Question Bank
Seed : Structure, Types and Germination

1. Describe the structure of a seed.

Ans. A mature seed consists of two essential parts :

(i) the seed coat, and

(ii) the embryo

The Seed coat : A seed is covered by a protective covering called the **seed coat**. It develops from integuments of the ovule. The seed coat is differentiated into two layers — outer **testa** and an inner **tegmen**. A scar called **hilum** represents the point of attachment of the seed to its stalk. There is a minute opening known as **micropyle** just below the **hilum**. It helps the seed to absorb water during germination and provides passage for the diffusion of respiratory gases.

The Embryo

The embryo is defined as the young or miniature plant enclosed within the seed coat. The embryo of a mature seed consists of five distinct parts —

(i) cotyledons, **(ii)** plumule, **(iii)** epicotyl, **(iv)** hypocotyl, and **(v)** radicle

The plumule, epicotyl, hypocotyl and radicle constitute the **embryonic axis** or **tigellum.**

The cotyledons, also known as **seed leaves**, are attached laterally to the embryonic axis. Dicotyledonous plants have two cotyledons, whereas only one cotyledon is found in monocotyledonous plants.

The part of the embryonic axis below the point of attachment of the cotyledons is known as **hypocotyl**. The basal tip of hypocotyl is called the **radicle**, which on germination of the seed gives rise to the root.

The part of the embryonic axis lying immediately above the point of attachment of the cotyledons is known as epicotyl.

Plumule is present at the tip of the epicotyl. When the seed germinates, plumule gives rise to the shoot.
In some seeds, there is an additional structure called the **endosperm**. It is a food storage tissue.
In seeds like those of gram, pea, bean and mustard, the food is stored in the cotyledons and there is no endosperm. Such seeds are known as **non-endospermic** or **exalbuminous**. In some seeds like those of castor, maize and rice, the food is mainly stored in the endosperm. Such seeds are known as **endospermic** or **albuminous seeds.**

2. Differentiate between the following :
(a) Epicotyl and hypocotyl (b) Radicle and plumule
(c) Coleorrhiza and Coleoptile.

Ans. (a) Differences between Epicotyl and Hypocotyl

Epicotyl	Hypocotyl
1. It is the part of embryo axis lying above the point of attachment of cotyledons in a seed. **2.** The tip of the epicotyl is called plumule.	It is the part of embryo axis lying below the point of attachment of cotyledons in a seed. The tip of hypocotyl is called radicle.

(b) Differences between Radicle and Plumule

Radicle	Plumule
1. It lies on the tip of embryonic axis below the point of attachment of cotyledons **2.** When the seed germinates, it gives rise to the root.	It lies on the tip of the embryonic axis above the point of attachment of cotyledons. When the seed germinates, it gives rise to the shoot.

(c) Differences between Coleorrhiza and Coleoptile

Coleorrhiza	Coleoptile
1. It is a protective sheath covering the radicle.	It is a protective sheath covering the plumule.

3. Mention five differences between a bean seed and a castor seed.

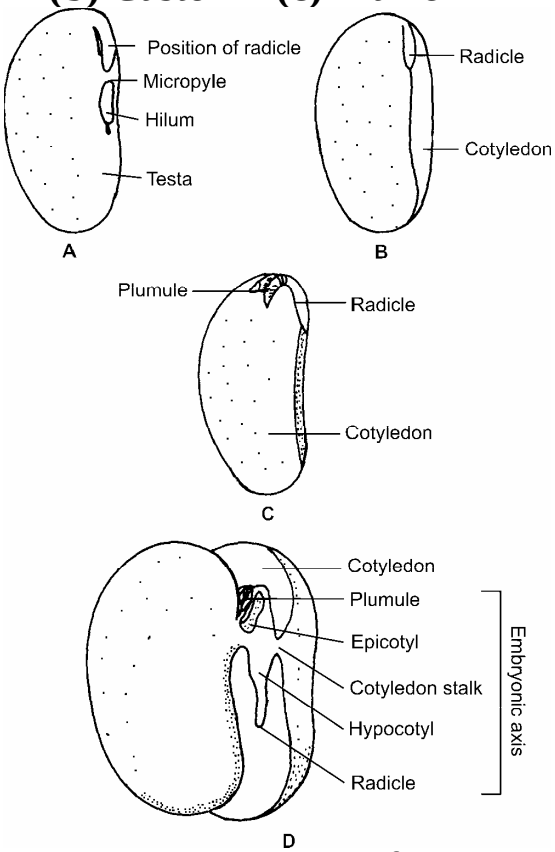
Ans. Differences between Bean seed and Castor seed

Bean seed	Castor seed
1. Seed coat is thin and brownish in colour	Seed coat is thick, hard and spotted black in colour.
2. Hilum and micropyle are visible.	Hilum and micropyle hidden by caruncle.
3. Two thick fleshy cotyledons present.	Two thin, papery cotyledons present.
4. Endosperm absent.	Endosperm forms the major part of the seed.
5. Caruncle absent.	Caruncle is present at one end of the seed.

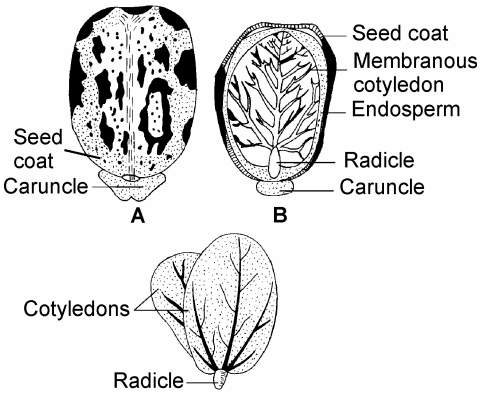
4. Draw labelled diagrams showing the structure of the following seeds :

(a) Bean **(b)** Castor **(c)** Maize

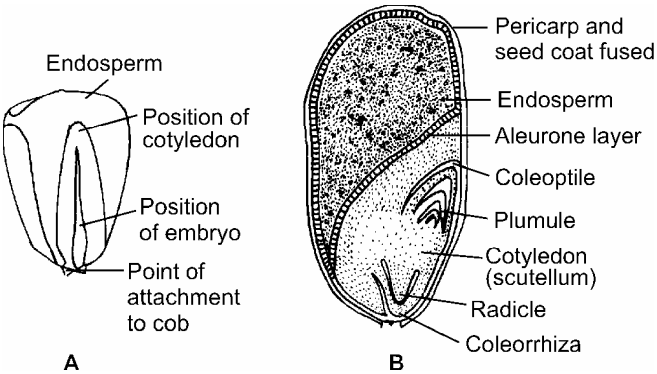
Ans.



Showing Structure of Bean Seed



Showing Structure of Castor Seed



Showing Structure of Maize Seed

5. Mention the functions of the following parts :

(a) Coleoptile **(b)** Coleorrhiza **(c)** Aleurone layer
(d) Seed coat **(e)** Micropyle **(f)** Endosperm
(g) Radicle **(h)** Plumule

Ans. (a) Coleoptile – It is a protective sheath around the plumule in cereal grains like maize. It covers the first leaves of the seedling.

(b) Coleorrhiza – It is a protective sheath around the radicle in cereal grains.

(c) Aleurone layer – It is the outermost protein-rich layer of the endosperm, and helps the seed during germination.

(d) Seed coat– Seed coat protects the delicate embryo present inside. The micropyle in the seed coat allows water to enter the seed and thereby helps in germination. Micropyle also allows gases to diffuse in and out through it.

(e) Micropyle– The micropyle in the seed coat allows water to enter the seed and thereby helps in germination. Micropyle also allows gases to diffuse in and out through it.

(f) Endosperm – It is a food-storage tissue in seeds; the stored food is utilized by the growing embryo during germination.

(g) Radicle – It gives rise to the root on seed germination.

(h) Plumule – On germination of seed, it gives rise to the shoot.

6. Define the following :

(a) Seed **(b)** Embryo **(c)** Exalbuminous seed

(d) Germination **(e)** Seed dormancy **(f)** Vivipary

Ans. (a) Seed – Seed is the fertilised and ripened ovule in flowering plants.

(b) Embryo – Embryo is the miniature young plant within the seed coat, consisting of an axis, bearing plumule at its apical end and radicle at the basal end and one or two laterelly attached cotyledons.

(c) Exalbuminous seed – A seed without endosperm at maturity.

(d) Germination – The process by which the embryo grows out of the seed coat and establishes itself as a seedling is called germination.

(e) Seed dormancy – A condition in which seeds do not germinate even when provided with all the conditions necessary for germination.

(f) Vivipary – It is the germination of seeds within the fruit while still attached to the parent plant.

7. What conditions are essential for seed germination? Describe their importance.

Ans. Seeds require following three conditions for germination :

(i) Water **(ii)** Availability of oxygen

(iii) Favourable temperature

Apart from the above requirements, some seeds require light for germination, while others germinate only in darkness.

Water : Germination starts with the rapid uptake of water by the seed through the micropyle and its surface. Intake of water helps the process of germination in the following ways :

(a) It softens the seed coat causing its rupture and thereby allowing the growing plumule and radicle to emerge;

(b) It accelerates the metabolic activities in the seed;

(c) It helps in the hydrolysis of stored food materials into soluble products; and

(d) It helps in the translocation of soluble products from the storage tissues to the developing embryo.

Oxygen : During germination, embryo resumes growth and for this energy is required. This energy comes from the oxidation of food material stored in the cotyledons or the endosperm which requires oxygen.

Temperature : A number of physiological processes occur within the seed during germination. Therefore, suitable temperature is always a necessity for germination. The range of optimum temperature varies greatly in different types of seeds. However, most of the seeds fail to germinate below 0°C and above 48°C. Optimum temperature ranges from 25°C to 35°C.

8. Differentiate between hypogeal and epigeal germination.

Ans. Differences between Hypogeal and Epigeal Germination.

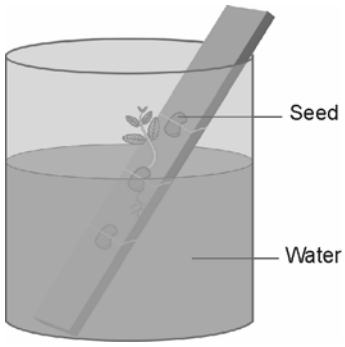
Hypogeal germination	Epigeal germination
1. Epicotyl elongates.	Hypocotyl elongates.
2. Cotyledons remain below the ground.	Cotyledons are lifted above the ground.
3. Examples – Gram, pea, maize.	**Examples** – Bean, cotton, castor.

9. Give two examples each of the following types of seeds :
(a) Dicotyledonous albuminous seed.
(b) Dicotyledonous exalbuminous seed.
(c) Monocotyledonous albuminous seed.

Ans. (a) Dicotyledonous albuminous seed – Castor, cotton.
(b) Dicotyledonous exalbuminous seed – Pea, gram.
(c) Monocotyledonous albuminous seed – Maize, wheat.

10. How would you demonstrate that oxygen and water are necessary for seeds to germinate?

Ans. Oxygen and water are necessary for seeds to germinate can be demonstrated by three bean seeds experiment.
the three bean seeds experiment
The three bean seeds are tied to a glass slide as shown in Figure and kept in a beaker containing water in such a way that top seed is above the water, middle one is just at water level and the third one deep in water. The beaker is then kept in a warm place (25°C– 30°C) for a few days.



Three bean seeds experiment

Result : After a few days, it will be noticed that the seed at the top does not germinate at all; the bottom one either does not germinate or stops germinating after some time; the middle one germinates properly.

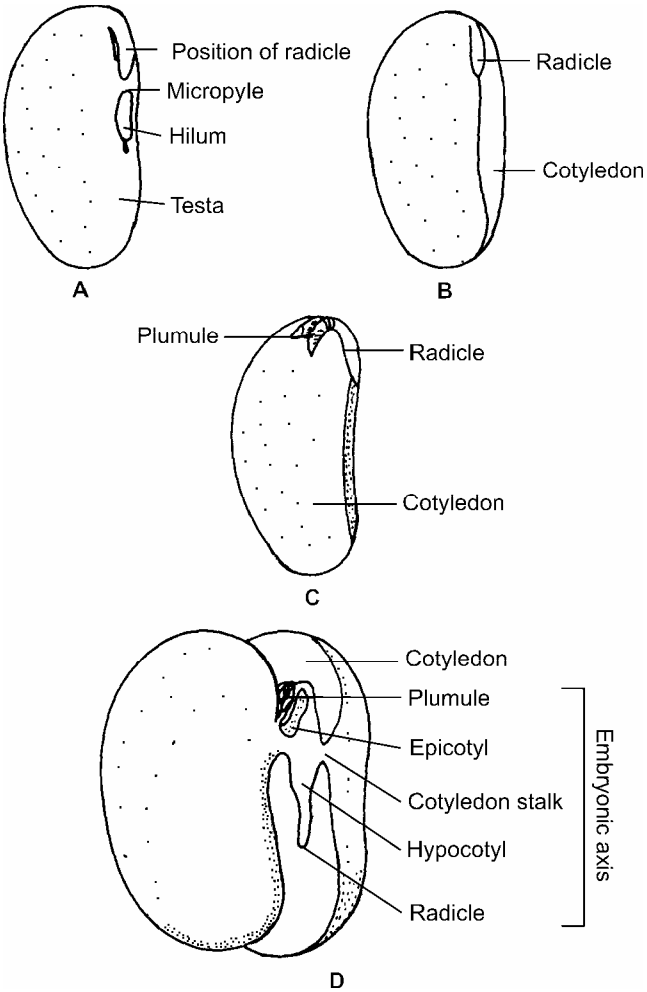
Inference : The experiment shows that air and water are necessary for germination. The top seed does not germinate because it gets only oxygen and no water. The bottom seed receives water but very little oxygen. The middle seed germinates properly as it receives both oxygen and water.

11. Why does a farmer plough his field and makes soil loose before sowing seeds?

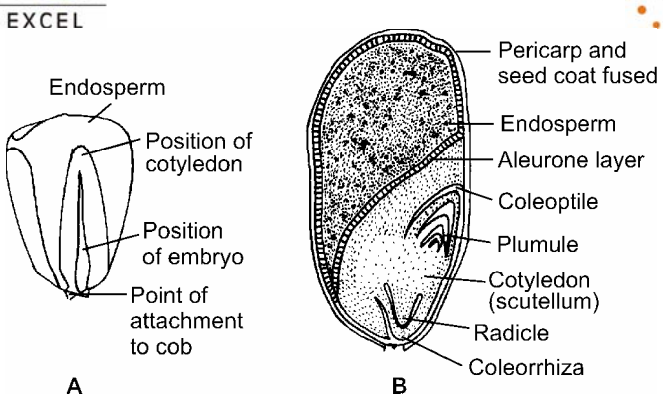
Ans. Ploughing the field and loosening of the soil is done before sowing seeds so that sufficient oxygen is available for seeds during germination. Germination of seeds does not take place without oxygen.

12. Outline the stages in the germination of following seeds with the help of labelled diagrams:
(a) Bean **(b)** Maize

Ans.



Showing Structure of Bean Seed



Showing Structure of Maize Seed

13. Name the following :

(i) Food storage part in pea seed

(ii) Food storage part in castor seed

(iii) Shield-shaped cotyledon in maize grain

(iv) Fleshy whitish outgrowth at the micropylar end in castor seed

(v) Protective sheath covering radicle in monocots.

Ans. (i) Cotyledon **(ii)** Endosperm **(iii)** Scutellum
(iv) Caruncle **(v)** Coleorrhiza

14. Fill in the blanks with appropriate word given in the brackets :

(i) The non-endospermic seeds are also called as _____ . (albuminous / exalbuminous)

(ii) The inner layer of the seed coat is called _____. (testa / tegmen)

(iii) The plumule of the seed gives rise to _____. (shoot / root)

(iv) The germination in gram seeds is _____and that of bean seeds is _____. (hypogeel / epigeal / viviparous)

(v) Caruncle is found in the seed of _____. (castor / pea)

(vi) Germination in Rhizophora is _____. (viviparous / epigeal)

(vii) The upper part of the embryo axis is called the _____. (radicle / plumule)

(viii) In _____ germination, the cotyledons remain under or just on the surface of the soil. (hypogeal / epigeal)

Ans. **(i)** Exalbuminous seeds **(ii)** Tegmen
(iii) Shoot **(iv)** Hypogeal, epigeal
(v) Castor **(vi)** Viviparous
(vii) Plumule **(viii)** Hypogeal.

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

(i) The protein-rich layer of endosperm in cereal grains is called scutellum.
(ii) The outer layer of seed coat is called testa.
(iii) Wheat grain is an exalbuminous monocot seed.
(iv) In hypogeal germination, the cotyledons remain below the ground surface.
(v) The scar on the seed coat where the seed is attached to its stalk (funicle) is called hilum.

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