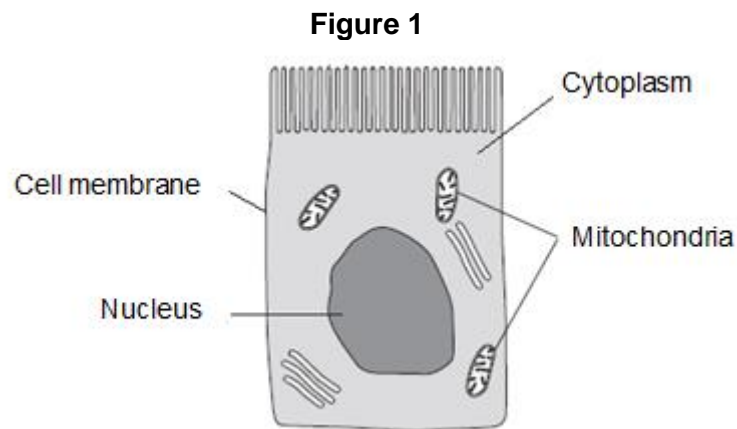


**4-6 Inheritance – Biology**

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



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

[1 mark]

Circle **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]

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**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]

Circle **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]

\_\_\_\_\_

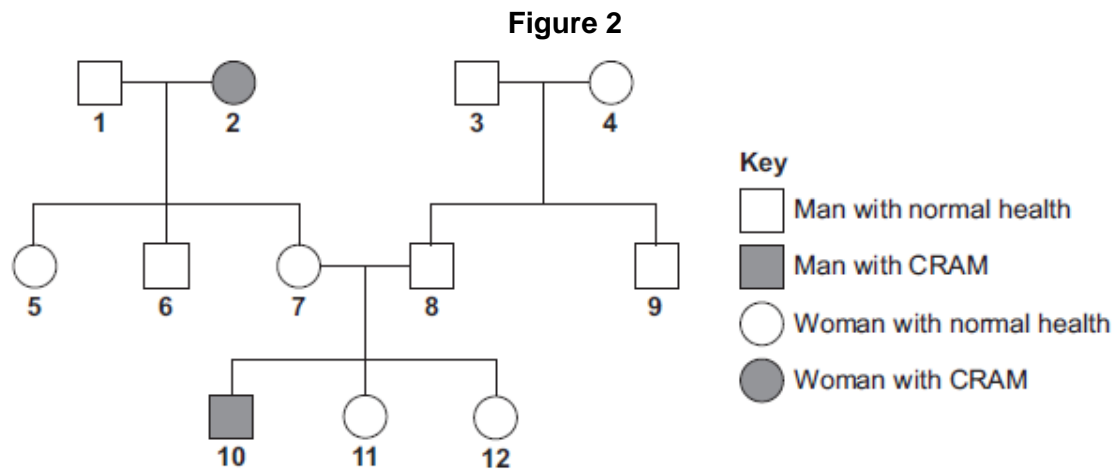
**2.4** A man and a woman decide to have a child.

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.



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]

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

[1 mark]

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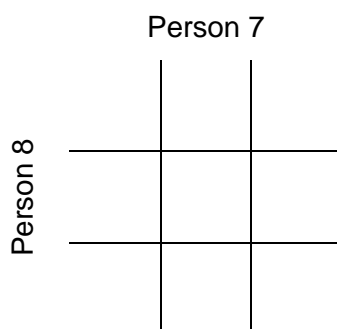
3.3 Persons 7 and 8 want to have another child.

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**



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]

---

**5.0** 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**



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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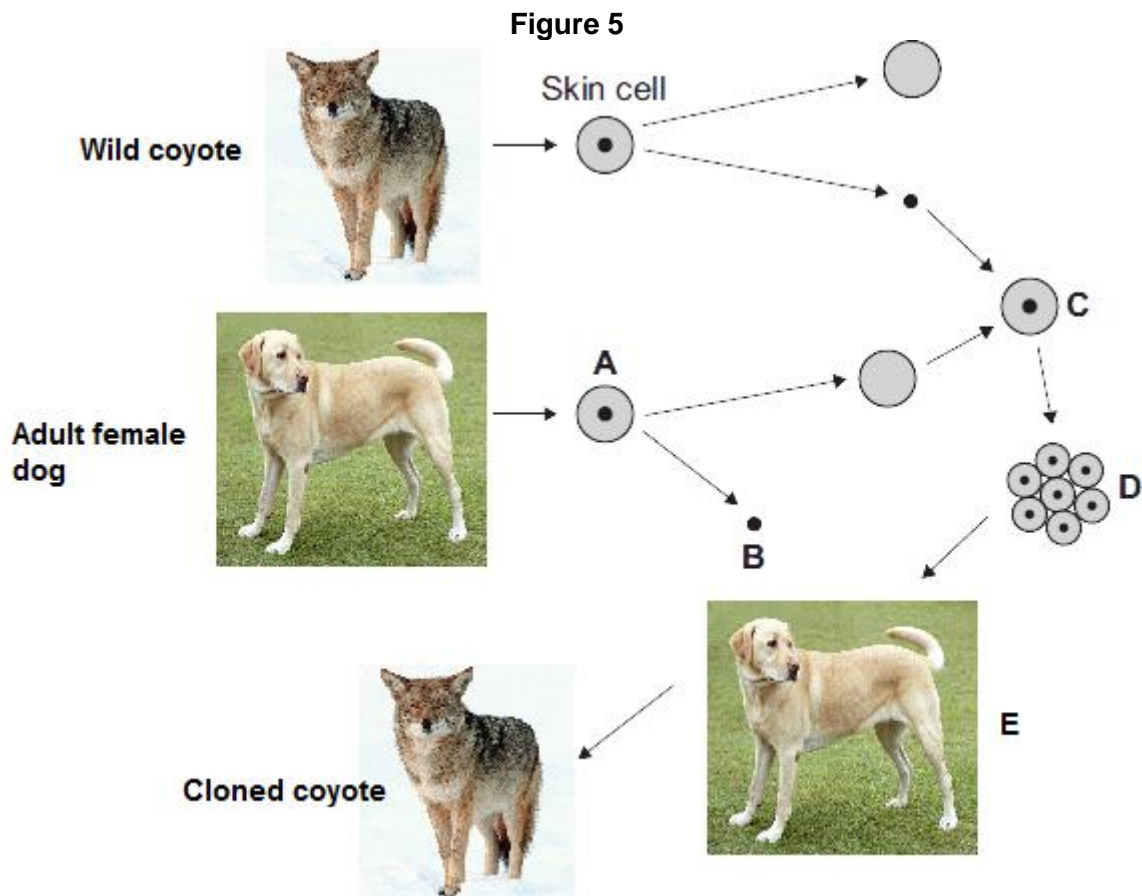
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7.0 In 2012 scientists cloned a wild coyote using skin cells. **Figure 5** show the cloning process.



7.1 What type of cell is cell **A**?

[1 mark]

Choose **one** word from the list.

**Egg cell**

**Embryo cell**

**Skin cell**

**Sperm cell**

7.2 Part **B** is removed from cell **A**.

What part of the cell is part **B**?

[1 mark]

Choose **one** word from the list.

**Cell membrane**

**Cytoplasm**

**Nucleus**

**Ribosomes**

7.3 Explain why part **B** is removed from cell **A**.

[1 mark]

---

**7.4** After cell **C** is formed, it divides into embryo cells.  
What is done to cell **C** to make it divide?

[1 mark]

Choose **one** phrase from the list.

Cell C is...

**treated with  
enzymes**

**added to other  
egg cells**

**mixed with  
sperm cells**

**given an  
electric shock**

Image acknowledgements

Komodo dragon

By Dezidor - Own work, CC BY 3.0, <https://commons.wikimedia.org/w/index.php?curid=2583986>

Coyote

By Yathin S Krishnappa – Own work, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=21284376>

Dog

By derivative work: Djmirko (talk)YellowLabradorLooking.jpg: User:Habj – YellowLabradorLooking.jpg, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=4469919>

## MARK SCHEME

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

Qu No.		Extra Information	Marks		
2.1	<b>Feature</b>	<b>Mitosis only</b>	<b>Meiosis only</b>	all three correct = 2 marks  2 correct = 1 mark  0 or 1 correct = 0 marks	2
	Produces new cells during growth and repair	✓			
	Produces gametes (sex cells)		✓		
	Produces genetically identical cells	✓			
2.2	(a man) testes/testis (a woman) ovary/ovaries	accept testicle do <b>not</b> accept 'ova'/ovule	1 1		
2.3	XX		1		
2.4	$\frac{1}{2}$ / 0.5 / 50% / 1:1 / 1 in 2	do <b>not</b> 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 <u>from 1/</u> <u>from father</u>	ignore they are carriers	1
3.3	gametes correct or parental genotypes correct: <b>N and n + N and n or Nn + Nn</b>	accept alternative symbols, if defined	1
	derivation of offspring genotypes: <b>NN + Nn + Nn + nn</b> <b>nn</b> identified as CRAM		1
	correct probability: 0.25	allow alternative if correct or parental gametes	1
		accept $\frac{1}{4}$ / 25% / 1 in 4 / 1 out of 4 / 1:3 do <b>not</b> accept 3:1 / 1:4	1



Qu No.		Extra Information	Marks
4.1	(so plants are) resistant to attack <b>or</b> resistant to herbicides  increase yield	allow frost resistance	1  1
4.2	any <b>one</b> from: <ul style="list-style-type: none"> <li>possible effect on wild flowers</li> <li>possible effect on insects</li> <li>possible effect on human health</li> </ul>		1

Qu No.		Extra Information	Marks
5.1	18.06 / 18 / 18.1	correct answer gains 2 marks  allow <b>1</b> mark for, <ul style="list-style-type: none"> <li><math>(4131 - 3499) \div 3499 \times 100</math></li> <li><math>632 \div 3499 \times 100</math></li> <li><math>((4131 \div 3499) \times 100) - 100</math></li> <li>0.18</li> </ul>	2
5.2	antibiotics kill non-resistant strain <b>or</b> resistant strain bacteria survive  resistant strain bacteria reproduce <b>or</b> resistant strain bacteria pass on genes  population of resistant strain increases <b>or</b> proportion of resistant bacteria increases <b>or</b> people more <u>likely</u> to be infected by resistant strain (than non-resistant strain)	accept resistant strain is the successful competitor  do <b>not</b> 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			
<b>Level 2:</b>	Clear and accurate account of the advantages of sexual and asexual reproduction for the komodo dragon. The account is clear and logical.		3–4
<b>Level 1:</b>	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
<b>Indicative content</b>			
<b>Advantages of asexual reproduction for the komodo dragon</b> <ul style="list-style-type: none"> <li>• Komodo dragon can have offspring when no male dragon is available</li> <li>• The komodo dragon does not need to expend energy searching for a mate</li> <li>• Producing an offspring is quicker than waiting to reproduce sexually</li> </ul> <b>Advantages of sexual reproduction for the komodo dragon</b> <ul style="list-style-type: none"> <li>• The offspring of the komodo dragon will show variation</li> <li>• (and therefore) not as susceptible to genetic disorders</li> <li>• if the environment changes the komodo dragon will possibly be more able to adapt</li> </ul>			

Qu No.		Extra Information	Marks
7.1	egg cell		1
7.2	nucleus		1
7.3	because this contains the dog genes/chromosomes		1
7.4	electric shock	accept genetic information/DNA/alleles	1