1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Bees



Photographer: Eigene Aufnahme, August 2006

Bees are insects that are important for the pollination of flowers of many plants. Bees are attracted to flowers to collect a sweet substance called nectar. After collecting nectar they return to their nest. Some of the nectar is used to make honey. Humans keep bees in small homes called hives and collect some of the honey. The bees live in a group called a colony inside the hive and they do not mate as individual pairs like most insects.

Each bee colony consists of a single fertile queen bee and her many infertile female offspring called worker bees. The colony also contains her male offspring called drones.

Under normal circumstances the fertile queen bee will fly out of the hive to mate with a number of drones from different hives. The queen takes the risk of mating in this way so that her offspring have extra genetic variation that may help to combat disease. The sperm are stored in the queen's body and released a few at a time as the eggs are laid. Some of the eggs may be fertilised by the sperm and some may not be fertilised. Fertilised eggs develop into worker bees with diploid body cells. Unfertilised eggs develop into drones.

The body cells of the fertile queen bee contain 32 chromosomes. The sperm cells produced by a single drone contain 16 chromosomes which are genetically identical to those of the other drones. If a queen bee mates with only one drone all the worker bees in the hive receive identical alleles from the drone and all the genetic variation comes from the queen. If the queen mates with two or more drones from different hives there will be greater variation in the worker bees.

It has been difficult to improve the characteristics of bees by selective breeding because bees do not mate as individual pairs. However, in the colony there are a small number of virgin queen bees that have not yet mated. These virgin queen bees can be used in selective breeding to form new colonies.

(a) What is meant by the term **pollination** (line 1)?

(1)

(b) Suggest why the bees collect nectar (lines 2 and 3).

(2)

(c) Suggest what is meant by the term **fertile** (line 7).

(1)

(d) Suggest how having 'extra genetic variation' may help the bees to combat disease (lines 12 and 13).

(2)

(e) How many chromosomes would you expect to find in an unfertilised bee egg?

(1)

(f) Explain what determines the genetic variation in worker bees.

(2)

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(g) Suggest two characteristics of a colony that would encourage a beekeeper to use the colony for selective breeding.

(2)

1 .....

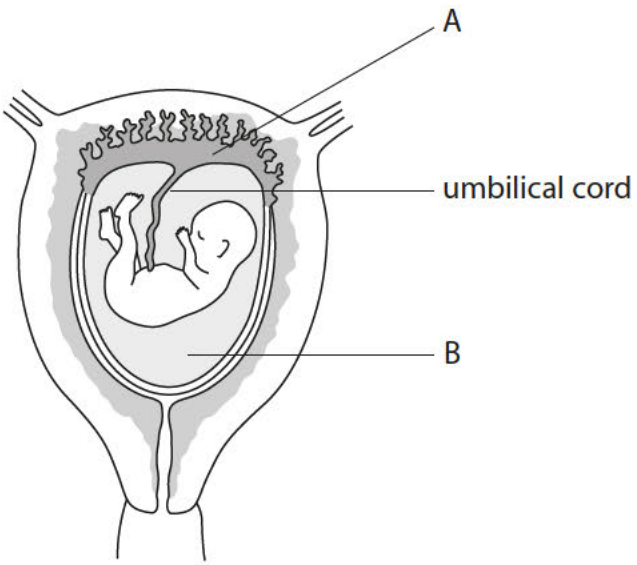
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2 .....

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(Total for Question = 11 marks)

2 The drawing shows a fetus developing in the uterus of a woman.



(a) (i) What is the function of part A?

(1)

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(ii) What is the function of part B?

(1)

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(iii) The umbilical cord transports small protein molecules from the mother to the fetus. These molecules help to provide immunity.

Name these small protein molecules.

(1)

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(b) Scientists can take cells from part A and use them to find out if the fetus has a genetic condition.

(i) How many chromosomes would the scientists find in a normal body cell from a fetus?

(1)

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(ii) Complete the table by ticking the box that shows the correct sex chromosomes the scientists would find in a body cell from a male fetus.

(1)

Sex chromosomes	Tick
XX	
X	
XY	
YY	
Y	

(c) The table shows the suggested daily intake of various components needed in the diet of a pregnant and a non-pregnant woman.

Daily suggested intake of component	Pregnant woman	Non-pregnant woman
energy in kJ	9660	8820
protein in grams	63	55
calcium in grams	1.2	0.7
iron in milligrams	15	12
vitamin C in milligrams	60	40
vitamin D in micrograms	40	10

(i) Name two components in the table that are important for the development of bones in the fetus of the pregnant woman.

(2)

1 .....

2 .....

(ii) Suggest two reasons why a pregnant woman needs more energy than a non-pregnant woman.

(2)

1 .....

2 .....

(iii) Suggest why the daily intake of iron is higher for a pregnant woman than a non-pregnant woman.

(3)

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(Total for Question = 12 marks)

3 (a) The table lists some processes used in plant reproduction.

In each box, place a tick (✓) if the process helps to produce offspring with genetic variation, or a cross (×) if it produces offspring with no genetic variation. The first one has been done for you.

(3)

Process	Genetic variation in offspring
runners producing new plants	×
micropropagation	
wind-pollination	
taking cuttings	
self-pollination of a flower	

(b) The photograph shows an eight-celled human embryo produced in human reproduction.



Describe the events that take place at fertilisation and up to the production of the eight-celled human embryo.

(4)

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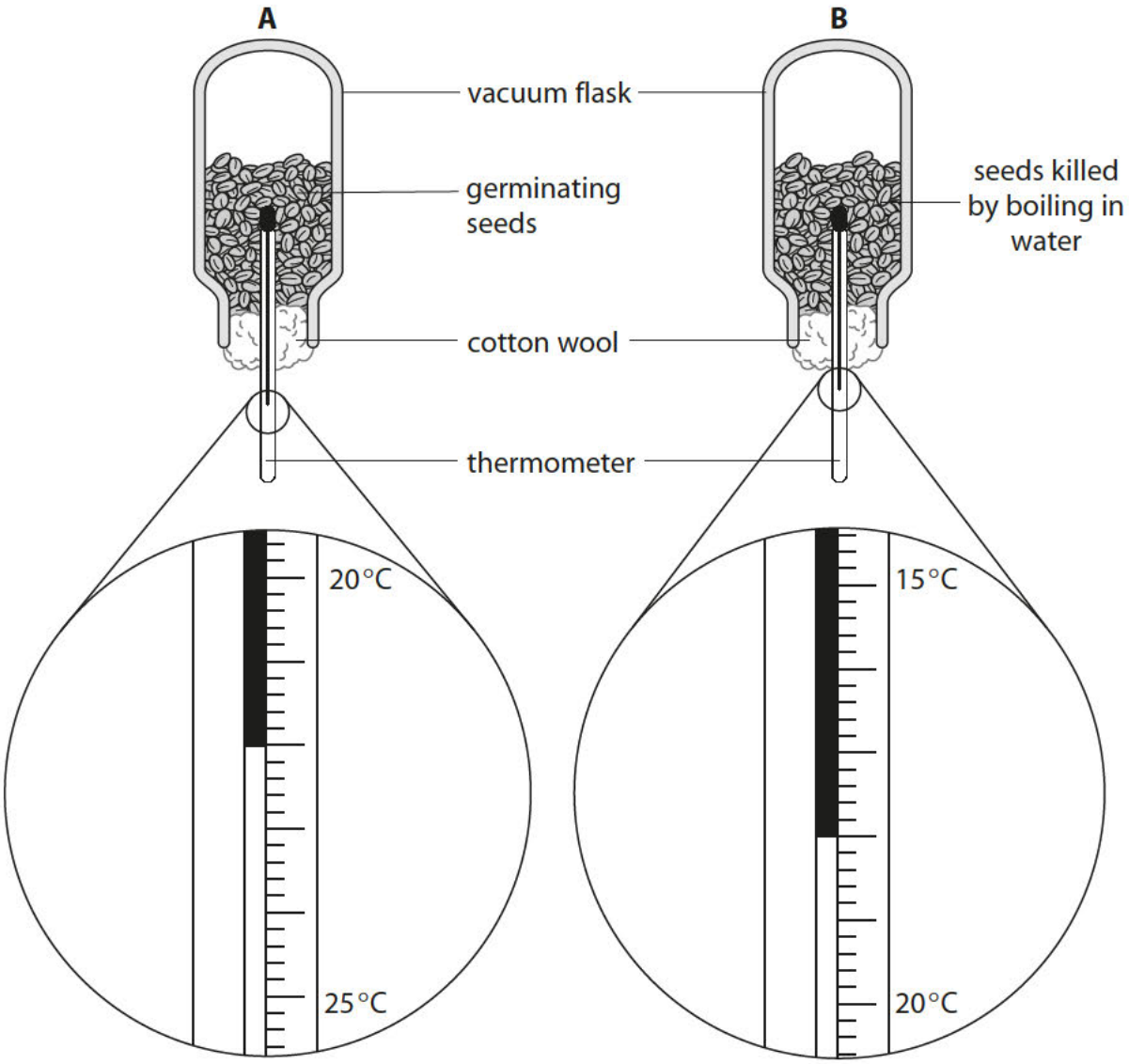
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(Total for Question = 7 marks)

4 The diagram shows the apparatus used in a seed germination experiment.



(a) The two samples of seeds started at the same temperature of 18 °C.

The diagram shows the temperature reading on each thermometer after 48 hours.

(i) Complete the table to show the temperature of flask A and flask B.

(1)

Temperature in °C	
Flask A	**Flask B**

(ii) Give a biological explanation for the difference in the temperature of flask A compared to flask B.

(2)

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(b) The seeds in both flasks were washed in disinfectant before being put into the flasks.

Suggest why this was done.

(1)

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(c) The cotton wool kept the thermometers in place and prevented the seeds from falling out of the flasks.

Suggest why cotton wool was used rather than a rubber bung.

(1)

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(d) The seeds used in the experiment were from the same species.

Suggest **one** other variable that needs to be controlled in this experiment.

(1)

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(Total for Question = 6 marks)

5 For a woman to become pregnant, a sperm must fertilise one of her eggs. At the time the egg is released, the body temperature rises slightly.

A woman wanted to become pregnant. She measured her body temperature each day for 28 days, starting on the first day of her menstrual cycle.

The chart she kept is shown below.

Day	Body temperature in °C
1	36.8
2	36.8
3	36.8
4	36.7
5	36.8
6	36.7
7	36.7
8	36.7
9	36.7
10	36.6
11	36.7
12	36.7
13	36.7
14	36.7
15	37.0
16	37.0
17	37.0
18	37.1
19	37.1
20	37.0
21	37.0
22	37.0
23	37.0
24	37.0
25	37.0
26	37.0
27	37.0
28	36.9

(a) (i) What was the total number of days that the body temperature of the woman was below 37.0 °C?

(1)

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(ii) On which day was an egg probably released from her ovary?

(1)

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(iii) Suggest how the woman could accurately determine her body temperature.

(2)

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(b) During the 28 days the ovary of the woman released two different hormones, A and B. The table shows some of the roles of these hormones.

Hormone A	Hormone B
repairs uterus lining	maintains uterus lining
develops secondary sexual characteristics	prevents egg release

(i) Name hormone A.

(1)

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(ii) Name hormone B.

(1)

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(iii) How do these hormones travel from the ovary to the uterus?

(1)

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(iv) Give **two** female secondary sexual characteristics.

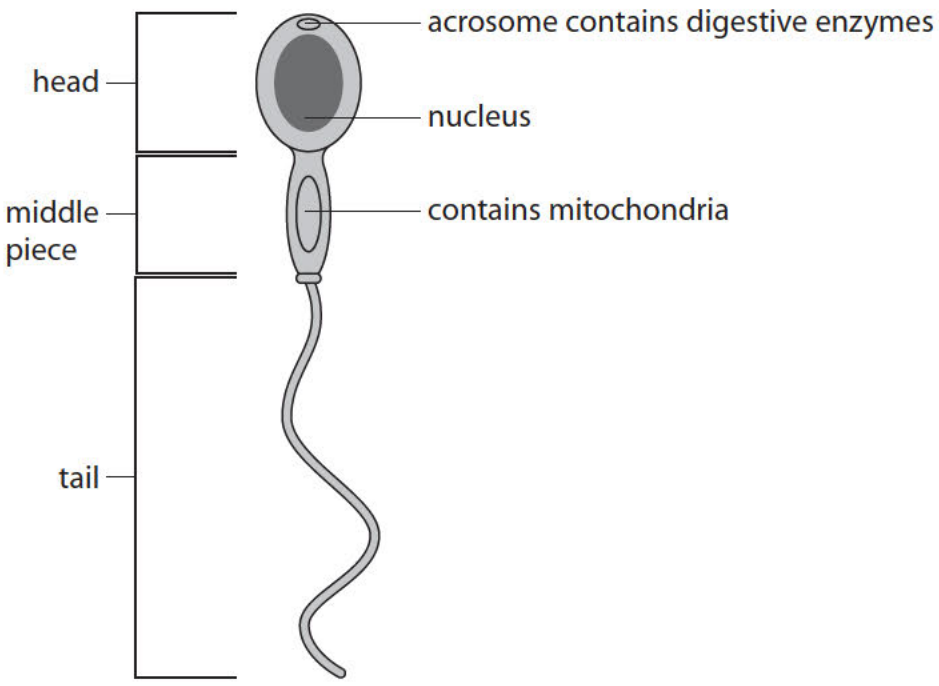
(2)

1 .....

2 .....

(Total for Question = 9 marks)

6 (a) The diagram shows a human sperm, which is a specialised cell.



Suggest the function of each of the sections of the sperm cell.

(i) head

(2)

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(ii) middle piece

(2)

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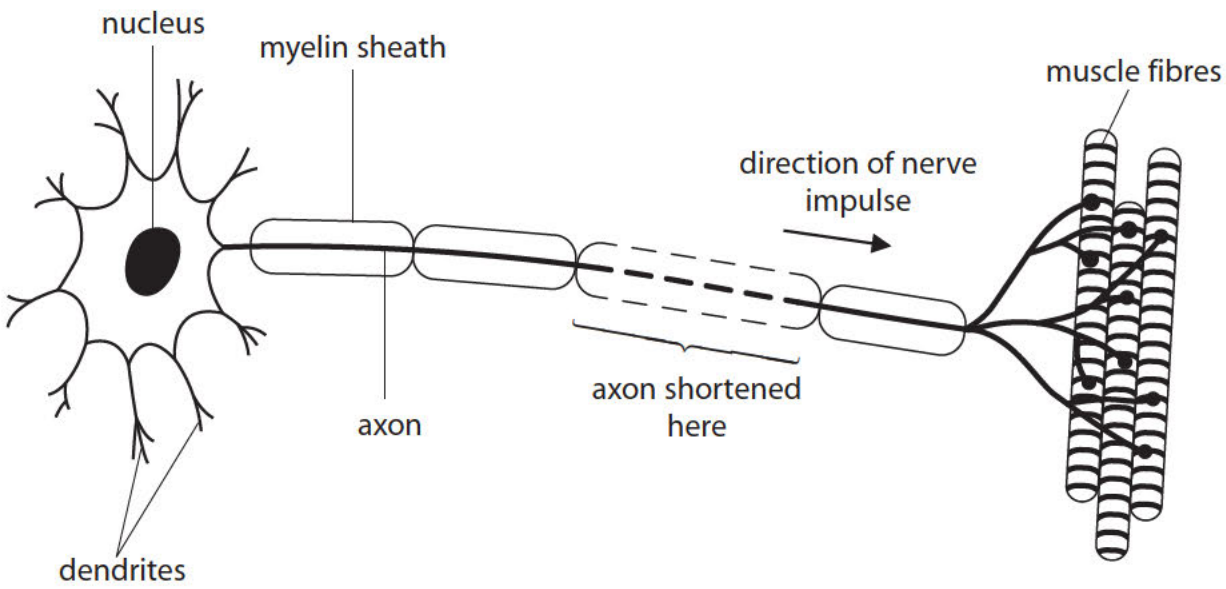
(iii) tail

(1)

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(b) The diagram shows a motor neurone, which is another specialised human cell.



Suggest two ways in which the structure of the motor neurone is adapted for its function.

(2)

1 .....

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2 .....

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(Total for Question = 7 marks)