Unit 12 · Sexual Reproduction

ANSWER KEY · FOR TEACHERS

Full marks 32

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. tapetum
2. sporopollenin
3. egg apparatus
4. geitonogamy
5. anemophily
6. porogamy
7. triple fusion
8. scutellum

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. nucellus
2. antipodals
3. polar nuclei
4. egg
5. synergids
6. micropyle

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **b.** the primary endosperm nucleus, 3n — K · 1

Triple fusion joins **three haploid nuclei**, a male gamete and the two polar nuclei, into the **primary endosperm nucleus**, which is **triploid (3n)**. The zygote (2n) comes from syngamy, the other half of double fertilization.

ii. **b.** the generative cell — U · 1

The small **generative cell** divides by **mitosis** into two male gametes, either before the pollen is shed (three-celled pollen) or in the pollen tube. The **vegetative cell** grows the tube and doesn't divide again.

iii. **b.** geitonogamy — U · 1

Maize has **separate male flowers (the tassel) and female flowers (the cob)** on the same plant. Pollen carried from the tassel to the silks of the same plant reaches **another flower of the same plant**: geitonogamy. Genetically it is self-pollination.

iv. **c.** bats — A · 1

Night opening, a **pale** color seen in the dark, a strong **musty smell** and plenty of **nectar**, held clear of the leaves where a flying animal can reach it: these are the marks of a **bat** flower (chiropterophily). Bee flowers open by day; bird flowers are red and scentless; wind flowers have no nectar or scent.

v. **b.** the pollen would develop poorly, so the plant would be male-sterile — A · 1

The **tapetum nourishes the developing pollen** and helps build its wall. If it fails early, the pollen grains don't develop properly and the plant gives little or no working pollen: it becomes **male-sterile**. Plant breeders use exactly such lines to make hybrid seed, since a male-sterile plant can't pollinate itself.

4 Short answers

a. MARKING SCHEME — K · 2

- ✓ The four layers in order: epidermis, endothecium, middle layers, tapetum.
- ✓ The tapetum nourishes the developing pollen.

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b. MARKING SCHEME U · 2

- ✓ Two correct features (e.g. small and dull, no nectar or scent).
- ✓ Two more (e.g. much light dry pollen, feathery exposed stigmas).

c. MARKING SCHEME A · 2

- ✓ Tomato: self-pollination keeps the variety pure.
- ✓ Maize breeding: cross-pollination gives variation and hybrid vigor.

d. MARKING SCHEME U · 3

- ✓ Three free-nuclear mitoses give eight nuclei, four at each pole.
- ✓ One from each pole moves to the middle as the polar nuclei.
- ✓ Egg apparatus at the micropylar end, three antipodals at the chalazal end: 7 cells, 8 nuclei.

5 Numerical problem

ANSWER A · 4

n = 12.

- Microspore mother cell **24** (2n, before meiosis); microspore **12**; generative cell **12**.
- Synergid **12**; antipodal **12** (all from the haploid megaspore by mitosis).
- Zygote **24** (n + n, syngamy).
- Primary endosperm nucleus **36** (n + n + n, triple fusion), and every endosperm cell **36** (made from it by mitosis).

MARKING SCHEME

- ✓ MMC 24; microspore and generative cell 12.
- ✓ Synergid and antipodal 12.
- ✓ Zygote 24.
- ✓ Primary endosperm nucleus and endosperm 36.

6 Long answer

ANSWER U · 4

Double fertilization is the fusion of **one male gamete with the egg** and of **the other with the central cell**, both from one pollen tube; it is found only in flowering plants.

1. The pollen tube enters the ovule, usually through the **micropyle** (porogamy).
2. Guided by the **filiform apparatus**, it enters **one synergid**, which degenerates, and releases its **two male gametes**.
3. **Syngamy**: one male gamete fuses with the **egg**, forming the **diploid zygote**, which grows into the embryo.
4. **Triple fusion**: the other fuses with the **two polar nuclei**, forming the **triploid primary endosperm nucleus**, which grows into the endosperm. The other synergid and the antipodals degenerate.

MARKING SCHEME

- ✓ Definition: two fusions by the two male gametes of one tube.
- ✓ Entry through the micropyle into a synergid, releasing two gametes.
- ✓ Syngamy: gamete + egg → zygote (2n).
- ✓ Triple fusion: gamete + two polar nuclei → primary endosperm nucleus (3n).

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7 Think

ANSWER HA · 3

In both, triple fusion forms an endosperm. In the **pea** the growing embryo **absorbs all of it** before the seed ripens and stores the food in its **thick cotyledons**: a **non-endospermic** seed. The seedling feeds from its **cotyledons**.

In **maize** the endosperm **stays** and stores the food: an **endospermic** seed. At germination the **scutellum** absorbs the digested endosperm for the seedling.

MARKING SCHEME

- ✓ Pea: the embryo uses up the endosperm, storing food in its cotyledons (non-endospermic).
- ✓ Maize: the endosperm persists as the store (endospermic).
- ✓ Pea seedling fed by cotyledons; maize by the scutellum from the endosperm.

8 Activity: Taking a flower apart

(not marked)

WHAT STUDENTS SHOULD FIND

The calyx (sepals) and corolla (petals) are the **accessory** whorls; the androecium (stamens) is **male** and the gynoecium (pistil) **female** (the essential whorls). Inside the ovary are small round **ovules**; after fertilization each ovule becomes a **seed** and the ovary a **fruit**.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	10	11	8	3	**32**

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