b)

According to de Broglie equation, the wavelength of electron will be given as

$$\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$$

$$\sqrt{V} = \frac{12.27 \times 10^{-10}}{1.227 \times 10^{-11}} = 10^2$$

$$\therefore V = 10^4 \text{ volts}$$

8. (c)

For the given case, since electric potential is found constant throughout the region.

Hence by using the equation of electric field,

$$\text{i.e., } E = -\frac{dV}{dr} = 0$$

We can conclude that the magnitude of electric field in the given region will be zero

9. (d)

$$PM = \rho RT \Rightarrow \rho = \frac{PM}{RT}$$

$$P = 249 \times 10^3 \text{ N / m}^2$$

$$M = 2 \times 10^{-3} \text{ kg}$$

$$T = 300 \text{ K}$$

$$\therefore \rho = \frac{(249 \times 10^3)(2 \times 10^{-3})}{8.3 \times 300} = \frac{0.2 \text{ kg}}{\text{m}^3}$$

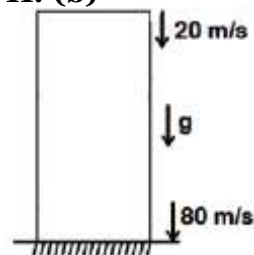
10. (d)

According to the kinetic theory of gases, the mean free path is linearly proportional to temperature and inversely proportional to pressure and molecular diameter,

$$\text{i.e., } \lambda = \frac{kT}{\sqrt{2}n\pi d^2}$$

$$\therefore \lambda \propto \frac{1}{\sqrt{2}n\pi d^2}$$

11. (b)



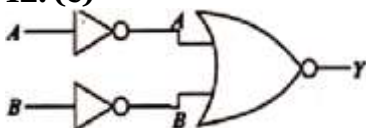
$$v^2 = u^2 + 2gh$$

$$v = 80 \text{ m/s}$$

$$u = 20 \text{ m/s}$$

$$h = \frac{v^2 - u^2}{2g} = \frac{6400 - 400}{20} = 300 \text{ m}$$

12. (c)



$$Y = \overline{\overline{A + B}}$$

$$= A.B$$

= A-B $\Rightarrow$ AND Gate

Truth Table

A B Y

0 0 0

0 1 0

1 0 0

1 1 1

13. (d)

$$V = \frac{kp \cos \theta}{r^2}$$

$$V = \frac{9 \times 10^9 \times 16 \times 10^{-9} \times \cos 60}{0.36}$$

$$V = 200V$$

14. (a)

Given that,

Mass of water in capillary or radius r , $m = 5$ g

Now, the force of surface tension balances the weight of water in capillary tube,

$$F_s = 2\pi r T \cos \theta = mg$$

Here, T and θ are constant

So, $m \propto r$

Hence,

$$\frac{m_2}{5.0} = \frac{2r}{r}$$

15. (a)

We know that at temperatures much lower than $G^\circ C$, the graph deviates significantly from a straight line.

Hence (a) is the correct among all,

16. (d)

For the given case, the electric field provides half of the intensity in an electromagnetic wave, and the magnetic field provides the other half.

Hence required ratio should be 1: 1

17. (c)

Given that,

Length of solenoid, $L = 50$ cm

Number of turns, $N = 100$

Current, $I = 2.5$ A

Now,

Magnetic field at centre of solenoid, $B = \mu_0 n I$

$$n = \frac{N}{L} = \frac{100}{50 \times 10^{-2}} = 200 \text{ turns/m}$$

$$I = 2.5 \text{ A}$$

By substituting the value of I in the equation of magnetic field we get

$$B = 4\pi \times 10^{-7} \times 200 \times 2.5$$

$$= 6.28 \times 10^{-4} \text{ T}$$

18. (b)

According to Bohr model, as we all know, is only valid for single electron species, In contrast, a single electron in orbit of a singly ionised neon atom,

Hence, Bohr model is not valid,

19. (d)

According to mass-energy equivalence.

$$E = mc^2$$

$$= 0.5 \times 10^{-3} \times (3 \times 10^8)^2$$

$$= 4.5 \times 10^{13} \text{ J}$$

20. (d)

Given that,

$$9.99 \text{ m} - 0.0099 \text{ m} = 9.9801 \text{ m}$$

In subtraction, the answer should be reported to the fewest number of decimal places possible, so the answer should be approximately 9.98 m.

21. (d)

Given that,

Difference of f_A and f_B , $\Delta f = 6 \text{ Hz}$

If tension decreases, f'_B decreases and becomes f''_B .

Now, difference of f_A and f_B , $\Delta f' = 7 \text{ Hz}$

$$\therefore f_A - f_B = 6 \text{ Hz}$$

Now, since $f_A = 530 \text{ Hz}$

$$\therefore f_B = 524 \text{ Hz}$$

22. (a)

When L is removed,

$$\tan \phi = \frac{|X_C|}{R} \Rightarrow \tan \frac{\pi}{3} = \frac{X_C}{R} \dots (i)$$

When C is removed,

$$\tan \phi = \frac{|X_L|}{R} \Rightarrow \tan \frac{\pi}{3} = \frac{X_L}{R} \dots (ii)$$

From (i) and (ii), $X_L = X_C$

Since, $X_L = X_C$, the circuit is in resonance.

$$Z = R$$

$$\text{Power factor} = \cos \phi = \frac{R}{Z} = 1$$

23. (c)

$$\Delta Q = ms\Delta T$$

$$\Delta Q = \frac{4}{3}\pi r^3 \rho s\Delta T$$

$$\frac{\Delta Q_1}{\Delta Q_2} = \left(\frac{r_1}{r_2}\right)^3$$

$$= (1.5)^3$$

$$= \frac{27}{8}$$

24. (a)

$$\mu = \tan i_b$$

$$1 < \mu < \infty$$

$$1 < \tan i_b < \infty$$

$$\tan^{-1}(1) < i_b < \tan^{-1}(\infty)$$

$$45^\circ < i_b < 90^\circ$$

25. (d)

The entire system is now thermally insulated in accordance with the given conditions, As a result, no heat exchange will occur, As a result, the process will be adiabatic.

26. (c)

Given that,

$$X_m = 599$$

$$B = 1200 \text{ Am}^{-1}$$

$$\mu_r = 1 + X_m = 600$$

$$\mu = \mu_r \mu_0$$

$$\mu = 600 \times 4\pi \times 10^{-7}$$

$$\mu = 2400\pi \times 10^{-7}$$

$$\mu = 2.4\pi \times 10^{-4} TmA^{-1}$$

27. (a)

Now for parallel plate capacitor,

$$C = KC_0$$

$$K = \frac{C}{C_0} = \frac{30}{6} = 5$$

$$K = \frac{\epsilon}{\epsilon_0}$$

$$\epsilon = K\epsilon_0$$

$$= 5 \times 8.85 \times 10^{-12}$$

$$= 0.44 \times 10^{-10} C^2 N^{-1} m^{-2}$$

28. (d)

$$\mu = \frac{Vd}{E}$$

$$= \frac{7.5 \times 10^{-4}}{3 \times 10^{-10}}$$

$$= 2.5 \times 10^6 m^2 V^{-1} s^{-1}$$

29. (b)

According to colour coding

Yellow $\Rightarrow 4$

Violet $\Rightarrow 7$

Brown $\Rightarrow 1$

Gold $\Rightarrow 5\%$

So, from the given data we know that

$$R = 47 \times 10^1 \pm 50\%$$

$$R = 470 \pm 5\% \Omega$$

30. (b)

As we know, for the given case the temperature coefficient of resistance for metals is positive, whereas the temperature coefficient of resistance for insulators and semiconductors is negative.

31. (d)

Now, the acceleration due to gravity at height h is given as

$$mg_h = \frac{mg_0}{\left(1 + \frac{h}{R}\right)^2}$$

$$W = \frac{72}{\left(1 + \frac{R/2}{R}\right)^2}$$

$$W = \frac{72}{(3/2)^2} = \frac{4}{9} \times 32 N$$

32. (a)

$$i_{rms} = c\omega \times \epsilon_{rms}$$

$$c = 40 \times 10^{-6} F$$

$$\omega = 2\pi f = 100\pi$$

$$\epsilon_{rms} = 200 V$$

$$\therefore i_{rms} = 200 \times 40 \times 10^{-6} \times 2\pi \times 50$$

$$= 2.5 A$$

33. (c)

If $y = A \sin \omega t$

$$\text{then } v = \frac{dy}{dt} \text{ dt}$$

$$v = A\omega \cos \omega t$$

$$a = \frac{dy}{dt}$$

$$a = -A\omega^2 \sin(\omega t)$$

$$a = A\omega^2 \sin(\omega t + \pi)$$

So, phase difference between displacement and acceleration is π .

34.(d)

For monoatomic gases, degree of freedom is 3.

Hence average thermal energy per molecule is $\frac{3}{2} k_B T$

$$\text{i.e., } KE_{\text{avg}} = \frac{3}{2} k_B T$$

35.(b)

$$v = \frac{3}{2} v_0$$

$$v' = \frac{v}{2} = \frac{3}{4} v_0$$

$$\therefore v' < v_0$$

$\therefore$ No photo electric emission will take place,

36.(b)

Now, As we know the expression for longitudinal stress and strain are

$$\text{Stress} = \frac{Mg}{A}$$

$$\text{Strain} = \frac{\Delta L}{L} = \frac{L_1 - L}{L}$$

Hence, the formula for Young's Modulus will be expressed as

$$\text{Young's modulus} = \frac{\text{Stress}}{\text{Strain}} = \frac{MgL}{A(L_1 - L)}$$

37.(a)

Light ray emerges normally from another surface, hence, angle of emergence, $e = 0$

Angle of refraction across second surface, $r_2 = 0$

$$\therefore r_1 + r_2 = A$$

$$\Rightarrow r_1 = A$$

Applying Snell's law on first surface, we get,

$$1 \times \sin i = \mu \times \sin r_1$$

$$\Rightarrow \sin i = \mu \sin A$$

Now, for small angle the angle of incidence will be

$$\therefore i = \mu A (\because \sin \theta \approx \theta)$$

38.(a)

The relation between torque and force can be expressed as

$$\vec{\tau} = \vec{r} \times \vec{F}$$

$$\vec{\tau} = 2k \times 3j$$

$$\vec{\tau} = -6i \text{ NM}$$

39.(a)

$$\text{Fringe width } \beta = \frac{\lambda D}{d}$$

$$\text{Now, } d' = \frac{d}{2} \text{ and } D' = 2D$$

$$\text{So, } \beta = \frac{\lambda(2D)}{d/2} = \frac{4\lambda D}{d}$$

$$\beta' = 4\beta$$

40. (a)

As we know, $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$

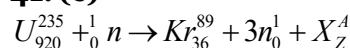
Thus,

$$1J = \frac{1}{1.6 \times 10^{-19}} \text{ eV}$$

$$10^{-20} J = \frac{10^{-20}}{1.6 \times 10^{-19}} \text{ eV}$$

$$= 0.06 \text{ eV}$$

41. (c)



$$92 + 0 = 36 + Z$$

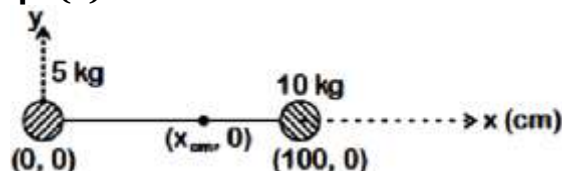
$$\Rightarrow Z = 56$$

$$235 + 1 = 89 + 3 + A$$

$$\Rightarrow A = 144$$

Hence for the given reaction ${}_{56}^{144}\text{Ba}$ will be generated

42. (a)



$$X_{cm} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$$

$$= \frac{5 \times 0 + 100 \times 10}{5 + 10} = \frac{200}{3} = 66.66 \text{ cm}$$

$$x_{cm} \approx 67 \text{ cm}$$

43. (a)

Given that,

$$\text{Intensity, } I = 20 \text{ W/cm}^2$$

$$\text{Area of cross section, } A = 20 \text{ cm}^2$$

$$\text{Time, } t = 1 \text{ min} = 60 \text{ sec}$$

Now,

$$\text{Energy received} = \text{Intensity} \times \text{Area} \times \text{Time}$$

$$E = IAt$$

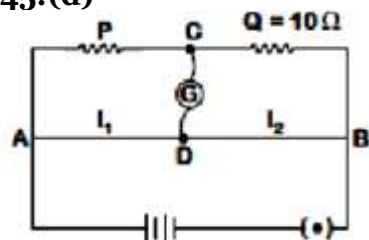
$$= 20 \times 20 \times 60$$

$$= 24 \times 10^3 \text{ J}$$

44. (d)

As we know, the width of the depletion region increases across the p and n junctions due to reverse biasing.

45. (d)



$$\text{Initially, } \frac{P}{10} = \frac{I_1}{I_2} = \frac{3}{2}$$

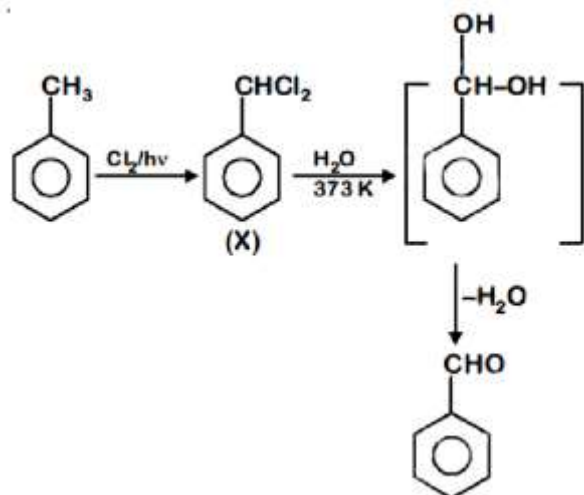
$$\Rightarrow P = \frac{30}{2} = 15\Omega$$

Now Resistance, $R = \frac{\rho l}{A}$

CHEMISTRY

46.(a)

Formation of X is halogenation reaction.



47.(c)

Electronic configuration for He_2 molecule is $\sigma 1s^2, \sigma^* 1s^2$

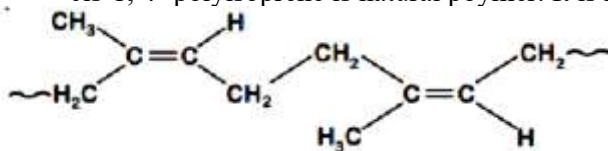
Bond order is calculated by $= \frac{1}{2}[N_b - N_a]$

$$= \frac{1}{2}[2 - 2] = 0$$

Since, bond order is zero, so He_2 molecule does not exist

48. (c)

cis-1, 4- polyisoprene is natural polymer. It is known as natural polymer.

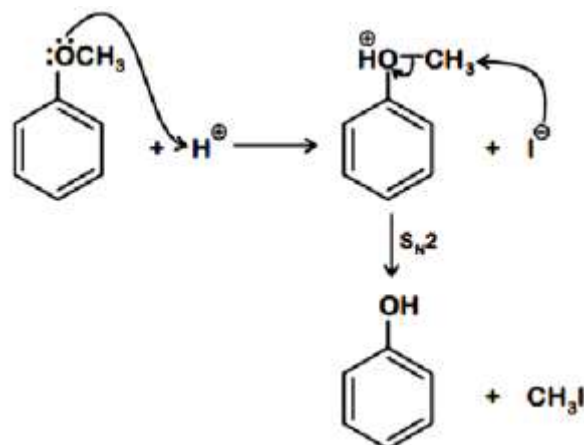


49.(d)

Heat of reaction is an extensive property, Hence, on change of amount/concentration of reactants heat of reaction changes.

50.(c)

It shows $\text{S}_\text{N}2$ mechanism.



51. (c)

${}_{71}^{175}\text{Lu}$

No. of Protons = Atomic number = 71 = No. of Electrons

No. of Neutrons = Mass no. - No. of Protons

= 175 - 71

= 104

52. (d)

Electronic configuration of Cr - [Ar] 3d⁵ 4s¹

Electronic configuration of Cr²⁺ - [Ar] 3d⁴

1	1	1	1	
---	---	---	---	--

Number of unpaired e⁻ = 4

Spin only magnetic moment is calculated by = $\sqrt{n(n+2)}$

n = number of unpaired e⁻ is calculated by-

So, Spin only magnetic moment = $\sqrt{4(4+2)}$

= $\sqrt{24} \text{ BM}$

= 4.90 BM

53. (d)

Generally metallic oxide is basic and non-metallic oxide is acidic.

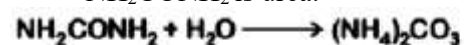
CO: Neutral oxide

BaO: Basic oxide

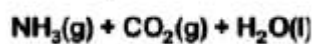
Al₂O₃: Amphoteric oxide

Cl₂O₇: Acidic oxide

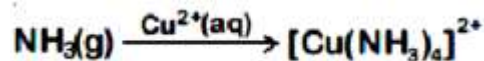
54. (d)

NH₂CONH₂ is urea.


(A)



(B)



(B)

(C)

[Blue coloured solution]

55. (c)

Mixture of CO and H₂ gases is known as water gas or synthesis gas,

Temporary hardness of water is due to bicarbonates of calcium and magnesium,

Diborane (B₂H₆) is an electron deficient hydride.

H₂O₂ is non-planar molecule having open book like structure.

56. (c)

Hydrogen bond is present in pure ethanol, On adding acetone, its molecules get in between the ethanol molecules and break some of the hydrogen bonds between them, This weakens the intermolecular attractive interactions and the solution shows positive deviation from Raoult's law.

57. (a)

Depression of freezing point is calculated by-

 $\Delta T_f = k_f m$

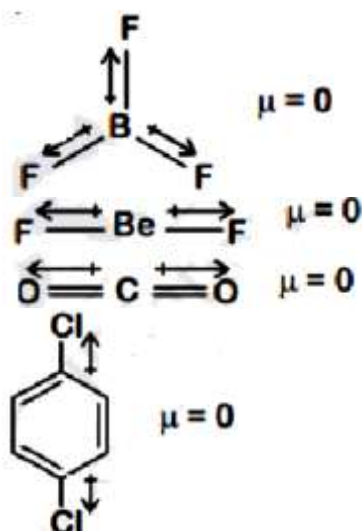
= 5.12 (K.kg mol⁻¹) x 0.078 (mol kg⁻¹)

= 0.399 K

0.40 K

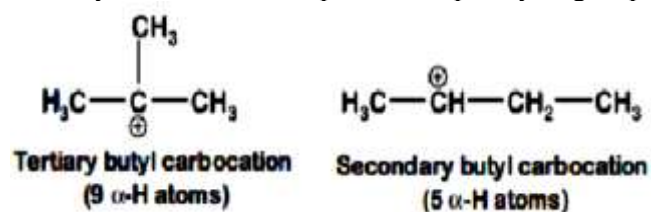
58. (b)

Dipole moment is observed by drawing structure of these molecules.



59. (b)

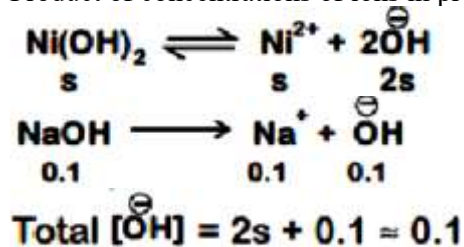
Stability of carbocation depends on alpha hydrogen, pH_a



More the number of α -H atoms, more will be the hyperconjugation effect hence more will be the stability of carbocation,

60. (c)

Product of concentrations of ions in product is known as Ionic product.



$$\text{Ionic product} = [\text{Ni}^{2+}][\text{OH}^-]^2$$

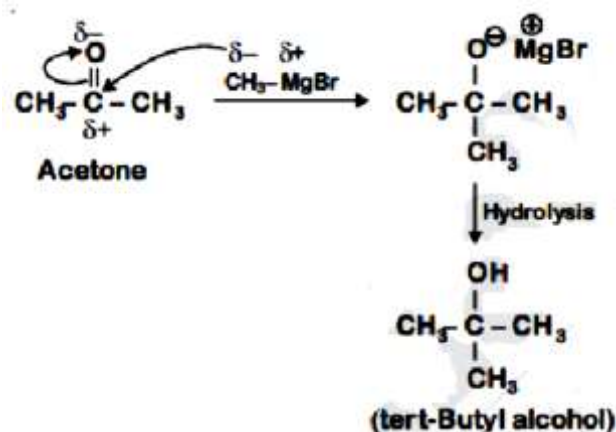
$$2 \times 10^{-15} = \text{s}(0.1)^2$$

$$\text{s} = 2 \times 10^{-13}$$

$$\text{Solubility of Ni(OH)}_2 = 2 \times 10^{-13} \text{ M}$$

61. (a)

Methyl magnesium chloride is Grignard reagent (R-MgX).

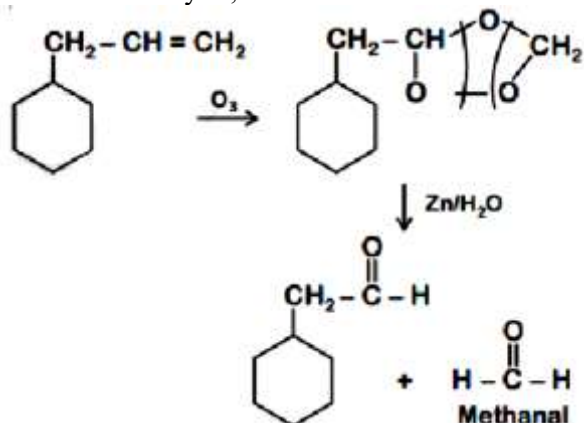


62.(c)

Aliphatic and aromatic primary amines give carbylamine test,

63.(a)

In ozonolysis, double bond is broken and oxygen is added.



64.(a)

Number of moles of N_2 and Ar will be-

$$n_{N_2} = \frac{7}{28} = \frac{1}{4} = 0.25$$

$$n_{Ar} = \frac{8}{40} = \frac{1}{5} = 0.20$$

Now, Applying Dalton's law of partial

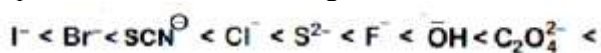
Pressure, $P_{N_2} = (x_{N_2})P_{Total}$

$$= \frac{0.25}{0.45} \times 27 \text{ Bar}$$

$$= \frac{5}{9} \times 27 = 15 \text{ Bar}$$

65.(c)

Spectrochemical series of ligands is-

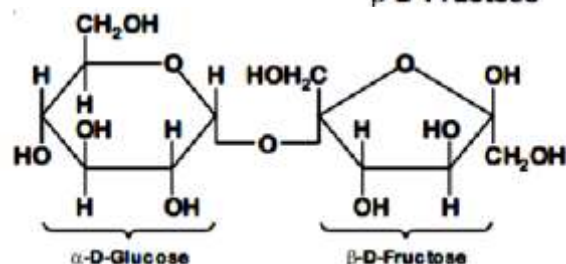
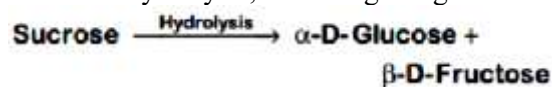


66.(d)

It is a type of partition chromatography in which a special quality paper known as chromatography paper is used.

67.(a)

On hydrolysis, Sucrose gives glucose and fructose.



68. (a)

Rate constant of first order is calculated by-

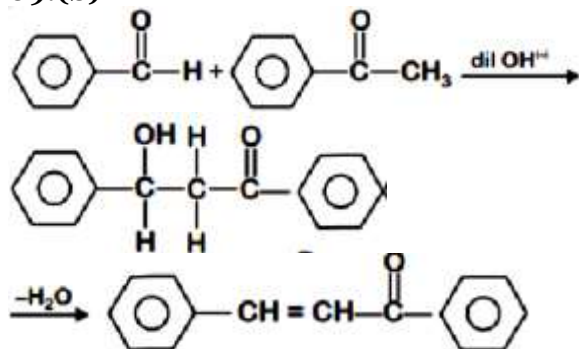
$$k = \frac{2.303}{t} \log \frac{A_0}{A} \quad (\text{First order rate equation})$$

$$4.606 \times 10^{-3} = \frac{2.303}{t} \log \frac{2}{0.2}$$

$$t = \frac{2.303}{4.606 \times 10^{-3}} \times \log 10$$

$$= \frac{10^3}{2} = 500 \text{ sec}$$

69.(b)



In the presence of dil.OH (-), benzaldehyde and acetophenone will react to undergo aldol condensation. This kind of aldol condensation is known as cross-aldol condensation.

70.(a)

The carboxyhaemoglobin is more stable than oxyhaemoglobin. So, this statement is not correct.

71. (c)

Gibbs free energy is calculated by-

$$\Delta G = \Delta G^0 + RT \ln Q$$

At equilibrium $\Delta G = 0$, $Q = K_{eq}$

So $\Delta_r G^0 = -RT \ln K_{eq}$

$$\Delta_r G^0 = -8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 300 \text{ K} \times \ln (2 \times 10^{13})$$

72. (d)

Since CaCl_2 and MgCl_2 are more soluble than NaCl , on passing $\text{HCl}_{(g)}$ through a solution containing CaCl_2 , MgCl_2 and NaCl then NaCl crystallizes out.

73. (c)

For BCC,

Relation between atomic radius and cell edge is-

$$\sqrt{3}a = 4r \text{ a edge length}$$

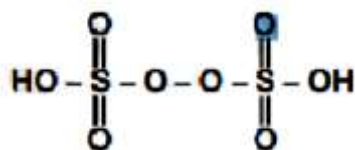
$$r = \frac{\sqrt{3}a}{4} \text{ r radius}$$

Given, $a = 288 \text{ pm}$

$$r = \frac{\sqrt{3}}{4} \times 288 \text{ pm}$$

74. (a)

From the structure of Peroxodisulphuric acid, you can see one -o-o- linkage is present.



Peroxodisulphuric acid

75. (b)

Oxidation state of Cr in CrO_4^{2-} is 6.

$$x - 8 = -2$$

$$x = +8 - 2$$

$$x = +6$$

Oxidation state of Cr in $Cr_2O_7^{2-}$ is +6

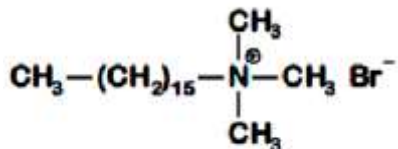
$$2x - 16 = -2$$

$$2x = +14 - 2$$

$$x = +6$$

76. (a)

Cetyltrimethyl ammonium bromide is a cationic detergent.



Cetyltrimethyl ammonium bromide

77. (c)

Free expansion $\Rightarrow P_{\text{ex}} = 0$ Work is calculated by-

$$\therefore w = -p_{\text{ex}} \Delta V = 0$$

$$\therefore \text{Adiabatic process} \Rightarrow q = 0$$

also, $\Delta U = q + w$ [first law of thermodynamics]

$$\therefore \Delta U = 0$$

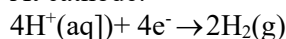
$\therefore$ Internal energy of an ideal gas is a function of temperature

$\therefore$ If internal energy remains constant $\Delta T = 0$

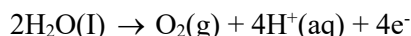
78. (d)

During the electrolysis of dil. sulphuric acid using Pt electrodes following reaction will take place.

At cathode:



At anode:



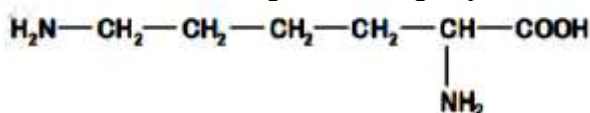
So, product obtained at anode is O_2 .

79. (b)

The iron obtained from blast furnace contains about 4% carbon and many impurities like S, P, Si, Mn in smaller amount. This is known as pig iron and cast into variety of shapes.

80. (b)

Bases which are having more NHH group than COOH group that is basic,



(Structure of Lysine)

Lysine is a basic amino acid

81. (b)

Unununium

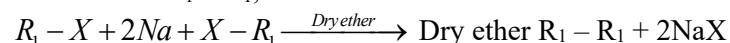
Atomic number = 111

IUPAC official name: Roentgenium

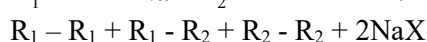
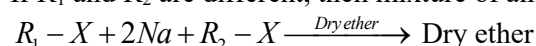
82. (a)

Wurtz reaction is used to prepare symmetrical

Alkanes like $\text{R}_1 - \text{R}_1$, as

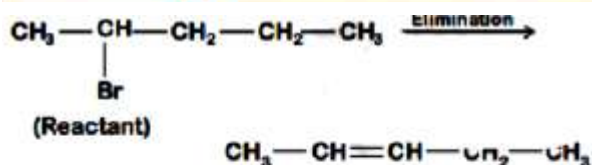


If R_1 and R_2 are different, then mixture of alkanes maybe obtained as

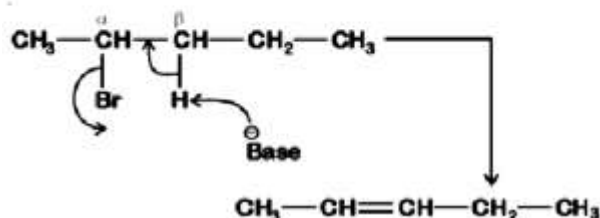


n-Heptane is unsymmetrical.

83. (b)



Mechanism:



Since β -hydrogen is abstracted it is β -elimination,
 Since more substituted alkene is formed, it follows zaitsev's rule,
 Since 'H' and 'Br' are removed, it is dehydrohalogenation.

84. (c)

1 equivalent of any substance is deposited by 1 F of charge,
 We have, 20 g calcium

$$\text{Number or equivalents} = \frac{\text{Given mass}}{\text{Equivalent mass}}$$

$$\text{Equivalent mass of Ca} = \frac{40}{2} = 20$$

So, 1 faraday of charge is required,

85.(b)

Number of atoms = Number of moles $\times N_A$

$$\text{Number of Mg atoms} = \frac{1}{24} \times N_A$$

$$\text{Number of O atoms} = \frac{1}{32} \times 2 \times N_A$$

$$\text{Number of Li atoms} = \frac{1}{7} \times N_A$$

$$\text{Number of Ag atoms} = \frac{1}{108} \times N_A$$

86. (b)

Given reaction, $2\text{Cl}_2(\text{g}) \rightarrow \text{Cl}_2(\text{g})$

We know that,

$\text{Cl}_{2(\text{g})} \rightarrow 2\text{Cl}_{(\text{g})}$ is endothermic reaction because it requires energy to break bond.

So reverse reaction is exothermic $\Delta_r H < 0$

Also, two gaseous atom combine together to form 1 gaseous molecule,

So, randomness $\Delta_r S < 0$

87.(b)

Dry ice, $\text{CO}_{2(\text{s})}$, is used as refrigerant for ice-cream and frozen food.

C_{60} contains 20 six membered rings, 12 five membered rings.

88. (a)

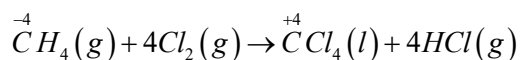
In colloidal solution, the potential difference between the fixed layer and the diffused layer of opposite charge is known as Zeta potential. The presence of equal and similar charges on colloidal particles is largely responsible in providing stability to the colloidal solution,

89. (a)

Oxidation number is calculated by-

$$\text{CH}_4 \Rightarrow x + 4 \times 1 = 0 \Rightarrow x = -4$$

$$\text{CCl}_4 \Rightarrow x + 4 \times (-1) = 0 \Rightarrow x = +4$$



Change in oxidation state of carbon is from -4 to +4

90. (b)

Potassium (K) activates many enzymes, participates in oxidation of glucose to produce ATP and helps in the transmission of nerve signal along with Na.

BIOLOGY

91. (a)

Presence of ketone bodies in urine {Ketonuria} and presence of glucose in urine (Glycosuria] are indicative of diabetes mellitus.

92.(b)

- (a) Placenta secretes human chorionic gonadotropin (hCG).
- (b) Zona pellucida is a primary egg membrane secreted by the secondary oocyte,
- (c) The secretions of bulbourethral glands help in lubrication of the penis.
- (d) Leydig cells synthesise and secrete testicular hormones called androgens.

93.(c)

- (a) In Bt cotton the specific Bt toxin gene was isolated from *Bacillus thuringiensis*.
- (b) The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency.
- (c) RNAi (RNA interference) takes place in all eukaryotic organisms as a method of cellular defence.
- (d) PCR is now routinely used to detect HIV in suspected AIDS patients.

94.(d)

Ori sequence is responsible for controlling the copy number of the linked DNA in the vector. Ori i.e, origin of replication is responsible for initiation of replication,

95.(c)

Cyclostomes have an elongated body bearing 6-15 pairs of gill slits for respiration, Air bladder is present in bony fishes belonging to class Osteichthyes which regulates buoyancy. Trygon, a cartilaginous fish, possesses poison sting, Heterocercal caudal fin is present in members of class Chondrichthyes.

96.(c)

ART in which embryos are transferred, include ZIFT and IUT i.e, Zygote Intrafallopian Transfer and Intra Uterine Transfer respectively, both are embryo transfer (FT) methods. In GIFT (Gamete Intrafallopian Transfer), gamete is transferred into the fallopian tube of female who cannot produce ova. ICSI is Intra cytoplasmic sperm injection in which sperm is directly injected into the ovum.

97. (c)

Inspiration is initiated by the contraction of diaphragm, which increases the volume of thoracic chamber in the antero-posterior axis. The contraction of external intercostal muscles increase the volume of the thoracic chamber in the dorsoventral axis

98. (a)

QRS complex represents the depolarisation of ventricles.

99.(d)

Trypsinogen is activated into active trypsin by an enzyme, enterokinase, secreted by the intestinal mucosa, Trypsinogen is a zymogen from pancreas.

100. (a)

Ileum is a highly coiled tube. Serosa is the outermost layer of the alimentary canal. A narrow finger-like tubular projection, the vermiform appendix arises from caecum part of large intestine, Ileum opens into the large intestine.

101. (c)

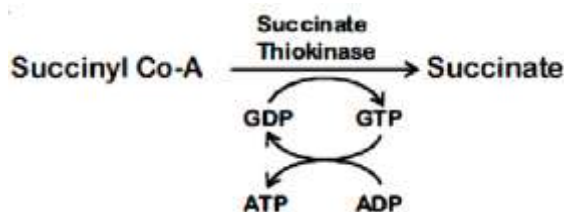
Ray florets have inferior ovary. Epigynous flowers are formed in family Asteraceae (e.g., Sunflower).

102. (b)

The sediment in settlement tank is called activated sludge. A small part of the activated sludge is pumped back into aeration tank. Remaining major part of the sludge is pumped into large tank called anaerobic 'sludge digesters'.

103. (d)

One substrate level phosphorylation in one turn of citric acid cycle occurs as per the following reaction:



104. (a)

During G₁ phase the cell is metabolically active and continuously grows but does not replicate its DNA. DNA synthesis takes place in S phase. Nuclear division occurs during karyokinesis. Reorganisation of all cell components takes place in M-Phase.

105. (b)

Chlorella and Spirulina are unicellular algae, Gelidium, Gracilaria, Laminaria and Sargassum are multicellular, Volvox is colonial

106. (a)

Active immunity is slow and takes time to give its full effective response in comparison to passive immunity where pre-formed antibodies are administered.

107. (b)

(a) 11th and 12th pairs of ribs are not connected ventrally and are therefore, called floating ribs.

(b) Acromion is a flat expanded process of spine of scapula. The lateral end of clavicle articulates with acromion process.

(c) Scapula is a flat triangular bone in the dorsal part of the thorax between 2nd and the 7th rib.

(d) Glenoid cavity of scapula articulates with head of the humerus to form the shoulder joint.

108. (a)

Lysine is a basic amino acid. Valine is a neutral amino acid, Glutamic acid is an acidic amino acid while Tyrosine is an aromatic amino acid.

109. (b)

The plant parts which consist of two generations one within the other are pollen grains inside the anther and embryo sac inside the ovule, Pollen grain is haploid inside the diploid anther, Embryo sac is haploid inside the diploid ovule,

110. (a)

Higher H⁺ concentration favours the dissociation of oxygen from oxyhaemoglobin in tissues, In the alveoli, high pO₂, low pCO₂, lesser H⁺ concentration and lower temperature favour formation of oxyhaemoglobin,

111. (a)

Organ of Corti is located on the basilar membrane.

The coiled portion of the labyrinth is called cochlea.

The Eustachian tube connects the middle ear cavity with the pharynx.

The middle ear contains ossicle called stapes that is attached to the oval window of the cochlea.

112. (d)

Spraying sugarcane crop with gibberellins increases the length of the stem, thus increasing the yield by as much as 20 tonnes per acre.

113. (c)

The roots that originate from the base of the stem are fibrous roots.

114. (a)

The head holds a small proportion of a nervous system while the rest is situated along the ventral part of its body.

115. (b)

Strobili or cones are found in Equisetum.

116. (a)

Dissolution of the synaptonemal complex occurs during Diplotene stage of Prophase-I of Meiosis-I.

117. (d)

Typhoid fever in humans is caused by pathogenic bacterium Salmonella typhi. Pneumonia is caused by Streptococcus pneumoniae and Haemophilus influenzae. Filariasis or elephantiasis is caused by the filarial worm, Wuchereria bancrofti and Wuchereria malayi. Malaria is caused by different species of Plasmodium.

118. (a)

The first phase of translation involves activation of amino acid in the presence of ATP and linked to their cognate tRNA - a process commonly called charging of tRNA or aminoacylation of tRNA.

119. (d)

- | | |
|-----------------------------------|--|
| (a) <i>Clostridium butylicum</i> | (i) Butyric acid |
| (b) <i>Trichoderma polysporum</i> | (ii) Cyclosporin-A |
| (c) <i>Monascus purpureus</i> | (iii) Blood cholesterol lowering agent |
| (d) <i>Aspergillus niger</i> | (iv) Citric acid |

120. (d)

In photorespiration, O_2 binds to RubisCo, As a result RuBP instead to being converted to 2 molecules of PGA bind with O_2 to form one molecule each of phosphoglycerate (3 carbon compound) and phosphoglycolate (2 carbon compound).

121. (a)

- (a) Iron - Essential for the formation of chlorophyll
 (b) Zinc - Needed for synthesis of auxin
 (c) Boron - Have a role in pollen grain germination
 (d) Manganese - Is involved in the splitting of water to liberate O_2 during photosynthesis

122. (b)

RNA polymerase facilitates opening of DNA helix during transcription.

123. (c)

In 1953, S.L. Miller, an American scientist created electric discharge in a closed flask containing CH_4 , H_2 , NH_3 and water vapor at $800^\circ C$.

124. (d)

Goblet cells of alimentary canal are modified from columnar epithelial cells which secrete mucus.

125. (a)

Cuboidal epithelium with brush border of microvilli is found in proximal convoluted tubule of nephron (PCT).

126. (c)

After excitement e^- is passed from PS-II (P_{680}) to primary electron acceptor (Pheophytin), From primary e^- acceptor, e^- is passed to plastoquinone, Plastoquinone (PQ) in turn transfer its e^- to Cyt b_6f complex. Therefore plastoquinone facilitates the transfer of electrons from PS-II to Cyt b_6f complex.

127. (a)

Distance between 2 base pairs in DNA helix = $0.34 \text{ nm} = 0.34 \times 10^{-9} \text{ m}$.

Total number of base pairs = $6.6 \times 10^9 \text{ bp}$

Therefore, length of DNA = $[0.34 \times 10^{-9}] \text{ m} \times 6.6 \times 10^9 \text{ bp} = 2.2 \text{ m}$.

128. (a)

Golgi bodies are site of formation of glycoproteins and glycolipids in eukaryotic cells.

129. (a)

The functional insulin has A and B chains linked together by disulphide bridges.

130. (a)

Sapwood is the outermost secondary xylem.

131. (d)

Floridean starch is a stored food material in red algae. Its structure is similar to amylopectin and glycogen.

132. (d)

Zygotene $\rightarrow$ Synapsis

Pachytene $\rightarrow$ Crossing over

Diplotene $\rightarrow$ Chiasmata formation

Diakinesis $\rightarrow$ Terminalisation

133. (c)

Eosinophils are associated with allergic reactions and release histaminase, destructive enzymes. Basophils secrete histamine, serotonin, heparin etc, and are involved in inflammatory reactions. Neutrophils are phagocytic cells. Both B and T lymphocytes are responsible for immune responses of the body.

134. (c)

In exponential growth, the initial growth is slow (lag phase) and it increases rapidly thereafter at an exponential rate in log or exponential phase.

135. (c)

Malonate is the competitive inhibitor of catalytic activity of succinic dehydrogenase, Collagen is

proteinaceous in nature and possesses peptide bonds, Chitin is a homopolymer present in the cell wall of fungi and exoskeleton of arthropods, Abrin and ricin are toxins, secondary metabolites,

136. (c)

Some dividing cells exit the cell cycle and enter vegetative inactive stage, called quiescent stage (G_0). This process occurs at the end of M-phase and beginning of G_1 phase.

137. (d)

Adrenal cortex secretes mineralocorticoids like aldosterone which increase the reabsorption of Na^+ and water from renal tubule that prevent diuresis

138. (d)

Viroids have free RNA without protein coat.

139. (d)

Plasmodium enters the human body as sporozoites (infectious stage) through the bite of infected female Anopheles mosquito.

140. (c)

Adenine pairs with thymine through two H-bonds i.e., $A = T$

141. (d)

Flippers of Penguins and Dolphins are an example of analogous organs. Analogous structures are a result of convergent evolution.

142. (d)

Montreal protocol was signed in 16 Sep, 1987 (Ozone day) and came into force on 1 Jan, 1989. It was aimed at stopping the production and import of ozone depleting substances (ODS) and reduce their concentration in the atmosphere.

143. (b)

Restriction endonucleases make cuts at specific positions within the DNA. They function by inspecting the length of a DNA sequence, Restriction endonuclease bind to the DNA and cut the two strands of double helix at specific points in their sugar-phosphate backbones. They are used in genetic engineering to form recombinant molecules of DNA, DNA ligases join the DNA fragments.

144. (a)

Hisardale is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Marino rams. In cross-breeding, superior males of one breed are mated with superior females of another breed.

145. (a)

Herbicide resistant weeds, drug resistant eukaryotes and man-created breeds of domesticated animals like dogs are examples of evolution by anthropogenic action.

Darwin's Finches of Galapagos islands are example of natural selection, adaptive radiation and founder's effect.

146. (b)

Meiotic division of secondary oocyte is completed after the entry of sperm in secondary oocyte which lead to the formation of a large ovum and a tiny 2nd polar body.

147. (d)

Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis, Net primary productivity is $GPP - \text{respiration}$, hence gross primary productivity is always more than NPP

148. (a)

ABO blood groups are controlled by the gene I. The gene I has three alleles I^A , I^B and i , The alleles I^A and I^B produce a slightly different form of the sugar while allele i does not produce any sugar. Because humans are diploid organisms, each person can possess at the most any two of the three I gene alleles.

149. (a)

Graves' disease is due to excess secretion of thyroid hormones (T_3 & T_4). Diabetes mellitus is due to hyposecretion of insulin from β -cells of pancreas. Diabetes insipidus is due to hyporelease of ADH from posterior pituitary, Addison's disease is due to hyposecretion of hormone from adrenal cortex

150. (b)

Robert May estimated global species diversity at about 7 million, Although some extreme estimates range from 20 to 50 million.

151. (c)

The attachment point of funicle and body of ovule is known as hilum.

152. (d)

(a) Locusta is a gregarious pest.

(b) In Echinoderms, adults are radially symmetrical but larvae are bilaterally symmetrical.

- (c) Scorpions respire through book lungs.
(d) Bioluminescence is well marked in ctenophores.

153. (c)

Embryological support for evolution was disapproved by Karl Ernst von Baer. He noted that embryos never pass through the adult stages of other animals during embryonic development.

154. (d)

- (a) *Bacillus thuringiensis* is a source of Cry proteins.
(b) *Thermus aquaticus* is a source of thermostable DNA polymerase (Taq polymerase) used in PCR.
(c) *Agrobacterium tumefaciens* is a cloning vector.
(d) The construction of 1st recombinant DNA molecule was performed using native plasmid of *Salmonella typhimurium*.

155. (c)

Gibberellic acid breaks seed dormancy. It activates synthesis of α -amylase which breaks down starch into simple sugar.

156. (d)

Inclusion bodies are not involved in ingestion of food particles.

157. (b)

The ovary is half inferior in Plum.

158. (c)

Grassland ecosystem is a terrestrial ecosystem. It includes various trophic levels-

1. First trophic level (T_1) - Grass
2. Second trophic level (T_2) - Rabbit
3. Third trophic level (T_3) - Crow
4. Fourth trophic level (T_4) - Vulture

159. (d)

Root pressure is positive hydrostatic pressure. It develops in tracheary elements at night and in early morning,

160. (c)

Ligases join the two DNA molecules.

161. (c)

All the given features are related to monocotyledonous stems.

162. (b)

Experimental verification of the chromosomal theory of inheritance was done by Morgan. (Note: Sutton and Boveri proposed chromosomal theory of inheritance but it was experimentally verified by T.H. Morgan.)

163. (c)

Bt cotton is resistant to cotton bollworm (Insect pest). Cry I Ac and Cry II Ab genes have been introduced in cotton to protect it from cotton bollworm, This makes Bt cotton a biopesticide.

164. (c)

Glucocorticoids stimulate gluconeogenesis, so increase blood sugar level. Glucagon is associated with hyperglycemia, Insulin acts on hepatocytes and adipocytes and is associated with hypoglycemia

165. (c)

The specific palindromic sequence which is recognised by EcoRI is

5'-GAATTC- 3'

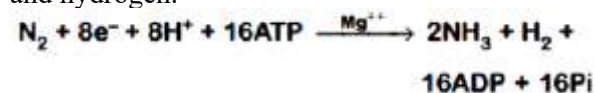
3'-CTTAAG- 5'

166. (b)

Inulin is a fructan (polysaccharide of fructose), Adjacent fructose units are linked through glycosidic bonds. Insulin is a protein composed of 51 amino acids, Adjacent amino acids are attached through peptide bonds.

167. (b)

The product(s) of reaction catalyzed by nitrogenase in root nodules of leguminous plants are ammonia and hydrogen.



168. (c)

High level of estrogen will send positive feedback to anterior pituitary for release of LH. FSH, LH and estrogen are at peak level during mid of menstrual cycle (28 day cycle). LH surge leads to ovulation

169. (b)

In vertebrata, notochord is present during embryonic period only as it is replaced by vertebral column. In chordates, central nervous system is dorsal and hollow.

170. (d)

Platyhelminthes are bilaterally symmetrical, triploblastic and acoelomate animals with organ level of organisation.

171. (b)

The largely tropical Amazonian rain forests in South America have the greatest biodiversity on earth

172. (a)

Phenylketonuria -Autosomal recessive disorder

Thalassemia -Autosomal recessive disorder

Haemophilia - X linked recessive disorder

Sickle cell anaemia - Autosomal recessive trait, caused due to mutation in gene present on chromosome no.11

173. (d)

Collagen is the most abundant protein in animal world and RuBisCO is the most abundant protein in the whole of the Biosphere.

174. (c)

Gonorrhoea, Syphilis, Genital herpes are sexually transmitted diseases, Gonorrhoea is caused by a bacterium *Neisseria gonorrhoeae*. Syphilis is caused by a bacterium *Treponema pallidum*. Genital herpes is caused by a virus Type-1 Herpes simplex virus

175. (c)

In majority of aquatic plants, the flowers emerge above the level of water. These may be pollinated by insects or wind as in water hyacinth and water lily.

176. (a)

A wide variety of chemical substances that we extract from plants on a commercial scale (nicotine, caffeine, quinine, strychnine, opium, etc.) are produced by them (plants) as defenses against grazers and browsers,

177. (a)

Mendel selected 14 true breeding plant varieties for his experiments.

178. (b)

Natality, mortality and sex ratio are population attributes while species interaction comes under population interactions,

179. (d)

UV-B radiations damage DNA and can cause mutations. In human eye, cornea absorbs UV- B radiations, and a high dose of UV-B causes inflammation of cornea called snow blindness, cataract, etc.

180. (d)

One substrate level phosphorylation in one turn of citric acid cycle occurs as per the following reaction:

