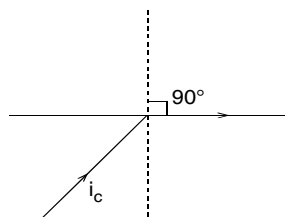


PHYSICS

- 1.(a) Heat supplied to a system is in the form of energy.
 $\therefore$ Its dimensional formula is $[M L^2 T^{-2}]$.
- 2.(b) $v^2 - u^2 = 2as$ or, $(0)^2 - (40)^2 = 2 \times a \times (200)$
 or, $a = \frac{-(40)^2}{2 \times 200} = -4 \text{ ms}^{-2}$ As, $v = u + at$ $\therefore 0 = 40 - 4(t) \Rightarrow t = \frac{40}{4} = 10 \text{ s}$
- 3.(a) It is an example of projectile motion. Therefore, the trajectory of the bomb is a parabola.
- 4.(a) $\vec{F} = 6\hat{i} - 8\hat{j}$ N, $a = 5 \text{ ms}^{-2}$ $\therefore F = \sqrt{(6)^2 + (-8)^2} = 10 \text{ N}$
 Mass of the body is, $m = \frac{F}{a} = \frac{10}{5} = 2 \text{ Kg}$
- 5.(a) Friction always opposes motion. A body does work against friction at the expense of its kinetic energy. Hence, the work done by a body against friction always results in the loss of kinetic energy.
- 6.(c) As, $K_{R_1} = K_{R_2}$ $\therefore \frac{1}{2} I_1 \omega_1^2 = \frac{1}{2} I_2 \omega_2^2$
 or, $\frac{\omega_1}{\omega_2} = \sqrt{\frac{I_2}{I_1}}$ or, $\frac{L_1}{L_2} = \frac{I_1 \omega_1}{I_2 \omega_2} = \frac{I_1}{I_2} \sqrt{\frac{I_2}{I_1}} = \sqrt{\frac{I_1}{I_2}}$
 $\therefore \frac{L_1}{L_2} = \sqrt{\frac{I_1}{I_2}} = \frac{1}{\sqrt{2}}$
- 7.(a) Acceleration due to gravity at a depth 'd' below the surface of the earth is
 $g' = g \left(1 - \frac{d}{R_E}\right)$
 The weight of the body on the surface of the Earth is $W = mg = 250 \text{ N}$
 Weight of the body at depth d is $W' = mg' = mg \left(1 - \frac{d}{R_E}\right)$
 Here, $d = \frac{R_E}{2}$ $\therefore W' = mg \left(1 - \frac{\frac{R_E}{2}}{R_E}\right) = \frac{mg}{2} = \frac{W}{2} = \frac{250 \text{ N}}{2} = 125 \text{ N}$
- 8.(d)
- 9.(a) Hydraulic brakes are based on Pascal's law
- 10.(c) $x = A \cos \omega t$
 $v = \frac{dx}{dt} = \frac{d}{dt} (A \cos \omega t) = -A\omega \sin \omega t$ $a = \frac{dv}{dt} = -A\omega^2 \cos \omega t = A\omega^2 \cos (\omega t + \pi)$
 Phase of displacement, $\phi_1 = \omega t$, phase of acceleration, $\phi_2 = \omega t + \pi$
 $\therefore$ Phase difference $= \phi_2 - \phi_1 = (\omega t + \pi) - \omega t = \pi$
- 11.(d) $0 \text{ K} = -273^\circ \text{C}$ (absolute zero temperature). As no matter exists at this temp, hence it can never be negative.
- 12.(b) When a bimetallic strip is cooled, it will bend towards the larger coefficient of linear expansion.
- 13.(c)
- | | | | | | | |
|---------------------------|------------------------------|-----------------------------|------------------------------|-------------------------------|------------------------------|---------------------------|
| Ice at 0°C | $\xrightarrow{\hspace{1cm}}$ | Water at 0°C | $\xrightarrow{\hspace{1cm}}$ | Water at 100°C | $\xrightarrow{\hspace{1cm}}$ | Ice at 0°C |
| $\downarrow$ | | $\downarrow$ | | $\downarrow$ | | $\downarrow$ |
| H fusion | | H (0 – 100°C) | | H vap | | |
| $= mL_f$ | | $= 1 \times 1 \times 100$ | | $= mL_v$ | | |
| $= 80 \text{ cal}$ | | | | $= 536 \text{ cal}$ | | |
- $\therefore$ Heat required $= 80 + 100 + 536 = 716 \text{ cal}$.
- 14.(c) $\frac{dT}{dt} \propto (T - T_0)$ $T_0 =$ surrounding temperature (constant)
- 15.(b) $C_p = \gamma C_v = \frac{\gamma R}{\gamma - 1} = \frac{1.4R}{1.4 - 1} = \frac{7}{2} R$
- 16.(b) Efficiency, $\eta = 1 - \frac{T_2}{T_1} = 1 - \frac{27 + 273}{627 + 273} = 1 - \frac{300}{900} \therefore \eta = \frac{2}{3}$
 But, $\eta = \frac{W}{Q}$ $\therefore W = \frac{2}{3} \times 3 \times 10^6 = 2 \times 10^6 \text{ calorie} = 4.2 \times 2 \times 10^6 \text{ Joule} = 8.4 \times 10^6 \text{ Joule}$
- 17.(a) Work done = Area enclosed by triangle ABC
 $= \frac{1}{2} AC \times BC = \frac{1}{2} \times (3V - V) \times (3P - P) = 2PV$

18.(a) To see his full image in a plane mirror a person requires a mirror of at least half of his height.

19.(d) For total internal reflection when $i = i_c$, then



Refracted ray grazes with the surface.

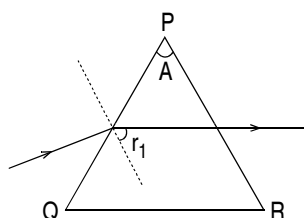
That means the angle of refraction $r = 90^\circ$

20.(c) By covering aperture, focal length does not change. But intensity is reduced by $\frac{1}{4}$ times, as aperture diameter $\frac{d}{2}$ is covered.

$$\therefore I' = I - \frac{I}{4} = \frac{3I}{4} \quad \therefore \text{New focal length} = f \text{ and intensity} = \frac{3I}{4}$$

21.(b) Light ray emerges normally from another surface, hence, e (angle of emergence) = 0

$$\therefore r_2 = 0 \quad r_1 + r_2 = A \Rightarrow r_1 = A$$



$$\mu_1 \sin i = \mu_2 \sin r$$

Applying Snell's law on first surface PQ

$$\Rightarrow \mu_1 \cdot \sin i = \mu_2 \cdot \sin r_1 \quad \Rightarrow \sin i = \mu \sin A$$

$$\text{For small angles } (\sin \theta \approx \theta) \quad \therefore i = \mu A$$

22.(d) Path difference for destructive interference in YDSE

$$\Rightarrow \Delta X_n = \frac{(2n-1)}{2} \lambda \quad \{n = 1, 2, 3, \dots\} \quad \Rightarrow \Delta X_{5th} = \frac{9\lambda}{2}$$

23.(a) $\beta = \frac{\lambda \cdot D}{d}$ where D = distance of screen from wire, d = diameter of wire

24.(c)

25.(c) It is given that,

First overtone of closed pipe = First overtone of open pipe

$$\Rightarrow 3\left(\frac{v}{4\ell_1}\right) = 2\left(\frac{v}{2\ell_2}\right); \text{ where } \ell_1 \text{ and } \ell_2 \text{ are the lengths of closed and open organ pipes. Hence, } \frac{\ell_1}{\ell_2} = \frac{3}{4}$$

26.(d)

27.(a) All charges reside on the outer surface, so that according to Gauss's law, the electric field inside a shell is zero.

28.(b)

29.(c) Heat produced = Energy of charged capacitor = $\frac{1}{2} CV^2 = \frac{1}{2} \times (2 \times 10^{-6}) \times (100)^2 = 0.01 \text{ J}$.

30.(c) Resistance, $R = \frac{\rho \ell}{A} = 4 \Omega \quad \therefore \ell' = 2\ell$

On stretching, the volume of the wire remains constant

$$\therefore \ell A = \ell' A' \quad \therefore A' = \frac{A}{2} \quad \therefore R' = \rho \frac{2\ell}{\frac{A}{2}} = 4R = 4 \times 4 \Omega = 16 \Omega$$

$\therefore$ The resistance of the new wire becomes 16Ω .

31.(c) To carry a current of 4 amperes, we need four paths, each carrying a current of one ampere. Let ' r ' be the resistance of each path.

These are connected in parallel. Hence, their equivalent resistance will be $\frac{R}{4}$. According to the given problem, $\frac{R}{4} = 5$ or $R = 20 \Omega$

For this purpose, two resistors should be connected. There are four such combinations.

Hence, the total number of resistors = $4 \times 2 = 8$

- 32.(a)** Faraday's laws are based on the conversion of electrical energy into mechanical energy, which is in accordance with the law of conservation of energy.
- 33.(b)** Force on a charged particle is given by,
 $F = qvB$. Here, $v = 0$ and also resultant B is zero. $\therefore$ Force = 0
- 34.(b)** We know that the magnetic field at the centre of circular coil,

$$B = \frac{\mu_0 I n}{2r} = \frac{4\pi \times 10^{-7} \times 2 \times 50}{2 \times 0.5} = 4\pi \times 10^{-5} \text{ T}$$
- 35.(c)** A current loop in a magnetic field is in equilibrium in two orientations, one is stable and another is unstable.
- 36.(c)** Electromagnets are typically made of soft iron because it has low retentivity and low coercivity. Low retentivity means that the material does not retain significant magnetism once the external magnetic field is removed, which is desirable for electromagnets that need to be easily demagnetized. Low coercivity means that the material can be magnetized and demagnetized with a relatively small external magnetic field, making it efficient for use in electromagnets.
- 37.(a)** $e = L \frac{di}{dt}$ Given that, $L = 40 \times 10^{-3} \text{ H}$, $di = 11\text{A} - 1\text{A} = 10\text{A}$
 and $dt = 4 \times 10^{-3} \text{ s}$ $\therefore e = 40 \times 10^{-3} \times \left(\frac{10}{4 \times 10^{-3}} \right) = 100 \text{ V}$
- 38.(d)**
- 39.(c)** Specific charge = $\frac{q}{m}$; Ratio = $\frac{\left(\frac{q}{m}\right)_\alpha}{\left(\frac{q}{m}\right)_p} = \frac{q_\alpha}{q_p} \times \frac{m_p}{m_\alpha} = \frac{1}{2}$
- 40.(b)** In an X-ray tube, high-energy electrons eject electrons from inner shells (such as the K-shell) of the target atoms. When electrons from higher energy levels fall into these vacancies, they emit X-ray photons of **specific energies**, producing the **characteristic X-ray spectrum**.
- 41.(c)** De-Broglie wavelength $\lambda = \frac{h}{mv}$ $\Rightarrow \frac{\lambda_\alpha}{\lambda_d} = \frac{m_d v_d}{m_\alpha v_\alpha}$ we know, $m_\alpha = 2m_d$
 Given: $v_\alpha = v$ and $v_d = 2v$ $\Rightarrow \frac{\lambda_\alpha}{\lambda_d} = \frac{v(2m_d)}{2vm_d} = 1$
- 42.(b)** Kinetic energy of thermal neutron with equilibrium is,

$$KE = \frac{3}{2} KT = \frac{p^2}{2m} \Rightarrow p = \sqrt{3mKT} \quad \lambda = \frac{h}{p} = \frac{h}{\sqrt{3mKT}}$$
- 43.(a)** The frequencies of the emitted photon in the Paschen series are given by,

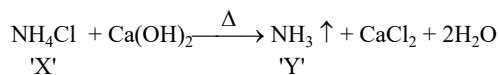
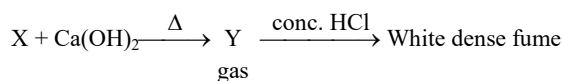
$$\nu = Rc \left(\frac{1}{3^2} - \frac{1}{n^2} \right) \text{ Where, } n = 4, 5, 6, \dots$$
 The highest frequency corresponds to $n = \infty$

$$\therefore \nu_{\text{highest}} = \frac{Rc}{9} = \frac{1.097 \times 10^7 \text{ m}^{-1} \times 3 \times 10^8 \text{ m/s}}{9} = 0.37 \times 10^{15} \text{ s}^{-1} = 3.7 \times 10^{14} \text{ s}^{-1} = 3.7 \times 10^{14} \text{ Hz}$$
- 44.(c)** Radius $\propto n^2$
 Hence, $R_1 : R_2 : R_3 = 1 : 4 : 9$
- 45.(a)** Silicon is the most commonly used semiconductor due to its abundance, low cost, and suitable properties for electronic devices.
- 46.(d)** NAND and NOR logic gates are called universal gates.
- 47.(b)** A pentavalent atom is to be added to a germanium crystal to make it an N-type semiconductor.
- 48.(d)**
- | | |
|-----------|---|
| Extrinsic | $\Rightarrow$ P- Type ($n_p \gg n_e$) |
| S.C. | $\Rightarrow$ N- Type ($n_e \gg n_p$) |
- 49.(a)** The neutrino is a type of lepton, a fundamental particle that does not participate in strong interactions. It has a very small mass and no electric charge.
- 50.(d)** Quark combination of an antineutron is $\bar{u} \bar{d} \bar{d}$.

CHEMISTRY

- 51.(d)** The form of charcoal most commonly used in gas masks is activated carbon, which is derived from materials like wood, coal, coconut shells.

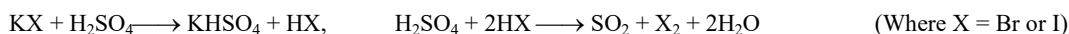
- 52.(c)** Gas 'Y' must be NH_3 because it produces white dense fume with conc. HCl and 'X' is NH_4Cl



And, $\text{NH}_3 + \text{conc. HCl} \longrightarrow \text{NH}_4\text{Cl}$ (white dense fume)

- 53.(d)** Amorphous sulphur (colloidal sulphur) is prepared by reacting H_2S gas through solution of any oxidant like HNO_3 , KMnO_4 and SO_2 .

- 54.(a)** HBr and HI cannot be prepared by heating bromide and iodide with conc. H_2SO_4 as HBr and HI are strong reducing agent and reduce H_2SO_4 to SO_2 and get themselves oxidized to bromine and iodine respectively.



- 55.(b)** Carbon and carbon monoxide reduce the metallic oxides to the free metals.

- 56.(a)** Sodium metals are most commonly used in street lights.

- 57.(c)** Alkaline earth metals show several characteristics that align with the general properties of representative elements.

- 58.(a)** The second ionization energy is always higher than the first ionization energy as an electron is to be removed from unipositive cation.

- 59.(c)** Poor shielding effect of d-electrons in Ga atoms counter balances the increase in atomic size due to the addition of a new shell.

- 60.(d)** $2\text{Ag} + \text{H}_2\text{S} \longrightarrow \text{Ag}_2\text{S} \downarrow + \text{H}_2 \uparrow$
 black ppt

- 61.(a)** Milliequivalents of acid = Normality $\times$ Volume (in litre) = $0.2 \times \frac{20}{1000} + 0.1 \times \frac{50}{1000} = 0.009$,

$$\text{Milliequivalents of base} = \text{Normality} \times \text{Volume (in litre)} = 0.5 \times \frac{20}{1000} = 0.01$$

Here, equivalent of base is more than acid. So, resulting solution is alkaline.

- 62.(c)** As the number of protons, increases in a nucleus, the coulombs repulsive force increases, which tends to break the nucleus apart. So, to keep the nucleus stable, more number of neutrons are needed.

- 63.(c)** Cu is above of Ag in electrochemical series and thus,



- 64.(a)** Rate = $K(\text{N}_2\text{O}_3) = 6.2 \times 10^{-1} \times 1.25 = 7.75 \times 10^{-1} \text{mol l}^{-1} \text{s}^{-1}$.

- 65.(d)** $\Delta H = \Delta E + \Delta n_g RT$ (1st law), $\Delta n_g = n_p - n_r = 0$ $\therefore \Delta H = \Delta E$

- 66.(d)** Molecularity of the reaction does not influence the rate of reaction and also molecularity of reaction never be negative, zero and fraction.

- 67.(b)** No. of moles in 2g of oxygen = $\frac{2}{16} = \frac{1}{8}$ mole.

No. of atoms of O = $\frac{1}{8} \times N_A$ atoms. Here N_A is the Avogadro's number.

No. of moles in 4g sulphur = $\frac{4}{32} = \frac{1}{8}$ mole, No. of atoms of S = $\frac{1}{8} \times N_A$ atoms.

- 68.(c)** Mass no. $\approx$ At. Wt.

Mass no. = no. of protons + no. of neutrons, At. No. = no. of protons.

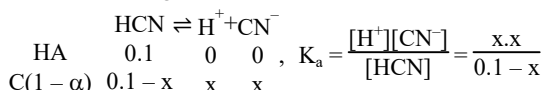
- 69.(c)** The boiling point of H_2O is more than that of H_2S because H_2O forms hydrogen bonding while H_2S does not.

- 70.(a)** The metal with the most negative value of standard electrode potential will have the maximum value of the reducing power. The metal with the most positive value of standard electrode potential will have the minimum value of reducing power.

- 71.(c)** $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$

$$\Delta n = 2 - 4 = -2, K_p = K_c [\text{RT}]^{\Delta n}, K_p = K_c [\text{RT}]^{-2}, K_c = \frac{K_p}{[\text{RT}]^{-2}} = \frac{1.44 \times 10^{-5}}{[0.082 \times 773]^{-2}}$$

- 72.(c)** Let 'd' be its degree of dissociation.



HCN is weak acid we can assume that x is very small compared to 0.1 M. So, $0.1 - x \approx 0.1$.

$$K_a = \frac{x^2}{0.1}, \quad 4 \times 10^{-10} \times 0.1 = x^2, \quad x = \sqrt{4 \times 10^{-10} \times 0.1}, \quad \therefore x = 6.3 \times 10^{-6} \text{M}.$$

73.(d) H_2O reacts as acid in this reaction.

74.(a) Body centered cubic lattice has a co-ordination number of 8.

75.(c) Here, Density of gas 'B' is 'd' (let) and pressure be P_2 , volume V_2 ,

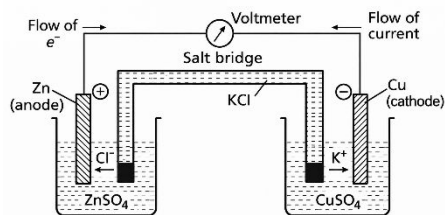
Density of gas 'A' is '2d' and pressure be P_1 , volume V_1

Molecular mass of 'B' is M (let), Molecular mass of 'A' is $M/2$

From combined gas equation,

$$P_1 V_1 = P_2 V_2 \quad (\because v = \frac{M}{d}) \quad \Rightarrow P_1 \frac{M}{d} = P_2 \frac{M}{d} \quad \Rightarrow P_1 \frac{M}{4d} = P_2 \frac{M}{d} \quad \Rightarrow \frac{P_1}{P_2} = 4.$$

76.(c) Daniel cell is an electrochemical cell in which Cu act as cathode and Zn act as anode.



In Daniel cell:

(i) Electron flow from the Zn anode to Cu cathode and direction of current flow is reverse i.e., Cu (cathode) to Zn (anode).

(ii) The cell reaction is: $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$

Thus, Cu^{2+} ions (cations) move towards Cu electrode (cathode) and get accumulated as Cu metal.

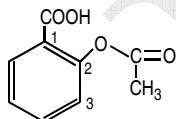
77.(a) $\Delta G = \Delta H - T\Delta S$

$$\Delta G = -2500 - (298 \times 7.4) =$$

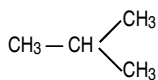
$$\Delta G = -2500 - 2205.2 = -4705.2 \text{ cal.}$$

Since $\Delta G < 0$, the reaction is **spontaneous** at 298 K.

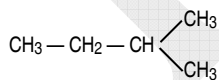
78.(b)



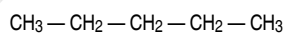
79.(d)



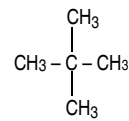
isobutane



isopentane



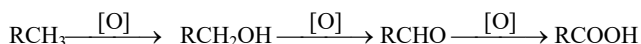
pentane



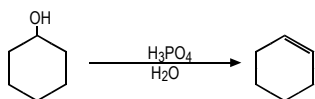
Neopentane

80.(b) $p\text{-NO}_2\text{-C}_6\text{H}_4\text{-CH}_2^+$ is the least stable carbocation. This is due to the strong electron withdrawing effect of -NO_2 group at para-position.

81.(d) Ether is not a product of oxidation of alkane. This can be explained with the help of the given below reaction.

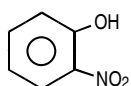


82.(b) The best method to prepare cyclohexene from cyclohexanone is by using conc. H_3PO_4 because among the given option dehydrating agent is only conc. H_3PO_4 . The other reagent may give substitution product as well.



83.(d) Sandmeyer's reaction is a type of substitution reaction that is widely used in the production of arylhalide from aryl diazonium salts. Copper salt like chloride, bromide and cyanide ions are used as catalyst in this reaction. Notably, the sandmeyer's reaction can be used to perform unique transformations on benzene.

84.(b)

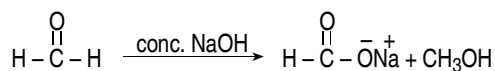


The nitro group in ortho position withdraws electrons from benzene making it more acidic forming stable compound after hydrogen is removed. Phenols are more acidic than alcohols due to the stabilization of phenoxide ion by resonance.

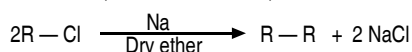
85.(b) Only aromatic ethers or alkyl aryl ethers undergoes electrophilic substitution reaction.

86.(a) Alkane, alkene and amine contains an electron releasing group. They will not produce α – hydrogen with a reaction of base. As aldehyde and ketones are strong electron withdrawing group, they can produce α – hydrogen easily by the reaction of base.

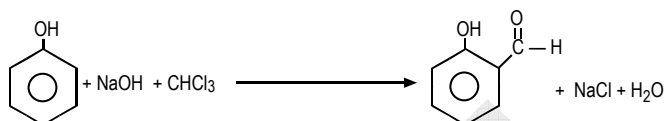
87.(a)



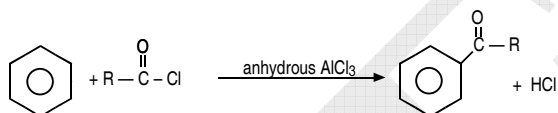
(cannizzaro reaction)



(wurtz reaction)

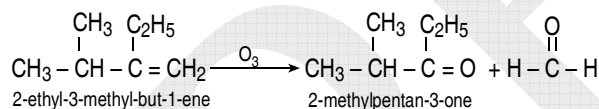


(Reimer – Tiemann reaction)



(Friedel – Craft's reaction)

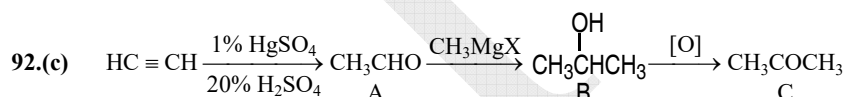
88.(a)



89.(a) Vinegar is a liquid containing acetic acid and water. This acetic acid is produced by the fermentation of ethanol by acetic acid bacteria. It is mainly used as a cooking ingredient. It is a 5 – 8% solution of acetic acid in water and mostly available mild acid.

90.(b) $\text{RCONH}_2 + \text{HNO}_2 \rightarrow \text{RCOOH} + \text{N}_2\uparrow + \text{H}_2\text{O}$

91.(d) $\text{C}_6\text{H}_5\text{CONHCH}_3 + \text{Zn} - \text{Hg}/\text{HCl} \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{NHCH}_3$. This reaction is Clemmenson reduction.



93.(b) • 2, 4 – DNPH reacts with carbonyl compounds to form a yellow/orange/red precipitate.

• Sodium reacts with compound having an acidic H such as alcohol (and phenols) to give alkoxide and hydrogen gas

• Ethers and most other oxygen containing neutral functionalities don't react with sodium metal and 2, 4 – DNPH.

94.(d) Gabriel phthalimide synthesis not preferred for preparing aniline because amine formation involves nucleophilic substitution of alkyl halides by the anion formed by phthalimide. But aryl halides do not undergo nucleophilic substitution.

95.(b) Types of dyes on basis of application:

• Acid dyes: These dyes contain groups such as $-\text{COOH}$, $-\text{SO}_3\text{H}$, or phenolic groups. The colour is mainly due to the negative ion of the dye. Examples: Orange I, Orange II, Methyl orange, Methyl red.

• Basic dyes: These dyes contain groups such as $-\text{NH}_3^+$ or $-\text{NR}_2^+$. The colour is associated with the positive ion of the dye. Examples: Aniline yellow, Butter yellow.

• Direct or substantive dyes: These dyes can be applied directly to fibres from solution and are generally azo or nitro dyes. Examples: Congo red, Martius yellow.

• Mordant or adjective dyes: These dyes are fixed to fibres using a metal ion (mordant). The colour produced may vary depending on the metal ion used. Example: Alizarin

• $\text{Al}^{3+} \rightarrow$ Rose red

• $\text{Fe}^{3+} \rightarrow$ Violet

• $\text{Ba}^{2+} \rightarrow$ Blue

• VAT dyes: are insoluble compounds which upon reduction give soluble product. Eg: Indigo and anthraquinone.

- 96.(a) Tranquilizers are chemical substances used to cure mental diseases. They reduce anxiety and induce sleep. These are also called psychotherapeutic drugs. Some of the common tranquilizers are barbituric acid and its derivatives.
- 97.(b) 1:3: The reaction:
$$\begin{array}{c} \text{N}_2 + 3\text{H}_2 \longrightarrow 2\text{NH}_3 \\ 1 \qquad 3 \end{array}$$
- 98.(c) Iodine in an aqueous solution: I_2 gives blue colour with starch.
- 99.(b)
- 100.(b) **Ammonium chloride (NH_4Cl)** sublimes on heating, whereas **sodium chloride (NaCl)** does not. Therefore, the two can be separated by **sublimation**.

ZOOLOGY

- 101.(b) The **ring-shaped form with a chromatin dot inside an RBC** is the **ring stage (young trophozoite)** of *Plasmodium*. It is seen during the erythrocytic stage of the parasite's life cycle.
- 102.(c) The sexual phase of Plasmodium occurs inside the female Anopheles mosquito, which acts as the definitive host. When a mosquito sucks blood from an infected person, it ingests gametocytes. In the gut (stomach) of the mosquito, these gametocytes develop into male and female gametes, fuse to form a zygote, and continue sexual reproduction. Therefore, the sexual cycle is completed in the gut of mosquito.
- 103.(c) The skin of an earthworm contains a special dark-brown pigment called porphyrin, located mainly in the circular muscle layer of its body wall. This pigment acts as a natural shield, protecting the earthworm from harmful solar ultraviolet (UV) radiation when it is accidentally exposed to strong sunlight. It is also responsible for giving the earthworm its characteristic dark-brown color on its dorsal surface.
- 104.(b) The **pharynx** of the earthworm acts as a **salivary chamber**. It contains pharyngeal glands that secrete saliva, which helps in lubricating and digesting food.
- 105.(b) The frog's stomach is divided into two regions. The **wider anterior region** is the **cardiac region**, while the narrower posterior region is the **pyloric region**.
- 106.(d) Adult frogs respire mainly through **lungs, skin (cutaneous respiration)**, and the **buccopharyngeal lining**. **Gills** are present in the tadpole stage and are not used by adult frogs throughout life.
- 107.(c) A **vestigial organ** is a reduced structure that has lost most or all of its original function during evolution. Examples in humans include the **vermiform appendix** and **coccyx**.
- 108.(b) Darwin's finches are living finches of the Galápagos Islands that show variations in beak structure associated with different feeding habits. They provide classic evidence for adaptive radiation and natural selection.
- 109.(d) Neanderthals and Cro-Magnons are among the later human groups in the traditional human-evolution sequence and are considered close to modern humans.
- 110.(d) Sponges (**Phylum Porifera**) were initially considered plants because they are **sessile** and attached to a surface. Later, the discovery of **water circulation through their body via numerous pores and canals** established their animal nature.
- 111.(b) Turbellarians belong to the phylum Platyhelminthes (flatworms) and are generally free-living. A common example is Planaria. In contrast, cestodes (tapeworms) and trematodes (flukes) are mostly parasitic.
- 112.(b) Crustaceans possess two pairs of antennae—the first pair is called antennules, and the second pair is the antennae. Insects have only one pair, while arachnids lack antennae.
- 113.(c) In Hemichordates, the body wall consists mainly of a single-layered epidermis with an underlying basement membrane and dermal connective tissue, rather than a distinct muscular dermis as stated in option (c). Hemichordates are exclusively marine, and their coelom is divided into protocoel, mesocoel, and metacoel.
- 114.(a) The Schneiderian membrane is the mucous membrane (respiratory mucosa) lining the nasal cavity. It contains pseudostratified ciliated columnar epithelium with goblet cells, which helps trap and remove dust and microorganisms from inhaled air.
- 115.(b) The marrow cavity (medullary cavity) of a long bone is internally lined by a thin connective tissue membrane called the endosteum. The outer surface of bone is covered by the periosteum.
- 116.(a) The sarcomere is the basic functional (contractile) unit of striated muscle. It extends from one Z-line (Z-disc) to the next Z-line. During muscle contraction, the actin and myosin filaments slide past each other within the sarcomere.
- 117.(b) In the peripheral nervous system (PNS), damaged axons can regenerate when the cell body (perikaryon) survives. Schwann cells proliferate and form a supportive pathway that guides the regenerating axon toward its target. The distal segment undergoes Wallerian degeneration, so regeneration does not occur from the distal segment itself.
- 118.(a) Cholera primarily affects the small intestine, where *Vibrio cholerae* produces toxin that causes profuse watery diarrhea and severe dehydration.
- 119.(c) PEP (Post-Exposure Prophylaxis) refers to the use of antiretroviral medicines after a possible exposure to HIV to reduce the risk of infection. It should be started as soon as possible after exposure.
- 120.(b) Hepatitis B is also known as serum hepatitis because it can be transmitted through infected blood and other body fluids. It is caused by the Hepatitis B virus (HBV).
- Hepatitis A → commonly called infectious hepatitis
 - Hepatitis B → serum hepatitis
 - Hepatitis D → delta hepatitis
 - Hepatitis E → enterically transmitted hepatitis

- 121.(b) Antibodies are immunoglobulin proteins present in blood that specifically bind and neutralize antigens/pathogens.
- 122.(c) The hard palate is formed mainly by the palatine processes of the maxillae and the horizontal plates of the palatine bones. The mandible does not contribute to the hard palate.
- 123.(b) The pancreas has both functions:
Exocrine: Pancreatic juice containing digestive enzymes is released into the duodenum.
Endocrine: Hormones such as insulin and glucagon are released into the blood by the islets of Langerhans.
- 124.(c) The malleus (hammer) is the first auditory ossicle of the middle ear. Its handle (manubrium) is directly attached to the tympanic membrane (eardrum). Sound vibrations from the eardrum are transmitted through the ossicles in the sequence: Malleus → Incus → Stapes. The stapes is attached to the oval window, while the cochlea is part of the inner ear and is not an ossicle.
- 125.(c) The eyelashes act as the first line of defense for the eye. They trap dust particles and trigger the blink reflex, preventing foreign particles from reaching the eyeball.
- Cornea → transparent front part for vision
 - Retina → light-sensitive layer for image formation
 - Choroid → vascular layer supplying nutrients
- 126.(b) The **pineal gland** is relatively more active during childhood and is associated with regulation of **biological rhythms and timing of puberty** through melatonin secretion. After puberty, its activity gradually **declines (functionally atrophies)** compared to earlier life stages.
- 127.(b) The right atrium consists of a smooth posterior part (sinus venarum) and a rough anterior part with muscoli pectinate. These two regions are separated by a vertical ridge called the crista terminalis.
- 128.(b) Auscultation is the process of listening to internal body sounds (like heartbeats or breath sounds) using a stethoscope.
- 129.(c) The adrenal cortex secretes small amounts of **androgens** (male sex hormones). When these hormones are produced in excessive amounts, especially due to adrenal tumors or adrenal hyperactivity, a female may develop male secondary sexual characteristics, a condition known as **virilism (masculinization)**.
- 130.(c) **Bartholin's glands (greater vestibular glands)** are a pair of mucus-secreting glands located on either side of the vaginal opening in the **vestibule of the vulva (external genitalia)**. Their secretion helps lubricate the vaginal entrance, reducing friction.
131. (b) Both apneustic and pneumotoxic center are present in pons which stimulate and inhibits inspiratory center. Inspiratory center is present in dorsal medulla. Expiratory center is present in ventral medulla
- 132.(b) Nodes of Ranvier are small gaps in the myelin sheath. The functions of nodes of Ranvier are speeding up nerve impulses, ion exchange, energy deficiency
- 133.(a) Bowman's glands are located in the olfactory mucosa of the nasal cavity. They secrete a watery fluid that dissolves odoriferous substances, enabling olfactory receptors to detect smells.
- Bowman's gland → Nose (olfactory region)
 - Bowman's capsule → Kidney (nephron)
 - Bowman's membrane → Eye (cornea)
- 134.(a) The **respiratory** tract branches in the following order: Trachea → Bronchi → Bronchioles → Terminal bronchioles → Respiratory bronchioles → Alveolar ducts → Alveoli
Therefore, bronchi give rise to bronchioles, not the reverse. Hence, statement (a) is incorrect.
- 135.(d) Trachoma is a bacterial infection of the eye caused by Chlamydia trachomatis. It affects the conjunctiva and cornea, leading to redness, irritation, and in severe cases, blindness if untreated.
Protanopia → genetic color blindness (not bacterial)
Xerophthalmia → vitamin A deficiency causing dryness of eyes
Glaucoma → increased intraocular pressure damaging optic nerve
- 136.(d) Oval window → Transmits vibrations from middle ear to inner ear
Cochlear duct → Part of inner ear involved in hearing
Auditory nerve → Carries hearing signals to the brain
- 137.(b) Dispersal movement refers to the spreading of organisms from a common habitat to different locations, helping them colonize new areas and reduce competition.
- 138.(b) Reduction of digits and development of hooves increase speed and efficiency in running, a characteristic feature of cursorial (running) animals such as horses and deer.
- 139.(c) A **transgenic animal** is one whose genome has been modified by introducing a gene from another organism. These animals are often used to produce useful human proteins, study gene functions, and develop medicines.
- 140.(b) Before an organ transplantation, it is important to ensure that the donor's tissues are compatible with those of the recipient. This compatibility is determined by comparing the Major Histocompatibility Complex (MHC) proteins, known as Human Leukocyte Antigens (HLA) in humans.
The process of identifying and matching these HLA antigens between donor and recipient is called tissue typing. A close HLA match reduces the chances of organ rejection by the recipient's immune system and increases the success rate of the transplant.

BOTANY

- 141.(a) Fructose is sweeter than glucose, so it contributes strongly to the sweetness of ripening fruits.
- 142.(c) The enzyme, which combines with the non-protein part to form a functional enzyme is known as the holoenzyme.
- 143.(d) Viruses are not applicable to cell theory. They are made up of proteins and one of the nucleic acids i.e., DNA or RNA. So, they lack protoplasm, the essential part of the cell.
- 144.(b) The **middle lamella** is a thin, cementing layer mainly composed of **pectic substances** that lies between the primary cell walls of adjacent plant cells and helps hold them together.
- 145.(d) Mitochondria is responsible for the process of respiration which is a destructive or catabolic process.
- 146.(b)
- 147.(d) Separation of sister chromatids is carried out at anaphase-II. In anaphase-I, chromosome separation and movement take place.
- 148.(b) Species occupies a key position in classification. It is a basic unit of classification /taxonomy.
- 149.(a) Because Monera includes bacteria in which a few are photoautotrophs e.g., green sulphur bacteria, a few are chemoautotrophs e.g., *Nitrosomonas* and rest are heterotrophs e.g., *Bacillus*
- 150.(b)
- 151.(c)
- 152.(d) The members of division Basidiomycota (class basidiomycetes) are commonly called club fungi because the basidia are club shaped.
- 153.(b) Kelps like *Fucus* and *Laminaria* (members of Phaeophyceae Brown algae) are rich source of iodine. 25% total iodine is obtained from kelps and also contain bromine, Cu, Zinc, Fe, Boron, Mn, Mo etc. Because of having iodine, the dried kelps are used to treat goiter.
- 154.(d) In Bryophytes, vascular tissue (i.e., xylem and phloem) are completely absent. Water and nutrients enter cell by diffusion when in pteridophytes, vascular tissue consists of xylem (without true vessels) and phloem (without companion cells).
- 155.(d) It is hairy structure which cover juvenile leaves in ferns.
- 156.(b) Endosperm is haploid and formed before fertilization and sporophytic (2n) phase is dominant in *Pinus*.
- 157.(c) Keystone species play a crucial role in maintaining the structure of an ecological community, influencing the abundance of other species.
- 158.(a) Because they cannot absorb water due to ice-formation.
- 159.(d) Climax community is the stable, self perpetuating and final biotic community that develops at the end of biotic succession and is in perfect harmony with the physical environment.
- 160.(d) Diatoms are producer, crustacea is primary consumer, fish is secondary consumer, seal is top consumer and bacteria are decomposers.
- 161.(d) Sieve tubes and companion cells are the parts of phloem.
- 162.(d) Intercalary meristem is responsible for increase in length. This meristem is present at the base of internodes or at the base of leaves or at the base of nodes.
- 163.(b) Endodermis is mostly single layered and is made up of parenchymatous barrel shaped compactly arranged cells. The inner and radial or transverse wall of endodermal cells have casparian strips of suberin.
- 164.(c) Because loss of water takes place through leaves by transpiration.
- 165.(a) The pure water, at atmospheric pressure, has zero water potential. The addition of any solute particles reduces the free energy of water. Thus, the water potential will be negative.
- 166.(a)
- 167.(a) The chloroplast pigment is fat soluble and are located in the lipid part of the thylakoid membranes.
- 168.(d) Phosphoglyceraldehyde is a product of dark reaction which is formed by the 1, 3 biphosphoglyceric acid react with 12 mols of NADPH₂
1, 3 biphosphoglyceric acid + 12 NADPH₂
Triose phosphate dehydrogenase → 3 phosphoglyceraldehyde + 12NADP⁺ + 12H₃PO₄.
- 169.(b)
- 170.(a) This phenomenon occurs when a gene has more than two alternative forms (alleles) in a population.
- 171.(d) As allele pairs separate or segregate during gamete formation and the paired condition is restored by random fusion of gametes during fertilization.
- 172.(c) All offspring are red flowered; according to Mendel's law of dominance.

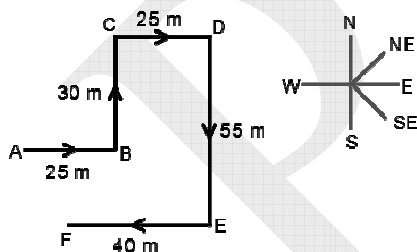
- 173.(b) Reverse transcriptase or RNA dependent DNA polymerase enzyme catalyzes the transcription of DNA by some viral RNA. This process is also known as teminism.
- 174.(d) Group O plasma contains **anti-A and anti-B antibodies**. Therefore, transfusing **group A red blood cells** into a group O recipient can cause an antigen–antibody reaction and agglutination.
- 175.(d) Individuals with Turner syndrome have one x chromosome (hh + xo) due to non-disjunction of sex chromosome in their parents
- 176.(a) At certain places, exine remains unthickened or missing and these places are known as germ pores.
- 177.(d)
- 178.(c) Intervarietal hybridization is in which parents involved in hybridization belong to the same species. In crop improvement programme this type of hybridization is commonly used. E.g., crossing of two varieties of wheat or other crops.
- 179.(c) In hybridization, two or more plants of unlike genotypes are crossed together to get offsprings with new desirable combinations of characters as a result of genetic recombination.
- 180.(b) *Azollapinnata* (aquatic fern) is a symbiotic nitrogen fixing cyanobacteria which is inoculated in rice fields in south-eastern Asia, and found to increase yield upto 50%.

MAT

- 181.(d) $P \% Q \rightarrow P$ is the mother of Q
 $Q + R \rightarrow Q$ is the father of R
 $R - T \rightarrow R$ is the brother of T
Hence, $\rightarrow Q$ is the father of T
 $T \times K \rightarrow T$ is the daughter of K
Hence, $\rightarrow Q$ is the husband of K.
Therefore, P is the mother-in-law of K.
- 182.(c) **SINGS**: The first letter of the word is moved to the last position and 'S' is placed at the beginning, to form the code.

- 183.(b)
- | | | | | | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 7 | 7 | 9 | 9 | 2 | 6 | 4 | 5 | 3 |
| $\times 2 \downarrow$ | $\times 3 \downarrow$ | $\times 4 \downarrow$ | $\times 2 \downarrow$ | $\times 3 \downarrow$ | $\times 4 \downarrow$ | $\times 2 \downarrow$ | $\times 3 \downarrow$ | $\times 4 \downarrow$ |
| 14 | 21 | 36 | 18 | 6 | 24 | 8 | 15 | 12 |

- 184.(d) Man's Movement:



Finally, he is towards the South-East from his starting Point.

- 185.(b) **Y**: W interchange the position of the letters as shown below:

NECESSARY
 ↕ ↕ ↕
 CENSSEYRA

The new letter sequence is CENSSEYRA

Clearly, the seventh letter from the left is Y. Hence, the answer is (b)

- 186.(b) Time lost in 1 hour = 5 min
Time lost in 6 hours = (5×6) min = 30 min
After 6 hours, the correct time will be 6 am and the clock will show 5 : 30 am.
- 187.(c) From option (c), we have
 $16 \times 8 \div 4 - 9 + 14$
 $= 16 \times 2 - 9 + 14$
 $= 32 - 9 + 14$
 $= 46 - 9 = 37$

188.(d) Since the accident has caused concern, it must be fatal. So, I follows. The use of the word 'again' in the statement justifies the fact mentioned in II. So, II also follows.

189.(d) Let the capacity of a bottle be 100 units

$$\therefore \text{Total capacity of bottles} = 100 + 100 = 200 \text{ units}$$

$$\text{Now, the amount of orange juice in both the bottles} = 35 + \frac{100}{3} = \frac{205}{3} \text{ unit}$$

$$\text{So, the amount of apple juice in both bottles} = 200 - \frac{205}{3} = \frac{395}{3} \text{ unit}$$

$$\therefore \text{Percentage of apple juice} = \frac{395}{3 \times 200} \times 100 = 65\frac{5}{6} \%$$

190.(c) Let the present ages of Shiv and Aman be $5x$ and $2x$ years respectively.

$$\text{Shiv's age 7 years hence} = (5x + 7) \text{ years}$$

$$\text{Aman's age 7 years hence} = (2x + 7) \text{ years}$$

According to the question,

$$\therefore \frac{5x+7}{2x+7} = \frac{4}{3} \Rightarrow 3(5x+7) = 4(2x+7)$$

$$\Rightarrow 15x + 21 = 8x + 28 \Rightarrow 7x = 7$$

$$\text{Hence, Shiv's age} = 5 \text{ years}$$

191.(d) Rs. 50,000: Let CP = x

$$\therefore \text{Loss} = x - 46000$$

$$\text{Profit} = 58000 - x$$

$$\Rightarrow (58000 - x) = 2(x - 46000)$$

$$\Rightarrow 58000 - x = 2x - 92000$$

$$\Rightarrow 58000 + 92000 = 2x + x$$

$$\Rightarrow 3x = 150000$$

$$\Rightarrow x = \text{Rs. } 50000$$

192.(b) 60: $P + C + M = C + 120 \Rightarrow P + M = 120$

$$\therefore \text{Required average} = \frac{P+M}{2} = \frac{120}{2} = 60$$

193.(a) Total time taken by David and Michael together

$$= 4 \text{ days } 19 \text{ hrs } 12 \text{ min} = 4 \text{ days } 19\frac{1}{5} \text{ hrs}$$

$$= 4 \text{ days} + \left(\frac{96}{5} \times \frac{1}{24}\right) \text{ days} = 4\frac{4}{5} \text{ days} = \frac{24}{5} \text{ days}$$

$$(\text{David} + \text{Michael})'s \text{ 1 day's work} = \frac{5}{24}$$

$$(\text{David's 1 day's work}) : (\text{Michael's 1 day's work})$$

$$= \frac{2}{3} : 1 = 2 : 3$$

$$\therefore \text{Michael's 1 day's work} = \left(\frac{5}{24} \times \frac{3}{5}\right) = \frac{1}{8}$$

Hence, Michael alone can finish the job in 8 days.

194.(d) 16 : 15: Let the distance covered in 1 leap of the dog be x and that covered in 1 leap of the hare be y .

$$\text{Then, } 3x = 4y \Rightarrow x = \frac{4}{3}y \Rightarrow 4x = \frac{16}{3}y$$

$$\therefore \text{Ratio of speeds of dog and hare}$$

= Ratio of distance covered by them in the same time

$$= 4x : 5y = \frac{16}{3}y : 5y = \frac{16}{3} : 5 = 16 : 15.$$

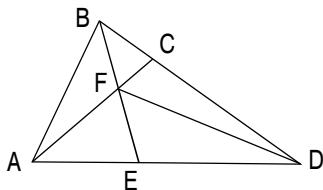
195.(d) 120 rolls: Number of cuts made to cut a roll into 10 pieces = 9.

Therefore Required number of rolls = $\frac{(45 \times 24)}{9} = 120.$

196.(d) D: Similar figure repeats in every second step.

197.(d) 5: Only in figure (5), the hand and legs are similar.

198.(d) 12:



The simplest triangle is ABF, AEF, BFC, CDF and DEF, i.e., 5 in numbers.

The triangles are composed of two components each ABE, BCDF, AEDF and ABCF, i.e., 4 in numbers.

The triangles are composed of three components each BDE and AFCDE, i.e., 2 in numbers.

There is only one triangle ABCDE composed of five components.

Thus, $5 + 4 + 2 + 1 = 12$ triangles in the figure.

199.(b) 2: In fig. (X), one of the dots lies in the region common to the circle and the square only, another dot lies in the region common to all the three figures - the circle, the square and the triangle and the third dot lies in the region common to the circle and the triangle only. In each of the alternatives (1), (3) and (4), there is no region common to the circle and the triangle only. Only fig. (2) consists of all three types of regions.

200.(a) 1: Each line across and down contains one each of the lines in a different position (the lines are moving downwards one notch at a time; when they reach the bottom they return to the top position at the next stage).

...The End...