Sample Paper – 03 (2016-17)
Class 12 Biology

General Instructions:

(i) All questions are compulsory.

(ii) This question paper consists of four Sections A, B, C and D. Section A contains 5 questions of one mark each, Section B is of 5 questions of two marks each, Section C is of 12 questions of three marks each and 1 question of four mark and Section D is of 3 questions of five marks each.

(iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.

(iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

Section A

1. What is the Ploidy of PEN?
2. What are explants?
3. What were the primitive earth conditions created by Miller?
4. Which enzyme is known as 'molecular scissors'?
5. The sequence of coding strand in a transcription unit is written as follows:
   5'- ATGCATGCATGCATGCATGC-3' Write the sequence of mRNA

Section B

6. What are the 2 types of cells lining the seminiferous tubules?
7. What are histones?
8. What do you mean by inbreeding depression? How this problem should be solved during animal breeding?

   Or

   Write with examples, how use of microbes helps us to make different types of cheese with specific texture & flavors?
9. What are the basic processes that lead to fluctuations in density of a given population.
10. What may be the reasons for low productivity of ocean?

Section C

11. What is the fate of the product of fertilization in humans?
12. How was the genetic code elucidated?
13. How was the theory of chemical evolution proved?
14. What are the different levels at which gene regulation can be achieved?
15. What are the primary lymphoid organs?
16. Explain some methods of Molecular Diagnosis.
17. Explain with examples, how do the plant animal interactions involve co-evolution.
18. Cancer is one of the most dreaded diseases of human beings and is a major cause of death all over the globe. Explain the
    (i) Causes of cancer

(ii) Techniques of detection and diagnosis
(iii) Treatment and cure.

19. The rate of decomposition of detritus is affected by the abiotic factors like availability of oxygen, pH of the soil substratum, temperature etc. Discuss.
20. What are the different methods of breeding?
21. When is insulin fully functional?
22. You have identified a useful gene in a bacteria. Make a flow chart of the steps that you would follow to transfer this gene to a plant.
23. A Couple young quarreled with the hospital authority on suspicion that their child had been exchanged after birth. The couple based their argument on the fact that their child is 'O' blood group whereas they are A and B blood groups respectively. The doctor smiled and explained.
    (a) What values of the doctor is reflected here?
    (b) How can the child be O blood group as explained by the doctor?
    (c) Which test method can be considered authentic to identify the biological parents of the child?
    (d) Name the other blood group(s) which the child could have inherited.

Section D

24. Explain and illustrate the development of the embryo sac

Or

Schematically represent spermatogenesis and oogenesis with ploidy at each stage.

25. (a) Formation of life was preceded by chemical evolution. Which is the experiment which proved this?
    (b) What is nucleosome?

Or

(a) Represent schematically the independent assortment of chromosomes.
(b) What are the requisites for a molecule to be a genetic material?

26. Elaborate on the key abiotic elements that contribute to the variation in habitats.

Or

What are the arguments for conserving biodiversity?

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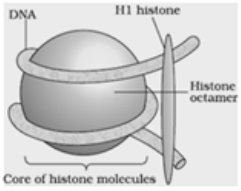
Answers
Section A

1. 3n.
2. Any part of a plant taken out and grown in a test tube, under sterile conditions in special nutrient media.
3. High temperature, volcanic storms, reducing atmosphere containing CH_4, NH_3.
4. Restriction enzymes.
5. 5' – AUGCAUGCAUGCAUGCAUGC – 3'

Section B

6. Each seminiferous tubule is lined on its inside by two types of cells called male germ cells (*spermatogonia*) and Sertoli cells. The male germ cells undergo meiotic divisions finally leading to sperm formation, while Sertoli cells provide nutrition to the germ cells.
7. 

Histones are positively charged , basic proteins. They organise to form a unit of eight molecules called as histone octamer. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.
8. Continued inbreeding, especially close inbreeding, usually reduces fertility and even productivity. This is called inbreeding depression. Whenever this becomes a problem, selected animals of the breeding population should be mated with unrelated superior animals of the same breed. This usually helps restore fertility and yield.

Or

Different varieties of cheese are known by their characteristic texture, flavor and taste, the specificity coming from the microbes used. For example, the large holes in 'Swiss cheese' are due to production of a large amount of CO_2 by a bacterium named *Propionibacteriumsharmanii*. The 'Roquefort cheese' are ripened by growing a specific fungi on them, which gives them a particular flavor.

9. The basic processes that lead to fluctuations in density of a given population are
   (i) Natality
   (ii) Mortality
   (iii) Immigration
   (iv) Emigration
10. Low productivity of ocean is due to following reasons:
   (i) Lack of light.
   (ii) High salinity.
   (iii) High pressure and
   (iv) Waves and tides.

Section C

11. The product of fertilization is the zygote.

The mitotic division starts as the zygote moves through the isthmus of the oviduct called cleavage towards the uterus and forms 2, 4, 8, 16 daughter cells called blastomeres. The embryo with 8 to 16 blastomeres is called a morula. The morula continues to divide and transforms into blastocyst as it moves further into the uterus. The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass. The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst. As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

12. A genetic code is that which directs the sequence of amino acids during synthesis of proteins. The chemical method developed by HarGobind Khorana was instrumental in synthesizing RNA molecules with defined combinations of bases (homopolymers and copolymers). Marshall Nirenberg's cell-free system for protein synthesis finally helped the code to be deciphered. Severo Ochoa enzyme (polynucleotide phosphorylase) was also helpful in polymerizing RNA with defined sequences in a template independent manner (enzymatic synthesis of RNA).
    The salient features of genetic code are as follows:
    (i) The codon is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids, hence they function as stop codons.
    (ii) One codon codes for only one amino acid, hence, it is unambiguous and specific.
    (iii) Some amino acids are coded by more than one codon, hence the code is degenerate.
    (iv) The codon is read in mRNA in a contiguous fashion. There are no punctuations.
    (v) The code is nearly universal: for example, from bacteria to human UUU would code for Phenylalanine (phe). Some exceptions to this rule have been found in mitochondrial codons, and in some protozoans.
    (vi) AUG has dual functions. It codes for Methionine (met), and it also act as initiator codon.
13. Oparin and Haldane proposed that the first form of life could have come from pre-existing non-living organic molecules (e.g. RNA, protein, etc.) and that formation of life was preceded by chemical evolution, i.e., formation of diverse organic molecules from inorganic constituents. The conditions on earth were – high temperature, volcanic storms, reducing atmosphere containing CH4, NH3, etc.
    Miller created similar conditions in a laboratory scale. He created electric discharge in a closed flask containing CH4, H2, NH3 and water vapour at 8000C. He observed formation of amino acids. In similar experiments others observed, formation of sugars, nitrogen bases, pigment and fats. Analysis of meteorite content also revealed similar compounds indicating that similar processes are occurring elsewhere in space.
14. Gene regulation could be exerted at
    (i) transcriptional level (formation of primary transcript),
    (ii) processing level (regulation of splicing),
    (iii) transport of mRNA from nucleus to the cytoplasm,
    (iv) translational level.
15. The primary lymphoid organs are **bone marrow** and **thymus** where immature lymphocytes differentiate into antigen-sensitive lymphocytes.
    (i) The bone marrow is the main lymphoid organ where all blood cells including lymphocytes are produced.
    (ii) The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained it reduces to a very small size.

(iii) Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes.

16. Recombinant DNA technology, Polymerase Chain Reaction (PCR) and Enzyme Linked Immuno-sorbent Assay (ELISA) are some of the techniques in Molecular Diagnosis.
Presence of a pathogen (bacteria, viruses, etc.) is normally suspected only when the pathogen has produced a disease symptom. By this time the concentration of pathogen is already very high in the body. However, very low concentration of a bacteria or virus (at a time when the symptoms of the disease are not yet visible) can be detected by amplification of their nucleic acid by PCR. PCR is now routinely used to detect HIV in suspected AIDS patients. It is being used to detect mutations in genes in suspected cancer patients too. It is a powerful techqnique to identify many other genetic disorders. A single stranded DNA or RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by using autoradiography. The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complimentarity with the mutated gene. ELISA is based on the principle of antigen-antibody interaction. Infection by pathogen can be detected by the presence of antigens (proteins, glycoproteins, etc.) or by detecting the antibodies synthesised against the pathogen.
17. Plant-animal interactions often involve co-evolution of the mutualists, that is, the evolutions of the flower and its pollinator species are tightly linked with one another. In many species of fig trees, there is a tight one-to-one relationship with the pollinator species of wasp. It means that a given fig species can be pollinated only by its 'partner' wasp species and no other species. The female wasp uses the fruit not only as an ovi-position (egg-laying) site but uses the developing seeds within the fruit for nourishing its larvae. The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites. In return for the favour of pollination the fig offers the wasp some of its developing seeds, as food for the developing wasp larvae.
The Mediterranean orchid Ophrys employs 'sexual deceit' to get pollination done by a species of bee. One petal of its flower bears an uncanny resemblance to the female of the bee in size, colour and markings. The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another flower, it transfers pollen to it and thus, pollinates the flower. If the female bee's colour patterns change even slightly for any reason during evolution, pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee.
18. In our body, cell growth and differentiation is highly controlled and regulated. In cancer cells, there is breakdown of these regulatory mechanisms. Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appear to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumors. Tumors are of two types: benign and malignant. Benign tumors normally remain confined to their original location and do not spread to other parts of the body and cause little damage. The malignant tumors, on the other hand are a mass of proliferating cells called neoplastic or tumor cells. These cells grow very rapidly, invading and damaging the surrounding normal tissues. As these cells actively divide and grow they also starve the normal cells by competing for vital nutrients.
Causes of Cancer-
(i) Ionizing radiations like X-rays and gamma rays and non-ionizing radiations.
(ii) The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer.
(iii) Cancer causing viruses called oncogenic viruses have genes called viral oncogenes.

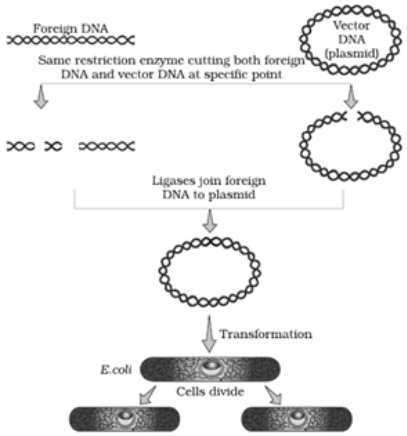
Treatment and cure-

(i) Surgery.

(ii) Radiation therapy In radiotherapy, tumor cells are irradiated lethally, taking proper care of the normal tissues surrounding the tumor mass.

(iii) Immunotherapy.

(iii) Several chemotherapeutic drugs are used to kill cancerous cells. Some of these are specific for particular tumors. Majority of drugs have side effects like hair loss, anemia, etc.

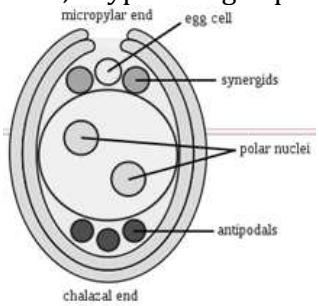
19. Decomposition is largely an oxygen-requiring process. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water-soluble substances like sugars. Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes. Warm and moist environment favor decomposition whereas low temperature inhibit decomposition resulting in buildup of organic materials.
20. The different methods of breeding are:
    (a) Inbreeding
    (b) Out breeding
    (c) Out crossing
    (d) Cross breeding and
    (e) Interspecific hybridization
21. Insulin is synthesised as a pro-hormone (like a pro-enzyme, the pro-hormone also needs to be processed before it becomes a fully mature and functional hormone) which contains an extra stretch called the C peptide. This C peptide is not present in the mature insulin and is removed during maturation into insulin.
22. 

23. (a) The doctor was assertive, patient and pragmatic.
    (b) Possible if the parents are hererozygotes, i.e. Ai x Bi. If the child receives i from both the parents, it becomes ii, and expresses O blood group.
    (c) DNA finger printing.
    (d) A or B or AB.

Section D

24. The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac. Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of

the embryo sac. Nuclear divisions are not followed immediately by cell wall formation. After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac. Six of the eight nuclei are surrounded by cell walls and organised into cells; the remaining two nuclei, called polar nuclei are situated below the egg apparatus in the large central cell. There is a characteristic distribution of the cells within the embryo sac. Three cells are grouped together at the micropylar end and constitute the egg apparatus. The egg apparatus, in turn, consists of two synergids and one egg cell. The synergids have special cellular thickenings at the micropylar tip called filiform apparatus, which play an important role in guiding the pollen tubes into the synergid. Three cells are at the chalazal end and are called the antipodals. The large central cell has two polar nuclei. Thus, a typical angiosperm embryo sac, at maturity is 8-nucleate and 7-celled.



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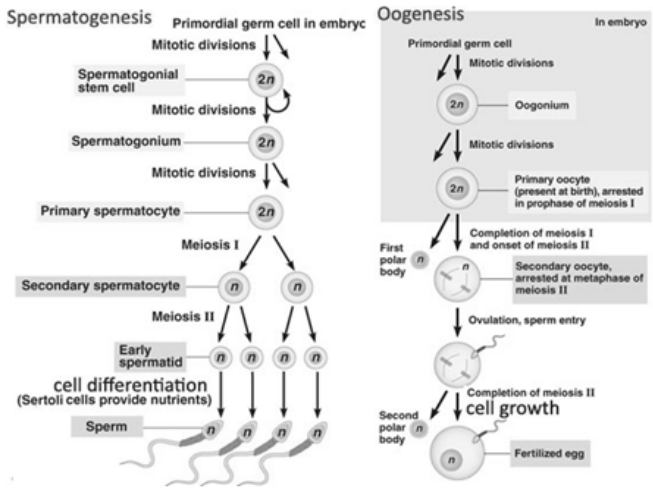
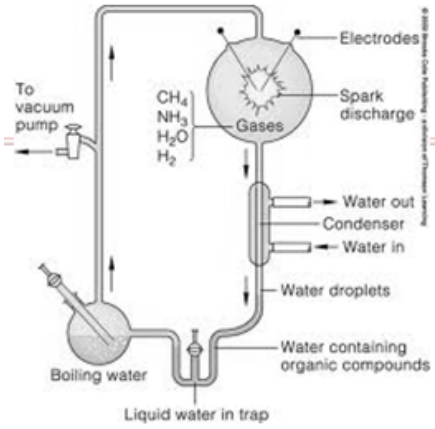
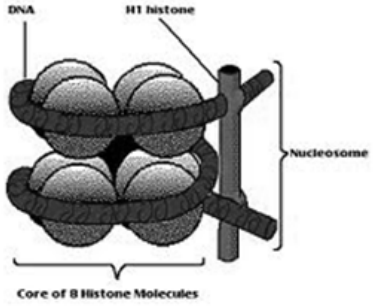


25. (a) The first form of life could have come from pre-existing non-living organic molecules (e.g. RNA, protein, etc.) and that formation of life was preceded by chemical evolution, i.e., formation of diverse organic molecules from inorganic constituents. The conditions on earth were – high temperature, volcanic storms, reducing atmosphere containing CH_4, NH_3, etc.



Miller and Urey created similar conditions in a laboratory scale. He created electric discharge in a closed flask containing CH4, H2, NH3 and water vapour at 8000C. He observed formation of amino acids. In similar experiments others observed, formation of sugars, nitrogen bases, pigment and fats. Analysis of meteorite content also revealed similar compounds indicating that similar processes are occurring elsewhere in space.

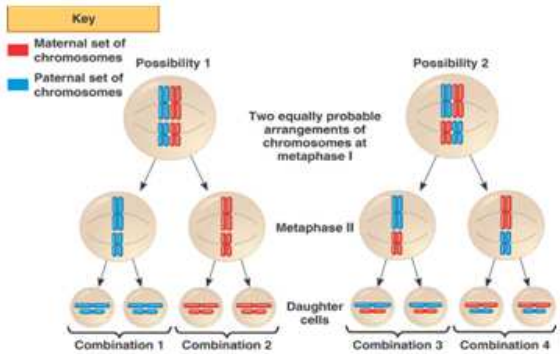
(b) In eukaryotes, the organization of DNA is complex. There is a set of positively charged, basic proteins called histones which are rich in the basic amino acid residues lysines and arginines. Both the amino acid residues carry positive charges in their side chains. Histones are organised to form a unit of eight molecules called as histone octamer. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome. A typical nucleosome contains 200 bp of DNA helix. Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin, thread-like stained (coloured) bodies seen in nucleus. The nucleosomes in chromatin are seen as 'beads-on-string' structure when viewed under electron microscope



Nucleosome

Or

(a)



(b) A molecule that can act as a genetic material must fulfill the following criteria:
(i) It should be able to generate its replica (Replication).
(ii) It should chemically and structurally be stable.
(iii) It should provide the scope for slow changes (mutation) that are required for evolution.
(iv) It should be able to express itself in the form of 'Mendelian Characters'.

26. The important ones are:

Abiotic components- temperature, water, light and soil.

Biotic components – pathogens, parasites, predators and competitors.

Temperature- It affects the kinetics of enzymes and through it the basal metabolism, activity and other physiological functions of the organism. A few organisms can tolerate and thrive in a wide range of temperatures (eurythermal), but, a vast majority of them are restricted to a narrow range of temperatures (stenothermal). The levels of thermal tolerance of different species determine to a large extent their geographical distribution.

Water- Life is unsustainable without water. Its availability is so limited in deserts that only special adaptations make it possible to live there. The productivity and distribution of plants is heavily dependent on water. For aquatic organisms the quality (chemical composition, pH and salinity) of water becomes important. Some organisms are tolerant of a wide range of salinities (euryhaline) but others are restricted to a narrow range (stenohaline). Many freshwater animals cannot live for long in sea water and vice versa because of the osmotic problems, they would face.

Light- is required for:

(a) Photosynthesis
(b) Flowering
(c) Diurnal and seasonal migrations of organisms.

Or

The **narrowly utilitarian** arguments for conserving biodiversity are obvious; humans derive countless direct economic benefits from nature food (cereals, pulses, fruits), firewood, fibre, construction material, industrial products (tannins, lubricants, dyes, resins, perfumes) and products of medicinal importance.

The **broadly utilitarian** argument says that biodiversity plays a major role in many ecosystem services that nature provides. Pollination (without which plants cannot give us fruits or seeds) is another service, ecosystems provide through pollinators layer – bees, bumblebees, birds and bats.

The **ethical** argument for conserving biodiversity relates to what we owe to millions of plant, animal and microbe species with whom we share this planet.