Question Bank
Pollination and Fertilisation

1. Define pollination. How does it differ from fertilisation?

Ans. Pollination is the transfer of pollen grains from the anthers to the stigma.

Fertilisation follows successful pollination and is the fusion of the nuclei of two dissimilar sexual units called the male and female gametes.

While pollination results in germination of pollen grains, formation of pollen tubes and the entry of pollen tube inside the ovary upto the ovules, fertilisation results in the formation of zygote and subsequently seeds.

2. Give two advantages and two disadvantages each of self and cross-pollination.

Ans. **Advantages of Self-pollination**

(i) Self-pollination being almost certain in bisexual flowers ensures continuity of the race.

(ii) Self-pollination helps to preserve the parental characters as the gametes from the same flower are involved.

(iii) It is economical as the plants do not have to produce pollen grains in large quantity.

(iv) Flowers need not be showy, nor they need to produce nectar or scent.

Disadvantages of Self-pollination

(i) New varieties cannot be obtained by self-pollination.

(ii) The genetic defects of the breed cannot be removed.

(iii) Repeated self-pollination leads to loss of vigour and vitality of the species. Seeds produced are smaller and weaker.

Advantages of Cross-pollination

(i) Cross-pollination results in healthier offsprings.

(ii) Seeds produced by cross-pollination have much better germinating capacity.

(iii) More abundant and viable seeds are produced.

(iv) Variations are introduced by cross-pollination.

Disadvantages of Cross-pollination

(i) Plants have to depend on external agencies for pollination, which may or may not be available at the proper time.

(ii) The pollen grains have to be produced in large quantity to ensure pollination. Thus, lot of pollen is wasted.

(iii) The process is less economical as various devices have to be adopted by the flowers to attract pollinating agents like the flowers have to be large, coloured, showy, scented and nectar producing.

3. State four differences between insect and wind-pollinated flowers.

Ans. Differences between Insect-and Wind-pollinated Flowers

Insect-pollinated flowers	Wind-pollinated flowers
1. Flowers have large and brightly coloured petals	Flowers are small and do not have showy petals.
2. Produce scent and nectar.	Do not produce scent and nectar.
3. Pollen grains are rough and sticky	Pollen grains are light and dry.
4. Pollen grains are produced in Small quantity.	Produced in large quantity.
5. Filaments short.	Filaments long to expose anthers in the air.
6. Stigmas are sticky, flat or knob-like.	Stigmas are large and feathery.
7. Essential whorls are not much exposed.	Male and female parts are exposed to wind.
8. Nectar guides are present on the petals.	Nectar guides generally absent.
Examples - *Salvia*, pea, petunia.	**Examples** - Maize, wheat, pine.

4. Give two examples each of wind, water and insect pollinated flowers.

Ans. Wind-pollinated flowers - Maize, pine.
Water-pollinated flowers - *Hydrilla*, *Vallisneria*.
Insect-pollinated flowers - Sweet pea, *Salvia*.

5. Normally, sepals fall after fertilisation. Name two fruits in which the sepals persist.

Ans. Brinjal, tomato.

6. In brief explain the method of pollination in a named flower.

Ans. The students can answer this question by taking any of the flowering examples:
(i) *Salvia* **(ii)** Sweet pea **(iii)** Maize **(iv)** *Vallisneria*.
All these are mentioned below for easy reference.

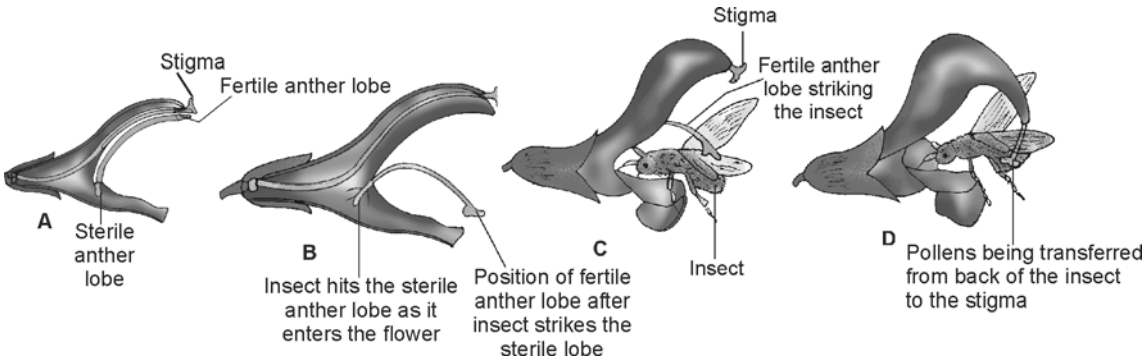
Insect-Pollination in *Salvia*

In *Salvia* pollination occurs by bees. The flower has bilipped (bilabiate) corolla with two epipetalous stamens.

The stamen and the style are hidden in upper lip forming a hood. The lower lip serves as landing place for the bee to alight on. The flower is protandrous, i.e., the stamen matures earlier than the carpel. The filament of stamen is very short and its upper end is connected to long curved connective. The connective acts as a lever whose unequal arms bear the two anther lobes; thus, the anther lobes are widely separated. The upper (outer) lobe is **fertile** while the lower one is **sterile** (without pollen grains). The sterile lobes of both anthers are situated at the corolla mouth which blocks the way to the nectar as the nectary is located at the base of the ovary.

When the bee enters the flower it pushes the lower sterile lobe, the long connective swings downward resulting in the bending of the stamen down with a jerk to sprinkle pollen grain on its back. When the bee visits another flower where stigma is ripe and is protruding out of the hood of upper lip, the pollen laiden back brushes against the stigma and the pollen grains stick to

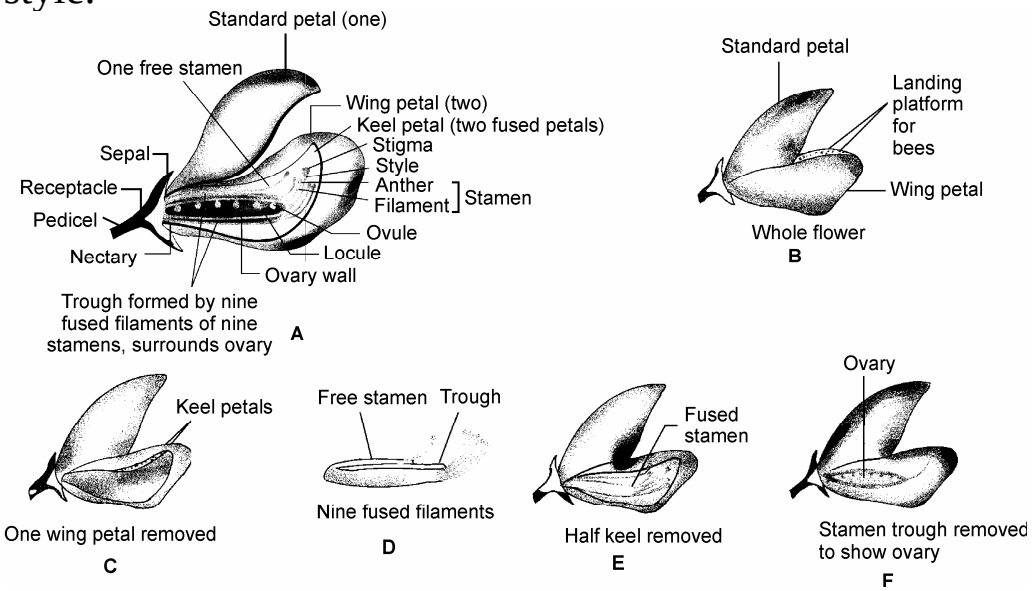
it. This is how pollination is brought about in *Salvia*, and is known as the **'lever mechanism'.**



Showing pollination in Salvia : A-B. L.S. of flower showing immature gynoecium and movement of stamen when pressed by insect C. A bee entering the corolla and getting dusted with pollen D. Bee entering another flower and transferring the pollen grains to stigma.

Pollination in Sweet pea (*Lathyrus*)

The sweet pea is pollinated by bumble bee. The flower has five petals—one large innermost **standard,** two lateral petals forming wing and the two innermost petals called the keel petals. There are 10 stamens, nine of which are fused together to form a staminal tube which encloses the ovary and part of style.

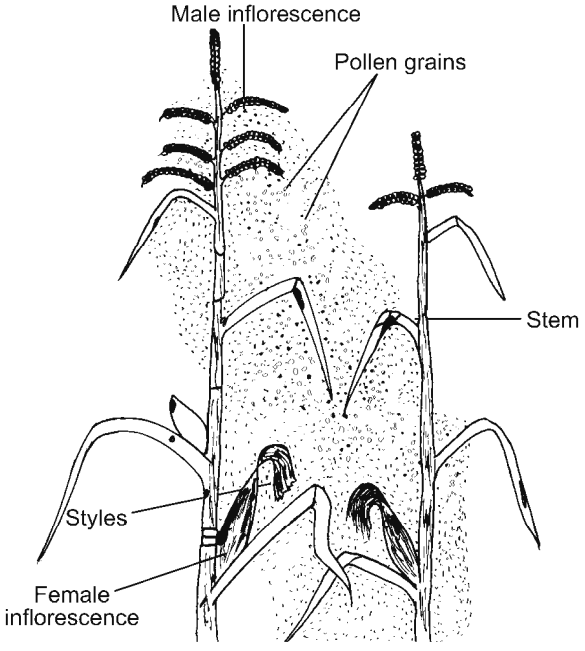


Showing structure of flower of sweet pea (A-F).

The bees are attracted by colour, scent and nectar. The two wing petals act as a landing platform for the bee. When a bee lands on the wing petals, its weight pulls them down along with the keel petals. The style and stigma emerge out touching the under surface of the bee that may be carrying the pollen from another flower, thus causing cross-pollination. Also, as the bee searches for nectar at the base of the ovary, the anthers may rub pollen grains against the body of the bee for cross-pollinating another flower.

Wind-Pollination in Maize

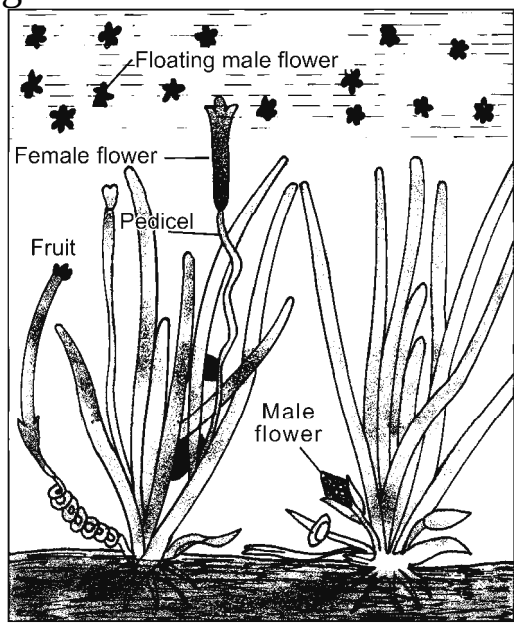
In maize plant, the male flowers are borne at the apex of the plant and the female flowers are borne near the base in the axil of the leaf. The male flowers produce large quantities of pollen grains. As the anthers burst, the pollen grains are blown by air current and many of them may fall on the feathery stigmas of the neighbouring plants which have long hanging styles with feathery stigma, thus bringing about cross-pollination.



Showing pollination in maize

Pollination in *Vallisneria*

Vallisneria is a unisexual submerged plant. The female flowers have long coiling stalks which bring the flowers on the surface of water. The male flowers grow under water. When ripe, the male flowers get detached from the plant and float on the surface of water. The free floating male flowers cluster around female flowers, their anthers burst and the pollen grains get attached to the stigma of female flowers. After pollination, the stalk of the female flower gets coiled, pulling the female flower once again under water.



Showing *Vallisneria* – a hydrophilous plant. A. Female plant B. Male plant.

7. State any three devices found in flowers which favour cross-pollination.

Ans. Devices which favour cross-pollination :

(i) Unisexuality : The unisexual flowers (male or female) may be borne on the same plant (as in maize, castor, cucumber) or on two separate plants (as in palm, mulberry, papaya). This condition favours cross-pollination.

(ii) Self Sterility : In this condition, the pollen grains of a flower do not germinate on the stigma of the same flower but germinate on the stigma of a flower borne by another plant of the same species; thus ensuring cross-pollination.
Examples - Apple, grape, rye.

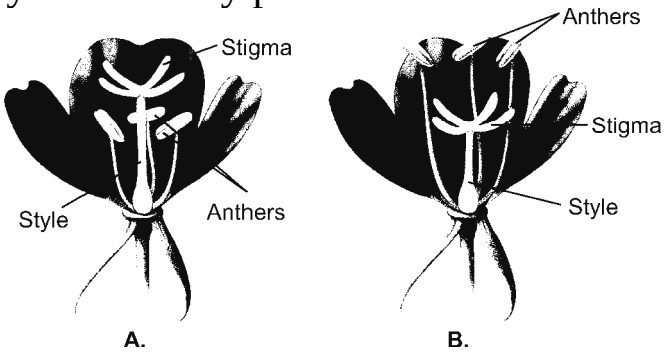
(iii) Dichogamy : The flowers are bisexual, but stamens and carpels mature at different times. This condition is known as **dichogamy** which stands as a barrier to self-pollination.
There are two states of dichogamy.

(a) Protogyny (Protos = first; **gyne** = female) : In this case, gynoecium matures earlier than the anthers of the same flower and the stigma receives the pollen grains brought from another flower.
Examples - Peepal, custard apple.

(b) Protoandry (Protos = first; **andros** = male): When the stamens mature earlier than the gynoecium of the same flower, the pollen grains are carried over to the stigma of another flower, as in pea, sunflower, salvia.

(iv) Herkogamy (Herkos = barrier) : In some bisexual flowers, some sort of barrier develops between stamens and the pistil of the same flower, thereby preventing self-pollination. For example, a hood covering the stigma acts as a barrier in pansy flowers. In *Gloriosa*, the stamens liberate the pollen grains on the outside, so that they are not able to land on the stigma of the same flower.

(v) Heterostyly (Heteros = different) : Some plants bear flowers of different forms. One form bears long stamens and short style, and the other form bears short stamens and long style. This condition favours cross-pollination. Dimorphic heterostyly is shown by primrose and oxalis.



Heterostyly in primrose (*Primula*) flowers

8. Mention whether the following statements are True (T) or False (F) :

(i) Fertilisation is fusion of anther and stigma.

(ii) Cross-pollination always occurs in unisexual flowers.

(iii) The generative nucleus in the pollen grain develops into two male gametes.

(iv) In maize, the pollination is brought about by insects.

(v) Anemophilous flowers are large and bright.

(vi) *Vallisneria* flowers are pollinated by wind.

Ans. (i) F **(ii)** F **(iii)** T **(iv)** F **(v)** F **(vi)** F

9. Name the floral parts which develop into following structures :

(i) seed **(ii)** pericarp **(iii)** seed coat **(iv)** fruit.

Ans. (i) Seed from ovule

(ii) Pericarp from ovary wall

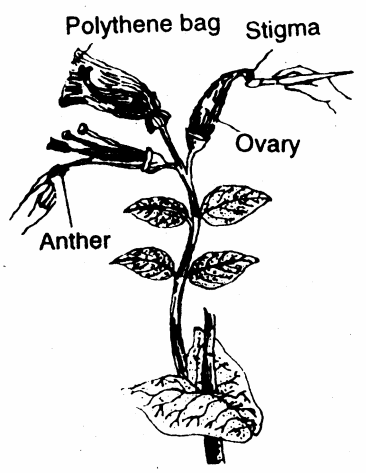
(iii) Seed coat from Integuments of ovule

(iv) Fruit from ovary.

10. Write a short note on artificial-pollination.

Ans. **Artificial pollination**

Man plays an important role in bringing about pollination artificially. For this, better yielding and better quality flowers are selected. Pollen grains from the ripe anthers are carefully removed and are dropped on the mature stigma of other plant of the same or related species. These pollinated flowers are now covered with polythene bags till fruits and seeds are produced. The seeds when sown in next season produce offsprings with slight variations. If this process is repeated for some generations, new varieties could be produced. This method is very commonly practised in garden plants such as pansy and stock or in crops like wheat and maize.



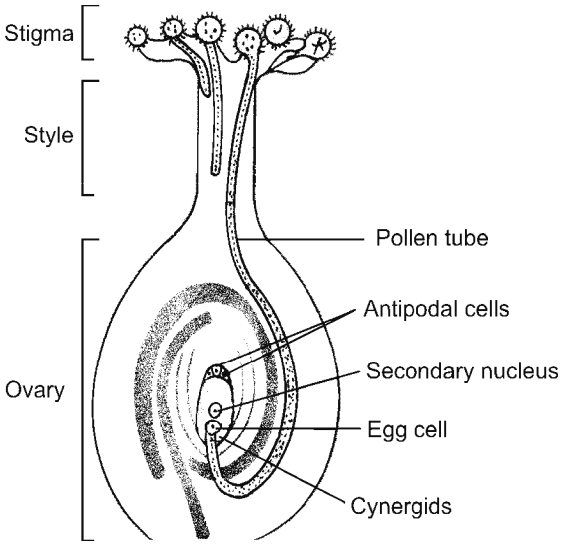
Showing artificial pollination in pea

11. What is the function of pollen tube? Trace its path from stigma to the female gamete by means of a diagram.

Ans. Functions of the pollen tube

(i) To carry the male gametes upto the embryo sac (inside the ovule) where female gamete is present.

(ii) To produce enzymes which dissolve the tissues of the style so that the pollen tube can travel the whole length of the style and reach the ovule.



Showing the path of pollen tube from stigma to the female gamete (egg).

12. Explain the following terms :

(i) Anemophilous flower **(ii)** Double fertilisation

(iii) Gametes **(iv)** Oospore

(v) Nectar guides **(vi)** Triple fusion

Ans. (i) Anemophilous flower : Wind-pollinated flower; wind brings about cross-pollination; flowers are usually small, inconspicuous and unattractive; pollen grains are produced in large number.

(ii) Double fertilisation : In flowering plants, each pollen grain produces two male gametes. One male gamete fuses with the female gamete, and the other fuses with the secondary nucleus. Since there are two fertilisations, it is called double fertilisation.

(iii) Gametes : An haploid cell taking part in sexual reproduction; two gamete nuclei (male and female) fuse during fertilisation, to initiate the development of a new individual.

(iv) Oospore : The product of fusion of male gamete with the female gamete, i.e. fertilisation, is called oospore.

(v) Nectar guides : Some flowers bear markings on the petals which lead to the nectaries present in the flower. These markings guide the insects towards the nectaries, and hence, are called nectar guides. The nectar guides help in pollination.

(vi) Triple Fusion : The fusion of one of the male gametes with secondary nucleus is termed as triple fusion, as it involves the fusion of three nuclei.

13. Distinguish between the following :

(i) Protandry and Protogyny

(ii) Self-pollination and Cross-pollination

(iii) Fruit and Seed

(iv) Tube nucleus and Generative nucleus

(v) Ovule and Seed.

Ans. (i) Differences between Protandry and Protogyny

(Both are contrivances for cross-pollination)

Protandry	Protogyny
The stamens in a bisexual flower mature earlier than the gynoecium of the same flower, so the pollen grains are carried over to the stigma of another flower.	The gynoecium in a bisexual flower matures earlier than the stamens of the same flower, so the stigma receives the pollen grains brought from another flower.

(ii) Differences between Self-pollination and Cross-pollination.

Self-pollination	Cross-pollination
1. Self-pollination occurs within a flower or between two flowers of the same plant.	Cross-pollination occurs between two flowers borne on different plants of the same species.
2. Flowers do not depend on other agencies for pollination.	Agents such as insects, water and wind are required for pollination.
3. Pollen grains are produced in small number.	Produced in large numbers.
4. No wastage of pollen grains occurs and thus economical.	Wastage of pollen grains occurs, hence, uneconomical.
5. Flowers are not attractive, nor do they produce nectar.	Flowers attract insects by various means like coloured petals, scent and nectar.
6. The offsprings produced are of the same genetic makeup, so purity of the race is maintained.	The offsprings produced may show variations and differ in genetic makeup.

(iii) Differences between Fruit and Seed

Fruit is the structure developing from the complete ovary, while a seed develops from the ovule.

(iv) Differences between Tube nucleus and Generative nucleus

(Both are nuclei present inside the pollen grain)

(a) The generative nucleus after germination of pollen grains divides into two male gametes inside the pollen tube, whereas the tube nucleus does not divide.

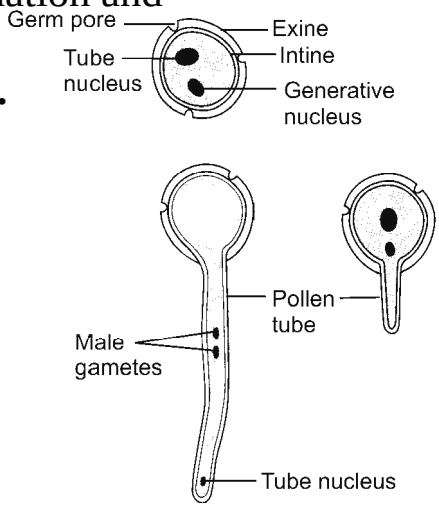
(b) In angiosperms, the two male gametes take part in the two fertilisations (double fertilisation) while tube nucleus is not involved in fertilisation.

(v) Differences between Ovule and Seed

Ovule	Seed
1. Ovule is a structure contained in the ovary.	Seed is present inside the fruit in angiosperms.
2. Inside the ovule, embryo sac containing the female gamete (or egg) is present.	It develops after fertilisation of the female gamete with the male gamete.
3. It is a pre-fertilisation female reproductive structure.	It is a post-fertilisation product.

14. Describe the events taking place between pollination and fertilisation.

Ans. Events between Pollination and Fertilisation.



Showing Pollen germination

After the pollen grains are deposited on the stigma, the pollen grains absorb water and sugar from the surface of stigma and swell up. From one of the germ pores, the intine comes out into a fine tube called **pollen tube**. This tube produces enzymes at the tip and dissolves the tissues of the style as it grows. Eventually, it travels down the whole length of the style into ovary.

In the meantime, inside the pollen tube, the generative nucleus divides into two **male gametes.**

The pollen tube carrying the two male gametes enters the embryo sac through the micropyle and its tip dissolves. The two male gametes are liberated inside the embryo sac.

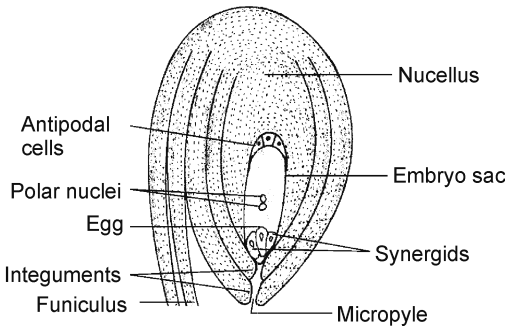
One male gamete fuses with the egg to form **zygote** which grows into an embryo and finally into a new plant. The other male gamete fuses with the secondary nucleus to form the **endosperm**, which provides nourishment to the growing embryo.

The fusion of the male gamete with the female gamete is called fertilisation. The process, in fact, involves two

fertilisations — one between male and female gametes and the other between the male gamete and the secondary nucleus. It is, therefore, also termed double **fertilisation.**

15. Draw a labelled diagram of ovule as seen in a section.

Ans.



Showing ovule in section

16. Describe the post-fertilisation changes taking place in an ovary.

Ans. Post-fertilisation changes

After fertilisation has taken place, the sepals, petals, stamens, style and stigma wither away and usually fall off. In some cases, the sepals may persist in a shrivelled form as in tomato, peas, or become fleshy as in brinjal. The ovary enlarges considerably.

Inside the ovule, the zygote undergoes cell divisions to form the embryo, consisting of the **radicle** and **the plumule**.

The changes occurring in the ovary after fertilisation are outlined in the following table.

Table showing changes occurring in the ovary after fertilisation.

Ovary	Fruit
1. Ovary wall	**1. Pericarp** (fruit wall) (a) epicarp (b) mesocarp (c) endocarp
2. Ovule (a) funicle (b) hilum (c) micropyle (d) integuments (i) outer integument (ii) inner integument (e) nucellus (f) embryo sac (i) antipodals (ii) egg cell (iii) secondary nucleus	**2. Seed** (a) stalk (b) hilum (c) micropyle (d) seed coat (i) testa (ii) tegmen (e) generally degenerates, if persists, called perisperm. (i) degenerate (ii) zygote $\longrightarrow$ embryo (iii) endosperm

17. Mention characteristics of entomophilous and anemophilous flowers.

Ans. (a) Entomophilous flowers

Entomophilous flowers have various adaptations for attracting the insects.

1. The flowers are large-sized and brightly coloured to attract the insects.
2. When flowers are not conspicuous, other parts become coloured and showy. For example, in bougainvillea bracts become colourful.
3. They produce nectar or scent which attracts insects, as in jasmine.
4. Some flowers bear markings or lines on the petals which act as nectar guides that lead the insects to the nectaries, as in pansy.

5. The pollen grains of entomophilous flowers are either rough or sticky so that they adhere to the body of insects easily.
6. The stigma is sticky, flat or lobed.
7. When the flowers are small, they form inflorescence to make them conspicuous and attractive. Common example is sunflower.

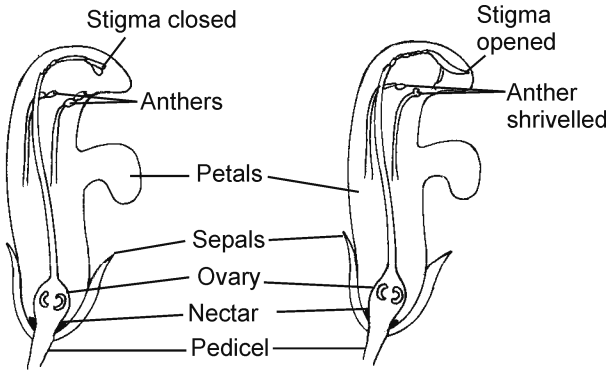
(b) Anemophilous flowers

Anemophilous or wind-pollinated flowers have following characteristics :

1. The flowers are usually small, inconspicuous and unattractive.
2. They do not produce scent or nectar.
3. The anthers produce large quantity of pollen grains.
4. The stamens are long and protrude out of the flower to be exposed to wind.
5. Anthers are large protruding out of the flowers and loosely attached to the long filaments so that they can easily be moved by the wind.
6. The pollen grains are smooth, light and dry and sometimes provided with wings as in pine so that they can easily be carried by wind to long distances.
7. Stigma is comparatively large branched and often feathery to trap the pollen grains, e.g. maize, rice, grasses, sugar cane, pine.

18. The diagram alongside shows a section through a flower at two stages of development.
Observe the diagram and answer the following questions :

(a) Write down two features in the diagram to show that the flower is insect-pollinated.



A Section of flower

(b) What information shown in the diagrams would suggest that cross-pollination takes place in the flower?

Ans. (a) (i) Nectary is present.

(ii) Anthers are present inside the corolla which is bilipped at the upper end, thus aiding the insect in reaching upto the nectary, and also getting brushed with the pollen.

(b) Flower shows protoandry as the stamens have shed the pollen grains even before the stigma is opened. This feature suggests cross-pollination.

19. Fill in the blanks with appropriate word given in the brackets.

(i) Cross-pollination takes place in all _____ plants. (monoecious/dioecious)

(ii) *Bougainvillea* flowers are pollinated by _____. (wind/insects/water)

(iii) Double fertilisation is common in _____. (gymnosperms/angiosperms)

(iv) *Salvia* is a _____ flower. (entomophilous/ornithophilous/hydrophilous)

(v) After fertilisation, the _____ becomes the fruit and the _____ becomes the seed. (ovule / ovary / integuments)

Ans. (i) dioecious **(ii)** insects **(iii)** angiosperms
(iv) entomophilous **(v)** ovary, ovule.