

Inheritance 8

Name: _____

Class: _____

Date: _____

Time: **67 minutes**

Marks: **67 marks**

Comments:

1.

Insecticides are chemicals which kill insects.
Insecticides may be sprayed onto crops to increase crop yield.

(a) Killing insects on crops increases crop yield.

Suggest why.

(1)

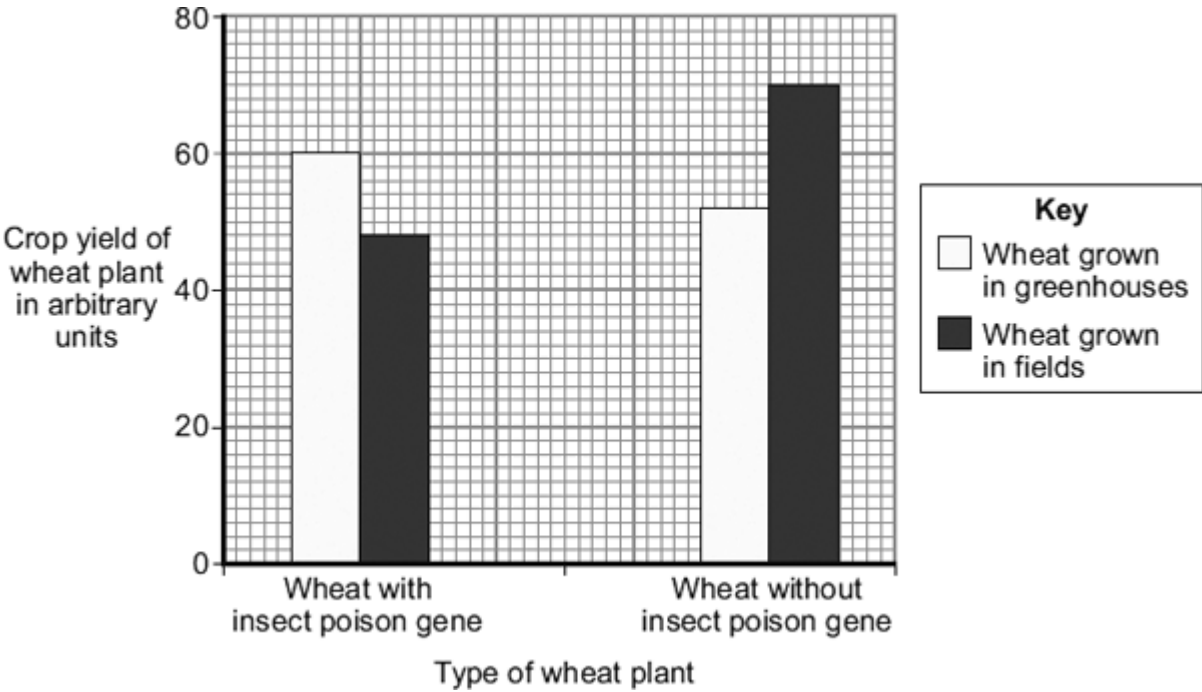
(b) A microorganism contains a gene which causes the production of an insect poison.

Scientists transferred the gene for production of the insect poison into wheat plants.
This makes genetically modified (GM) wheat.

The scientists:

- grew wheat plants with the insect poison gene in fields and in greenhouses
- grew wheat plants without the insect poison gene in fields and in greenhouses
- measured the crop yield of the wheat plants.

The bar chart shows the results.



(i) What was the yield of the wheat with the insect poison gene grown in greenhouses?

_____ arbitrary units

(1)

- (ii) The yield from wheat without the insect poison gene grown in greenhouses was different from the yield you gave in (b)(i).

Describe this difference in yield.

(2)

- (iii) Look again at the bar chart.

What advice would you give to a farmer about the type of wheat to grow in fields?

Give a reason for your answer.

(2)

- (c) Some people are concerned about the use of GM crops.

Why?

(2)

(Total 8 marks)

2.

People may be immunised against diseases using vaccines.

(a) (i) Which part of the vaccine stimulates the body's defence system?

(2)

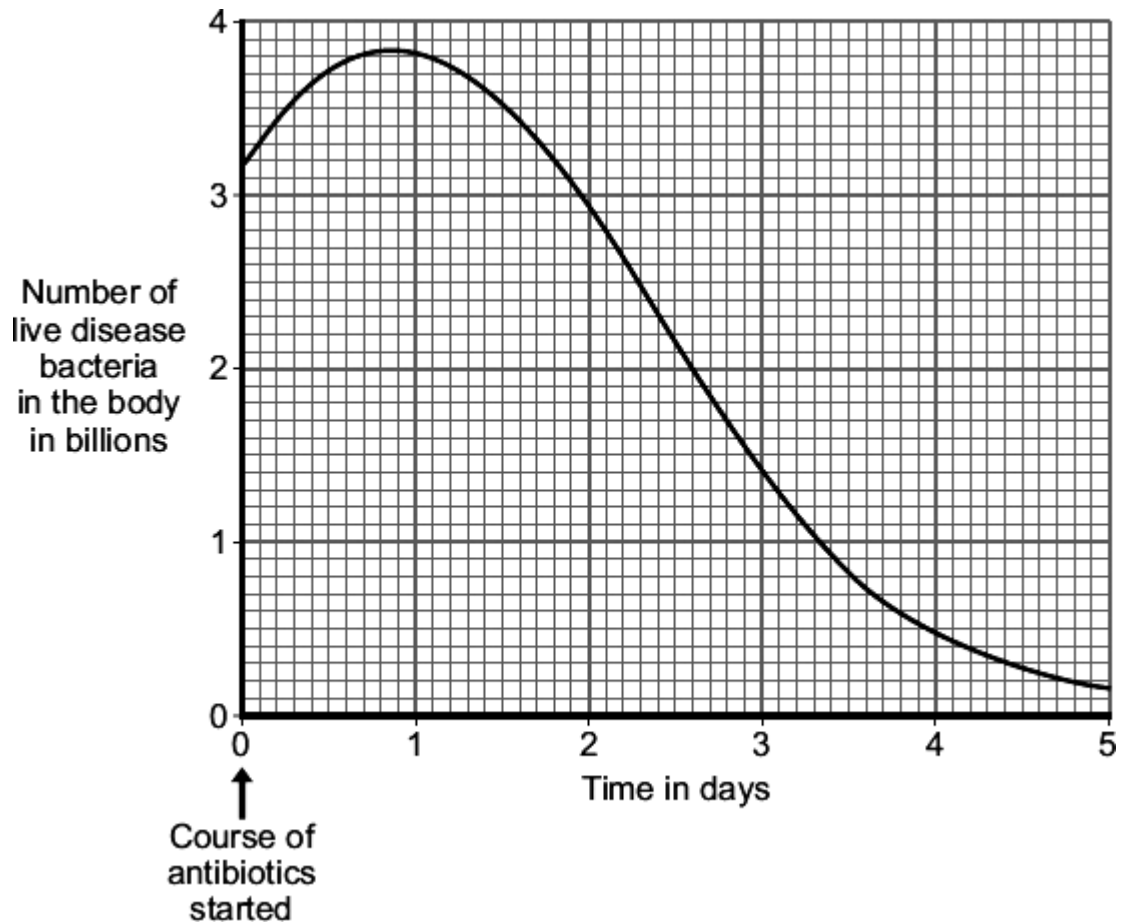
(ii) A person has been vaccinated against measles. The person comes in contact with the measles pathogen. The person does **not** catch measles.

Explain why.

(3)

- (b) A man catches a disease. The man has **not** been immunised against this disease. A doctor gives the man a course of antibiotics.

The graph shows how the number of live disease bacteria in the body changes when the man is taking the antibiotics.



- (i) Four days after starting the course of antibiotics the man feels well again. It is important that the man does **not** stop taking the antibiotics.

Explain why.

Use information from the graph.

(2)

(ii) Occasionally a new, resistant strain of a pathogen appears.

The new strain may spread rapidly.

Explain why.

(3)

(Total 10 marks)

3.

The picture shows a zebra fish.



Illustration © Emily S. Damstra

Zebra fish are small freshwater fish that usually have black and silver stripes. Zebra fish can tolerate a wide range of environmental conditions.

- (a) Scientists have genetically modified zebra fish to act as pollution indicators. The genetically modified zebra fish have a gene transferred from a jellyfish. The gene allows the stripes of the zebra fish to change colour.

Describe how the scientists produced the genetically modified zebra fish.

(3)

- (b) Some scientists are worried about the production of genetically modified zebra fish. Suggest reasons why.

(2)

(Total 5 marks)

4.

(a) Animal breeders use sexual reproduction to produce new strains of animals.

How does sexual reproduction produce variation?

(2)

(b) A salmon is a type of fish.

Scientists have created a GM (genetically modified) 'super' salmon.

The scientists transferred a gene from a fish called a pout into a salmon. The gene increases the secretion of growth hormone in the salmon. The GM salmon grows much faster than an ordinary salmon, reaching market size up to one year earlier. Many more GM salmon will be grown in fish farms.

(i) Describe how a gene can be transferred from a pout into a salmon.

(3)

(ii) The government might not allow the production of GM salmon.

Suggest **one** reason why.

(1)

(Total 6 marks)

5.

The diagram shows a strawberry plant.

The parent plant grows side shoots.

New plants grow on the side shoots.



© D.G. Mackean

The new plants will all have the same inherited characteristics as the original parent plant.

Complete the sentences to explain why.

Use words from the box.

asexual	differentiation	embryos	fertilisation
gametes	genes	mitosis	sexual

(a) The new plant is produced by _____ reproduction.

(1)

(b) In this type of reproduction, body cells divide by _____

(1)

(c) The new plant has the same _____ as the parent plant.

(1)

(Total 3 marks)

6.

Many strains of bacteria have developed resistance to antibiotics.

The table shows the number of people infected with a resistant strain of one species of bacterium in the UK.

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

- (a) Calculate the percentage increase in the number of people infected with the resistant strain between 2004 and 2008.

Show clearly how you work out your answer.

Percentage increase = _____

(2)

- (b) Explain, in terms of natural selection, why the number of people infected with the resistant strain of the bacterium is increasing.

(3)

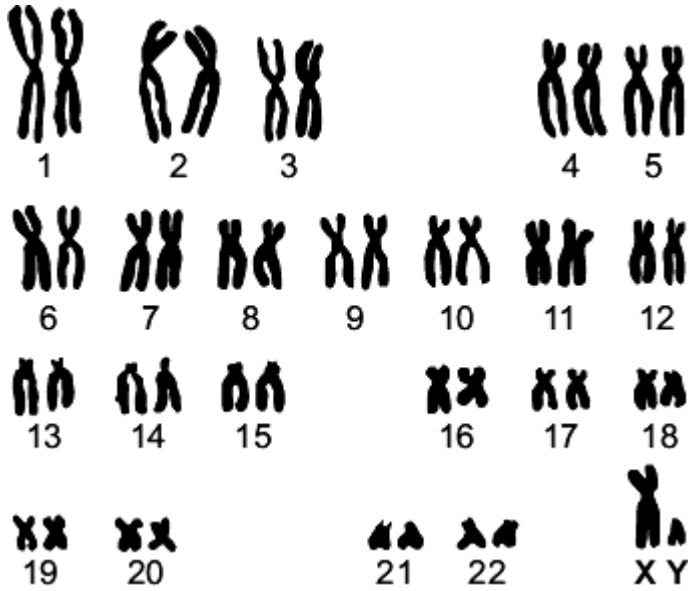
(Total 5 marks)

7.

When scientists look at dividing cells under a microscope, they can see strands that contain a chemical called DNA.

A photograph of these strands can be cut up and re-arranged.

The diagram shows an arrangement of the strands from a human cell.



(a) What name is given to the strands containing DNA shown in the diagram?

Draw a ring around **one** answer.

- alleles**
- chromosomes**
- genes**

(1)

(b) Look carefully at the diagram.

(i) The cell was taken from a man and not from a woman.

How can you tell?

(1)

(ii) What evidence is there that the strands are from a body cell, and not from a gamete?

Tick (✓) **one** box.

The strands are arranged in order of size.

The strands are in pairs.

Gametes are made in the testes and ovaries.

(1)

(iii) When a human cell is not dividing the strands containing DNA are **not** clearly visible.

Draw a ring around the correct answer to complete the sentence.

In a human cell, the DNA is normally found in the

cell membrane.

cytoplasm.

nucleus.

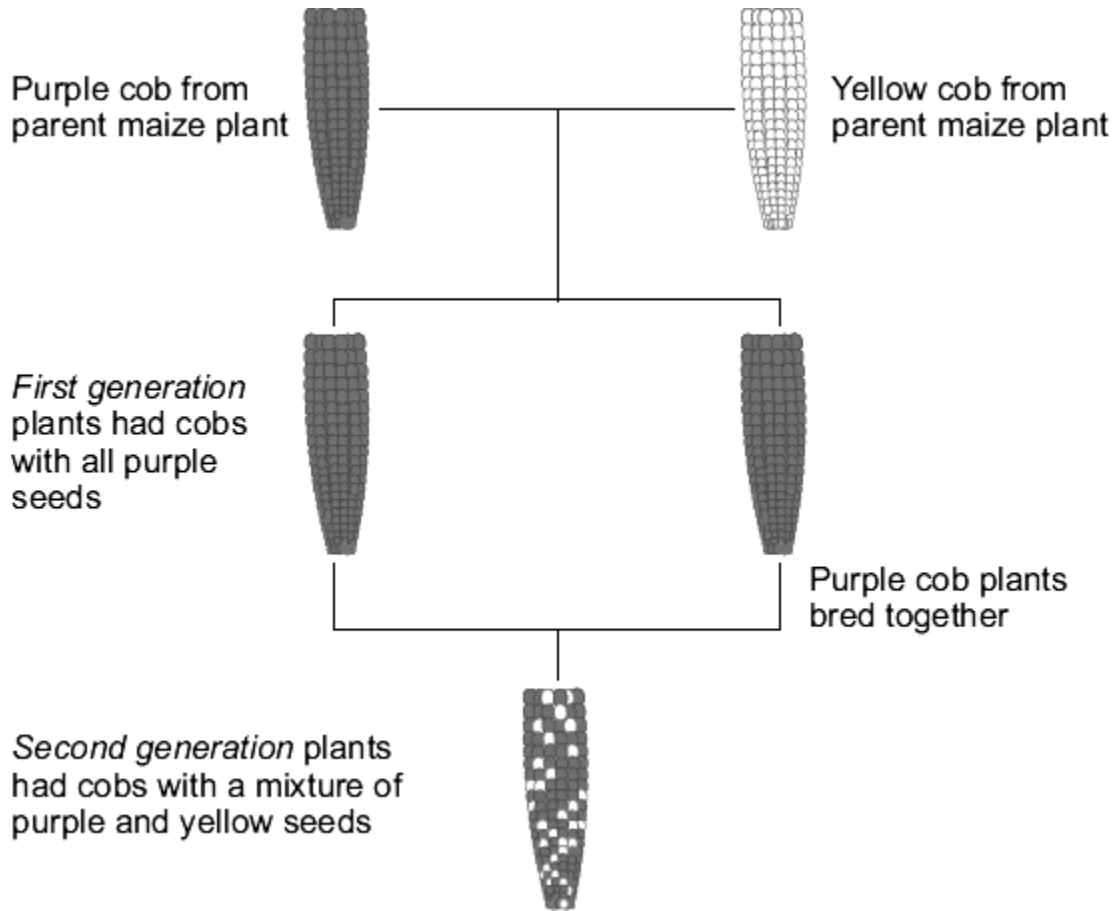
(1)

(Total 4 marks)

9. Maize plants reproduce sexually to form maize cobs. Each maize cob has many seeds.

The colour of the seeds is controlled by a gene. The gene has two alleles, purple and yellow.

The diagram shows the cobs produced by breeding maize plants.



(a) Use words from the box to complete the sentences.

dominant	environmental	recessive
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(i) The first generation plants show that the purple allele is

(1)

(ii) The second generation plants show that the yellow allele is

(1)

(b) The allele for purple can be represented by the letter **A**.
The allele for yellow can be represented by the letter **a**.

(i) What alleles does a yellow seed have?

Draw a ring around **one** answer.

AA

Aa

aa

(1)

(ii) What alleles does a purple seed from a *first* generation plant have?

Draw a ring around **one** answer.

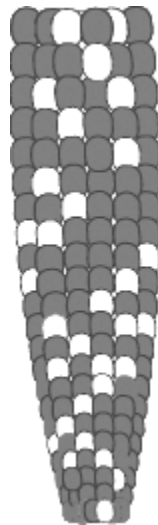
AA

Aa

aa

(1)

(c) The drawing shows a cob from one of the *second* generation plants.



A student counted 334 purple seeds and 110 yellow seeds on this maize cob.

What is the approximate ratio of purple seeds to yellow seeds on the cob?

Tick (✓) **one** box.

3 purple : 1 yellow

1 purple : 3 yellow

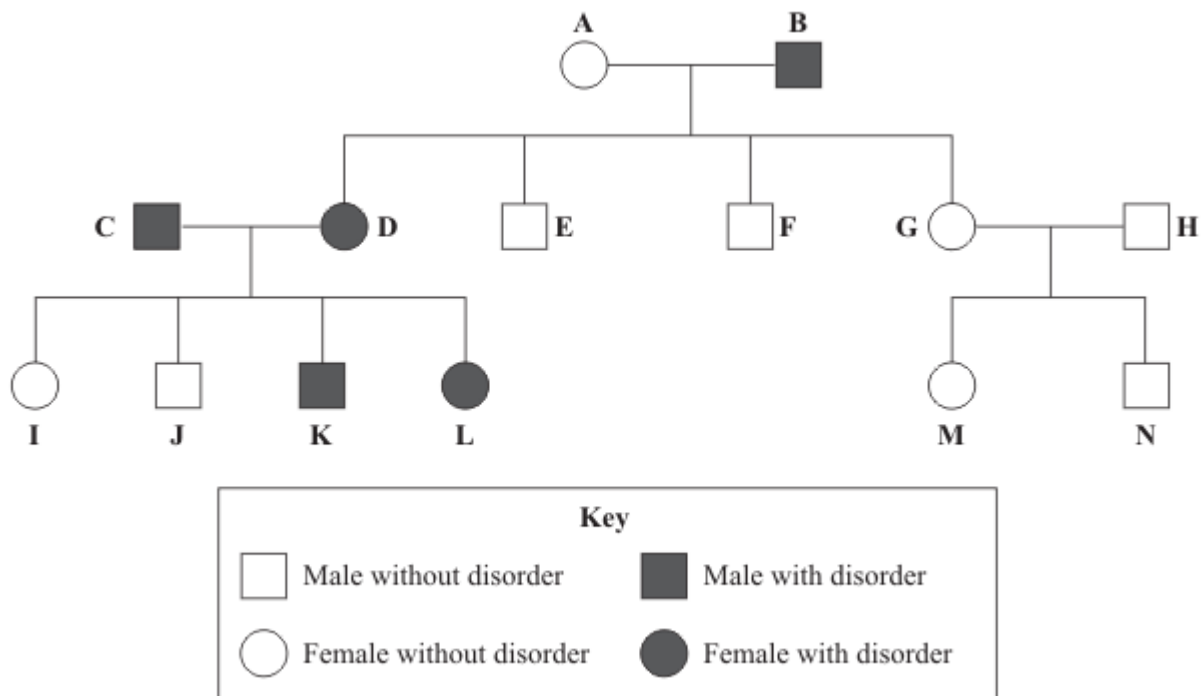
1 purple : 1 yellow

(1)

(Total 5 marks)

10.

The diagram shows a family tree in which some individuals have an inherited disorder, which may cause serious long-term health problems.



(a) What proportion of the children of **A** and **B** have the disorder?

(1)

- (b) Explain the evidence from the diagram which shows that the allele for the disorder is dominant.

Use the appropriate letters to identify individuals in your answer.

You may use genetic diagrams in your explanation. There is space for you to draw a genetic diagram at the top of the facing page.

(3)

- (c) (i) What is meant by 'embryo screening'?

(1)

- (ii) A doctor suggests that couple **C** and **D** should have their embryos screened but that couple **G** and **H** do **not** need this procedure.

Explain the reasons for the doctor's suggestions.

(3)

(Total 8 marks)

11.

The photograph shows a snake eating a toad.



Cane toads were first introduced into Australia in 1935. The toads contain toxins and most species of Australian snake die after eating the toad.

The cane toad toxin does not affect all snakes the same way. Longer snakes are less affected by toad toxin.

Scientists investigated how red-bellied black snakes had changed in the 70 years since cane toads were introduced into their area. They found that red-bellied black snakes had become longer by around 3 – 5 %.

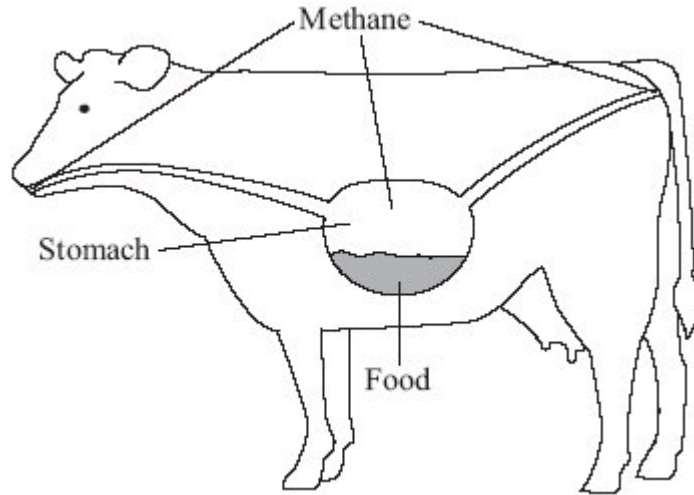
Suggest an explanation for the change in the body length of the red-bellied black snakes since the introduction of the cane toads.

(Total 4 marks)

12.

Scientists are investigating how to reduce methane emissions from cattle.

Most of this methane is emitted by the cows belching.



Scientists have found that less methane is belched if the cows eat high-sugar rye grass.

This rye grass has been produced by genetic engineering.

- (i) Suggest how the high-sugar rye grass might have been produced by genetic engineering.

(3)

- (ii) Some people might object to the growing of genetically-engineered, high-sugar rye grass for feeding cattle.

Give **two** reasons why.

1. _____

2. _____

(2)

(Total 5 marks)

Mark schemes

- 1.** (a) insects don't eat / damage crop
allow idea of insects carrying plant disease 1
- (b) (i) 60 1
- (ii) lower (yield)
accept 'higher' if answer clearly refers to wheat with transferred gene
allow yield is only 52 or goes down to 52 1
- by 8 (arbitrary units)
accept ecf from (b)(i) for 2 marks 1
- (iii) grow / use wheat without insect poison (gene) 1
- higher yield (in fields)
accept bigger crop / more wheat
ignore grows better 1
- (c) *ignore unnatural / unethical / against religion unqualified*
(concerned about)
accept specific examples given
effect on populations of (wild) flowers / insects
ignore harms the environment 1
- effect of eating GM crops on human health
allow harmful to humans if eaten 1
- 2.** (a) (i) dead / inactive / weakened
allow antigen / protein
ignore ref to other components
ignore small amount 1
- pathogen / bacterium / virus / microorganism
ignore germs / disease 1
- [8]

(ii) *antigen / antibiotic instead of antibody = max 2*

white blood cells produce / release antibodies

accept lymphocytes / leucocytes / memory cells produce antibodies
*do **not** accept phagocytes*

1

antibodies produced quickly

1

(these) antibodies destroy the pathogen

allow kill

*do **not** accept antibodies engulf pathogens*

1

(b) (i) (live) bacteria still in body

ignore numbers

1

would reproduce

ignore mutation / growth

1

(ii) antibiotics / treatment ineffective **or** resistant pathogens survive

accept resistant out compete non-resistant

1

these reproduce

1

population of resistant pathogens increases

allow (resistant pathogens reproduce) rapidly

1

[10]

3.

(a) (jellyfish) gene(s) cut out

1

ref to enzymes (at any stage)

1

(gene) transferred to zebra fish at early stage of development / embryo / egg

ignore removal of zebra fish genes

1

- (b) any **two** from:
- ignore unethical / religious / unnatural*
 - could transfer gene to other (fish) species
 - effects on food chains
accept effects on other species / humans who eat them
 - effects on zebra fish themselves, eg may out compete non GM zebra fish
- 2

[5]

4.

- (a) fusion of gametes / named gametes
allow meet / join / fertilise
- 1
- results in mixing of genetic information / DNA / chromosomes
accept genetic information / DNA / chromosomes from two parents
- 1
- (b) (i) use enzyme
- 1
- to cut gene from pout chromosome / DNA
- 1
- insert gene into salmon chromosome / DNA / egg / embryo / nucleus
accept use of plasmid as carrier
ignore salmon / cell
- 1
- (ii) eg fear of gene transfer to wild salmon / extinction of wild salmon /
fear of harmful effect on consumers / unsure of long term effects
ignore cruel / ethics / morals / religion / unnatural / economics
- 1

[6]

5.

- (a) asexual
- 1
- (b) mitosis
- 1
- (c) genes
- 1

[3]

6.	<p>(a) 18.06 / 18 / 18.1</p> <p><i>correct answer gains 2 marks</i></p> <p><i>if answer incorrect evidence of</i></p> <p>$(4131 - 3499) \div 3499 \times 100$</p> <p>or $632 \div 3499 \times 100$</p> <p>or $((4131 \div 3499) \times 100) - 100$</p> <p>or 0.18</p> <p><i>gains 1 mark</i></p>	2
	<p>(b) antibiotics kill non-resistant strain</p> <p>or resistant strain bacteria survive</p> <p><i>accept resistant strain the successful competitor</i></p> <p><i>do not accept intentional adaptation</i></p> <p><i>ignore strongest / fittest survive</i></p> <p><i>ignore mutation</i></p> <p><i>ignore people do not finish antibiotic course</i></p>	1
	<p>resistant strain bacteria reproduce</p> <p>or resistant strain bacteria pass on genes</p>	1
	<p>population of resistant strain increases or proportion of resistant bacteria increases</p> <p><i>allow high numbers of resistant bacteria</i></p>	
	<p>or</p> <p>people more <u>likely</u> to be infected by resistant strain (than non-resistant strain)</p>	1
		[5]
7.	<p>(a) chromosomes</p>	1
	<p>(b) (i) has XY / Y</p> <p><i>allow female would be XX / has no Y</i></p>	1
	<p>(ii) The strands are in pairs</p>	1
	<p>(iii) nucleus</p>	1
		[4]
8.	<p>mutation or <u>variation</u> or <u>range</u> of sizes</p> <p><i>do not accept deliberate mutation or factor caused mutation</i></p>	1
	<p>warm(er) / dry(er) now</p> <p><i>allow global warming</i></p>	1

if warmer more smaller lambs / sheep survive winter

award 'survival' point only if linked to warmer / dryer conditions

1

or if warmer sheep do not need fat / wool / fur to keep warm

or if warmer smaller sheep can lose heat more readily / do not overheat / keep cool (so survive)

*do **not** accept smaller sheep retain more heat*

or if warmer smaller sheep have larger SA / V ratio (so survive)

*do **not** accept smaller sheep have smaller SA / V ratio*

or if dryer smaller lambs / sheep need less grass (to survive)

ignore small sheep feed easier on grass

small sheep breed / pass genes / mutations / characteristics to next generation

*do **not** accept if Lamarckian*

ignore competition / predation / human influence

1

[4]

9.

(a) (i) dominant

allow clear indication

1

(ii) recessive

allow clear indication

1

(b) (i) aa

extra ring drawn cancels the mark

1

(ii) Aa

extra ring drawn cancels the mark

1

(c) 3 purple : 1 yellow

extra box ticked cancels the mark

1

[5]

10.

- (a) 1 in 4 / 1/4 / 1: 3 / 25% / 0.25
do not accept 3:1 / 1:4 / 2:6

1

- (b) **either** from C **and** D
*accept synonyms for dominant / recessive eg
Normal / faulty
accept genetic diagram if clearly referring to correct individuals or
genotypes on family tree
allow 'gene' for 'allele'*

any **three** from:

- C **and** D have disorder
ignore 'C & D are carriers'
- I/J don't have disorder
- C **and** D have dominant **and** recessive alleles
- recessive alleles from C **and** D passed to I/J
or I/J have two recessive alleles
*NB if allele was recessive then all offspring of C **and** D would have the disorder = 3 marks*

or from A **and** B

assume response refers to A + B unless contradicted

- A is homozygous recessive / rr, **and** B is heterozygous / Rr can be shown in words or symbols
allow any symbol
- offspring can be rr **or** Rr described
allow without key

3

- (c) (i) (embryos) checked for inherited / genetic disorders / conditions
accept diseases for disorders

1

(ii) any **three** from:

- C/D have disorder / have dominant allele
accept disease / condition
accept 'gene' for 'allele'
ignore reference to 'carriers'
- chance of embryo / foetus / child having disorder
or may pass on alleles for disorder to their offspring
- C/D might want to decide on termination **or** prepare for child with disorder
- G **and** H don.t have disorder / both homozygous recessive / have no dominant alleles (for this disorder)
- so offspring (of G **and** H) cannot / don.t have disorder

3

[8]

11. any **four** from

- mutation
*do **not** accept 'had to mutate / decided to mutate'*
- produces longer snake **or** there is variation in snake length
*do **not** accept 'had to adapt and became longer'*
- longer snake less susceptible to toxin **or** longer snake survives
- survivors reproduce
- gene passed to next generation
allow characteristic passed to next generation

[4]

12.

(i) any **three** from:

ignore references to other methods eg tissue culture and embryo transplantation

- remove gene
- use of enzymes
- from plant with high sugar production

allow from bacteria

- insert gene into rye grass

3

(ii) any **two** from eg

- concern about effect on (health) of cow
- concern about effects on human (health)
- concern about food chain effects **or** effects on ecosystem
- effect on gene pool

*ignore not natural **or** cost*

ignore ethical / religious arguments

if no other marks awarded

'we don't know the long term effects' = 1 mark

2

[5]