Practice Question Set For A-Level
Subject : Biology
Paper-2 Topic: 8 The control of gene expressions

Name of the Student:_____
Max. Marks : 18 Marks **Time : 18 Minutes**

Q1.

Testosterone is a steroid hormone that belongs to a group of male sex hormones called androgens.

(a) Steroid hormones are hydrophobic.

Explain why steroid hormones can rapidly enter a cell by passing through its cell-surface membrane.

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(2)

(b) In the cytoplasm, testosterone binds to a specific androgen receptor (AR).
An AR is a protein.

Suggest and explain why testosterone binds to a specific AR.

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(2)

(c) The binding of testosterone to an AR changes the shape of the AR. This AR molecule now enters the nucleus and stimulates gene expression.

Suggest how the AR could stimulate gene expression.

(2)

The gene that codes for the AR has a variable number of CAG repeats.
Some studies have shown an association between the number of CAG repeats and the risk of developing prostate cancer.

The table below shows the results of a statistical test from one study.

Number of CAG repeats in the *AR* gene	**Probability (P) value**
⩽ 16	0.02
⩽ 17	0.30
⩽ 18	0.07
⩽ 19	0.09
⩾ 20	0.06

(d) What can you conclude from the data in the table above?

(3)

(Total 9 marks)

Q2.

Alport syndrome (AS) is an inherited disorder that affects kidney glomeruli of both men and women. Affected individuals have proteinuria (high quantities of protein in their urine).

(a) Suggest how AS could cause proteinuria.

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(2)

(b) AS results from a sex-linked mutation.

In a male with AS, where would the sex-linked mutation be located?

Tick (✓) **one** box.

The homologous section of a Y chromosome	☐
The homologous section of an X chromosome	☐
The non-homologous section of a Y chromosome	☐
The non-homologous section of an X chromosome	☐

(1)

Scientists investigated the use of transplanted stem cells to treat AS in mice.

The scientists set up four experimental groups.

Group **A** – 40 wild type* mice
Group **B** – 40 AS mice
Group **C** – 40 AS mice that received stem cells from AS mice
Group **D** – 40 AS mice that received stem cells from wild type mice

*Wild type mice are mice **not** affected by AS.

After 20 weeks, the scientists measured the quantity of protein in the urine using a scale from 0 (lowest quantity) to +++++ (highest quantity).

The results the scientists obtained are shown in below table.

Group	**Maximum quantity of protein in urine at 20 weeks**	**Percentage of mice with this quantity of protein**

A	0	100
B	+++++	97.5
C	+++++	100
D	++	68

(c) Using all the information, evaluate the use of stem cells to treat AS in humans.

(4)

(d) The scientists carried out further work to investigate how the transplanted stem cells developed after transplantation.

- The scientists transplanted stem cells from wild type male mice into AS female mice.
- After 20 weeks, they found that the quantity of protein in the urine of these female mice had significantly decreased.
- They examined cells from glomeruli in the female mice. Some of these cells contained a Y chromosome.

Suggest how the transplanted stem cells reduce proteinuria.

(2)
(Total 9 marks)