

# Reproduction

## Question Paper 1

<b>Level</b>	GCSE (9-1)
<b>Subject</b>	Combined Science – Trilogy - Biology
<b>Exam Board</b>	AQA
<b>Topic</b>	4.6 Inheritance Variation and Evolution
<b>Sub-Topic</b>	Reproduction
<b>Difficulty Level</b>	Gold Level
<b>Booklet</b>	Question Paper 1

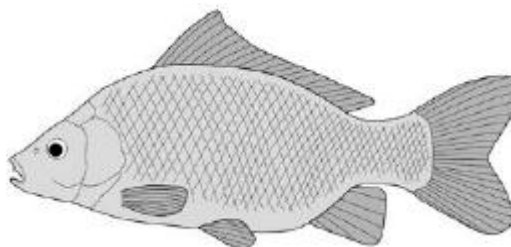
**Time Allowed:** 56 minutes

**Score:** / 54

**Percentage:** /100

**Grade Boundaries:**

**Q1.** The figure below shows a carp.



- (a) A mutation causes a blue colour in some carp.

What is a mutation?

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(1)

- (b) Suggest how a mutation could cause a different colour in carp.

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(1)

- (c) Two alleles control the body colour of carp:

- brown (**B**)
- blue (**b**).

The brown allele is dominant to the blue allele.

Two carp that are heterozygous for colour are crossed and produce  $2.6 \times 10^5$  offspring.

Approximately how many of the offspring are expected to be blue?

Draw a genetic diagram to explain your answer.

Give your answer in standard form.

Number of offspring expected to be blue = .....

(5)

- (d) A scientist wanted to find out whether a brown carp has the genotype **BB** or **Bb**.

Describe what genetic cross a scientist could do to determine this.

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(2)  
(Total 9 marks)

**Q2.** Huntington's disease is an inherited disorder that affects the nervous system.

It is caused by a dominant allele.

A man is heterozygous for Huntington's disease.

His partner is healthy and does not have the allele that causes Huntington's disease.

- (a) What are the genotypes of the man and the woman?

Use:

- **H** for the allele that causes Huntington's disease
- **h** for the healthy allele.

Man's genotype .....

Woman's genotype .....

(1)

- (b) The couple want to have a child.

Use a Punnett square to determine the probability of the child having Huntington's disease.

Circle the genotypes of any children that will have Huntington's disease.

Probability of child having Huntington's disease = .....

(4)

- (c) The couple visit a genetic counsellor, who gives them the following options.
1. Adopt a child.
  2. Gamete donation – uses sperm from another man to fertilise the woman's eggs by in vitro fertilisation (IVF).
  3. Conceive naturally.
  4. Use pre-implantation genetic diagnosis (PGD).
    - Many embryos are produced by IVF using gametes from the man and woman.
    - Embryos are tested for Huntington's disease and a healthy embryo is implanted into the woman's uterus.
    - The risk of implanting an embryo with the allele for Huntington's disease is 0.2%.
    - Costs the NHS about £11 000.
  5. Conceive naturally and use prenatal diagnosis (PND) once the woman becomes pregnant.
    - A sample of the placenta is taken at 10 weeks of pregnancy or a sample of fluid is taken from around the developing baby at 16 weeks of pregnancy.
    - The sample is tested for the Huntington's allele.
    - A 0.5–1.0% risk of miscarriage.
    - About 1% of samples collected are unsuitable for testing.
    - Costs the NHS about £600.

The couple decide they want to have a healthy baby that is their own biological offspring.

Evaluate the options.

Suggest which option would be best for the couple.

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(6)  
(Total 11 marks)

**Q3.**Read the information.

Insects can be both useful and harmful to crop plants.  
Insects such as bees pollinate the flowers of some crop plants. Pollination is needed for successful sexual reproduction of crop plants.  
Some insects eat crops and other insects eat the insects that eat crops.

Corn borers are insects that eat maize plants.  
A toxin produced by the bacterium *Bacillus thuringiensis* kills insects.  
Scientists grow *Bacillus thuringiensis* in large containers. The toxin is collected from the containers and is sprayed over maize crops to kill corn borers.

A company has developed genetically modified (GM) maize plants. GM maize plants contain a gene from *Bacillus thuringiensis*. This gene changes the GM maize plants so that they produce the toxin.

- (a) Describe how scientists can transfer the gene from *Bacillus thuringiensis* to maize plants.

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(3)

- (b) Would you advise farmers to grow GM maize plants?

Justify your answer by giving advantages and disadvantages of growing GM maize plants.

Use the information from the box and your own knowledge to help you.

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(4)  
(Total 7 marks)

**Q4.**Phenylketonuria (PKU) is an inherited condition. PKU makes people ill.

- (a) PKU is caused by a recessive allele.

- (i) What is an allele?

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(1)

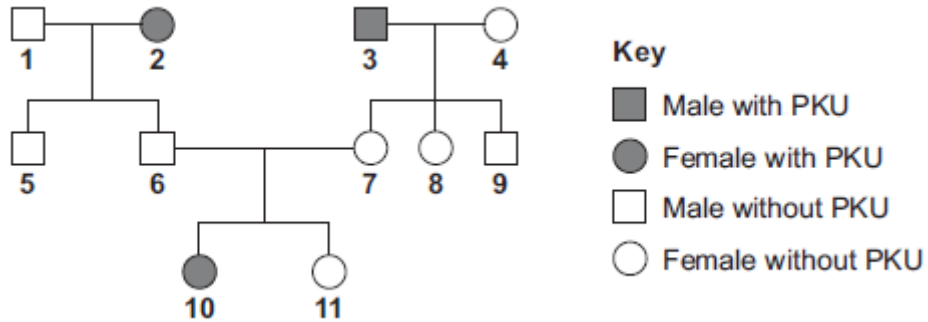
- (ii) What is meant by recessive?

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(1)

- (b) The diagram below shows the inheritance of PKU in one family.



- (i) Give **one** piece of evidence from the diagram that PKU is caused by a recessive allele.

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(1)

- (ii) Persons **6** and **7** are planning to have another child.  
Use a genetic diagram to find the probability that the new child will have PKU.

Use the following symbols in your answer:

**N** = the dominant allele for **not** having PKU

**n** = the recessive allele for PKU.

Probability = .....

(4)

- (c) Persons **6** and **7** wish to avoid having another child with PKU.

A genetic counsellor advises that they could produce several embryos by IVF treatment.

- (i) During IVF treatment, each fertilised egg cell forms an embryo by cell division.

Name this type of cell division.

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(1)

- (ii) An embryo screening technique could be used to find the genotype of each embryo.

An unaffected embryo could then be placed in person 7's uterus.

The screening technique is carried out on a cell from an embryo after just three cell divisions of the fertilised egg.

How many cells will there be in an embryo after the fertilised egg has

divided three times?

(1)

- (iii) During embryo screening, a technician tests the genetic material of the embryo to find out which alleles are present.

The genetic material is made up of large molecules of a chemical substance.

Name this chemical substance.

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(1)

- (d) Some people have ethical objections to embryo screening.

- (i) Give **one** ethical objection to embryo screening.

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(1)

- (ii) Give **one** reason in favour of embryo screening.

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(1)

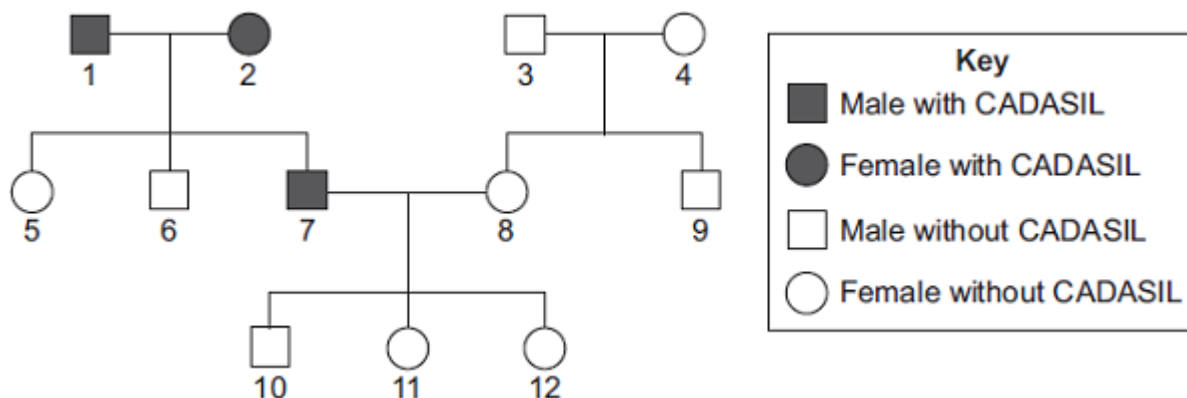
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**Q5.** CADASIL is an inherited disorder caused by a dominant allele.

CADASIL leads to weakening of blood vessels in the brain.

The diagram shows the inheritance of CADASIL in one family.



(a) CADASIL is caused by a *dominant allele*.

(i) What is a *dominant allele*?

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(1)

(ii) What is the evidence in the diagram that CADASIL is caused by a dominant allele?

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(1)

(iii) Person 7 has CADASIL.

Is person 7 homozygous or heterozygous for the CADASIL allele?

Give evidence for your answer from the diagram.

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(1)

(b) Persons 7 and 8 are planning to have another baby.

Use a genetic diagram to find the probability that the new baby will develop into a person with CADASIL.

Use the following symbols to represent alleles.

**D** = allele for CADASIL

**d** = allele for not having CADASIL

Probability = .....

**(4)**

- (c) Scientists are trying to develop a treatment for CADASIL using stem cells.

Specially treated stem cells would be injected into the damaged part of the brain.

- (i) Why do the scientists use stem cells?

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**(2)**

- (ii) Embryonic stem cells can be obtained by removing a few cells from a human embryo. In 2006, scientists in Japan discovered how to change adult skin cells into stem cells. Suggest **one** advantage of using stem cells from adult skin cells.

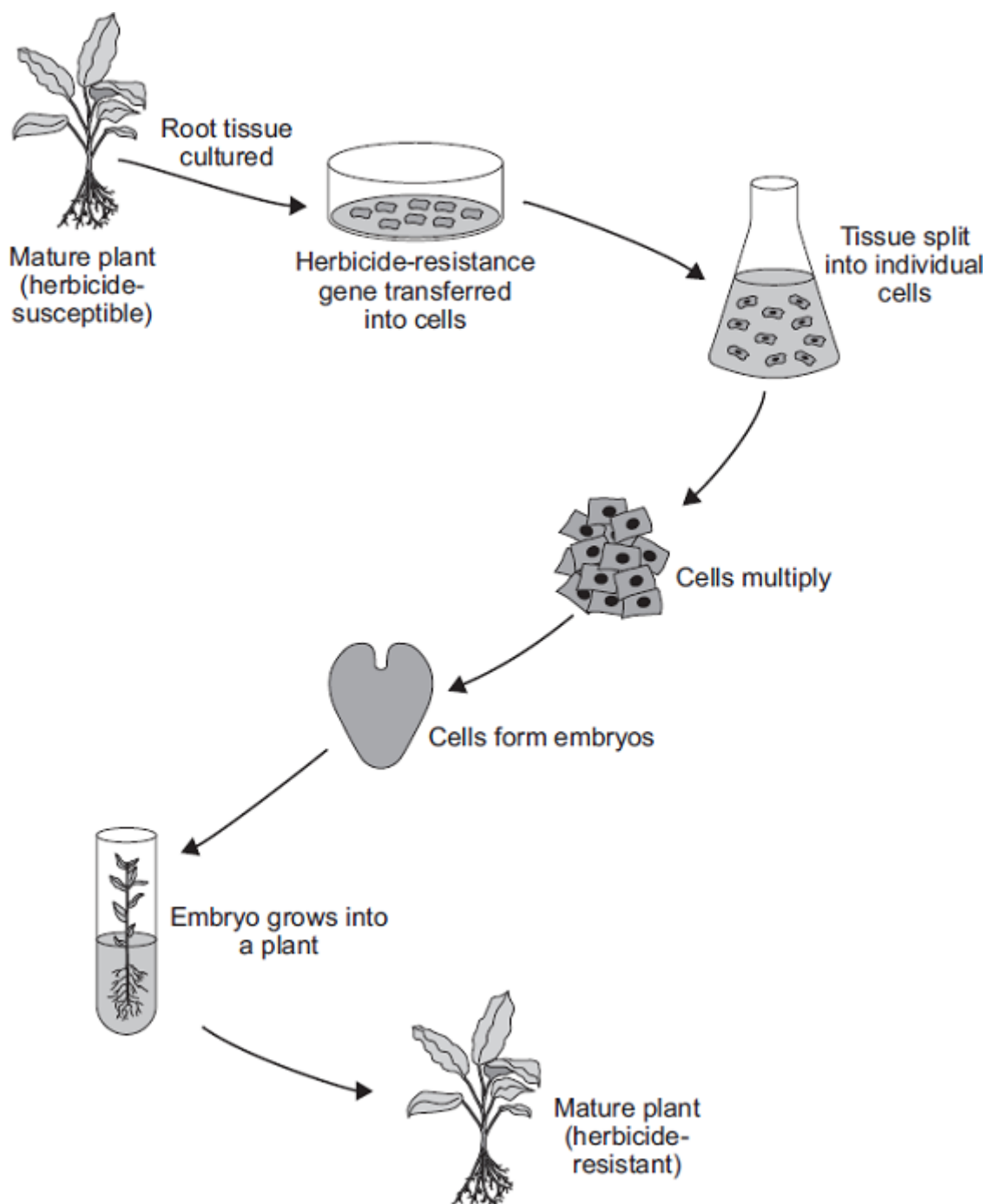
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**(1)**

**(Total 10 marks)**

**Q6.** The diagram shows one method of producing herbicide-resistant crop plants.



- (a) The herbicide-resistance gene is cut out of a chromosome of a herbicide-resistant plant.

How is the herbicide-resistance gene cut out of the chromosome?

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(1)

- (b) Apart from having the herbicide-resistance gene, the herbicide-resistant plants are identical to the herbicide-susceptible plants.

Explain why.

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(2)

- (c) Suggest **one** advantage to a farmer of growing herbicide-resistant crops.

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(1)

- (d) Many people are opposed to the growing of herbicide-resistant crops produced in this way.

Suggest **one** reason why.

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(1)

(Total 5 marks)