1. (a) A gamopetalous flower is one in which the petals are fused together to form a single unit. An irregular flower is one in which the petals are not symmetrical. An example of a gamopetalous irregular flower is the **snapdragon**. The snapdragon has a fused corolla with two lips, the upper lip having two petals and the lower lip having three petals. The petals are not symmetrical, with the two upper petals forming a hood and the three lower petals forming a lower lip [12].

(b) the distinction between syngenesious and synandrous stamens:

- **Syngenesious Stamens**: In this condition, the stamens remain united by their anthers while the filaments are free[1]. An example of a plant with syngenesious stamens is the Sunflower[1].
- **Synandrous Stamens**: This refers to the condition in which the anthers and filaments of the stamens in the androecium are completely united throughout their length[1]. An example of a plant with synandrous stamens is the Gourd[1].

In summary, the key difference lies in the way the anthers and filaments are fused. In syngenesious stamens, only the anthers are fused, while in synandrous stamens, both the anthers and filaments are fused[1].

© the difference between axile and free central placentation:

- **Axile Placentation**: In this type of placentation, the placenta develops from the central axis which corresponds to the confluent margins of carpels. The ovules are attached to the placenta in a multilocular ovary[1]. Examples of plants with axile placentation include China rose, tomato, and lemon[1].

- **Free Central Placentation**: In this type, the placenta develops in the center of the ovary as a prolongation of the floral axis and the ovules are attached on this axis[1]. It occurs in a multicarpellary but unilocular ovary[1]. Examples of plants with free central placentation include Dianthus and Primrose[1].

Here are the key differences:

Criteria	Free Central Placentation	Axile Placentation
Number of locules in ovary	Unilocular ovary[1]	Multilocular ovary[1]

Criteria	Free Central Placentation	Axile Placentation
Presence of septa	Absent[1]	Present[1]
Location of ovules	Ovules are borne on the central axis[1]	Ovules are attached to the placenta in the axial position[1]
Examples	Dianthus, Primrose[1]	China rose, lemon, tomato[1]

(d) A **Syconus** is a type of fruit formed from a hollow fleshy inflorescence stalk with tiny flowers inside. It is found in plants like figs and is composed of several flowers, making it a multiple and an accessory fruit[1]. The receptacle forms a hollow chamber in the syconium and its inner wall is covered by a shell of rufous florets[1]. Each floret produces fruit and seed[1].

(e) The **Tapetum** is a specialized layer of nutritive cells found within the anther of flowering plants. It plays a crucial role in the nutrition and development of pollen grains, and also serves as a source of precursors for the pollen coat[12].

(f) The term "double fertilization" is used because two fertilization events occur in the process[1234]:

1. **Fertilization of the egg**: One of the two sperm cells fuses with the egg cell to form a diploid zygote, which eventually develops into the embryo[1234].

2. **Fertilization of the polar nuclei**: The other sperm cell fuses with the two polar nuclei located in the central cell of the embryo sac, forming a triploid cell[1234]. This triploid cell develops into the endosperm, which provides nourishment to the developing embryo[1234].

Because these two fertilization events occur simultaneously, the process is referred to as "double fertilization"[1234].

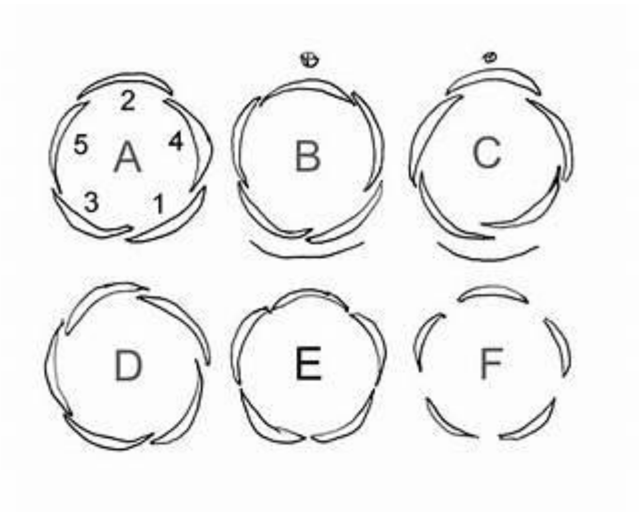
(g) **Cleavage Polyembryony** is a type of polyembryony where a young embryo or zygote divides into two or more units[12]. These units eventually develop or mature into independent embryos[12]. It is common in gymnosperms and comparatively rare in angiosperms[13]. An example of a plant exhibiting this phenomenon is Pinus[1]. This process is also referred to as zygote cleavage or budding[12].

2. (a) An **Actinomorphic Flower** is one that exhibits radial symmetry, meaning it can be divided into two equal halves along any diameter[1234]. Examples of plants with actinomorphic flowers include the rose and tulip[4], and plants from the family Liliaceae.

Sure, here are the detailed descriptions of different types of polypetalous forms of corolla:

1. **Cruciform**: This form has four unguiculate or clawed, free petals arranged in the shape of a cross[1234]. An example of a plant with cruciform corolla is Mustard[1234].
2. **Caryophyllaceous**: This form comprises five free petals, in which the claws and limbs are perpendicular to each other[1234]. An example of a plant with caryophyllaceous corolla is Dianthus[1234].
3. **Rosaceous**: This form comprises clawless petals, which only contain limbs expanding outwards[1234]. An example of a plant with rosaceous corolla is Rose[1234].
4. **Papilionaceous**: This form has a butterfly-shaped five petals and the upper petal encloses lateral wings[1234]. An example of a plant with papilionaceous corolla is Pea[1234].

(b)



Sure, here are the different types of aestivation in angiosperms:

1. **Valvate Aestivation**: In this type, the margins of sepals or petals simply touch each other but they do not overlap[1]. Examples include Hibiscus rosa-sinensis and plants of the family Mimosaceae[1].

2. **Twisted Aestivation**: In this type, the sepals or the petals are arranged in such a way that one margin overlaps the margin of the next one and the other margin is overlapped by the margin of another[1]. Examples include Hibiscus rosa-sinensis, Gossypium sp. of Malvaceae, species of Nerium sp., Thevetia sp., etc. of Apocynaceae[1].

3. **Imbricate Aestivation**: In imbricate aestivation, one of the petals or sepals overlaps the margins of the two adjoining members and the two margins of another member are overlapped, while the remaining three behave as twisted fashion[1]. Examples include species of Brassica (Cruciferae), Capparis (Capparidaceae), Delonix, Cassia, Caesalpinia (Caesalpinaceae), etc[1].

4. **Quincuncial Aestivation**: In this type, the margins of sepals or petals are arranged in such a way that out of the five members two are outer, two are inner and the odd fifth posterior being overlapped along its one margin, the other margin overlapping[1]. Examples include calyx of most plants of Asclepiadaceae (Calotropis sp.), Myrtaceae (Psidium guajava), etc[1].

5. **Vexillary Aestivation**: This is a type of imbricate aestivation, where out of the five petals the odd fifth posterior (known as standard or vexillum) one is the largest and the outermost, it overlaps the two lateral petals (known as wings or alae) and the lateral petals again in turn partly overlap the two smallest and innermost petals known as keel[1]. Examples include corolla of all flower of plants belonging to the family Papilionaceae[1].

(c) Sure, here are the detailed descriptions:

- **Campanulate Corolla**: This form of corolla is bell-shaped, with the tube rounded towards the base and gradually widening upwards[12]. The petals are fused to form a bell-like structure[12]. An example of a plant with a campanulate corolla is Physalis[12].

- **Infundibuliform Corolla**: In this form, the petals are organized like an inverted funnel[12]. The petals are fused to form a funnel-shaped corolla, with the tube gradually widening into limbs[12]. An example of a plant with an infundibuliform corolla is Datura[31].

As for composite fruits, they are fruits that emerge from the entire inflorescence[456]. They develop from a large number of blossoms (inflorescence), and the entire inflorescence produces a composite or numerous fruit[456]. The flowers, and the peduncles on which they have been borne, play a role in the fruit's growth[456]. Examples of composite fruits include mulberry and anjeer[46].

(d) The **ABC Model of Flower Development** is a scientific model that describes how flowering plants produce a pattern of gene expression in meristems, leading to the appearance of a flower[12]. This model demonstrates the presence of three classes of genes that regulate the development of floral organs[12]:

- **Class A genes**: When expressed, these genes induce the development of sepals in the first whorl[1].
- **Class B genes**: These genes interact with Class A genes to induce the development of petals in the second whorl. They also interact with Class C genes to form stamens in the third whorl[1].
- **Class C genes**: These genes induce the formation of carpels in the fourth whorl[1].

The ABC model is based on the observation that mutants induce the right floral organs to develop in the wrong whorls[1]. The analysis of ABC model is based on the use of molecular genetics and formulated on the observation that mutants induce right floral organs to develop in wrong whorls[1]. In the flower of angiosperms there are usually four concentric whorls of organs, i.e. sepal, petal, stamen and carpel that are formed in whorl 1, whorl 2, whorl 3 and whorl 4 respectively, the whorl 1 being on the peripheral side[1].

Florigen, on the other hand, is a protein capable of inducing flowering time in angiosperms[3]. It is often referred to as the "flowering hormone" and is encoded by the FT gene and its orthologs in various plants[3]. Florigens are produced in the leaves and act in the shoot apical meristem of buds and growing tips[3]. When the light goes down to 12 hours or less, the leaves start to manufacture florigen, which triggers flowering[45].

3) (a) Special cymose inflorescence refers to certain unique forms of cymose inflorescence, which include hypanthodium, cyathium, and verticillaster[1]

Sure, here are the detailed descriptions of hypanthodium, cyathium, and verticillaster inflorescence types:

1. **Hypanthodium**: This is a special type of cymose inflorescence where the main axis forms a cup-shaped structure with a cavity having both male and female flowers and a small apical opening[1,2]. The receptacle in this type of inflorescence becomes spherical, like a hollow-sphere (syconium) with a cavity inside, and it is formed by the fusion of the rachis of the three cymes in the vicinity of each other[2]. These spherical receptacles are like a closed fleshy vessel having a tiny opening at the apex; it opens to the exterior with this opening[1]. There are several small, sessile flowers that are produced from the inner surface of the receptacle[1]. Three types of unisexual flowers are seen arranged on the inner surface of the receptacle in the cymose groups. They are – male, sterile female and fertile female flowers[1]. Examples of plants with hypanthodium inflorescence include Banyan (Ficus bengalensis), Peepal (Ficus religiosa), and Fig (Ficus carica)[2].
2. **Cyathium**: In this type of inflorescence, there is a cup-like cluster of altered leaves that surrounds a female flower and many male flowers[1]. It appears as a single flower[1]. The cupular structure seems to be developed by an involucre of bracts[1]. There is one female flower at the centre, which is encircled by several stalked male flowers, while the male flowers are with brackets[1]. This type of inflorescence can be seen in the Spurge family[2].
3. **Verticillaster**: This type of inflorescence is typical of plants with opposite leaves[1]. Verticillaster has two clusters of sessile flowers developing from the two opposite axils of leaves[1]. Each cluster has a dichasial cyme arrangement[1]. Examples of plants with verticillaster inflorescence include Ocimum and Salvia[1].

(b) Sure, here are the detailed descriptions of different types of fleshy indehiscent fruits:

1. **Berry**: This fruit develops from a bicarpellary or multicarpellary, syncarpous ovary. The entire fruit is fleshy except for a thin skin and the seeds contained inside[1]. Examples include Tomato, Date Palm, Grapes, and Brinjal[1].

2. **Drupe**: This fruit develops from a monocarpellary, superior ovary. It is usually one-seeded. The pericarp is differentiated into an outer skinny epicarp, a fleshy and pulpy mesocarp, and a hard and stony endocarp around the seed[1]. Examples include Mango and Coconut[1].

3. **Pepo**: This fruit develops from a tricarpellary inferior ovary. The pericarp turns leathery or woody which encloses a fleshy mesocarp and a smooth endocarp[1]. Examples include Cucumber, Watermelon, Bottle Gourd, and Pumpkin[1].

4. **Hesperidium**: This fruit develops from a multicarpellary, multilocular, syncarpous, superior ovary. The fruit wall is differentiated into a leathery epicarp with oil glands, a middle fibrous mesocarp, and the endocarp forms distinct chambers, containing juicy hairs[1]. Examples include Orange and Lemon[1].

5. **Pome**: This fruit develops from a multicarpellary, syncarpous, inferior ovary. The receptacle also develops along with the ovary and becomes fleshy, enclosing the true fruit[1]. In pome, the epicarp is a thin skin-like and endocarp is cartilaginous[1]. Examples include Apple and Pear[1].

6. **Balausta**: This is a fleshy indehiscent fruit developing from a multicarpellary, multilocular inferior ovary whose pericarp is tough and leathery[123]. Seeds are attached irregularly with the testa being the edible portion[123]. An example is Pomegranate[123].

© **Megasporogenesis** is the process by which megaspores are produced from the megaspore mother cell[1,2,3]. The megaspore mother cell is a diploid cell that undergoes meiosis to produce four haploid megaspores[1,2,3]. Out of these four, only one megaspore is functional and the rest three degenerate[1,2,3]. The functional megaspore then divides mitotically to form the embryo sac, a process called megagametogenesis[1,2,3].

There are three main types of **megagametogenesis**[4,5]:

1. **Monosporic**: This is the most common type of megagametogenesis, where only one megaspore undergoes megagametogenesis, while the other three undergo programmed cell death[4,5]. Examples include Oenothera and Polygonum[4].
2. **Bisporic**: In this type, two genetically different haploid nuclei are involved in the development of the embryo sac[4,5]. Examples include Allium, Scilla, and Trillium[4].
3. **Tetrasporic**: In this type, all four megaspores take part in embryo sac development[4]. An example is Peperomia[4].

(d) Endosperm development in angiosperms is a crucial process that occurs after fertilization and leads to the formation of the endosperm, a tissue that provides nourishment to the developing embryo[1,2,3,4,5]. There are three main types of endosperm development based on their development pattern[1,2,3,4,5]:

1. **Nuclear Endosperm**: This is the most common type of endosperm found. Here, the primary endosperm nucleus divides repeatedly without cytokinesis, resulting in the formation of a large number of free nuclei in the cell[1,2,3,4,5]. A large central vacuole is formed and nuclei get arranged at the periphery[1,2,3,4,5]. Examples include maize, rice, wheat, cotton, sunflower[1,2,3,4,5].
2. **Cellular Endosperm**: In this type, cell wall formation follows each cell division. Thus, the endosperm divides into many segments[1,2,3,4,5]. Examples include peperomia, villarsia Drimys[4].
3. **Helobial Endosperm**: This is an intermediate form between the other two types[1,2,3,4,5]. The primary endosperm nucleus divides into two cells, one of which continues to divide while the other may remain undivided or divide further[1,2,3,4,5].

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As for the **nucellus**, it is the central part of an ovule that encloses the embryo sac, i.e., the female gametophyte[6]. It is a mass of parenchymatous tissue surrounded by the integumentary layers in an ovule[7]. The nucellus has abundant food reserves and thus, acts as the nutritive tissue for the developing embryo[7]. In some seeds, such as beet and black pepper, the nucellus forms the perisperm after fertilization[7].

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(e) **Vegetative Reproduction** and **Agamospermy** are both forms of asexual reproduction, but they differ in the following ways[1234]:

- **Vegetative Reproduction**: This involves the production of new plants from vegetative parts such as roots, stems, and leaves[2]. The new plants are genetically identical to the parent plant[2]. Vegetative reproduction does not involve the formation of seeds[2].
- **Agamospermy**: This involves the production of seeds without fertilization[13]. The seeds are produced from unfertilized ovules and are genetically identical to the parent plant[13]. Agamospermy does not involve vegetative reproduction[13].

Apomixis is a form of asexual reproduction that occurs via seeds, in which embryos develop without fertilization[5]. There are three main types of apomixis[5]:

1. **Diplospory**: In diplospory, the embryo sac is derived from the megaspore mother cell either directly by mitotic division or by interrupting meiosis[5]. The embryo sac is unreduced and has the same number of chromosomes and genetic material as the parent plant[5].
2. **Apospory**: In apospory, the nucellar cells give rise to the apomictic embryo sac[5]. It is the most common type of apomixis in higher plants[5]. Aposporous initial cells differentiate and undergo mitosis to produce an embryo sac[5]. Sometimes multiple embryo sacs may be found[5].
3. **Adventitious Embryony**: This is a type of sporophytic apomixis, where embryos are produced directly from the nucellus or the integument of the ovule[5]. The embryo develops by mitotic division and forms a bud-like structure[5]. Simultaneous fertilization in the adjoining sexual embryo sac is required to form viable seeds[5].

An example of an apomictic plant species is the dandelion (Taraxacum)[6].