

1 Living things can be classified into groups.

(a) Scientists look at structures inside cells to classify living things.

Suggest **one** structure found in cells that can be used to classify living things.

(1)

(b) The table below shows one system for classifying humans.

X	Animalia
Phylum	Chordata
Class	Mammalia
Order	Primates
Family	Hominidae
Genus	<i>Homo</i>
Species	<i>Sapiens</i>

Who devised this system of classification?

Tick **one** box.

Darwin

Linnaeus

Wallace

Woese

(1)

- (c) Look at the table above.
X is the largest category in this classification.
Name category **X**.

(1)

- (d) Give the **binomial name** of humans.
Use information in the table above.

(1)

- (e) Suggest **one** way that classification systems are useful to scientists.

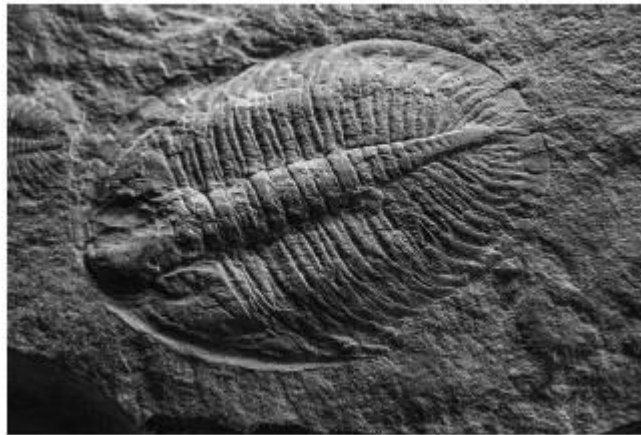
(1)

(Total 5 marks)

2

Figure 1 shows a photograph of a fossil of a trilobite.

Figure 1



(a) When were trilobites alive?

Tick **one** box.

- Between 20 and 50 years ago.
- Between 20 and 50 thousand years ago.
- Between 200 and 500 thousand years ago.
- Between 200 and 500 million years ago.

(1)

(b) Suggest how the fossil in **Figure 1** was formed.

Tick **one** box.

- The organism left a footprint behind.
- The organism was buried by rocks.
- The organism was frozen in ice.
- The organism was replaced by minerals.

(1)

(c) Trilobites are extinct.

What does extinct mean?

Tick **one** box.

- The species evolved into another species.
- The species does not have any soft tissue parts.
- There are no organisms of that species alive today.
- There are not enough of the species alive to reproduce.

(1)

- (d) Hyoliths are another type of fossil. Hyoliths were discovered in the 1800s and thought to be a type of snail.

In 2017 scientists used modern techniques to place hyoliths into a different group.

Suggest a modern technique that the scientists may have used.

Tick **one** box.

DNA analysis

Genetic modification

Light microscopy

Selective breeding

(1)

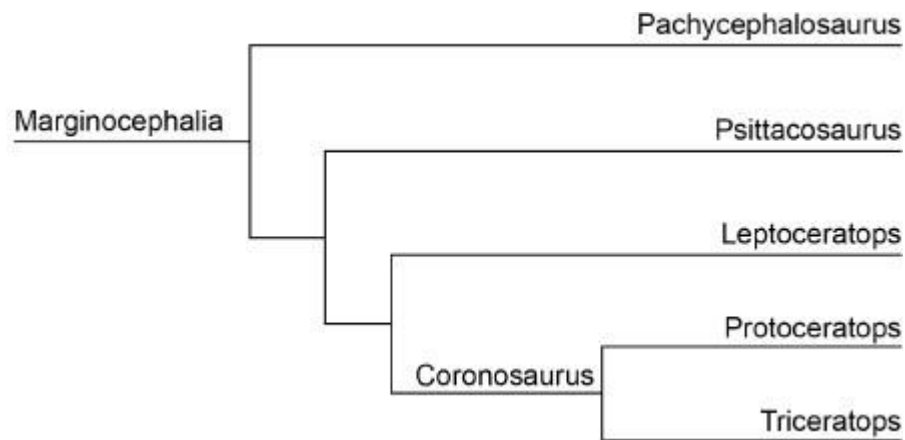
- (e) Which scientist developed the traditional classification system for all living organisms?

(1)

The fossil record is used to draw evolutionary trees.

Figure 2 shows an evolutionary tree for a group of dinosaurs.

Figure 2



- (f) Suggest which **two** of these dinosaurs are most closely related.

_____ and _____

(1)

(g) Name a common ancestor of Triceratops and Leptoceratops.

(1)

(h) How does the fossil record provide evidence for Darwin's theory of evolution?

Tick **one** box.

Dinosaurs became extinct 65 million years ago.

Fossils have been found in most countries of the world.

Older fossils have a simpler structure.

Trilobites belong to the arthropod group of animals.

(1)

(Total 8 marks)

3

This question is about reproduction.

(a) Complete the sentences.

Choose answers from the box.

asexual	clones	eggs	gametes
meiosis	mitosis	sexual	variation

Identical offspring are produced by _____ reproduction.

These offspring are called_____.

In another form of reproduction male and female _____
join at fertilisation.

This leads to _____ in the offspring.

The embryo grows by a type of cell division called_____.

(5)

(b) The body cells of a kangaroo have 16 chromosomes.
How many chromosomes will an egg cell of a kangaroo have?

Tick **one** box.

4 8 16 32

(1)

(c) Which sex chromosomes will be in the body cells of a male kangaroo?

Tick **one** box.

XX XZ XY YZ

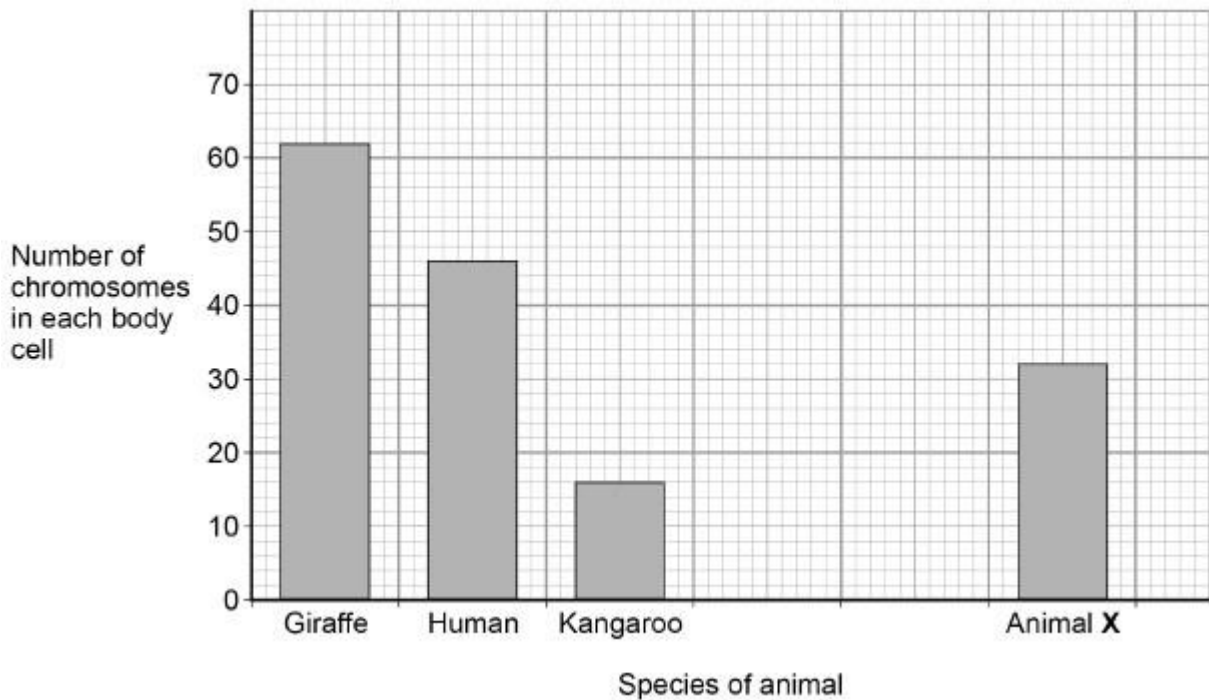
(1)

Different species of animal have different numbers of chromosomes in their body cells.

The table shows the chromosome number of some species.

Species of animal	Number of chromosomes in each body cell
Giraffe	62
Human	46
Kangaroo	16
Snail	24
Zebra fish	50

(d) Plot the data from the table for the snail and for the zebra fish on the graph.



(2)

(e) Look at the graph.

How many more chromosomes are there in the body cells of giraffes than in the body cells of animal X?

Number of chromosomes = _____

(1)

(f) A student concluded:

‘the bigger an animal, the more chromosomes it has in each body cell.’

This is **not** a valid conclusion.

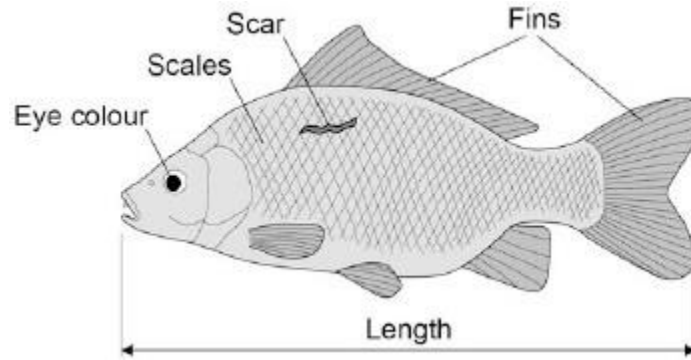
Give **one** reason why.

(1)

(Total 11 marks)

4 **Figure 1** shows a fish called a carp.

Figure 1



The characteristics of an animal can be a result of:

- only genetic causes
- only environmental causes
- both genetic **and** environmental causes.

(a) Give **one** characteristic shown in **Figure 1** for each different cause.

Only genetic causes _____

Only environmental causes _____

Both genetic **and** environmental causes _____

(3)

(b) Two alleles control the body colour of carp:

- brown (**B**)
- blue (**b**).

The brown allele is dominant to the blue allele.

The genetic cross from breeding two carp is shown in **Figure 2**.

Figure 2

	B	b
b	Bb	
b		

Complete **Figure 2**.

(2)

(c) Draw a ring around **one** blue offspring shown in **Figure 2**.

(1)

(d) What is the probability that the offspring from this genetic cross will be brown?

Tick **two** boxes.

0

0.25

0.5

1.0

(1)

(e) Carp can produce large numbers of offspring.

The two carp crossed in **Figure 2** had 260 000 offspring.

Approximately how many offspring are expected to be brown?

Brown carp offspring = _____

(1)

(f) A pond contains carp used for breeding.

The carp for breeding are brown or blue.

A red carp has been seen.

The red carp was **not** added to the pond.

Suggest what might have caused the red carp to appear.

(1)

(Total 9 marks)

5

Pompe disorder is an inherited condition that affects thousands of people.

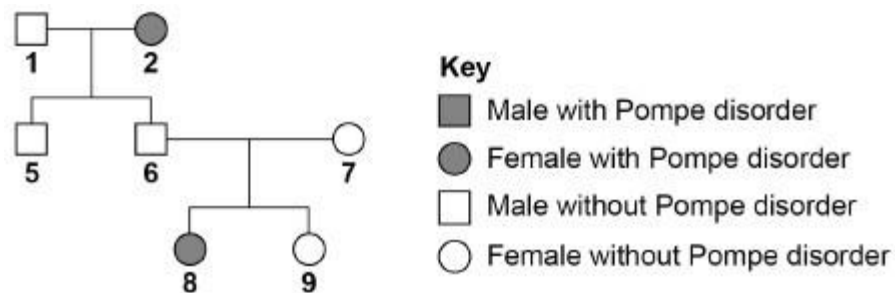
Pompe disorder is caused by the GAA gene.

(a) What is a gene made of?

(1)

Figure 1 shows the inheritance of Pompe disorder in one family.

Figure 1



Pompe disorder is caused by a recessive allele.

r is the allele for Pompe disorder

R is the allele for no Pompe disorder

(b) Person **2** has Pompe disorder.

What is the genotype of person **2**?

(1)

(c) Look at **Figure 1**.

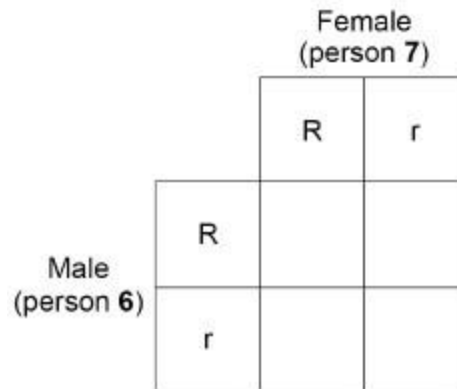
Explain how we can tell Pompe disorder is caused by a recessive allele.

(2)

(d) Persons **6** and **7** decide to have another child.

Complete the genetic diagram in **Figure 2**.

Figure 2



(2)

(e) Draw a ring around any offspring in **Figure 2** who will have Pompe disorder.

(1)

(f) What is the probability of persons **6** and **7** having another child with Pompe disorder?

(1)

(g) A new drug to treat Pompe disorder has been successfully trialled on mice.

The drug now has approval for the next stage of clinical testing.

Describe the next steps in testing the new drug before it can be approved for use.

(4)

(Total 12 marks)

6

Rose black spot is a disease that affects rose plants.

The leaves of infected plants develop black spots, then turn yellow and drop off the plant.

(a) Give the name of the substance in leaves that is broken down when leaves change from green to yellow.

(1)

(b) Rose black spot can be transferred between plants in water droplets.

Draw **one** line from each method of black spot prevention to the explanation of why that method works.

Method	Explanation
Plant roses with large gaps between plants	Fungus spores are removed
	Helps leaves dry faster
	Increases infection in warm weather
Clear dead leaves	Prevents rain falling on the leaves

(2)

(c) Fungicides can be sprayed on rose plants to prevent infection with black spot.

Some fungicides appear to be less effective than they were 10 years ago.

Suggest why the fungicides are less effective now compared with 10 years ago.

(1)

Some gardeners claim that rose black spot has become more of a problem since the Clean Air Act of 1958.

The table shows how the mass of sulfur dioxide (SO₂) emissions has changed.

Year	SO ₂ emissions from each source in megagrams			Total SO ₂ emissions in megagrams
	Power stations	Manufacturing industry	Homes and transport	
1970	3300	1750	X	6200
1980	3250	900	550	4700
1990	2900	450	300	3650
2000	900	150	150	1200
2010	250	100	50	400

(d) The sulfur dioxide emissions in the table are shown in megagrams.

Calculate value X in the table.

X = _____ Mg

(1)

(e) Give your answer to part (d) in kilograms.

1 megagram = 1000 kilograms

X = _____ Kg

(1)

(f) How have power stations reduced their sulfur dioxide emissions?

Tick **one** box.

Power stations used more at night than during the day

Power stations generate more electricity

Power stations use less coal

Power stations use more oil

(1)

A gardener concluded that the information in the table shows the Clean Air Act of 1958 changed sulfur dioxide emissions.

(g) Give **one** reason to support the conclusion.

(1)

(h) Give **one** reason why the conclusion may **not** be valid.

(1)

(i) Suggest how changing sulfur dioxide emissions increased the number of cases of rose black spot.

(2)

(Total 11 marks)

Mark schemes

- 1**
- (a) Relevant organelle found in cells such as nucleus, mitochondria 1
- (b) Linnaeus 1
- (c) Kingdom 1
- (d) *Homo Sapiens*
ignore underlining, italics or not, capitals or not 1
- (e) Any **one** from:
- to know which species are closely related
or
study evolution
 - to monitor biodiversity
 - to identify different organisms such as two different species 1
- 2**
- (a) between 200 and 500 million years ago 2
- (b) the organism was replaced by minerals 1
- (c) there are no organisms of that species alive today 1
- (d) DNA analysis 1
- (e) (Carl) Linnaeus 1
- (f) Protoceratops **and** Triceratops
allow
*Coronosaurus **and** Triceratops*
or
*Protoceratops **and** Coronosaurus*
or
*Marginocephalia **and** Pachycephalosaurus* 1
- (g) Marginocephalia 1
- (h) older fossils have a simpler structure 1

[8]

3	(a) asexual	1
	clones	1
	gametes	1
	variation	1
	mitosis	
	<i>in this order</i>	1
	(b) 8	1
	(c) XY	1
	(d) both bars correctly plotted	1
	correct labels on x-axis	
	<i>allow labels mark even if bars incorrect</i>	1
	(e) 30	1
	(f) any one from:	
	• because zebra fish is small and has high number of chromosomes	
	• not all animals are listed	
	• not enough data	
	• animals have different sizes during their life but the chromosome number stays the same	
	<i>allow other sensible conclusions</i>	1

[11]

- 4** (a) **only genetic causes**
any **one** from:
- pattern of scales
 - number of fins
 - eye colour

1

only environmental causes:

- scar

1

both genetic and environmental causes:

- length

1

(b)

	B	b
b		bb
b	Bb	bb

allow 2 correct for 1 mark

2

(c) any bb circled

1

(d) 0.5

allow ecf from 04.2

1

(e) $(260\,000 / 2 =) 130\,000$

allow ecf from 04.4

1

(f) mutation

allow change in diet / hormones / DNA

1

[9]

5 (a) (small section of) DNA

1

(b) rr

1

(c) persons **6** and **7** (don't have Pompe but) have a child with Pompe disorder

1

(therefore) each parent must be a carrier

or

have a copy of the recessive gene

allow neither parent has Pompe disorder

1

(d)

		mother (number 7)	
		R	r
father (number 6)	R	RR	Rr
	r	Rr	rr

1 mark for first row

1

1 mark for second row

1

(e) ring drawn around **rr**

1

(f) 0.25

allow 1 in 4

*do **not** accept 1:4*

1

(g) tested on healthy volunteers

1

(then) tested on patients

1

any **two** from:

- monitored for safety
- monitored for dosage
- monitored for efficacy
- carried out as a double-blind trial
- use of placebo

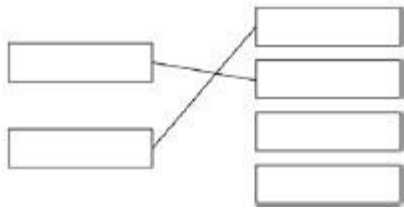
2

[12]

6 (a) chlorophyll

ignore chloroplast

1



(b)

do **not** accept more than one line from each method

1
1

(c) black spot / fungus has evolved / mutated to be resistant (to the fungicide)

1

(d) $(6200 - (3300 + 1750) =) 1150$ (Mg)

1

(e) $1150 \times 1000 = 1150000$ (kg)

1

(f) power stations use less coal

1

(g) less sulfur dioxide from all sources / total

1

(h) any **one** from:

- data only shown from 1970
- fewer power stations (therefore fewer emissions)

1

(i) less sulfur dioxide

or

less acid rain

1

(that) destroyed fungus / spores

1

[11]