7.2 Transcription & Gene Expression

Question Paper

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

Time allowed: 10

Score: /5

Percentage: /100

Question 1

The reaction of bacteria to DNA damage is called the SOS response. During this response, the cell cycle stops and a DNA damage repair system is induced. Two main proteins are involved, namely LexA and RecA. In normal cells, the LexA protein is bound to a section of prokaryotic DNA called the SOS box, which codes for various genes involved with DNA repair. In cells with DNA damage, RecA will bind to and cleave the LexA protein.

Which of the following correctly identifies each of the components of the SOS response?

	LexA	RecA	SOS box
A.	Repressor protein	Activator protein	Transcription factor
B.	Activator protein	Repressor protein	Promoter
C.	Repressor protein	Activator protein	Promoter
D.	Activator protein	Repressor protein	Silencer sequence

[1 mark]

Question 2

Which of the following applies to both mutations **and** epigenetics?

I. It may affect the visible characteristics of an organism
II. The DNA base sequence can change and impact the expression of genes
III. Environmental factors may play an important role in the development of changes
IV. Modifications may be passed on to the next generation at a cellular level
V. The amino acid tails of histones are modified by methylation, acetylation and phosphorylation

A. I, IV and V.

B. I, III and IV.

C. II, III and IV.

D. I, III, IV and V.

[1 mark]

Question 3

Female embryos contain two copies of the X chromosome, even though they initially do not need both copies to be active. In order to avoid producing double the amount of polypeptides required, the paternal X chromosome is inactivated during the first few divisions after fertilisation. This is done by the methylation of lysine on different histones.

Which of the following provides the most accurate explanation of how this would inactivate the paternal X chromosome?

A. Adding a methyl group to lysine will maintain the negative charge to allow chromatin to become more condensed and inhibit transcription of the genes.

B. Adding a methyl group to lysine will maintain the positive charge to allow chromatin to become less condensed and inhibit transcription of the genes.

C. Adding a methyl group to lysine will maintain the positive charge to allow chromatin to become more condensed and promote transcription of the genes.

D. Adding a methyl group to lysine will maintain the positive charge to allow chromatin to become more condensed and inhibit the transcription of the genes.

[1 mark]

Question 4

The muscle protein titin is an important component of cardiac muscle tissue. Several forms of titin exist, even though it is coded for by the same gene. During the development of the foetal heart, titin exists in the form of long, springy protein strands, while in the adult heart titin is much shorter.

Which of the following provides the most plausible explanation for the occurrence of the different forms of titin?

A. Different post-transcriptional changes are made to the pre-mRNA of the titin gene, resulting in different mature mRNA molecules that can be translated into different polypeptides.

B. Different exons of the gene coding for titin are spliced to form different mature mRNA molecules that can be translated into different polypeptides.

C. Different introns of the gene coding for titin are joined together to form different mature mRNA molecules that can be translated into different polypeptides.

D. Different poly-A tails are added to the 3' end of pre-mRNA molecules, resulting in different mature mRNA molecules that can be translated into different polypeptides.

[1 mark]

Question 5

Which of the following provides a reason why prokaryotic mRNA does not require post-transcriptional modification?

I. Prokaryotic DNA is a circular, double-stranded molecule, therefore mRNA molecules are less complex than in eukaryotes.
II. A lack of a nuclear membrane means that transcription and translation can be coupled together.
III. Prokaryotic DNA lacks introns, which means that no splicing needs to occur.
IV. Prokaryotes have smaller, 70S ribosomes.
V. RNA polymerase in prokaryotes will transcribe a single strand of mRNA.

A. I and V only.

B. II, III and IV.

C. II and III only.

D. I, II and V.

[1 mark]