GCE Biology

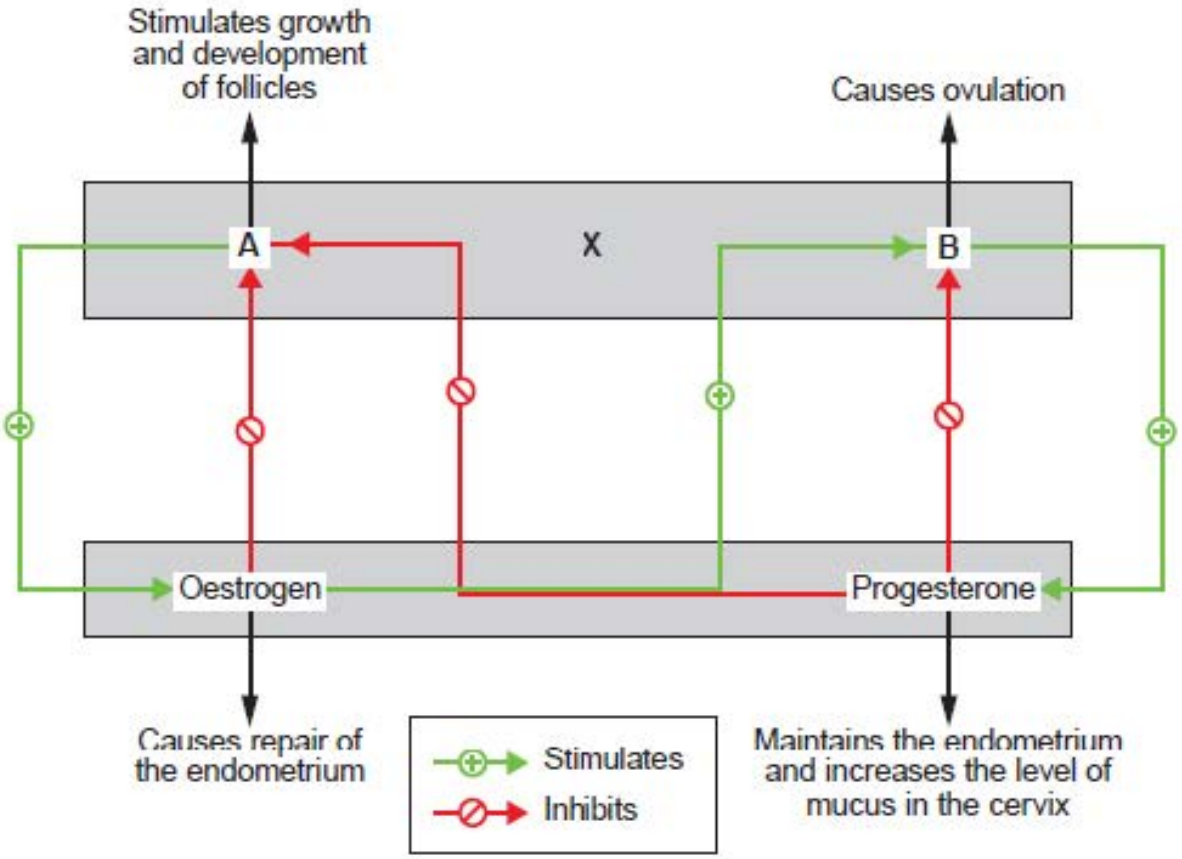
S21-A400U20-1

Assessment Resource 18

Continuity of Life Resource I

1. The menstrual cycle is controlled by the interaction of a number of different hormones as shown in the flow chart in **image** 1.1

Image 1.1



(a) (i) State the names of the hormones labelled **A** and **B** in **image** 1.1 and the name of structure **X** where they are secreted into the blood. [2]

A .....

B .....

X .....

(ii) With reference to **image** 1.1, conclude how oestrogen and progesterone in the combined contraceptive pill, act to reduce the likelihood of fertilisation. [3]

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Sperm production in human males is also dependent on the interaction of hormones A and B and their effects on different organs and tissues.

(b) State the following:

(i) the term used to describe the process of sperm production. [1]

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(ii) the precise location of sperm production in human males. [1]

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(c) Research into the development of a male contraceptive has focussed on reducing the production of spermatozoa. One possible method has been to increase the blood concentration of testosterone by administering a drug called TU.

One study involved 898 Chinese men between 20 and 45 years of age. All men starting the trial had fathered a child in the previous two years. Following an initial dose of 1000 mg, the men were all given an injection of 500 mg of TU each month for 30 months.

(i) Calculate the total mass of TU given to each man during the period of the trial. **Give your answer in grams.** [2]

mass of TU = ... g

(ii) State **two** criteria that were used to select the men included in the trial. [2]

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(iii) Semen samples were collected on a regular basis and the number of spermatozoa per cm^3 determined.
Of the original 898 men in the trial, 4.8% did not respond to the drug and remained fertile. Calculate the number of men who did respond to the drug. [2]

number of men who did respond to the drug = ...

(iv) The number of pregnancies in the partners of the men in the trial was also recorded. Suggest why sperm counts were carried out during the trial rather than relying on pregnancy rate alone as a measure of contraceptive success. [1]

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(d) Similar trials in other parts of the world have produced different degrees of success. Identify **two** changes to the study to validate the use of TU as a male contraceptive world-wide. Justify your suggested changes. [2]

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2. Ferns are terrestrial, non-flowering plants that first appeared in the fossil record about 360 million years ago. They are similar to other terrestrial plants in that they have vascular systems for transport of water, ions and products of photosynthesis around the plant. **Image** 2.1 shows the leaves of a fern plant.

Image 2.1

(a) (i) Name the vascular tissues you would expect to find in ferns. [1]

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(ii) Ferns have chloroplasts with the same structure and photosynthetic pigments as flowering plants. Name **two** photosynthetic pigments found in ferns and state **precisely** where in the chloroplast you would expect to find them. [2]

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(iii) Identify the type of nutrition found in ferns. [1]

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Classification of ferns was originally based on morphological features, but cross-fertilisation between unrelated species has produced hybrids that have often been classified as different species.

In recent years, analysis of the chloroplast genome has enabled botanists to identify hybrid forms as the chloroplast is inherited only from the female gamete.

Image 2.2 shows the gel electrophoresis of digested chloroplast DNA from four species of *Asplenium* fern. A DNA ladder was included to estimate the length of DNA fragments from the species of fern in number of base pairs.

Image 2.2

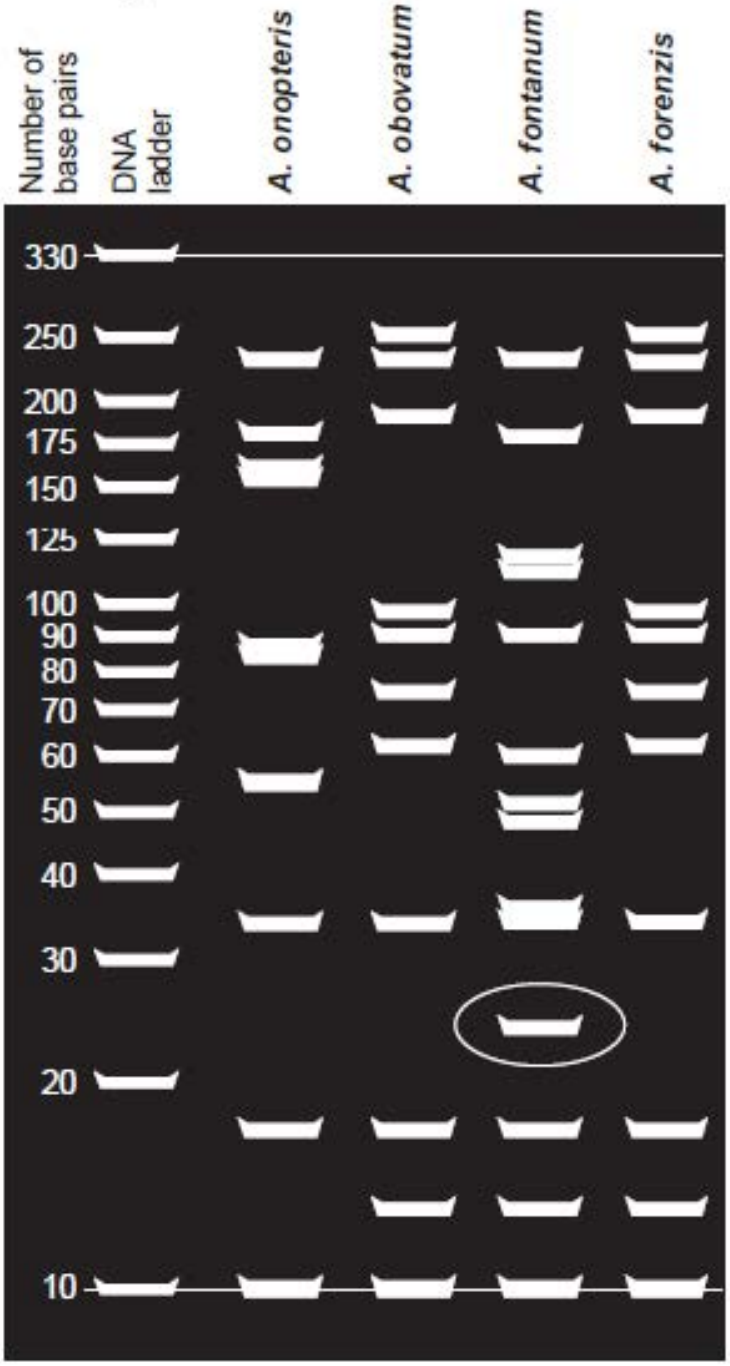


Table 2.3

number of base pairs	$\log_{10}$ number of base pairs	distance travelled / mm
10	1.00	128
20	1.30	103
30	1.47	88
40	1.60	78
50	1.70	70
60	1.78	63
70	1.85	57
80	1.90	53
90	1.95	48
100	2.00	44
125	2.10	36
150	.....	30
175	2.24	25
200	2.30	19
250	.....	10
330	2.52	0

(b) (i) **Complete table 2.3** by calculating the $\log_{10}$ value of the number of base pairs in the DNA fragments in the DNA ladder. [1]

(ii) **Graph 2.4** shows some of the data from **table 2.3**.

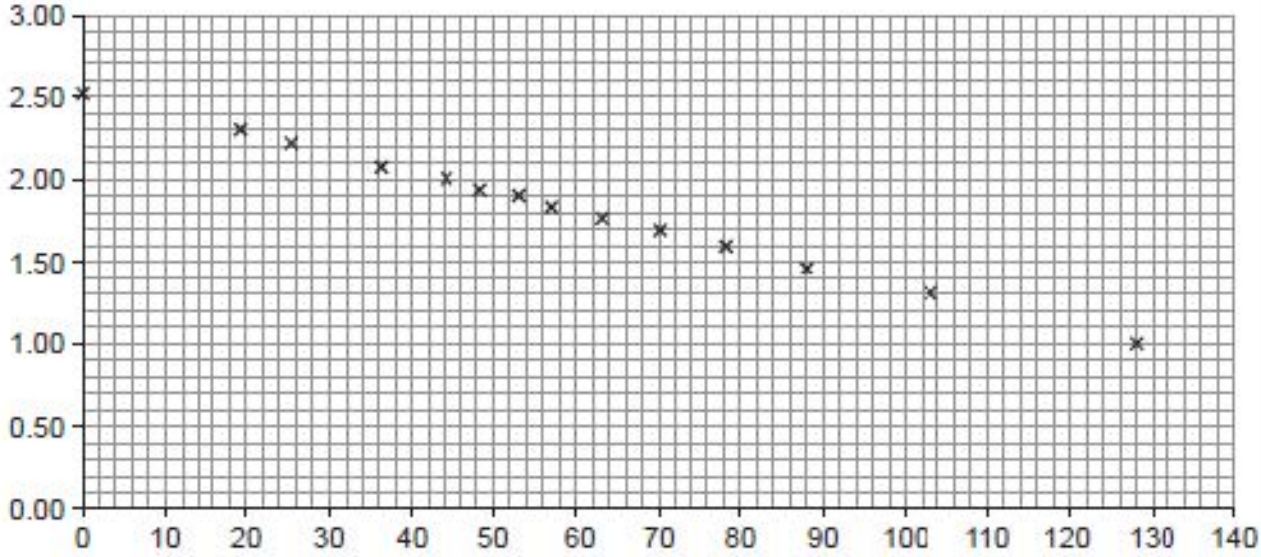
On **graph 2.4**:

I. label the axes [1]

II. plot the values for 10 mm and 30 mm [1]

III. draw a line of best fit through the plots. [1]

Graph 2.4



(iii) I. One fragment from *A. fontanum* has a circle drawn around it on the gel electrophoresis in **image 2.2**. This fragment travelled a distance of 95 mm. Use **graph 2.4** to estimate the $\log_{10}$ of the number of base pairs in this fragment. **Show how you estimated this value on graph 2.4.** [2]

Log_{10} estimated number of base pairs in DNA fragment = ...

II. If $100 = 10^2$, then $\log_{10} 100 = 2$ and $10^2 = 100$.
Use this relationship and your answer to the previous question to determine the estimated number of base pairs in this fragment. [1]

Estimated number of base pairs in DNA fragment = ...

(iv) Suggest how you could modify the method to estimate the length of this DNA fragment more accurately. [1]

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(v) It is known that *A. forenzis* is a hybrid of *A. fontanum* and one of the other two species shown on the gel electrophoresis in **image 2.2**. Use the information given to conclude which species provided the female gamete to produce the hybrid *A. forenzis*. Explain your answer. [3]

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