Inheritance 1

Name: _____

Class: _____

Date: _____

Time: **91 minutes**

Marks: **84 marks**

Comments:

1. Farmers can increase crop yield by controlling the conditions that plants grow in.

(a) Draw **one** line from each substance to how the substance increases crop yield.

Substance	How the substance increases crop yield
	Add mineral ions to the soil
Fertiliser	Decreases carbon dioxide concentration in the soil
Herbicide	Increases oxygen concentration in the air
	Kills weeds that compete with crops

(2)

(b) **Figure 1** shows a food chain for a farmer's field.

Figure 1

Seeds → Mice → Owls

Which is the secondary consumer in the food chain?

Tick (✓) **one** box.

- Seeds ☐
- Mice ☐
- Owls ☐

(1)

(c) Bees are insects that live in hives.

The bees fly in and out of the hives.

Figure 2 shows a crop growing in a field.

The farmer has added bee hives to increase the number of bees in the field.

Figure 2

Increasing the number of bees and other insects increases crop yield.

Which are **two** ways that increasing the number of insects in an area will increase crop yield?

Tick (✓) **two** boxes.

Insects change the soil pH around the crop. ☐

Insects eat leaves from the crop. ☐

Insects eat pests on the crop. ☐

Insects pollinate the crop. ☐

Insects shelter in the crop. ☐

(2)

(d) Some farmers increase the size of hedgerows between fields where crops grow.

Suggest **one** reason why.

_____

_____

(1)

Peat comes from peat bogs.

(e) Peat can be used to produce garden compost.

The table below compares peat compost with a sample of soil.

	Mineral ion concentration	**Speed at which water drains through**
Peat compost	Low	Slow
Soil	High	Fast

Young plants have short roots.

Explain **one** advantage of growing young plants in peat compost instead of in soil.

_____

_____

_____

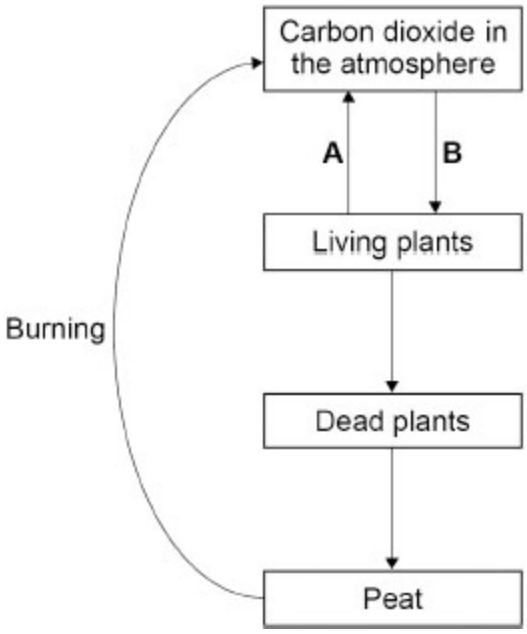
_____

(2)

Peat can also be burnt as fuel.

Figure 3 shows part of the carbon cycle.

Figure 3



(f) Name process **A** and process **B**.

Choose answers from the box.

condensation	**photosynthesis**	**respiration**	**transpiration**

Process **A** _____

Process **B** _____

(2)

(g) Peat contains carbon compounds.

Explain why burning peat contributes to climate change.

_____

_____

_____

_____

(2)

(h) Decay is an important process in the carbon cycle.

Which **two** types of organism cause decay?

Tick (✓) **two** boxes.

Algae	☐
Animals	☐
Bacteria	☐
Fungi	☐
Plants	☐

(2)

(i) Deforestation affects the carbon cycle.

Give **one** use of the land after the land has been cleared by deforestation.

_____

_____

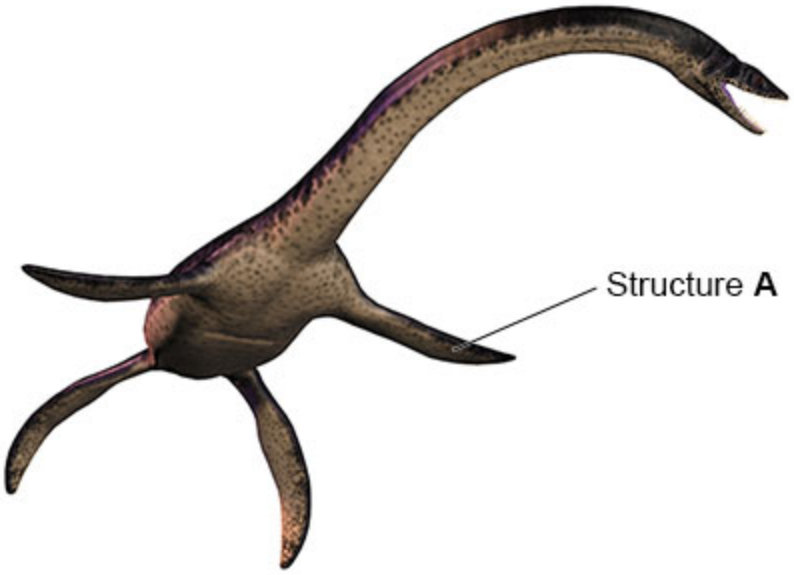
(1)

(Total 15 marks)

2. Plesiosaurs are extinct animals that lived in the ocean.

Figure 1 shows what scientists think a living plesiosaur may have looked like.

Figure 1



(a) Scientists think that the plesiosaur had smooth skin.

Suggest why the scientists **cannot** be certain what the skin of the plesiosaur was like.

_____

_____

(1)

(b) Explain how structure **A** in **Figure 1** helped the plesiosaur survive in the ocean.

_____

_____

_____

_____

(2)

(c) Plesiosaurs may have moved rapidly upwards to hold their heads above the water surface to search for prey.

What type of adaptation was the rapid upwards movement?

Tick (✓) **one** box.

Behavioural ☐

Chemical ☐

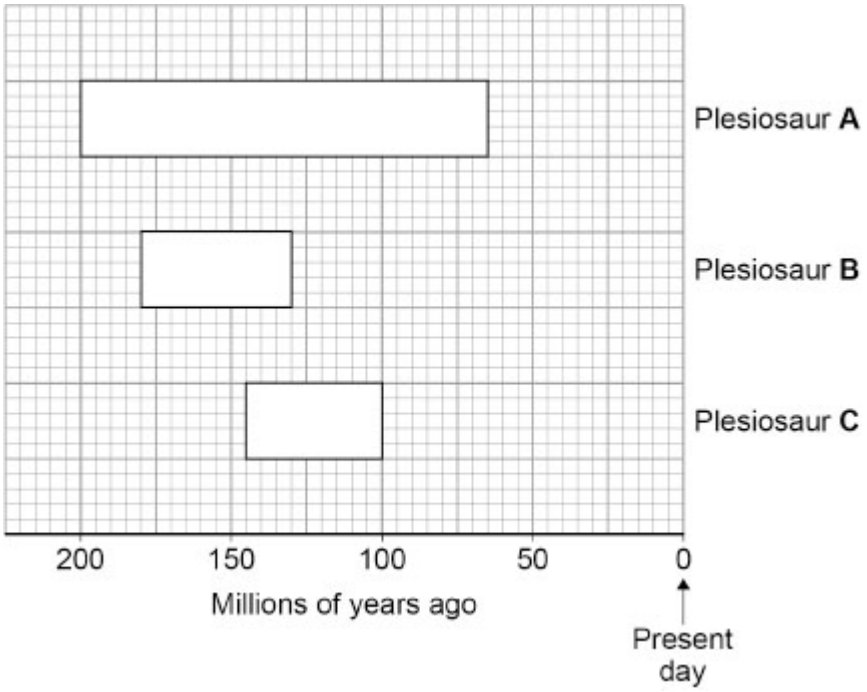
Structural ☐

(1)

Scientists use fossils to estimate when different types of plesiosaur existed.

Figure 2 shows when three types of plesiosaur existed.

Figure 2



(d) When did plesiosaur **A** first evolve?

Use **Figure 2**.

_____ million years ago

(1)

(e) Determine how many million years plesiosaur **B** existed for.

Use **Figure 2**.

_____

_____

_____

Time = _____ million years

(2)

(f) The exact year of extinction of all plesiosaur species can only be estimated.

Which are **two** reasons why?

Tick (✓) **two** boxes.

All plesiosaurs will have formed fossils. ☐

Not all plesiosaur fossils have been discovered. ☐

Plesiosaur bones do not decay. ☐

Plesiosaurs had many predators. ☐

Some plesiosaur fossils will have been destroyed. ☐

(2)

(g) What evidence from **Figure 2** shows that plesiosaur **C** might have evolved from plesiosaur **B**?

Tick (✓) **one** box.

Plesiosaur **B** and plesiosaur **C** did not exist at the same time. ☐

Plesiosaur **B** existed before plesiosaur **C**. ☐

Plesiosaur **B** became extinct more recently than plesiosaur **C**. ☐

(1)

(h) Evolution can be studied using evidence from:

- fossils
- antibiotic-resistant bacteria.

Suggest **two** reasons why it is easier to study evolution in bacteria than to study evolution using fossils.

1 _____

_____

2 _____

_____

(2)

(i) Give **one** reason why doctors are concerned about antibiotic-resistant bacteria.

_____

_____

(1)

(Total 13 marks)

3. This question is about genetics.

The fur colour of rabbits is controlled by two alleles.

(a) Draw **one** line from each term to the meaning of the term relating to genetics in rabbits.

Term	Meaning of the term
Chromosome	A fur colour that is seen
Gene	A whole strand of DNA found in the nucleus of a rabbit cell
Genome	Codes for a protein that affects fur colour
	The complete genetic composition of a rabbit

(3)

(b) In rabbits:

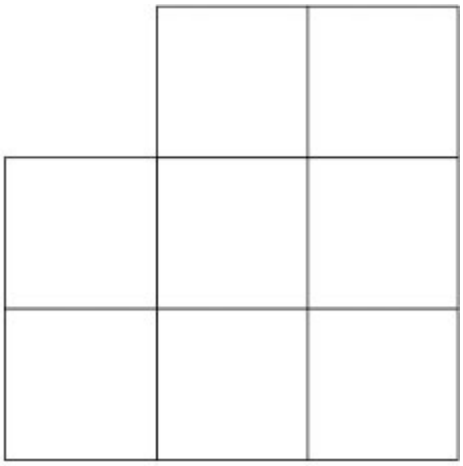
- the allele for brown fur (**B**) is dominant
- the allele for white fur (**b**) is recessive.

A rabbit with the alleles **Bb** and a rabbit with the alleles **bb** breed together.

Determine the probability that one of the offspring will have white fur.

You should:

- complete the Punnett square diagram
- identify any offspring that will have white fur.



Probability = _____

(5)

(c) A male rabbit is heterozygous for fur colour.

The rabbit's body cells have the genotype **Bb**.

One of the sperm cells from the rabbit has the allele **b**.

Explain why the alleles in the rabbit's body cells and the allele in the sperm cell are different.

_____

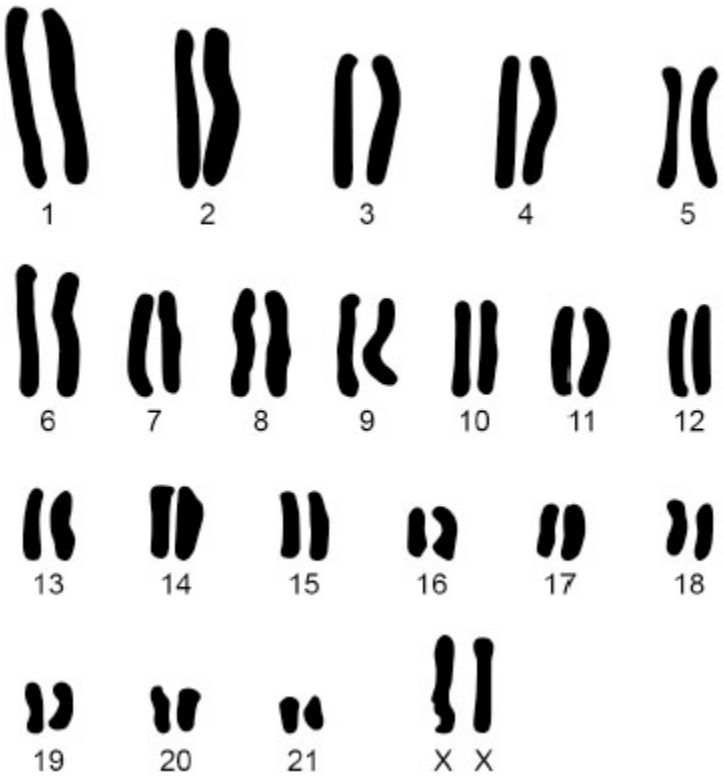
_____

_____

_____

(2)

The figure below shows the chromosomes of a rabbit.



(d) How many chromosomes would be found in a skin cell of a rabbit?

Use the figure above.

Number of chromosomes = _____

(1)

(e) The sex of a rabbit is controlled in the same way as the sex of a human.

Give the evidence from the figure above that the rabbit is female.

_____

_____

(1)

(Total 12 marks)

4. Farmers can increase crop yield by controlling the conditions the plants grow in.

(a) Maize is a crop plant.

A variety of maize has been genetically modified (GM) to be resistant to a herbicide.

Explain how growing GM herbicide-resistant maize can produce a larger yield than growing non-GM maize.

(4)

(b) Explain how growing a GM herbicide-resistant crop can **decrease** the biodiversity of animals.

(2)

Bees are a type of insect.

The number of insects near a crop can be increased by planting hedgerows.

(c) Increasing the number of bees **and** other insects increases crop yield.

Suggest **two** reasons why increasing the number of insects can increase crop yield.

1

2

(2)

(d) Hedgerows provide habitats for insects.

Give **one** reason why increasing hedgerow habitats increases insect numbers.

_____

_____

(1)

(e) Some farmland contains areas of peat.

When peat is dug up:

- the oxygen levels in the peat increase
- the peat decays quickly.

Explain why increasing the level of oxygen in peat contributes to climate change.

_____

_____

_____

_____

_____

(2)

(Total 11 marks)

5. Plesiosaurs are extinct reptiles that lived in the ocean.

The figure below shows a fossil of a plesiosaur.

(a) Plesiosaurs may have moved rapidly upwards to hold their heads above the water surface to search for prey.

What **type** of adaptation was the rapid upwards movement?

_____

(1)

(b) Give **two biotic** factors that may have caused the extinction of plesiosaurs.

1 _____

_____

2 _____

_____

(2)

(c) Describe how the plesiosaur fossil in the figure above could have been formed.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(d) Scientists use fossils to study evolution.

Suggest **two** reasons why scientists **cannot** study the mutations involved in the evolution of plesiosaurs.

Do **not** refer to extinction in your answer.

1 _____

_____

2 _____

_____

(2)

(e) The table below shows part of the classification of a plesiosaur.

Complete the table below.

Classification group	**Name**
Domain	
Kingdom	Animalia
	Chordata
Class	Reptilia
	Plesiosaur
	Cryptoclididae
Genus	Cryptoclidus
Species	eurymerus

(2)

(f) Give the binomial name of the plesiosaur in the table above.

_____

(1)

(Total 11 marks)

6. Cystic fibrosis is a genetic disorder.

(a) Cystic fibrosis affects the movement of substances into and out of cells.

Which part of a cell controls the movement of substances into and out of the cell?

Tick (✓) **one** box.

Cell membrane ☐

Cytoplasm ☐

Mitochondria ☐

(1)

Cystic fibrosis is caused by a recessive allele, **b**.

(b) What name is given to the allele **B**?

Tick (✓) **one** box.

DNA ☐

Dominant ☐

Gene ☐

(1)

(c) Which term describes the genotype **Bb**?

Tick (✓) **one** box.

Chromosome ☐

Heterozygous ☐

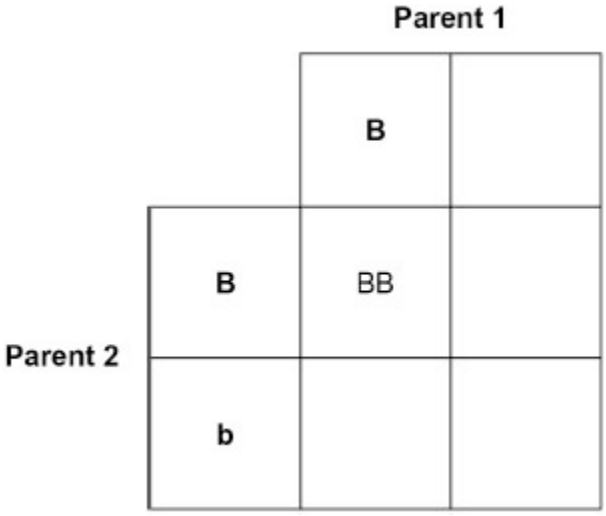
Phenotype ☐

(1)

(d) Two people plan to have a child.

Both people have the genotype **Bb**.

Complete the figure below to show the possible genotypes of the child.



(3)

(e) What is the chance that a child of these parents will have cystic fibrosis?

Use the figure above.

Tick (✓) **one** box.

0% ☐ 25% ☐ 50% ☐ 75% ☐

(1)

(f) An embryo can be tested to find out its genotype.

What is the name of the testing process?

Tick (✓) **one** box.

Genetic engineering ☐

Screening ☐

Selective breeding ☐

(1)

(g) Inherited disorders can be caused by changes in DNA.

What is the name of a change in DNA?

Tick (✓) **one** box.

Genome ☐

Helix ☐

Mutation ☐

(1)

(h) Inheritance is one cause of variation in a population.

Environmental factors also cause variation in a population.

Suggest **one** environmental cause of variation in a human population.

Do **not** refer to inheritance or to changes in DNA in your answer.

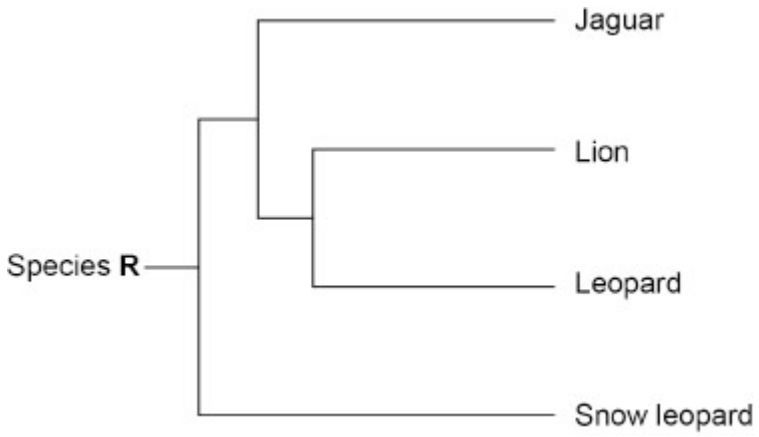
_____

_____

(1)

(Total 10 marks)

7. The figure below shows an evolutionary tree.



(a) Which species in the figure above is most closely related to lions?

Tick (✓) **one** box.

Jaguar ☐

Leopard ☐

Snow leopard ☐

(1)

(b) Tigers are more closely related to snow leopards than to jaguars.

Draw a line on the figure above to show the evolution of tigers.

Label the line 'Tiger'.

(1)

(c) What is represented by species **R** on the figure above?

Tick (✓) **one** box.

A species recently evolved from jaguars. ☐

A species that may evolve in the future. ☐

A species that the other species evolved from. ☐

(1)

(d) Complete the sentence.

Choose the answer from the box.

classification	**homeostasis**	**natural selection**

Evolution occurs by the process of _____ .

(1)

(e) Species can become extinct.

Give **two** possible causes of extinction.

1 _____

_____

2 _____

_____

(2)

(f) Fossils are used to study the evolution of some species.

Suggest **one** reason why fossils are used to study evolution.

_____

_____

(1)

Some bacteria have evolved to be resistant to penicillin.

Penicillin is an antibiotic.

(g) How has the process of evolution produced bacteria that are resistant to penicillin?

Write the stages, **A**, **B**, **C**, **D** and **E** in the correct order.

The first stage has been completed for you.

A The bacteria with mutations are more likely to survive.

B The population of bacteria is exposed to penicillin.

C The mutation for resistance to penicillin is passed on to offspring.

D Variation in the population of bacteria is caused by mutation.

E The surviving bacteria reproduce.

D → _____ → _____ → _____ → _____

(3)

(h) New antibiotics are **not** likely to control the spread of bacteria that are resistant to antibiotics.

What are **two** reasons why?

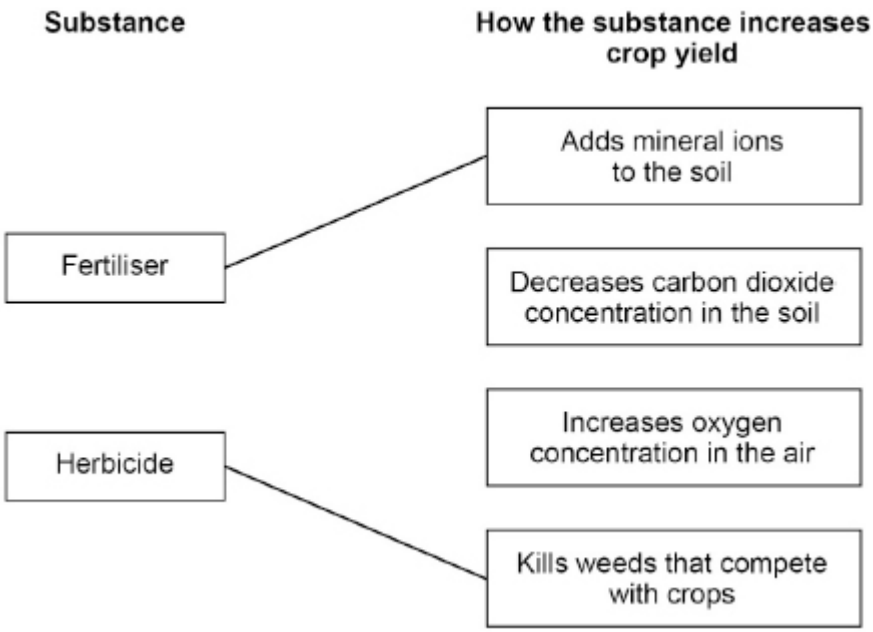
Tick (✓) **two** boxes.

Antibiotics kill all types of bacteria.	☐
Antibiotic resistant bacteria will continue to evolve.	☐
Bacteria reproduce very rapidly.	☐
New antibiotics are cheap to produce.	☐
Testing new antibiotics is quick.	☐

(2)

(Total 12 marks)

1. (a)



do **not** accept more than one line from a box on the left

2

(b) owls

1

(c) insects eat pests on the crop

1

insects pollinate the crop

1

(d) any **one** from:

- as a habitat for (beneficial) insects / animals

  allow as a shelter / space for (beneficial) insects / animals
- to keep (larger) animals out

  or

  to keep people out

  allow to protect (the crop) from (larger) animals

  allow to protect (the crop) from people

  ignore keep insects / birds out

  ignore to protect the crop unqualified

  ignore to stop pests eating the crop
- (to increase) biodiversity

  allow to increase the number of insects / plants

  allow descriptions of increasing biodiversity
- to reduce wind speed

  allow act as wind break
- as a habitat for predators of crop damaging organisms

  ignore to reduce pests unqualified
- to prevent / reduce soil erosion

  ignore so more (crop) can be grown

1

(e) water takes more time to drain (through)

allow converse if clearly referring to soil

allow there will be more water (in the peat compost)

*allow water drains / moves slow**er***

allow water drains / moves more slowly

ignore water drains slow / slowly

1

(so) water is more likely to be taken up by plants

allow (so) there is more time for plants to take up water

or

(so) do not need to water plants (as) frequently

allow (so) reduces water use

or

(which is an advantage because) young plants cannot reach water that is deep (in soil / compost)

ignore references to cost

*allow **2** marks for water more likely to be taken up by plants before it drains away*

1

(f) (**A**) respiration

1

(**B**) photosynthesis

answer line takes precedence

1

(g) (burning peat) releases / increases carbon dioxide

allow (burning peat) releases / increases CO_2

ignore burning releases carbon

*do **not** accept peat contains carbon dioxide*

1

(which) causes / increases global warming

allow (which) is a greenhouse gas

allow (which) causes the greenhouse effect

ignore (which) causes / increases climate change

1

(h) bacteria

1

fungi

1

(i) farming (cattle / biofuel / crops / animals)

allow examples of farming a crop / animal

allow building

allow named type of building eg houses / factories

allow mining

allow landfill

allow reforestation / rewilding

1

[15]

2. (a) any **one** from:

- (skin / body / plesiosaur) decays
  - *allow (skin / body / plesiosaur) not preserved*
- skin was not fossilised
- not enough evidence
  - *allow no evidence*
  - *allow description such as no DNA or no photographs*
- no-one has seen one
  - *allow no-one was there (at the time)*
- fossils are (usually) from bones

1

(b) (limbs / feet / legs / arms / hands are) flat(tened) / streamlined / paddle-like / wide

allow flippers / fins

1

for swimming

allow for movement / propulsion / pushing (through water or out of water onto land)

allow to hold on to mate

allow to kill prey

allow to fight / protect / defend

1

(c) behavioural

1

(d) 200 (million years ago)

allow two hundred

ignore addition of 'million years ago'

1

(e) 130 **and** 180

allow (one small square is 5 million years, so) 10 × 5

1

50 (million years)

ignore addition of 'million years'

1

(f) not all plesiosaur fossils have been discovered

1

some plesiosaur fossils will have been destroyed

1

(g) plesiosaur **B** existed before plesiosaur **C**

1

(h) any **two** from:

- bacteria have a short life-cycle (so rapid evolution)

  allow converse if clearly referring to fossils

  allow evolution in bacteria is fast(er)
- bacteria are continuing to evolve

  allow (many) fossilised species are extinct
- can study the DNA of bacteria

  allow not able to study DNA from fossils

  allow fossils do not contain DNA / chromosomes / genes / alleles
- bacteria are more easily available

  allow many / some fossils have been destroyed

  allow there are gaps in the fossil record

2

(i) (people with infections of antibiotic-resistant bacteria) cannot be treated (with those antibiotics)

allow (antibiotic-resistant) bacteria cannot be killed

allow antibiotics will not work

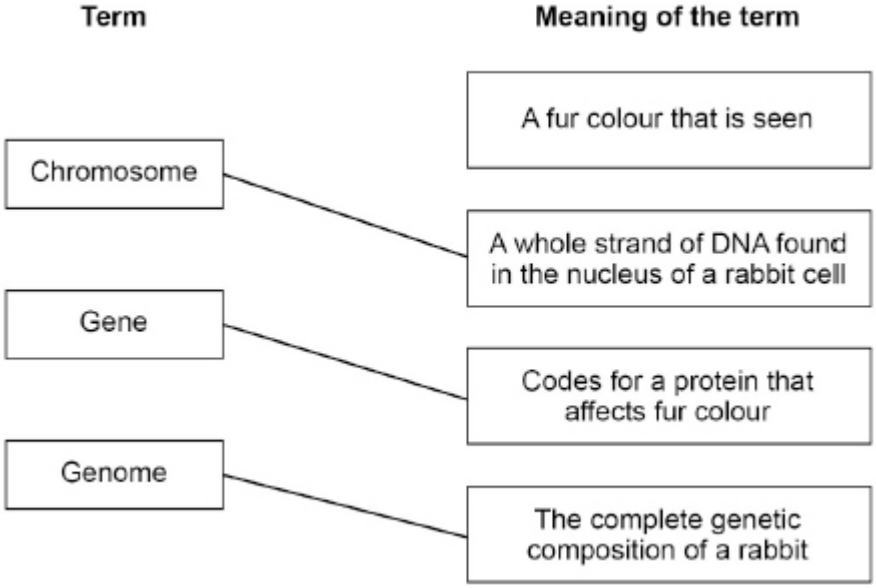
allow the infection may kill people

allow development of new antibiotic(s) is costly / slow

1

[13]

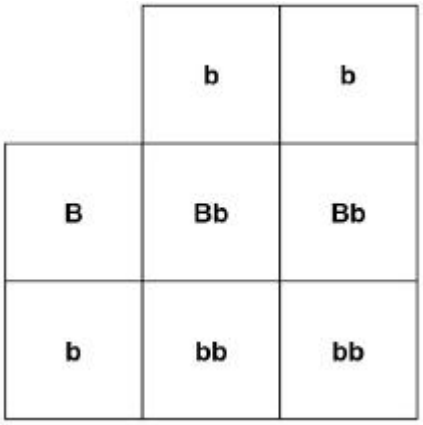
3. (a)



do **not** accept more than one line from a box on the left

3

(b)



gametes correct

allow in either position in Punnett square

1

offspring genotypes correctly derived

allow correct derivation of offspring genotypes from incorrect gametes

*allow 3 correctly derived offspring genotypes for **1** mark*

2

any **bb** offspring identified as having white fur

1

0.5

probability must match offspring genotypes if given

*allow 50% **or** 1 in 2 **or***

1:1 **or** $\frac{1}{2}$

*do **not** accept 1:2*

1

(c) sperm have one of each chromosome (pair)

*allow gamete(s) **or** sex cells for sperm throughout*
*allow sperm have one **set** of chromosomes / genes*
allow sperm (only) have one allele for each gene
allow sperm are haploid
allow sperm have half the (number / amount of) chromosomes (compared with a body cell)
allow sperm have 23 / 22 chromosomes
ignore sperm have one allele
ignore sperm have half the DNA / genes

1

sperm are produced by meiosis
or
body cells have two of each chromosome

allow body cells have pairs of chromosomes
allow body cells are diploid
allow body cells have 46 / 44 chromosomes
*allow **B** and **b** are (alleles) on 2 chromosomes (of the same pair)*

1

(d) 44

allow 22 pairs

1

(e) has two X (chromosomes)

allow XX
allow the rabbit is not XY
allow the rabbit does not have a Y (chromosome)
allow the rabbit only has X (chromosomes)
allow both (X) sex chromosomes are the same size

1

[12]

4.

(a) herbicide is added / sprayed (on soil / land / field / crop / maize)

1

(so) weeds killed **and** (GM) maize / crop not killed

*allow (so) unwanted plants killed **and** (GM) maize / crop not killed*

*allow **only** the weeds are killed*

1

(so) (GM) maize / crop has less competition for light / water / minerals / ions / space

allow (so) (GM) maize / crop has more light / water / minerals / ions / space

ignore reference to nutrients ignore (GM) maize / crop has less competition unqualified

1

(so more) photosynthesis to produce glucose which produces protein / cellulose / starch / fat (for growth)

allow (so more) photosynthesis to produce glucose which produces amino acids (for growth)

1

(b) use of herbicide kills weeds / wildflowers / plants (that are not the crop)

allow increased use of herbicide / weedkiller

ignore (more) use of pesticides ignore herbicide kills animals / insects

1

(causes) fewer weeds **or** fewer other plants therefore less food for animals / insects

allow fewer wildflowers therefore less food for animals / insects

allow less variety of food therefore lower number of species of animals / insects

*allow fewer weeds / wildflowers **or** fewer other plants therefore more competition for food*

1

(c) crops / plants may be insect / bee pollinated

allow for pollination

1

insects may be predators of (crop) pests

allow a description eg insects eat crop pests

allow bees may be predators of (crop) pests

1

(d) provides source of food / shelter (for insects / bees / pollinators)

allow protection / hiding from predators

1

(e) (as oxygen level increases decay increases due to aerobic) respiration of microorganisms

allow (aerobic) respiration of bacteria / fungi / decomposers

1

(which) releases carbon dioxide causing global warming

allow (which) releases carbon dioxide which is a greenhouse gas

allow (which) releases carbon dioxide causing the greenhouse effect

ignore (which) releases carbon dioxide causing climate change

1

[11]

5. (a) behaviour(al)

allow functional

1

(b) any **two** from:

- (new) predators

  allow hunters / poachers
- (new) disease / pathogen

  allow named example
- competition for food

  allow lack of food
- lack of mates

  allow competition for mates

  ignore habitat

  ignore competition unqualified

2

(c) (plesiosaur) died and sank (to bottom of ocean / sea)

*allow skeleton **or** hard parts for bones throughout*

ignore compression

ignore reference to oxygen

1

any **two** from:

- (plesiosaur died and) is buried in sediment / sand / mud / silt

  *do **not** accept plesiosaur (died and) is buried in rock(s)*
- (only) soft parts decayed / eaten

  or

  bones were not decayed / eaten
- bone(s) / remains replaced by minerals

  allow mineralisation of bones

  allow bone(s) left imprint in mud / sand / sediment (that then hardened to rock)

  ignore bones turned to stone / rock

2

(d) any **two** from:

- fossil record may be incomplete

  allow not all fossils have been found

  allow (some) fossils may have been destroyed

  allow there are not enough fossils (to study)
- DNA will be destroyed by fossil formation

  allow chromosomes / genes / alleles will be destroyed by fossil formation

  allow fossils do not contain DNA / chromosomes / genes / alleles
- no evidence of soft tissues which are decomposed (before fossilisation)
- only able to study phenotype (from fossils)

  allow only able to study observable characteristics (of bones / skeleton)

2

(e)

Classification group	**Name**
	eukaryota / eukaryote(s)
phylum / phyla	
order	
family	

***2** marks for 4 correct*

***1** mark for 2 or 3 correct*

***No** marks for 1 correct*

ignore italics and upper / lower case letters

2

(f) Cryptoclidus eurymerus

ignore italics and upper / lower case letters

*do **not** accept Cryptoclididae eurymerus*

1

[11]

6. (a) cell membrane

1

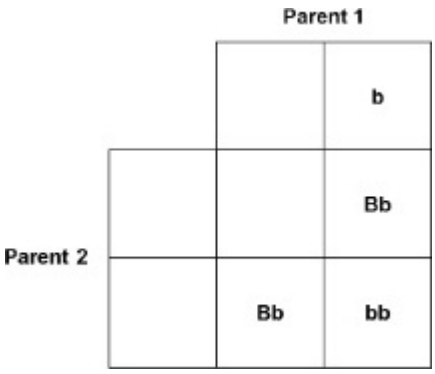
(b) dominant

1

(c) heterozygous

1

(d)



*allow **1** mark for **b** correct*

1

*allow **2** marks for all 3 offspring genotypes correctly derived from gametes shown / given*

*allow **1** mark for 1 or 2 offspring genotypes correctly derived from gametes shown / given*

derived genotypes must match parental gamete if given

2

(e) 25%

*response must match part **(d)***
*if no answer in part **(d)***
allow 25%

1

(f) screening

1

(g) mutation

1

(h) any **one** from:

- diet
- behaviour

allow descriptions

allow examples such as physical damage, scars, tattoos, (body) piercings, smoking, use of hair / nail colourings / dye

- infection
- named environmental cause of variation such as sunlight

allow air pollution
ignore climate unqualified

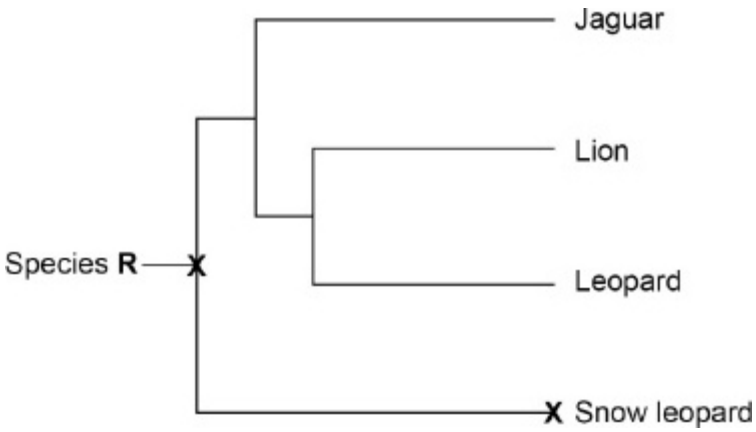
1

[10]

7. (a) leopard

1

(b) a branch / line drawn at any point between 'X' marks, labelled 'tiger(s)'



1

(c) a species that the other species evolved from

1

(d) natural selection

1

(e) any **two** from:

- drought
- ice age
- global warming

  if none of these awarded
  *allow **1** mark for climate change*
  ignore weather

- volcanic activity
- asteroid collision

  if neither of these awarded
  *allow **1** mark for catastrophic event **or** natural disaster*

- (new) predators

  allow named example
  allow hunters

- (new) disease / pathogen

  allow named example

- competition for food

  allow lack of food

- competition for mates

  allow lack of mates
  ignore competition unqualified

- lack of habitat

  or habitat change

  ignore environment change

  ignore isolation
  ignore pollution

2

(f) any **one** from:

- if species is extinct
- if (fossil) species is unknown
- evolution is (usually) slow
- (fossils) show (evolutionary) change

  ignore fossils are (usually) very old

1

(g) **(D) → B → A → E → C**

*allow **1** mark for link **B** → **A***

*allow **1** mark for link **A** → **E***

*allow **1** mark for link **E** → **C***

3

(h) antibiotic resistant bacteria will continue to evolve

1

bacteria reproduce very rapidly

1

[12]