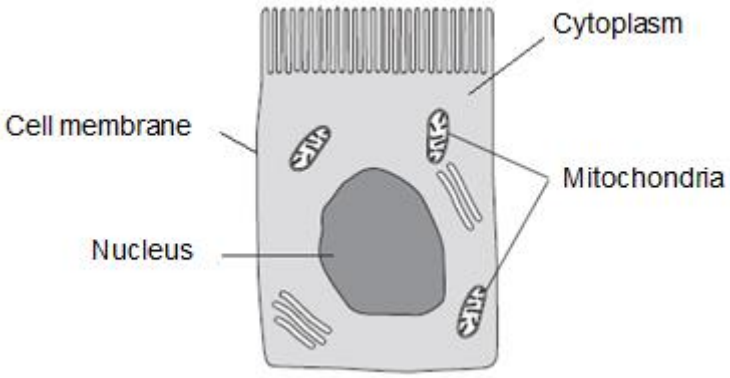
## 4-6 Inheritance – Trilogy

**1.0** **Figure 1** shows a cell from the small intestine.

**Figure 1**




**1.1** Which part of the cell contains chromosomes?

**[1 mark]**

Choose **one** part from the list.

Cell membrane Cytoplasm Nucleus Mitochondria

**1.2** Chromosomes contain many genes. Genes have different forms.

What is the name given to different forms of a gene?

**[1 mark]**

_____

**1.3** Eye colour is controlled by genes.

In a genetic diagram:

- B = brown
- b= blue

The genotype of one individual is bb.

Which words can be used to describe the genotype of this person?

**[2 marks]**

Choose **two** words from the list.

**Dominant** **Heterozygous** **Homozygous** **Recessive** **Phenotype**

**1.4** Tobacco plants have 48 chromosomes.

State how many chromosomes tobacco plant pollen cells have.

**[1 mark]**

_____

**2.0** Mitosis and meiosis are types of cell division.

**2.1** For each feature in the table, tick **one** box to show if the feature occurs:

- only in mitosis
- only in meiosis.

**[2 marks]**

| Feature | Only in mitosis | Only in meiosis |
|---|---|---|
| Produces new cells during growth and repair | | |
| Produces gametes (sex cells) | | |
| Produces genetically identical cells | | |

**2.2** Name the organ that produces gametes (sex cells) in:

**[2 marks]**

A man _____

A woman _____

**2.3** **X** and **Y** chromosomes are the sex chromosomes. They determine a person's sex.

What sex chromosomes will be found in the body cells of a woman?

**[1 mark]**

_____

**2.4** A man and a woman decide to have a child.

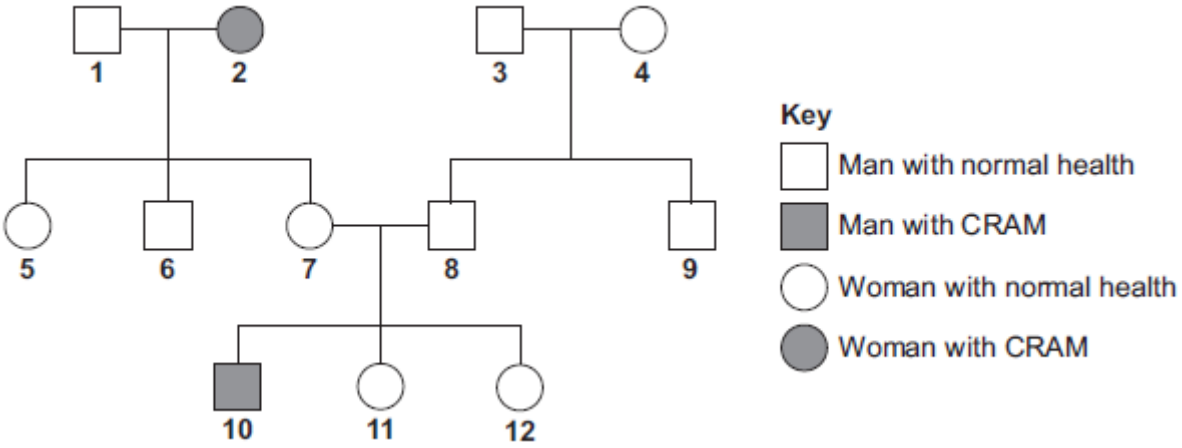
What is the chance that the child will be a boy?

**[1 mark]**

_____

**3.0** CRAM is an inherited condition which causes muscle breakdown.
The breakdown products enter the urine, making it dark-coloured.
**Figure 2** shows the inheritance of CRAM in one family.

**Figure 2**




CRAM is caused by a recessive allele, **n**.
The allele for normal health is **N**.

**3.1** Give evidence from the diagram that CRAM is caused by a **recessive** allele.

**[1 mark]**

_____

**3.2** None of person **2**'s children have CRAM.
Explain why.

**[1 mark]**

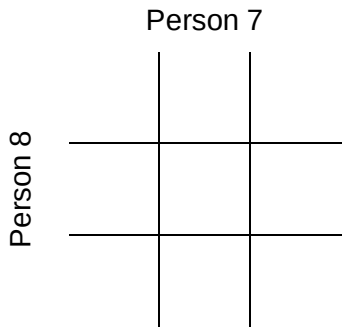
_____

_____

**3.3** Persons **7** and **8** want to have another child.
What is the probability that this child will have CRAM?
Complete the Punnett square diagram in **Figure 3** to explain your answer.

**[4 marks]**

**Figure 3**




Probability = _____

**4.0** In recent years, more crops grown in the world are genetically modified (GM) crops.

**4.1** Give **two** reasons why some crops are genetically modified.

**[2 marks]**

_____

_____

**4.2** Give **one** reason why some scientists are concerned about GM crops.

**[1 mark]**

_____

**5.** Many strains of bacteria have developed resistance to antibiotics.
**Table 1** shows the number of people infected with a resistant strain of one species of bacterium in the UK.

**Table 1**

| Year | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|
| Number of people infected with the resistant strain | 3499 | 3553 | 3767 | 3809 | 4131 |

**5.1** Calculate the percentage increase in the number of people infected with the resistant strain between 2004 and 2008.

**[2 marks]**

Percentage increase = _____ %

**5.2** Explain, in terms of natural selection, why the number of people infected with the resistant strain of the bacterium is increasing.

**[3 marks]**

_____

_____

_____

**6.1** Asexual and sexual reproduction are two different processes.
**Figure 4** shows a komodo dragon, which can reproduce both sexually and asexually.

**Figure 4**

Image acknowledgements
Komodo dragon
By Dezidor - Own work, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=2583986

There are advantages of both asexual and sexual reproduction.
Compare the advantages of asexual reproduction with the advantages of sexual reproduction in animals like komodo dragons.

**[4 marks]**

**MARK SCHEME**

| Qu No. | | Extra Information | Marks |
|---|---|---|---|
| 1.1 | nucleus | | 1 |
| 1.2 | alleles | ignore ref to homozygous/heterozygous | 1 |
| 1.3 | homozygous<br><br>recessive | | 1<br><br>1 |
| 1.4 | 24 | | 1 |

| Qu No. | | Extra Information | Marks |
|---|---|---|---|
| 2.1 | <table><tr><th>Feature</th><th>Mitosis only</th><th>Meiosis only</th></tr><tr><td>Produces new cells during growth and repair</td><td>✓</td><td></td></tr><tr><td>Produces gametes (sex cells)</td><td></td><td>✓</td></tr><tr><td>Produces genetically identical cells</td><td>✓</td><td></td></tr></table> | all three correct = 2 marks<br><br>2 correct = 1 mark<br><br>0 or 1 correct = 0 marks | 2 |
| 2.2 | (a man) testes/testis<br>(a woman) ovary/ovaries | accept testicle<br>do **not** accept 'ova'/ovule | 1<br>1 |
| 2.3 | XX | | 1 |
| 2.4 | ½ / 0.5 / 50% / 1:1 / 1 in 2 | do **not** accept 1:2 / 50/50<br>allow 50:50<br>allow 2 in 4 | 1 |

| Qu No. | | Extra Information | Marks |
|---|---|---|---|
| 3.1 | unaffected parents have an affected child | allow 7 and 8 have 10<br>allow skips a generation | 1 |
| 3.2 | (all) inherit N/normal/ dominant allele <u>from 1</u>/<u>from father</u> | ignore they are carriers | 1 |
| 3.3 | gametes correct or parental genotypes correct:<br>**N** and **n** + **N** and **n or Nn + Nn**<br><br>derivation of offspring genotypes:<br>**NN + Nn + Nn + nn**<br>**nn** identified as CRAM<br>correct probability: 0.25 | <br><br>accept alternative symbols, if defined<br><br><br>allow alternative if correct or parental gametes<br><br>accept ¼ / 25% / 1 in 4 / 1 out of 4 / 1:3<br>do **not** accept 3:1 / 1:4 | 1<br><br><br>1<br><br><br>1<br><br>1 |

| Qu No. | | Extra Information | Marks |
|---|---|---|---|
| 4.1 | (so plants are) resistant to attack **or** resistant to herbicides<br>increase yield | <br>allow frost resistance | 1<br>1 |
| 4.2 | any **one** from:<br>• possible effect on wild flowers<br>• possible effect on insects<br>• possible effect on human health | | 1 |

| Qu No. | | Extra Information | Marks |
|---|---|---|---|
| 5.1 | 18.06 / 18 / 18.1 | correct answer gains 2 marks<br>allow **1** mark for,<br>• (4131 – 3499) ÷ 3499 × 100<br>• 632 ÷ 3499 × 100<br>• ((4131 ÷ 3499) × 100 ) – 100<br>• 0.18 | 2 |
| 5.2 | antibiotics kill non-resistant strain **or** resistant strain<br>bacteria survive<br><br><br><br><br>resistant strain bacteria reproduce **or** resistant strain bacteria pass on genes<br>population of resistant strain increases **or** proportion of resistant bacteria increases<br>**or**<br>people more <u>likely</u> to be infected by resistant strain (than non-resistant strain) | accept resistant strain is the successful competitor<br>do **not** accept intentional adaptation<br>ignore strongest/fittest survive<br>ignore mutation<br>ignore people do not finish antibiotic course<br><br>allow high numbers of resistant bacteria | 1<br><br><br><br><br>1<br><br>1 |

| Qu No. | | Extra Information | Marks |
|---|---|---|---|
| 6.1 | | | |
| **Level 2** | Clear and accurate account of the advantages of sexual and asexual reproduction for the komodo dragon. The account is clear and logical | | 3–4 |
| **Level 1:** | Relevant statements are made about the advantages of sexual or asexual reproduction. The statements may not be related to the komodo dragon and the account may not be logical. | | 1–2 |
| | No relevant content. | | 0 |
| **Indicative content** | | | |
| **Advantages of asexual reproduction for the komodo dragon**<br>• Komodo dragon can have offspring when no male dragon is available<br>• The komodo dragon does not need to expend energy searching for a mate<br>• Producing an offspring is quicker than waiting to reproduce sexually<br>**Advantages of sexual reproduction for the komodo dragon**<br>• The offspring of the komodo dragon will show variation<br>• (and therefore) not as susceptible to genetic disorders<br>• if the environment changes the komodo dragon will possibly be more able to adapt | | | |