

Name of the Student: _____

Max. Marks : 22 Marks

Time : 22 Minutes

Q1.

Scientists investigated the role of a protein called CENP-W in mitosis. Their method involved cell fractionation and ultracentrifugation.

- (a) The scientists began by lysing (breaking open) cells and organelles using a detergent that dissolves lipids in water.

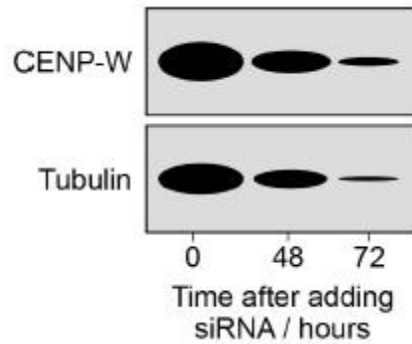
Suggest how the detergent releases CENP-W from cells.

(2)

- (b) Explain how ultracentrifugation separates CENP-W from other molecules.

The scientists treated cells in a culture with small interfering RNA (siRNA). This siRNA causes RNA interference of expression of the *CENP-W* gene. The scientists took samples of cells at 0, 48 and 72 hours after adding the siRNA. They then used gel electrophoresis to separate CENP-W and tubulin from these samples.

The diagram shows the results of the electrophoresis. The size of each band is proportional to the amount of CENP-W or tubulin present.



Suggest how the siRNA produced these results.

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(3)
(Total 7 marks)

Q2.

- (a) There are different types of gene mutation.

Put a tick (✓) in the box next to the statement which describes **incorrectly** the effect of the mutation in an exon of a gene.

A substitution may not result in a change to the encoded amino acid.

☐

An inversion will result in a change in the number of DNA bases.

☐

A deletion will result in a frame shift.

☐

An addition will result in a frame shift.

☐

(1)

- (b) Describe how alterations to tumour suppressor genes can lead to the development of tumours.

(3)

- (c) A type of malignant tumour cell divides every 8 hours.

Starting with one of these cells, how many tumour cells will be present after 4 weeks?
Assume none of these cells will die.

Give your answer in standard form.

Answer = _____

(2)

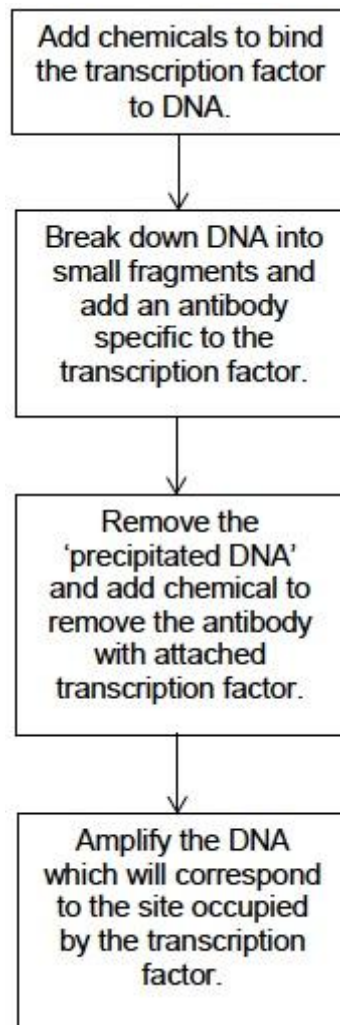
(Total 6 marks)

Q3.

(a) What is meant by a genome?

(1)

Chromatin immunoprecipitation is one method to determine where a transcription factor binds to DNA. The principle behind this procedure is shown in the chart.



(b) Explain why the antibody binds to the transcription factor.

(2)

(c) Use the chart to explain what 'precipitated DNA' consists of.

(1)

Soybeans are used in a number of processed foods. However, soybeans contain a protein known as P34 that causes an allergic response in some people. Scientists have created transgenic soybeans that produce single-stranded cDNA, which prevents transcription of the *P34* gene. They used recombinant plasmids as vectors to transform soybean cells. After they had screened these cells for production of the P34 protein, they cultured the transformed cells to form soybean plants.

- (d) Suggest how single-stranded cDNA could prevent transcription of the *P34* gene.

(1)

- (e) Describe the roles of **two** named types of enzymes used to insert DNA fragments into plasmids.

Type of enzyme _____

Role _____

Type of enzyme _____

Role _____

(2)

- (f) The soybean cells were screened for the presence of the P34 protein. This process involved the use of gel electrophoresis to separate proteins extracted from soybean cells.

Suggest **two** features of the structure of different proteins that enable them to be separated by gel electrophoresis.

1. _____

2. _____

(2)
(Total 9 marks)