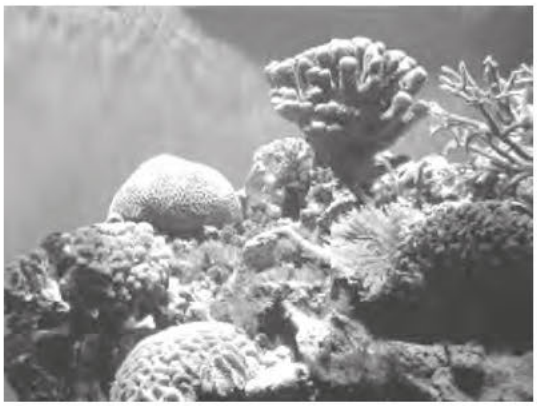
1 Corals are animals that live on the sea bed.

The photograph shows some species of coral.



(a) Corals can reproduce sexually, releasing sperm cells into the water.

The mass of DNA in one sperm cell from a species of coral is 0.5 picogram.

(i) Suggest the mass of DNA that would be present in an unfertilised egg cell of the same species.

(1)

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(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The term used to describe the number of chromosomes in an egg or sperm cell is

(1)

☐ **A** diploid

☐ **B** gamete

☐ **C** haploid

☐ **D** zygote

(iii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The base pairs in DNA are

(1)

☐ **A** thymine with adenine, cytosine with guanine

☐ **B** thymine with guanine, adenine with cytosine

☐ **C** uracil with adenine, guanine with cytosine

☐ **D** uracil with thymine, guanine with cytosine

(iv) Name the bond that joins the base pairs together.

(1)

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(b) After fertilisation, mitosis takes place to form an embryo.

The embryo develops into new coral.

(i) Describe mitosis.

(3)

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(ii) Describe how the embryo develops into new coral.

(3)

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(Total for Question 1 = 10 marks)

2 Elk, *Alces alces,* are members of the deer family.

Elk mate in the autumn and their calves are born in the spring.



(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

During the mating season males make sounds to attract females.

This type of behaviour is part of

(1)

☐ **A** conditioning

☐ **B** courtship

☐ **C** habituation

☐ **D** imprinting

(ii) Females are also attracted to males by the size of their antlers.

Suggest why a male elk may move away if challenged by another male with larger antlers.

(1)

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(b) A pregnant elk will search for a group of thick bushes in which to give birth.

Explain an advantage of this behaviour.

(2)

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(c) (i) Some plants produce tannins.

Tannins are toxic. The tannins stop some herbivores from eating these plants.

Elk produce proteins in their saliva which bind to the tannins and make them inactive.

This inter-relationship is a product of co-evolution.

Describe the advantages to the elk of producing tannin-binding proteins in their saliva.

(2)

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(ii) The development of flower structure and insect behaviour is another example of co-evolution.

Describe how this relationship benefits the plant.

(2)

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(Total for Question 2 = 8 marks)

3 (a) Sperm cells and egg cells are needed for human sexual reproduction.

Describe in detail the type of cell division that produces sperm cells.

(4)

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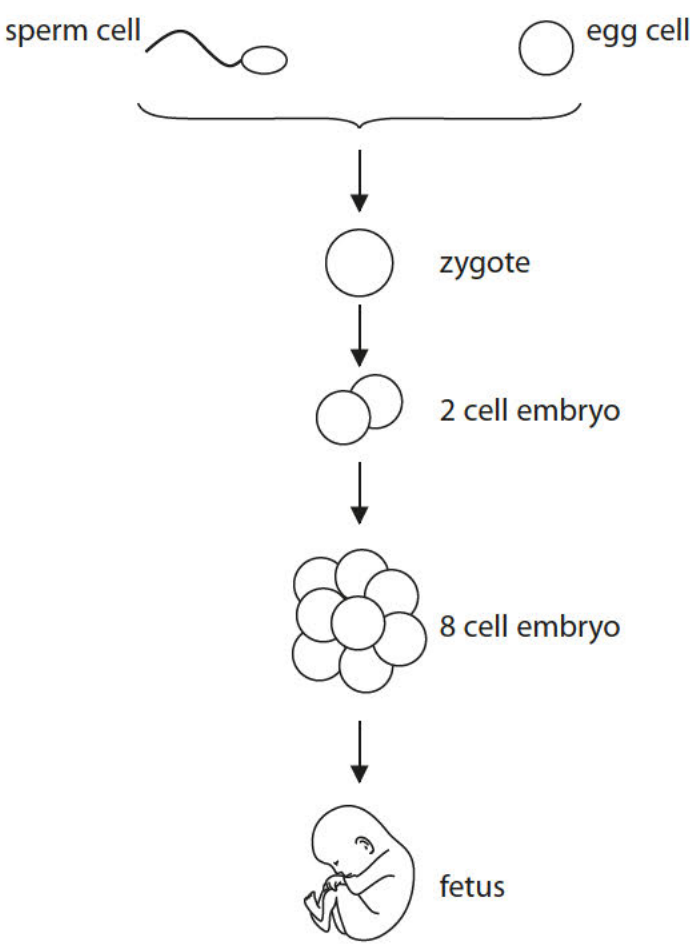
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*(b) The diagram shows some of the stages that occur in the formation of a human fetus.



Using the diagram and your own knowledge, describe the processes that take place in the formation of the fetus from a sperm cell and an egg cell.

(6)

(c) State **two** differences between sexual reproduction and asexual reproduction.

(2)

(Total for Question 3 = 12 marks)

4 The photograph shows a sperm cell and an egg cell just before fertilisation.



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(a) Which row describes the sperm cell and the egg cell before fertilisation?

Place a cross (☒) in the box next to your answer.

(1)

	sperm cell	egg cell
☐ **A**	diploid	diploid
☐ **B**	diploid	haploid
☐ **C**	haploid	diploid
☐ **D**	haploid	haploid

(b) The sperm cell contains DNA.

Describe the structure of DNA.

(3)

(c) Information in a DNA strand can be transcribed to make a strand of mRNA.

Describe how this mRNA strand is then used to make proteins.

(4)

(Total for Question 4 = 8 marks)

5 Gregor Mendel investigated the genetics of peas.

He did not know about genes but showed that inherited characteristics can be dominant or recessive.

(a) Explain how Mendel used homozygous tall and homozygous short pea plants to show that the tall allele is dominant to the short allele.

(2)

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(b) Figure 4 shows a strawberry plant that has produced several runners and new strawberry plantlets are growing at the end of each runner. This is asexual reproduction.

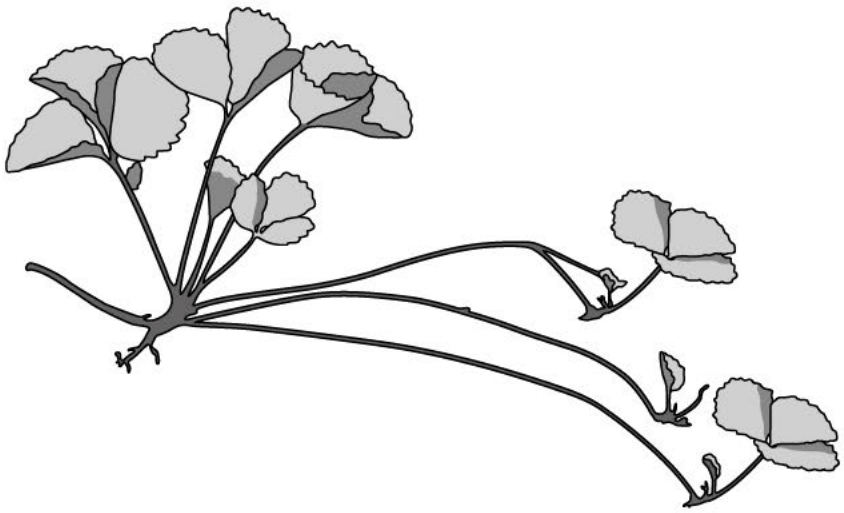


Figure 4

(i) Explain why asexual reproduction in strawberries is beneficial to strawberry farmers.

(2)

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(ii) Strawberry fruits, containing seeds, are produced after a flower is fertilised.

Explain why seed production is an advantage to the strawberry plant.

(2)

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(c) Duchenne muscular dystrophy is a sex-linked recessive genetic disorder caused by a mutation on a single gene on the X-chromosome.

The letter D can be used for the dominant allele and the letter d for the recessive allele.

Figure 5 shows the inheritance of Duchenne muscular dystrophy in a family.

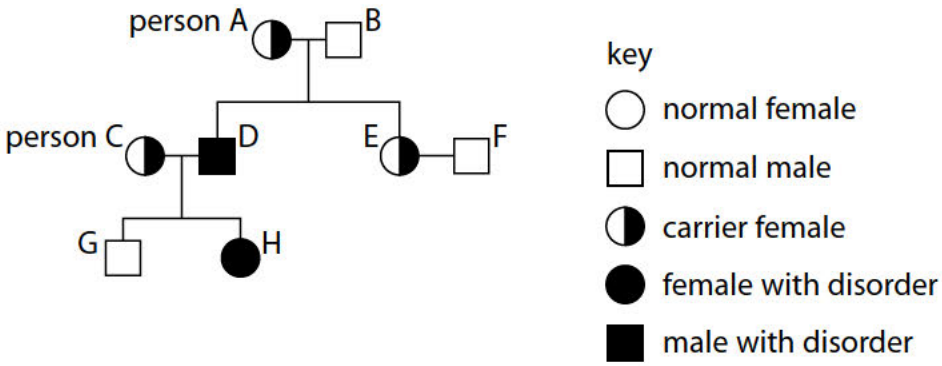


Figure 5

(i) What is the percentage chance of any child from person A inheriting the mutated allele?

(1)

- ☐ **A** 0%
- ☐ **B** 25%
- ☐ **C** 50%
- ☐ **D** 75%

(ii) Explain the conclusion that can be made about the genotype of person C.

(2)

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(Total for Question 5 = 9 marks)