Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0024777569

BIOLOGY **5090/22**

Paper 2 Theory **October/November 2020**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Section A: answer **all** questions.
- Section B: answer **all** questions.
- Section C: answer **either** Question 8 **or** Question 9.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Blank pages are indicated.

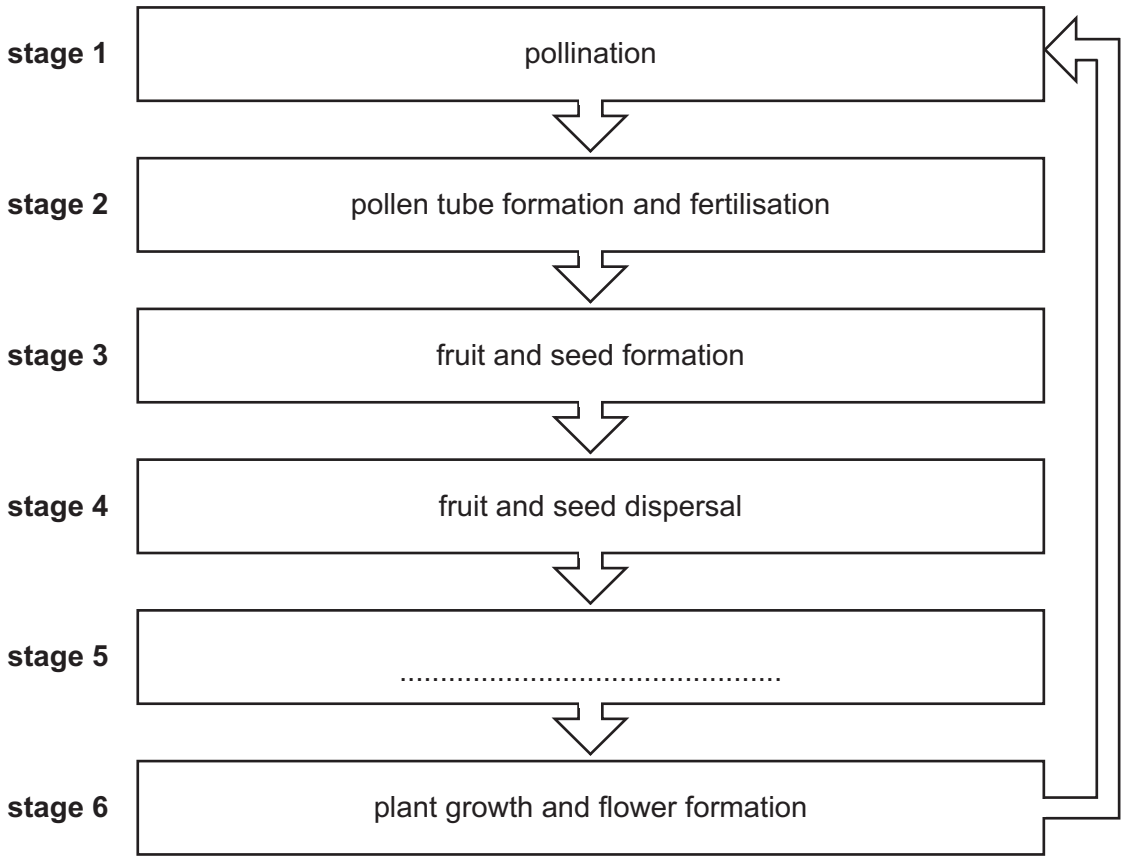
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Section A

Answer **all** questions in this section.

Write your answers in the spaces provided.

1 The flow chart shows stages in the life cycle of a flowering plant.



(a) The name of **stage 5** of the life cycle has not been included in the flow chart.

During this stage a radicle and a plumule are formed from a seed.

(i) State, in the correct place on the flow chart, the name of **stage 5**. [1]

(ii) Describe the role of enzymes in this stage of the plant's life cycle.

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..... [3]

(b) **Two** of the stages in the life cycle of this flowering plant **may** depend on the action of an animal.

Identify each of these stages **and** for each stage describe how the action of an animal may be required.

stage .....

action of an animal .....

.....

.....

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stage .....

action of an animal .....

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[6]

[Total: 10]

2 In 1931 a scientist was pouring the powdered form of a chemical called PTC into a bottle. A small amount of the powder accidentally blew into the air. A short time later another scientist working in the same room said that she had a bitter taste in her mouth from the powder in the air.

(a) Describe, with reference to **named** components of the nervous system, the nervous pathway that led to the scientist detecting that the powder tasted bitter.

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..... [4]

(b) The scientist pouring the powder did **not** detect any bitter taste.

It was later found that inheritance of two forms of the same gene determine if a person is able to detect a bitter taste from PTC or not.

(i) State the term used for different forms of the same gene.

..... [1]

(ii) Several years afterwards, it was found that environmental factors cause people to detect a range of different strengths of bitter taste from PTC.

State the type of variation now known to be shown by this characteristic.

..... [1]

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(c) Chemicals similar to PTC with a bitter taste are produced by some plants to prevent them from being eaten.

Animals that eat **only** plants have fewer genes that enable them to detect chemicals that taste bitter than animals that eat **both** plants and animals.

(i) State the trophic level of plants in a food web.

..... [1]

(ii) State the term used for animals that eat **only** plants.

..... [1]

(iii) Suggest why animals that eat only plants have fewer genes that enable them to detect chemicals that taste bitter than animals that eat both plants and animals.

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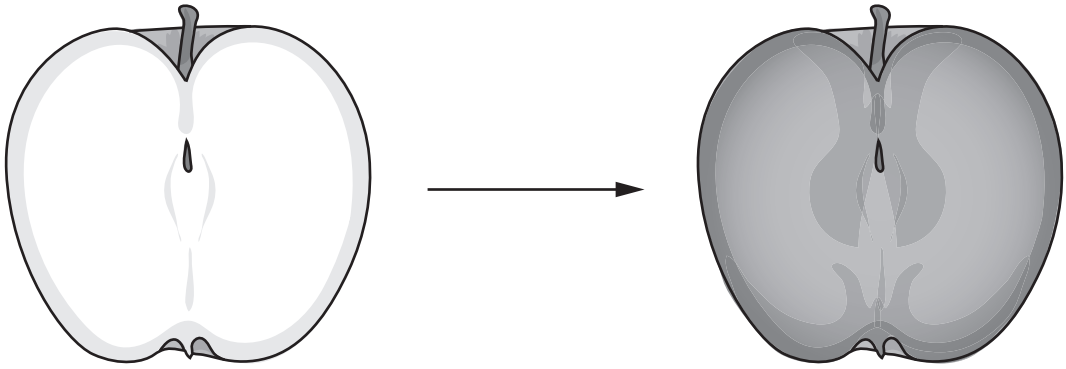
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..... [2]

[Total: 10]

3 When an apple fruit is cut open, the cut surface of apple tissue quickly becomes brown and is less likely to be eaten. This change in colour is shown in the diagram.



white apple tissue immediately after being cut

brown apple tissue a short time after being cut

(a) The change in colour of the apple tissue is due to a series of chemical reactions. An enzyme called PPO acts as a catalyst for one of these reactions.

(i) State what is meant by the term *catalyst*.

.....

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..... [2]

(ii) The change in colour can be prevented by placing the cut surface of apple tissue in boiling water for a short time immediately after the fruit is cut.

Explain this observation using the *lock and key* hypothesis of enzyme action.

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..... [4]

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(b) Scientists have recently used the process of genetic engineering to develop a type of apple that does **not** produce the enzyme PPO in its tissues.

Suggest possible advantages of this type of apple.

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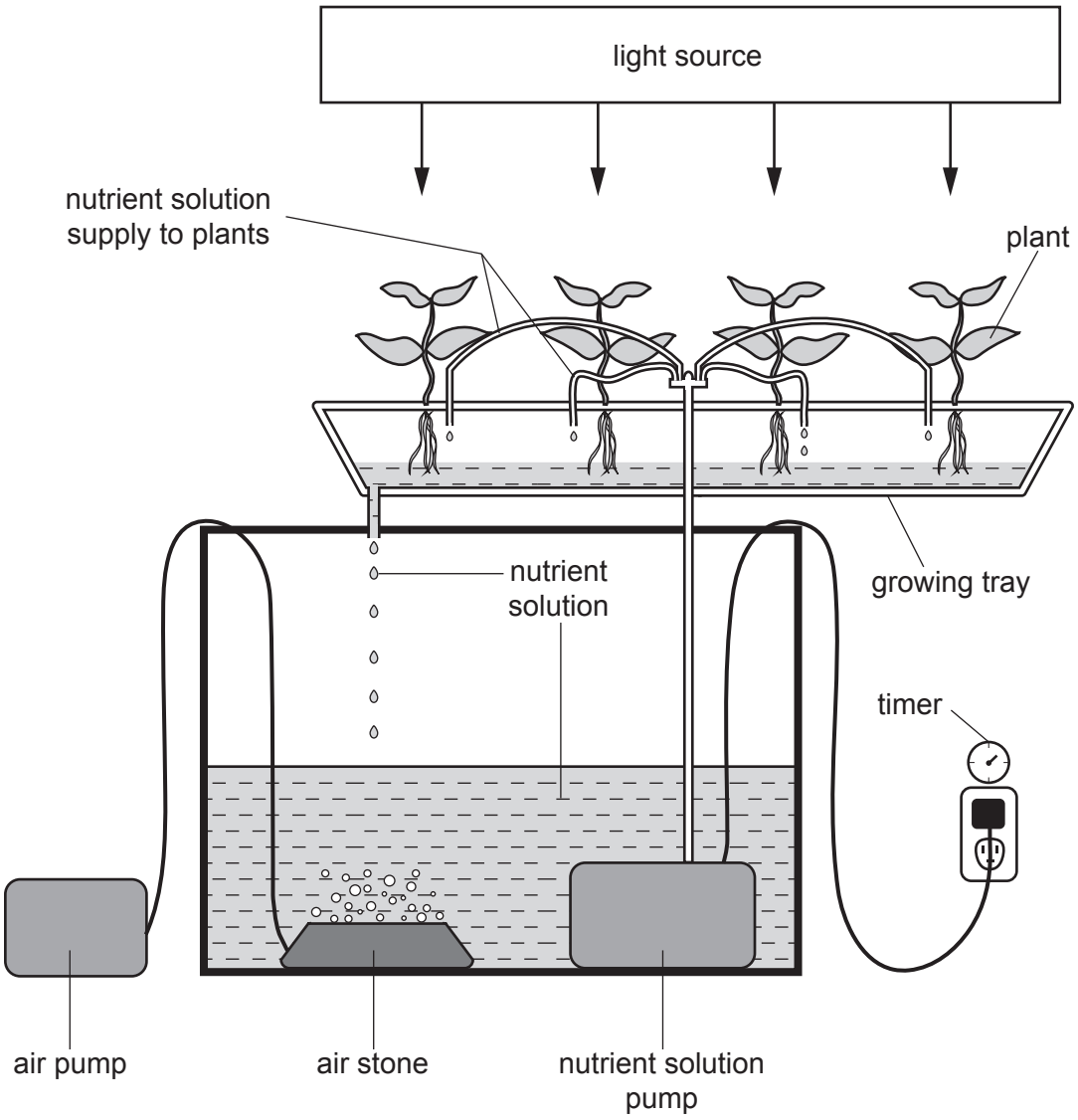
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[Total: 9]

4 Hydroponics is a technique used to grow plants without soil.

The diagram shows plants being grown using hydroponics.



(a) The leaves of the plants are provided with a source of light for photosynthesis.

State, in **either** words **or** symbols, the equation for photosynthesis.

..... [2]

(b) The roots of the plants are provided with a nutrient solution. The nutrient solution contains magnesium ions.

Air is pumped through the nutrient solution using an air stone that contains many very small holes.

(i) Explain the advantage to the cells of the plant roots of pumping air through the nutrient solution using the air stone.

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..... [4]

(ii) State the type of cell in plant roots that absorbs magnesium ions from the solution.

..... [1]

(iii) State the process that transports magnesium ions against a concentration gradient into this type of cell.

..... [1]

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[Turn over

(c) Farmers grew groups of 20 tomato plants for the same length of time in nutrient solutions with a range of different concentrations of magnesium ions.

They determined the best concentration of magnesium ions for growth by measuring the following for each group of 20 tomato plants:

- the mean height of the tomato plant stems (cm)
- the mean mass of the tomato plant stems and leaves (g).

The results of the investigation are shown in the table.

concentration of magnesium ions / parts per million	**mean height of tomato plant stems / cm**	**mean mass of tomato plant stems and leaves / g**
0	20.0	6.3
50	30.3	11.7
125	32.6	12.3
250	23.4	10.4
500	20.4	8.0

(i) State the best concentration of magnesium ions for growth.

..... parts per million [1]

(ii) Explain your answer using the results of the investigation **and** your knowledge of the importance of magnesium ions to plants.

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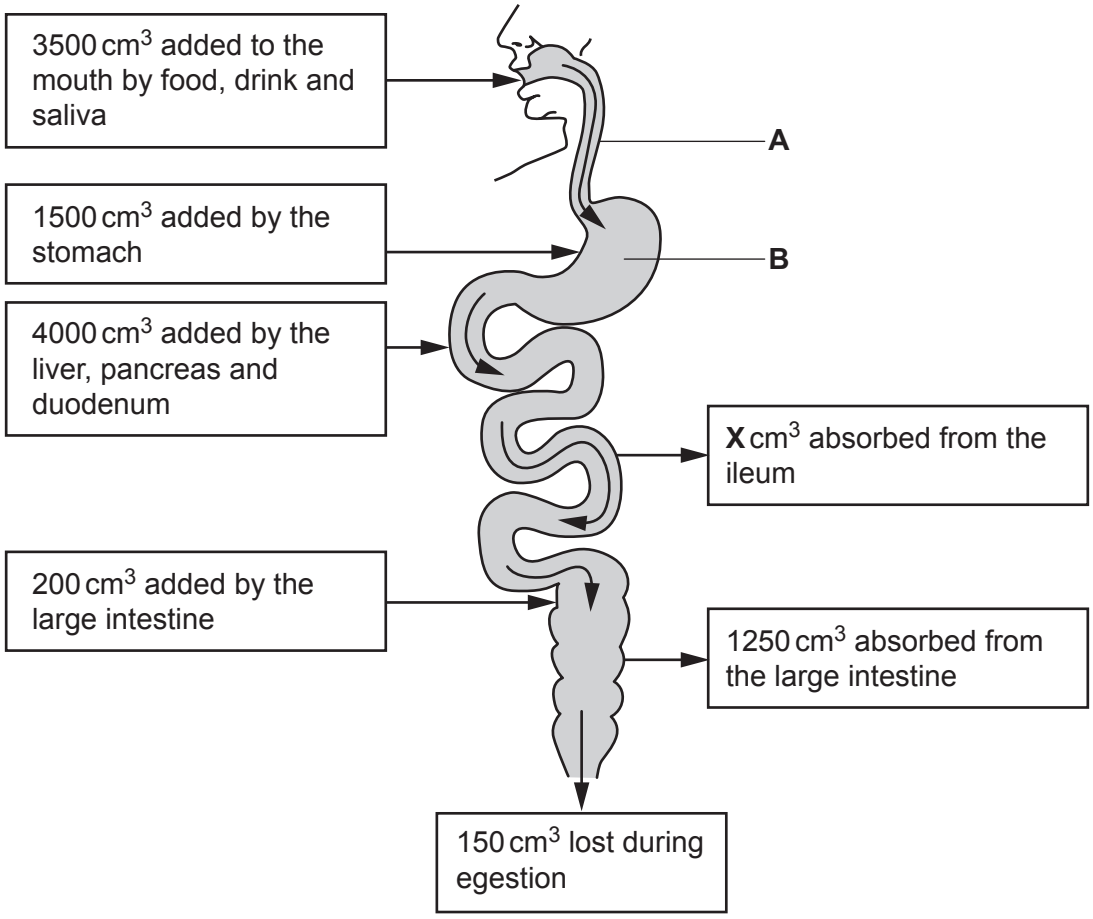
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[Total: 13]

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Question 5 starts on the next page.

5 The diagram shows the total volume of water entering and leaving organs of the human alimentary canal during one day.



(a) (i) Name the organs labelled **A** and **B**.

A .....

B .....

[2]

(ii) Calculate the volume of water, **X**, absorbed from the ileum.

..... cm^3 [1]

(iii) Describe the absorption of water from the ileum.

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..... [3]

(b) State how a **named** organ causes some of the water absorbed from the ileum to later become water in the urine.

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..... [2]

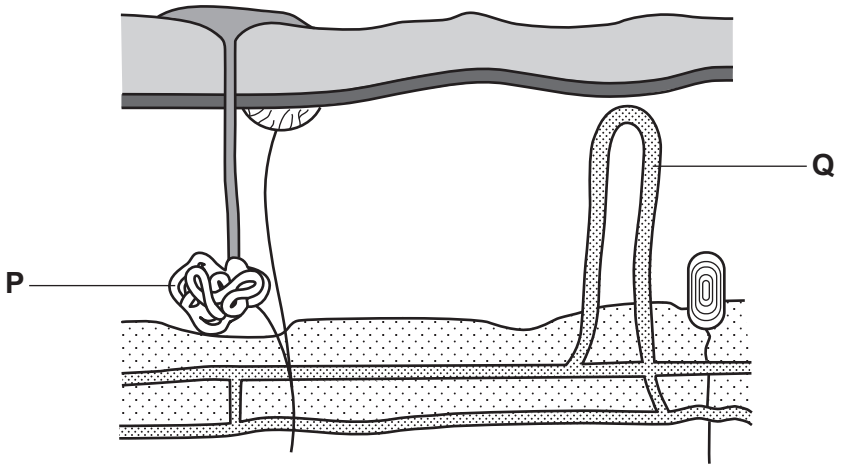
[Total: 8]

Section B

Answer **both** questions in this section.

Write your answers in the spaces provided.

6 The diagram shows a vertical section through human skin in a hot environment.



(a) Name **and** outline the role of **P** and **Q** in the control of body temperature when a person is in a hot environment.

P .....

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Q .....

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[7]

(b) Explain how the process of temperature control in humans is an example of:

homeostasis .....

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negative feedback. .....

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[3]

[Total: 10]

7 The kidneys are organs of excretion.

(a) Define the term *excretion*.

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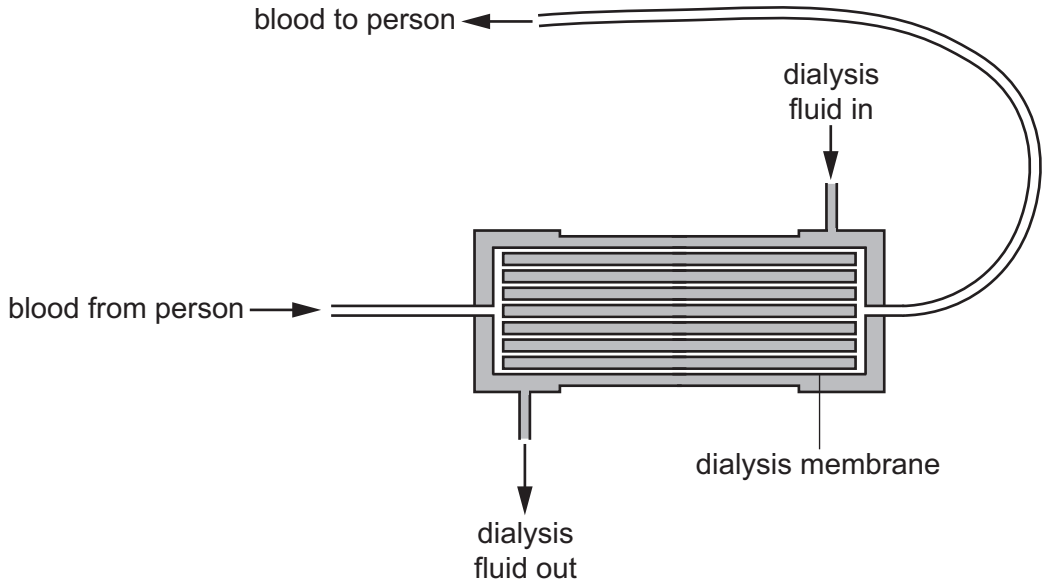
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..... [3]

(b) A person with kidney damage requires the process of dialysis to take place several times each week.

Dialysis is carried out using a kidney machine connected to the blood supply of the person.

The diagram shows a section through the internal structure of a kidney machine.



(i) Describe the structure of the dialysis membrane **and** explain how it functions.

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..... [5]

(ii) Explain why the dialysis fluid in the kidney machine must be continuously replaced.

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..... [2]

[Total: 10]

Section C

Answer **either** Question 8 **or** Question 9.

Write your answers in the spaces provided.

8 Describe the principal roles, in terms of coordinating and regulating bodily functions, of:

(a) the cerebrum

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..... [5]

(b) the cerebellum

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..... [2]

(c) the hypothalamus.

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..... [3]

[Total: 10]

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9 **(a)** Explain how surgery may be used as an effective method of birth control in:

a man

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a woman.

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[5]

(b) Surgical methods of birth control do **not** prevent the spread of pathogens, such as HIV, that cause sexually transmitted diseases.

Describe the methods by which the spread of HIV may be controlled.

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..... [5]

[Total: 10]

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