

Solved Paper 2018

BIOLOGY

Time : 3 Hours

Class-XII

Max. Marks : 70

General Instructions:

- There are a total of 26 questions and five sections in the question paper. All questions are compulsory.
- Section A contains questions number 1 to 5, very short-answer type question of 1 mark each.
- Section B contains questions number 6 to 10, short-answer type I questions of 2 marks each.
- Section C contains question number 11 to 22, short-answer type II question of 3 marks each.
- Section D contains question number 23, value based question* of 4 marks.
- Section E contains question number 24 to 26, long-answer type questions of 5 marks each.
- There is no overall choice in the question paper, however, an internal choice is provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any one of the two given alternatives.

SECTION - A

1. Write the dual purpose served by Deoxyribonucleoside triphosphates in polymerisation. 1

Ans. Acts as a substrate, provide energy (from the terminal two phosphates). $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2018]

2. Name two diseases whose spread can be controlled by the eradication of *Aedes mosquitoes*. 1

Ans. Dengue, Chikungunya // Yellow Fever / Eastern Equine Encephalitis / West Nile Fever / Zika / Zika Virus Disease (Any two) $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2018]

3. How do cytokine barriers provide innate immunity in humans? 1

Ans. Interferon (proteins), secreted by virus infected cells (protect non - infected cells from further viral infection) $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2018]

4. Write the names of the following :

- A 15 mya primate that was ape-like
- A 2 mya primate that lived in East African grasslands. 1

Ans. (a) *Dryopithecus*. $\frac{1}{2}$
(b) *Australopithecines* / *Australopithecus* / *Homo habilis* $\frac{1}{2}$
[CBSE Marking Scheme, 2018]

5. Mention the chemical change that pro-insulin undergoes, to be able to act as mature insulin. 1

Ans. Removal of C - peptide (from pro-insulin). 1
[CBSE Marking Scheme, 2018]

Detailed Answer:

Insulin is synthesized as a pro-hormone, which needs to be processed before it becomes a fully mature and functional hormone. The pro-hormone is a single polypeptide chain with an extra stretch called the C peptide. This is removed during maturation.

SECTION - B

6. Your advice is sought to improve the nitrogen content of the soil to be used for cultivation of a non leguminous terrestrial crop.

- Recommend two microbes that can enrich the soil with nitrogen.
- Why do leguminous crops not require such enrichment of the soil? 2

Ans. (a) *Azospirillum* / *Azotobacter* / *Anabaena* / *Nostoc* / *Oscillatoria* / *Frankia*
(Any two correct names of microbes)

$\frac{1}{2} + \frac{1}{2}$
(If cyanobacteria mentioned = $\frac{1}{2}$, but if along with *cyanobacteria*, *Anabaena* / *Nostoc* / *Oscillatoria* mentioned then No mark on cyanobacteria)

- They can fix atmospheric nitrogen, due to presence of *Rhizobium* / N_2 fixing bacteria in their root nodules $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2018]

Detailed Answer:

(b) Leguminous crops contain rhizobium bacteria in their root nodules. These bacteria fix the atmospheric nitrogen directly into the soil. This decreases nitrogen deficiency in the soil and makes it fertile.

7. **With the help of an algebraic equation, how did Hardy-Weinberg explain that in a given population the frequency of occurrence of alleles of a gene is supposed to remain the same through generations?** 2

OR

Although a prokaryotic cell has no defined nucleus, yet DNA is not scattered throughout the cell. Explain.

Ans. In a population of diploid organisms.

If frequency of allele A = p and frequency of allele $a = q$ ½

Expected genotype frequency under random mating are

AA = p^2 (for the AA homozygotes)

aa = q^2 (for the aa homozygotes)

Aa = $2pq$ (for the Aa heterozygotes) ½

(In absence of selection, mutation, genetic drift or other forces allelic frequency p and q are constant through generation)

Therefore $p^2 + 2pq + q^2 = 1$ 1

[CBSE Marking Scheme, 2018]

OR

DNA is negatively charged, positively charged proteins, hold it in places, in large loops (in a region termed as nucleoid) ½ × 4

[CBSE Marking Scheme, 2018]

Detailed Answer:

The Hardy-Weinberg model enables us to compare a population's actual genetic structure over time with the genetic structure we would expect if the population were in Hardy-Weinberg equilibrium (*i.e.*, not evolving). If genotype frequencies differ from those we would expect under equilibrium, we can assume that one or more of the model's assumptions are being violated, and attempt to determine which one(s).

Hardy and Weinberg assigned the letter p to the frequency of the dominant allele A and the letter q to the frequency of the recessive allele a.

Since the sum of all the alleles must equal 100%, then $p + q = 1$. They then reasoned that all the random possible combinations of the members of a

population would equal $(p+q)^2$ or $p^2 + 2pq + q^2$.

The overall equation for the Hardy-Weinberg equilibrium is expressed in this way:

$$p^2 + 2pq + q^2 = 1 \text{ [binomial expansion of } (p + q)^2] \quad 2$$

OR

In prokaryotic cell, the DNA is not scattered throughout the cell but present in the form of a membrane less structure called nucleoid. The prokaryotic cells use a specific mechanism to pack the genetic material tightly into this region.

The prokaryotic cells do take up a measure against this by folding the fibres and forming genophore.

- * 8. **How did a citizen group called Friends of Areata Marsh, Arcata, California, USA, help to improve water quality of the marshland using Integrated Waste Water Treatment? Explain in four steps.** 2
- * 9. **You have obtained a high yielding variety of tomato. Name and explain the procedure that ensures retention of the desired characteristics repeatedly in large populations of future generations of the tomato crop.** 2
10. (a) **Name the source plant of heroin drug How is it obtained from the plant?**
- (b) **Write the effects of heroin on the human body.** 2

Ans. (a) *Papaver somniferum* / Poppy plant. ½

Extracted from latex of the plant / acetylation of morphine (obtained from the latex of plant). ½

(b) Depressant, slows down body function.

[CBSE Marking Scheme, 2018] ½ + ½

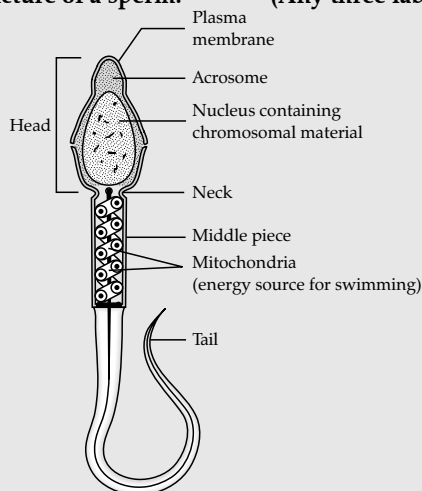
Detailed Answer:

- (a) Poppy plant (*Papaver somniferum*) is the source of heroine drug. Chemically, heroin is diacetyl morphine. It is obtained by acetylation of morphine. Morphine is extracted from the latex of poppy plant.
- (b) Heroin acts as a depressant by affecting the central nervous system (CNS). It binds to the specific opioid receptors present in our CNS and slows down body functions. It reduces heartbeat, blood pressure and urine output, increase blood sugar and causes constipation.

SECTION - C

11. **Draw a diagram of a mature human sperm. Label any three parts and write their functions.** 3

Ans. Structure of a sperm: (Any three labelling)



1/2 x 3

Plasma membrane: Envelope of the sperm

Acrosome: Filled with enzyme that help fertilization of ovum

Mitochondria: Energy source for swimming

Middle Piece: Possess mitochondria which is the energy source for swimming

Tail: For movement of sperm

Nucleus: Containing chromosomal material

(Functions of the parts labelled) 1/2 x 3
[CBSE Marking Scheme, 2018]

12. (a) Expand VNTR and describe its role in DNA fingerprinting.
(b) List any two applications of DNA fingerprinting technique. 3

Ans. (a) VNTR - (i) Variable Number of Tandem Repeat(s) 1/2
(ii) used as a probe (because of its high degree of polymorphism) 1/2
(b) Forensic science / criminal investigation (any point related to forensic science) / determine population and genetic diversities / paternity testing / maternity testing / study of evolutionary biology (Any two) 1+1
[CBSE Marking Scheme, 2018]

13. Differentiate between Parthenocarpy and Parthenogenesis. Give one example of each. 3

Ans. Differences between parthenogenesis and parthenocarpy :

Parthenogenesis	Parthenocarpy
New organism develops without fertilization. 1	Formation of fruit without fertilization. 1
e.g., Drones / male honey bee 1/2	e.g., banana / grapes / any other correct example. 1/2

1 1/2 + 1 1/2

[CBSE Marking Scheme, 2018]

14. Medically it is advised to all young mothers that breast feeding is the best for their newborn babies. Do you agree? Give reasons in support of your answer. 3

Ans. Yes = 1,
provides nutrition (calcium, fats, lactose) / provides (passive) immunity / provides antibodies / Ig A
(Any two) 1+1
[CBSE Marking Scheme, 2018]

Detailed Answer:

Yes, breast feeding is important for newborn babies. The milk produced during initial stages of lactation called colostrum is a rich source of antibodies. This antibodies protect the baby from external viral and bacterial infection. It also has a balanced nutrients, which is extremely beneficial for newborn babies.

- * 15. Explain the mechanism of 'sex determination' in birds. How does it differ from that of human beings?
16. (a) How has the development of bioreactor helped in biotechnology?
(b) Name the most commonly used bioreactor and describe its working.

Ans. (a) Larger biomass / large volume of culture can be processed leading to higher yields of desired specific products (protein / enzymes), under controlled condition. 1/2+1/2
(b) Stirring type 1/2
• Mixing of reactor contents evenly (with agitator system or a stirrer) 1/2
• Facilitates oxygen availability 1/2
• Temperature / pH / foam control // under optimum conditions 1/2
[CBSE Marking Scheme, 2018]

Detailed Answer:

- (a) Bioreactors are the vessels in which raw materials are biologically converted into specific products, enzymes etc., using microbial plant, animal or human cells. A bioreactor provides the optimal growth conditions such as temperature, pH, substrate, salts, vitamins, oxygen to obtain large amount of the desired product.
(b) The most commonly used bioreactors are of stirring type. A stirred tank reactor is generally cylindrical in shape or with curved base to facilitate the mixing of the reactor contents. The stirrer facilitates even mixing and oxygen availability throughout the bioreactor. Alternatively, the air can be bubbled through the reactor. The bioreactor has following systems-agitator system, an oxygen delivery system, a foam control system

a temperature control system and pH control system. It also has sampling ports so that small volumes of the culture can be withdrawn periodically.

17. Explain the roles of the following with the help of an example each in recombinant DNA technology:
 (a) Restriction Enzymes herbi
 (b) Plasmids 3

Ans. (a) It recognises a specific sequence of base pairs, palindromes, and cuts the DNA strand at a specific site $\frac{1}{2} + \frac{1}{2}$
 e.g., EcoRI / Hind II or any other correct example $\frac{1}{2}$
 (b) Act as vectors / cloning of desired alien gene / foreign gene 1
 e.g., pBR322 / plasmid of *Salmonella* / plasmid of *Agrobacterium* / Ti Plasmid / Tumour inducing Plasmid $\frac{1}{2}$
 [CBSE Marking Scheme, 2018]

*18. Explain out-breeding, out-crossing and cross-breeding practices in animal husbandry. 3

19. (a) Organic farmers prefer biological control of diseases and pests to the use of chemicals for the same purpose. Justify.
 (b) Give an example of a bacterium, a fungus and an insect that are used as biocontrol agents. 3

Ans. (a) (i) Reduces dependence on toxic chemicals.
 (ii) Protects our ecosystem or environment.
 (iii) Protects and conserves non-target organisms / they are species-specific.
 (iv) These chemicals being non-biodegradable may pollute the environment permanently.
 (v) These chemicals being non-biodegradable may cause biomagnification.
 (Any three) $\frac{1}{2} \times 3$
 (b) Bacteria : *Bacillus thuringiensis* $\frac{1}{2}$
 Fungus : *Trichoderma* $\frac{1}{2}$
 Insect : Ladybird / Dragonfly / Moth or any other correct example $\frac{1}{2}$
 [CBSE Marking Scheme, 2018]

20. (a) Differentiate between analogous and homologous structures.
 (b) Select and write analogous structures from the list given below:
 (i) Wings of butterfly and birds
 (ii) Vertebrate hearts
 (iii) Tendrils of bougainvillea and cucurbita
 (iv) Tubers of sweet potato and potato 3

Ans. Differences between analogous and homologous structures :
 (a) **Analogous:** Anatomically not similar though perform similar functions / are a result of convergent evolution. 1

Homologous : Anatomically similar (but perform different functions) / are a result of divergent evolution. 1

- (b) Option (i) Wings of butterfly and birds /
 (iv) Tubers of sweet potato and potato
 (Any one) 1

[CBSE Marking Scheme, 2018]

Detailed Answer:

Homologous organs	Analogous organs
The organs of different species of common descent which look different and perform different functions, but have similar basic structure, similar topographic relationship, and similar embryonic origin are called homologous organs.	The organs which have the same function and are superficially alike but are quite different in their fundamental structure and embryonic origin are called analogous organs.
Homology is based on divergent evolution.	Analogy is based on convergent evolution.
e.g., : Vertebrate Forelimbs, Insect Mouth Parts, Thorns and Tendrils of some Plants.	e.g., : Insect and Bird Wings, Fins and Flippers, Cephalopod, Vertebrate eyes and Tubers of sweet potato and potato

21. (a) "India has greater ecosystem diversity than Norway." Do you agree with the statement? Give reasons in support of your answer.
 (b) Write the difference between genetic biodiversity and species biodiversity that exists at all the levels of biological organisation. 3

OR

- * Explain the effect on the characteristics of a river other urban swage is discharged into it. 3

Ans. (a) Yes $\frac{1}{2}$
India / tropical region :
 (i) are less seasonal / more constant / more predictable.
 (ii) promote niche specialisation leading to greater bio-diversity.
 (iii) Species diversity increases as we move towards equator.
 (iv) More number of species exist.
 (Any one) $\frac{1}{2}$

Norway / temperate region :

- (i) more seasonal / less constant / less predictable.
 (ii) do not promote niche specialisation leading to low bio-diversity.

(iii) Species diversity decreases as we move away from equator.

(iv) Less number of species exist.

(Any one) $\frac{1}{2}$

(b) (i) **Genetic diversity** : Diversity / variation within a species over its distributional range / same explained with the help of a correct example. 1

(ii) **Species diversity** : Diversity / variation at a species level / same explained with the help of a correct example. 1

[CBSE Marking Scheme, 2018]

* 22. How has the use of *Agrobacterium* as vectors helped in controlling *Meloidogyne incognita* infestation in tobacco plants? Explain in correct sequence. 3

SECTION - D

* 23. Looking at the deteriorating air quality because of air pollution in many cities of the country, the citizens are very much worried and concerned about their health. The doctors have declared health emergency in the cities where the air quality is very severely poor.

(a) Mention any two major causes of air pollution.

(b) Write any two harmful effects of air pollution to plants and humans.

(c) As a captain of your school Eco-club, suggest any two programmes you would plan to organise in the school so as to bring awareness among the students on how to check air pollution in and around the school. 5

SECTION - E

24. (a) Describe any two devices in a flowering plant which prevent both autogamy and geitonogamy.

(b) Explain the events upto double fertilisation after the pollen tube enters one of the synergize in an ovule of an angiosperm. 5

OR

(a) Explain menstrual cycle in human females.

(b) How can the scientific understanding of the menstrual cycle of human females help as a contraceptive measure?

Ans. (a) (i) Dioecy / production of unisexual flowers (in different plants)

(ii) Self incompatibility 1+1

(b) (i) Pollen tube releases 2 male gametes in the cytoplasm of synergize

(ii) One male gamete fuses with egg cell syngamy, resulting in diploid zygote

(iii) Other male gamete fuses with polar nuclei / triple fusion, to form triploid PEN (Primary Endosperm Nucleus) / PEC (Primary Endosperm Cell) 1×3

OR

(a) (i) **Menstrual Phase** : Menstrual flow occurs / due to breakdown of endometrial lining of uterus, when fertilization does not occur.

(ii) **Follicular Phase** : Primary follicles grow into mature Graafian follicles and endometrium regenerates through proliferation, changes induced by pituitary and ovarian hormones.

(iii) **Ovulatory Phase** : LH surge, induces rupture of Graafian follicle and release of secondary oocyte / ovum during middle of cycle (i.e. 14th day).

(iv) **Luteal phase** : Ruptured Graafian follicle transforms into corpus luteum which secrete large amount of progesterone, essential for maintaining endometrium. 1 × 4

(b) Because ovulation occurs during mid cycle chances of fertilisation are very high so, couples should abstain from coitus between day 10 - 17. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2018]

25. (a) Write the scientific name of the organism Thomas Hunt Morgan and his colleagues worked with for their experiments. Explain the correlation between linkage and recombination with respect to genes as studied by them.

(b) How did Sturtevant explain gene mapping while working with Morgan? 5

OR

(a) State the 'Central dogma' as proposed by Francis Crick. Are there any exceptions to it? Support your answer with a reason and an example.

(b) Explain how the biochemical characterisation (nature) of "Transforming Principle" was determined, which was not defined from Griffith's experiments. 5

Ans. (a) *Drosophila melanogaster*. 1

They observed that two genes (located closely on a chromosome) did not segregate independently of each other (F_2 ratio deviated significantly from 9:3:3:1). $\frac{1}{2}$

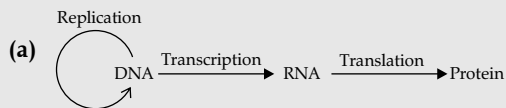
Tightly linked genes tend to show fewer (lesser) recombinant frequency of parental traits / show higher (more) frequency of parental type. $\frac{1}{2}$

Loosely linked genes show higher percentage (more) of recombinant frequency of parental traits / lower frequency percentage of parental type. $\frac{1}{2}$

Genes present on same chromosome are said to be linked and the recombinant frequency depends on their relative distance on the chromosome. $\frac{1}{2}$

- (b) Alfred Sturtevant used the recombination frequency between gene pairs as a measure of physical distance between genes and 'mapped' their position on the chromosome. This process of mapping the gene positions was termed as gene mapping, which are used today for genome sequencing projects as in Human Genome Project. **1+1**

OR



$1\frac{1}{2}$

Yes, in some viruses flow of information is in reverse direction / reverse transcription $\frac{1}{2}+\frac{1}{2}$

e.g., Any Retrovirus / HIV $\frac{1}{2}$

- (b) Protein + Protease \rightarrow transformation occurred (R cell to S type) $\frac{1}{2}$

RNA + RNA ase \rightarrow transformation occurred

(R cell to S type) $\frac{1}{2}$

DNA + DNA ase \rightarrow transformation inhibited

$\frac{1}{2}$

Hence DNA alone is the transforming material $\frac{1}{2}$

[CBSE Marking Scheme, 2018]

26. * (a) Following are the responses of different animals to various abiotic factors. Describe each one with the help of an example.

(i) Regulate

(ii) Conform

(iii) Migrate

(iv) Suspend

- (b) If 8 individuals in a population of 80 butterflies die in a week, calculate the death rate of population of butterflies during that period. **5**

OR

- (a) What is a trophic level in an ecosystem? What is 'standing crop' with reference to it?
- (b) Explain the role of the 'first trophic level' in an ecosystem.
- (c) How is the detritus food chain connected with the grazing food chain in a natural ecosystem? **5**

Ans. (b) Death rate = $\frac{8}{80} = 0.1$, individuals per butterfly per week. $\frac{1}{2}+\frac{1}{2}$

OR

- (a) Specific place of an organism in a food chain, mass of living material (biomass) at each trophic level at a particular time. **1+1**
- (b) First trophic level has producers / autotrophs, which trap solar energy / to produce food (photosynthesis). **1+1**
- (c) Organisms of the Detritus food chain (DFC) are the prey to the Grazing food chain (GFC) organism, the dead remains of GFC are decomposed into simple inorganic materials which are absorbed by DFC organisms. $\frac{1}{2}+\frac{1}{2}$

[CBSE Marking Scheme, 2018]

