

Class XII

Biology (Subject Code-044)

Maximum Marks: 70

Time: 3 hours

Section A (1 Mark Each)

1. C 480

Q2. D. 0:1:7

Q3. A. The smaller ribosomal sub-unit

Q4. A) Ramapithecus → Homo habilis → Homo erectus → Homo sapiens

Q5. C) both ii and iv

Q6. C) Chilled ethanol

Q7. C) Both [a] and [b]

Q8. D) All of the above

Q9. C)

Q10. A) Hyaluronidase

Q11. A) Corona radiata

Q12. (c) pre-existing variation in the population

Q13. Answer: (a) Meloidogyne incognita infects the root of tobacco plant that leads to the degradation of cell walls of the roots and reduce the yield

Q14. (b)

Q15. (d)

Q16. (d)

Section B

Q17. To determine the genotype of the tall plant, whether it is homozygous dominant or heterozygous, 1
as dwarfness is a recessive trait which is expressed only in homozygous condition, and he was sure of
genotype of dwarf plant. 1

or

Q17. The pedigree shows an autosomal recessive disorder. The parents are the carrier of the disease 1
so the disease will be visible in only a few offsprings. The other offsprings will be either a carrier or non-
carrier. 1

Q18. An alien DNA cannot become a part of chromosome anywhere along its length and replicate normally due to the absence of origin of replication where the replication process is initiated. 2

Q19. Cloning Vector pBR 322

A- BamHI

B- PstI

C- Ampicillin resistance gene (ampR)

1/2x4=2

Q20. In ELISA, the antigen-antibody interactions always use an enzyme-labelled antigen or antibody. The enzyme activity is measured with the help of a calorimeter using a substrate that changes colour when modified by the enzyme. After the substrate addition, the light is absorbed by the product formed and is represented in the numeric values.

1/2x4=2

Q21. During pregnancy, all the events of the menstrual cycle stop and there is no menstruation. Menstruation occurs only when the egg that is released is not fertilized. But in pregnancy, the released egg is fertilized, hCG and progesterone supports and maintain the uterine lining and hence the uterine lining does not shed, instead nourishes the fetus.

1/2x4=2

Section C

Q22. Transcription is the process of conversion of DNA to mRNA. The post-transcriptional modifications include:

Capping at 5'-end- The 5' cap protects the RNA from ribonuclease.

Poly-A tail at 3'-end- The poly-A tail protects the mRNA from enzymatic degradation.

mRNA splicing removal of introns and ligation of exons- The introns are spliced during mRNA splicing and the exons are joined together to form a continuous sequence that codes for a functional protein. 3

Q23. Function of DNA ligase:

DNA ligase joins the Okazaki fragment formed on a lagging strand by creating 3' → 5' phosphodiester bonds between them.

- The leading strand continues to replicate in every generation.
- The newly synthesised continuous DNA fragment formed on the leading strand will show a peak of high molecular weight.
- The Okazaki fragments formed on the lagging strand will show a peak of low molecular weight.
- Therefore two peaks will be formed, the best suitable graph which represents the result of centrifugation is graph (a).

3

Q24. Hardy-Weinberg principle states that the sum of allelic frequencies in a population remains constant.

1/2

Five factors are known to affect Hardy-Weinberg equilibrium. These are gene migration or gene flow, genetic drift, mutation, genetic recombination and natural selection.

2/1/2

Q25. The recombinant human insulin can be produced by following steps:

1. The human insulin is extracted from pancreatic cells of humans and two genes are extracted that are responsible for insulin chain A and chain B production.
2. In the second step we extract a plasmid DNA from a bacterium and form a plasmid vector.
3. Then insert the human insulin chain A and B producing genes into this plasmid vector. This results in the formation of recombinants DNA.
4. The next step is introduction of recombinant DNA again into the bacterial cell. This results in the formation of the recombinant bacterium.
5. Then put the recombinant bacteria into the large fermentation tank where it multiplies. Each bacterium will produce human insulin chain A and chain B.
6. These A and B insulin chains are then extracted, purified and combined by creating disulfide bonds to form human insulin. 1/2x6=3

Q26. Branching Descent- It is the process in which new species originate from a single ancestor. They became adapted to the new environment through reproductive isolation. For eg., Darwin's finches which evolved from a single grain eater species. 1.5

Natural Selection- In this process, the variations in an individual facilitate better survival of species. They reproduce in large numbers. These variations are passed on to successive generations which help them to survive in the changing environmental conditions. For eg., few giraffes have long necks while others have short necks. If the low-lying shrubs are eliminated for some reason, the giraffes with short necks would be replaced by giraffes with long necks. 1.5

Q27. Sex education should be introduced to school going children for the following reasons:

To make the students aware that the bodily changes they are experiencing during puberty are absolutely normal and natural.

To help them speak up when they face any sexual harassment in society.

The students will get to know about the facts of life from a supportive source instead of some absurd show or movie.

They will be made aware of the risks involved in having unsafe sex.

They must know about various contraceptive methods.

They should understand the functions performed by various organs of reproductive system. 1/2x6=3

Q28. In lac operon of E. coli, there are three structural genes (z, y, and a) which are required for metabolism of lactose, these are regulated by a common promoter and regulatory gene (i gene). The i gene codes for the repressor of the lac operon which is synthesized constitutively. The z gene codes for beta-galactosidase (β -gal), the y gene codes for permease and a gene encodes a transacetylase. 2

In the presence of an inducer (lactose), the repressor is inactivated by interaction with the inducer which allows RNA polymerase access to the promoter and transcription proceeds. 1

Section D

- Q29.i) a ii) b iii) b iv) d or iv) c
- Q30.i) GIFT ii) c iii) d (both assertion and reason are false)
- iv) b or d

Section E

Q31 a) Hemizygous– It is a condition in which an organism has only one copy of a gene or DNA sequence present in diploid cells. 1

b) Colour blindness is a sex-linked disorder and the genes responsible are present on the X-chromosome. To become affected by the disease, the female should possess the alleles for colour blindness on both the X-chromosomes. If the allele is present on only one chromosome, the female becomes a carrier of the disease. Since males have only one X-chromosome, it carrying the allele renders them affected. That is why males are more prone to colour blindness. 4

Or

Recombination is the process of producing a new combination of genes by crossing over during meiosis.

Applications:

It is a means of introducing new traits.

Variability is increased, which is necessary for natural selection.

It is used for preparing linkage chromosome maps.

The desired recombinants produced as a result of crossing over are selected by the plant breeders to produce new crop varieties.

Recombinants can be produced by genetic engineering for HYV. 1+4=5

Q32. (i) NH_4Cl (Ammonium chloride) with N^{14} atom. 1

(ii) It is to show that after one generation *E. coli* with ^{15}N -DNA in a medium of ^{14}N , has DNA of intermediate density between the light and heavy DNAs.

It shows that of the two strands, only one strand is synthesised newly, using the ^{14}N -nitrogen source in the medium. 1.5

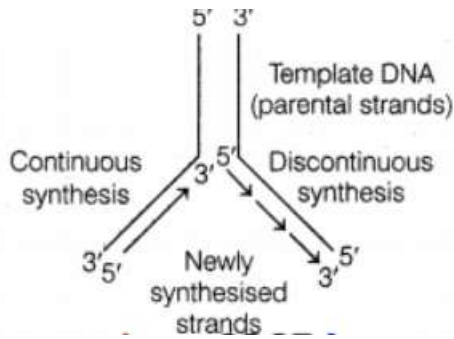
(iii) The heavy and light DNA molecules can be differentiated by centrifugation in a cesium chloride (CsCl) density gradient.

The ^{15}N -DNA was heavier than ^{14}N -DNA and the hybrid $^{15}\text{N} - ^{14}\text{N}$ -DNA was intermediate between the two newly form DNA strands. 1.5

(iv) Scientists concluded that the DNA replication is semi-conservative, i.e., of the two strands of DNA, one is the parental strand, while the other is newly synthesized. 1

or

Replication in DNA strand occurs within a small opening of the DNA helix, known as replication fork.

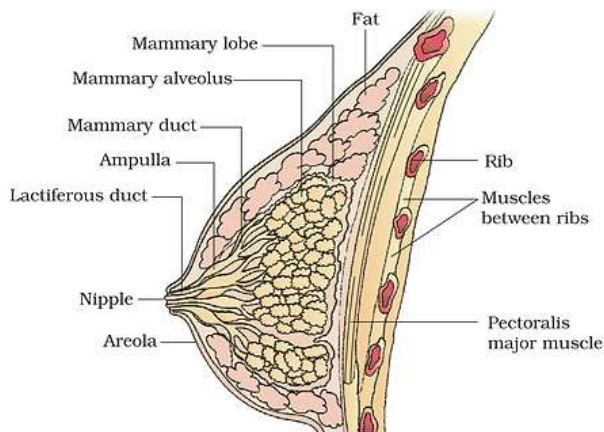


2

DNA polymerases catalyse polymerisation only in one direction, i.e. $5' \rightarrow 3'$. It creates additional complications at the replicating fork. Consequently, on one strand (template $3' \rightarrow 5'$), the replication is continuous. This is known as leading strand, while on the other strand (template $5' \rightarrow 3'$), it is discontinuous. This is known as lagging strand. 2

The discontinuously synthesised fragments called Okazaki fragments are later joined by DNA ligase. 1

Q.33.



Or

