Studentpad

K-CET BIOLOGY PAPER 2022-23

Time : 120 Min	Bio : Full Portion Paper	Marks : 60

Hints and Solutions

01) Ans: **A)** Vicia faba
Sol: Taylor's experiment on Vicia faba root tips was using autoradiography technique and further he used tritiated thymidine $\left(H^3 - tdR\right)$.

02) Ans: **C)** passive

03) Ans: **B)** Agrobacterium tumefaciens

04) Ans: **B)** Low rainfall
Sol: Deserts have 25 cm (10 inches) or less of precipitation which show poor biodiversity and their productivity is minimum.

05) Ans: **A)** Photosystem II
Sol: Photosystem II is present in appressed part of grana thylakoids. It has chlorophyll a, b and carotenoids and it consists of a photocentre $\left(P_{680}\right)$, oxygen evolving complex, light harvesting complex (LHC II) and some electron carriers. Oxygen evolving complex contains Mn^{2+}, Ca^{2+} and Cl^{-}.

06) Ans: **A)** Glomus
Sol: Glomus is an example of endomycorrhiza. It is a symbiotic associations with plants. The fungal symbiont in these association absorbs phosphorus from soil and passes it to the plant. Plants having such association show other benefits also, such as resistance to root- borne pathogens, tolerance to salinity and drought, and an overall increase in plant growth and development. Nostoc is a blue green algae, Agaricus is a basidiomycetes, Rhizobium is a eubacteria.

07) Ans: **A)** gene therapy
Sol: The therapy given in 1990 to a four-year-old girl with adenosine deaminase (ADA) deficiency is gene therapy. It is a technique of genetic engineering which involves replacement of a faulty/disease causing gene by a normal healthy functional gene. The first clinical gene therapy was given in 1990 to a 4-years old girl with adenosine (ADA) deficiency and this enzyme is very important for the immune system to function. The deficiency of this enzyme can lead to severe combined immune deficiency (SCID).

08) Ans: **C)** Spores
Sol: In asexual reproduction of Mucor three type of non-motile mitospores are produced. i.e., sporangiospores, chlamydospores and oidia.

09) Ans: **A)** two-celled
Sol: In over 60 % of angiosperms (mostly dicots), pollen grains are shed at 2-celled stage. In the remaining species, the generative cell divise mitotically to produce the two male hametes before pollen grains are shed (3-celled stage).

10) Ans: **B)** P-700

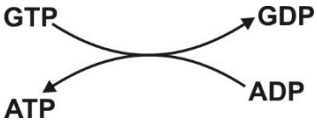
11) Ans: **C)** unpaired bases
Sol: The end of fragments of DNA molecule are sticky because of unpaired bases. Restriction endonucleases, cleave DNA duplex at specific points in such a way that single -stranded free ends project from each fragment of DNA duplex. These single- stranded free ends are termed as "sticky ends" as they can join similar complementary ends of DNA fragment from some other source as they contain unpaired bases.

12) Ans: **B)** Succinyl CoA to succinic acid
Sol: Succinyl - CoA is converted by enzyme succinyl CoA synthesis thiokinase to form succinate (a 4 carbon component). The reaction releases sufficient energy to form ATP (in plants) or GTP (in animals). GTP can form ATP through a coupled reaction.

$$\text{Succinyl CoA} + GDP / ADP + H_3PO_4$$

$$\xrightarrow[\text{synthetase thiokinase}]{\text{succinyl CoA}}$$

$$\text{Succinate} + CoA + GTP / ATP \times [2]$$



13) Ans: **A)** AB
Sol: Blood group 'AB' has both the antigens and no antibodies.

14) Ans: **A)** Structural units of ovaries of female cockroach
Sol: Ovarioles are structural units of ovaries of female cockroach. In female cockroach, there are two ovaries, one on either side of the alimentary canal. Each ovary consists of eight ovarioles or ovarian tubules that produce ova. All the filaments of the eight ovarioles of each ovary are united to form a ligament and the ligaments of both ovaries meet in the middle line and get attached to the fat bodies. Ovarioles pass the ova to the oviduct.

15) Ans: **B)** In vitro fertilization and embryo transfer
Sol: In vitro fertilisation (IVF) proceed by embryo transfer (ET) is a method use to treat infertility and

Studentpad 2022-23

commonly known as the 'Test tube baby' programme.
IVF-Fertilisation outside the body is almost similar conditions as that in the body.
In this method ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory.
ZIFT (Zygote Intra Fallopian Transfer): The zygote or early embryos (up to 8 blastomeres) could then be transferred in to the fallopian tube.
IUT (Intra Uterine Transfer): Embryos with more than 8 blastomeres could be transferred into the uterus, to complete its further development.

16) Ans: **D)** All of these

17) Ans: **D)** none of these
Sol: Starch sheath is also known as endodermis, a single layer of compactly arranged cells which are generally Parenchymatous, but have distinct wall characteristics clearly seen in roots. In some stems it is identifiable by innermost layer of cortex. Caspary (1865-66) intrduced a band of the wall material in the radial and transverse walls of endodermis. This particular wall material is chemically different from the rest of the wall. It is known as casparian strip or starch sheath and it is believed to be made of suberin and found in roots.

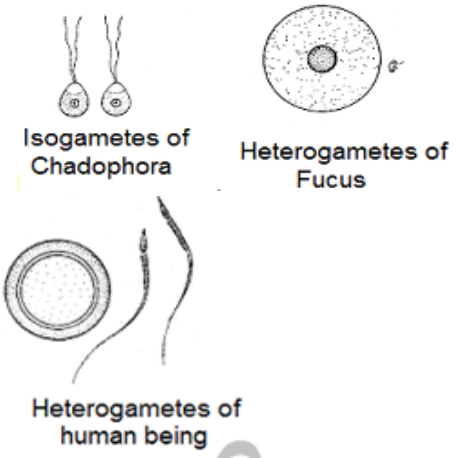
18) Ans: **B)** auto immune response

19) Ans: **D)** tRNA
Sol: From the very beginning of the proposition of code, it was clear to Francis Crick that there has to be a mechanism to read the code and also to link it to the amino acids, as amino acids have no structural specialties to read the code uniquely. He postulated the presence of an adapter molecule that would on one hand read the code and one other hand would bind to specific amino acids. The tRNA, then called sRNA (soluble RNA), was known before the genetic code was postulated.

20) Ans: **D)** 51%
Sol: Vulnerable species refer to those species whose present population is sufficient but is under-going depletion because of some factor, or factors so that, it is facing risk of extinction in medium term future. Out of the total threatened species, 34-51% are vulnerable (34% mammals, 36% birds, 43% reptiles, 48% amphibians and 51% angiosperms).

21) Ans: **C)** Soil erosion
Sol: Top soil is the vital part of the soil and serves as the chief source of nutrition for plants. Loss or disturbance of top soil by natural agents such as water, wind, gravity or ice is called soil erosion.

22) Ans: **C)** a-isogametes of Cladophora, b-heterogametes of Fucus, a heterogametes of human beings
Sol:



23) Ans: **B)** Vivipary
Sol: Vivipary is undesirable for annual crop plants as seeds cannot be stored for next season.
Seed germinated inside the fruit while attached to the plant is called viviparous germination.
Vivipary is found in halophytes or marshy plants e.g.: Rhizophora and Sonneratia

24) Ans: **A)** Naked seeds in cones
Sol: Because Pinus is gymnosperm plant.

25) Ans: **B)** Bacteria (Actinomycetes)

26) Ans: **C)** progesterone and estrogen
Sol: A contraceptive pill contains progesterone and ostrogen hormone which prevents ovulation and helps in birth control.

27) Ans: **B)** IUCN
Sol: IUCN (International Union of Conservation of Nature and Natural Resources) is now called World Conservation Union (WCU). It has its headquarters at Morges, Switzerland. It publishes and maintain a red data book or red list which is a catalogue of taxa facing risk of extinction. Red data book or red list was initiated in 1963. The Red list of year 2000 has made assessment of 18,000 species.

28) Ans: **C)** Penicillium notatum restrict the growth of Staphylococci.
Sol: Penicillium notatum restrict the growth of Staphylococci. Acetobacter aceti produces acetic acid and Saccharomyces cerevisiae is used for commercial production of ethanol. Streptococcus produces streptokinase which is genetically modified by to be used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack. Bacteria which produces methane are collectively known as methanogens, and one such common bacterium is Methanobacterium. These bacteria are commonly found in the anaerobic sludge during sewage treatment.

29) Ans: **D)** All of these
Sol: AIDS is a viral disease caused by HIV (Human Immunodeficiency Virus). Such common means are:
i) Infected blood transfusion

Studentpad 2022-23

ii) Sexual intercourse with an infected partner without a condom
iii) From infected mother to child through placenta
iv) Use of contaminated needles, razors and syringes
v) Artificial insemination
vi) Organ transplantation

30) Ans: **D)** Conclavin- A, morphine, codeine, vinblastine
Sol: Secondary metabolites are derivatives of primary metabolites which have no direct function in growth and development of plants. These compounds are accessory rather than central to the functioning. e.g., arbrin, cellulose, gums, diterpenes, carotenoids, curcumin, rubber etc. whereas Argenine, tyrosine, glycine, serine and phenylalanine are amino acids, which are primary metabolites.

31) Ans: **D)** All of the above.
Sol: When alien species are introduced unintentionally or deliberately it results in decline in biodiversity e.g., when Nile Perch was introduced into Lake Victoria in East Africa it led to extinction of cichlid fish in the lake. Introduction of water hyacinth led to the environmental damage and threat to our native species in water bodies. The illegal introduction of the African catfish for aquaculture purposes has posed a threat to the indigenous catfishes in Indian rivers.

32) Ans: **C)** Mutualism, protocooperation, commensalism cannot be included under Symbiosis

33) Ans: **D)** date and place of collection, English, local and botanical names, family, collector's name.
Sol: A printed label $(7\times12\text{cm})$ giving the following information is fixed on the lower, right corner of herbarium sheet:
(i) Scientific name of plant, (ii) Common/vernacular name, (iii) Family, (iv) Locality, (v)Date of collection, (vi) Collection number, (vii) Name of collector, (viii) Plant characteristics (optional), (ix) Name of institution (optional).

34) Ans: **C)** Emasculation, bagging, pollenation, rebagging
Sol: A breeder is interested in crossing different species and often genera to combine desirable characters to produce commercially 'superior' varieties.
Artificial hybridisation is one of the major approaches of crop improvement programme.
In such crossing experiments it is important to make sure that only the desired pollen grains are used for pollination and the stigma is protected from contamination (from unwanted pollen). This is achieved by emasculation and baggiing techniques.
If the female parent bears bisexual flowers, removal of anthers referred to as emasculation.
Emasculated flowers covered with a bag of suitable size, generally made up of butter paper to prevent contamination of its stigma with unwanted pollen. This process is known as bagging. Pollen grains collected from anthers of the male are dusted on the stigma, and flowers are rebagged, the fruits allowed to develop.

35) Ans: **D)** Both proteins and lipids
Sol: Plasma membranes are fluid mosaic or quasifluid mosaic in nature and are bimolecular layer of lipids and proteins.

36) Ans: **D)** 1986

37) Ans: **D)** 32
Sol: Metaphase is the best time to quantify and study the morphology of chromosomes. At metaphase, the condensed chromosomes with two chromatids are organized at the equatorial plate. Kinetochore, consisting of multilayered plates of proteins, forms on opposite sides of each centromere and becomes intimately associated with the two sister chromatids. In onion root tip, each somatic cell contains 8 chromosomes. A cell undergoing cell division has duplicated its chromosomes thus a cell at metaphase stage of cell division has 16 chromosomes. As each chromosome has two kinetochores so during metaphase 32 kinetochores can be seen.

38) Ans: **C)** Mitochondria and 9+2 arrangement of microtubules

39) Ans: **B)** DNA dependent RNA polymerase

40) Ans: **D)** Glaucoma

41) Ans: **D)** the ovum and sperms are transported simultaneously to ampullary -isthmic junction of the Fallopian tube
Sol: If the ovum and sperms are transported simultaneously to ampullary -isthmic junction of the Fallopian tube, then only fertilisation in humans is practically feasible. The fusion of a haploid male gamete (sperm) and a haploid female gamete (ovum) to form a diploid zygote is known as fertilisation. In human beings, it takes place in the ampullary isthmic junction of the oviduct (Fallopian tube).

42) Ans: **C)**

a	b	c
1	1	2

Sol:

	Column I		Column II
a	XO type	1	Male heterogamety
b	XY type	1	Male heterogamety
c	ZW type	2	Female heterogamety

In both cases (XO and XY type) males produce two different type of gametes, (a) either with or without X-chromosome or (b) some gametes with X-chromosome and some with Y-chromosome. This types of sex determination mechanism is designated to be the example of male heterogamety.
In ZW type of sex determination two different types

Studentpad 2022-23

of gametes in yerms of the sex chromosomes, are produced by females, i.e. female heterogamety.

43) Ans: **D)** ligase
Sol: A foreign DNA and plasmid cut by the same restriction endonuclease can be joined to form a recombinant plasmid using ligase enzyme. Ligases are important in the synthesis and repair of many biological molecules, including DNA ligase and it is used in genetic engineering to insert foreign DNA into cloning vectors.

44) Ans: **A)** Complementary genes

45) Ans: **C)** a, b, c, d and e
Sol: CO_2 gas is produced in the following process:
a. Fermentation of dough
b. Cheese making
c. Production of beverages
d. Biogas production
e. Alcoholic fermentation

46) Ans: **C)** There is a chemical bonding between oxygen and haemoglobin
Sol: Haemoglobin is an iron containing respiratory pigment which occurs in red blood cells. It is a tetrameric conjugated protein and can find four oxygen molecule by co-ordination bonds.

47) Ans: **C)** A = Membrana granulosa
B = Theca interna
C = Ovum
D = Cumulus oophorus
E = Anturm
F = Theca externa

48) Ans: **D)** calcium chloride
Sol: In order to induce the bacterial uptake of plasmids the bacteria are made competent by first treating with calcium chloride. Calcium salts increase the efficiency so that DNA enters the bacterium through pores in its cell wall.
Recombinant DNA can then be forced into such cells by incubating cells in the recombinant DNA on ice, followed by placing them briefly at high temperature i.e. 42° C (heat shock) and then putting them back on ice.

49) Ans: **C)** Carbonic anhydrase
Sol: Carbonic anhydrase enzyme is essential for the transport of CO_2 as bicarbonate in blood. The large fraction of carbon dioxide (about 70%) is converted to bicarbonate ions $\left(HCO_3^-\right)$ and transported in plasma. When carbon dioxide diffuses into the RBCs, it combines with water, forming carbonic acid $\left(H_2CO_3\right)$. H_2CO_3 is unstable and quickly dissociates into hydrogen ions and bicarbonate ions.

$$\underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{Water}}{H_2O} \xrightleftharpoons{\text{Carbonic anhydrase}} \underset{\text{Carbonic acid}}{H_2CO_3} \rightleftharpoons \underset{\text{Hydrogen ions}}{H^+} + \underset{\text{Bicabonate ions}}{HCO_3}$$

This reaction is thousands times faster in erythrocytes as they contain carbonic anhydrase, an enzyme that reversibly catalyses the conversion of carbon dioxide and water to carbonic acid.

50) Ans: **D)** none of the above
Sol: Gene therapy is the technique of genetic engineering to replace a defective gene that has been performed by doctors all over the world on different patients including children and adults. Gene therapy treatments cannot be used in all conditions, e.g., multigene or multifunctional disorders such as cardiovascular diseases, diabetes, sickle cell anaemia, arthritis etc. are difficult to treat effectively using gene therapy. The disorders that arise from single gene mutations. e.g., cystic fibrosis, muscular dystrophy etc. can be effectively treated using gene therapy.

51) Ans: **B)** Extra nuclear DNA

52) Ans: **D)** iii, iv
Sol: Every gene, contains the information to express a particular trait. In a diploid organism, the there are two copies of each gene, i.e. as a pair of alleles.
Now, these two alleles need not always be identical, as in a heterozygote. One of them may be different due to some changes that it has undergone which modifies the information that particular allele contains.
Let's take an example of a gene that contains the information for producing an enzyme. Now there are two copies of this gene, the two allelic forms.
Let us assume (as is more common) that the normal allele produces the normal enzyme that is needed for the transformation of a substrate S.
Theoretically, the modified allele could be responsible for production of:
the normal/less efficient enzyme, or
a non-functional enzyme, or
no enzyme at all
In the first case, the modified allele is equivalent to the unmodified allel, i.e. it will produce the same phenotype/trait, i.e. result in the transformation of substrate S. Such equivalent allele pairs are very common.
But, if the allele produces a non-functional enzyme or no enzyme, the phenotype may be effected.
The phenotype/trait will only be dependent on the functioning of the unmodified allele.
The unmodified (functioning) allele, which represents the original phenotype is the dominant allele and the modified allele is generally the recessive allele.
Therefore, in the example above the recessive trait is seen due to non-functional enzyme or because no enzyme is produced.

53) Ans: **A)** Afferent arteriole

Studentpad 2022-23

54) Ans: **C)** 50%
Sol: Escherichia coli completely radioactive DNA was allowed to replicate in non-radioactive medium for two generations (40 minutes). 50% bacteria are with radioactive DNA.
DNA extracted from the culture after another generation [that is after 40 minutes, II generation] was composed of equal amounts of this hybrid DNA and of 'light' DNA.

55) Ans: **B)** Tobacco
Sol: Photoperiodism is phenomena in which plant response to duration and timings of light and dark period. It was first studied by W.W. Garner and H.A Allard (1920) in tobacco. They observed that Maryland Mammoth variety of tobacco could be made to flower in summer by reducing the light hours with artificial darkening.

56) Ans: **A)** First child will survive
Sol: Rh^- woman married with Rh^+ man, become sensitized simply by carrying a Rh^+ child within her body. Some of the cells from the embryo may mix into her own blood stream in development. The first child of the parents with this genetic back ground is nearly always normal.

57) Ans: **A)** Cotton bollworms and corn borer respectively
Sol: Bt toxin genes were isolated from Bacillus thuringiensis and incorporated into several crop plants such as cotton. Two cry genes, cryIAc and cryIIAb have been incorporated in cotton and the genetically modified crop is called Bt cotton as it contains Bt toxin genes against cotton bollworms. Protein encoded by gene cryIAb controls the infestation of corn borer insects in Bt corn.

58) Ans: **B)** Translation

59) Ans: **A)** Klinefelter syndrome

60) Ans: **A)** Asparagus
Sol: Cladode are nearly similar to phylloclade with the difference that cladode may by made up of only one internode e.g, Asparagus (Satavar) or two internodes e.g., Ruscus.

Studentpad 2022-23