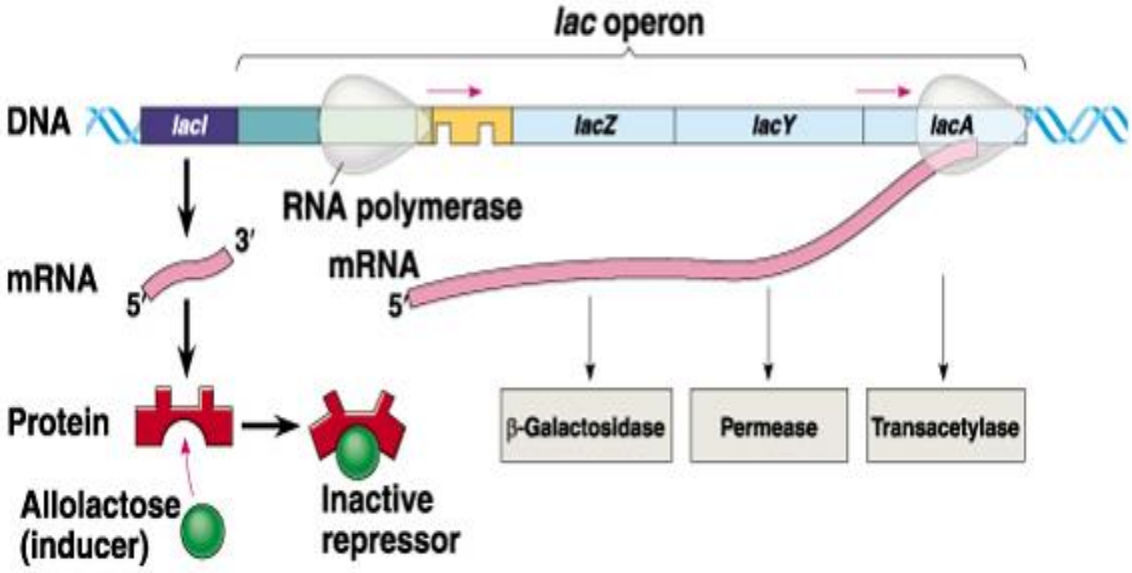
CBT AUGUST 2024
CLASS – XII: BIOLOGY

GENERAL INSTRUCTION :

SCORE AND REVIEW OF ALL THE QUESTIONS WILL BE PROVIDED IN THE EMAIL TO ALL THE STUDENTS ON NEXT DAY AND AFTER CLOSING OF QUIZ TIME.
IMPORTANT : ALL THE STUDENTS SHOULD FILL THE CORRECT SCHOOL NAME FROM DROP DOWN BUTTON

Q1 The entire region of the *E. coli* genome involved in lactose metabolism and control of *lac* gene expression is termed the *lac* operon. This region of DNA comprises sequences that contain several types of information—open reading frames for two classes of proteins (enzymatic and regulatory), binding sites for RNA polymerase (promoter regions), and binding sites for regulatory proteins. In sequence within the genome (Figure 1), the elements of the *lac* operon include the following:



1. How many structural genes are present in a lac operon?
a) One
b) Five
c) Three
d) Seven
FEEDBACK
Answer: c
Explanation: A lac operon consists of one regulatory gene (i) and three structural genes (z, y and a). The "i" in regulatory gene is derived from the word "inhibitor".

2. What does the structural gene (y) of a lac operon code for?
a) **β**-galactosidase
b) Transacetylase
c) Permease
d) Glucagon
FEEDBACK

Answer: c
Explanation: The structural gene (z) of the lac operon codes for **β**-galactosidase. It is responsible for the hydrolysis of polysaccharides. The 'y' genes code for permease. It increases the permeability of a cell to **β**-galactosidase. The 'a' genes code for transacetylase.

3. Which of the following is responsible for the switching on and off of the lac operon?
a) Lactose
b) Ethanol
c) Malate
d) Fructose
FEEDBACK
Answer: a
Explanation: The substrate for the enzyme **β**-galactosidase is lactose. The lac operon can either be in its switched on or off position. This operation is being regulated by lactose which is also known as the inducer.

4. What is the regulation of a lac operon by a repressor known as?
a) Neutral regulation
b) Positive regulation
c) Mixed regulation
d) Negative regulation
FEEDBACK
Answer: d
Explanation: The regulation of a lac operon by the repressor is known as negative regulation. At rare occasions, lac operons are also observed to be under the control of positive regulation. In negative regulation, the operon cannot transcribe the RNA polymerase enzyme.

5. Assertion (A) : Each operon has its specific operator and specific repressor.

Reason (R) : Lac operator is present only in the Lac operon and it interacts specifically with Lac repressor only.

The correct option among the following is:

(a)(A) is true. (R) is true and (R) is the correct explanation of (A)

(b)(A) is true. (R) is true but (R) is not the correct explanation of (A)

(c)(A) is true but (R) is false

Answer: a
FEEDBACK

An operon is a functional part of the DNA that encodes a cluster of genes that are transcribed together to form a single mRNA molecule coding multiple proteins.

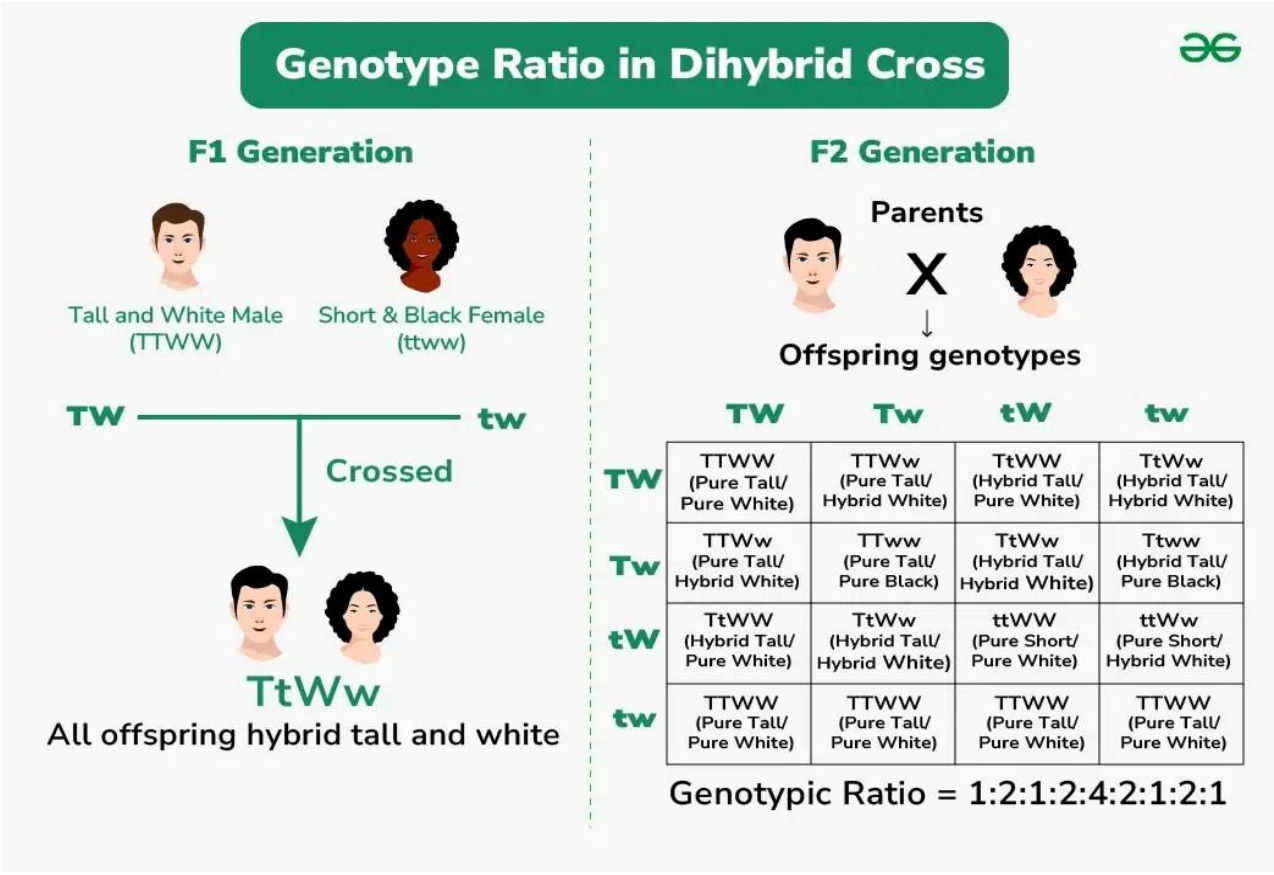
In an operon, the action of structural genes is regulated by the operator site with the help of a repressor protein. Repressor protein is produced by the action of gene i (inhibitor) known as the regulator gene. The gene expression depends on whether the operator is switched on or switched off.

In Lac operon, if the operator is switched on, the three structural genes z, y, and a are transcribed by RNA Polymerase into a single mRNA molecule. Switching on or switching off of the operator is regulated by a protein called a repressor. When this protein is attached to the

operator and blocks it, the switch is turned off and structural genes are not expressed. When an inducer like lactose binds to the repressor, the operator site will be free for the binding of RNA polymerase and transcription starts.

Q2: To analyze the segregation of both traits at the same time in the same individual, Mendel crossed a pure breeding line of green, wrinkled peas with a pure breeding line of yellow, round peas to produce F_1 progeny that were all green and round, and which were also **dihybrids**; they carried two alleles at each of two loci. If the alleles for the two genes for pea shape and pea color cannot be separated from each other, then in the F_2 generation, the offspring should be only green, round pea plants or yellow, wrinkled plants, like the P generation plants.

If the genes controlling shape and color can be inherited independently, then what is the probability of phenotypes in the F_2 generation? Using the product rule, we can multiply the individual probabilities of obtaining a round phenotype (¾) with the probability of obtaining a yellow phenotype (¾), then ¾ × ¾ = 9/16 of the progeny would be both round and green. Likewise, ¾ × ¼ = 3/16 of the progeny would be both round and yellow, and so on. By applying the product rule to all combinations of phenotypes, we can predict a **9:3:3:1** phenotypic ratio among the progeny of a dihybrid cross, if certain conditions are met, including the independent segregation of the alleles at each locus.



1. What is the phenotypic ratio of F2 generation in a dihybrid cross?
a) 3:1
b) 1:2:1

c) 9:3:1
d) 9:3:3:1

Answer: d
FEEDBACK: The F2 generation in a dihybrid cross produces all possible phenotypes. The ratio obtained for it is 9:3:3:1.

2. In Mendel's experiments on garden pea plants, he performed a dihybrid cross of round yellow and green wrinkled seed plants. In the F2 generation, he sampled 1600 plants. Which of the following represents the correct number of plants of each phenotype?
a) 900 round yellow, 300 round green, 300 wrinkled yellow and 100 wrinkled green
b) 900 round green, 300 round yellow, 300 wrinkled yellow and 100 wrinkled green
c) 900 wrinkled green, 300 round yellow, 300 wrinkled yellow and 100 round green
d) 900 round green, 300 wrinkled green, 300 wrinkled yellow and 100 round yellow

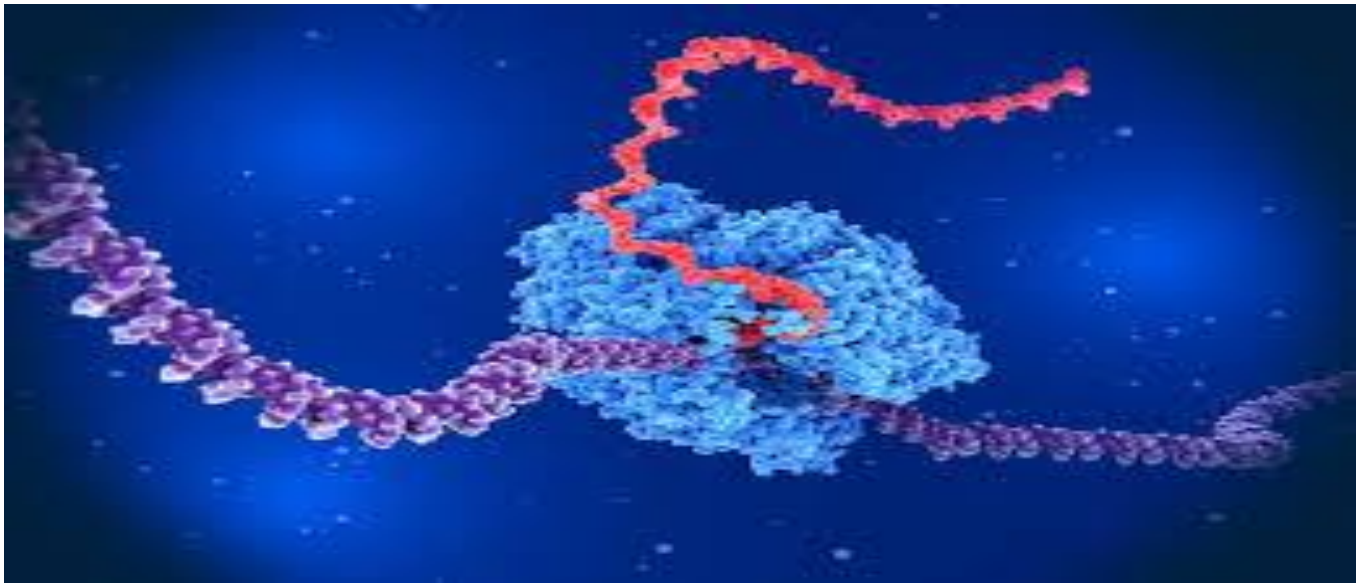
Answer: a
FEEDBACK: The F2 progeny of a dihybrid Mendelian cross has a phenotypic ratio of 9:3:3:1. Thus of the 1600 plants sampled, 900 will be round yellow, 300 round green, 300 wrinkled yellow and 100 wrinkled green

3. Assertion :The law of independent assortment can be studied by means of dihybrid cross. Reason: The law of independent assortment is applicable only to linked genes.

A. Both Assertion and Reason are correct and Reason is the correct explanation for Assertion
B. Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion
C. Assertion is correct but Reason is incorrect
D. Both Assertion and Reason are incorrect
Answer: C
FEEDBACK
The law of independent assortment states that two factors of each character assort or separate independent of the factors of other characters at the time of gamete formation and get randomly rearranged in the offspring producing both parental and new combinations of traits. The principle of law of independent assortment is applicable to only those factors or genes which are either located distantly on the same chromosome or occur on different chromosomes. Actually, a chromosome bears hundreds of genes. All the genes of factors present on a chromosome are inherited together except when crossing overtakes place.
So, the correct answer is 'Assertion is correct but Reason is incorrect'.

Q3 Have you ever had to transcribe something? Maybe someone left a message on your voicemail, and you had to write it down on paper. Or maybe you took notes in class, then rewrote them neatly to help you review.
As these examples show, *transcription* is a process in which information is rewritten. Transcription is something we do in our everyday lives, and it's also something our cells must

do, in a more specialized and narrowly defined way. In biology, **transcription** is the process of copying out the DNA sequence of a gene in the similar alphabet of RNA.



1. What is the role of RNA polymerase III?
a) Transcription of rRNAs
b) Transcription of mRNAs
c) Transcription of tRNAs
d) Transcription of hnRNA
Answer: c

FEED BACKrRNAs are transcribed with the help of RNA polymerase I. RNA polymerase II is responsible for the transcription of mRNA, which is the heterogeneous nuclear RNA (hnRNA). RNA polymerase III transcribes the tRNAs, 5srRNAs and snRNAs.

2. Sigma factor is the part of the
a) DNA Ligase
b) RNA Polymerase
c) DNA Polymerase
d) Endonuclease
Answer. RNA Polymerase is the right answer.

FEED BACK

RNA polymerase contains the Sigma factor. Sigma functions as an initiation factor, binding to DNA – dependent RNA polymerase and altering its specificity so that the RNA polymerase can start the transcription process.

LINK FOR CBT

https://forms.gle/aZHtRg7Bpb5jB6227