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# BIOLOGY

## THE CONTROL OF GENE EXPRESSION

Level & Board	AQA (A-LEVEL)
TOPIC:	REGULATION OF TRANSCRIPTION AND TRANSLATION
PAPER TYPE:	QUESTION PAPER- 1
TOTAL QUESTIONS	6
TOTAL MARKS	56

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## **Regulation of Transcription and Translation QP 1**

1.

Researchers discovered a link between cadmium ion exposure and prostate cancer.

The scientists looked into how human prostate gland cells were affected by cadmium ions.

These cells were cultured in a liquid growth media, and samples were taken out periodically.

The amount of non-methylated DNA and the methyltransferase enzyme's activity were evaluated for each sample.

An enzyme called methyltransferase gives some DNA bases methyl groups. Methylation is the process of adding a methyl group.

**(a)** As a control, the scientists established a different culture.

Describe the setup of the control experiment that the scientists would have used in this study. **(2)**

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2.

Figures 1 and 2 present the findings of the scientists.

Figure 1

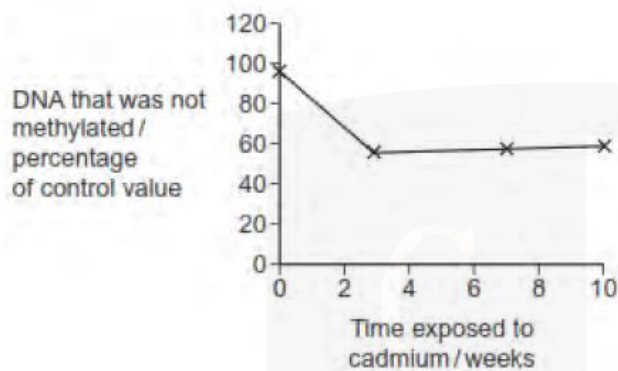
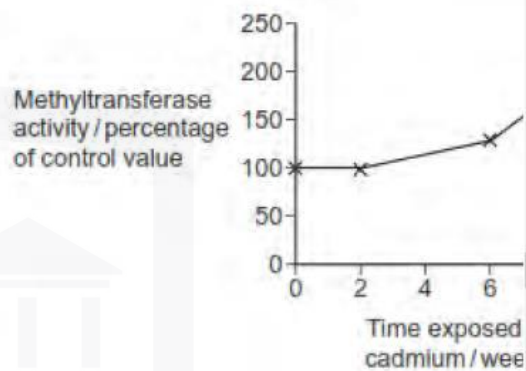


Figure 2



(a) In percentage terms relative to the control values, the scientists presented their findings.

Explain why. (2)

**(b)** Explain how exposure to cadmium ions impacted DNA methylation using details from Figure 1. **(2)**

**(c)** Make suggestions about the source of the alteration to the DNA depicted in Figure 1 using the data from Figure 2. **(2)**

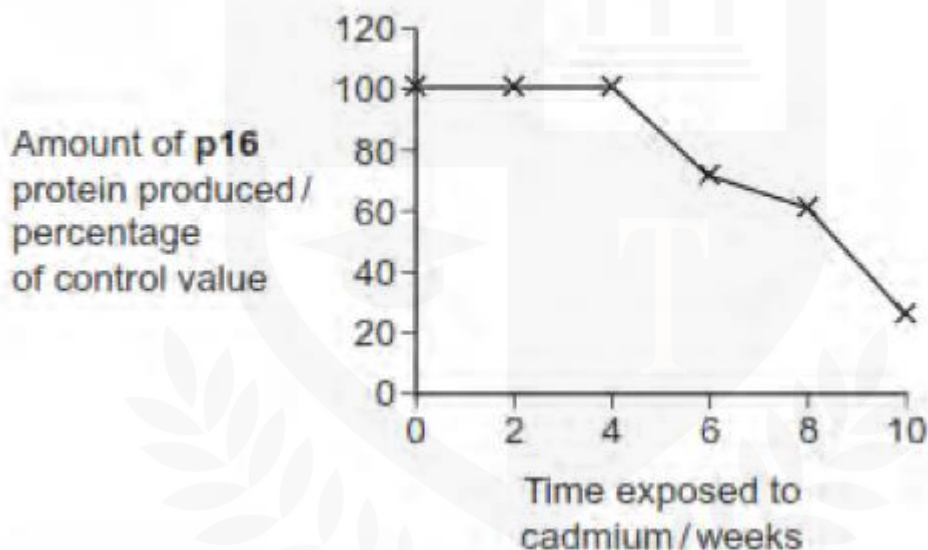
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3.

(a) A gene known as p16, a tumor suppressor, is found in prostate gland cells. The amount of p16 protein generated was also measured by the scientists during the experiment.

Their findings are displayed in Figure 3.

**Figure 3**



The p16 gene's promoter DNA was discovered by the scientists to be methylated. The nucleotide sequence known as the promoter is where RNA-polymerase attaches itself to a DNA molecule.

Describe how the alterations depicted in Figure 3 might be brought about by methylation of the p16 gene's promoter region. **(2)**

**(b)** The investigators collected samples of the cadmium-treated prostate cells from the lab cultures every week of the study. These cells were put into mice, and the formation of tumors in the mice was seen.

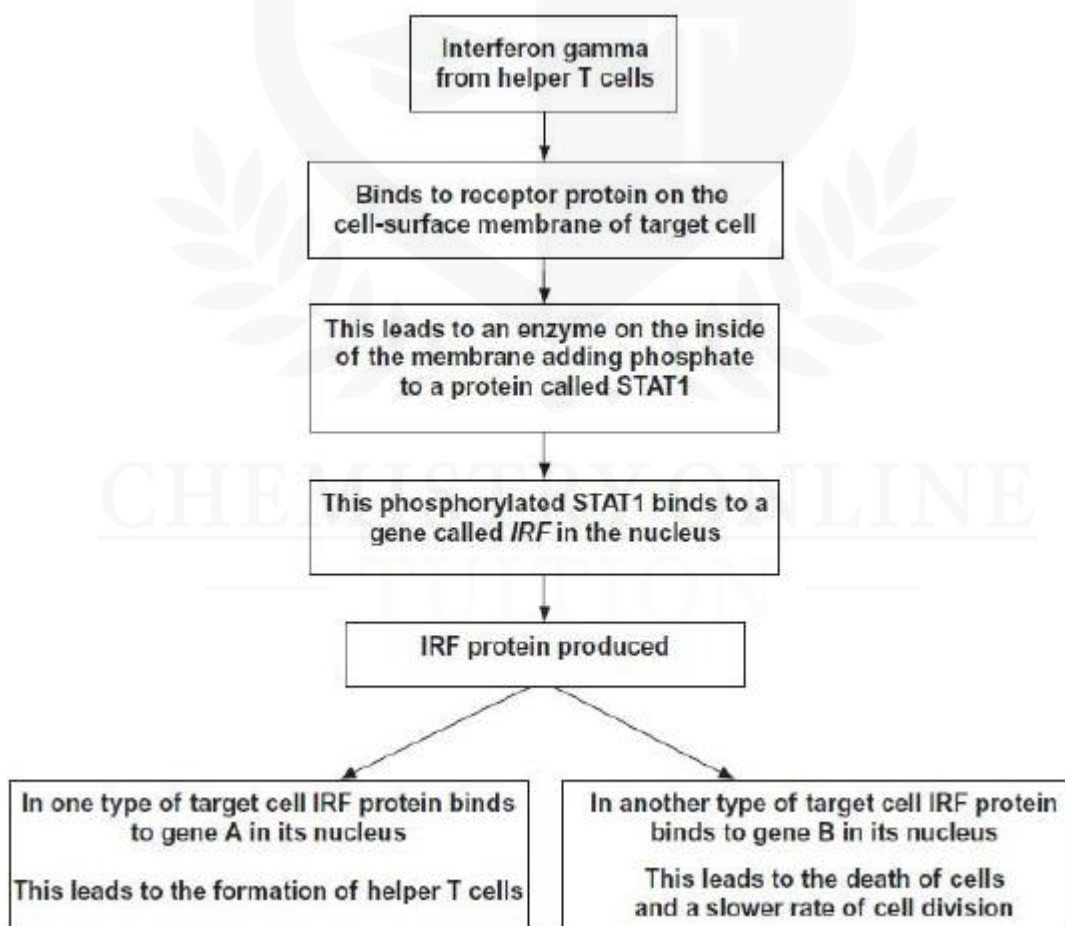
Tumors in the animals didn't start to grow until the samples collected during the ninth week.

Explain why using data from Figures 1, 2, and 3. **(4)**

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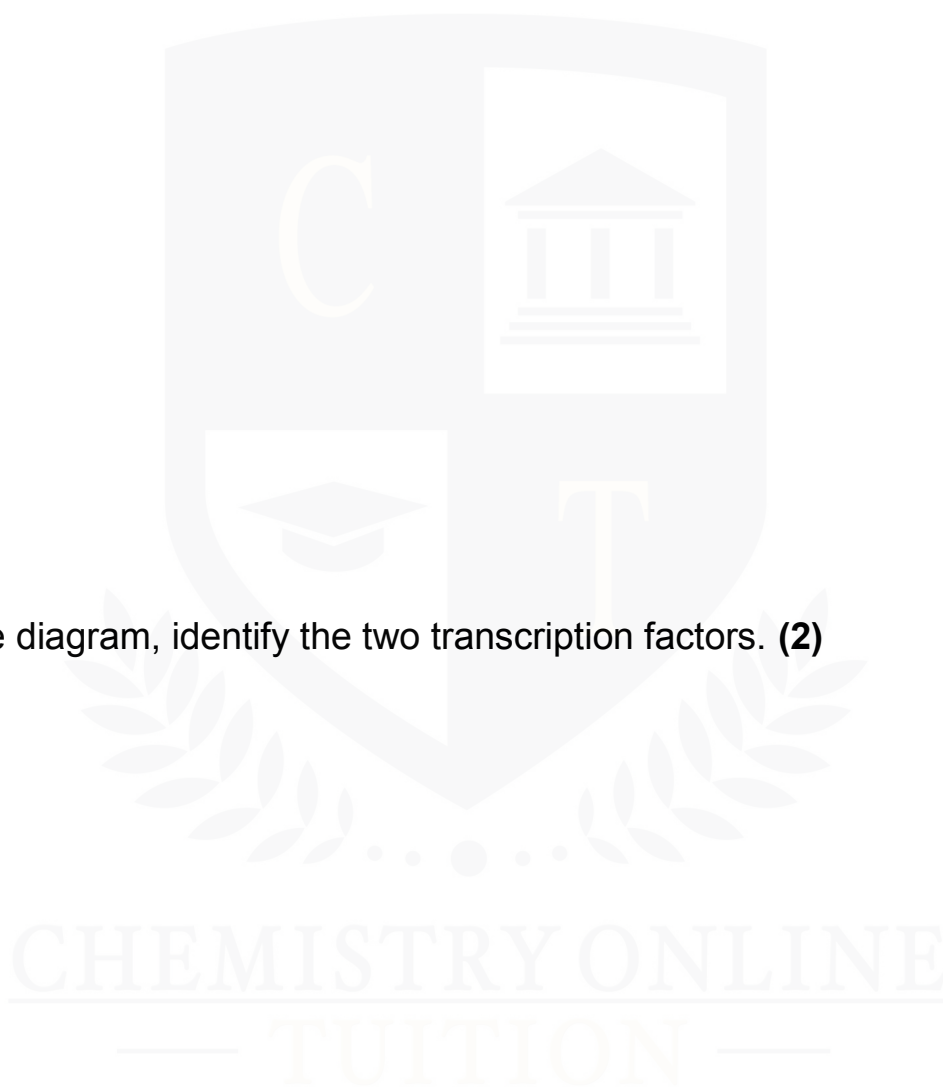
4.

The figure illustrates the three genes that interferon gamma controls.



**(a)** Explain how the creation of phosphorylated STAT1 is caused by interferon gamma binding to its receptor protein using the information in the diagram. **(2)**

**(b)** In the diagram, identify the two transcription factors. **(2)**





**(c)** Positive feedback is seen by the way interferon gamma controls the development of helper T cells.

Justify its inclusion as an illustration of good feedback. **(2)**

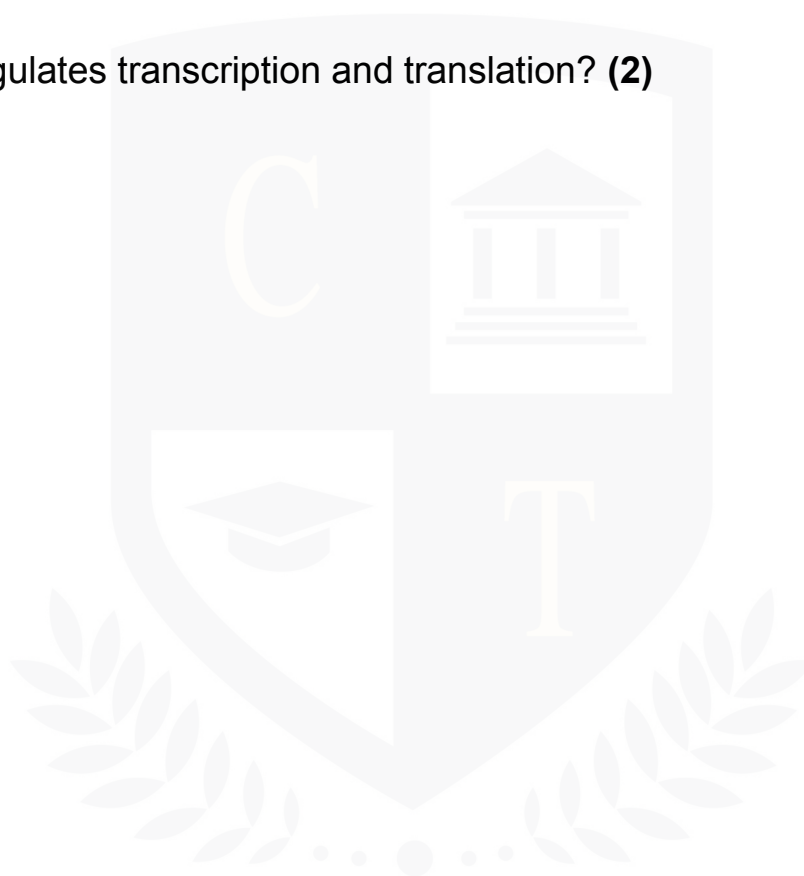


**(d)** One potential tumor suppressor gene is the IRF gene.

Provide an explanation of how the IRF gene functions as a tumor suppressor gene using the data in the diagram. **(3)**

**5.**

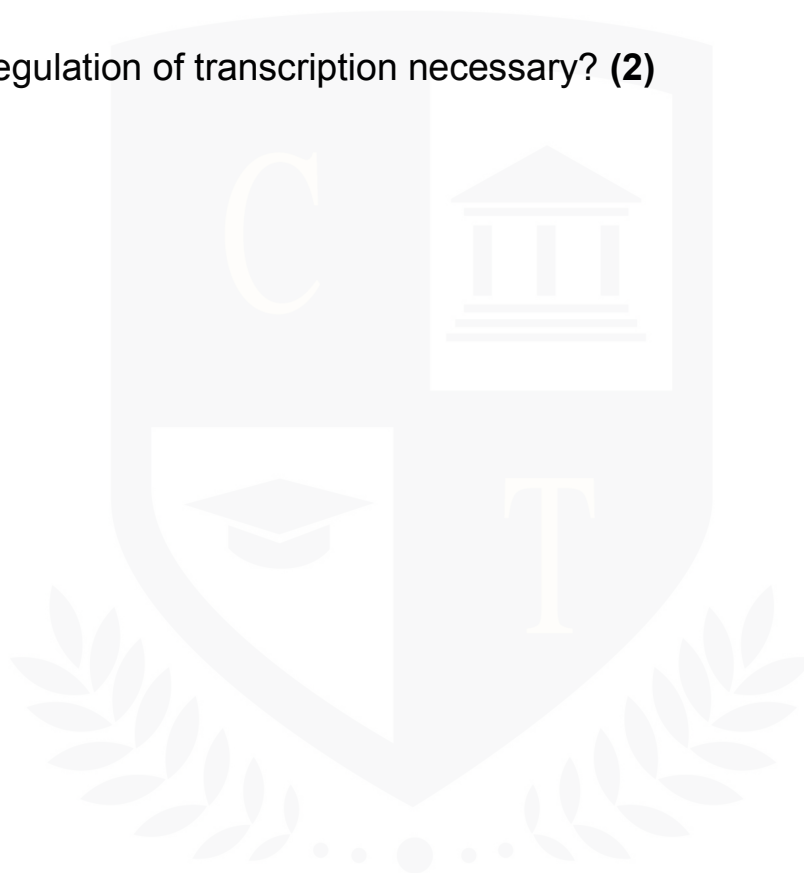
**(a) What regulates transcription and translation? (2)**



**(b) Why is transcription and translation regulation necessary for cells? (2)**

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**(c) Why is regulation of transcription necessary? (2)**



**(d) Is transcription regulated in bacteria? (2)**

**6.**

**(a)** Your essay should be written in a continuous prose style.

You will be graded on the correctness of science in your essay.

Along with the quality of your written communication, it will be graded based on how well you choose pertinent information from various sections of the specification.

The most points that can be given out are

Scientific	16
Breadth of knowledge	3
Relevance	3
Quality of written communication	3

Write a paper on the following subject:

Technology and Science Using DNA. **(25)**

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