

QB365
Important Questions - Molecular Basic of Inheritance
12th Standard CBSE

Biology

Reg.No. :

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Time : 01:00:00 Hrs

Total Marks : 50

Section - A

- 1) Jumping genes given by Barbara Mclintock are also called 1
(a) Transposons (b) Mutons (c) Cistrons (d) Vectors
- 2) DNA polymerase that helps in DNA replication is of 1
(a) Two types (b) Three types (c) Four types (d) Only one type
- 3) One of these is not prepared directly from DNA 1
(a) Another DNA (b) mRNA (c) Protein (d) rRNA
- 4) During splicing, the exons are joined and the enzyme which catalyzes this reaction is 1
(a) RNA ligase (b) RNA catalase (c) RNA permease (d) RNA polymerase
- 5) The two polynucleotide chains in DNA are 1
(a) Discontinuous (b) Antiparallel (c) Semiconservative (d) Parallel
- 6) The distance between the genes a,b,c,d in mapping units are 1
a-d=3.5; b-c=1; a-b=6;
c-d=1.5; a-c=5
Find out the sequence of arrangement of these genes
(a) acdb (b) abcd (c) adbc (d) acbd (e) adcb
- 7) The number of stop codons which do not code for any amino acid is 1
(a) 1 (b) 2 (c) 3 (d) 4
- 8) Removal of introns and joining the exons in a defined order in a transcription unit is called 1
(a) Tailing (b) Transformation (c) Capping (d) Splicing
- 9) Discontinuous synthesis of DNA occurs in one strand, because: 1
(a) DNA molecule being synthesised is very long
(b) DNA dependent DNA polymerase catalyses polymerisation only in one direction (5'→3')
(c) it is a more efficient process (d) DNA ligase has to have a role
- 10) Which of the following stops in transcription is catalysed by RNA polymerase? 1
(a) Initiation (b) Elongation (c) Termination (d) All of the above

Section - B

- 11) How do histones acquire positive charge? 2
- 12) Mention the role of ribosomes in peptide bond formation. How does ATP facilitate it? 2
- 13) Write two possible uses of single nucleotide polymorphism. 2

- 14) (a) Differentiate between template strand and coding strand of DNA. 2
 (b) Name the source of energy for the replication of DNA.
- 15) Differentiate between Repetitive DNA and Satellite DNA 2
- 16) Recall the experiment of Frederick Griffith. If RNA instead of DNA was the genetic material would the heat-killed S-strain of the bacteria have transformed the R-strain into S-strain? Explain your answer 2
- 17) Give two reasons why both the strands of DNA are not copied during transcription 2
- 18) Write the full form of VNTR. How is VNTR different from 'probe'? 2
- 19) Name a few enzymes involved in DNA replication other than DNA polymerase and ligase. Name the key function for each of them. 2
- 20) Given below are the sequences of nucleotides in a particular mRNA and amino acids coded by it 2
 UUU AUG UUC GAC UUA GUG UAA
 Phe - Met - Phe - Glu - Leu - Val
 Write the properties of genetic code that can be and cannot be correlated from the above given data.

Section - C

- 21) In the medium, where E. coli was growing, lactose was added, which induced the lac operon. Then why does the lac operon shut down sometime after addition of lactose in the medium? 5
- 22) A tRNA is charged with the amino acid phenylalanine. (i) At what end of the tRNA is the amino acid attached? 5
 (ii) What is the mRNA codon that codes for phenylalanine? (iii) Name the enzyme responsible for this attachment.
- 23) Describe the process of DNA replication. 5
- 24) Describe the Hershey-Chase experiment. Write the conclusion they arrived at after the experiment. 5

Section - A

- 1) (a) Transposons 1
- 2) (d) Only one type 1
- 3) (c) Protein 1
- 4) (a) RNA ligase 1
- 5) (b) Antiparallel 1
- 6) (e) adcb 1
- 7) (c) 3 1
- 8) (d) Splicing 1
- 9) (b) DNA dependent DNA polymerase catalyses polymerisation only in one direction (5'→3') 1
- 10) (b) Elongation 1

Section - B

11)

2

-A protein acquires a charge depending on the abundance of amino acid residues with charged side chains.

-Histones are rich in basic amino acids, lysines and arginines which carry positive charges in their side chains; hence histones are positively charged.

12)

2

Role of Ribosomes (i) Ribosomes are the main cellular factory of protein synthesis the large subunit has two sites (P and A) for binding of amino acids, so that they are close to each other for formation of peptide bond. (ii) They also act as catalyst (23s rRNA) in prokaryotes for formation of peptide bonds. ATP provides energy for the activation of amino acids.

13)

2

Single nucleotide polymorphism helps in (i) finding the chromosomal locations of disease-associated genes or sequences of DNA and (ii) tracing human history

14)

2

| Template strand | Coding strand |
|--|--|
| 1) This is the strand of DNA with 3' → 5' polarity 2) It functions as the template for transcription and codes for RNA | 1) This is the strand DNA with 5' → 3' polarity 2) It does not code for any region of RNA during transcription |

(b) Deoxynucleoside triphosphates.

15)

2

| Repetitive DNA | Satellite DNA |
|--|--|
| -Repetitive DNA refers to the sequences of DNA when a small stretch of DNA is repeated many times; They code for proteins. | -Satellite DNA refers to those repetitive DNA sequences which do not code for any protein but form a large portion of the gene |

16)

2

-The presence of 2'OH-group of ribose makes RNA more labile and prone to degradation. -In the heat-killed S-strain, it would not have remained functional and hence would not have transformed the R-cells into S-cells.

17)

2

Both the strands of DNA are not copied during transcription for the following reasons:

- (i) If both the strands of DNA are copied, two different RNAs (complementary to each other) and hence two different polypeptides would be formed; if a segment of DNA produces two polypeptides, the genetic information machinery becomes complicated.
- (ii) The two complementary RNA molecules (produced simultaneously) would form a double-stranded RNA rather than getting translated into polypeptides.
- (iii) RNA polymerase carries out polymerisation in the 5' ~ 3' direction and hence the DNA strand with 3' ~ 5' polarity acts as the template strand.

18)

2

Variable Number of Tandem Repeats(VNTR).

Difference between VNTR and

VNTR

It is a class of satellite DNA, where a small sequence is arranged randomly in many copy numbers.

Probe

It is a radioactivity labelled VNTR, used for hybridisation with DNA segments.

19)

2

The enzymes involved in DNA replication other than DNA polymerase and ligase are listed below with their functions:

Helicase -opens the helix

Topoisomerases-Removes the tension caused due to unwinding

DNA ligase -Joins the cut DNA strands

20)

2

(i) UAA does not code for any amino acid; it is a termination codon.

(ii) Genetic code is specific and unambiguous, i.e. one codon codes for a particular amino acid only.

(iii) Genetic code is degenerate, as one amino acid is coded by more than codon, e.g. UUU and UUC code for phenylalanine.

(iv) Genetic code is read in a contiguous manner without any punctuation (any three) AUG has a dual function; it is initiation codon as well as codes for methionine.

Section - C

21)

5

Lac Operon

- Lac Operon has three structural genes, controlled as a unit by an operator gene.
- The i gene codes for a protein, repressor, which has high affinity for the operator and binds to it.
- When lactose enters the cell and becomes activated, it binds to the repressor protein; consequently there is a change in the conformation of the repressor and it does not bind to the operator.
- This provides an access of RNA polymerase to the structural genes.
- Transcription continues, i.e. the lac operon is switched on.

22) (i) It is attached at the 3' end of tRNA.

5

(ii) UUU and UUC.

(iii) Aminoacyl-tRNA synthetase.

Synthesis of DNA

- During replication of DNA, the two strands unwind upto a point and a replication fork is formed.
- Since the unwinding cannot take place for the entire length, replication starts from the replication fork.
- Both the strands act as templates for DNA synthesis.
- DNA polymerase is the enzyme that polymerises the bases/nucleotides into a strand of DNA.
- Since this enzyme polymerises the nucleotides in $5' \rightarrow 3'$ direction only, on one of the template strands (with $3' \rightarrow 5'$ polarity), the new strand is synthesised as a continuous stretch (leading strand); it is called continuous synthesis.
- On the other template strand, (with $5' \rightarrow 3'$ polarity), DNA strand is synthesised as short stretches (using primers), called Okazaki fragments; this is called discontinuous synthesis.
- Later, these short stretches are joined by DNA-ligase (lagging strand).

Alfred Hershey and Martha Chase proved that DNA is the genetic material.

Experiment of Hershey and Chase

- They made two different preparations of the phage; in one, the DNA was made radioactive with ^{32}P and in the other, the protein coat was made radioactive with ^{35}S .
- These two phage preparations were allowed to infect the bacterial cells separately.
- Soon after infection, the cultures were gently agitated in a blender to separate the adhering protein coats of the virus from the bacterial cells.
- The culture was also centrifuged to separate the viral coat and the bacterial cells.
- It was found that when the phage containing radioactive DNA was used to infect the bacteria, its radioactivity was found in the bacterial cells (in the sediment) indicating that the DNA has been injected into the bacterial cell.
- So, DNA is the genetic material and not proteins.