# SEXUAL REPRODUCTION IN FLOWERING PLANTS

| Q.No | Question | Marks |
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| | **Multiple Choice Question** | |
| Q.16 | During apomictic seed formation, there is no reduction division and the gametes (both egg cell and the pollen/sperm cells) are diploid.<br><br>What is the ploidy of the endosperm formed through apomixis?<br><br>A. 2n<br>B. 3n<br>C. 4n<br>D. 6n | 1 |
| Q.17 | "Cells of the tapetum of a microsporangium are usually multinucleate".<br><br>Which of the following can be a reason for the tapetal cells to become multinucleate?<br><br>A. They fuse with the polar cells of the megasporangium.<br>B. They do not undergo karyokinesis.<br>C. They do not undergo cytokinesis.<br>D. They do not undergo mitosis. | 1 |
| Q.18 | Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R).<br><br>Assertion (A): Pollen tube germinates through the germ pores on the pollen grains.<br><br>Reasoning (R): Pollen-pistil compatibility chemicals help to dissolve sporopollenin for the pollen tube to germinate.<br><br>Which of the following is correct?<br><br>A. Both A and R are true, and R is a correct explanation of A.<br>B. Both A and R are true, but R is not a correct explanation of A.<br>C. A is true, but R is false.<br>D. A is false, but R is true. | 1 |
| Q.19 | The image below is that of an extinct angiosperm species *Archaefructus*. | 1 |

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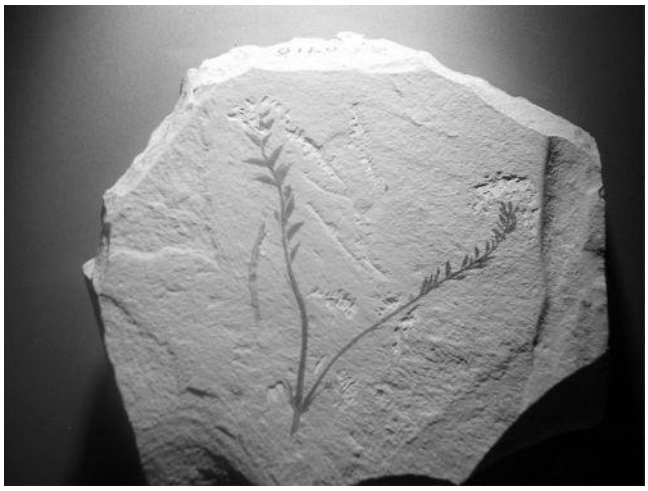
| |  <br>In a *science fiction movie*, scientists find fossilised pollen grains of *Archaefructus* and use them to fertilise a modern genus of *Archaefructus.* Nitya thinks that these pollen grains can be found under polar ice sheets where the temperature is around -40°C.<br><br>Is she correct and why?<br><br>A. Yes, because -40°C is enough to keep pollen grains viable.<br>B. No, because the pollen grains will get wet and won't function.<br>C. Yes, because pollen grains are viable at any temperature for several years.<br>D. No, because pollen grains need to be stored at much lower temperatures to be viable. | |
| Q.20 | Which of the following is TRUE for a flower giving rise to a false fruit in apple?<br><br>A. The ovary is infertile.<br>B. The ovary does not undergo fertilisation.<br>C. The thalamus undergoes fertilisation.<br>D. The thalamus forms a part of the fruit. | 1 |
| Q.21 | Two statements are given - one labelled Assertion (A) and the other labelled Reason (R).<br><br>Assertion (A): Endosperm in a flowering plant is formed before the formation of the embryo.<br><br>Reason (R): The endosperm provides food to the developing embryo.<br><br>Which of the following is correct?<br><br>A. Both A and R are true, but R is not the correct explanation of the assertion<br>B. Both A and R are true, and R is the correct explanation of the assertion.<br>C. A is true, but R is false.<br>D. A is false, but R is true | 1 |
| **Free Response Questions/Subjective Questions** | | |

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| Q.22 | The exine layer of pollen grains contains sporopollenin which is a highly resistant chemical. Sporopollenin allows pollen grains to be well-preserved as fossils.<br>(a) Can fossilised pollens fertilise an ovum of the same species in the present day? Justify.<br>(b) How do scientists preserve pollen grains for later use? | 2 |
| Q.23 | State ONE characteristic of a pollen grain that can help students identify:<br>(a) a water-pollinated pollen grain<br>(b) an animal-pollinated pollen grain. | 2 |
| Q.24 | "Continued self-pollination results in inbreeding depression".<br>(a) Mention ONE impact of inbreeding depression on the upcoming generations in a farmland.<br>(b) State ONE way in which cross-pollination helps in avoiding inbreeding depression. | 2 |
| Q.25 | Pollen grains are shed at either a two-celled stage or a three-celled stage and may take some time to reach the stigma for fertilisation. The pollen grains germinate on the stigma of the flowers.<br>(a) Where do the pollen grains get the nutrition to remain viable and germinate on the stigma?<br>(b) Mention the cell divisions that a microspore mother cell goes through to reach a three-celled pollen grain stage. | 3 |
| Q.26 | *Set up:* An area with different species of plants. A colour tracer is added to the pollen of species A.<br>*Observation:* The pollen from species A reaches the flowers of species A as well as species B. However, pollination occurs only with the flower of the species A.<br>(a) Name and explain the phenomenon underlying this observation.<br>(b) How can a farmer prevent any more pollen grains from landing on the stigma of flowers of the same species after she has artificially pollinated the flowers? | 3 |
| Q.27 | Bees transfer pollen from the younger flowers at the top of a plant to the older flowers at the base.<br>Is this an example of self-pollination or cross-pollination? Justify. | 2 |
| Q.28 | A floral formula is a concise representation of the structure of a flower. the following symbols are used to represent different facts about the flower:<br>K= calyx<br>C= corolla | 5 |

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| | A= androecium<br><br>G= gynoecium<br><br>For example, a floral formula $K_5C_5A_5G_2$ means that the flower has 5 sepals, 5 petals, 5 stamens and 2 carpels in the ovary.<br><br>Rishabh comes across a floral formula $K_6C_6A_{10}G_0$ for **all flowers** in a plant.<br><br>(a) What does the floral formula indicate about the sexuality of the flowers?<br><br>(b) What kind of pollination (self or cross) will the plant show? Justify.<br><br>(c) What kind of fruits will this plant bear and why?<br><br>(d) If this flower is seen to have large, yellow showy petals, what is the most likely pollinating agent for the flower? | |
| Q.29 | The embryo sac represents the female gametophyte in a flowering plant.<br>(a) What are the constituents of the egg apparatus in the embryo sac?<br>(b) What is the ploidy of the cells of the egg apparatus?<br>(c) The formation of the embryo sac involves mitotic divisions that are "free nuclear" till the 8-celled stage. What does the term "free nuclear" mean?<br>(d) The filiform apparatus at the micropylar end forms an important part of the embryo sac. What is the importance of the filiform apparatus? | 5 |
| Q.30 | (a) The image below shows a blue-throated hummingbird visiting a flower.<br>  <br>What is the benefit that the flower derives from the hummingbird? Justify.<br>(b) What kind of pollen grains would a flower most likely have when it is seen to be visited regularly by birds and butterflies?<br>(c) "Self-pollinated flowers mostly do not need pollinating agents." Mention whether this statement is true or false with a reason for your answer. | 5 |
| Q.31 | Give a reason for each of the following:<br>(a) The exine of pollen grains is very hard.<br>(b) The endosperm of flowering plants is triploid. | 5 |

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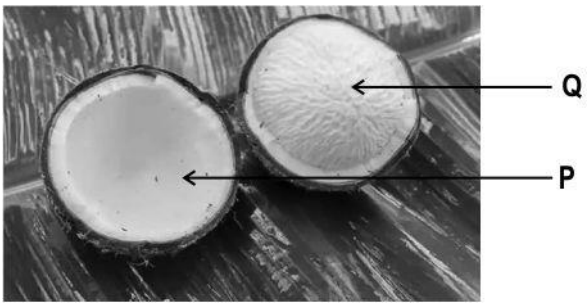
| | (c) A pollen grain landing on a stigma does not ensure fertilisation.<br>(d) Sexual reproduction brings in variation.<br>(e) Seeds of hybrid varieties need to be produced afresh every year. | |
| Q.32 | "A typical angiosperm anther is bilobed and dithecous".<br>Draw a labelled diagram to show how the anther would look like in a transverse section. | 2 |
| Q.33 | Cells of the microspore tetrads are diploid.<br>Is this statement TRUE? Justify your answer. | 2 |
| Q.34 | A farmer sowed tomatoes (plants with both sexes in the same flower) and bitter gourd (plants with both sexes in different flowers on the same plant) on his farmland.<br>(a) To ensure cross-pollination, what should the farmer do in each of the cases?<br>(b) If the male flowers from the tomato plant are removed and pollen is dusted, can the flower grow into a fruit? Why or why not? | 2 |
| Q.35 | Describe a process that can enable you to observe pollen tube germination under laboratory conditions. | 3 |
| Q.36 | Sudha cracked open a coconut and found the following content as shown in the image below:<br>  <br>(a) Identify the parts of the seed labelled P and Q.<br>(b) What is most likely to have happened to the coconut water?<br>(c) What is the ploidy of the coconut water that we drink from the tender coconut? Justify. | 3 |
| Q.37 | Some scientists have used modified techniques of the conventional methods of artificial hybridisation. One such reference is that of Reddy *et al* (1970) where:<br>- a razor blade is used to make an incision on one side of a flower bud and some petals are removed.<br>- forceps are used to emasculate the flower<br>- the bud is covered with a drinking straw made of plastic. | 3 |

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| | - the open end of the straw is bent.<br><br>- the straw is removed during pollination and replaced once pollination is completed.<br><br>[Ref: http://oar.icrisat.org/959/1/RA_00166.pdf]<br><br>(a) What process of a conventional method of artificial hybridisation method is the straw mimicking?<br><br>(b) State 2 possible benefits of bending the straw. | |
| Q.38 | Consider two plants species as described below:<br><br>Species P: bisexual, androecium and gynoecium mature at the same time and anther and style are almost of the same height<br><br>Species Q: unisexual, androecium matures later than the gynoecium and anthers are longer than the styles<br><br>(a) What kind of pollination is likely to be seen in species P and Q. Give a reason for your answer in each case.<br><br>(b) If a plant cultiver wants more viable varieties of offsprings, which species should he choose to cultivate and why? | 3 |

## Answer key and Marking Scheme

| Q.No | Answers | Marks |
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| Q.16 | D. 6n | 1 |
| Q.17 | C. They do not undergo cytokinesis. | 1 |
| Q.18 | C. A is true, but R is false. | 1 |
| Q.19 | D. No, because pollen grains needs to be stored at much lower temperatures to be viable. | 1 |
| Q.20 | D. The thalamus forms a part of the fruit. | 1 |
| Q.21 | B. Both A and R are true, and R is the correct explanation of the assertion. | 1 |
| Q.22 | (a) 0.5 marks each for stating yes/no and reason:<br>- no<br>- because pollen grains cannot remain viable for such a long time as that taken for fossilization.<br>(b) in liquid nitrogen at very low temperature conditions | 2 |
| Q.23 | 1 mark for each correct answer:<br>(a) The pollen grain will have a mucilagenous covering to avoid getting wet.<br>(b) The pollen grains will have a sticky exterior.<br>*[Accept any other valid answer]* | 2 |
| Q.24 | (a) Inbreeding depression can result in loss of fertility and vigour in the existing population.<br>(b) Cross pollination brings about variation of characters that help in increased vigour of the population | 2 |
| Q.25 | (a) The vegetative cell of the two or three- celled pollen grains provide nutrition.<br>(b) 1 mark for each correct division:<br>- microspore mother cells undergoes meiotic division to form the microspores<br>- microspores undergo mitotic division to form the three-celled stage | 3 |

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| Q.26 | (a) 1 mark each for correct name and explanation:<br><br>- pollen-pistil interaction<br><br>- The ability of a pollen grain to germinate its pollen tube on the stigma of a flower is controlled by certain chemical interactions. This chemical compatibility is termed as pollen-pistil interaction.<br><br>(b) by the technique of bagging or covering the stigma of the flower with a bag made of butter paper | 3 |
| Q.27 | 1 mark each for identification and reason:<br><br>- self pollination<br><br>- because it is the transfer of pollen grains from the anther of a flower to the stigma of another flower on the same plant | 2 |
| Q.28 | (a) It is an unisexual /staminate flower<br><br>(b) 0.5 marks each for identification and reason:<br><br>cross-pollination because all flowers on the plant are unisexual<br><br>(c) 1 mark each for identification and reason:<br><br>- The plant will not bear fruits because it is a staminate flower.<br><br>(d) insects/small animals/birds | 5 |
| Q.29 | (a) 1 mark for each correct name:<br><br>- synergids<br><br>- egg cell<br><br>(b) haploid<br><br>(c) Nuclear divisions are not followed by cell wall formation/cytoplasmic division<br><br>(d) The filiform apparatus guides the pollen tube into the synergids. | 5 |
| Q.30 | (a) 1 mark each for reward and reason:<br><br>- The hummingbird aids in pollination.<br><br>- Pollen grains stick to the beak of the bird when it inserts its beak into the flower.<br><br>(b) sticky pollen grains | 5 |

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| | (c) 1 mark each for identifying true or false and reason:<br><br>- True<br><br>- The pollen grains are not carried too far to be dependent on agents for transfer. | |
| Q.31 | (a) to protect the generative cells<br><br>(b) one of the male gametes fuse with two polar nuclei forming (n+n+n) nucleus of the endosperm<br><br>(c) there is a pollen-pistil compatibility factor that allows fertilisation<br><br>(d) fusion of two gametes coming from two parents ensures mixing of characters<br><br>(e) the characters in the progeny separate out and do not maintain hybrid characters | 5 |
| Q.32 | 0.5 marks each for each of the following:<br><br>- four lobes<br><br>- lines of dehiscence<br><br>- pollen sacs<br><br>- pollen grains | 2 |
| Q.33 | False.<br><br>Microspore tetrads develops from diploid sporogenous tissue by meiosis. | 2 |
| Q.34 | (a) 0.5 marks for each of the following:<br><br>- Emasculation will be required in tomato plants.<br><br>- Removal of female flowers in the bitter gourd plant.<br><br>*[Accept any other valid answer.]*<br><br>(b) 0.5 marks for each of the following:<br><br>- Yes<br><br>- The ovary needs to be present for fertilization to happen. | 2 |
| Q.35 | 1 mark for each of the following:<br><br>- dust some pollen grains onto a slide | 3 |

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| | - add a drop of sugar solution<br><br>- allow the slide to rest for 10-15 minutes and observe under a microscope | |
| Q.36 | (a) 0.5 marks for each correct answer:<br><br>- P: endosperm<br><br>- Q: embryo<br><br>(b) The coconut water would have been consumed by the developing embryo.<br><br>(c) 0.5 marks for each correct answer:<br><br>- 3n<br><br>- it is free-nuclear endosperm | 3 |
| Q.37 | (a) bagging (2 marks)<br><br>(b) 1 mark for each correct answer:<br><br>- prevents contamination of the style from unwanted pollen grains<br><br>- prevents loss of pollen grains after pollination<br><br>*[Accept any other valid answers]* | 3 |
| Q.38 | (a) 0.5 marks each for :<br><br>Species P: self pollination<br><br>Reason: androecium and gynoecium mature at the same time/ anthers and styles are of the same length. Hence, the pollen grains of the same plant can pollinate/fertilise the ovary of the same flower.<br><br>Species Q: cross pollination<br><br>Reason: unisexual/androecium and gynoecium mature at different times/anthers and styles are of different length. Hence, the pollens of the same plant will not be able to reach the stigma of the flowers of the same plant.<br><br>[Consider any ONE reason and accept any other valid reason]<br><br>(b) 0.5 marks each for name and reason:<br><br>Species Q as it undergoes cross pollination | 3 |