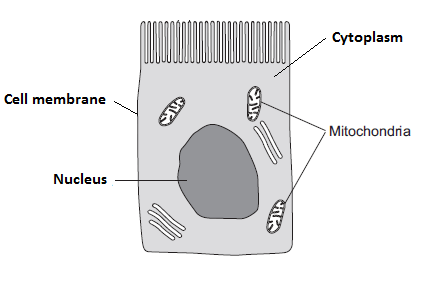
**4-6 Inheritance – Trilogy**

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

**Figure 1**



**1.1** Which part of the cell contains chromosomes?  
Choose **one** part from the list.

[1 mark]

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]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**1.2** 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?  
Choose **two** words from the list.

[2 marks]

Dominant Heterozygous Homozygous Recessive Phenotype

**1.4** Tobacco plants have 48 chromosomes.

State how many chromosomes do 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.

|  |  |  |
| --- | --- | --- |
| **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]

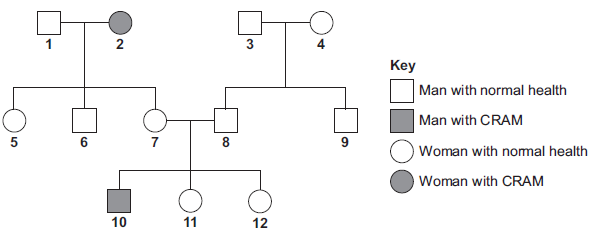
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**2.4** A man and a woman decide to have a child.  
What is the chance that the child will be a boy?

[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.

[2 marks]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**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**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Person 7** | |
|  |  |  |  |
| **Person 8** |  |  |  |
|  |  |  |

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]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**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]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**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]

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**MARK SCHEME**

|  |  |  |  |
| --- | --- | --- | --- |
| **Qu No.** |  | **Extra Information** | **Marks** |
| 1.1 | Nucleus |  | 1 |
| 1.2 | Alleles | ignore ref to homozygous / heterozygous | 1 |
| 1.3 | homozygous  recessive |  | 1  1 |
| 1.4 | 24 |  | 1 |

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

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

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Qu No.** |  | **Extra Information** | **Marks** |
| 5.1 | 18.06 / 18 / 18.1 | correct answer gains 2 marks  allow **1** mark for,  • (4131 - 3499) ÷ 3499 × 100  • 632 ÷ 3499 × 100  • ((4131 ÷ 3499) × 100 ) – 100  • 0.18 | 2 |
| 5.2 | antibiotics kill non-resistant  strain or resistant strain  bacteria survive  resistant strain bacteria  reproduce **or** resistant strain  bacteria pass on genes  population of resistant strain  increases **or** proportion of  resistant bacteria increases  **or**  people more likely to be  infected by resistant strain  (than non-resistant strain) | accept resistant strain is the successful competitor  do **not** accept intentional adaptation  ignore strongest / fittest survive  ignore mutation  ignore people do not finish antibiotic course  allow high numbers of resistant bacteria | 1  1  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**  • Komodo dragon can have offspring when no male dragon is available  • The Komodo dragon does not need to expend energy searching for a mate  • Producing an offspring is quicker than waiting to reproduce sexually  **Advantages of sexual reproduction for the komodo dragon**  • The offspring of the komodo dragon will show variation  • (and therefore) not as susceptible to genetic disorders  • if the environment changes the komodo dragon will possibly be more able to adapt | | |  |