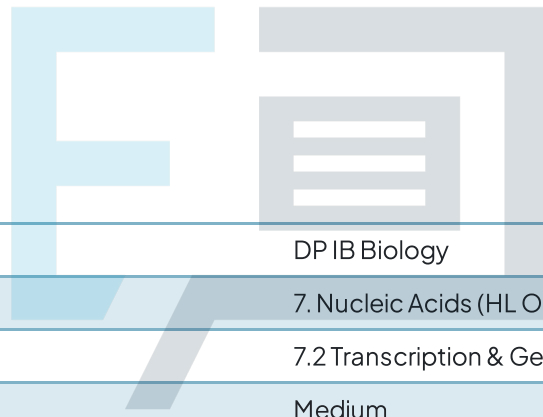




7.2 Transcription & Gene Expression

Mark Schemes



Course	DP IB Biology
Section	7. Nucleic Acids (HL Only)
Topic	7.2 Transcription & Gene Expression
Difficulty	Medium

Exam Papers Practice

To be used by all students preparing for DP IB Biology HL
Students of other boards may also find this useful

1

The correct answer is **C** because the promoter is a non-coding sequence of DNA (does not code for a polypeptide) that acts as the binding site for RNA polymerase during the initiation of transcription.

Statement I is incorrect as although the promoter sequence is located before the gene it is not transcribed and is not classed as part of the gene. **Statement IV** is incorrect as promoter regions are found in both eukaryotes and prokaryotes.

2

The correct answer is **A** because activator proteins bind to enhancer sequences to increase the rate of transcription

- Option **B** is incorrect as it is the opposite - this would decrease or block transcription
- Option **C** is incorrect as HRE is a DNA sequence and not a protein
- Option **D** is incorrect as general transcription factors bind directly to the promoter to help initiate transcription. In this example HIF binds to the enhancer sequence

3

The correct answer is **D**

- Option **A** is incorrect as the LAC repressor protein is required for repression of the genes involved in lactose metabolism
- Option **B** is incorrect as this statement describes what happens in the presence of lactose
- Option **C** is incorrect as the gene that codes for the LAC repressor protein is expressed in the absence of lactose.

4

The correct answer is **D**

- Option **A** is incorrect as although there can be differences in mutation rates between twins, it is dependent on many factors and is not the most likely explanation. Interestingly, recent research on early developmental mutations in twins is impacting the classical interpretation about epigenetics!
- Option **B** is incorrect as although epigenetic changes can influence the expression of a gene encoding for a protein, they can't alter the structure of the protein
- Option **C** is incorrect as **both** twins would be expected to inherit any epigenetic modifications from the parents but these are **lost** very early on in embryonic development

5

The correct answer is **A** because histone tails contain positively charged lysine which binds to negatively charged DNA. Acetylation neutralises this charge causing the DNA to be less tightly wrapped.

- Option **C** is incorrect as it is the opposite of what happens
- Option **B** is incorrect as acetylation stimulates gene expression as the DNA is more readily accessible
- Option **D** is incorrect as acetylation neutralises the positive charge of the histone tail

6

The correct answer is **C** because methylation of DNA suppresses the transcription of the affected gene by inhibiting the binding of transcription factors.

- Option **A** is incorrect as the expression of the gene is repressed through methylation
- Option **B** is an incorrect statement as methylation does not disrupt the hydrogen bonds between base pairs
- Option **D** is incorrect, breaks in DNA can actually trigger methylation (but you don't need to know this for IB!)



7

The correct answer is **B** because statements I and II are the only correct statements

Statements III and IV are incorrect as RNA polymerase uses the antisense strand as a template during transcription and synthesises mRNA in a 5' to 3' direction

8

The correct answer is **C** because a particular exon (coding region) may or may not be incorporated into the final mature mRNA. Exons can be spliced in different ways to produce a range of mature mRNA molecules that differ in their amino acid sequence and therefore, final protein structure.

- Option **A** is incorrect as introns are the non-coding regions and are removed during splicing
- Option **B** and **C** are incorrect, exons can be duplicated and genes can be fused together but these phenomena are not due to alternative splicing

9

The correct answer is **D** because these three post-transcriptional modification steps of pre-mRNA must occur to form mature mRNA before it is transported out of the nucleus to the cytoplasm.

- Option **A** is incorrect because a poly-A-tail (long chain of adenine nucleotides) needs to be added to the 3' end of the pre-mRNA, not removed
- Option **B** is incorrect as transcription has been completed so RNA polymerase does not need to bind
- Option **C** is incorrect because non-coding sequences need to be removed from the pre-mRNA before translation occurs at the ribosome

10

The correct answer is **C**.

Changes in DNA Methylation occurs throughout the lifetime and can be affected by numerous factors. It is thought that gaining a better understanding of these changes will lead to better treatment and prevention of diseases like cancer. The only incorrect statement is **IV**, although certain cytosine bases can become methylated they are still cytosine and base-pair normally with guanine. Consequently, the base sequence of DNA does not change.



Exam Papers Practice