CBSE Class 12 Biology

Sample Paper 04 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

i. All questions are compulsory.
ii. The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
iii. Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.
iv. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
v. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. At what stage of life oogenesis is initiated in a human female? When does the oocyte complete oogenesis?
2. What is trophoectoderm?
3. A diploid organism is heterozygous for 4 loci, how many types of gametes can be produced?
4. Name an oral pill used as a contraceptive by human females. Explain, how does it prevent pregnancy?
5. Provide an instance where the population size of species can be estimated indirectly, without actually counting them or seeing them.
6. Name the type of cross that would help to find the genotype of a pea plant bearing violet flowers.
7. Write the scientific name of the organism that Morgan used for his linkage experiment.
8. Name any two physiological barriers that provide innate immunity.
9. Name the cry genes that control cotton bollworm and corn borer, respectively.

10. Name the scientists who were awarded the Nobel Prize for discovering the potential of Penicillium.
11. **Assertion:** An organism with a lethal mutation may not even develop beyond the zygote stage.

    Reason: All types of gene mutations are lethal.

    a. The assertion is a true statement but the reason is false.
    b. Both assertion and reason are true and the reason is the correct explanation of the assertion.
    c. Both assertion and reason are true but the reason is not the correct explanation of the assertion.
    d. Both assertion and reason are false.

OR

Assertion: The cross between red and white flower bearing snapdragon plants results in a pink coloured flower.

Reason: Incomplete dominance of red and white flower results into pink coloured flower.

a. Both assertion and reason are correct.
b. The assertion is correct but the reason is incorrect
c. The assertion is incorrect but the reason is correct.
d. Both assertion and reason are incorrect.

12. **Assertion:** There is a time lag between the infection and appearance of the first symptoms of AIDS.

    Reason: This period may vary from a few months to many years up to 10 years.

    a. Both assertion and reason are correct.
    b. The assertion is correct but the reason is incorrect
    c. Both assertion and reason are incorrect
    d. Reason is correct but not explains the assertion
13. **Assertion**: Genetic map up of an organism or individual lies in the DNA sequence.

    Reason: If two individual differs, then their DNA sequence should also be different.

    a. Both assertion and reason are correct
    b. Assertion is correct but reason is incorrect
    c. Assertion is incorrect but reason is correct

d. Both assertion and reason are incorrect

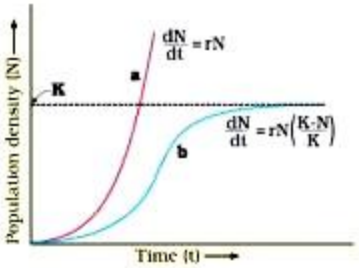
14. **Assertion:** The pattern of species diversity on earth is not uniformly distributed.
Reason: Species variation is generally highest in the tropics and decreases towards the poles.
    a. Both assertion and reason are correct.
    b. Assertion is correct but reason is incorrect.
    c. Both assertion and reason are incorrect.
    d. Assertion is incorrect but the reason is correct.
15. **Read the following and answer any four questions:**
The size of a population for any species is not a static parameter. It keeps changing in time, depending on various factors including food availability, predation pressure and reduces weather. The changes in population density give an idea of what is happening to the population whether it is flourishing or declining. The density of a population in a given habitat during a given period fluctuates due to changes in four basic processes, two of which contribute an increase in population density and two to a decrease. Under normal conditions, births and deaths are the most important factors influencing population density. Ideally, when resources in the habitat are unlimited, each species has the ability to realise fully its innate potential to grow in number, as Darwin observed while developing his theory of natural selection. Then the population grows in an exponential or geometric fashion.
    i. Which of the following would necessarily decrease the density of a population in a given habitat?
        a. Natality > mortality
        b. Immigration > emigration
        c. Mortality
        d. Natality
    ii. Which of the following factors has a negative effect on the population growth rate?
        a. Emigration
        b. Immigration
        c. Natality
        d. none of these
    iii. Which of the following factors influence population density under normal conditions?
        a. Deaths

b. Immigration
c. Emigration
d. Both (a) and (c)

iv. Which of the following equations correctly represents the exponential population growth curve?

a. $\frac{dN}{dt} = rN$
b. $\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$
c. $N_t = N_0 e^r t$
d. Both (a) and (c)

v. In the given population growth curve K represent?



a. Population density at time 't'
b. Intrinsic rate of natural increase
c. Carrying capacity
d. none of these

16. **Read the following and answer any four questions:**

Pollination is the transfer of pollen grain (shed from the anther) to the stigma of a pistil. Flowering plants have evolved an amazing array of adaptation to achieve pollination. There are three different kinds of pollination. Pollination within the same flower i.e self-pollination. Some plants produce two types of flower chasmogamous and cleistogamous another kind of pollination is the transfer of pollen grain from the anther to the stigma of the same plant or anther to the stigma of different plants. Various agents are used in pollination. Pollination is carried out by water, wind, and animal.

i. Pollination which is achieved with in the same flower is termed as:

a. Autogamy
b. Xenogamy
c. Geitonogamy
d. None of these

ii. The abiotic agent of pollination is:
   a. wind
   b. water
   c. animal
   d. Both (a) and (b)

iii. Which of the following feature should be present for wind pollination?
   a. Non-sticky and light pollen grain
   b. The long stalk of flower
   c. Colourful flower
   d. None of these

iv. Wind pollination is common in:
   a. Vallisneria
   b. Hydrilla
   c. Grasses
   d. Zostera

v. **Assertion -** Cleistogamous flower are invariably autogamous has no chance of cross pollen landing on the stigma.
   Reason - Cleistogamous flower produces assured seed set only in the presence of pollinators.
   a. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
   b. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
   c. The Assertion is true but the Reason is false
   d. Both the statements are false

Section B

17. What are the two factors which have raised life expectancy in the developing countries?
18. Sex determination is based on particular chromosomes in both birds and humans. State two points of difference between their mechanisms of sex determination.
19. Write the functions of
   i. cry IAc gene
   ii. RNA interference (RNAi)
20. Name the disorder for which the first clinical gene therapy was conducted.

OR

How is 'Rosie' considered different from a normal cow? Explain.

21. Discuss the role of enzyme DNA ligase plays during DNA replication.
22. How are bacteria made capable to take up recombinant DNA? Name the bacteria used for this process.

OR

How are the DNA fragments separated by gel electrophoresis visualised and separated for use in constructing recombinant DNA?

23. In the biosphere, immense biological diversity exists at all levels of biological organization. Explain any two levels of biodiversity.
24. Define producers and consumers.
25. Is it true that there is more solar energy available in the tropics? Explain briefly.

Section C

26. If a true breeding homozygous pea plant with green pod and axial flowers as dominant characters is crossed with a recessive homozygous pea plant with yellow pods and terminal flowers, then what would be the:
    (a) Genotypes of the two parents
    (b) Phenotypes and genotypes of the F_1 offspring
    (c) Phenotypic distribution ratio in F_2 population
27. Now, the sequencing of total genomes is getting less expensive day by the day. Soon it may be affordable for a common man to get his genome sequenced. What could be the advantage and disadvantage of this development?
28. For an organ transplant, it is an advantage to have an identical twin. Why?
29. Describe the various evidences for genetic role of DNA.
30. What are the misconceptions about the transmission or acquiring AIDS?

OR

Why is using tobacco in any form injurious to health? Explain.

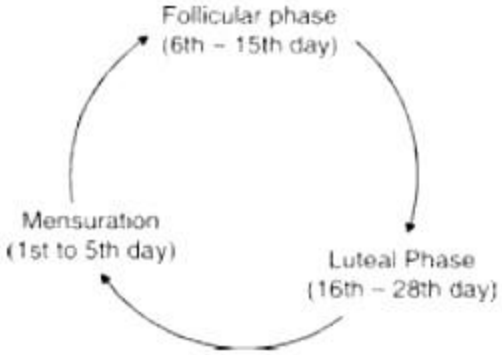
Section D

31. i. How is 'oogenesis' markedly different from 'spermatogenesis' with respect to the growth till puberty in the humans?

ii. Draw a sectional view of human ovary and label the different follicular stages, ovum and corpus luteum.

OR

The events of the menstrual cycle are represented below. Answer the question following the diagram.



i. State the levels of FSH, LH and progesterone simply by mentioning high or low, around 13^{th} and 14^{th} day and 21^{st} to 23^{rd} day.

ii. In which of the above-mentioned phases does the egg travel to the fallopian tube?

iii. Why is there no menstruation upon fertilisation?

32. The development of bioreactors is required to produced large quantities of products.

i. Give optimum growth conditions used in bioreactors.

ii. Draw a well labelled diagram of simple stirred-tank bioreactor.

iii. How does a simple stirred tank bioreactor differ from sparged stirred tank bioreactor ?

OR

i. Explain how to find whether an *E.coli* bacterium has transformed or not when a recombinant DNA bearing ampicillin resistant gene is transferred into it.

ii. What does the ampicillin resistant gene act as in the above case?

33. Explain the interrelationship between organic farming and biofertilizers, with the help of any three suitable examples.

OR

How is primary effluent treated in a sewage treatment plant before it can safely be released into rivers or streams?

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Solution

Section A

1. Oogenesis is initiated during the embryonic stage of a female foetus.
   Oocyte completes oogenesis when a sperm enters the secondary oocyte.
2. Trophoectoderm is the outer layer of the mammalian blastocyst after differentiation of the ectoderm, mesoderm, and endoderm when the outer layer is continuous with the ectoderm of the embryo.
3. 2^4 (16 gametes can be produced) types
4. 'Saheli' is a contraceptive pill used by females to space children.
   Saheli inhibits ovulation and implantation. It alters the quality of cervical mucus to prevent the entry of sperms into cervix.
5. Tiger population in National parks is calculated on the basis of pugmarks and faecal matter.
6. To find the genotype of a pea plant bearing violet flowers a test cross would be carried out.
7. Drosophila melanogaster.
8. Two physiological barriers that provide innate immunity are:
   i. The Acid in the stomach
   ii. Saliva in the mouth
   iii. Tears from eyes
9. The cry genes that control cotton bollworm are cry IAc and cry IIAb.
   Corn borer is controlled by cry IAb.
10. Alexander Fleming, Ernest Chain, and Howard Florey were the scientists who were awarded the Nobel Prize for discovering the potential of Penicillium.
11. (a) The assertion is a true statement but the reason is false.
    Explanation: An organism with the lethal mutation may not even develop beyond the zygote stage due to change in the gene but all kinds of mutations are not lethal. The mutation is the main source of variation essential for evolution.

OR

(a) Both assertion and reason are correct.

Explanation: In Snapdragon flower, a cross between true-breeding white and red coloured flower produces a pink coloured flower in F1generation. This happens due to incomplete dominance of alleles over the other.

12. (a) Both assertion and reason are correct.

    Explanation: The time between infection with the virus and the onset of symptoms of AIDS (the incubation period) ranges from a few months to ten years or more. Infected persons can spread the virus during the incubation period.

13. (a) Both assertion and reason are correct

    Explanation: DNA sequencing is the process of determining the precise order of nucleotides within a DNA molecule. It includes any method or technology that is used to determine the order of the four bases—adenine, guanine, cytosine, and thymine- in a strand of DNA.

    Genetic map up of an organism or individual lies in the DNA sequence. If two individual differs, then their DNA sequence should also be different.

14. (a) Both assertion and reason are correct.

    Explanation: Biodiversity is not uniform throughout the world but varies with latitude and altitude. Favourable environmental conditions favour speciation and make it possible for a larger number of species to exist there, i.e., biodiversity is more in such areas than the others. Latitudinal Gradients Species diversity decreased from the equator towards poles. The tropics harbor more species than temperate and polar regions.

15. i. (c) Mortality
    ii. (a) Emigration
    iii. (b) deaths
    iv. (d) Both (a) and (c)
    v. (c) carrying capacity

16. i. (a) Autogamy
    ii. (d) Both (a) and (b)
    iii. (a) Non-sticky and light pollen grain
    iv. (c) Grasses
    v. (c) The Assertion is true and the reason is false

Section B

17. i. Decline in death rate.

ii. Increase in medical facilities.

18. Birds

(i) Female : Autosomes +ZW

Male : Autosomes + ZZ

(ii) Male homogametic, female heterogametic

Human beings

Autosomes + XX

Autosomes + X

Female homogametic

Male heerogametic

19. i. cry IAc codes for toxic insecticidal protein as inactive protoxins in *Bacillus thuringinesis*. This toxin kills the cotton bollworm.

    ii. RNA interference is associated with the silencing of specific mRNA and is a method of cellular defense in eukaryotes.

20. The first patient to be treated with gene therapy was a four year old girl treated at the NIH Clinical Center in 1990. She had a congenital disease called Severe Combined Immuno Deficiency (SCID), which is caused by Adenosine deaminase (ADA) deficiency, which severely affects immunity and the ability to fight infections.

    For the therapy, her white blood cells were taken from her and inserted with the correct genes for making ADA and then reinjected into her. This process was performed by Dr. W. French Anderson from the National Heart, Lung and Blood Institute.

OR

Rosie is the first transgenic cow produced In 1997. It produced human protein-enriched milk at 2.4 grams per litre. This transgenic milk is a more nutritionally balanced product than natural bovine milk and could be given to babies or the elderly with special nutritional or digestive needs. Rosie's milk contains the human gene alpha-lactalbumin.

21. DNA ligase facilitates the joining of Okazaki fragments in lagging DNA strands together by catalysing the formation of phosphodiester bond It also played a role in repairing single-strand breaks in duplex DNA.

22. - By treating bacteria with cold calcium chloride or lysozyme.

    - Escherichia coli, Bacillus subtilis

OR

The separated DNA fragments are stained with ethidium bromide.

i. By the exposure to UV radiation, the separated DNA fragments become visible as orange-coloured bands.
ii. The separated bands of DNA are cut out from the agarose gel and DNA is extracted from these gel pieces, this process is called elution.

23. Levels of Biodiversity in Biosphere:
    i. Genetic diversity- It refers to the diversity of genes within a species. For example, there are more than 50000 genetically different strains of rice in India.
    ii. Species diversity- It refers to the number of different species within a given region For example, Western Ghats have a greater amphibian species diversity than the Eastern Ghats.
24. Producers are organisms that manufacture organic food from simple inorganic compounds by the process of photosynthesis while consumers are organisms that get food by eating producers or their products.
25. It is absolutely true that more solar energy is available in the tropics. Sunlight falls directly at the tropics. Because of straight illumination, the duration of the day is longer at the tropics than at higher latitudes. Due to this, plenty of sunlight is available in the tropics. Better availability of solar energy results in higher productivity which in turn might contribute indirectly to greater diversity.

Section C

26. (a) GGAA and ggaa
    (b) Plant with green pod and axial flowers : GgAa
    (c) Green pod : Green pod : Yellow pod: Yellow pod
    Axial flower: Terminal flower : Axial flower : Terminal flower
    9 : 3 : 3 : 1
27. **Advantages of Affordable Genome Sequencing:** It can help in settling disputes which may arise in case of parentage of a child. This can also help in disputes of property inheritance by finding the bonafide beneficiary. The human genome can also help in preparing a database on people with criminal records. It can help in identifying the chances of genetic disorders in a family.
    Disadvantages: Genome sequencing can have serious issues of privacy. Some employers may misuse the data to blackmail their employees. Many private matters may leak into the public domain; creating embarrassment for the affected person.

28. Organ transplant involves a critical issue of tissue rejection. This happens because the immune system always tries to reject any foreign substance. In case of identical twins; most of the tissues would identical in both the individuals. Hence, chances of tissue rejection would be minimal if donor-acceptor pair is from identical twins. Hence, an identical twin is considered to be an advantage for an organ transplant.
29. **Evidence for the genetic role of DNA:**
    i. It occurs in all cells thus can act as genetic material.
    ii. It is capable of replication thus can form its own carbon copies.
    iii. DNA copies are precisely the same as the original DNA hence not changing the information.
    iv. The amount of DNA per cell is constant.
    v. DNA is much stable during cellular metabolism which is necessary for genetic material.
    vi. DNA regulates cellular activities through transcription and translation.
    vii. DNA is the main component of chromosomes and chromosomes act as vehicles of hereditary information.
30. There are many wrong beliefs and misconceptions about the AIDS. AIDS cannot be acquired by the following activities:
    i. Insect bites
    ii. Crowded transport
    iii. Shaking hands
    iv. Sharing towels
    v. Coughing and sneezing
    vi. Kissing and embracing
    vii. Sharing utilities and telephone
    viii. Swimmingpools and toilets.

OR

Tobacco contains a large number of chemical substances including nicotine, which stimulates adrenal gland to release adrenaline and nor adrenaline into blood circulation, both of which raise blood pressure and increase heart rate.

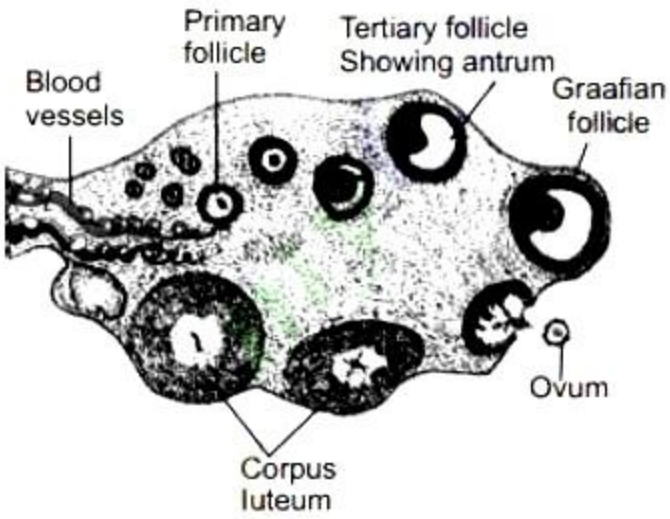
- Tobacco chewing is associated with increased risk of cancer of the oral cavity.
- Smoking reduces oxygen carrying capacity.

Section D

31. i. Oogenesis is markedly different from spermatogenesis in the following aspects-

Spermatogenesis	Oogensis
It occurs in males, starting from puberty till the complete life cycle.	It starts before birth during embryonic development and occurs till menopause.
A single spermatogonium after second meiotic division forms four haploid spermatids, that mature to form spermatozoa.	a single oogonium after second meiotic division produces one ovum and two non-functional polar bodies.
The process of spermatogenesis, i.e. second meiotic division completes in testes and releases mature sperms.	The second meiotic division of oogenesis completes in Fallopian tube when sperm enters the secondary oocyte.

ii. A diagrammatic sectional view of ovary showing different stages-



OR

i.

Hormone	13-14th day	21-23rd day
FSH	HIGH	LOW
LH	HIGH	LOW

Progesterone	Low	High

ii. Luteal

iii. There is no menstruation upon fertilization because the ovum which was to shed gets implanted. Uterine wall and blood vessels maintain the embryo.

32. i. Temperature, pH, substrates, salts, vitamins and oxygen.

ii. Simple stirred-tank bioreactor

iii. The stirrer facilitates even mixing and oxygen availability throughout simple-stirred tank bioreactor, whereas in case of sparged stirred tank bioreactor, air is bubbled throughout the reactor for proper mixing.

OR

i. When an *E.coli* bacterium is transformed with a recombinant DNA bearing ampicillin-resistant gene in its plasmid, the recombinant plasmid will lose tetracycline resistance due to the insertion of foreign DNA but can still be selected out from non-recombinant ones by plating the transformants on ampicillin containing a medium. The transformants growing on ampicillin containing medium are then transferred to a medium containing tetracycline. The recombinants will grow on ampicillin containing medium but not one that containing tetracycline. But non-recombinant will grow on the medium containing both the antibiotics.

ii. In this case, one antibiotic gene helps in selecting the transformants whereas the other antibiotic resistance gene gets inactivated due to the insertion of alien DNA and helps in the selection of recombinants. Ampicillin resistant gene in the above case helps in selecting the transformants and act as a selectable marker.

33.
- Farmers using organic farming use biofertilizers (organisms that enrich the nutrient quality of the soil) instead of chemical fertilizer.
- The main sources of biofertilizers are bacteria, fungi, and cyanobacteria.
- Example- *Rhizobium* in the root nodules of leguminous plants (symbiotic) fix

atmospheric N_2 and enrich the soil. Other free-living bacteria which can fix atmospheric nitrogen are *Azotobacter* and *Azospirillium*. Mycorrhiza which is a symbiotic association between fungus of genus *Glomus* and roots of higher plants absorb phosphorus from soil. They also make the plant resistant to root borne pathogens, tolerant to salinity and drought, and an overall increase in plant growth and development. Cyanobacteria; autotrophic microbes, fix atmospheric nitrogen and increases organic matter in the soil (*e.g. Anabaena / Nostoc / Oscillatoria)*.

OR

Sewage through filtration and sedimentation forms supernatant part the primary effluent and all the solids that settle down form the primary sludge.

Secondary treatment or Biological treatment of primary effluent involves different steps:

i. Primary effluent is passed into large aeration tanks.
ii. It is constantly agitated mechanically and the air is pumped into it.
iii. This allows vig0rous growth of useful aerobic associated with fungal filaments to form mesh like structures).
iv. The microbes decompose the major part of the organic matter in the effluent.
v. It reduces the BOD (Biological oxygen demand) of the effluent.
vi. BOD refers to the amount of oxygen that would be consumed if all the organic matter in one liter of water were oxidized by bacteria.
vii. When the BOD of sewage is reduced significantly the effluent is passed into a settling tank where the bacterial flocks are allowed to sediment forming the activated sludge.
viii. A small part of activated sludge is pumped back into the aeration tank to serve as the inoculum.
ix. The remaining major part of activated sludge is pumped into large tanks called Anaerobic sludge digesters.
x. Here, another type of anaerobic bacteria digest the bacteria and fungi in the sludge producing methane, hydrogen sulphide and carbon dioxide i.e., Biogas, can be used as a source of energy as it is inflammable.