Answers SAMPLE PAPER-4

1. The distance of image is equal to the distance of object from the mirror. Therefore, the distance of image from the mirror is 10 cm. (1)

Or

Given, focal length of concave mirror, $f = -10$ cm

Distance of object from concave mirror, $u = -20$ cm

From the mirror formula,

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

$$\Rightarrow \quad \frac{1}{-20}+\frac{1}{v}=\frac{1}{-10}$$

$$\Rightarrow \quad \frac{1}{v}=\frac{1}{20}-\frac{1}{10}$$

$$\Rightarrow \quad \frac{1}{v}=\frac{1-2}{20} \Rightarrow \frac{1}{v}=\frac{-1}{20}$$

$$\Rightarrow \quad v=-20 \text{ cm}$$

(1)

2. Carbon tetrachloride is a covalent compound and covalent compounds comprises only atoms and not ions. Thus, due to the absence of ions, these are generally poor conductors of electricity. (1)

3. The diaphragm and intercostal muscles relax when we breathe out. This compresses the chest cavity forcing the air out of lungs. (1)

4. Refractive index of medium w.r.t air,

$$_a\mu_m = \frac{\text{Speed of light in air}}{\text{Speed of light in medium}} = \frac{3\times10^8}{2.5\times10^8} = 1.2$$

(1)

Or

Since light rays in the medium *B* goes towards normal. So, it has greater refractive index and lesser velocity of light w.r.t. medium *A*. So, refractive index of medium *B* w.r.t. medium *A* is greater than unity. (1)

5. As the pH increases, acidity decreases. Thus, the correct order of acidity of *A*, *B*, *C* and *D* is

$$C < B < D < A$$

pH 8 7 6 2

~~Hence, the image is formed at the centre of curvature of mirror.~~ (1)

6. The enzyme salivary amylase is involved in the starch digestion in mouth. Lipase helps in fat digestion, protease is involved in the digestion of proteins. (1)

Or

'Budding' is seen in *Hydra*. Parent *Hydra* develops a bud at its lower end. This grow in size and finally breaks off to live independently. (1)

7. Given, heat, $H = 100$ J

Resistance, $R = 4\Omega$

Time, $t = 1$s

Heat produced, $H = I^2Rt \Rightarrow I = \sqrt{\frac{H}{Rt}} = \sqrt{\frac{100}{4\times1}} = 5A$

Potential difference across the resistor, $V = IR = 5 \times 4 = 20V$ (1)

8. It the bottom of a vessel is getting black, then it means that the air holes are blocked and fuel is getting wasted as it is not burning completely. (1)

Or

Substances that are capable of providing oxygen to other substances are called oxidising agents.

Alkaline potassium permanganate ($KMnO_4$) or acidified potassium dichromate ($K_2Cr_2O_7$) act as an oxidising agent in oxidising alcohols into acids. (1)

9. The glucose which enters nephron along with filterate is selectively reabsorbed since, urine flows along the tube. (1)

Or

The respiration include breaking down of digested food using oxygen. Since, the respiration produces a lot of energy in form of ATP, it is exothermic process in nature. (1)

10. According to Rayleigh, the amplitude of scattered light (a) is inversely proportional to the square of wavelength (λ) i.e., (1)

$$a \propto \frac{1}{\lambda^2}$$

11. Sodium (*A*) burns with golden flame. It combines with chlorine (*B*), (atomic number 17) to give NaCl (*C*), aqueous solution of which on electrolysis produces NaOH (*D*) and hydrogen gas.
Thus compound *D* is NaOH. (1)

12. The colour of the emergent ray will be white because the outer faces of the prism behave like hollow plates. (1)

13. An alloy is a homogeneous mixture of two or more metals or a metal and a non-metal. It is prepared by mixing the metals in molten form and then cooling the mixture. The electrical conductivity and melting point of an alloy is less than that of pure metals. (1)

e.g.

Alloy	Composition	Uses
Brass	Cooper and zinc	Utensils and taps
Bronze	Cooper and tin	Medals, statues and valves

Or

A series of similarly constiuted compounds in which the members present have the same functional group and similar chemical properties and any two successive members in a particular series differ in their molecular formula by ($—CH_2$) unit, is called a homologous series. e.g. Alkane series C_nH_{2n+2}.

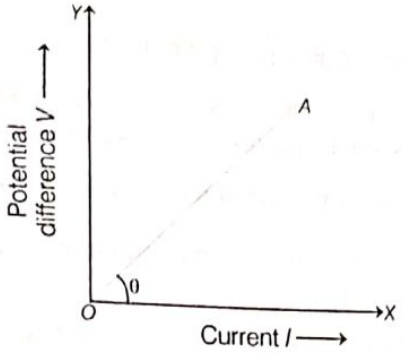
CH_4	Methane	C_2H_6	Ethane
C_3H_3	Propane	C_4H_{10}	Butane
C_5H_{12}	Pentane		

(1)

14. (c) Transpiration is a process in which water is lost in the form of water vapour. It occurs through the stomata present on the leaves. Hence, Assertion is true, but Reason is false. (1)

15. (a) According to Ohm's law, $V \propto I$

Hence, the graph of V *versus* I is a straight line.



V-I graph for metal conductor

Both Assertion and Reason are correct and Reason is the correct explanation of Assertion. (1)

16. (c) Food cans are not coated with zinc because it being more reactive than tin, can react with organic acids present in the food. Assertion is true but Reason is false. (1)

17.

17. (i) (c) Pollination, fertilisation, embryo, seedling. (1)

17. (ii) (a) Generative nucleus and tube nucleus. (1)

17. (iii) (d) Fertilisation of egg and central cell by two sperms brough by same pollen tube. (1)

17. (iv) (c) Stigma and anther mature at the same time. (1)

17. (v) (d) Tapetum help in the dehiscence of anther. (1)

18.

18. (i) (c) Metallic character increase as the size increase

∵ Size of $C > D > A$

Metallic character of $C > D > A$. i.e. Increasing order is A < D < C (1)

18. (ii) (b) Element B (aluminium) can form amphoteric oxide, i.e. Al_2O_3. (1)

18. (iii) (c) Element 'A' is sodium. It readily gives electron in last shell to react with halogen. It is also immersed in kerosene to prevent its reactivity with atmosphere as it form Na_2O_2. It loses electron and it is metallic in nature. It have low value of electronegativity. (1)

18. (iv) (c) 'D' element has two electrons in last shell. It readily loses electron to achieve stable inert gas configuration. Hence, it is metallic in nature. (1)

18. (v) (a) ∵ Element A, B, E have same number of shell (1)

∴ The belong to same period.

19.

19. (i) (c) Heat produced in a wire is directly proportional to square of current (I^2). So, heat produced will become four times. (1)

19. (ii) (b) Power of bulb, $P = I^2R$

For the same current $P \propto R$

but for the same voltage $P \propto \frac{1}{R}$ or $R \propto \frac{1}{P}$

So, resistance order of all bulb is, $R_{25W} > R_{40W} > R_{60W}$

According to Joule's law of heating, $H \propto R$ (for the same current and time)

Hence, order of heat produced is $H_{25W} > H_{40W} > H_{60W}$. (1)

19. (iii) (c) The most of electric power consumed by the filament of an electric bulb appears as heat, only a small amount of electric power is converted into light. So, filament type electric bulbs are not power efficient. (1)

19. (iv) (b) Given, $V = 250$ V

$R = 500\,\Omega$ and $t = 10$ s

Current, $I = \frac{V}{R} = \frac{250}{500} = 0.5$ A

Heat energy produced,

$H = I^2Rt = (0.5)^2 \times 500 \times 10 = 1250$ J (1)

19. (v) (b) In series combination, less current will flow due to increase in resistance of the circuit and potential difference across each resistance is less than that of applied potential. While in parallel combination for the same potential, current is inversely proportional to resistance $\left(I \propto \frac{1}{R}\right)$, so more current will flow through R_1 than that in series combination. Hence, from Joule's law of heating,

$H = I^2Rt$

Heat produced in R_1 in parallel combination will be more as compared to their series combination. More heat will be produceed in R_1 in circuit II as compared to other two resistors (for $R_1 > R_2 > R_3$). (1)

20.

20. (i) (a) It is an organ that is found in all species. (1)

20. (ii) (c) The placenta allow oxygen and nutrient to diffuse from the mother blood into embryonic blood capillaries and remove metabolic water such as CO_2 and used from the embryo blood. (1)

20. (iii) (a) Egg has much large size than a sperm. The number of egg produced is few hundred, while sperm produced in billion. (1)

20. (iv) (b) The umbilical vein use carries oxygenated blood and the umbilical artery carries deoxygenated blood. (1)

20. (v) (a) Ovulation occur between day 11 to 17 day or 14 to 28 day menstrual cycle when the uterus lining has reached is maximum thickness. (1)

21. (i) **Permanent magnet** It produces a strong magnetic field across rectangular coil in electric motor. This field is used to rotate the coil when current flows through it. (1)

(ii) **Split rings (commutator)** The function of commutator is to reverse the direction of current flowing through the coil after every half rotation. In an electric motor, split rings acts as commutator. (1)

22. It is a lustrous, divalent element, so it is a metal and only very reactive metal can react with NaOH. In the first case, a base reacts with a metal, and in the second case, an acid reacts with a metal.

Hence, hydrogen gas is most likely to be produced during these reactions.

The produced H_2 gas can be identified by bringing matchstick near the reaction vessel. The gas burns with a pop sound. This confirms that the gas is H_2.

$$M + 2NaOH \longrightarrow Na_2MO_2 + H_2$$

$$M + 2HCl \longrightarrow MCl_2 + H_2$$ (2)

23. (i) Reproductive health education is important as it makes us aware of various issues related with reproductive health, e.g. contraception and its measures. It help us to prevent and control transmission (spreading) of various STDs. (1)

(ii) Birth control is practiced for family planning. Its use helps to avoid unwanted pregnancy. Knowledge of birth control is necessary to curb the growing population and occurrence of STDs in sexually active individuals. (1)

Or

The reproductive structures with their functions are as follows :

(i) **Vagina** receives the sperms from the male partner and also serves as birth canal.

(ii) **Oviduct** carries ova or egg from ovary to the uterus and is the site for egg's fertilisation. (2)

24. (i) **Human beings** excrete out nitrogenous wastes generated by various metabolic activities in the form of urine through the process of urination.

(ii) **Unicellular organisms** excrete out wastes accumulated in body through the process of diffusion.

(iii) **Plants** remove excess water through the process of transpiration. (2)

25. The given reactions are completed as follows :

$$\underset{(X)}{2NaOH} + Zn \longrightarrow \underset{(A)}{Na_2ZnO_2} + H_2\,(g)$$

$$\underset{(X)}{NaOH} + HCl \longrightarrow \underset{(B)}{NaCl} + H_2O$$

$$\underset{(X)}{NaOH} + CH_3COOH \longrightarrow \underset{(C)}{CH_3COO^-Na^+} + H_2O$$

Thus, X – NaOH (Sodium hydroxide)
A – Na_2ZnO_2 (Sodium zincate)
B – NaCl (Sodium chloride)
C – CH_3COONa (Sodium acetate)

(2)

Or

(i) $\underset{\text{Hydrochloric acid}}{HCl}\,(aq) \rightleftharpoons H^+(aq) + Cl^-(aq)$

(ii) $HNO_3\,(aq) \rightleftharpoons H^+(aq) + NO_3^-(aq)$ (Nitric acid)

(iii) $\underset{\text{Sulphuric acid}}{H_2SO_4}\,(aq) \rightleftharpoons 2H^+(aq) + SO_4^{2-}(aq)$

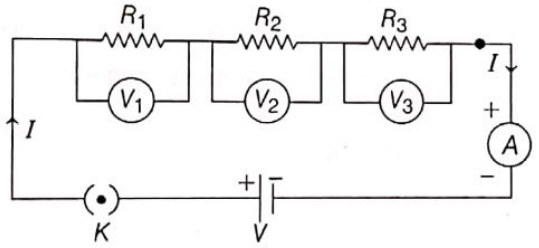
(iv) $\underset{\text{Sodium hydroxide}}{NaOH}\,(aq) \rightleftharpoons Na^+(aq) + OH^-(aq)$

(v) $\underset{\text{Potassium hydroxide}}{KOH}\,(aq) \rightleftharpoons K^+(aq) + OH^-(aq)$

(vi) $\underset{\text{Magnesium hydroxide}}{Mg(OH)_2}\,(aq) \rightleftharpoons Mg^{2+}(aq) + 2OH^-(aq)$

(2)

26. **Series combination of resistors** When two or more resistors are connected end to end, then they are said to be **connected in series**. The following figure shows the connection of resistors in series:



(1)

An applied potential V produces current I in the resistors R_1, R_2 and R_3 causing a potential drop V_1, V_2 and V_3 respectively, through each resistor.

Total potential, $V = V_1 + V_2 + V_3$

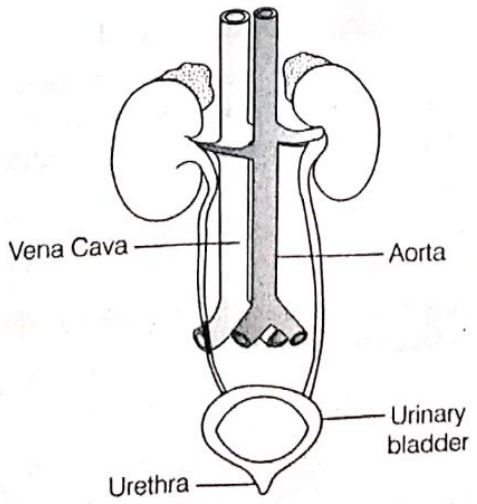
By Ohm's law, $V_1 = IR_1, V_2 = IR_2$ and $V_3 = IR_3$

Thus, $V = V_1 + V_2 + V_3 = IR_1 + IR_2 + IR_3 \Rightarrow V = I(R_1 + R_2 + R_3)$

If R be the equivalent resistance, $V = IR$

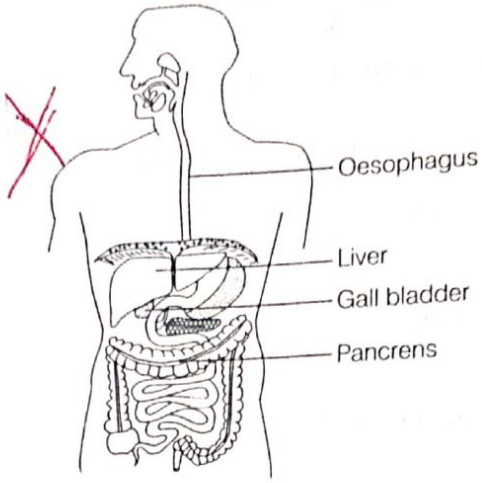
Hence, $IR = I(R_1 + R_2 + R_3) \Rightarrow R = R_1 + R_2 + R_3$ (1)

27. (i) **Human Excretory System**



Aorta and vena cava are components of the circulatory system. (1½)

(ii) **The Two Vital Functions of Kidney**



(a) Kidney takes wastes out of blood and forms urine.

(b) Kidney maintain water balance of our body. (1½)

28. All children obtain chromosomes from both parents. Females have a perfect pair of sex chromosome (homogametic) and thus, contribute X–chromosome to both the sexes of progeny, but males have a mismatched pair (heterogametic) in which one is X-chromosome (normal size) and the other is Y-chromosome (short in size). Hence, an egg fertilised by X-chromosome carrying sperm results in a zygote with XX, which becomes a female and if an egg is fertilised by Y-chromosome carrying sperm, it results in a XY zygote that becomes male.

Thus, the sex of the children is determined by the type of gamete they inherit from their father. (3)

29. (i) The power of lens is defined as the reciprocal of its focal length.

$$\text{Power of lens} = \frac{1}{\text{Focal length of the lens}}$$

i.e., $P = \frac{1}{f}$

The unit of power of a lens is dioptre (D). (1)

(ii) Power of combination of lenses,

$$P = P_1 + P_2$$

$$= +3.5 + (-2.5) = 3.5 - 2.5 = +1.0\ \text{D}$$

$$\text{Power, } P = \frac{1}{f}$$

$$1 = \frac{1}{f}$$

$$f = +1\ \text{m}$$

So, the focal length of this combination of lenses is +1 m. (2)

30. Carbon has 4 electrons in its outermost shell. It cannot lose 4 electrons to form C^{4+} cation because very high energy is required to remove 4 electrons leaving behind a carbon with 6 protons in its nucleus holding onto just 2 electrons. It also cannot gain 4 electrons to form C^{4-} anion because it is difficult for 6 protons to hold into 10 electrons.

The type of bonds formed in ionic compounds are ionic or electrovalent bonds and in compounds formed by carbon are covalent bonds. (2)

As the molecules in covalent compounds are held by weak van der Waals' forces, hence they have low melting point as compared to ionic compounds. (1)

31. *X* is calcium carbonate ($CaCO_3$).

Y is slaked lime [$Ca(OH)_2$].

G is chlorine (Cl_2) gas.

Z is bleaching powder ($CaOCl_2$).

The reactions involved are :

(i) $\underset{(X)}{CaCO_3(s)} \xrightarrow{\Delta} CaO(s) + \underset{\text{(Acidic gas)}}{CO_2(g)}\uparrow$

(ii) $CO_2(g) + \underset{(Y)}{Ca(OH)_2(aq)} \longrightarrow \underset{(X)}{CaCO_3(s)} + H_2O(g)$

(iii) $2NaCl\,(aq) + 2H_2O\,(l) \longrightarrow 2NaOH\,(aq) + Cl_2(g) + H_2(g)$

(iv) $\underset{(G)}{Cl_2(g)} + \underset{\substack{(Dry)\\(Y)}}{Ca(OH)_2(s)} \longrightarrow \underset{(Z)}{CaOCl_2(s)} + H_2O(l)$ (3)

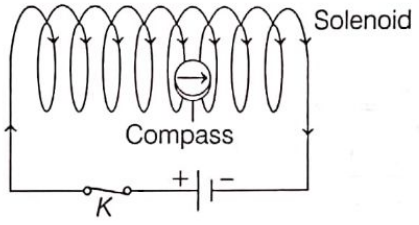
32. (i) When North-pole is pushed into the coil, a momentary deflection is observed in the galvanometer. This deflection indicates that a momentary current is produced in the coil. The direction of current in the coil will be anti-clockwise. (1)

(ii) When the magnet is at rest, there is no deflection is the galvanometer. It indicates that no current is produced in the coil in this case. (1)

(iii) When the magnet is pulled out of the coil, a deflection in the opposite direction is observed. It indicates that the current produced in the coil is in opposite direction. (1)

Or

(i) As the current flows from the positive terminal to the negative terminal, so current flows in solenoid as shown below



(1)

(ii) The direction of the magnetic field inside the solenoid always points from the induced South-pole towards the induced North-pole. (1)

(iii) If the key *K* is opened, the current in solenoid coil become zero and the uniform magnetic field produced on the axis of solenoid will vanish. However, the compass needle will point in the direction North and South due to Earth's magnetic field. (1)

33. The biotic component of the ecosystem includes the living organisms. On the basis of the manner in which they obtain their sustenance from the environment, they can be classified into the following groups :

(i) **Producers** These include all the green plants and blue-green algae. Which can produce food by the process of photosynthesis. They are the source of nutrition for rest of the ecosystem. (1)

(ii) **Consumers** The organisms which are dependent on producers for their nutritional requirement and consume food prepared by producers. They are further divided into following three categories :

- **Herbivores** These are **primary** or **first order consumers** which feed directly on the producers, i.e. plants. e.g. grazing animals like zebra, goat, horse, sheep, etc.
- **Carnivores** These are the animals that feed on other animals.The carnivores which feed on herbivores are called **second order consumers.** (2)
- **Omnivores** These are animals that feed on both plants and animals, e.g. humans and bears.

(iii) **Decomposers** These are microorganisms which feed on decaying and dead organic matter. They breakdown the remains of dead animals and plants, to releases various substances that can be used by other members of the ecosystem, e.g. bacteria and fungi. (2)

34. (i) (a) The magnification +1 produced by a plane mirror means that the image formed is virtual and erect and of same size as that of object. (1)

(b) If the magnification has minus sign, then the image is real and inverted and the size of the image is $\left(\frac{3}{4}\right)$th the size of that of object, i.e., diminished. (1)

(ii) Given, for convex mirror, $u = -20$ m and $R = 4$ m

So, focal length, $f = \frac{R}{2} = \frac{4}{2} = 2$ m

Using mirror formula, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{2} + \frac{1}{20} = \frac{10+1}{20} = \frac{11}{20}$ or $v = \frac{20}{11} = 1.81$ m

Thus, the car would appears at a distance of 1.81 m from the convex mirror.

As we know that, magnification, $m = \frac{-v}{u} = \frac{-20/11}{-20} = \frac{1}{11}$

Thus, the size of the image of the car will be a fraction of $\left(\frac{1}{11}\right)$ th of the actual size of the car through the convex mirror. (3)

Or

(i) Given, power of lens, $P = +1.5$ D

As power, $P = \frac{1}{f \text{ (in metre)}}$

So, $f = \frac{1}{P} = \frac{1}{1.5} = \frac{10}{15} = 0.67$ m $\Rightarrow f = 0.67 \times 100 = 67$ cm

It is a converging lens because its focal length is positive. (2)

(ii) Given, focal length of the lens, $f = -30$ cm

Distance of an object, $u = ?$

$\therefore$ Magnification, $m = \frac{\pm v}{u}$

$\Rightarrow \quad \frac{1}{2} = \frac{\pm v}{u} \Rightarrow v = \pm \frac{1}{2} u$.

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

Case I

If $v = +\frac{1}{2}u \Rightarrow \frac{1}{-30} = \frac{2}{u} - \frac{1}{u} = \frac{+2-1}{u} \Rightarrow \frac{1}{30} = \frac{-1}{u}$ or $u = -30$ cm

Case II

If $v = -\frac{1}{2}u \Rightarrow -\frac{1}{30} = -\frac{2}{u} - \frac{1}{u} = \frac{-1-2}{u} = \frac{-3}{u}$ or $\frac{1}{30} = \frac{3}{u} \Rightarrow u = 90$ cm

$u = +90$ cm is not possible.

$\therefore$ The object distance is 30 cm. (3)

35. Water of crystallisation is the fixed number of water molecules present in one formula unit of a salt. The common name for compound containing ten molecules of water of crystallisation is washing soda and its chemical formula is $Na_2CO_3.10H_2O$. (1)

Preparation

$$\underset{\text{Sodium chloride}}{NaCl(s)} + \underset{\text{Water}}{H_2O(l)} + \underset{\text{Carbon dioxide}}{CO_2(g)} + \underset{\text{Ammonia}}{NH_3(g)} \longrightarrow \underset{\text{Ammonium chloride}}{NH_4Cl(g)} + \underset{\text{Sodium bicarbonate}}{NaHCO_3(s)}$$

$$\underset{\text{Sodium bicarbonate}}{2NaHCO_3(s)} \xrightarrow{\text{Heat}} \underset{\text{Sodium carbonate}}{Na_2CO_3(s)} + H_2O(l) + CO_2(g)\uparrow$$

$$\underset{\text{Soda ash}}{Na_2CO_3(s)} + 10H_2O(l) \longrightarrow \underset{\text{Washing soda}}{Na_2CO_3.10H_2O(s)}$$

(2)

Uses : It is

(i) used in glass, soap and paper industries.

(ii) used for removing permanent hardness of water. (2)

36. (i) Difference between vegetative propagation and spore formation is:

Vegetative Propagation	Spore Formation
New plants are obtained from different parts of parent body like leaves, stems, etc.	Spores when fall on land, have the ability to germinate and produce new fungal colonies under favourable conditions.

(ii) Difference between bud of *Hydra* and *Bryophyllum* is:

Bud of *Hydra*	Bud of Bryophyllum
It is seen during budding as an outgrowth on the body of *Hydra* which gets fully grown and then detaches from the body and becomes a new individual.	This is present on the leaf margins of *Bryophyllum* and develop into a new plant when it comes in contact with soil and other favourable conditions.

(iii) Difference between fragmentation and regeneration is:

Fragmentation	Regeneration
The method in which multicellular organism breaks up into two or more smaller fragments each of which develop into mature organisms.	The growth of a whole new organism from any of its body part, i.e. single segment forming new individual.

(iv) Fission in *Amoeba* is binary and in *Plasmodium* is multiple. The difference is:

Binary Fission	Multiple Fission
The division of parental body into two identical daughter cells at a time.	The parental body divides into numerous daughter cells simultaneously.

(v) Difference between pollen tube and style are:

Pollen Tube	Style
It is a tube growing out of pollen grain when it reaches stigma.	The middle elongated part of the carpel, i.e. female part of a flower.
It transports male gametes from pollen grains to ovules.	The attachment of stigma to the ovary.

(1 × 5 = 5)

Or

(i) Its secretion form 20-30% of semen, which is essential for the mobility of sperms. (1)

(iii) It transfers sperm into the vagina of the female during copulation. (1)

(iii) It is a common passage for both the sperms and urine. (1)

(iv) It produces sperms and male sex hormones called testosterone. (1)

(v) Ureter takes urine form kidney to urinary bladder. (1)