



Sample Paper-03

Class 12th NEET (2024)

BOTANY

ANSWER KEY

1. (1)
2. (1)
3. (4)
4. (4)
5. (4)
6. (4)
7. (4)
8. (4)
9. (4)
10. (2)
11. (2)
12. (4)
13. (2)
14. (4)
15. (3)
16. (4)
17. (2)
18. (3)
19. (1)
20. (1)
21. (3)
22. (3)
23. (3)
24. (2)
25. (3)

26. (2)
27. (3)
28. (4)
29. (4)
30. (3)
31. (1)
32. (4)
33. (4)
34. (1)
35. (4)
36. (1)
37. (1)
38. (3)
39. (2)
40. (3)
41. (2)
42. (2)
43. (1)
44. (3)
45. (4)
46. (4)
47. (3)
48. (4)
49. (3)
50. (3)



HINTS AND SOLUTION

1. (1)
Gynoecium indicates the female reproductive part of the flower which consists of pistil. Each pistil has three parts, that is, stigma, style and ovary. Inside the ovarian cavity, the placenta is located. Arising from the placenta there are the megasporangia, commonly called ovules.
The functional megaspore undergoing the meiotic division develops into the female gametophyte or embryo sac. Thalamus, tapetum and stamen are not a part of gynoecium. Thalamus is the part of flower which form the base on which all the floral whorls rest up on. Tapetum is the inner most nutritive layer or microsporangium and stamens are male reproductive part (androecium) of plant.
2. (1)
The pollination that occurs in opened flowers is called chasmogamy. It is of two types, that is, self-pollination (autogamy) and cross-pollination.
Cross-pollination is of two types, that is, geitonogamy and xenogamy. So, we can say that chasmogamous flowers exhibit both autogamy (self-pollination) and allogamy (cross pollination). While, in cleistogamous flower the anthers and stigma lies close to each other within the closed flowers.
3. (4)
The outermost and innermost wall layers of microsporangium in an anther are respectively, epidermis and tapetum. A typical microsporangium is generally surrounded by four-wall layers, that is, the epidermis, (outermost protective layer), endothecia, (middle fibrous layers) and the tapetum (innermost nutritive layer).
4. (4)
Double fertilisation is the process in angiosperms. It involves fusion of one male gamete (haploid) with egg (haploid) to form zygote (diploid) that gives rise to embryo accompanied with fusion of other male gamete (haploid) with two polar nuclei (secondary nucleus) to form primary endosperm nucleus (PEN) that gives rise to a nutritive tissue called endosperm.
5. (4)
When the male plant is tetraploid the gamete formed after meiotic division will be diploid. The female plant is diploid as a result, the gamete formed after the meiotic division will be haploid. The endosperm cell is formed by the fusion of two polar nuclei and one male gamete.
The two polar nuclei means $(n + n) = 2n$ and one male gamete = $2n$, which fuses to form an endosperm cell = $4n$ or tetraploid.
6. (4)
Perisperm is a nutritive tissue of a seed derived from the nucellus and deposited externally to the embryo sac. It is diploid.
7. (4)
Seeds of a large number of species live for several years. Some seeds can remain alive for hundreds of years. There are several records of very old yet viable seeds. The oldest is that of a lupine, *Lupinus arcticus* excavated from Arctic Tundra. The seed germinated and flowered after an estimated record of 10,000 years of dormancy.
8. (4)
Microspore mother cell (MMC) = 1 meiotic division = 4 microspores In each microspore = 2 mitotic division = 2 male gametes or sperms.
So, in 4 microspores = 8 mitotic divisions are required. Hence, for the production of 16 sperms 2 meiotic divisions and 16 mitotic divisions are required.
9. (4)
Total types of gametes that an organism can produce is represented by 2^n . Here, n = number of genes for which the organism is heterozygous. The given genotype $AaBbCcDd$ is heterozygous for 4 genes and can make $2^4 = 16$ types of gametes. Thus, the correct answer is option D.
10. (2)
Pure white coloured recessive pea plant – rr
Pure red coloured dominant pea plant - RR
Cross between both: $RR \times rr \rightarrow Rr$ (Heterozygous Red)
According to Mendel's law of dominance, the dominant character will express even if it is heterozygous.



11. (2)
Map distance between A and B genes = Number of recombinants/Total number of progeny $\times 100$
 $= (320 + 315/900 + 320 + 315 + 920) \times 100$
 $= (635/2450) \times 100 = 25.8$ map units.
12. (4)
Heterogamy means when an individual have two different types of sex chromosomes. Human males show heterogamy with XY chromosomes. Male grasshopper also shows heterogamy with XO chromosomes.
13. (2)
If the sister is colour blind (X^cX^c) and brother is normal (XY), then their father was colour blind (X^cY) but mother was carrier (X^cX).
14. (4)
The skin colour of man is determined by three polygenes. If two mulattoes ($AaBbCc$) marry, then seven phenotypic expressions are possible in the progeny with the phenotypic ratio of 1:6:15:20:15:6:1.
15. (3)
Test-cross is an experimental method to determine the genotype of organisms. In this cross, the unknown genotype is crossed with known homozygous recessive genotype. It is used to distinguish the pure homozygous (recessive) and hybrid (heterozygous dominant). Thus, the correct answer is option C.
16. (4)
In ABO blood groups the number of genotypes and phenotypes are 6 and 4 respectively.
Genotypes: $|A|A|, |A|i, |B|i, |A|^B, ii, |B|^B$.
Phenotypes: A, B, AB and O.
17. (2)
In co-dominance, both the alleles are able to express themselves independently when present together resulting in a phenotype that is intermediate between both the parental homozygous phenotypes, thereby resembling both of them. E.g., roan coat colour in cattle is a result of co-dominance of alleles for white and red coat colour.
18. (3)
In human beings, 45 chromosomes/single X/XO abnormality causes Turner's syndrome. Individuals having a single X chromosome $2A + XO$ (45) have female sexual differentiation but ovaries are rudimentary. Other associated phenotypes of this condition are short stature, webbed neck, broad chest, lack of secondary sexual characteristics and sterility. Thus, any unbalance in the copies of the sex chromosomes may disrupt the genetic information necessary for normal sexual development.
19. (1)
3-D model of tRNA looks like flattened L-shaped molecule. tRNA acts as adapter molecule which carries amino acids to the site of protein synthesis (i.e., ribosomes). Most accepted model for tRNA structure is clover leaf model.
20. (1)
Deoxyribonucleic acid and ribonucleic acid as the name suggests are made up of several nucleotide monomers. Each nucleotide consists of pentose sugar, phosphate group and nitrogenous bases. DNA has deoxyribose sugar whereas RNA has ribose sugar. The bases in DNA molecule are A, T, G and C whereas in RNA, thymine is absent and instead uracil is found.
21. (3)
Genetic code is non-ambiguous. Non-ambiguous code means that there is no ambiguity about a particular code. One codon specifies only one amino acid and not any other. There are 64 codons. Out of 64, 3 are stop codons or non-sense codons, i.e., these do not code for any amino acid and rest 61 code for 20 amino acids.
22. (3)
Beta-galactosidase is synthesized by E.coli to catalyze hydrolysis of lactose into galactose and glucose.
23. (3)
Translation is the process of polymerisation of amino acids to form a polypeptide. The order and sequence of amino acids are defined by the sequence of bases in the mRNA. The amino acids are joined by a bond that is known as a peptide bond. Formation of a peptide bond requires energy. So, in the first phase itself amino acids are activated in the presence of ATP and linked to their cognate tRNA-a process commonly called as charging of tRNA or aminoacylation of tRNA.



24. (2)
In eukaryotes, the mono-cistron-ic structural genes have interrupted coding sequences, that is, the genes in eukaryotes are split. The coding sequences or expressed sequences are defined as exons. These sequences (exons) appear in mature or processed RNA, thus exons are interrupted by introns or intervening sequences which do not appear in mature or processed RNA.
25. (3)
The RNA polymerase holo-enzyme transcribes the structural gene and the terminator regions. RNA polymerase consists of a number of sub-units, including a sigma factor (transcription factor) that catalyses the process of transcription. It recognises the start signals or promoter region on DNA which then along with RNA polymerase binds to promoter to initiate the transcription. In eukaryotes there are three RNA polymerases: I, II and III. The process includes a proof-reading mechanism.
26. (2)
According to Chargaff's rules of base pairing, (i) The amount of adenine is always equal to the amount of thymine and the amount of guanine is always equal to the amount of cytosine, (ii) Adenine is joined to thymine with two hydrogen bonds and guanine is joined to cytosine by three hydrogen bonds, (iii) The ratio of adenine to thymine and that of guanine to cytosine is always equal to one, that is., AG: TC = 1. In the given organism, the DNA is not following the Chargaff's rule, hence it can be concluded that it is a single-stranded DNA, not double-stranded.
27. (3)
The Severo Ochoa enzyme is polynucleotide phosphorylase. It helps in artificial synthesis of RNA in a template independent manner.
28. (4)
In a food chain, energy stored at the producer level is called as primary productivity. Energy stored at the consumer level is called as secondary productivity. In other words, it is the rate of formation of new organic matter by consumers. It is the rate of energy storage at consumer level. Consumer level includes herbivores, carnivores and decomposers. Gross primary productivity is the rate of photosynthesis. Net primary productivity is the rate of storage of organic matter except which is utilized for the respiration by plants. It is the total biomass available for consumers. Thus, the correct answer is 'Net primary productivity and secondary productivity'.
29. (4)
Ecosystem involves biotic & abiotic components. Abiotic components include non-living components while as biotic components include living components.
30. (3)
Tertiary consumers depend on the primary carnivores for food. In grazing food chain prime source of energy is sun.
31. (1)
Herbivores are eaten by primary carnivores. Only 10% of the herbivore's productivity is utilized for raising productivity of primary carnivores. The rest is consumed in ingestion, respiration, maintenance of body heat and other activities. Higher carnivores similarly are able to retain only 10% of energy present in primary carnivores. It is called 10% law which was proposed by Lindemann. Accordingly, if plant trapped 40 J of energy, mice will have 4 J, snake will have 0.4 J and hence, peacock will have 0.04 J of energy.
32. (4)
Four important functional aspects of the ecosystem are productivity, decomposition, energy flow and nutrient cycling.
33. (4)
Lantana, Eichhornia (water hyacinth) and African catfish (*Clarias gariepinus*) are neither threatened, nor indigenous species of India. They all are alien (or exotic) species which are invasive and have a harmful impact on the indigenous species leading to their extinction.
34. (1)
A forest in a tropical region like Ecuador has up to ten times as many species of vascular plants as a forest of equal area in a temperate region like the Midwest of the USA. In general, species diversity decreases as we move away from the equator towards the poles.
35. (4)
Sacred groves are forest patches around the places of worship, which are held in high esteem by tribal communities. These are found in several parts of India, e.g. Karnataka, Maharashtra, etc.



36. (1)
The rivets which are the parts of the wings are more important because they are directly involved with the flight function. These rivets on wings are compared to the key-species of an ecosystem.
37. (1)
Columbia-**1400 species** of birds. Colombia located near the equator has nearly 1,400 species of birds while New York at 41°N has 105 species and Greenland at 71°N only 56 species. India, with much of its land area in the tropical latitudes, has more than 1,200 species of birds.
38. (3)
$$\frac{dN}{dt} = (B - D) \times N$$
$$= (0.55 - 0.45) \times 1000 = 0.10 \times 1000 = 100$$
39. (2)
Competition is the competitive relationship between two organisms of same species for getting the same resources (food, habitat, light, moisture). It is a negative interaction as sometimes both the competing organisms are harmed or die.
40. (3)
The general parasitic adaptations are (i) anaerobic respiration in internal parasites, (ii) loss of certain organs, (iii) presence of adhesive organs, (iv) excessive multiplication, (v) resistant cysts and eggs for safe transfer of their progeny to new hosts and (vi) well developed and complicated reproductive organs.
41. (2)
In commensalism one partner is benefitted and the other is neither benefitted nor harmed. In Symbiosis both the interacting partners are benefitted.
42. (2)
Natality and immigration positively contribute to the population growth while mortality and emigration are negative factors. In the given question, the net increase in population is natality + immigration = 250 + 20 = 270
The net decrease in population is mortality + emigration = 240 + 30 = 270
Thus, net increase in population = 270 – 270 = 0
43. (1)
Organisms that are r-selected (r-strategists) able to colonise a habitat rapidly, utilising the food and other resources before other organisms are established and begin to compete. The r-strategists tend to be relatively small organisms with short life spans (e.g., bacteria) and often live in temporary or unstable environments; characteristically their survival depends on their ability to produce large numbers of offspring rather than on their ability to compete.
44. (3)
Methanobacterium is useful in the production of biogas. *Penicillium notatum* is used to produce penicillin, an antibiotic. *Acetobacter aceti* is used to obtain acetic acid.
45. (4)
The sediment in a settling tank is called activated sludge. A small part of it is pumped back into the aeration tank to serve as the inoculum. While the remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters.
46. (4)
Biochemical oxygen demand (BOD) is estimated by measuring the amount of oxygen consumption or is a measure of the organic pollution of water. It refers to the amount of dissolved oxygen required to decompose the organic matter in waste water. A high BOD indicates heavy pollution with little oxygen remaining for fish.
47. (3)
Glomus, is a genus of arbuscular mycorrhizal fungi and all species form a symbiotic relationship with plant roots. They help the plant in the absorption of nutrients, especially phosphorus from soil.
48. (4)
Baculoviruses are pathogens that attack insects and other arthropods. The majority of them used as a biological control agents are in the genus Nucleopolyhedrovirus. These viruses are excellent candidates for species specific, narrow spectrum insecticidal applications.



49. (3)

Klinefelter's syndrome occurs by the union of an abnormal XX egg and a normal Y sperm or a normal X egg and abnormal XY sperm. The individual has 47 chromosomes ($44 + XXY$). Such persons are sterile males with undeveloped testes, mental retardation, sparse body hair, long limbs and with some female characteristics such as enlarged breast, i.e., gynaecomastia.

50. (3)

Genetic material should be structurally and chemically stable otherwise its expression will change and lead to loss of several metabolic functions, etc.



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