ANSWER KEY & MARKING SCHEME · CBSE CLASS 12

Sexual Reproduction in Flowering Plants

Biology · Chapter 1 · Use this with the Board Paper · Companion to Quick Drill

HOW TO USE

Attempt the Board Paper first (closed-book, full time). Then come here. For 2-mark+ questions, compare your answer to the model. For 3-4 mark questions, also consult the **Topper Templates** below — these show the exact step-by-step structure that scores full marks per CBSE marking-scheme conventions.

MODEL ANSWERS · BOARD PAPER

Section A — VSA (1 mark × 4)

Q1. What is the ploidy of the primary endosperm nucleus? ***[1 mark]***

Ans: Triploid (3n).

Q2. Name the cell that gives rise to the embryo sac. ***[1 mark]***

Ans: Functional megaspore (the surviving one of the 4 megaspores from megasporogenesis).

Q3. What is autogamy? ***[1 mark]***

Ans: Self-pollination within the same flower.

Q4. Define apomixis. ***[1 mark]***

Ans: Formation of seeds without fertilisation.

Section B — SA-I (2 marks × 3)

Q5. Differentiate between geitonogamy and xenogamy. ***[2 marks]***

Ans: Geitonogamy: pollen transferred from one flower to another flower of the SAME plant. Functionally cross-pollination, but genetically equivalent to self-pollination. Xenogamy: pollen transferred between flowers of DIFFERENT plants of the same species. True cross-pollination — generates genetic variation.

Q6. Name two outbreeding devices and explain one. ***[2 marks]***

Ans: Two devices: (i) Self-incompatibility — genetic mechanism preventing same-plant pollen from fertilising. (ii) Dichogamy — anther and stigma mature at different times. EXPLAIN dichogamy: in protandrous flowers (e.g., sunflower), pollen is shed BEFORE the stigma is receptive; cross-pollination is forced. In protogynous flowers (e.g., fig), stigma matures before pollen is released.

Q7. List three differences between microsporogenesis and megasporogenesis. ***[2 marks]***

Ans: (1) Location: microsporogenesis in anther (microsporangium) vs megasporogenesis in ovule (nucellus). (2) Number of products: microsporogenesis gives 4 functional microspores; megasporogenesis gives 4 megaspores but only 1 is functional (chalazal). (3) Outcome: microspores form pollen (male gametophyte); megaspore forms embryo sac (female gametophyte).

Section C — SA-II (3 marks × 3)

Q8. Explain double fertilisation with the help of a diagram. ***[3 marks]***

Ans: Double fertilisation = TWO fusion events in the same embryo sac after pollen tube reaches it. Sequence: (1) Pollen tube enters embryo sac via micropyle, releases 2 male gametes. (2) Syngamy: male gamete 1 (n) + egg cell (n) → ZYGOTE (2n). (3) Triple fusion: male gamete 2 (n) + 2 polar nuclei (n + n) → PRIMARY ENDOSPERM NUCLEUS (3n, triploid). Both are 'fertilisation' events ⇒ DOUBLE fertilisation. Unique to angiosperms. Diagram: show ovule, pollen tube entering through micropyle, 2 m.g.s released — one fusing with egg, other with central cell.

Q9. Draw a labeled diagram of a mature pollen grain. Mention any two functions of the tapetum. ***[3 marks]***

Ans: Diagram: mature pollen grain shows EXINE (outer, made of sporopollenin, with germ pores) + INTINE (inner, cellulosic) + cytoplasm + VEGETATIVE cell (large, with abundant cytoplasm) + GENERATIVE cell (small, may have already divided into 2 male gametes). Label all parts. Functions of tapetum: (1) Provides nutrition to developing pollen grains; (2) Contributes the sporopollenin and pollenkitt to the exine.

Q10. Differentiate between apomixis and polyembryony with one example each. ***[3 marks]***

> **Ans:** APOMIXIS: formation of seeds WITHOUT fertilisation; the embryo develops from an unfertilised cell (nucellus, integument, or egg). Example: some grasses (Poa). Resulting plants are GENETIC CLONES of the parent. POLYEMBRYONY: presence of MORE THAN ONE EMBRYO in a single seed. Multiple embryos may form from cleavage of the zygote or from nucellus/integument cells. Example: citrus, mango. The two can co-occur (e.g., citrus shows polyembryony where some embryos are apomictic and one is zygotic) but the CONCEPTS are distinct.

Section D — Long Answer (5 marks × 2)

Q11. Draw a labeled diagram of a mature embryo sac of a typical angiosperm. Identify the cells and state their ploidy and the number of nuclei. ***[5 marks]***

> **Ans:** Diagram: oval embryo sac with micropylar end (top) and chalazal end (bottom). At micropylar end: EGG CELL (n) in centre, flanked by 2 SYNERGIDS (n each) — together the EGG APPARATUS. Centre: large CENTRAL CELL containing 2 POLAR NUCLEI (each n; together 2n diploid). At chalazal end: 3 ANTIPODAL CELLS (each n). Total: 7 cells (egg + 2 synergids + 1 central + 3 antipodals); 8 nuclei (counting the 2 polar nuclei separately within the central cell). All cells are HAPLOID (n) before fertilisation.

Q12. Describe the development of dicot embryo from zygote to mature embryo with the help of suitable diagrams. ***[6 marks]***

> **Ans:** Stage 1 — PROEMBRYO: zygote divides asymmetrically (transverse division) into a larger basal cell (towards micropyle) and a smaller terminal cell. Basal cell forms the suspensor; terminal cell forms the embryo proper. Stage 2 — GLOBULAR: terminal cell divides multiple times to form a globular mass. Suspensor anchors the embryo to the embryo sac wall and conducts nutrients. Stage 3 — HEART: globular embryo elongates and forms two cotyledon primordia → heart-shaped appearance. Stage 4 — TORPEDO: cotyledons elongate, embryo axis (radicle below, plumule above) becomes distinguishable. Stage 5 — MATURE EMBRYO: cotyledons fully developed, contain food reserves; embryo axis has plumule (shoot tip), radicle (root tip), epicotyl, hypocotyl. Diagram: show all 5 stages with clear cell-arrangement differences. KEY: dicot has TWO cotyledons (vs ONE in monocot).

★ TOPPER ANSWER TEMPLATES

3 TEMPLATES · MEMORISE THE FORMAT

★ TOPPER TEMPLATE — 5-mark: 'Draw a labeled diagram of the mature embryo sac (8-nucleate 7-celled). Identify its parts.'

Annual

Step 1 ***[1 mark]***	**Outer outline**	Draw an oval/elongated shape representing the embryo sac inside the ovule. Show the micropylar end at top, chalazal at bottom.
Step 2 ***[1 mark]***	**Micropylar end — 3 cells**	At the micropylar end, draw: 1 egg cell (centre, pear-shaped) flanked by 2 synergids. Together: the egg apparatus.
Step 3 ***[1 mark]***	**Centre — central cell with 2 polar nuclei**	Draw the large central cell occupying most of the embryo sac. Show two polar nuclei inside it (they will later fuse with the 2nd male gamete).
Step 4 ***[1 mark]***	**Chalazal end — 3 antipodal cells**	At the chalazal end, draw 3 small antipodal cells (a row or cluster). These are non-functional in fertilisation.
Step 5 ***[1 mark]***	**Labels + nuclear count statement**	Label all 7 cells clearly. State: 'Mature embryo sac has 7 cells and 8 nuclei (2 polar nuclei in the central cell counted separately).' This statement alone is often worth 1 mark.

COMMON LOSS OF MARKS:

- Missing micropylar/chalazal orientation — half mark.
- Drawing 3 polar nuclei (wrong) — should be 2. −1 mark.
- Forgetting the 7-cells-8-nuclei statement at the end.

★ TOPPER TEMPLATE — 5-mark: 'Explain double fertilisation. Why is it called so? Significance.'
Annual

Step 1 *[1 mark]*	**Pollen tube delivery**	After germination of pollen on stigma, the pollen tube grows through the style and enters the embryo sac via the micropyle. It carries two male gametes (n each) — formed by mitotic division of the generative cell.
Step 2 *[1 mark]*	**First fusion → zygote**	Male gamete 1 (n) fuses with the egg cell (n) → ZYGOTE (2n). This is SYNGAMY. The zygote develops into the embryo.
Step 3 *[1 mark]*	**Second fusion → endosperm**	Male gamete 2 (n) fuses with the 2 polar nuclei (n + n = 2n) in the central cell → PRIMARY ENDOSPERM NUCLEUS (3n, TRIPLOID). This is TRIPLE FUSION. The PEN develops into endosperm tissue.
Step 4 *[1 mark]*	**Why 'double'**	Both fusions are 'fertilisations' — two distinct fusion events in the same embryo sac. Hence 'DOUBLE fertilisation'. Unique to flowering plants (angiosperms).
Step 5 *[1 mark]*	**Significance**	(a) Embryo (2n) develops from zygote. (b) Endosperm (3n) provides nutrition to embryo during seed development. (c) Endosperm formation only after fertilisation = no wasted resources on unfertilised ovules. (d) Triploid endosperm has hybrid vigour. (e) Angiosperms' evolutionary success owes much to this efficient resource allocation.

COMMON LOSS OF MARKS:
- Not naming syngamy + triple fusion explicitly.
- Forgetting endosperm is 3n (TRIPLOID).
- Not stating significance in the final part.

★ TOPPER TEMPLATE — 3-mark: 'List and explain three outbreeding devices in plants.'
2018, 2019, 2022

Step 1 *[1 mark]*	**Dichogamy**	Pollen and stigma mature at different times within the same flower. Protandry (pollen first, e.g., sunflower) and protogyny (stigma first, e.g., fig).
Step 2 *[1 mark]*	**Self-incompatibility**	Genetic mechanism preventing pollen from same flower (or same genotype) from fertilising. E.g., Brassica family. Prevents inbreeding even if pollen lands on stigma.
Step 3 *[1 mark]*	**Heterostyly + unisexual flowers**	Heterostyly: flowers of same species have different style/stamen lengths (e.g., Primula) → pollen from one type only fertilises stigma of another. Or: plants are monoecious (male & female flowers separate, e.g., maize) or dioecious (male & female plants separate, e.g., papaya).

COMMON LOSS OF MARKS:
- Listing only 1-2 devices.
- Naming device without explaining mechanism.
- Not giving an example for each.

MARKING SCHEME — GENERAL NOTES
- Diagrams MUST be labeled — auto −0.5 if labels are missing or sloppy.
- State ploidy (n, 2n, 3n) wherever relevant — examiners check this explicitly.
- Use NCERT terminology consistently: 'embryo sac' not 'female gametophyte', 'pollen grain' not 'male gametophyte'.
- Counter-example or specific example is mandatory in 'differentiate' questions.
- For 5-mark diagram questions, drawing alone is ~2-3 marks; labels + identification statements complete the score.