Q1.

(a) What is the proteome of a cell?

_____

_____

_____

_____

(1)

(b) Give **two** structural differences between a molecule of messenger RNA (mRNA) and a molecule of transfer RNA (tRNA).

1. _____

_____

_____

_____

_____

2. _____

_____

_____

_____

_____

(2)

(c) Starting with mRNA in the cytoplasm, describe how translation leads to the production of a polypeptide.

Do **not** include descriptions of transcription and splicing in your answer.

(5)

(Total 8 marks)

Q2.

Scientists investigated the species of insects found in a wood and in a nearby wheat field. The scientists collected insects by placing traps at sites chosen at random both in the wood and in the wheat field.

The table shows the data collected in the wood and in the wheat field.

Species of insect	Number of organisms of each species

	Wood	Wheat field
Bird-cherry oat aphid	0	216
Beech aphid	563	0
Large white butterfly	20	0
Lacewing	12	3
7-spot ladybird	36	0
2-spot ladybird	9	1
Total number of organisms of all species	640	220

(a) The scientists collected insects at sites chosen at random. Explain the importance of the sites being chosen at random.

_____

_____

_____

(1)

(b) (i) Use the formula

$$d = \frac{N(N-1)}{\sum n(N-1)}$$

to calculate the index of diversity for the insects caught in the wood, where

d = index of diversity
N = total number of organisms of all species
n = total number of organisms of each species

Show your working.

Answer _____

(2)

(ii) Without carrying out any further calculations, estimate whether the index of diversity for the wheat field would be higher or lower than the index of diversity for the wood.

Explain how you arrived at your answer.

_____

_____

(2)

(c) A journalist concluded that this investigation showed that farming reduces species diversity.
Evaluate this conclusion.

(2)

(d) Farmers were offered grants by the government to plant hedges around their fields.
Explain the effect planting hedges could have on the index of diversity for animals.

(2)
(Total 9 marks)

Q3.

Costa Rica is a Central American country. It has a high level of species diversity.

(a) There are over 12 000 species of plants in Costa Rica. Explain how this has resulted in a high species diversity of animals.

(2)

(b) The number of species present is one way to measure biodiversity. Explain why an index of diversity may be a more useful measure of biodiversity.

(2)

(c) Crops grown in Costa Rica are sprayed with pesticides. Pesticides are substances that kill pests. Scientists think that pollution of water by pesticides has reduced the number of species of frog.

(i) Frogs lay their eggs in pools of water. These eggs are small. Use this information to explain why frogs' eggs are very likely to be affected by pesticides in the water.

(2)

(ii) An increase in temperature leads to evaporation of water. Suggest how evaporation may increase the effect of pesticides on frogs' eggs.

(1)

(Total 7 marks)

Q4.

The Amazonian forest today contains a very high diversity of bird species.

- Over the last 2 000 000 years, long periods of dry climate caused this forest to separate into a number of smaller forests.
- Different plant communities developed in each of these smaller forests.
- Each time the climate became wetter again, the smaller forests grew in size and merged to reform the Amazonian forest.

(a) Use the information provided to explain how a very high diversity of bird species

has developed in the Amazonian forest.

(5)

(b) Speciation is far less frequent in the reformed Amazonian forest. Suggest one reason for this.

_____

_____

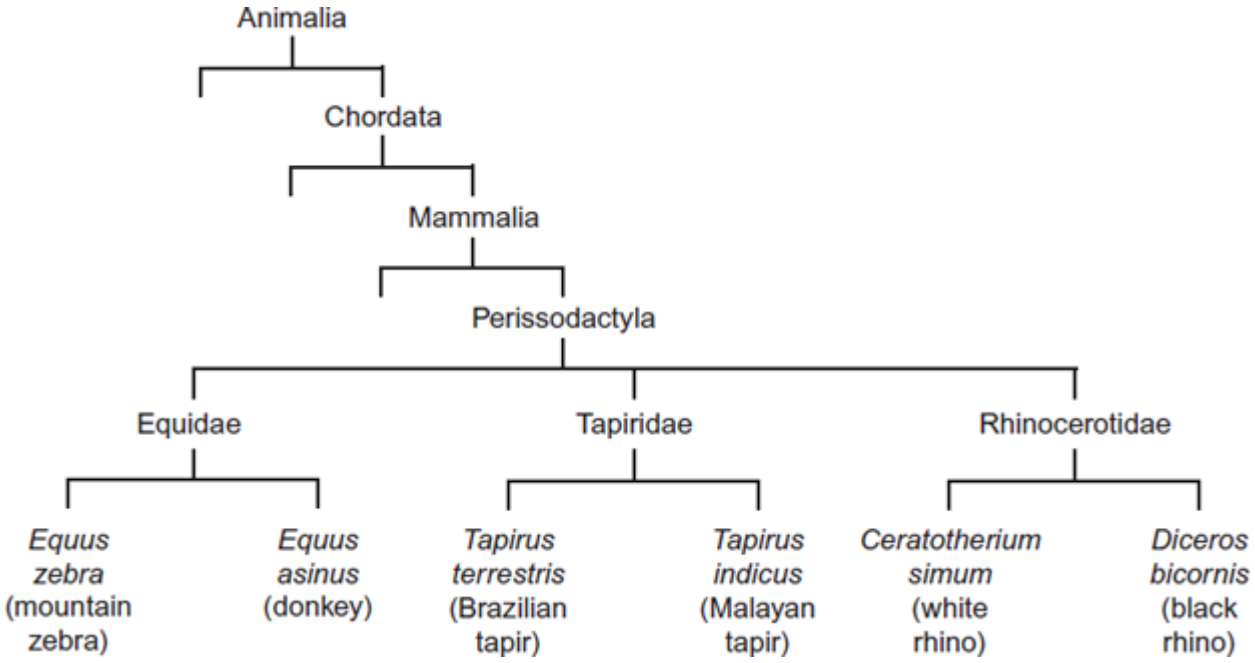
_____

(1)

(Total 6 marks)

Q5.

The following figure shows how some animals with hooves are classified.



(a) This type of classification can be described as a phylogenetic hierarchy.

(i) What is meant by a **hierarchy**?

_____

_____

_____

_____

(Extra space) _____

_____

(2)

(ii) How many different families are shown in the figure?

(1)

(iii) To which phylum does the white rhino belong?

_____

(1)

(b) (i) Explain the role of independent segregation in meiosis.

_____

_____

_____

_____

(2)

(ii) A zedonk is the offspring produced from breeding a mountain zebra with a donkey.

- The body cells of a mountain zebra contain 32 chromosomes.
- The body cells of a donkey contain 62 chromosomes.

Use this information to suggest why zedonks are usually infertile.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q6.

(a) Give **three** ways in which courtship behaviour increases the probability of successful mating.

1. _____

2. _____

3. _____

(3)

Male field crickets produce a courtship song by vibrating their wings. The natural song contains seven low-pitched ‘chirps’ followed by two high-pitched ‘ticks’.

Scientists recorded this song and used a computer program to change the number of chirps and ticks. Different versions of the song were then played back continuously to females in the presence of a male. This male had previously had one wing removed so he

could not produce a courtship song. The scientists determined the percentage of females that showed courtship behaviour within 5 minutes of hearing each recorded song.

The results of the scientists' playback experiments are shown in the table below.

Version of recorded song played	Number of chirps	Number of ticks	Percentage of females that showed courtship behaviour within 5 minutes
K	No song played		30
L (natural)	7	2	83
M	7	0	70
N	0	2	65
O	7	1	83
P	7	4	82

(b) The scientists wanted to know if the recorded natural song was less effective than the natural song in stimulating courtship behaviour.

Suggest how the scientists could determine if the recorded natural song (**L**) was less effective than the natural song.

_____

_____

_____

_____

_____

(2)

(c) A student concluded from the data in the table above that the number of chirps and ticks is essential for successfully stimulating courtship behaviour.

Do these data support this conclusion? Explain your answer.

_____

_____

_____

_____

_____

_____

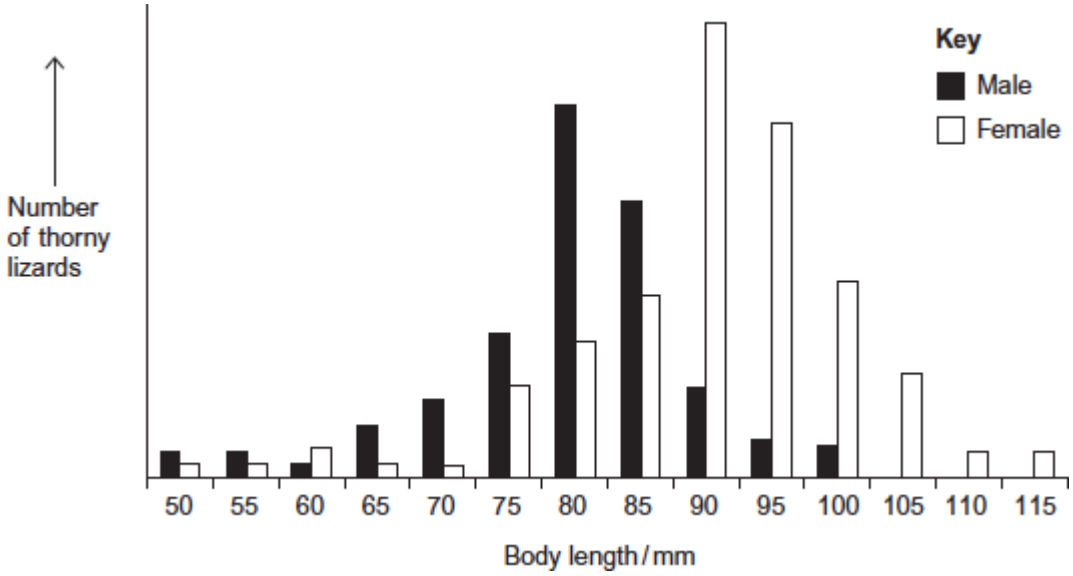
[Extra space] _____

(4)

(Total 9 marks)

Q7.

(a) Ecologists measured the body lengths of male and female thorny lizards living in the same habitat. The ecologists measured the body lengths to the nearest 5 mm. The graph shows how they presented their results.



Give **two** differences in the variation in body length of male and female thorny lizards.

1. _____

_____

2. _____

_____

(2)

(b) Another group of ecologists investigated biodiversity of lizards in a woodland area.

Their results are shown in the table.

Lizard species	Number of individuals
Dominican giant anole	5
Hispaniolan green anole	11
Hispaniolan stout anole	22
Bark anole	91
Hispaniolan grass anole	13
Cope's galliwasp	5
Cochran's least gecko	8
Peninsula least gecko	1

The index of diversity can be calculated using the formula

$$d = \frac{N(N-1)}{\Sigma n(n-1)}$$

where

d = index of diversity
N = total number of organisms of all species
n = total number of organisms of each species

(i) Use the formula to calculate the index of diversity of lizards in the woodland area.
Show your working.

Answer = _____

(2)

(ii) The ecologists also determined the index of diversity of lizards in an oil palm plantation next to the woodland area. They found fewer species of plant in the oil palm plantation. Lizards feed on plants and insects.

Explain why fewer species of plant would lead to fewer species of lizard in the oil palm plantation.

_____

_____

[Extra space] _____

(3)

(Total 7 marks)

Q8.

A student investigated the distribution of plants in a heathland.

The table below shows the number of plants he found in a sample area of 1 m^2.

Species of plant	Number counted in 1 m^2
Common heather	2
Red fescue	14
Vetch	2
White clover	8

(a) What is the species richness of this sample?

(1)

(b) Calculate the index of diversity of this sample. Show your working.

Use the following formula to calculate the index of diversity.

$$d = \frac{N(N-1)}{\Sigma n(n-1)}$$

where N is the total number of organisms of all species
and n is the total number of organisms of each species

Index of diversity = _____

(2)

(c) Suggest how this student would obtain data to give a more precise value for the index of diversity of this habitat.

_____

_____

_____

_____

_____

(2)

(Total 5 marks)

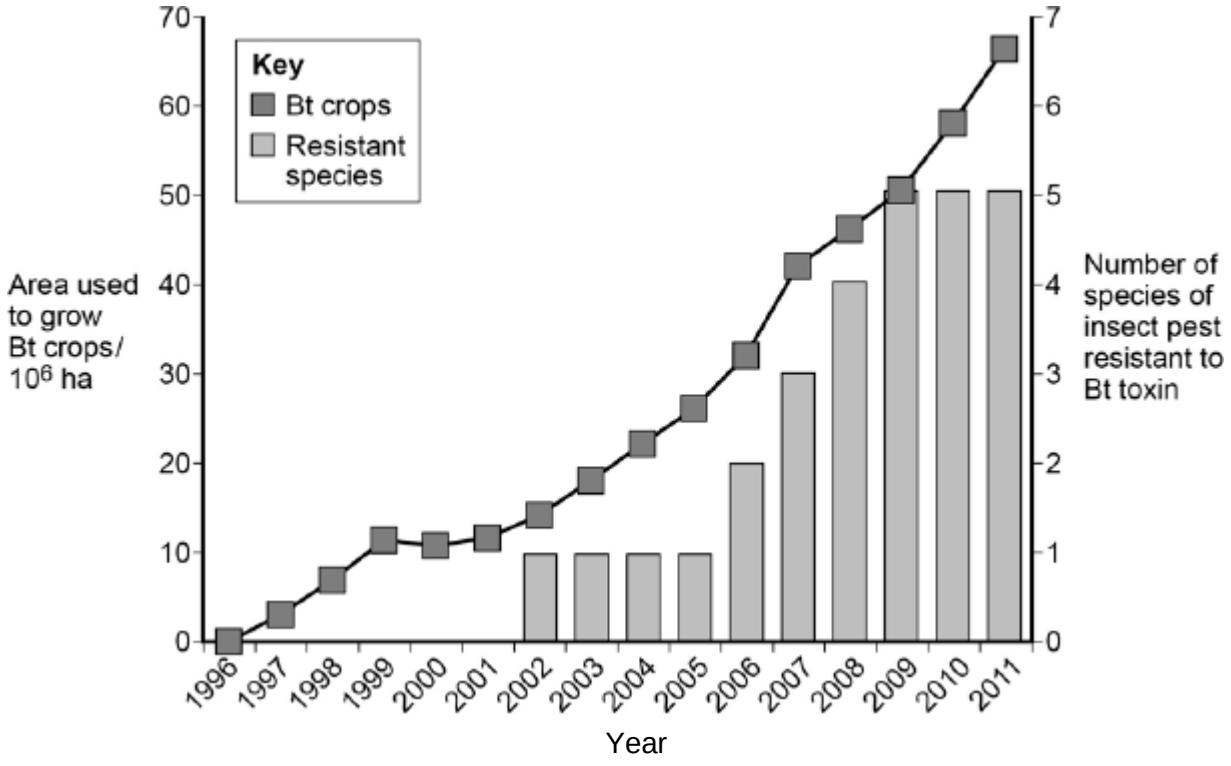
Q9.

To reduce the damage caused by insect pests, some farmers spray their fields of crop plants with pesticide. Many of these pesticides have been shown to cause environmental damage.

Bt plants have been genetically modified to produce a toxin that kills insect pests. The use of Bt crop plants has led to a reduction in the use of pesticides.

Scientists have found that some species of insect pest have become resistant to the toxin produced by the Bt crop plants.

The figure below shows information about the use of Bt crops and the number of species of insect pest resistant to the Bt toxin in one country.



(a) Can you conclude that the insect pest resistant to Bt toxin found in the years 2002

to 2005 was the same insect species? Explain your answer.

_____

_____

(1)

(b) One farmer stated that the increase in the use of Bt crop plants had caused a mutation in one of the insect species and that this mutation had spread to other species of insect. Was he correct? Explain your answer.

_____

_____

_____

_____

_____

_____

_____

_____

(Extra space) _____

_____

_____

_____

(4)

(c) There was a time lag between the introduction of Bt crops and the appearance of the first insect species that was resistant to the Bt toxin.
Explain why there was a time lag.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

Q10.

Read the following passage.

Some insect species feed on the leaves of plants. These leaf-chewers bite off pieces of leaves. Other insect species feed on sap from phloem or xylem. These sap-feeders have sharp, piercing mouthparts that they insert directly into either xylem or phloem. Leaf-chewers and insects that feed on xylem sap are active feeders; this means they use their jaw muscles to obtain their food. In contrast, insects that feed on phloem sap are passive feeders; this means they do not use their jaw muscles to take up sap from phloem.

Feeding on phloem sap presents two problems. Firstly, phloem sap has sa high sugar concentration. This could lead to a high pressure of liquid in the insect's gut because of water entering the gut from the insect's body tissues. A phloem-sap-feeder polymerises some of these sugars into polysaccharides which are passed out of its anus as 'honey dew'. The secondproblem is that phloem sap has a low concentration of amino acids. Phloem-sap-feeding insects rely on bacteria in their guts to produce amino acids. Each phloem-sap-feeding insect receives a few of these bacteria from its parent. This has resulted in a reduction in the genetic diversity of the bacteria found within these insects.

A scientist investigated the effect of three different insects on the growth of a plant called the goldenrod. He found that leaf-chewing insects and xylem-sap-feeding insects caused a much greater reduction in total leaf area than did phloem-sap-feeding insects.

Use the information from the passage and your own knowledge to answer the following questions.

(a) Phloem-sap-feeders are passive feeders (lines 6–7).
Phloem-sap-feeders do not use their jaw muscles to take up sap from phloem.

Explain why they can take up sap without using their jaw muscles.

_____

_____

_____

_____

_____

_____

_____

(3)

(b) A phloem-sap-feeder polymerises some of these sugars into polysaccharides (line 12-13).
Suggest the advantage of this.

_____

_____

_____

_____

_____

(2)

(c) Each phloem-sap-feeding insect receives a few of these bacteria from its parent. (lines 16–17).

Suggest how this has caused a reduction in genetic diversity of the bacteria.

_____

_____

_____

_____

_____

(2)

(d) A scientist found that leaf-chewers and xylem-sap-feeders had a greater effect on plant growth than phloem-sap-feeders (lines 20–22).

Other than environmental factors, give **two** features the scientist would have controlled in his experiment to ensure this conclusion was valid.

1. _____

_____

2. _____

_____

(2)

(e) The scientist used the reduction in total leaf area of the experimental plants as an indicator of plant growth.

Outline a method by which you could find the area of a plant leaf.

_____

_____

_____

(1)

(Total 10 marks)

Q11.

A student investigated the species richness and index of diversity of insects in three different habitats, a barley field, a wheat field and a hedge.

Her results are shown in the table below.

	Number of individuals of each insect species in each habitat		
Insect species	**Barley field**	**Wheat field**	**Hedge**
a	32	4	34
b	78	0	12
c	0	126	22
d	0	5	12
e	0	0	8
f	0	0	42
g	0	25	13
h	0	10	12
i	0	0	12
j	42	41	0
Species richness			
Total number of insects (N)			

(a) Complete the table for species richness and the total number of insects of each habitat.

(2)

(b) Calculate the index of diversity of the wheat field.

Use the following formula:

$$d = \frac{N(N-1)}{\sum n(n-1)}$$

where N = total number of organisms

and n = total number of organisms of each species.

_____

_____

(2)

(c) The index of diversity of the insects was higher in the hedge than in the barley field. Suggest why.

_____

(3)

(Total 7 marks)

Q12.

(a) There are many different species of field mouse in Europe. Using a phylogenetic classification, all of these species have names that start with *Apodemus*.

What information does this give about field mice?

(2)

The long-tailed field mouse, *Apodemus sylvaticus*, is a small mammal common in mainland Britain.

(b) Complete **Table 1** to show the classification of the long-tailed field mouse.

Table 1

Taxon	Name of Taxon
	Eukarya
Kingdom	Animalia
	Chordata
	Mammalia
Order	Rodentia
Family	Muridae

(2)

The St. Kilda field mouse lives only on one island off the coast of Scotland. It is very similar in appearance to the long-tailed field mouse but is larger and has lighter coloured fur.

Biologists wanted to find out if the St. Kilda field mouse and the long-tailed field mouse populations belonged to different species. They measured the length of the same features of a large number of individuals from the two populations.

The results are shown in **Table 2**.

Table 2

Population	Mean length (±SD) / mm	
	Head and body	Tail
St. Kilda field mouse	112.3 (±9.3)	105.5 (±8.4)
Long-tailed field mouse	95.2 (±8.2)	90.2 (±7.3)

(c) Do the data in **Table 2** provide evidence that the two populations belong to different species? Use calculations of ratios to support your answer.

(3)

(d) Describe how breeding experiments could determine whether the two populations are from the same species.

(2)

(Total 9 marks)

Q13.

(a) A student used a dilution series to investigate the number of cells present in a liquid culture of bacteria.

Describe how he made a 1 in 10 dilution and then used **this** to make a 1 in 1000 dilution of the original liquid culture of bacteria.

(3)

(b) Using an optical microscope, the student determined there were 15 cells in 0.004 mm^3 of the 1 in 1000 dilution of the culture.

Calculate the number of cells in 1 cm^3 of undiluted liquid culture.

Answer = _____ Number of cells

(2)

(c) The student looked at cells in the 1 in 10 dilution during his preliminary work. He decided **not** to use this dilution to determine the number of cells in the undiluted liquid culture.

Suggest an explanation for the student's decision.

(2)

(d) On some farms, animals are routinely given antibiotics in their food.

Scientists investigated whether these farm animals had antibiotic-resistant bacteria in their intestines. They tested the bacteria for resistance to two antibiotics, tetracycline and streptomycin.

Their results are shown in the table.

Antibiotic	**Percentage of antibiotic-resistant bacteria**
Tetracycline	29
Streptomycin	13

Suggest and explain **one** reason why bacteria resistant to tetracycline are more common than bacteria resistant to streptomycin in these farm animals.

(2)

(e) In recent years, these farm animals have not been given tetracycline in their food. Despite this, the percentage of bacteria resistant to tetracycline has remained constant.

Suggest **one** reason why.

(1)

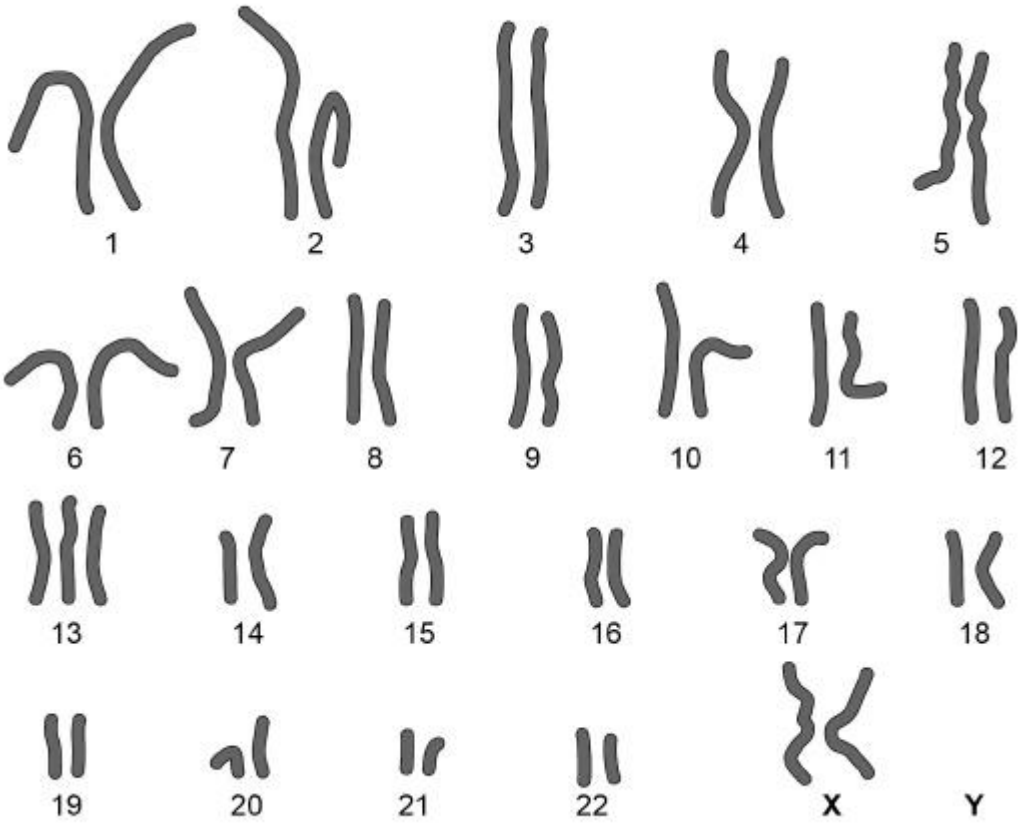
(Total 10 marks)

Q14.

Patau syndrome is a condition caused by a mutation affecting chromosome number. All the cells of the body will have this mutation.

Figure 1 shows the chromosomes from one of the cells of a female who has Patau syndrome.

Figure 1



(a) What is the effect of Patau syndrome on the chromosomes of this female?

(1)

(b) Describe how the change in chromosome number in Patau syndrome was

produced.

(2)

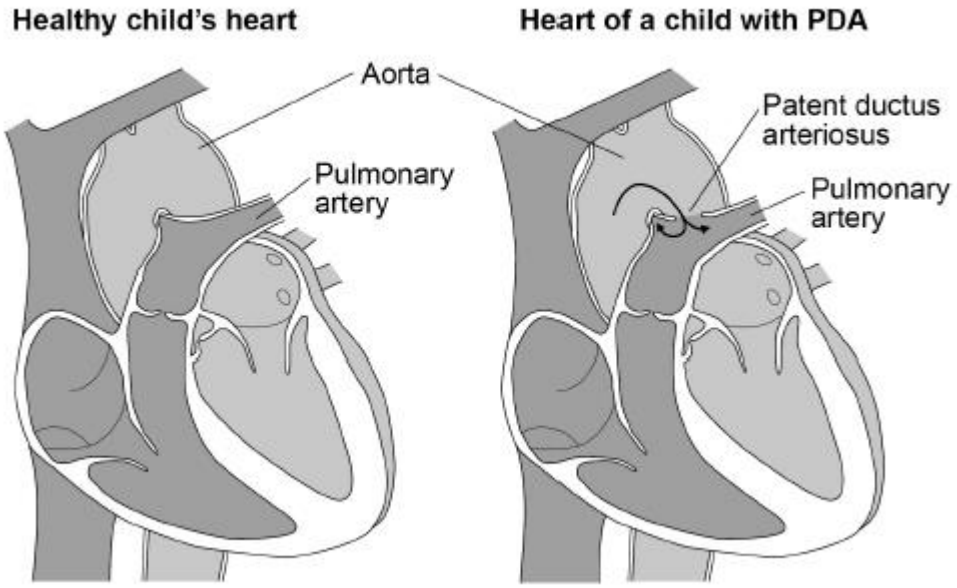
(c) Explain why all the cells of the body will have this mutation.

(2)

(d) Most children born with Patau syndrome die in the first 12 months, often due to defects of circulation of blood.

One of these defects is patent ductus arteriosus (PDA). This can result in some of the blood flowing between the aorta and the pulmonary artery.
Figure 2 shows a healthy child's heart and the heart of a child with PDA.

Figure 2



Suggest how the flow of some of the blood between the aorta and pulmonary artery could cause children to die in the first 12 months.

(3)

(Total 8 marks)

Q15.

A student investigated the effect of three types of disinfectant on the growth of *Lactobacillus* bacteria.

During the investigation, the student:

- boiled the agar before pouring the agar plates
- transferred 0.5 cm^3 of a diluted liquid culture of *Lactobacillus* onto each agar plate
- left some agar plates as controls
- added to other agar plates different concentrations of the disinfectants as shown in the table in part (a).

After 2 days, she counted the number of colonies of bacteria on each agar plate.

(a) Explain the purpose of:

boiling the agar _____

_____

_____

_____

transferring the same volume of liquid culture onto each agar plate.

_____

_____

_____

_____

(2)

The three disinfectants used by the student were Lysol, propan-2-ol and ammonia.

The table shows the student's results.

Concentration of disinfectant / arbitrary units	**Number of colonies of bacteria**		
	Lysol	**Propan-2-ol**	**Ammonia**
0	300	300	300
5	0	290	300
10	0	195	295
15	0	0	275
20	0	0	240

The liquid culture the student transferred was diluted by 1 in 10 000 (10^{-4}).

(b) Use information in this question to calculate how many bacteria were present in 1 cm^3 of undiluted liquid culture.

Answer = _____

(2)

(c) The student concluded that the minimum concentration of propan-2-ol needed to stop the growth of *Lactobacillus* was 15 units. This conclusion is incorrect.

Describe how you could obtain a more accurate estimate of the minimum concentration of propan-2-ol needed to stop the growth of this species of bacterium.

_____

_____

_____

_____

_____

_____

_____

(2)

(Total 6 marks)

Q16.

(a) Define each of the following terms.

Species _____

_____

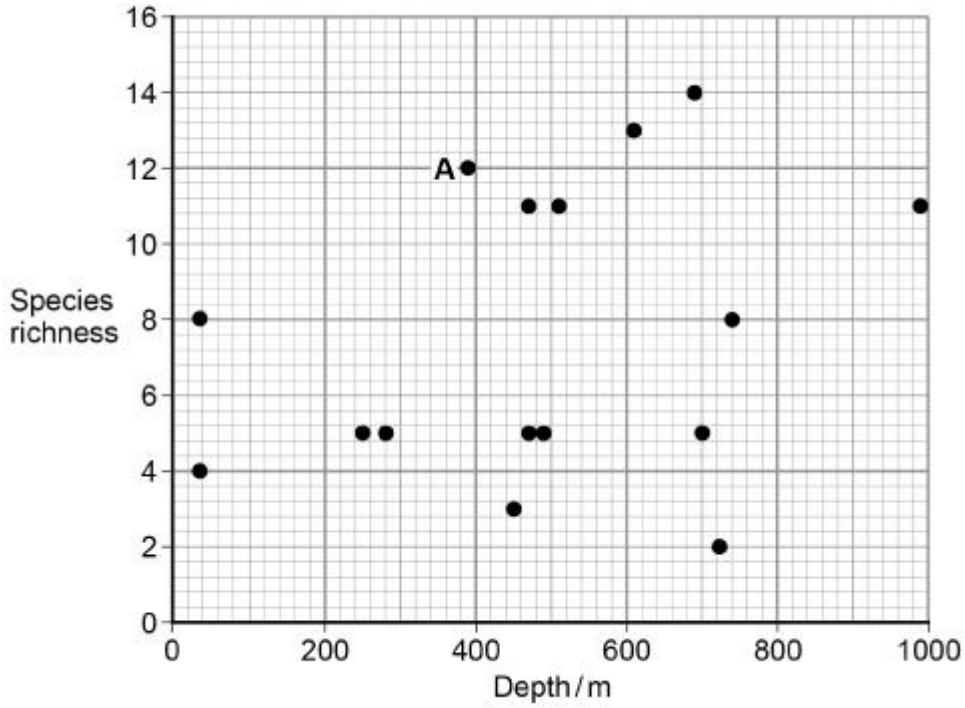
Species richness _____

_____

(2)

Scientists investigated the species richness of fish caught at various depths in the Pacific Ocean close to the western coast of Chile.

The graph shows the scientists' results. 68% of all the fish caught in this investigation came from sample **A**.



(b) What is the modal value of species richness?

_____

(1)

(c) 68% of all the fish caught in this investigation came from sample **A**.
A student thought this showed that sample **A** had a greater index of diversity than any of the other samples.

It is **not** possible to draw this conclusion from the given data. Give reasons why.

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 6 marks)

Q1.

(a) (The proteome is the full) range of / number of different proteins that a cell is able to produce (at a given time);

OR

(The proteome is the full) range of / number of different proteins the genome / DNA is able to code for;

Do not accept number of proteins unqualified

1

(b) 1. mRNA does not have hydrogen bonds / base pairing, tRNA does;
OR
mRNA is linear / straight chain, tRNA is cloverleaf;

2. mRNA does not have an amino acid binding site, tRNA does;
Accept mRNA cannot carry an amino acid, tRNA can

3. mRNA has more nucleotides;
Accept mRNA is longer or converse

4. (Different) mRNAs have different lengths, all tRNAs are similar / same length;

5. mRNA has codons, tRNA has an anticodon;
Statements must be comparative

2 max

(c) 1. mRNA associates with a ribosome / ribosome attaches to mRNA;
Idea of association is required

2. Ribosome moves to / finds the start codon / AUG;

3. tRNA brings / carries (appropriate / specific) amino acid;
Must be explicitly stated and not inferred.

4. Anticodon (on tRNA complementary) to codon (on mRNA);

5. Ribosome moves along to next codon;
OR
Ribosome 'fits' around two codons / can fit two tRNAs;
Must be explicitly stated and not inferred.

6. (Process repeated and) amino acids join by peptide bonds / condensation reaction (to form polypeptide);
OR
(Process repeated and) amino acids joined using (energy from) ATP (to form polypeptide);

5

[8]

Q2.

(a) Removes bias;

1

(b) (i) 1. 1.28 / 1.29 / 1.285 / 1.3

1. Ignore more than 3dp

2. Answer incorrect but shows clear understanding of Σ

2. Σ = 318250. Allow mark if denominator written out. Incorrect denominator but evidence of understanding gains mark

2

(ii) Diversity index would be lower (NO MARK)

Assume wheat field if site unspecified

1. Fewer species / Beech aphid / Large white butterfly / 7-spot ladybird absent / only three species / species diversity lower / mostly one species / mostly bird-cherry aphid;

1. Allow species richness in context of few species

2. Fewer plant species;

2. Allow one type of food source if clearly plant

2

(c) For:

1. Data support the claim / evidence supports claim;

1. Ignore reference to correlation / causation

Against:

2. Only wheat field / only comparing with wood / one type of habitat / only insects considered;

2 max

(d) 1. Greater variety of plants;

2. Another habitat / more habitats / places to live / niches / another food source / more food types;

2. Answers referring to 'more food' should not be credited. Allow reference to either animal or plant as foods

2

[9]

Q3.

(a) Greater variety / different foods;

More habitats / niches;

Answers only referring to 'more food' should not be credited but allow 'more food sources'.

2

(b) Also measures number of individuals in a species / different proportions of species;

Some species may be present in low / high numbers;

First marking point can only be awarded if there is a reference to species.

2

(c) (i) Large surface area to volume (ratio) / permeable / thin (outer layer);
Correct reference to diffusion;

Accept (Eggs) cannot move (out of water) for 1 mark

2

(ii) Concentration (of pesticide) is increased;

1

[7]

Q4.

(a) 1. No interbreeding / gene pools are separate / <u>geographic(al)</u> isolation;

Accept: all marks if answer written in context of producing increased diversity of plants

1 Do not award this mark in context of new species being formed and then not interbreeding

1 Accept reproductive isolation as an alternative to no interbreeding

2. Mutation;

2 Accept: genetic variation

3. Different selection pressures / different foods / niches / habitats;

3 Accept: different environment / biotic / abiotic conditions or <u>named</u> condition

3 Neutral: different climates

4. Adapted organisms survive and breed / differential reproductive success;

5. Change / increase in allele frequency / frequencies;

5

(b) Similar / same environmental / abiotic / biotic factors / similar / same selection pressures / no isolation / gene flow can occur (within a species);

Accept: same environment

1

[6]

Q5.

(a) (i) 1. Groups within groups;

*Accept: idea of larg<u>er</u> groups at the top **or** small<u>er</u> groups at the bottom*

2. No overlap (between groups);

2

(ii) **3**;

1

(iii) Chordata;

Accept: if phonetically correct eg 'Cordata'

1

(b) (i) 1. (To provide) genetic variation;
Genetic variation must be directly stated and not implied

2. (Allows) different combinations of maternal and paternal chromosomes / alleles;
Accept: any allele of one gene can combine with any allele of another gene

2

(ii) 1. (Zedonk has) 47 / odd / uneven number of chromosomes;
Accept: diploid number would be odd
Reject: if wrong number of chromosomes is given

2. Chromosomes cannot pair / are not homologous / chromosome number cannot be halved / meiosis cannot occur / sex cells / haploid cells are not produced;
Accept: cannot have half a chromosome
***Q** Reject: meiosis cannot occur **in** sex cells*

2

[8]

Q6.

(a) 1. Recognise / identify / attract same species;
Ignore: references to letting them produce fertile offspring

2. Stimulates / synchronises mating / production / release of gametes;

3. Recognition / attraction of mate / opposite sex;
Accept finding a mate
Accept: gender

4. Indication of (sexual) maturity / fertility / receptivity / readiness to mate;
5. Formation of a pair bond / bond between two organisms (to have / raise young).

3 max

(b) 1. Use a (real) male (with intact wings / no wing removed);
Mark ignoring reference to birds / or other types of animals
Accept: use a real cricket, since only males sing

2. Determine (percentage) response (of females compared with **L**).
*Accept: compare results with **L***

2

(c) 1. Lowest / only 30% courtship with no song / K / (or) courtship still occurred when no song played / **K**;
Note: throughout, for courtship accept response / stimulation / reaction
Neutral: references to methodology
Answer must make clear there is no song / version K

2. Reduced courtship when no ticks / M / there is some courtship when no

ticks / M;

3. Reduced courtship when no chirps / N / there is some courtship when no chirps / N;

Accept: use of figures from the table <u>in an explanation</u>

4. (So) courtship must involve a visual stimulus / other factor involved;

5. Chirps more important as lowest courtship when none / N / ticks less important as similar courtship when changed / M;

Must make comparison to gain mark

6. Data only show presence and absence of chirps / 0 and 7 chirps.

Note: 'courtship still occurred when no sound played so a visual stimulus / other factor / something else (e.g. pheromone?) must be involved'

= 2 marks

4 max

[9]

Q7.

(a) 1. Females are (generally) longer / larger / bigger / up to 115(mm) / males are (generally) shorter / smaller / up to 100(mm);

Ignore: tall

Accept: females have a larger / 90 modal / peak / most common value <u>and</u> males have a smaller / 80 modal / peak / most common value

Accept mean length of females greater / mean length of males shorter

Reject: use of mean in relation to 80 mm or 90 mm

Reject: Most of the females are 90 mm long / most of the males are 80 mm long

2. Females show a greater range / variation / males show a narrower range / variation.

Accept: correct use of figures from the graph: the range of males is 50 to 100 <u>and</u> of females is 50 to 115 / the spread is 50 for males <u>and</u> 65 for females

2

(b) (i) **2.6** to **2.7** = 2 marks;
Incorrect answer but evidence of a numerator of **24180 OR 156 × 155** <u>or</u> denominator of **9014** = 1 mark;

2

(ii) (Fewer plant species) − no mark

1. (So) few(er) habitats / niches;

Ignore habitat size

***Q** Neutral: fewer homes*

2. (So) lower diversity of <u>insects</u> / fewer <u>insect</u> species / fewer <u>insect</u> types;

***Q** Neutral: fewer <u>insects</u>*

Accept less variety of insects

3. (So) fewer food sources / less variety of food.

Q *Neutral: less food*

Ignore references to pesticides, farmers' actions, competition between lizards and evolution

3

[7]

Q8.

(a) 4:

1

(b) 2.68(6).

If answer incorrect:
Σn(n-1) = 242 = 1 mark
N(N-1) = 650 = 1 mark

2

(c) 1. Take more samples and find mean;
2. Method for randomised samples described.

Allow larger area = 1 mark

2

[5]

Q9.

(a) (No – no mark)
Graph / bar chart only shows number of species, not the name of the species.

1

(b) (No – no mark)
1. Mutations are spontaneous / random;
2. Only the rate of mutation is affected by environment;
3. Different species do not interbreed / do not produce fertile offspring;
4. So mutation / gene / allele cannot be passed from one species to another.

Ignore references to correlation does not prove causation

4

(c) 1. Initially one / few insects with favourable mutation / allele;
2. Individuals with (favourable) mutation / allele will have more offspring;
3. Takes many generations for (favourable) mutation / allele to become the most common allele (of this gene).

3

[8]

Q10.

(a) 1. Contents of phloem vessel pushed into insect's mouth by high pressure;

2. (High pressure in phloem vessel) caused by loading of sugars into phloem in leaf;

3. And (resulting) entry of water by osmosis.

3

(b) 1. Polysaccharides are insoluble;

2. So do not affect water potential of gut.

2

(c) 1. (Only few bacteria passed from parent, so) only a few (copies of) genes passed on (in bacteria);

2. May not / does not include all alleles (of genes, so diversity reduced)
OR
Small number of bacteria transmitted means unrepresentative sample.

2

(d) 1. Number / mass / density of insects per plant;

2. Stage of development / size of plants / insects;
Ignore any abiotic factor

2

(e) Draw around leaf on graph paper **and** count squares;

1

[10]

Q11.

(a)

3	6	9
152	211	167

2

(b) 2.45
Use of the correct denominator = 1 mark

2

(c) 1. More plant species;

2. More food sources / variety of food;

3. More habitats / niches;
Allow converse for barley field
More food = neutral

3

[7]

Q12.

(a) 1. Same genus;

2. Same evolutionary origin / common ancestor.

2

(b)

Taxon	Name of Taxon
Domain	Eukarya
Kingdom	Animalia
Phylum	Chordata
Class	Mammalia
Order	Rodentia
Family	Muridae

3 correct = 2 marks
2 correct = 1 mark
1 or 0 correct = 0 marks

2

(c) 1. (No) SDs of means of body sizes / sizes of parts of bodies overlap;

2. Calculation of correct head and body: tail ratios;

3. Almost identical, so same body shape / proportions;

3

(d) 1. Breed the two mice together;

2. (Same species) produce fertile offspring.

2

[9]

Q13.

(a) 1. Add 1 part (bacteria) culture to 9 parts (sterile) liquid (to make 10^{-1} dilution);
Accept water / nutrient / broth for liquid

2. Mix (well);
Accept stir

3. Repeat using 9 parts fresh (sterile) liquid and 1 part of 10^{-1} and 10^{-2} dilutions to make 10^{-3} dilution;
OR
Add 1 part 10^{-1} (suspension) to 99 parts (sterile) liquid (to make 10^{-3} dilution);
Accept water / nutrient / broth for liquid
Reject 1 part (undiluted) culture added to 999 parts liquid

3

(b) 3.75×10^9 / 3 750 000 000;;
Accept for 1 mark: 3750 000 / 3.75×10^6 (cells per mm^3)
OR
3.75×10^{12} (wrong volume conversion)
OR
3750 (cells per mm^3 of diluted culture)
OR
Evidence of using correct dilution conversion and correct

volume conversion, i.e., × 1000 and × 1000

2

(c) 1. **Count** unlikely to be accurate / repeatable / reproducible / reliable;

2. Because too many cells;
OR
Because cells overlapping / not spread out;

2

(d) 1. Tetracycline used more often / in higher doses;

2. Resistant bacteria more likely to (survive and reproduce and) pass on allele/gene for (tetracycline) resistance;
OR

3. More / higher frequency of mutations (for tetracycline resistance);
Reject reference to mutation being caused by use of antibiotic

4. (so) gene passed on to more bacteria;
OR

5. Tetracycline used over longer time period;

6. More time for (chance) mutation to occur / for selection to occur;
Ignore reference to resistant animals
Ignore reference to immunity

2

(e) No selection against resistant bacteria / resistance gene/allele;
OR
Bacteria pass on (resistance) gene / allele when they reproduce;
OR
Bacteria resistant to tetracycline are passed on from one generation of farm animals to the next (probably via faeces);
OR
Environment does not change, so stabilising selection occurs;
Accept no selection to get rid of it
Reject reference to mitosis or immunity

1

[10]

Q14.

(a) Three of chromosome 13 / an extra chromosome 13;
Accept trisomy 13
*Accept circle around three chromosomes or any other correct indication on **Figure 1***
Do not allow references to any other chromosomes.
Do not accept chromatids for chromosomes.

1

(b) 1. In meiosis;
2. Homologous chromosomes / sister chromatids do not separate;
2. Accept non-disjunction

2 max

(c) 1. Mutation / extra chromosome in gamete / egg / sperm (that formed zygote);
2. All cells derived (from a single cell / zygote) by mitosis;
OR
3. All cells derived from a single cell / zygote by mitosis;
4. Mitosis produces genetically identical cells / a clone;

*Mark points 1 and 2 **OR** 3 and 4*

4. Accept: have same DNA / same alleles

2

(d) 1. (Some) oxygenated blood (from the aorta) flows into pulmonary artery;
OR
Less oxygenated blood flows out through aorta;
OR
Lower blood pressure in aorta;
2. Less oxygen delivered to cells / tissues / organs / named organ / via named blood vessel;
3. So less / not enough oxygen for aerobic respiration (in cell / tissue / organ);
4. Tissue / organ doesn't grow / develop properly (causing death);
OR
Tissue dies / organ stops working (causing death);

1. Accept mixing of deoxygenated with oxygenated blood in pulmonary artery

2. Do not accept "no oxygen"

3. Do not accept "produce energy"

3 max

[8]

Q15.

(a) 1. So no contamination / other bacteria;
2. So same number of bacteria transferred **to** allow comparison;

1. Accept sterilisation / kills all (bacteria)

2. Allow amount / concentration for number

2

(b) 6 000 000
OR
6×10^6;

1 mark for 3 000 000

OR

3×10^6

Allow 1 mark for 600 (in $1cm^3$ of diluted culture)

2

(c) 1. (Several) values between 10 and 15 (units);
2. Repetitions of each;

1. Accept descriptions of this

Ignore repeat the investigation / repeat at 10 and 15 units.

2

[6]

Q16.

(a) 1. Species = (A group of) organisms that are able to produce fertile offspring;
2. Species richness = the number of (different) species in a community;

2. Accept in a habitat / ecosystem / area

2. Reject in a population

2. Ignore 'types' unqualified

2

(b) 5;

1

(c) 1. Number of individuals of each species not known;
2. **Almost** all (of sample A / the 68%) could be of the same species;
3. Two / other samples have a higher number of species / higher species richness but a lower number of individuals / fish;
4. Other samples may have more individuals of each species;

2. If not stated otherwise, assume MP2 relates to sample A / 68%

3 max

[6]