

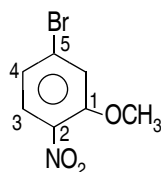
PHYSICS

- 1.(b)
- 2.(b) $a = g \sin \theta, \ell = \frac{h}{\sin \theta} \Rightarrow \frac{h}{\sin \theta} = \frac{1}{2} g \sin \theta t^2$
 $\Rightarrow t \propto \frac{1}{\sin \theta} \therefore \frac{t_2}{t_1} = \frac{\sin \theta_1}{\sin \theta_2} = \frac{\sin 30^\circ}{\sin 60^\circ} = \frac{1}{\sqrt{3}} \quad \therefore t_2 = \frac{t_1}{\sqrt{3}} = \frac{3}{\sqrt{3}} = \sqrt{3} \text{ s.}$
- 3.(a) $\frac{H}{T^2} = \frac{u^2 \sin^2 \theta / 2g}{(2u \sin \theta / g)^2} = \frac{g}{8} = \frac{10}{8} = \frac{5}{4}.$
- 4.(c) For the block to remain stationary, $m \cos \theta \alpha = mg \sin \alpha \Rightarrow a = g \tan \alpha$
- 5.(d) Difference = $(1.2 - 1.2)$ Joule. = Zero
- 6.(a) When a bullet gets embedded in a solid block, the whole kinetic energy gets lost. This will be a perfectly inelastic collision in which only momentum is conserved.
- 7.(a) $\tau = \frac{\Delta J}{\Delta t}$. When $\tau = 0$, $\Delta J = 0$ or $J = \text{constant}$.
- 8.(d) Amplitude $a = \sqrt{A^2 + B^2} = \sqrt{4^2 + 4^2} = 4\sqrt{2}$
- 9.(d) In an artificial satellite, water is weightless, so water will rise due to surface tension upto full length of the capillary.
- 10.(c) $V_T = \frac{2}{9} \frac{(\rho - \sigma) g R^2}{n} \propto R^2$
- 11.(a) The cylindrical bulb has a larger area than the spherical bulb, so it will take in more heat quickly.
- 12.(a) Anomalous expansion of water occurs when cooled from 4°C to 0°C . Hence, the sealed glass jar will be broken.
- 13.(b) When the boiling point of water rises, the latent heat decreases. The reason is that at higher temperatures, the intermolecular forces of water will become weak and less heat is required to break them out.
- 14.(d) $P = \frac{1}{3} \rho c^2 \Rightarrow P \propto \rho$
- 15.(a) $\Delta U = \text{same}, W_A > W_B$ So, $Q_A = Q_B$
- 16.(c) Rough and black surfaces are good emitters and good absorbers, while shining and white surfaces are bad emitters and bad absorbers.
- 17.(a) $\Delta V = 0 \Rightarrow P \Delta V = 0 \Rightarrow \Delta W = 0$
- 18.(b) A sound wave is an example of a mechanical wave, which requires a medium for its propagation. In outer space, we have a vacuum, and hence, no sound wave propagation is possible there.
- 19.(c) Light is a transverse wave and sound is a longitudinal wave.
- 20.(c) Let f' and λ' represent frequency and wavelength of light in a medium, respectively.
 So, $f' = \frac{f}{\lambda'} = \frac{c/\mu}{\lambda/\mu} = \frac{c}{\lambda} = f$
- 21.(d) In minimum deviation, $i = e = 30^\circ$, so the angle between the emergent ray and the second refracting surface is $90^\circ - 30^\circ = 60^\circ$
- 22.(d) The phase difference between the light waves reaching the third bright fringe from the central fringe will be $\Delta\phi = 2n\pi$ [where, $n = 3$]
 $\Delta\phi = 2 \times 3 \times \pi = 6\pi$
- 23.(a) For a single slit diffraction pattern $d \sin \theta = \lambda$ (d = slit width) Angular width = $2\theta = 2 \sin^{-1} \left(\frac{\lambda}{d} \right)$
- 24.(c) $I = 4 I_0 \cos^2(\phi/2) \Rightarrow \phi = 2\pi/3 \Rightarrow \Delta x \times (2\pi/\lambda) = 2\pi/3 = \lambda/3 \quad \sin \theta = \Delta x/d \Rightarrow \sin \theta = \lambda/3d$
- 25.(a) Power of the combination, $P = P_1 + P_2 = 12 - 2 = 10 \text{ D}$
 $\therefore$ Focal length of the combination, $F = \frac{100}{P} = \frac{100}{10} = 10 \text{ cm}$
- 26.(b) Current through each arm DAC and $DBC = 1 \text{ A}$
 $V_D - V_A = 2$ and $V_D - V_B = 3 \Rightarrow V_A - V_B = +1 \text{ V}$
- 27.(c) Free electron theory best explains the mechanism of heat production in a conductor.
- 28.(d) Magnetic field inside the hollow conductor (tube) is zero.
- 29.(d) $B_H = \sqrt{3} B_v$, also $\tan \theta = \frac{B_v}{B_H} = \frac{1}{\sqrt{3}} \therefore \theta = 30^\circ$
- 30.(b) Peak voltage = $V_{\text{rms}} \times \sqrt{2} = 220 \times \sqrt{2} = 311 \text{ V}$

- 31.(d) Induction furnace, galvanometer damping and speedometer of automobile are the application of eddy currents. Crystallography is done by diffraction
- 32.(c)
- 33.(b) At resonance, the current is maximum and the power delivered by the source is maximum.
 i.e. $X_C = X_L \Rightarrow \frac{1}{\omega C} = \omega L$
- 34.(a) When current is passed through a spring, it gets compressed.
- 35.(d) Negative charge means an excess of electrons, which increases the mass of sphere B.
- 36.(d) Total flux is the total field lines passing through any closed area: $\phi = \frac{\Sigma q}{\epsilon_0} = 0$ i.e., net charge on dipole is zero.
- 37.(b) The given arrangement is equivalent to the parallel combination of three identical capacitors. Hence equivalent capacitance = $3C = \frac{3\epsilon_0 A}{d}$.
- 38.(c)
- 39.(b) Charged particles trace a circular path in a perpendicular magnetic field.
- 40.(b) Stopping potential does not depend on the relative distance between the source and the cell.
- 41.(d) The Nucleus of a heavy atom captures an electron of the k-orbit. This is a radioactive process, so the vacancy of this electron is filled by an outer electron and x-rays are produced.
- 42.(a) $h\nu = h\nu_0 + KE_{\max}$
 $\Rightarrow KE_{\max} = h\nu - h\nu_0$ On comparing this equation with $y = mx + c$, we get $m = h = \text{Universal constant}$
- 43.(a) P.E. $\propto -\frac{1}{r}$ and K.E. $\propto \frac{1}{r}$, As r increases, so K.E. decreases but P.E. increases.
- 44.(a) The penetration power of γ is 100 times that of β , while that of β is 100 times of α .
- 45.(a) The increasing order of energy gap: Tellurium < germanium < silicon
- 46.(b) Due to the large concentration of electrons in N-side and holes in P-side, they diffuse from their own side to the other side. Hence depletion region is produced.
- 47.(b) For the 'AND' gate, if the output is 1, then both inputs must be 1.
- 48.(a) The strong nuclear force operates over a very short range (on the order of 10^{-15} meters) and binds quarks together to form protons, neutrons, and other hadrons. It is much stronger than the electromagnetic force, but its range is limited.
- 49.(c) Proton is baryon particle. A proton is a baryon (hadron) composed of three quarks. A boson is a different class of particle characterized by integer spin.
- 50.(a) In case of full wave rectifier, the Fundamental frequency = $2 \times \text{mains frequency} = 2 \times 50 = 100 \text{ Hz}$

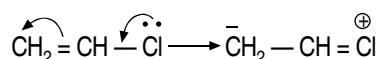
CHEMISTRY

- 51.(d) 5-bromo-2-nitro-1-methoxybenzene:



5-bromo-2-nitro-1-methoxybenzene

- 52.(a) The non-reactivity in cleavage of the C-Cl atom in $\text{CH}_2 = \text{CH} - \text{Cl}$ is due to resonance stabilisation. The lone pair on Cl - atom can participate in delocalisation to give two resonating structure.

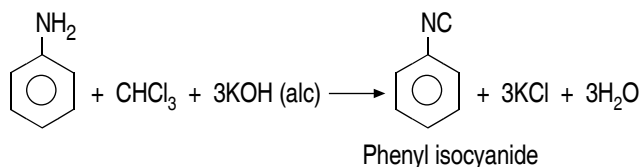
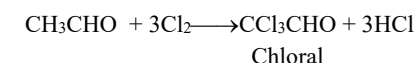


- 53.(b) Aromatic compounds exhibit following properties

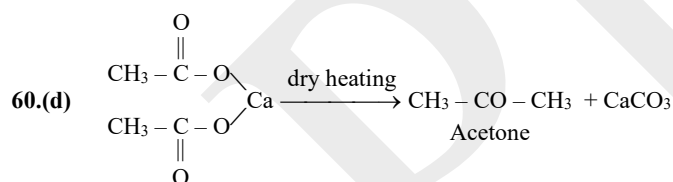
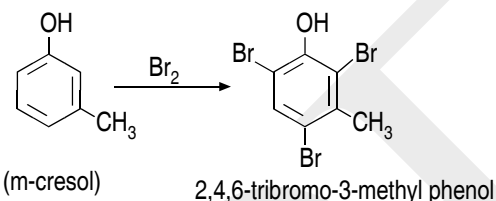
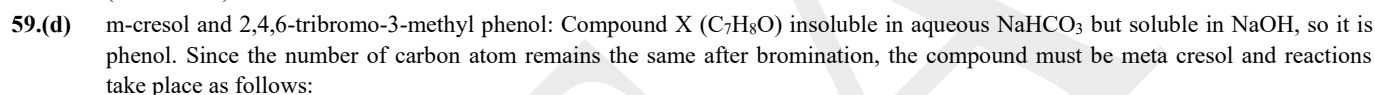
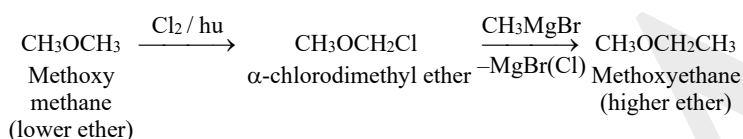
- They obey Huckel rule $(4n + 2)\pi e^-$
- They involve delocalisation of π -electron
- Molecule must be planar (i.e. sp^2 hybridised).

$\therefore$ Benzene satisfy all these conditions. So, it will be aromatic nature.

- 54.(d) $2\text{CH}_3\text{COONa} + 2\text{H}_2\text{O} \xrightarrow{\text{Electrolysis}} \text{CH}_3 - \text{CH}_3 + 2\text{CO}_2 + 2\text{NaOH} + \text{H}_2$. This reaction is known as Kolbe's electrolytic method.



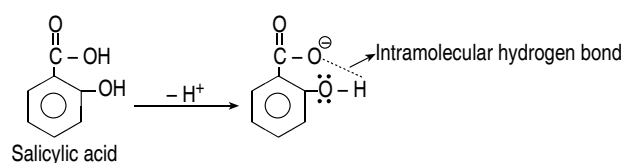
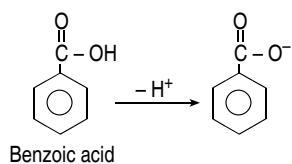
This reaction is called carbylamine reaction and it is actually the test of primarily amine.



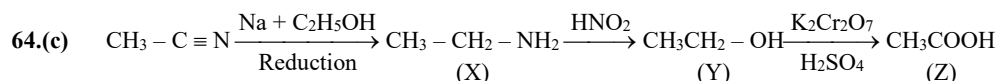
(Calcium acetate)

61.(b) When reaction between any alkene and water gas ($\text{CO} + \text{H}_2$) is occurs at high temperature and high pressure the product will be an aldehyde and this process is called oxo process.

62.(c) Iodoform test is carried out in hot alkaline medium. Under these conditions the esters will hydrolyse to give corresponding alcohols. Now ethyl alcohol will respond to iodoform test to give yellow ppt. of iodoform while methanol will give no iodoform test.



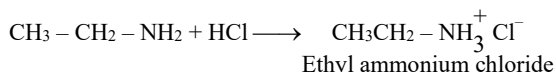
After transfer of proton, the hydrogen bonding in salicylate ion is stronger than the hydrogen bonding (intra molecular) in a salicylic acid. The conjugate base is more stabilized, hence salicylic acid is more acidic than benzoic acid.



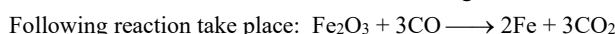
65.(a) The cyanide ion (CN^-) is a nucleophilic species due to its negative charge and the presence of lone pair of electrons on the carbon atom.

66.(c) Formaldehyde (HCHO) does not contain α -hydrogen. So, will not undergo aldol-condensation.

67.(d) Amines are basic in nature, they react with acid to form salt.



68.(d) In blast furnace at $400 - 600^\circ\text{C}$, for the smelting of iron



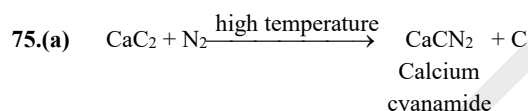
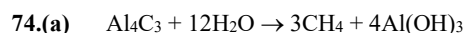
69.(b) Electropositive character decreases across the period as metallic character decreases.

70.(a) Mercury ores are rare. It occurs in small quantities in the native state. Cinnabar (HgS) is the most important ore of mercury.

71.(d) Hydrogen is a non-metal while all other members of group 1 (alkali metals) are metal.

72.(c) In the transition elements, the d-orbitals are successively filled. The general electronic configuration of d-block is $(n-1)d^{1-10}ns^{1-2}$

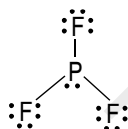
73.(a) Acidity of oxides increases with decrease in electropositive character of central atom. Be is least electropositive. So, it will produce most acidic oxide.



76.(c) For the purification of red bauxite which contains iron oxide as impurity $\rightarrow$ Baeyer's process.

For purification of white bauxite which contains silica as the main impurity $\rightarrow$ Serpeck's process.

77.(c) PF_3 has a lone pair on phosphorous and can donate electron, act as Lewis base. BF_3 and SiF_4 are electron-deficient and act as Lewis acid. CF_4 is very stable molecule with no lone pairs available for donation.



78.(a) The law of constant composition states that "a pure compound always contains the same elements in the same proportions by mass".

79.(c) One mole of electron = 6.023×10^{23} electron

Mass of one electron = $9.1 \times 10^{-28} \text{ gm}$

Mass of one mole of electrons

$$= 6.023 \times 10^{23} \times 9.1 \times 10^{-28} \text{ gm}$$

$$= 5.48 \times 10^{-4} \text{ gm}$$

$$= 5.48 \times 10^{-4} \times 1000 \text{ mg}$$

$$= 0.548 \text{ gm} \approx 0.55 \text{ mg}$$

80.(b) In a f-subshell, 14 electrons can be accommodated, out of which 7 will have clockwise spin and 7 will have anti-clockwise spin.

81.(a) Given that

$P_1 = 76 \text{ cm}$ of Hg (Initial pressure at N.T.P.)

$P_2 = ?$, $V_1 = 5 \text{ litre}$, $V_2 = 30 + 5 = 35 \text{ litres}$

According to Boyle's law

$$P_1 V_1 = P_2 V_2 ; 76 \times 5 = P_2 \times 35$$

$$P_2 = \frac{76 \times 5}{35} \Rightarrow P_2 = 10.8 \text{ cm of Hg}$$

82.(c) Milli equivalents of $\text{H}_2\text{SO}_4 = 30 \times 1 = 30$

Milli. eq. of H_2SO_4 after passing $\text{NH}_3 = 30 \times 0.2 = 6$

Milli. eq. of H_2SO_4 lost = $30 - 6 = 24$

So, Milli. eq. of ammonia passed = Milli. eq. of H_2SO_4 lost

$$\Rightarrow \frac{w}{17} \times 1000 = 24 \quad W_{\text{NH}_3} = 0.408\text{g}$$

Now,

17 gm of ammonia gas required 22.4ℓ

$$0.408 \text{ gm of ammonia gas required} = \frac{22.4}{17} \times 0.408 = \frac{22.4 \times 0.408}{17} = 0.5376 \text{ litre} = 537.6\text{mL}$$

$\therefore$ Volume of ammonia gas required = 537.6 mL.

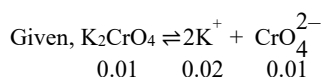
83.(a) 0.2 water + 0.8 ethanol

X_A = mole fraction of water, X_B = mole fraction of ethanol

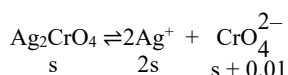
$$X_A = \frac{N_1}{N_1 + N_2}, X_B = \frac{N_2}{N_2 + N_1} \quad \therefore \text{Mole fraction of water} = 0.2 \text{ and ethanol} = 0.8.$$

84.(c) Lowering the pressure would favor the side of the reaction with more moles of gas, which is the reactants side (1 mole of N_2 and 3 moles of H_2 , totaling 4 moles) compared to the products side (2 moles of NH_3). Therefore, lowering the pressure would decrease the yield of ammonia.

85.(d)



and for Ag_2CrO_4



$$K_{\text{sp}} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}]$$

$$K_{\text{sp}} = [2s]^2 \cdot (s + 0.01) \Rightarrow 4s^2 \cdot (s + 0.01)$$

$$= 4(2 \times 10^{-8}) \cdot (2 \times 10^{-8} + 0.01)$$

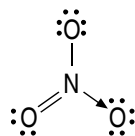
2×10^{-8} is very small as compared to 0.01. So, it can be neglected.

$$= 4 \times 4 \times 10^{-16} \times 0.01$$

$$= 16 \times 10^{-18}$$

86.(d) The equilibrium constant (K) depends only on temperature and not on the concentrations of reactants or product.

87.(b) Species with sp^2 hybridisation are plane triangular in shape. Among the given species NO_3^- is sp^2 hybridized with no lone pair of electrons on central atom, N. Whereas N_3 and CO_2 are sp hybridised a linear shape. NO_2^- are sp^2 hybridized but lone pair present on the central atom and bent structure.



88.(b) Half-life of zero order,

$$t_{1/2} = \frac{[A_0]}{2K}$$

$$\therefore t_{1/2} \propto [A_0]$$

$\therefore t_{1/2}$ will be doubled on doubling the initial concentration.

89.(b) $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \longrightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$

$$\Delta n = n_p - n_r = 3 - 6 = -3$$

$$\therefore \Delta H = \Delta E + \Delta nRT \text{ or } \Delta H - \Delta E = \Delta nRT = -3RT$$

90.(c) Heisenberg uncertainty principle: It is impossible to specify at any given moment both the position and momentum (velocity) of an electron.

91.(a) More negative is the reduction potential, greater will be the reducing power.

92.(c) Gold has higher reduction potential than iron. Thus, iron cannot be deposited on the surface of gold.

93.(a) $\Delta H = 186.5 \text{ KJ mol}^{-1}$

Boiling point of water = $(100^{\circ}\text{C} + 273)\text{K} = 373\text{K}$, Entropy change $(\Delta S) = \frac{\Delta H}{T} = \frac{186.5}{373} = 0.5 \text{ KJmol}^{-1}\text{K}^{-1}$

- 94.(a) Body centered cubic lattice has a co-ordination number of 8.
- 95.(d) Both as addition and condensation polymer: On the basis of mode of formation, polymer are classified as addition polymer and condensation polymers.
- 96.(b) Toluene: Saccharin is made from toluene. Saccharin is an artificial sweetener used as a substitution for sugar. It is added to food substance and beverages to impart sweetness.
- 97.(c) The Castner-Kellner Cell is an electrolytic cell used for production of sodium hydroxide (NaOH) from aqueous brine solution (NaCl).
 At cathode
 $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$
 $\text{Na} + \text{Hg} \rightarrow \text{Na-Hg}$ (sodium amalgam)
 At anode
 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
- 98.(d) Portland cement is primarily made by heating a mixture of:
 Limestone – CaCO_3
 Clay – Silica and alumina
 Gypsum – $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- 99.(b) **Methyl orange** changes color in the acidic pH range, approximately **pH 3.1–4.4**. Therefore, it is suitable for titrations where the equivalence point lies in the acidic region, such as: **Strong acid + weak base $\rightarrow$ acidic equivalence point $\rightarrow$ methyl orange**
- 100.(a) **Distillation** is mainly used for separating and purifying **liquids**, based on differences in their boiling points. It is not a standard method for purifying **solid impurities**.

ZOOLOGY

- 101.(a) Maurer's dots are coarse, irregular granules found in RBCs infected with *Plasmodium falciparum*.
P. falciparum $\rightarrow$ Maurer's dots
P. vivax $\rightarrow$ Schüffner's dots
P. malariae $\rightarrow$ Ziemann's dots
- 102.(c) *Plasmodium* multiplies **asexually inside human RBCs by schizogony**. During this process, the parasite's nucleus divides repeatedly, followed by division of the cytoplasm to form numerous **merozoites**. Eventually, the RBC ruptures and releases the merozoites, which infect other RBCs.
- 103.(a) In the coelomic fluid of *Pheretima* (earthworm), **phagocytes are the most numerous and largest coelomocytes**. They are amoeboid cells that engulf foreign particles, microorganisms, and cellular debris, thereby helping in **defence and immunity**.
- 104.(b) In *Pheretima*, the accessory glands open into the genital papillae. These glands secrete substances that assist in reproduction and are associated with the genital region.
- 105.(d) During frog gastrulation, the small cells of the animal pole called micromeres divide rapidly and gradually spread over the large yolk-rich macromeres of the vegetal pole. This covering movement is known as epiboly
- 106.(b) The corpus luteum is a temporary endocrine structure formed after ovulation from the ruptured Graafian follicle. It secretes progesterone and is well developed in mammals such as rabbits.
 In frogs:
 True corpus luteum is absent or poorly developed.
 Ovaries mainly contain yolk-rich ova.
 Therefore, corpus luteum is absent in frog but present in rabbit.
- 107.(a)
- 108.(b) Mast cells are connective tissue cells that contain granules rich in substances such as histamine and heparin. They are particularly abundant in areolar (loose) connective tissue, especially around blood vessels.
- 109.(d) Cardiac muscle is a specialized, striated and involuntary muscle found in the heart. It contracts rhythmically and continuously throughout life.
- 110.(c) Nodes of Ranvier are small gaps between adjacent segments of the myelin sheath along a myelinated axon.
- 111.(a) Since, same animals of a niche have the similar requirements of food, light, water, space, shelter and mate, etc, so intraspecific competition (between animals of same species) is more acute than interspecific, when different animals have different requirements and adaptations (i.e., different niche). In same niche, there will always a competition but it is more severe, when similar animal species are present and less, when different animals are there with a few similar needs.
- 112.(b) The Cro-Magnon man had the largest cranial capacity among the given options.
 Approximate cranial capacities:

Cro-Magnon man → about 1600 cc

Neanderthal man → about 1450 cc

Peking man → about 1000 cc

Java ape man → about 900 cc

- 113.(d)** The theory of hot dilute soup was given by Haldane to refer to prebiotic oceans, where organic biomolecules were produced from simple inorganic compounds.
- 114.(a)** A **stone canal** is a part of the **water vascular system**, a unique feature of **echinoderms** such as starfishes and sea urchins. Therefore, its presence is characteristic of **phylum Echinodermata**.
- 115.(a)** Birds and reptiles → One occipital condyle (monocondylic).
Mammals and amphibians → Two occipital condyles (dicondylic).
- 116.(c)** *Antedon* belongs to Class Crinoidea of Phylum Echinodermata. Crinoids are commonly called sea lilies or feather stars. Although adult *Antedon* is free-swimming, it resembles a sea lily in appearance.
- Sea star → Class Asteroidea (e.g., *Asterias*)
 - Brittle star → Class Ophiuroidea (e.g., *Ophiura*)
 - Sea cucumber → Class Holothuroidea (e.g., *Holothuria*)
- 118.(b)** Haemoptysis means the expectoration (coughing out) of blood from the respiratory tract, usually due to lung diseases such as tuberculosis, bronchitis, or lung cancer.
- Haemoptysis = Blood with cough
 - Haematemesis = Blood with vomiting
- 119.(c)** Typhoid fever is an acute systemic infectious disease caused by the bacterium *Salmonella typhi*. It mainly spreads in areas with poor sanitation and contaminated food or water.
- Bacterial disease → True: Typhoid is caused by *Salmonella typhi*, a Gram-negative bacterium.
 - Affects small intestine → True: The bacteria invade the ileum (part of small intestine), especially Peyer's patches, leading to inflammation and ulceration.
 - Faeco-oral transmission → True: The infection spreads through contaminated food and water due to improper hygiene and sanitation.
- 120.(d)** • World AIDS day → 1st December • Malaria Day → 20th August
• Mosquito day → 29th August • World cancer → 4th February
- 121.(b)**
- T-lymphocytes → responsible for cell-mediated immunity (kills infected cells directly).
 - Macrophages → act as phagocytes and antigen-presenting cells, not antibody producers.
 - Neutrophils → involved in innate immunity and phagocytosis, not antibody formation.
- 122.(b)** Wharton's duct is the excretory duct of the submandibular gland. Blockage of this duct prevents saliva from reaching the mouth, leading to dry mouth and difficulty in chewing and swallowing.
- Submandibular gland → Wharton's duct
 - Parotid gland → Stensen's duct
 - Sublingual gland → Ducts of Rivinus
- 123.(b)** The duodenum is the first part of the small intestine. The common bile duct (carrying bile from the liver and gall bladder) and the pancreatic duct (carrying pancreatic juice) open into the duodenum through the hepatopancreatic ampulla (Ampulla of Vater). Therefore, a blockage at the entry point of these digestive secretions would affect the duodenum.
- 124.(b)** Flow of urine: Nephron → Collecting ducts → Renal pelvis → Ureter → Urinary bladder
- Urethra → carries urine from bladder to outside the body
 - Nephron → functional unit of kidney (urine formation site)
 - Renal artery → supplies blood to kidneys
- 125.(d)** The proximal convoluted tubule (PCT) is the main site of reabsorption in the nephron. About 65–70% of filtered water and sodium ions and almost all glucose and amino acids are reabsorbed here.
- Water → reabsorbed by osmosis.
 - Sodium ions (Na⁺) → actively reabsorbed.
 - Amino acids → almost completely reabsorbed by active transport.
 - Insulin → is a hormone produced by the pancreas, not a normal substance reabsorbed from the filtrate in the PCT.
- 126.(c)** Vitreous chamber in eyes lies in behind the lens. vitreous humour which helps maintain the shape of the eyeball
- 127.(c)** The tectorial membrane is an a cellular, gelatinous structure located within the cochlea of the inner ear, playing a crucial role in the auditory process
- 128.(b)** The epiglottis is a flap-like structure located at the top of the larynx. During swallowing, it automatically folds down to cover the opening of the trachea (windpipe), thus preventing food and liquids from entering the respiratory tract.

- 129.(d) Hemoglobin contains iron (Fe^{2+}) in its heme group. This iron binds reversibly with oxygen, allowing hemoglobin to transport oxygen from lungs to tissues.
- 130.(c) Capillary are the site of exchange of oxygen, carbon dioxide, nutrients, and wastes between blood and tissues. They have the smallest lumen and very thin (one-cell thick) walls, making diffusion efficient.
- 131.(b) Heart sounds are mainly of two types: “lub” and “dup”. The second heart sound, called “dup” (S2), is produced when the semilunar valves (aortic and pulmonary valves) close at the end of ventricular systole.
This closure prevents the backflow of blood into the ventricles and marks the beginning of ventricular relaxation (diastole).
- 132.(a) During vertebrate evolution, the forebrain (prosencephalon) has shown the greatest relative increase in size compared to other brain regions. This increase is mainly due to the enormous expansion of the cerebrum, especially the cerebral cortex.
- 133.(a) The ventral (anterior) root of a spinal nerve carries efferent (motor) fibres only. These include:
Somatic motor fibres → control voluntary muscles
Visceral motor fibres (autonomic) → control smooth muscle, cardiac muscle, and glands
In contrast, the dorsal root carries sensory (afferent) fibres
- 134.(a) The inner lining of the uterus (endometrium) has two parts. During menstruation, only the stratum functionalis is shed off when fertilization does not occur. The stratum basalis remains and helps rebuild the lining in the next cycle.
- 135.(c) Sperms are formed in the seminiferous tubules but are immature and non-motile. They gain motility and fertilizing ability in the epididymis during storage and maturation.
- 136.(c) The pituitary gland secretes growth hormone (GH), which is responsible for normal growth and height development.
- 137.(a) Menotaxis is the orientation of an animal at a constant angle to a stimulus, such as sunlight. The Grayling butterfly maintains a fixed angle with the sun while flying, which helps it escape predators effectively.
• Telotaxis → movement directed toward a single stimulus source.
• Tropotaxis → orientation by comparing stimuli received simultaneously by paired receptors.
• Klinotaxis → orientation achieved by successive sampling of stimulus intensity.
- 138.(c) • Arboreal: Animals adapted for living on trees, e.g., monkeys and squirrels.
• Cursorial: Animals adapted for running, e.g., horse and deer.
• Fossorial: Animals adapted for digging and burrowing, e.g., mole and rabbit.
• Aerial: Animals adapted for flying in air, e.g., birds and bats.
- 139.(c) • Antibodies: Proteins produced by B-cells that help destroy foreign antigens but are not the primary cause of graft recognition.
• T-cells: Immune cells involved in rejection, but they react against foreign MHC molecules.
• MHC molecules: Cell-surface proteins responsible for tissue compatibility; mismatch leads to transplant rejection.
• B-cells: Cells producing antibodies; they assist immune response but are not the main transplantation antigens.
- 140.(d) Biodegradable pollution is caused by substances that can be broken down naturally by microorganisms such as bacteria and fungi. Domestic wastes like vegetable peels, food remains, paper, and other organic materials decompose through natural processes, so they are included under biodegradable pollution.

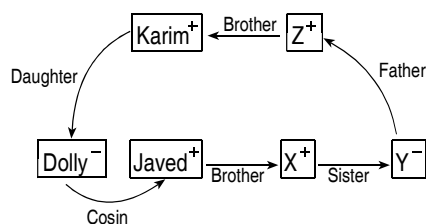
BOTANY

- 141.(c) This is the cellular process where messenger RNA (mRNA) is decoded to build a specific protein or enzyme.
- 142.(c) Glycerol is a component of lipids, not a carbohydrate
- 143.(d)
- 144.(c) A **bacteriophage** such as **T4 phage** has a characteristic **icosahedral head containing genetic material and ahelical tail** used for attachment to and injection of genetic material into bacteria.
- 145.(c) Conidia are non-motile spores produced exogenously by constrictions at the tip of special hyphae called conidiophores.
- 146.(d) **Helotism** refers to the symbiotic association between **algae and fungi**, as seen in **lichens**. The alga prepares food by photosynthesis, while the fungus provides water, minerals, shelter, and support.
- 147.(d) Sexual reproduction in *Spirogyra* can be described as fusion of two morphologically identical, but physiologically dissimilar gametes
- 148.(c) In **Funaria (moss)**, the **spore germinates to form a protonema**, which subsequently develops into the **leafy gametophyte**.
- 149.(d)
- 150.(d) Winged pollen grains produced in microsporangium represents the male gametophyte of *Pinus*.
- 151.(b) **Bisexual** — both stamens and carpels are present. **Zygomorphic** — the flower can be divided into two equal halves in only one plane. **Papilionaceous** — corolla consists of one standard, two wings, and two keel petals.
- 152.(d) Dalbergiasissoo is found in tropical climates in natural and planted forests of Nepal. Dalbergiasissoo (Shisham, Sissoo) is one of the most important timber species.
- 153.(d) Proto co-operation is the interaction between two living organisms of different species in which both are mutually benefitted but they can live without each other.

- 154.(b) In **primary succession**, the first organisms to establish themselves in a previously unoccupied, bare area are called **pioneer species**.
- 155.(c)
- 156.(a) Sclereids is composed of sclerenchymatous cells, lignified walls and long tubular pits. The sclereids may be spherical, oval, cylindrical, T-shaped, dumbbell-shaped or even stellate in size.
- 157.(d) The wall area bearing perforation is called perforation plate. Usually, the perforations in vessels are present in the end walls but they may be present in the lateral wall too.
- 158.(a) After secondary growth, the youngest layer of secondary phloem in a dicot stem is located just outside the vascular cambium.
- 159.(a) Glycolysis occurs in the cytoplasm of the cell, where glucose is broken down into pyruvate, producing a small amount of energy in the form of ATP. It is indeed an anaerobic process, meaning it does not require oxygen.
- 160.(a) A cell can gain or lose water from an adjacent cell on the basis of its D.P.D. This movement is from lower DPD (X) to higher DPD (Y).
- 161.(d) Photosynthesis is an oxidation reduction process where H_2O is oxidized by photolysis into O_2 and CO_2 is reduced into carbohydrates.
- 162.(d) In C_4 plants, the carbon dioxide fixation occurs in bundle sheath cells.
- 163.(d) $Acetyl\ CoA + Oxaloacetate + H_2O \xrightarrow[\text{Synthetase}]{\text{Citrate}} citrate + CoA$
- 164.(c) 50% of the sons are expected to be haemophilic, **while daughters are not affected but may be carriers**.
- 165.(b) Dominant factor: It is one of a pair of alleles which can express itself whether present in homozygous or heterozygous state.
- 166.(b) Mendel's law of independent assortment is not universally accepted and is applied only to genes present on different chromosomes and not to genes present on the same chromosome.
- 167.(b) DNA polymerase can add a new nucleotide only to the **free 3'-OH group** of the growing strand. Therefore, DNA synthesis always proceeds in the **5' → 3' direction**.
- 168.(d)
- 169.(b) *Mirabilis jalapa* shows incomplete dominance.
- 170.(d) Vacuole and Lysosomes are bound by a single membrane.
- 171.(d) Infoldings of plasma membrane in bacteria is called mesosomes, which are analogous to mitochondria.
- 172.(d) Ribosomes are called as site of protein synthesis because two sub-units of ribosomes are attached with the thread of mRNA. This mRNA contains anticodes for protein synthesis.
- 173.(b) The basic structural unit of chromatin is the **nucleosome**, in which a segment of **DNA is wrapped around a core of histone proteins**.
- 174.(d) When cells are not to divide after G_1 phase and start undergoing differentiation into specific types of cells, such cells are said to be in G_0 phase/ G_0 state.
- 175.(d) Separation of sister chromatids is carried out at anaphase-II. In anaphase-I, chromosome separation and movement take place.
- 176.(a) The flower that never opens, doesn't shed pollen, and has a bisexual flower is Cleistogamous flower. These flowers self-pollinate without opening.
- 177.(c) Pollen grains are able to withstand extreme temperatures and desiccation because their exine is composed of sporopollenin, which is highly resistant to degradation.
- 178.(b)
- 179.(b)
- 180.(a) **Golden Rice** is a genetically modified crop developed to produce increased amounts of **β -carotene(provitamin A)** in the rice endosperm. β -carotene can be converted into **vitamin A** in the human body.

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181.(b)



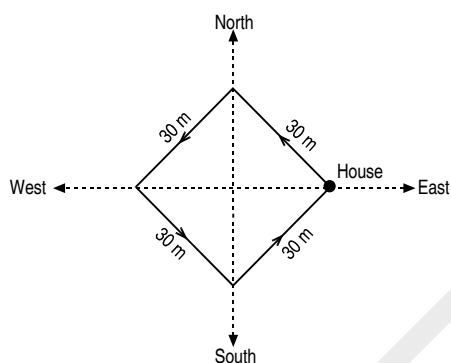
Hence, Javed is the cousin of Dolly.

182.(c) Cape is the land projected into water and bay is the portion of water body projected into land.

183.(c) $3 \times 2 - 1 = 6 - 1 = 5$
 $5 \times 2 - 2 = 10 - 2 = 8$
 $8 \times 2 - 3 = 16 - 3 = 13$
 $13 \times 2 - 4 = 26 - 4 = 22$
 $22 \times 2 - 5 = 44 - 5 = \boxed{39}$

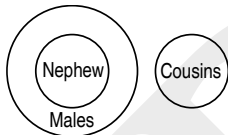
- 184.(b) Sadikshya leaves her house at 6:40 am
 She reaches Alisha's house in 25 min
 Both leave for office, 15 min after 7:05 am,
 i.e., 7:05 + 0:15 at 7:20 am.

- 185.(a) Movements are as follows :



Now, I am going in North-East Direction.

- 186.(d) Here, series moves with the addition of 6, 12, 24, 48, 96 and 192, respectively. Hence, the missing number is 202.
 187.(d) All nephews are males; cousin is a separate entity.



- 188.(d) Clearly, prevention from mosquitoes and elimination of mosquitoes are two ways to prevent malaria. So, both the courses follow.

- 189.(d) Ratio of boys and girls = 5 : 3

$$\therefore 5x + 3x = 640$$

$$X = 80 \quad \therefore \text{Number of girls} = 240$$

$$\text{Number of boys} = 400$$

Now, 30 more girls are admitted. So new number of girls = 270.

Let x new boys be admitted so that the ratio of boys and girls = 14 : 9

$$\therefore \frac{400 + x}{270} = \frac{14}{9}$$

$$\Rightarrow 3600 + 9x = 3780$$

$$\Rightarrow 9x = 180 \Rightarrow x = 20$$

- 190.(c) Let us find the weight he is using

$$\text{Gain\%} = \frac{\text{Error}}{\text{True value} - \text{error}} \times 100$$

$$25\% = \frac{x}{1000 - x}$$

$$\frac{25}{100} = \frac{x}{1000 - x}$$

$$\frac{1}{4} = \frac{x}{1000 - x}$$

$$1000 - x = 4x$$

$$5x = 1000$$

$$\Rightarrow x = 200$$

$\therefore$ He is using a weight of 800 gm. Customer is paying 10% less means he is paying for 900 gm

$\therefore$ On every 800 gm he is getting a profit of 100gm

$$\therefore \text{Profit}\% = \frac{100}{800} \times 100 = 12.5\%$$

191.(b) $n_1 = 10, a_1 = 30, n_2 = 5, a_2 = 33$

$$\therefore \text{Average} = \frac{n_1 a_1 + n_2 a_2}{n_1 + n_2} = \frac{10 \times 30 + 5 \times 33}{10 + 5} = 31 \text{ years}$$

192.(c) Let the time taken by the three friends together to do the work be x hours.

Then, time taken by Anne alone = $(x + 6)$ hrs;

time taken by Bob alone = $(x + 1)$ hrs;

time taken by Chris alone = $2x$ hrs.

According to the question,

$$\frac{1}{x+6} + \frac{1}{x+1} + \frac{1}{2x} = \frac{1}{x}$$

$$\Rightarrow \frac{2x(x+1) + 2x(x+6) + (x+1)(x+6)}{2x(x+6)(x+1)} = \frac{1}{x}$$

$$\Rightarrow 5x^2 + 21x + 6 = 2(x^2 + 7x + 6)$$

$$\Rightarrow 3x^2 + 7x - 6 = 0$$

$$\Rightarrow (x+3)(3x-2) = 0 \Rightarrow x = \frac{2}{3} \quad [\because x \neq -3]$$

$$\therefore \text{Required time} = \frac{2}{3} \text{ hrs} = \left(\frac{2}{3} \times 60\right) \text{ min} = 40 \text{ min}$$

193.(b) Due to stoppage, the bus covers $(64 - 48) = 16$ km less per hour.

$$\text{Time taken to cover 16 km} = \left(\frac{16}{64} \times 60\right) \text{ min} = 15 \text{ min.}$$

Hence, stoppage time per hour = 15 min.

194.(b) Let the Original number is $(X + 10Y)$

According to question,

Sum of the digit of the number = 12

$$X + Y = 12 \text{ ----- (1)}$$

When digit interchanged, number become 36 more than original number, so, $10X + Y = 10Y + X + 36$

$$X - Y = 4 \text{ ----- (2)}$$

On solving equation (1) and (2), we get

$$X = 8 \qquad Y = 4$$

So, original number = $X + 10Y = 8 + 10 \times 4 = 48$

195.(b) Part filled by $(A + B + C)$ in 3 minutes = 3

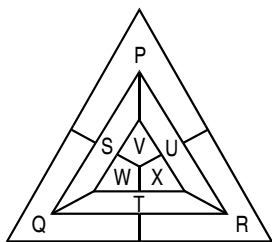
$$= 3 \times \left(\frac{1}{30} + \frac{1}{20} + \frac{1}{10}\right) = \left(3 \times \frac{11}{60}\right) = \frac{11}{20}$$

$$\text{Part filled by C in 3 minutes} = \frac{3}{10}$$

$$\therefore \text{Required ratio} = \left(\frac{3}{10} \times \frac{20}{11}\right) = \frac{6}{11}$$

196.(a) In each step, the dot moves one space CW and the arrow moves two spaces CW.

197.(a) The various spaces in the figure may be labelled as shown.



The spaces P, Q and R have to be shaded by three different colours definitely (since each of these three spaces lies adjacent to the other two). Now, in order that no two adjacent spaces be shaded with the colours of the spaces T, U and S must be shaded with the colours of the spaces P, Q and R respectively. Also, the spaces X, V and W must be shaded with the colours of the spaces S, T and U respectively i.e., with the colours of the spaces R, P and Q respectively. Thus, minimum three colours are required.

- 198.(c)** When the sheet in fig. (X) is folded, then one of the faces of the cube formed will be of the form and this face will lie opposite the face bearing a square. Also, one of the blank faces lies opposite another blank face and the third blank face lies opposite the face bearing an '=' sign. Clearly, all the three blank faces cannot appear adjacent to each other. So, the cube shown in fig. (2) which has all the three blank faces adjacent to each other cannot be formed. Hence, only the cubes shown in figures 1, 3 and 4 can be formed.

199.(b)

- 200.(b)** 1, 5, 6 have two similar elements, one inside the other.
 2, 3, 4 contain straight lines each dividing, the figure into two equal parts.
 7, 8, 9 have one element placed inside a different element.

...The End...