Inheritance 5

Name: _____

Class: _____

Date: _____

Time: **90 minutes**

Marks: **84 marks**

Comments:

1. *Pseudomonas* bacteria cause infections in hospital patients.

A new strain of *Pseudomonas* bacteria has evolved. This new strain can only be killed by one antibiotic called fluroquinolone.

Scientists want to prevent the new strain of *Pseudomonas* from spreading in the human population.

Explain the advice doctors should be given to prevent the spread of the new strain.

(Total 6 marks)

2. The genetic material in cells is made of DNA.

(a) Which **two** of the following describe the structure of DNA?

Tick **two** boxes.

A double helix ☐

A monomer ☐

A polymer ☐

A protein ☐

A single strand ☐

(2)

(b) Complete the sentences.

Choose answers from the box.

clone	**disorder**	**gene**
genome	**mutation**	

A small section of DNA which codes for one protein is called a _____ .

All the genetic material of an organism is called its _____ .

(2)

(c) Gametes (sex cells) contain half the amount of DNA compared to body cells.

Give the names of the **two** types of gametes in humans.

_____ and _____

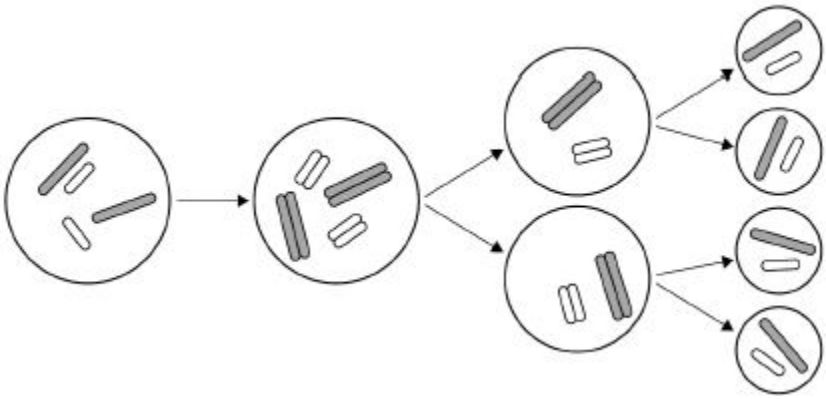
(1)

(d) What is the process called when the gametes join?

_____

(1)

(e) The diagram below shows cell division by meiosis to form gametes.



Which **two** features in the diagram above show that this cell division is meiosis and **not** mitosis?

Tick **two** boxes.

The cell divides twice ☐

The chromosomes pull apart into the new cells ☐

The cytoplasm divides into new cells ☐

The DNA is copied ☐

The new cells have half the number of chromosomes ☐

(2)

(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 ☐

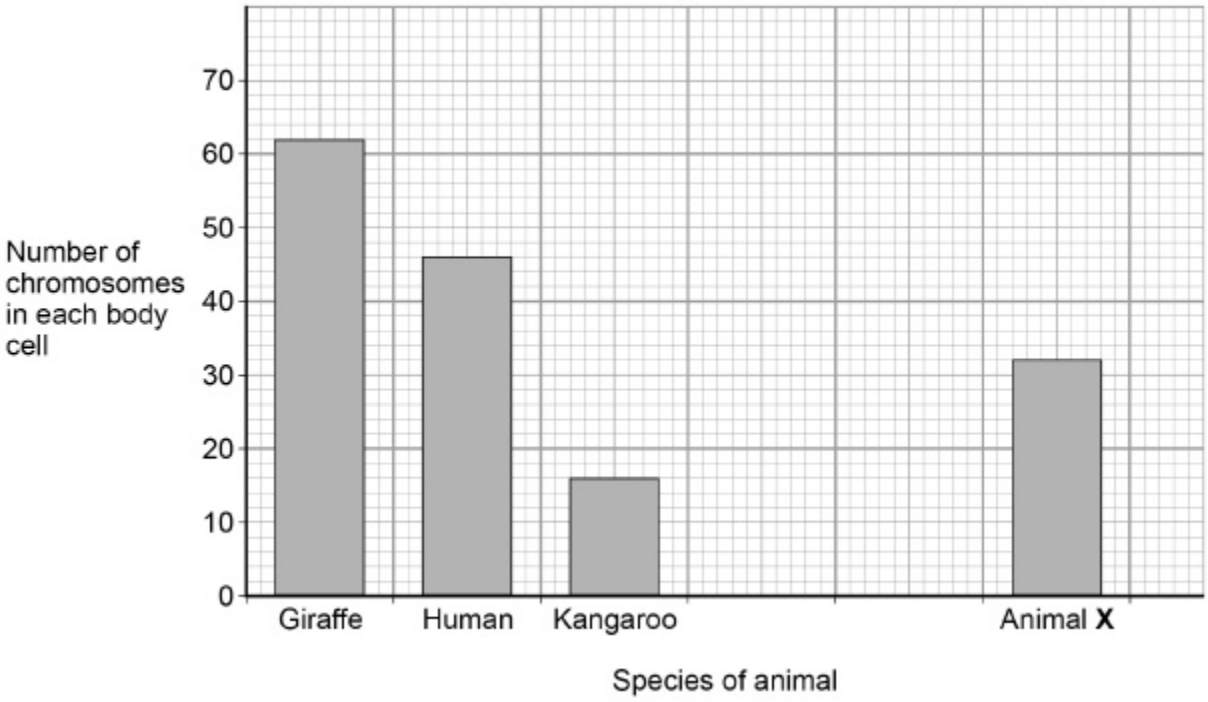
(1)

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.

_____

_____

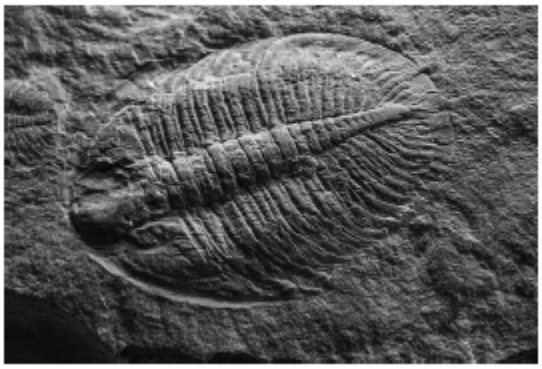
(1)

(Total 11 marks)

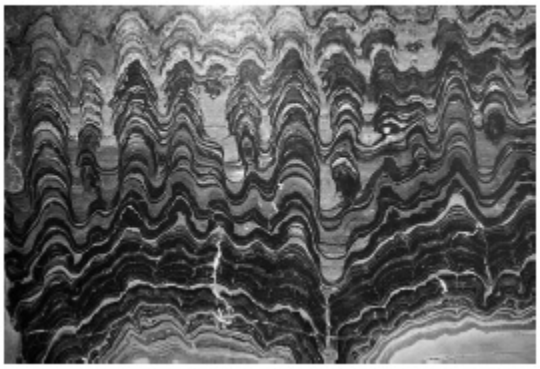
4. **Figure 1** shows photographs of fossils of extinct organisms.

Figure 1

Fossil A



Fossil B



(a) What is a fossil?

_____

_____

_____

_____

(2)

(b) What does extinct mean?

_____

_____

(1)

(c) **Fossil A** is a trilobite which had a shell, eyes and limbs.

Fossil B is a stromatolite formed by layers of microorganisms.

Which **two** statements suggest that the microorganisms lived at an earlier time than the trilobites?

Tick **two** boxes.

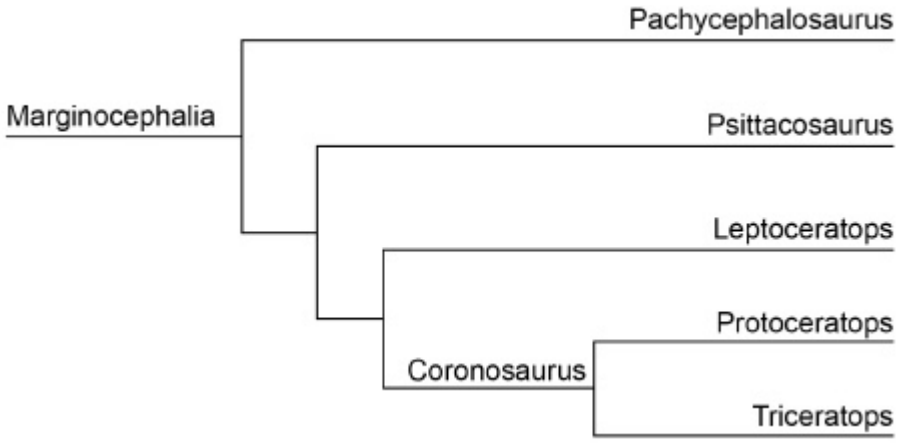
Microorganisms have a more simple structure than a trilobite.	☐
Stromatolites are found in older rock than trilobites.	☐
Stromatolites are layers of minerals left behind by millions of microorganisms.	☐
Stromatolites structures are larger than trilobite fossils.	☐
Trilobites lived in the sediment on the sea floor.	☐

(2)

Figure 2 shows an evolutionary tree drawn from the fossil record in the 1970s.

The evolutionary tree is for a group of dinosaurs.

Figure 2



(d) Scientists in the 1970s did radiocarbon dating on all the fossils.

Which fossil gave the earliest radiocarbon date?

_____

(1)

(e) Suggest which **two** types of dinosaur fossils showed the most similar features.

_____

(1)

(f) Give **one** reason why this evolutionary tree might **not** be correct.

_____

_____

(1)

(Total 8 marks)

5. This question is about reproduction.

(a) Describe the difference between the way hormonal and non-hormonal methods of contraception work.

Give **one** example of each method of contraception.

_____

_____

_____

_____

_____

_____

(3)

The urine of women using hormonal methods of contraception contains high levels of progesterone.

Concentrations of 1–3 ng/dm^3 of progesterone are found in the water of rivers near sewage outflow points.

Scientists investigated the effect of different concentrations of progesterone in water on fish reproduction.

This is the method used.

1. Prepare tanks of water containing different concentrations of progesterone.

2. Put a breeding pair of fish into each tank.

3. Record the number of eggs produced per day by the female in each tank for 14 days.

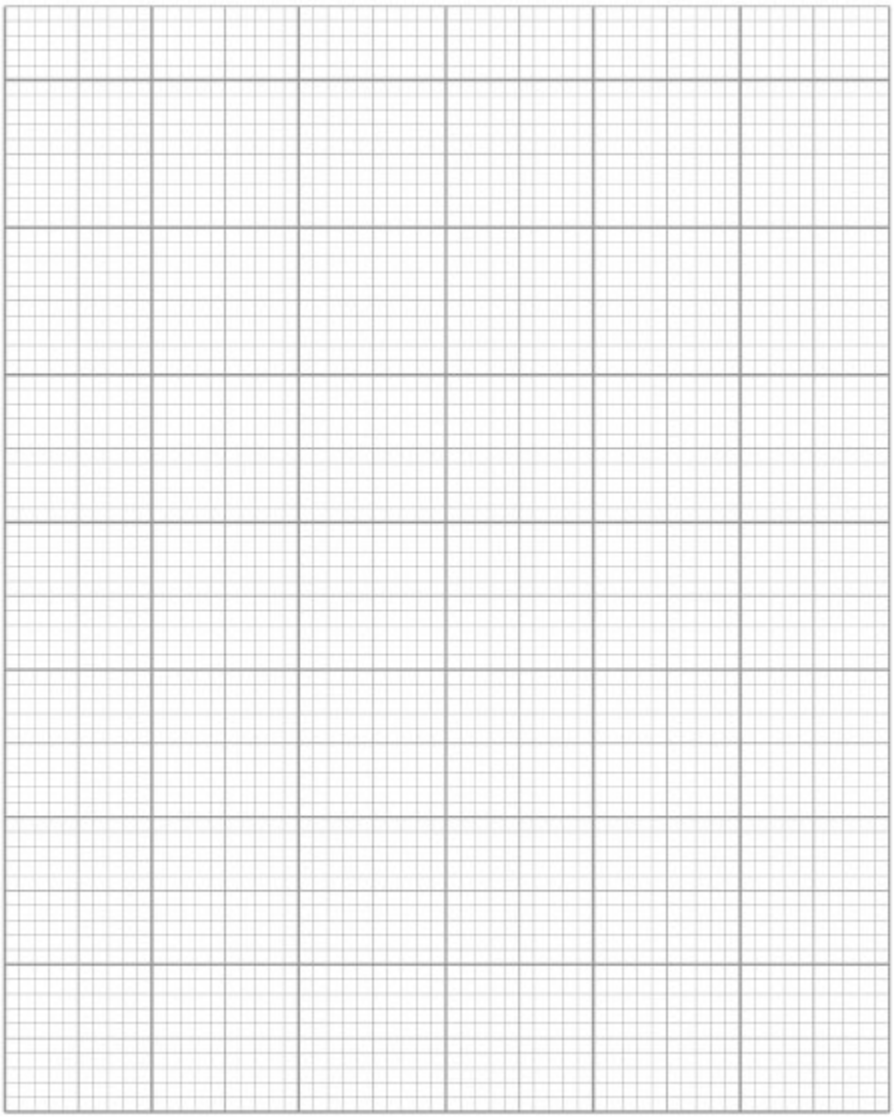
The table shows the results.

Concentration of progesterone in water in ng/dm^3	**Mean number of eggs produced per day**
0.0	28.6
0.8	4.5
1.5	3.2
3.0	2.8
10.0	1.1
20.0	0.2

(b) Plot the data from the table on the grid.

You should:

- label each axis
- use a suitable scale
- draw a line of best fit.



(4)

(c) Describe the effect on fish reproduction of the concentrations of progesterone found in rivers near sewage outflows.

Use data from your graph.

(2)

(Total 9 marks)

6. Control of blood glucose concentration is an important aspect of homeostasis.

When the blood glucose concentration is too high the hormone insulin is released.

(a) Name the hormone released when the blood glucose concentration is too low.

(1)

(b) Explain how the **two** hormones keep the blood glucose concentration at the correct level in a healthy human body.

(5)

The two hormones which control blood glucose concentration are proteins.

Proteins are made according to information stored in the DNA structure of genes.

(c) Describe the structure of DNA.

(2)

(d) Describe how DNA controls the structure of a protein.

(2)

(e) Polydactyly and cystic fibrosis are both inherited disorders caused by faulty DNA.

- Polydactyly is caused by a dominant allele.
- Cystic fibrosis is caused by a recessive allele.

Mother **A** has polydactyly.

Mother **B** has cystic fibrosis.

Mother **A** is more likely to have a child with polydactyly than Mother **B** having a child with cystic fibrosis.

Explain why.

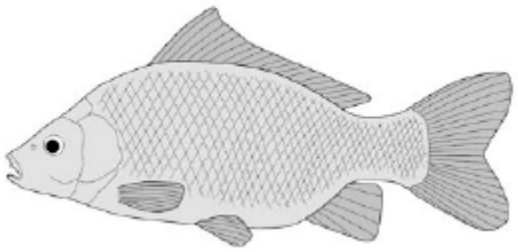
Assume the fathers of the children have no alleles for polydactyly or cystic fibrosis.

You may use genetic diagrams in your answer.

(3)

(Total 13 marks)

7. The figure below shows a carp.



(a) A mutation causes a blue colour in some carp.

What is a mutation?

_____

_____

(1)

(b) Suggest how a mutation could cause a different colour in carp.

_____

_____

(1)

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

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

The brown allele is dominant to the blue allele.

Two carp that are heterozygous for colour are crossed and produce 2.6×10^5 offspring.

Approximately how many of the offspring are expected to be blue?

Draw a genetic diagram to explain your answer.

Give your answer in standard form.

Number of offspring expected to be blue = _____

(5)

(d) A scientist wanted to find out whether a brown carp has the genotype **BB** or **Bb**.

Describe what genetic cross a scientist could do to determine this.

_____

_____

_____

_____

_____

_____

(2)

(Total 9 marks)

8. In the 18th century a binomial system of grouping similar organisms was developed.

Before the binomial system was developed the common briar rose had the following names:

- *Rosa sylvestris inodora seu canina*
- *Rosa sylvestris alba cum rubore folio glabro*.

In the binomial system, the same rose is called *Rosa canina*.

(a) One advantage of the binomial system is that the name is shorter than the names used before this system.

Suggest **two other** advantages of the binomial system.

1. _____

_____

2. _____

_____

(2)

(b) Classification systems have changed in the last 50 years.

Give **one** reason why we now have more information to classify organisms.

_____

_____

(1)

(c) ‘Archaea’ is one of the groups in the three-domain system of classification.

Give **two** features of the domain Archaea.

1. _____

_____

2. _____

_____

(2)

(Total 5 marks)

9. Moose are animals that eat grass.

Figure 1 shows a moose.

Figure 1

© Wildnerdpix/iStock/Thinkstock

Figure 2 shows a food chain.

Figure 2

Grass ⟶ Moose ⟶ Wolves

(a) Name the secondary consumer shown in **Figure 2**.

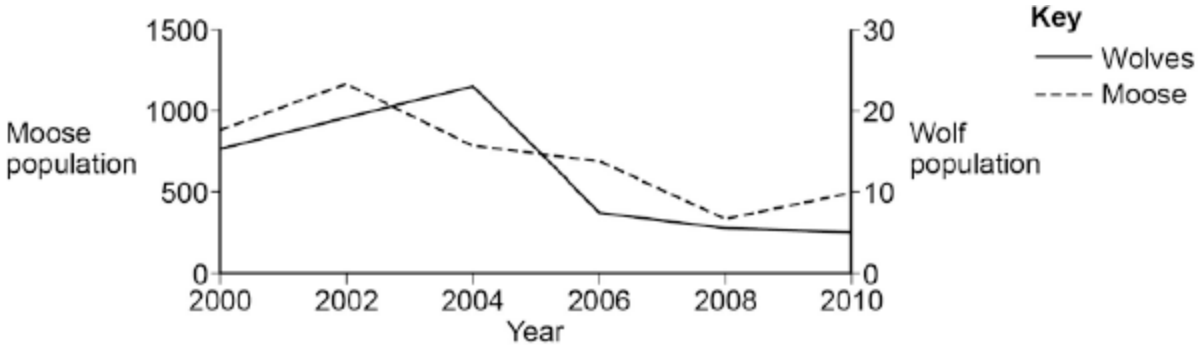
_____

(1)

(b) **Figure 3** shows how the moose population and wolf population have changed in one area.

This is a predator-prey cycle.

Figure 3



In 2004 the line on **Figure 3** for wolves is above the line for moose.

How does **Figure 3** show that there are more moose than wolves in 2004?

_____

_____

(1)

(c) Suggest why the moose population decreased between 2002 and 2004.

Use information from **Figure 3**.

_____

_____

(1)

(d) The number of wolves is one biotic factor that could affect the size of the moose population.

Give **two** other biotic factors that could affect the size of the moose population.

1. _____

_____

2. _____

_____

(2)

(e) Moose have distinct characteristics such as antlers.

Describe how moose may have evolved to have large antlers.

(5)

(Total 10 marks)

10. 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	*Homo*
Species	*Sapiens*

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)

1.

Level 3: Relevant points (advice / reasons) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (advice / reasons) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

precautions with reasons

- do not prescribe fluroquinolone / antibiotics for mild infections
- because they will get better due to the body's normal immune system

- do not prescribe fluroquinolone / antibiotics for viral infections / colds / flu
- because antibiotics do not kill viruses

- if you do prescribe fluroquinolone / antibiotics make sure the patient finishes the course
- because any bacteria left may develop resistance, survive and reproduce rapidly (due to lack of competition)

- only prescribe fluroquinolone if the patient has the new strain
- because routine use would lead to an increase in resistant bacteria

other relevant content

- doctors and nurses in the practice / hospital should be using antibacterial / alcohol hand wash between each patient **and / or** disinfectant to clean wards
- to kill (resistant) bacteria

- doctors should isolate patients with this strain of bacteria
- to prevent other patients getting the resistant infection

[6]

2.

(a) a double helix

1

a polymer

1

(b) gene

1

genome

1

in this order only

(c) sperm **and** egg(s) / ova / ovum

in either order

1

(d) fertilisation

1

(e) the cell divides twice

1

the new cells have half the number of chromosomes

1

[8]

3. (a) asexual

1

clones

1

gametes

1

variation

1

mitosis

in this order

1

(b) 8

1

(c) XY

1

(d) both bars correctly plotted

1

correct labels on x-axis

allow labels mark even if bars incorrect

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

allow other sensible conclusions

1

[11]

4. (a) remains / traces of organisms

1

from millions of years ago

1

(b) no individuals of a species still alive

1

(c) microorganisms have a simpler structure than a trilobite

1

stromatolites are found in older rock than trilobites

1

(d) Marginocephalia

1

(e) Protoceratops **and** Triceratops
(in either order)

allow

*Coronosaurus **and** Triceratops*

or

*Coronosaurus **and** Protoceratops*

or

*Marginocephalia **and** Pachycephalosaurus*

1

(f) any **one** from:

- the fossil record is not complete
- new fossils may have been found since 1970s
- DNA / chemical analysis may have given new information

1

[8]

5. (a) (hormonal uses chemicals / synthetic) hormones to prevent an egg being released

allow 'to prevent maturation of eggs'

1

(non-hormonal has a barrier which) prevents the sperm reaching an egg **or** prevents implantation

1

a correct example of each type

1

(b) suitable scales and axes labels correct

1

all points plotted accurately

*allow **1** mark for 5 accurate points*

2

line of best fit

*allow a bar chart for max **3** marks*

1

(c) decrease egg production

1

by between 6–10 times

allow ecf from their graph

1

[9]

6. (a) glucagon

correct spelling only

1

(b) if glucose too high (insulin causes) glucose to enter liver / muscle cells
or
glucose to be converted to glycogen

1

so blood glucose levels fall

1

when glucose gets too low (glucagon causes) glycogen breakdown in liver / muscle cells

allow ecf from part (a)

1

so glucose enters blood and raises level again

1

this is called negative feedback

1

(c) any **two** from:

- polymer
- made of two strands
- (twisted) in a double helix

allow:

- *backbone of strands contains sugar and phosphate groups*
- *(cross) linked by pairs of bases*
- *correct names of four bases or base pairs*

2

(d) contains a code

1

for a sequence of amino acids which forms a specific protein

1

(e) mother **A** (polydactyly)

50% / half of children will have polydactyly if parent is heterozygous as it only takes one allele to show the disorder and half the sperm / ova / gametes will have faulty allele.

1

(and) all / 100% will have polydactyly if parent is homozygous as faulty gene will always be passed on

1

(but) for mother **B** (cystic fibrosis) none / 0% of children will have cystic fibrosis as it would need a second allele from the other parent before the disorder would be present

allow genetic diagram(s) if correct and offspring ratio clearly indicated.

1

[13]

7. (a) a change in the DNA / gene

1

(b) produces a different protein / enzyme that is responsible for colour

1

(c) parents genotype both Bb

allow correctly derived gametes

1

offspring genotypes correctly derived

1

bb identified as blue

allow ring around bb only

1

65 000

allow ecf or 260 000 × 0.25

1

6.5×10^4

1

(d) cross with **bb** / blue carp

*allow annotated Punnett square diagram(s) of cross with **bb** carp*

1

if any offspring are blue, the parent was **Bb** / heterozygous

allow converse

1

*allow cross with known **Bb** carp*

*if any offspring are blue, other parent was **Bb** / heterozygous*

[9]

8. (a) same name to everyone

1

(genus) part gives information on ancestry

1

(b) any **one** from:

- DNA / RNA analysis
- improvements to (electron) microscopes
- improved understanding of biochemical processes
- evidence of internal structures being more developed

1

(c) <u>primitive</u> bacteria / prokaryotes

1

(often) from extreme environments / extremophiles

1

[5]

9. (a) wolves

1

(b) moose and wolves are on different scales

1

(c) wolf population has increased so more moose are eaten

*do **not** accept there are more wolves than moose*

1

(d) any **two** from:

- (other) predators

  allow correct examples

  allow 'humans hunting moose'
- (new) pathogens

  allow diseases
- competition

2

(e) any **four** from:

- variation (within species) of antler size

  allow description relating to antlers
- (caused by) different genes
- as a result of sexual reproduction / process of meiosis / mutation
- (phenotype) most suited to environment most likely to survive and breed

  ignore natural selection unqualified
- genes for large antlers (more likely to be) passed on to next generation

4

reference to mate selection
or
fighting
or
gaining territory
or
competition for mates
or
avoiding predation

1

[10]

10. (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

[5]