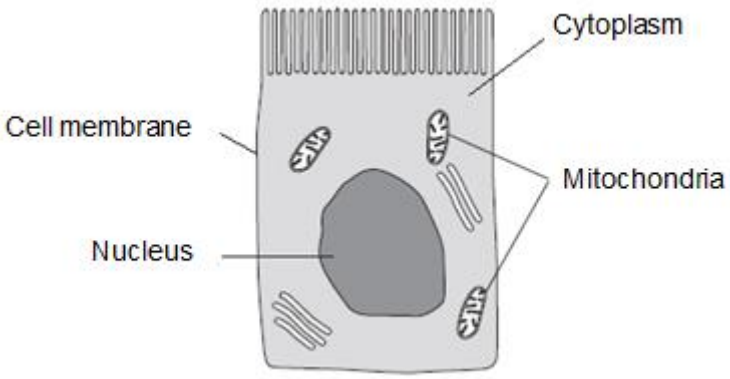
4-6 Inheritance – Biology

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

Figure 1



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]

_____

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]

_____

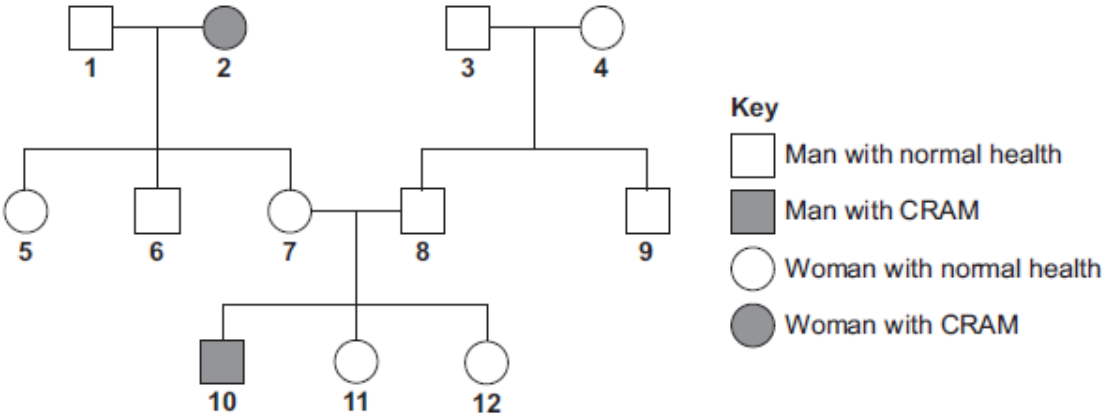
2.4 A man and a woman decide to have a child.
What is the chance that the child will be a boy?

[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.

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]

_____

_____

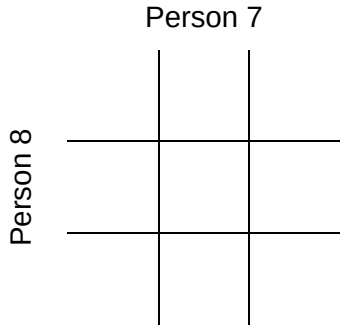
3.3 Persons **7** and **8** want to have another child.

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]

_____

5.0 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]

_____

_____

_____

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

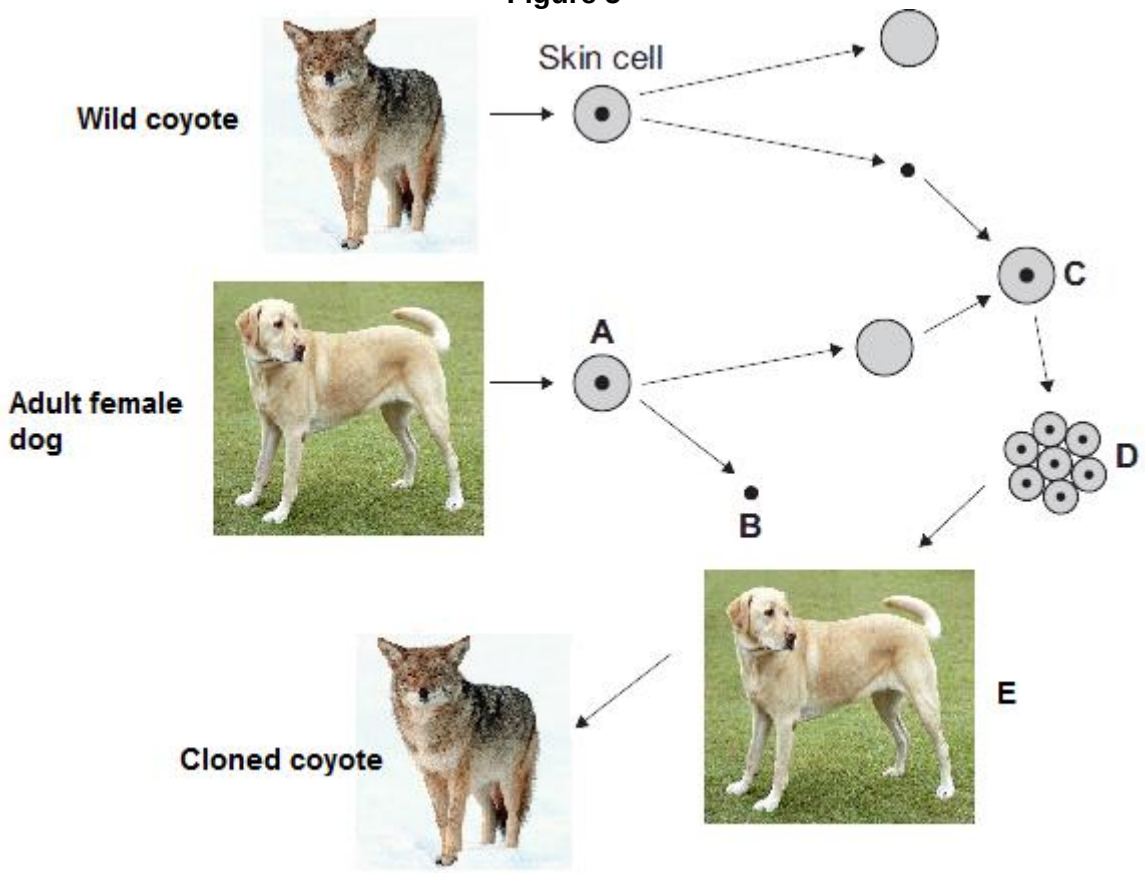
Figure 4

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]

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

Figure 5



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 recessive		1 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 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 <u>from 1</u>/<u>from father</u>	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			

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