

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

Date: 19/11/2021

Subject: Biology

Topic : Molecular Basis of  
Inheritance

Class: Standard XII

1. Removal of introns and joining the exons in a defined order in a transcription unit is called:

- ☐ A. Tailing
- ☐ B. Transformation
- ☐ C. Capping
- ☒ D. Splicing

In molecular biology, splicing is the editing of the nascent precursor messenger RNA (pre-mRNA) transcript. After splicing, introns are removed and exons are joined together (ligated).

2. All of the following are found in prokaryotic mRNA except

- ☐ A. AUG
- ☐ B. UGA codon
- ☒ C. introns
- ☐ D. uracil

Eukaryotes harbor introns in the genomic structure, whereas no prokaryotes identified so far carry introns.

Introns are non-functional gene sequences that are removed by a process called splicing post transcription in eukaryotes.

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

3. If the sequence of the coding strand in a transcription unit is written as follows

5'-TGAAGTGTAGCATGC-3'.

Find out the correct sequence of the m-RNA transcribed from it.

- ☒ A. 5'-UGAACUGUAGCAUGC-3'
- ☐ B. 3'-CGUACGAUGACAAGU-5'
- ☐ C. 3'-CGUACGAUGUCAAGU-5'
- ☐ D. 5'-UGACUGUAGCUUGC-3'

If the coding strand in a transcription unit is 5'-TGAAGTGTAGCATGC-3'. Then, it is known that the sequence of mRNA is same as the coding strand of DNA. However, in RNA, thymine is replaced by uracil. Hence, the sequence of mRNA will be 5'-UGAACUGUAGCAUGC-3'.

4. Polycistronic mRNA is characteristic of:

- ☒ A. Prokaryotes
- ☐ B. Eukaryotes
- ☐ C. Both a and b
- ☐ D. Viruses

Polycistronic mRNA is a mRNA that encodes several proteins and is characteristic of many bacterial (prokaryotes) and chloroplast mRNAs. Polycistronic mRNA carries several open reading frames (ORFs), each of which is translated into a polypeptide. Polycistronic mRNAs consist of a leader sequence which precedes the first gene. The gene is followed by an intercistronic region and then another gene.

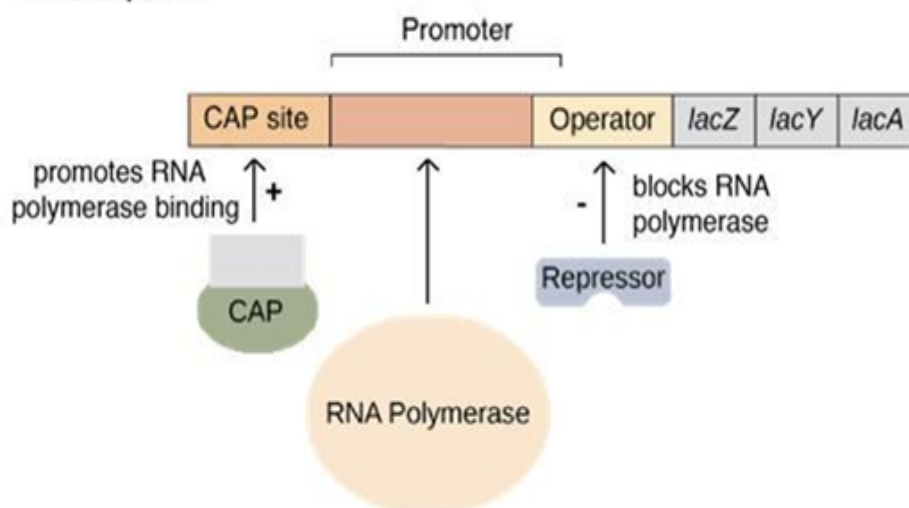
## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

5. *Lac* operon has

- ☐ A. Y genes
- ☐ B. Z genes
- ☐ C. A genes
- ☒ D. all the above

The *lac* operon consists of three adjacent structural genes, a promoter, a terminator, and an operator. The three structural genes are: *lacZ*, *lacY*, and *lacA*.

The *lac* operon:



6. Which of the following is true of RNA synthesis (transcription)?

- ☒ A. RNA synthesis is always in the 5' - 3' direction
- ☐ B. RNA polymerase needs a primer to initiate transcription
- ☐ C. In transcription, U is inserted opposite T
- ☐ D. New nucleotides are added on to the 2' OH of the ribose sugar

In transcription, as in DNA replication, nucleotides are added on to the 3' OH of the growing chain so RNA synthesis is always in the 5' - 3' direction. Unlike DNA synthesis, a primer is not needed for initiating a new strand. RNA contains U instead of T, and U base pairs with A and is inserted opposite A (not T) in the template.

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

7. Constitutive genes are those genes which are active

- ☒ A. during developmental stages
- ☒ B. during differentiation stages
- ☒ C. throughout lifetime
- ☒ D. at a particular stage of life

A constitutive gene is a gene that is transcribed continually as opposed to a facultative gene, which is only transcribed when needed.

A housekeeping gene is typically a constitutive gene that is transcribed at a relatively constant level. Examples of housekeeping genes include actin, GAPDH (Glyceraldehyde 3-phosphate dehydrogenase) and ubiquitin.

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

8. In a DNA segment, 10 N<sub>2</sub> bases are present. How many sugar molecules are present in this segment?

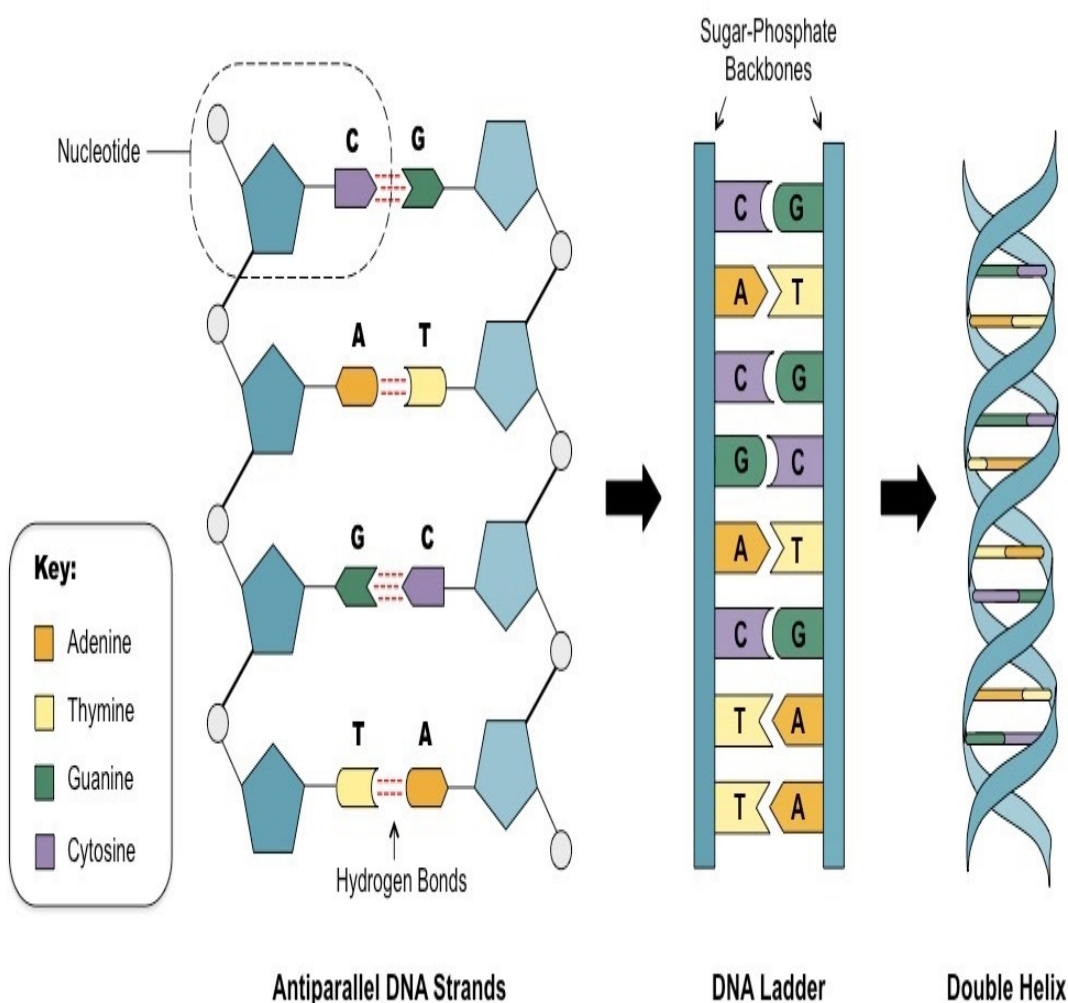
- ☐ A. 5
- ☒ B. 10
- ☐ C. 15
- ☐ D. 20

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

DNA is a double stranded helical structure. Each strand is made up of nitrogenous base, deoxyribose sugar and phosphate group.

Deoxyribose sugar and phosphate group forms the backbone and nitrogenous base is attached to sugar projects inwards to form bond with other nitrogenous base of other strand.

So, the number of nitrogenous bases will be equal to the number of sugar molecules. Hence, 10 sugar molecules are present.



## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

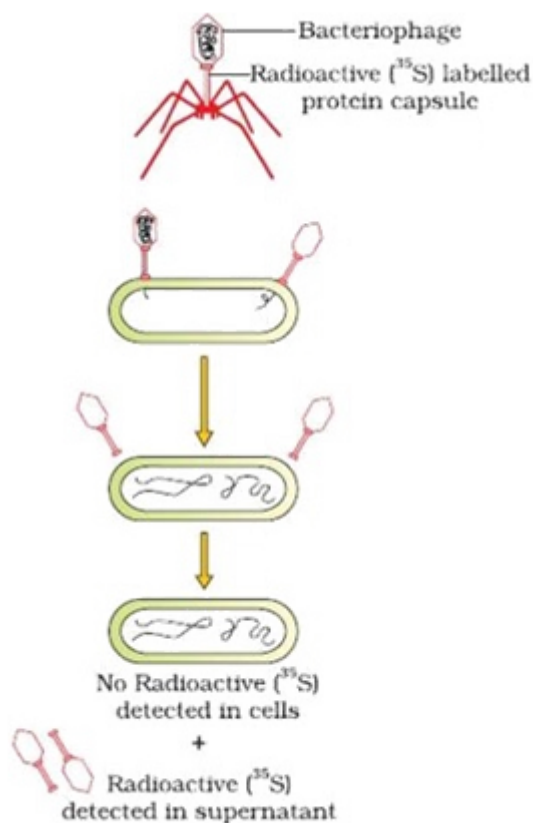
9. A double stranded DNA molecule with 6390 base pairs long will have the following number of turns:

- ☒ A. 639  
☐ B. 63.9  
☐ C. 6.39  
☐ D. 31.95

In a DNA double helix, 10 base pairs are present in 1 turn. Thus, 6390 base pairs will be present in  $1/10 \times 6390 = 639$  turns

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

10. *E.coli* was infected with bacteriophage having radioactive ( $S^{35}$ ) protein in a culture. It was blended, centrifuged and distribution of  $S^{35}$  determined. What does the experiment show?

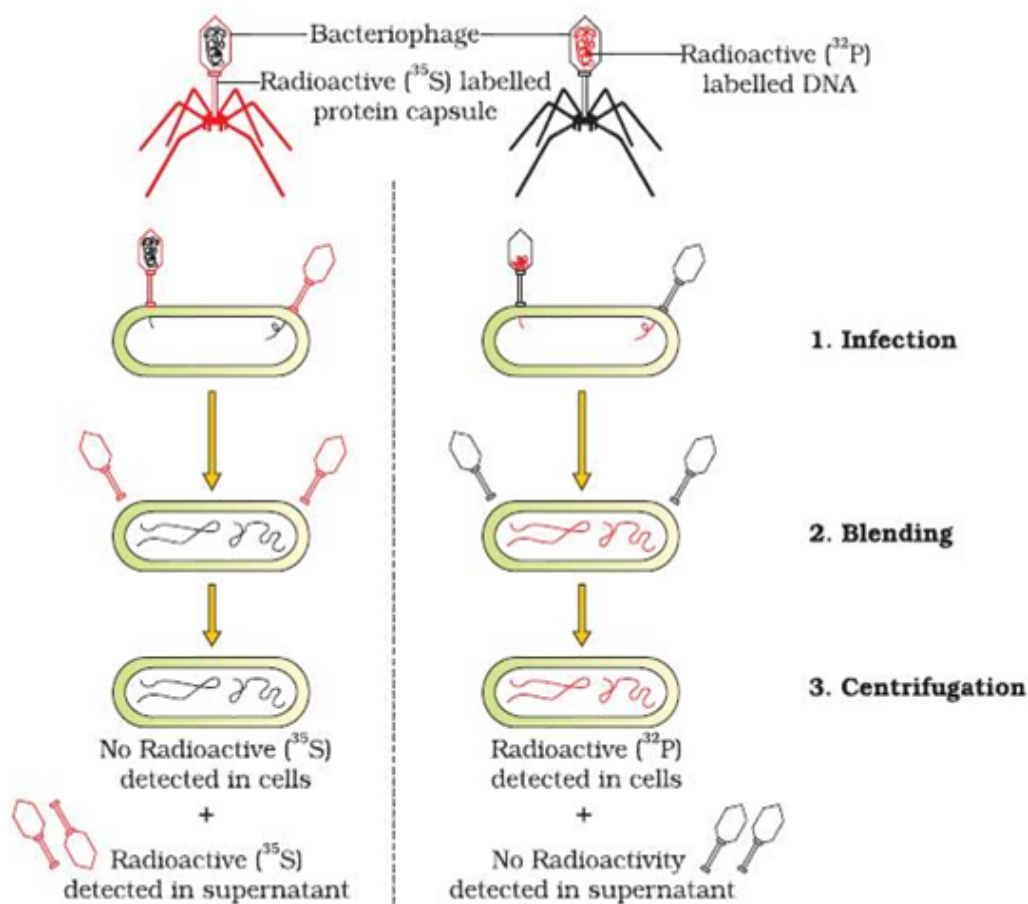


- ☒ A. Protein is not the genetic material
- ☒ B. *DNA* is not involved in heredity
- ☒ C. Nothing is proved
- ☒ D. *DNA* is the genetic material



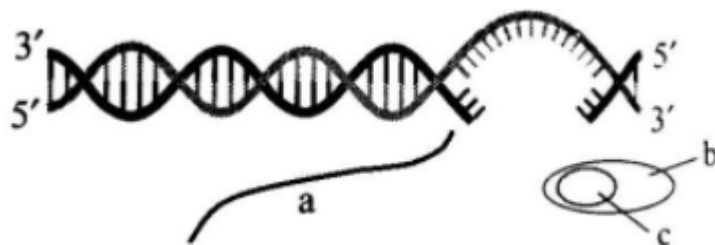
## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

The unequivocal proof that *DNA* is the genetic material came from the experiments of Alfred Hershey and Martha Chase (1952). They worked with viruses that infect bacteria called bacteriophages. Their experiment provided that DNA is the genetic material and not the protein.



## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

11. The given figure represents the process of transcription in bacteria.

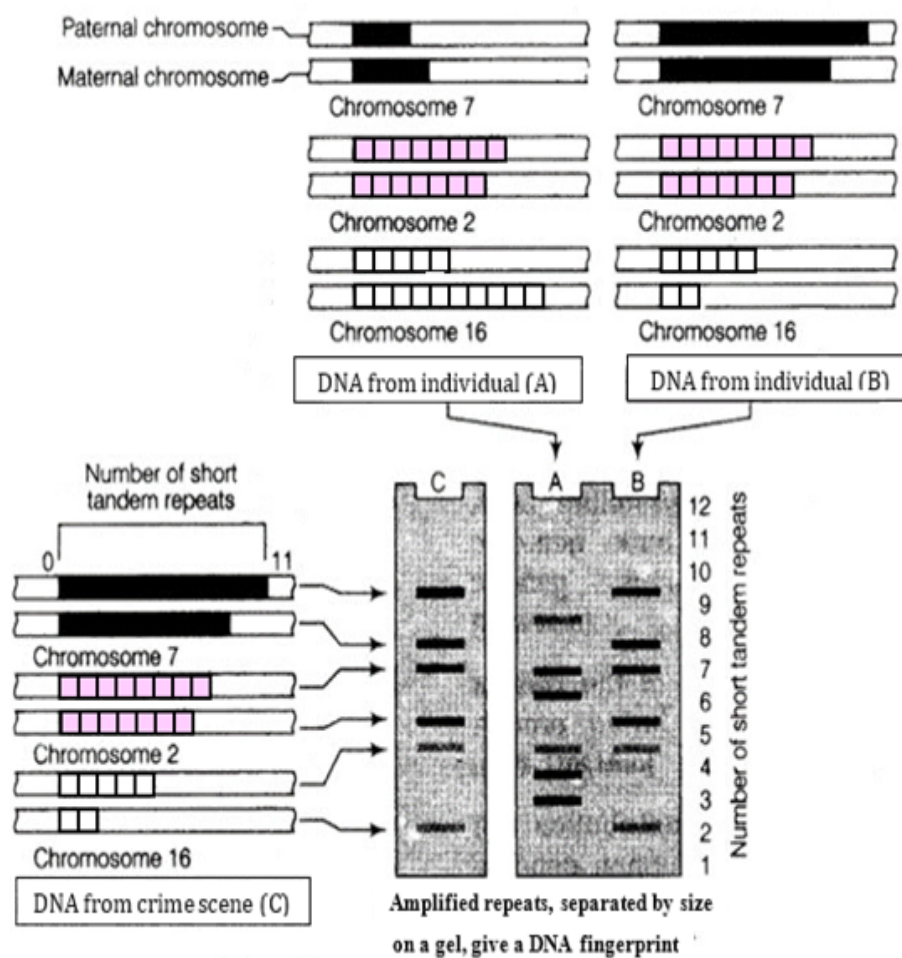


- ☐ A.  $a$  – DNA,  $b$  – RNA,  $c$  – Promoter
- ☒ B.  $a$  – RNA,  $b$  – RNA~polymerase,  $c$  – Rho factor
- ☐ C.  $a$  – RNA,  $b$  – RNA~polymerase,  $c$  – Sigma~ factor
- ☐ D.  $a$  – DNA,  $b$  – DNA~polymerase,  $c$  – RNA

As transcription proceeds the initiation and elongation, steps are mediated by the *RNA* polymerase enzyme (*DNA* dependent *RNA* polymerase). As a result, the *RNA* transcript is synthesized as a single stranded structure and releases when the *Rho* factor binds to the enzyme *RNA* polymerase to terminate the transcription.

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

12. In the schematic representation, few representative chromosomes have been shown containing different copy number of VNTR. Which of the following individual is criminal on the behalf of this?



- ☒ A. Individual 'A'
- ☒ B. Individual 'B'
- ☒ C. Can't be predicated
- ☒ D. Neither 'A' nor 'B', any other individual

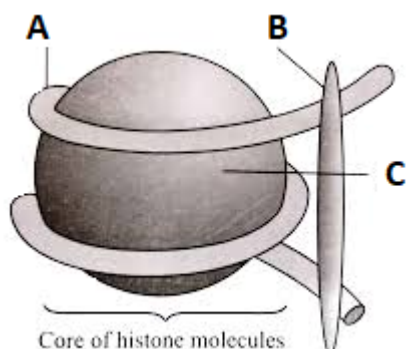
## **BYJU'S Study Planner for Board Term I (CBSE Grade 12)**

Individual "B" may be involved in the crime as his DNA fragment matches the DNA segment from the crime scene. Genes are short sequences present in DNA strand that are responsible for the particular characteristics of an individual. PCR is a technique used to amplify the DNA molecules present in a small sample in order to obtain a large amount of DNA sequence for the test. This is followed by restriction fragment length polymorphism (RFLP). RFLP analysis is used to identify the repeated sequences by detecting a specific sequence pattern of Variable Number Tandem Repeats which becomes that individual's DNA profile. This is the basis of DNA fingerprinting.

BYJU'S

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

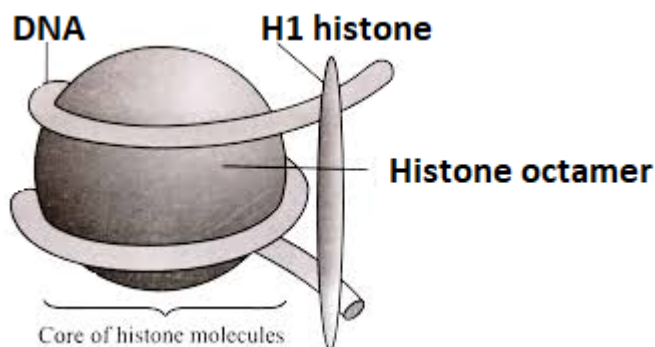
13. The given figure shows the structure of nucleosomes with their parts labelled as A, B and C. Identify A, B and C.



- ☒ A. A – DNA; B – H1 histone; C – Histone octamer
- ☐ B. A – H1 histone; B – DNA; C – Histone octamer
- ☐ C. A – Histone octamer; B – RNA; C – H1 histone
- ☐ D. A – RNA; B – H1 histone; C – Histone octamer

Nucleosome is a structural unit of a eukaryotic chromosome which consists of a length of DNA coiled around a core of histones known as the histone octamer.

In the given figure of nucleosome structure, A represents negatively charged DNA which is wrapped around the positively charged core of the nucleosome known as the histone octamer (represented by C). B represents H1 histone which is also known as 'linker histone'. It plays a very important role in the compaction of chromosomes.



## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

14. Assertion (A): In eukaryotes, both introns and exons are transcribed to form hnRNA.

Reason (R): The exons are removed to make the final transcript by splicing.

- ☒ A. Both assertion and reason are true and reason is the correct explanation of assertion
- ☒ B. Both assertion and reason are true but reason is not the correct explanation of assertion
- ☒ C. Assertion is true but the reason is false
- ☒ D. Both assertion and reason are false

The genetic information from one strand of the DNA is copied into RNA during transcription. Hence, synthesis of RNA occurs during transcription.

In eukaryotes, the monocistronic structural genes contain both exons and introns. Exons are the coding sequences (code for amino acids) and introns are the non-coding sequences.

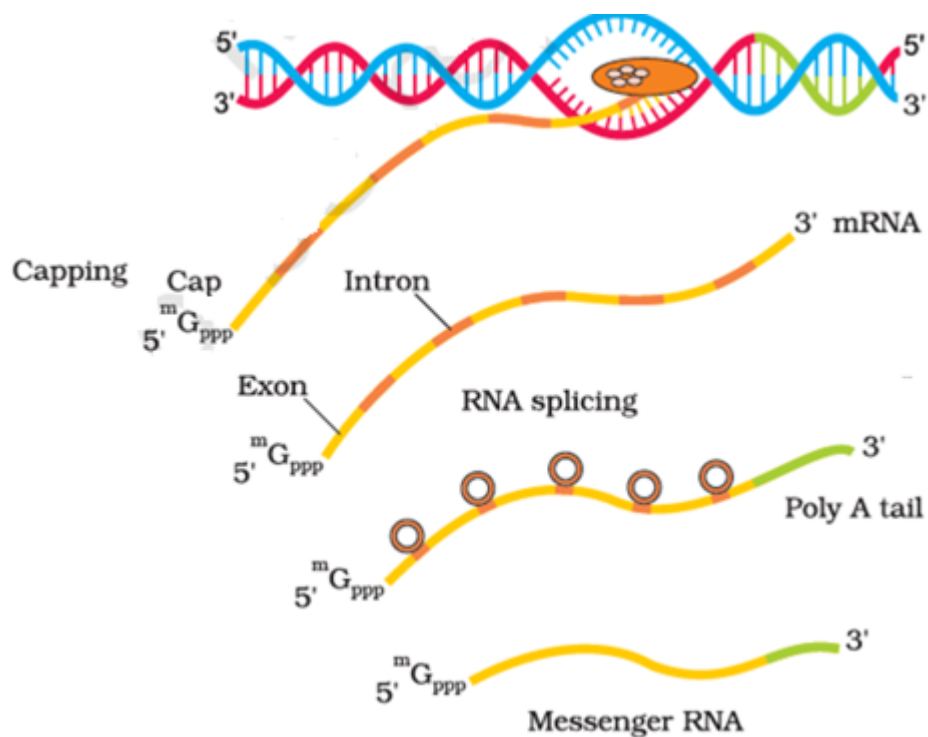
During transcription, both the exons and introns are transcribed to form the pre-mRNA or heterogeneous nuclear RNA (hnRNA). Thus, the assertion holds true.

The hnRNA undergoes post-transcriptional modifications to form the functional mRNA.

The post-transcriptional modifications include a process called splicing in which there is removal of introns and subsequent joining of exons.

Therefore, the mature or functional mRNA contains only exons. Hence the reason is false.

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)



## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

15. Assertion: In eukaryotes, replication and transcription occur in the nucleus but translation takes place in the cytoplasm.

Reason: mRNA is transferred from the nucleus into cytoplasm where ribosomes and amino acids are available for protein synthesis.

- ☒ A. Both assertion and reason are true and reason is the correct explanation of assertion
- ☐ B. Both assertion and reason are true but reason is not the correct explanation of assertion
- ☐ C. Assertion is true but reason is false
- ☐ D. Both assertion and reason are false

Replication is the process by which cells make an extra copy of DNA. Transcription is the process by which the genetic information from one of the strands of DNA is copied on to a mRNA. In eukaryotes, DNA replication and transcription take place in the nucleus.

The mRNA formed by in the nucleus is then transported out into the cytoplasm through the nuclear pore after being processed (it undergoes splicing, capping and tailing within the nucleus).

Translation refers to the process of polymerisation of amino acids to form a polypeptide. Since the ribosomes and amino acids required for translation are present in the cytoplasm, the process occurs in the cytoplasm.



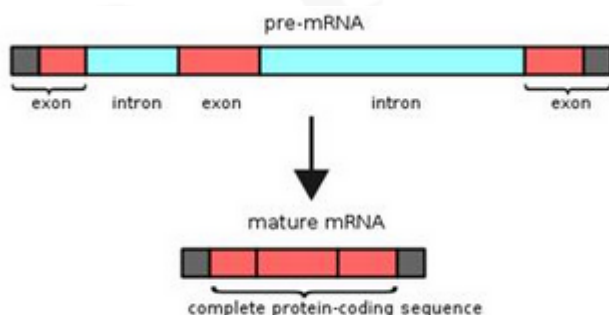
## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

16. A biologist isolated a gene from a human cell, attached it to a plasmid and inserted the plasmid into a bacterium. The bacterium made a new protein, but it was nothing like the protein normally produced in a human cell. Why?

- ☒ A. The gene contained introns
- ☐ B. The gene did not have sticky ends
- ☐ C. The biologist should have cloned the gene
- ☐ D. The bacterium had undergone a transformation

A biologist isolated a gene from a human cell, attached it to a plasmid and inserted the plasmid into a bacterium. The bacterium made a new protein, but it was nothing like the protein normally produced in a human cell, i.e. insulin. It is because of the presence of introns on the gene.

An intron is a long stretch of noncoding DNA found between exons (or coding regions) in a gene. Genes that contain introns are known as discontinuous or split genes as the coding regions are not continuous.



## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

17. During analysis of the *DNA* of an organism having 5386 nucleotides find out  $A = 29\%$ ,  $G = 17\%$ ,  $C = 32\%$ ,  $T = 17\%$ . Considering the Chargaff's rule, it can be concluded that:

- ☒ A. It is double-stranded linear *DNA*
- ☒ B. It is double-stranded circular *DNA*
- ☒ C. It is single-stranded *DNA*
- ☒ D. Both a and b

If there are 5386 nucleotides and  $A = 29\%$ ,  $G = 17\%$ ,  $C = 32\%$  and  $T = 17\%$ , then considering the Chargaff's rule, it can be concluded that it is a single-stranded *DNA* as the ratio of adenine and thymine is not equal to the amount of guanine and cytosine.

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

18. In the biochemical characterisation of the transforming principle, it was found that the process of transformation is not affected by which of the following enzymes?
- A. DNase
  - B. RNase
  - C. Peptidase
  - D. Lipase

☒ A. A, B, D

☒ B. A, C, D

☒ C. B, C, D

☒ D. A, B, C

The process of transformation is not affected by RNase, peptidase and lipase.

Transformation is the genetic alteration of a cell that happens as a result of direct uptake and incorporation of genetic material from the surroundings through the cell membrane.

Avery, MacLeod and McCarty used three experimental tubes to which RNases, proteinases and DNase were added along with heat-killed S-strain bacteria and live R-strain bacteria.

Among the three sets of experimental tubes, those to which RNase and proteinase were added, still retained the ability to transform R-strain to live S-strain. Therefore, neither RNA nor protein could be the transforming principle. It was only in the tubes to which DNase was added, that transformation could not happen. It was thus concluded that DNA is the genetic material.

## BYJU'S Study Planner for Board Term I (CBSE Grade 12)

19. Which result is false according to Griffith's experiment?

- ☒ A. S Strain → Mice die
- ☒ B. R strain → Mice live
- ☒ C. S Strain (Heat killed) → Mice live
- ☒ D. S Strain (Heat killed) + R Strain (Live) → Mice live

Mice injected with S strain dies because it is the virulent form.

Mice injected with the R strain live because R strain is avirulent and is easily detected by the immune system of the mice and is killed.

Mice injected with heat killed S strain lives.

The mice injected with heat killed S strain and live R strain die because DNA from virulent S Strain is transformed into R Strain & R strain bacteria becomes virulent.

20. Match the type of RNA in column I with its function in column II.

Column I	Column II
1. mRNA	A. reads the genetic code
2. tRNA	B. catalytic role
3. rRNA	C. acts as a template

- ☒ A. 1-A, 2-B, 3-C
- ☒ B. 1-B, 2-C, 3-A
- ☒ C. 1-C, 2-A, 3-B
- ☒ D. 1-C, 2-B, 3-A

The synthesis of proteins requires three types of RNAs.

- mRNA (messenger RNA) acts as a template for the synthesis of proteins.
- tRNA (transfer RNA) helps in bringing the amino acids and reads the genetic code on the mRNA.
- rRNA (ribosomal RNA) plays a critical role as a catalytic agent during protein synthesis.