Question Paper Code. 57/2/1

SECTION A

Q. Nos. 1 - 5 are of one mark each

1. Meiosis is an essential event in the sexual life cycle of any organism. Give two reasons.

Ans. (i) Meiosis helps in formation of gametes by reductional division & maintains number of chromosomes constant / maintains ploidy = ½

(ii) Recombination of genes in offsprings / brings variation = ½

[1 Mark]

2. How does a degenerate code differ from an unambiguous one?

Ans. Degenerate Code : one amino acid coded by more than one codon = ½

Unambiguous code : One codon for one amino acid = ½

[1 Mark]

3. Write the hypothetical proposals put forth by Oparin and Haldane.

Ans. Oparin & Haldane : First form of life could have (origin of life) come from pre existing non living organic molecules = ½

formation of diverse organic molecules from inorganic constituents/ formation of life was preceeded by chemical evolution = ½

[1 Mark]

4. Write the function of RNA polymerase II.

Ans. RNA polymerase II - transcribes precursor of mRNA / hn RNA

[1 Mark]

5. "Man can be a primary as well as a secondary consumer." Justify this statement.

Ans. Vegetarian diet - Primary consumer = ½

Non vegetarian diet - Secondary consumer = ½

[1 Mark]

SECTION B

Q. Nos. 6 - 10 are of two marks each

6. Suggest two advantages to a farmer for using apomictic seeds of hybrid varieties.

Ans. (i) No segregation of characters in hybrid progeny = 1

(ii) Apomictic hybrid seeds can be used to grow crop year after year /

economical as ordinary hybrid seeds are not used to grow crop year after year = 1

[2 Marks]

7. When does a geneticist need to carry a test cross? How is it carried?

Ans. To know unknown genotype of the dominant trait (homozygous or heterozygous) = 1

by crossing the unknown genotype with corresponding recessive trait, = ½

if progeny is 50% dominant -Heterozygous/
if all dominant - Homozygous } ½

[2 Marks]

8. Differentiate between outbreeding and outcrossing.

Ans. Outbreeding -Breeding of unrelated animals (no common ancestor for 4 - 6 generations)

belonging to same breed or different breed or different species = 1

Outcrossing - breeding within the animals of same breed having no common ancestors for 4 - 6 generation on either side of their pedigree = 1

[2 Marks]

OR

Bottled fruit juices are clearer as compared to those made at home. Explain.

Ans. Enzyme Pectinase , protease are added for clearing them = 1 + 1

[2 Marks]

9. When you go for a trek / trip to any high altitude places, you are advised to take it easy and rest for the first two days. Comment, giving reasons.

Ans. Altitude sickness / due to low O_2 availability } = ½

Body compensates low oxygen availabilty during rest by increasing R.B.C production , decreasing the binding capacity of haemoglobin , increasing breathing rate = ½ + ½ + ½

[2 Marks]

10. What is joint forest management? How can it help in conservation of forests?

Ans. JFM - A programme (initiated by Govt. of India in 1980) where govt. works closely with local communities for protecting & managing forests = 1

Forests are conserved by locals in a sustainable manner as locals are also benefitted with forest products / (fruits / gum / rubber / medicines etc) = 1

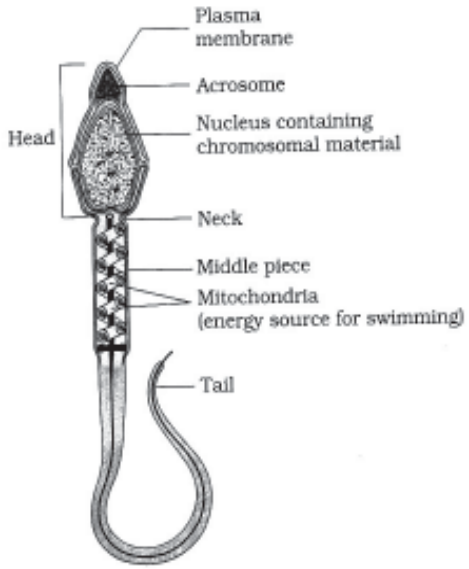
[2 Marks]

SECTION C

Q. Nos. 11 - 22 are of three marks each

11. Draw a labeled diagram of a human sperm.

Ans.



(any six labels = ½ × 6)

[3 Marks]

12. What is amniocentesis? Justify the statutory ban on it.

Ans. Study of chromosonal pattern in amniotic fluid of foetus ,

It is misused to detect the sex of the foetus ,

ban to check female foeticide

(= 1 × 3)

[3 Marks]

13. (a) Name the kind of diseases/disorders that are likely to occur in humans if

(i) Mutation in the gene that codes for an enzyme phenyl alanine hydrolase occurs,

(ii) There is an extra copy of chromosome 21,

(iii) the karyotype is XXY.

(b) Mention any one symptom of the diseases/disorders named above.

Ans. (a & b)

(i) Phenylketonuria , mental retardation = ½ + ½

(ii) Down' s syndrome , short statured / small round head / furrowed tongue / partially open mouth / broad palm with characteristics palm crease / retarded mental physical and psychomotor development = ½ + ½

(iii) Klinefelter's Syndrome , Overall masculine development with feminine features (enlarged breast / Gynaecomastia) / sterile = ½ + ½

(any one symptom from each category , any other appropriate symptom)

[3 Marks]

14. How was a heavy isotope of nitrogen used to provide experimental evidence to semi-conservative mode of DNA-replication?

Ans. E.coli were allowed to grow on medium containing ^{15}N for many generations so that ^{15}N was incorporated in newly synthesized DNA making it heavy DNA (Nitrogen is important constituent of DNA) = ½

The heavy DNA can be differentiated from light DNA by Caesium Chloride Density Gradient centrifugation , = ½

The above E.coli (with ^{15}N) were then transferred in medium containing ^{14}N and, samples were taken out after 20 minutes and after 40 minutes = ½

Extracted DNA was centrifuged and measured to get their density , = ½

DNA extracted after 20 minutes (Ist Generation) showed an intermediate hybrid density / ^{14}N ^{15}N, = ½

DNA extracted after 40 minutes (2nd Generation) showed equal amount of Light DNA / ^{14}N and hybrid DNA / ^{14}N ^{15}N = ½

= ½ × 6

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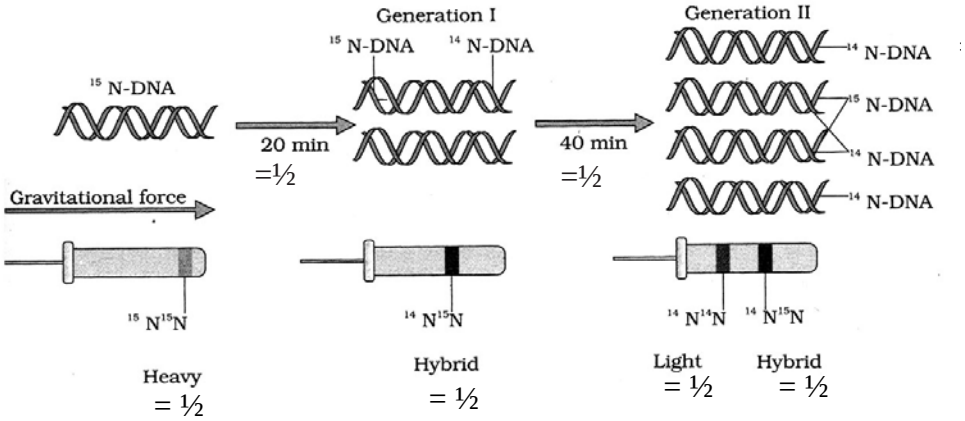


[3 Marks]

15. Explain convergent evolution with the help of two examples.

Ans. <u>Convergent Evolution</u>

Presence of organs in different organisms that are not anatomically similar but they perform similar functions , and two or more group of unrelated animals come to resemble each other for similar mode of life or habitat = ½ + ½

eg. (i) Wings of butterfly and Wings of birds / Wings of bats

(ii) Potato (stem) - sweet potato (root)

(iii) Eye of octopus and eye of mammals

(iv) Flippers of Penguin and flippers of dolphins

(or any other example of Analogous organs)

(any 2 examples) = 1 + 1

[3 Marks]

16. How can sewage be used to generate biogas ? Explain.

Ans. When BOD of sewage is reduced , effluent is passed into a settling tank for bacterial flocs to settle down (which is Activated sludge) = ½ + ½

Activated sludge is pumped into anaerobic sludge digesters , Bacteria grow anaerobically and digest bacteria & fungi in sludge = ½ + ½

During digestion bacteria produce a mixture of gases containing methane , hydrogen sulphide and CO_2 = ½ + ½

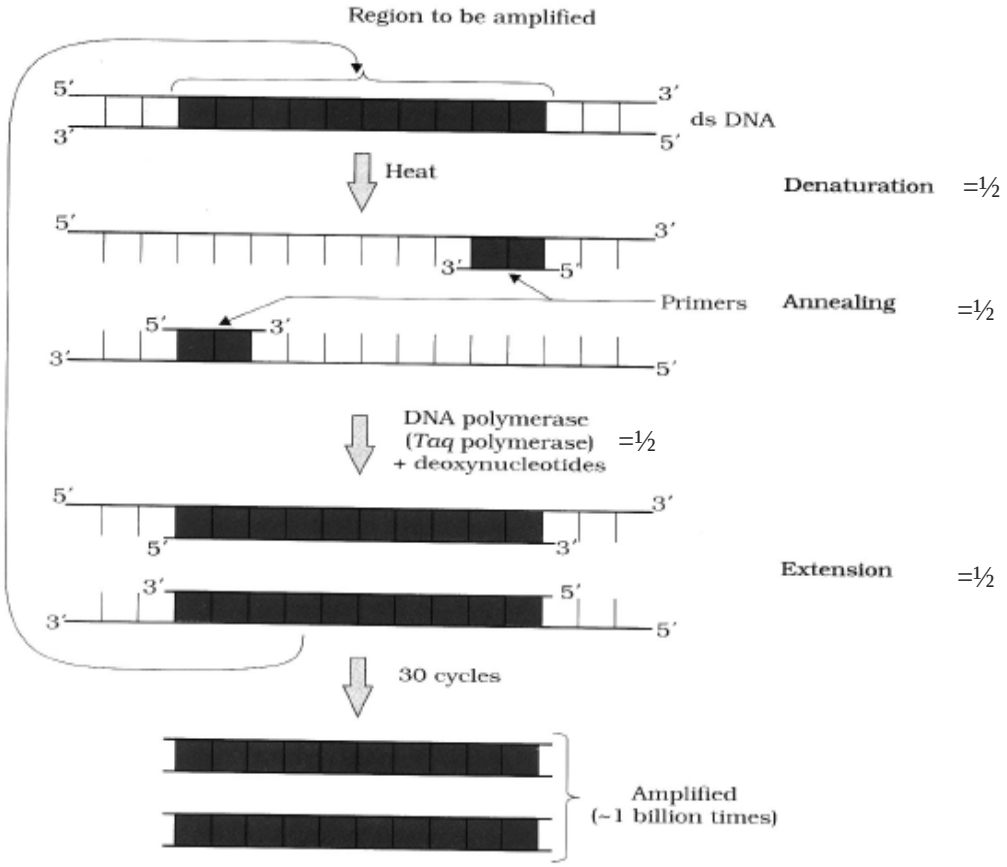
[3 Marks]

17. Many copies of a specific gene of interest are required to study the detailed sequencing of bases in it. Name and explain the process that can help in developing large number of copies of this gene of interest.

Ans. Polymerase Chain Reaction = 1

- Denaturation / Separation of ds DNA (by high temperature) = ½
- Annealing - Two sets of primers are added which anneal to 3' end of each separated strand as they act as initiator of replication = ½
- Extension - DNA Polymerase / Taq polymerase =½ , extends primer by adding nucleotides using DNA as templates = ½

} //



[3 Marks]

18. Prepare a flow chart in formation of recombinant DNA by the action of restriction endonuclease enzyme EcoRI.

Ans. Restriction endonuclease (EcoRI) inspects the length of the DNA sequence of both vector and foreign DNA ,

↓

binds to the specific recognition sequence / palindromic sequence ,

↓

cuts the strand of DNA between G and A ,

↓

only when the sequence GAATTC is present in the DNA ,

↓

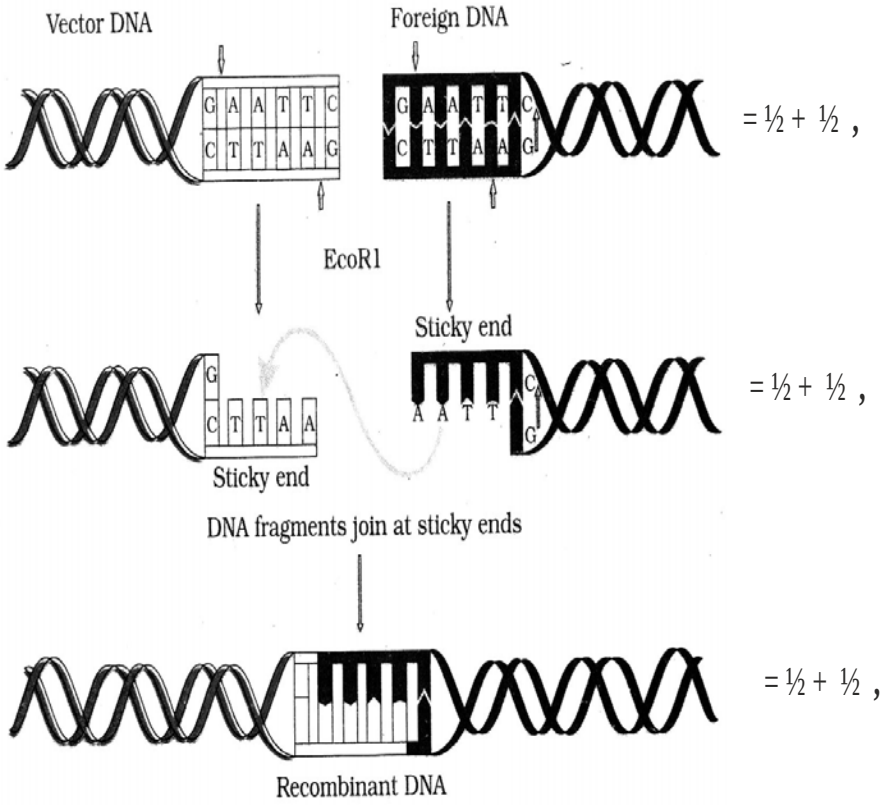
leaving single stranded overhanging stretches called sticky ends ,

↓

Ligases joins host and foreign DNA strands at sticky ends to form recombinant DNA

= ½ × 6

// diagram can also be accepted in lieu of flow chart



[3 Marks]

OR

Name and explain the technique used for separating DNA fragments and making them available for biotechnology experiments.

Ans. Gel electrophoresis = 1

- Negatively charged DNA fragments are forced to move towards the anode under electric field on agarose gel ,
- DNA fragments get separated according to their size / Small fragments cover large distance & large fragments cover small distances ,
- These fragments are visualised after staining with ethidium bromide followed by exposure under UV rays
- The separated bands of DNA are cut out from the gel & extracted (elution) = ½ × 4

[3 Marks]

19. One of the major contributions of biotechnology is to develop pest-resistant varieties of cotton plants. Explain how it has been made possible.

Ans. (i) Introducing Bt toxin gene / cry gene from *Bacillus thuringiensis* , into cotton plant using r-DNA technology = ½ + ½

(ii) cry gene produces insecticidal protein in inactive stage (protoxin) which after ingestion is converted into active form in the gut of insect , due to alkaline pH there = ½ + ½

(iii) This toxin binds to surface of midgut epithelial cells , causes swelling and lysis leading to death of insect = ½ + ½

[3 Marks]

20. Justify the importance of decomposers in an ecosystem.

Ans.

- Natural cleansing agents / scavengers ,
- Help to breakdown dead and waste material into simple inorganic materials ,
- Help in recycling of nutrients = 1 × 3

[3 Marks]

21. Differentiate between mutualism, parasitism and commensalism. Provide one example for each of them.

Ans. Mutualism - Relationship between two organisms in which both organisms get benefitted = ½

Eg. Mycorrhizae (Roots of higher plants and fungi) / Lichen (algae and fungi) / any other suitable example = ½

Parasitism - Relationship / interaction in which only one species gets benefitted and other get harmed = ½

Eg. Round worm in human intestine // cuscuta and higher plants (angiosperms) // hedge plants or any other suitable example = ½

Commensalism - Interaction in which one species is benefitted & the other is neither harmed nor benefitted = ½

Eg. Orchid growing as an epiphyte on mango tree branch / any other suitable example = ½

= ½ × 6

[3 Marks]

22. Compare narrowly utilitarian and broadly utilitarian approaches to conserve biodiversity, with the help of suitable examples.

Ans. Narrowly Utilitarian - Humans derive countless direct economic benefits from nature = 1

eg. dyes / resin / food / wood etc (or any other suitable example) = ½

Broadly utilatarian - plays major role in many ecosystem services that nature provides = 1

eg. pollination / aesthetic pleasure / production of oxygen (or any other suitable example) = ½

[3 Marks]

SECTION D

Q. No. 23 is of four marks

23. You have attended a birthday party hosted by one of your classmates. You found some guests at the party sitting in a corner making a lot of noise and consuming 'something'. After a while one of the boys from the group started screaming, behaving abnormally and sweating profusely. On enquiry you found that the group members were taking drugs.

(a) Would you inform your parents/school authorities ? Yes / No. Give reasons in support of your answer.

(b) Prepare a note to be circulated amongst the schoolmates about the sources and dangers of any two drugs.

(c) Write any two ways that you will suggest to your school principal so as to promote awareness amongst the youth against the use of these drugs.

Ans. (a) Yes, so that it does not become a habit by repeated use / consumption of drugs may cause harmful effects / any other reason = 1

(b) • Drug : Cocaine - Source is plant Erythroxylum coca = ½

Danger - effects central nervous system / interferes with transport of neurotransmitter (dopamine) = ½

• Drug : Opioids / heroin / smack - source is latex of Papaver somniferum / poppy plant = ½

Danger - slows down body function = ½

• Drug : Cannabinoids source is Cannabis (sativa) = ½

Danger - effects cardiovascular system = ½

(Any two drugs and their danger) = 1 + 1

(c) By organising : -

Poster competitions / Street play / talk by experts / interviews / any other appropriate awareness campaign (any two) = ½ + ½

[4 Marks]

SECTION E

Q. Nos. 24 - 26 are of five marks each

24. (a) Explain the events after pollination leading to the formation of a seed in angiosperms.

(b) Mention the ploidy levels of the cells of different parts of an albuminous seed.

Ans. (a) (i) Pistil accepts right type pollen , pollen grain germinates to produce pollen tube that grows and reaches the ovary , male gametes enter the ovule through micropyle , one male gamete fuses with nucleus of egg cell to form diploid zygote , other male gamete fuses with two polar nuclei forming primary endosperm cell which develops into endosperm , diploid zygote develops into embryo , followed by development of ovule into seed = ½ × 8

(b) Embryo - 2n / diploid = ½

Endosperm - 3n / triploid = ½

[5 Marks]

OR

Explain the process of fertilization and implantation in humans.

Ans. Fertilisation : Sperm comes in contact with zona pellucida layer of ovum , and induces changes in the membrane that blocks the entry of additional sperms , this induces completion of second meiotic division to form second polar body and haploid ovum (ootid) , nucleus of sperm fuses with that of ovum to form diploid zygote = ½ × 4

Implantation : Repeated cleavage in zygote results in formation of blastocyst , whose outer layer is called trophoblast , and an inner group of cells called inner cell mass , trophoblast layer gets attached to endometrium , inner cell mass gets differentiated as embryo , uterine cells divide rapidly and covers the blastocyst that becomes embedded in the endometrium= ½ × 6

[5 Marks]

25. (a) State and explain the law of segregation as proposed by Mendel in a monohybrid cross.

(b) Write the Mendelian F_2 Phenotypic ratio in a dihybrid cross. State the law that he proposed on the basis of this ratio. How is this law different from the law of segregation?

Ans. (a) Law of segregation : Paired alleles get segregated during gamete formation , and a gamete receives only one of the two alleles = ½ + ½

cross TT × tt

↓ ↓

gamete (T)(T) (t)(t) = 1

(b) Phenotypic ratio → 9 : 3 : 3 : 1 = 1

Law of Independent Assortment , = ½

It states that when two pairs of traits are combined in a hybrid segregation of one pair of character is independent of other pair of characters = ½

In law of segregation two alleles of same trait (gene) get segregated , while in law of independent assortment two genes pairs of different traits get segregated = ½ + ½

[5 Marks]

OR

(a) Describe the experiment which demonstrated the existence of "transforming principle".

(b) How was the biochemical nature of this "transforming principle" determined by Avery, MacLeod and McCarty?

Ans. (a) (Frederick Griffith) Streptococcus pneumoniae are grown on culture plate and found having two strains ,

R - Non Virulent (rough) ,

S - Virulent (smooth) ,

Mice infected with R-strain lived ,

Mice infected with S-strain died ,

Mice infected with heat killed S-strain - Lived ,

Mice infected with heat killed S + R - Died ,

He observed that R-strain has been transformed to S-strain = ½ × 8

(b) They purified protein RNA & DNA from heat killed S - Strain , added these chemical to culture medium containing live R-cell separately and discovered that it was DNA only that transforms R strain to S strain = ½ + ½

//

Added these chemicals in culture medium separately each containing protease RNAase and DNAase respectively extracted from heat killed S-strain and added live R-cells , Introduction of RNAases & proteases did not affect transformation but when DNAases was introduced it inhibited transformation ½ + ½

[5 Marks]

26. Under polio prevention programme, infants in India were given polio vaccines on a large scale at regular intervals to eradicate polio from the country.

(a) What is a vaccine? Explain how it imparts immunity to the child against the disease.

(b) With the help of an example each, differentiate between active and passive immunity.

Ans. (a) Vaccine – It is inactivated or weakened pathogen that is inoculated into the body of the child = 1

Vaccines generate memory - B & T - cells that recognize the pathogen quickly on subsequent exposure , produce specific antibodies against the pathogen / antigen = ½ + ½

(b) Active Immunity – Immunity that an organism develops due to direct exposure of pathogen by producing antibodies in the body = 1

eg .vaccination / infections / hepatitis etc. = ½

Passive Immunity - readymade antibodies are directly given to protect the body from foreign pathogens = 1

eg. Colostrum / tetanus / antitoxin for snake bite etc. = ½

[5 Marks]

OR

What are bio fertilizers? Describe their role in agriculture. Why are they preferred to chemical fertilizers?

Ans. Biofertilizers – are organisms that enrich the nutrient quality of the soil = 1

Role – (i) increase nutrient quality

(ii) fix atmospheric nitrogen

(iii) resistant to root borne pathogens

(iv) tolerance to salinity and drought

(v) overall increase in plant growth and development (any four) = ½ × 4 = 2

These are preferred to chemical fertilizers because

- They do not pollute soil / air / water = 1
- do not spoil soil texture or pH of the soil = 1

[5 Marks]