St Mary's Science Department

A level Biology

Homework Book

Diversity

Name: _____

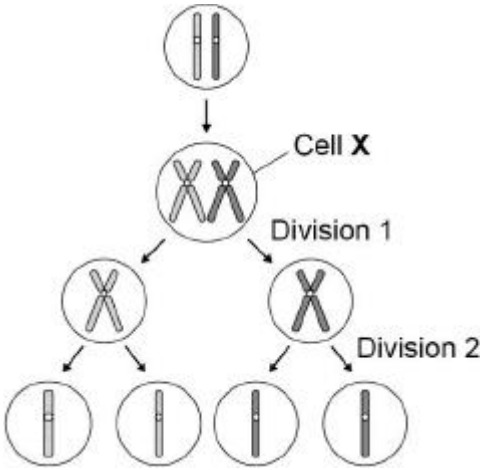
Class: _____

Teacher : _____

Questions	Date given	Date due	Mark
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
Total Score		Grade	

Q1.

The figure below summarises the process of meiosis. The circles represent cells and the structures within each cell represent chromosomes.



(a) Describe and explain the appearance of **one** of the chromosomes in cell **X**.

(3)

(b) Describe what has happened during division 1 in the figure above.

(2)

(c) Identify **one** event that occurred during division 2 but **not** during division 1.

(1)

(d) Name **two** ways in which meiosis produces genetic variation.

1. _____

2. _____

(2)

(Total 8 marks)

Q2.

(a) The genetic code is **degenerate** and **non-overlapping**.

Explain the meaning of:

Degenerate _____

_____

Non-overlapping _____

_____

(2)

The table shows a short section of a messenger RNA (mRNA) molecule and the section of a polypeptide for which it codes.

mRNA	G G G	G C U	U C A	C C G	G C A	A C G
Polypeptide	glycine	alanine	serine	proline	alanine	threonine

(b) Name the bases represented in the table by:

A _____

C _____

G _____

U _____

(2)

(c) Use information in the table to give the sequence of bases in **DNA** that codes for serine.

_____

(1)

(Total 5 marks)

Feedback	Mark (out of)	Score
Skill	**Strength**	**Could improve**
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q3.

(a) A mutation can lead to the production of a non-functional enzyme. Explain how.

(6)

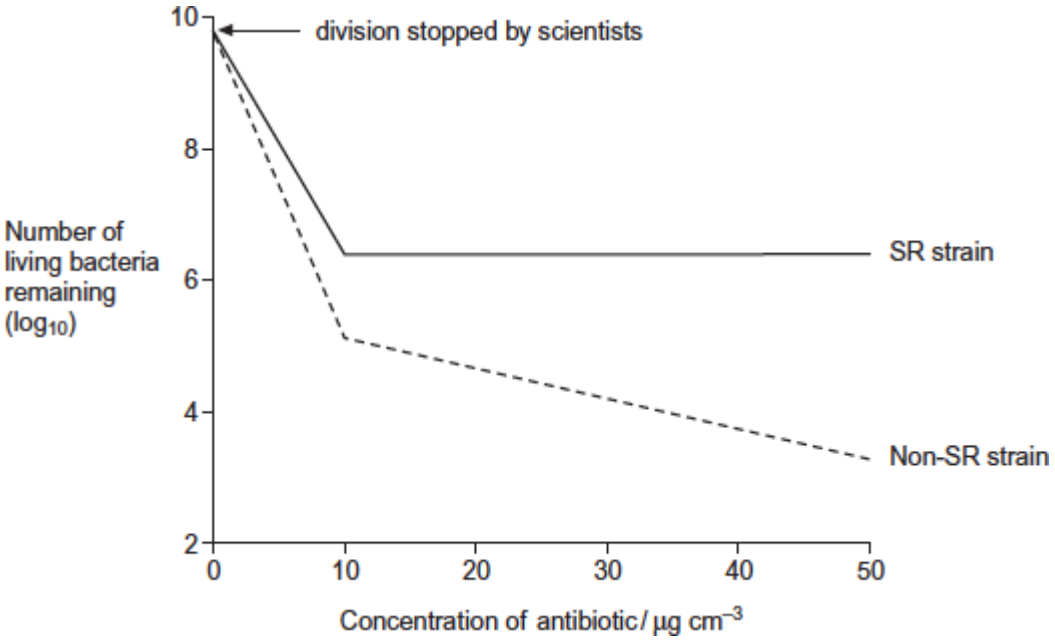
Scientists investigated the effect of a specific antibiotic on two strains of the same species of bacterium.

- One strain, SR, shows a **stringent response** in the presence of this antibiotic. Part of this response involves stopping cell division. This gives this strain a greater resistance to the effects of this antibiotic.
- The other strain, non-SR, cannot carry out a stringent response.

The scientists grew cultures of the SR strain and the non-SR strain containing the same number of bacterial cells. They then stopped each strain from dividing and exposed them to different concentrations of the antibiotic. After a fixed time, the scientists estimated the number of living bacteria remaining in the cultures.

Figure 1 shows their results.

Figure 1



(b) Describe differences in the effect of increasing the concentration of antibiotic on the SR strain and the non-SR strain.

(2)

(c) One way in which the stringent response gives resistance to this antibiotic is by stopping cell division.

The scientists concluded that stopping cell division is not the **only** way in which the stringent response gives resistance to this antibiotic.

Explain how **Figure 1** supports this conclusion.

(2)

(d) The stringent response involves a number of enzyme-catalysed reactions.

Explain how scientists could use this knowledge to design drugs that make the treatment of infections caused by the SR strain more successful.

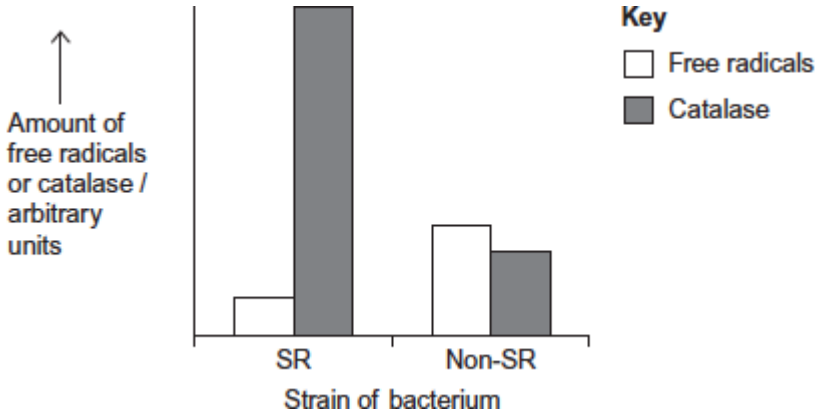
(2)

The antibiotic damages the bacterium by causing the production of substances called free radicals.

The scientists exposed the SR strain and the non-SR strain to the antibiotic. They then measured the amounts of free radicals and an enzyme called catalase in both strains.

Figure 2 shows their results.

Figure 2



(e) Use the information provided and **Figure 2** to suggest an explanation for the greater resistance of the SR strain to this antibiotic.

(3)

(Total 15 marks)

Feedback	Mark (out of)	Score
Skill	**Strength**	**Could improve**
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q4.

(a) Describe the appearance and behaviour of chromosomes during mitosis.

(5)

(b) Describe and explain the processes that occur during meiosis that increase genetic variation.

(5)

(Total 10 marks)

Q5.

Haemoglobin is a protein. It is made of two alpha polypeptides and two beta polypeptides. Each alpha polypeptide has 141 amino acids and each beta polypeptide has 146 amino acids.

(a) What term is used to describe the structure of a protein made of two or more polypeptides?

_____

(1)

(b) Calculate the minimum number of DNA bases needed to code for the number of amino acids in one alpha polypeptide.

Answer = _____

(1)

(c) Describe the role of haemoglobin in supplying oxygen to the tissues of the body.

_____

_____

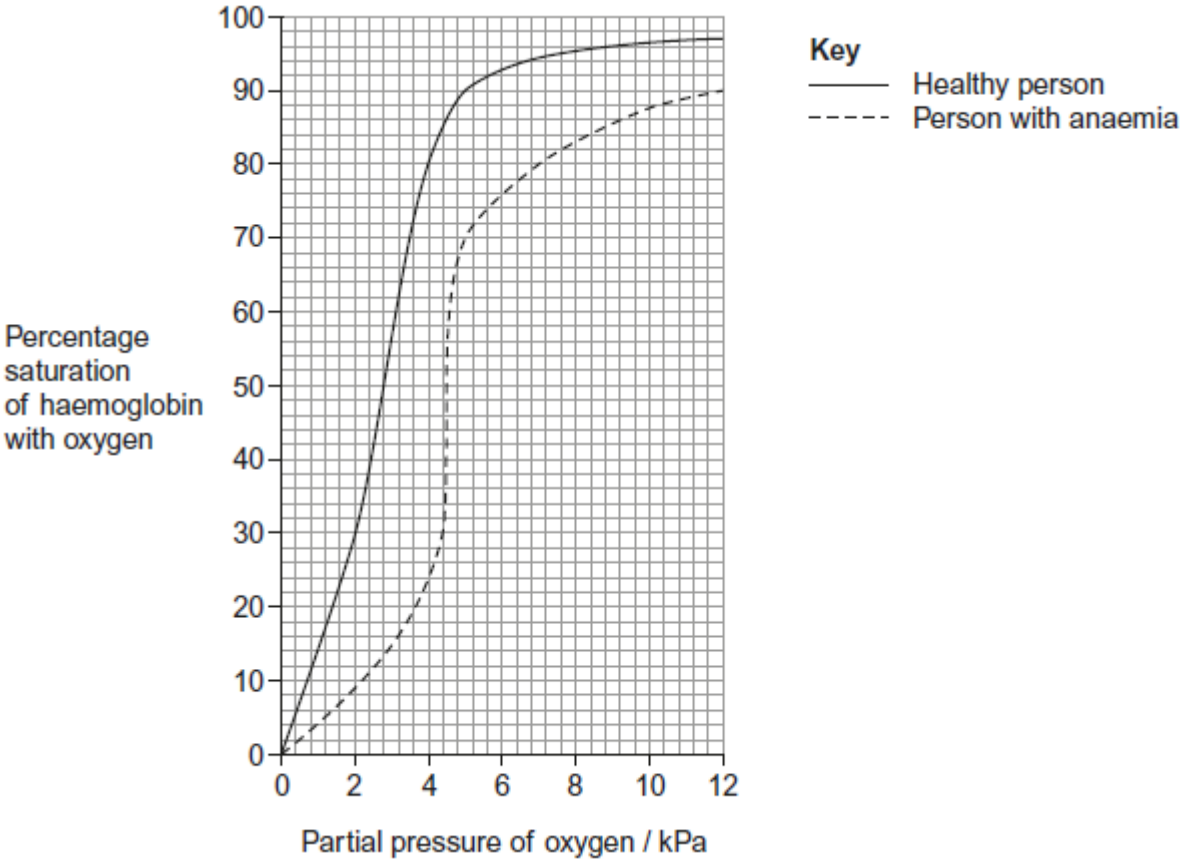
_____

_____

(2)

Anaemia is a condition in which there is a decrease in the concentration of haemoglobin in blood. In some people with anaemia, substances are produced which change the oxygen dissociation curve of haemoglobin.

The graph shows the effect of these substances on the oxygen dissociation curve of haemoglobin.



(d) (i) Use information in the graph to find the difference in the percentage saturation of haemoglobin with oxygen between a healthy person and a person with anaemia at a partial pressure of oxygen of 4 kPa.

Answer = _____

(1)

(ii) Explain the advantage to a person with anaemia of the change shown in the oxygen dissociation curve.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

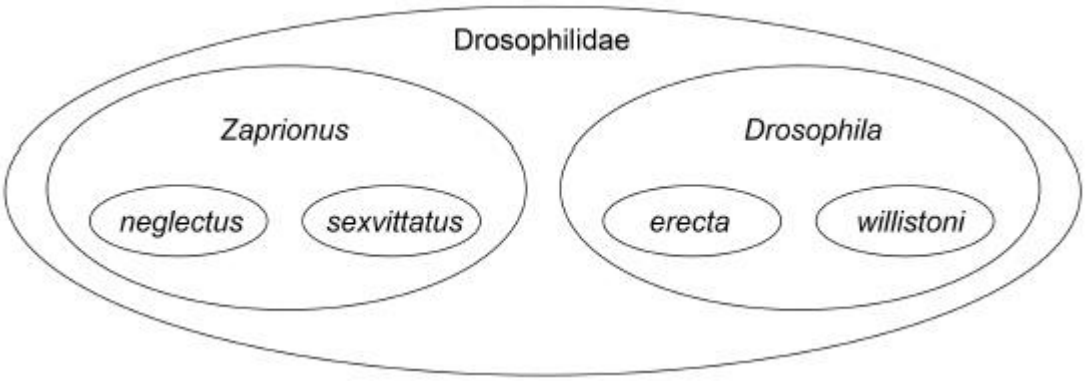
(Total 8 marks)

Feedback	Mark (out of)	Score
Skill	**Strength**	**Could improve**
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q6.

Figure 1 represents the phylogenetic classification of **four** different species of fruit fly.

Figure 1



(a) **Figure 1** shows a hierarchy. Explain how.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(2)

(b) Name the taxon to which Drosophilidae belongs.

_____

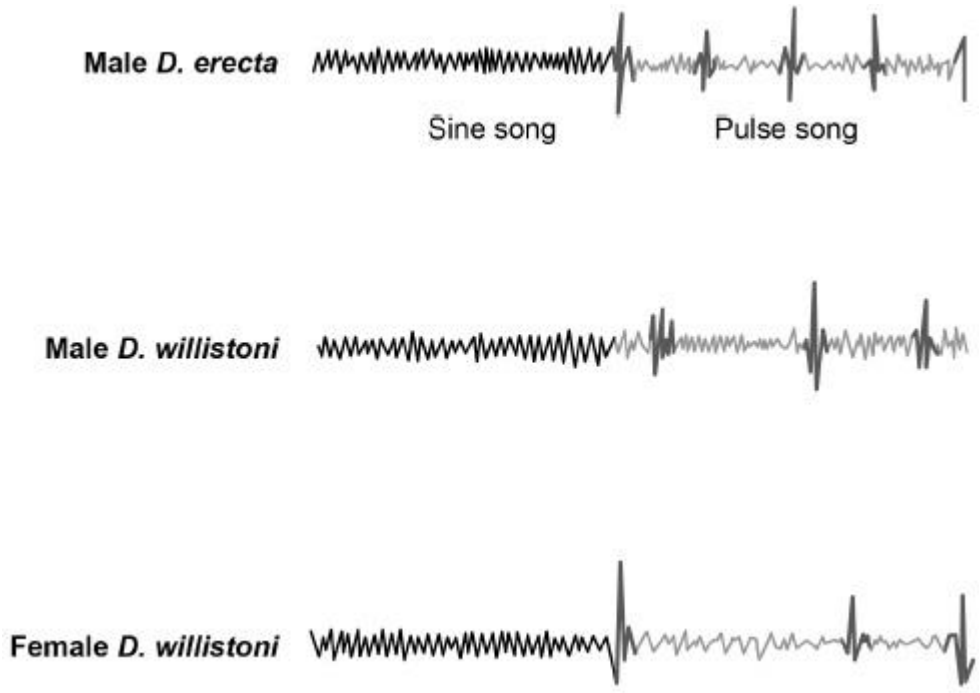
(1)

Drosophila fruit flies display courtship behaviour. One of the stages of courtship is singing by males. Normally a male will produce a 'sine song', in which continual noise is made, and a 'pulse song', in which there is continual noise with some louder peaks.

Scientists showed fruit flies a visual stimulus that made them sing. They made recordings of these songs.

Figure 2 shows the recordings of the songs of three flies over the same time period.

Figure 2



(c) D. erecta and *D. willistoni* are closely related species but different species.

Describe evidence from **Figure 2** that supports this statement.

(2)

(d) The scientists repeated their experiments, using female fruit flies as the visual stimulus. When a male and female *D. willistoni* were together, their songs led to mating.

When two female *D. willistoni* were together, their songs did **not** lead to any attempt to mate.

Use information from **Figure 2** to suggest why the two females did not attempt to mate.

(2)

(Total 7 marks)

Q7.

Malaria is a disease caused by a parasite. Scientists investigated the effect of malaria on competition between two species of *Anolis* lizard on a small Caribbean island. They sampled both populations by collecting lizards from a large number of sites on the island.

(a) (i) Explain the importance of collecting lizards from a large number of sites.

(1)

(ii) Describe **one** method the scientists could have used to ensure that the sites were chosen without bias.

(2)

(iii) The population number of both species of lizard varied at different times of the year. Suggest **two** reasons why.

1. _____

_____

2. _____

_____

(2)

The scientists investigated the percentage of lizards of both species that were infected with malaria at different sites on the island. They collected samples of both lizards at intervals of 3 months for 1 year. They also recorded the elevation (height above sea level) of each site. Some of their results are shown in the table.

Site	**Elevation of collection site / metres**	**Total number of *A. gingivinus* collected in one year**	**Percentage of *A. gingivinus* infected with malaria**	**Total number of *A. wattsi* collected in one year**	**Percentage of *A. wattsi* infected with malaria**
1	10	13	0	0	0
2	80	30	0	0	0
3	120	35	23	3	0
4	200	40	30	7	0
5	300	52	46	12	0
6	315	35	31	13	1
7	370	155	37	79	2
8	414	124	44	68	4

(b) When analysing their results, the scientists used the percentage of lizards infected at each site, rather than the number of lizards infected. Explain why.

_____

_____

_____

_____

_____

(2)

(c) A preliminary study suggested that malarial infections were more common at higher elevations. Use the information provided to evaluate this suggestion.

(2)

(d) (i) As a result of this investigation, the scientists concluded that the presence of malaria provided a competitive advantage to *A. wattsi.* Use the information provided to explain how they reached this conclusion.

(2)

(ii) The malarial parasite of *Anolis* lizards destroys both red and white blood cells.Suggest how an increase in the percentage of *A. gingivinus* infected with malaria could result in *A.wattsi* having a competitive advantage.

(2)

(iii) The scientists carried out a statistical test to determine whether the correlation between the number of *A. wattsi* collected and the percentage of *A. gingivinus* infected was significant. They obtained a value for P of < 0.01.

Use the terms **probability** and **chance** to help explain what this means.

(2)

(Total 15 marks)

Feedback	Mark (out of)	Score
Skill	**Strength**	**Could improve**
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q8.

(a) What **two** measurements are needed to calculate an index of diversity?

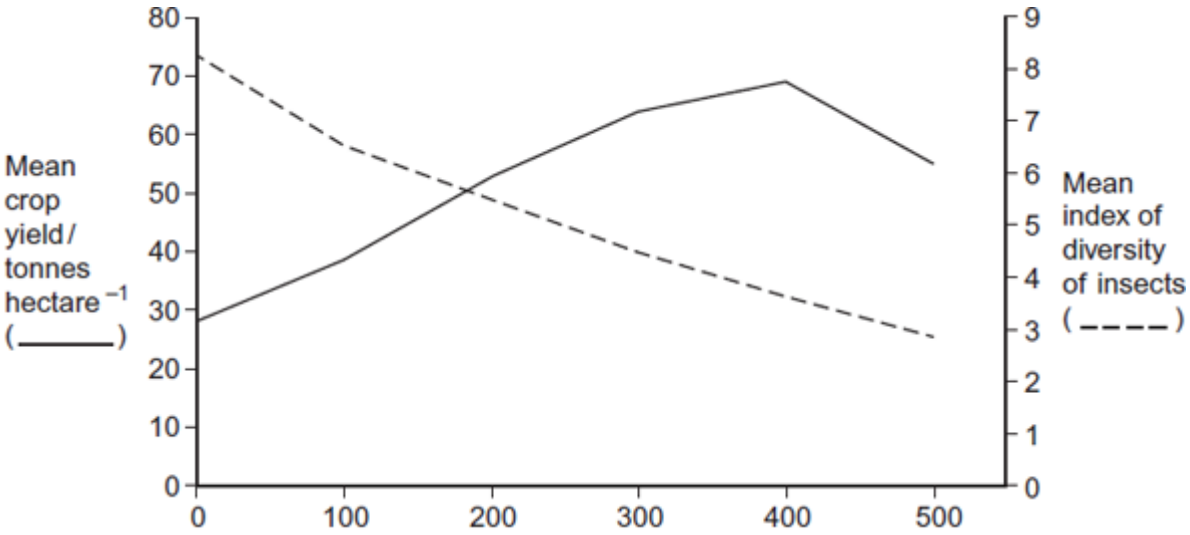
1. _____

2. _____

(2)

(b) A herbicide is a chemical used to kill weeds. Ecologists investigated the effect of a herbicide on crop yield and the diversity of insects. They sprayed different fields with the same volume of different concentrations of the herbicide. At harvest, the ecologists determined the mean crop yield and the mean index of diversity of insects for fields that had received the same concentration of the herbicide.

The figure below shows their results.



(i) Some fields acted as controls. They were sprayed with a solution that did not contain the herbicide. Explain the purpose of these control fields.

_____

_____

_____

(1)

(ii) Suggest an explanation for the relationship between the concentration of herbicide and the mean crop yield.

_____

_____

_____

_____

(2)

(iii) Explain the relationship between the concentration of herbicide and the mean

index of diversity of insects.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

Q9.

Scientists investigated the presence of bacteria resistant to the antibiotic neomycin in turkeys, chickens and the farmers who kept the turkeys and chickens. They looked for *Escherichia coli* (*E. coli*) resistant to neomycin. At 46 farms, the scientists obtained samples of bacteria from faeces of turkeys, turkey farmers, chickens and chicken farmers. The turkey farmers very often used turkey food containing neomycin. The chicken farmers did not use chicken food containing neomycin very often.

The bacteria were grown on nutrient agar in cultures. The nutrient agar contained neomycin. Any resistant bacteria grew and divided to form visible colonies.

The results are shown in the table

Samples taken from	**Percentage of samples of faeces containing *E. coli* resistant to neomycin**
Turkeys	81
Turkeys farmers	57
Chickens	24
Chicken farmers	8

(a) Suggest **two** hypotheses the scientists were testing in this investigation.

Hypothesis 1 _____

_____

Hypothesis 2 _____

_____

_____

(2)

(b) (i) Describe what the results in the table show.

_____

_____

_____

_____

_____

(2)

(ii) Suggest and explain **one** reason for the observed differences in percentage of neomycin-resistant *E. coli* in turkeys and chickens.

_____

_____

_____

_____

_____

(2)

(c) The scientists followed strict safety guidelines when collecting samples of faeces. Apart from the risk of contamination from *E. coli* this was especially important when collecting samples from humans.

Explain why.

_____

_____

_____

(1)

(d) Use the information provided to identify and explain **one** way in which the scientists increased the reliability of their method.

_____

_____

_____

_____

_____

(2)

(e) Suggest how the scientists could use DNA to investigate whether the neomycin-resistant bacteria in farmers were identical to the strain of bacteria in the birds they kept.

(2)

(f) At one time, most animal feeds contained antibiotics that increased the rate of animal growth. In the UK, fewer animal feeds now contain antibiotics.

Suggest reasons why.

(4)

(Total 15 marks)

Feedback	Mark (out of)	Score
Skill	**Strength**	**Could improve**
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

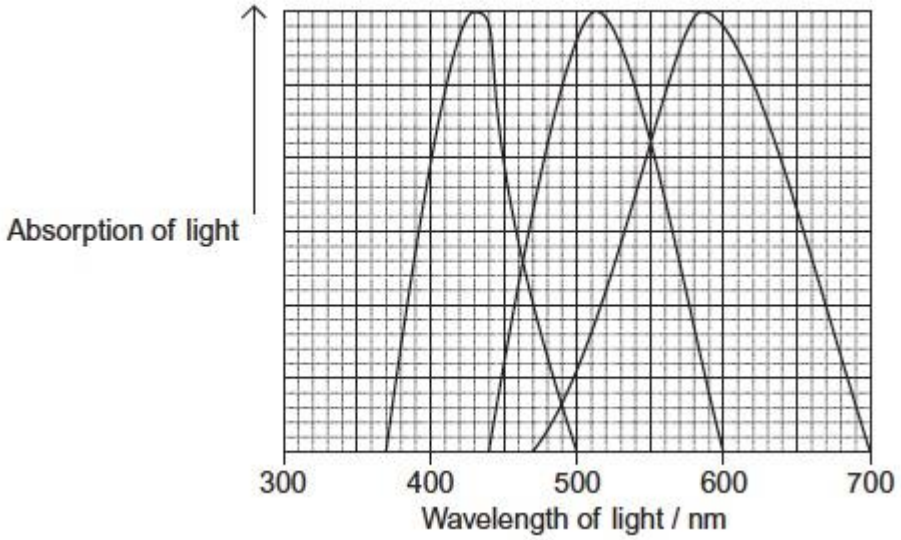
Q10.

The retinas in the eyes of humans and birds have cone cells that absorb light of different wavelengths.

Resource A

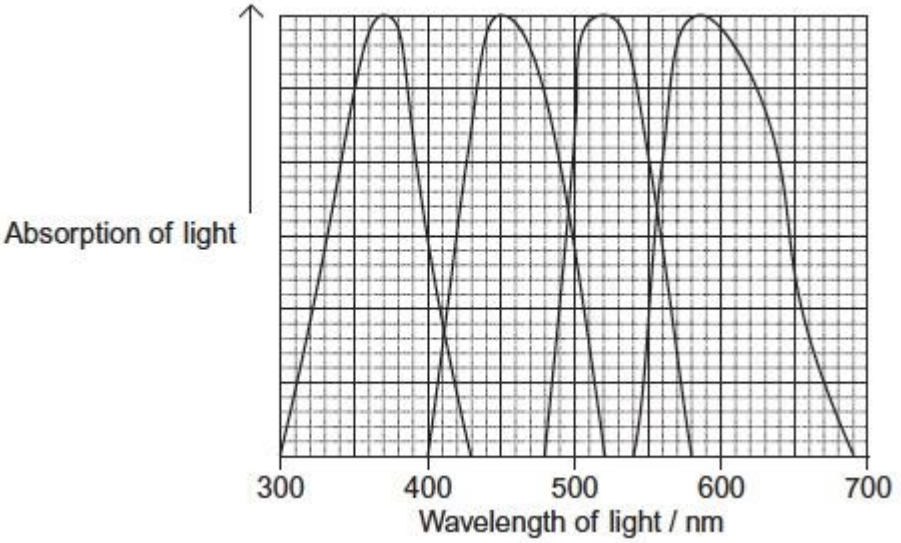
A scientist recorded the absorption of light of different wavelengths by different types of human cone cells. Her results are shown in **Figure 1**. Each curve shows the absorption of light by one type of cone cell.

Figure 1



She also recorded the absorption of light of different wavelengths by different types of bird cone cells. These results are shown in **Figure 2**. Each curve shows the absorption of light by one type of cone cell.

Figure 2



Resource B

Bluethroats are a species of small brightly coloured bird. The feathers on the throats of male birds reflect UV light (370 nm). Scientists investigated the response of female bluethroats to this reflected UV light.

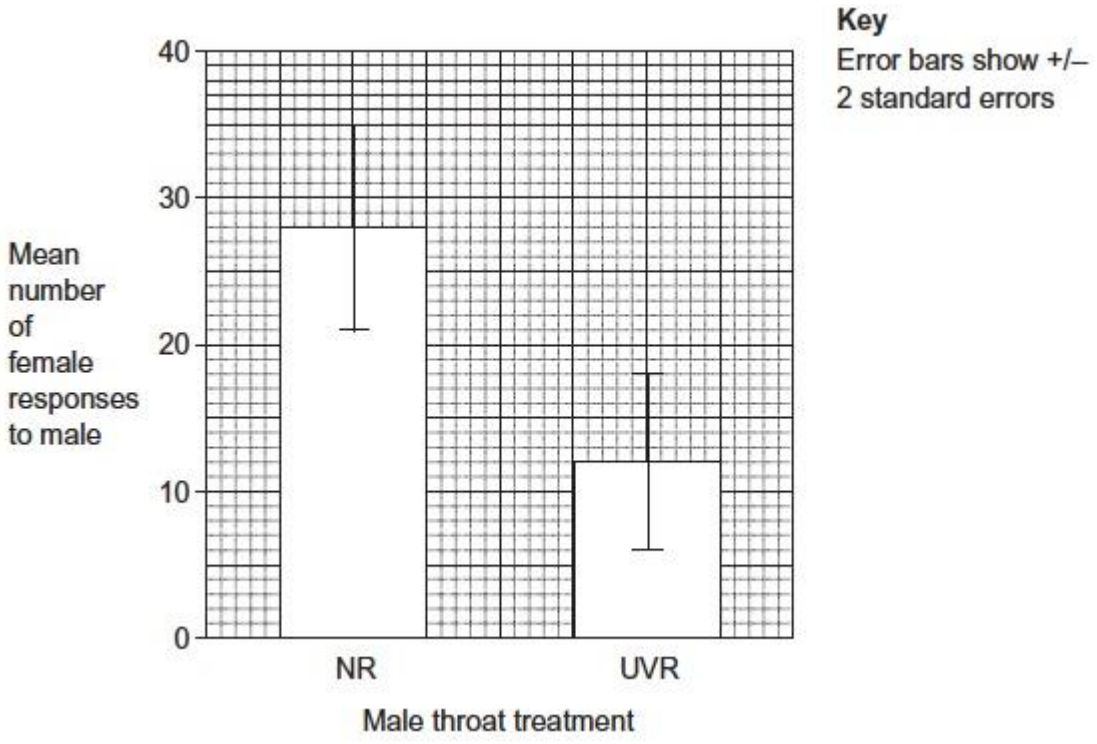
The scientists used 40 male birds selected because they were very similar to each other. The scientists treated the throat feathers of male birds as follows:

- they put a clear oil on the throat feathers of 20 males. They described these males as no UV reduction (NR).
- they put the same oil on the throat feathers of another 20 males but the oil contained a substance that absorbs UV light. They described these males as UV reduced (UVR).

In each experiment, the scientists placed two males where a female could see them. One male was NR and the other was UVR. During the next 5 minutes, they recorded how many times the female responded by moving towards each male.

Their results are shown in **Figure 3**.

Figure 3



Use **Resource B** to answer Questions (a) to (d).

(a) The male birds were selected because they were very similar to each other. Suggest **two** reasons why it was important that they were of similar age.

1

_____

_____

_____

2

(2)

(b) Of the 40 male birds the scientists selected 20 to receive the NR treatment. They selected these birds at random.
Suggest how.

(1)

(c) The scientists recorded how many times each female moved towards a male.

In designing the experiment, suggest **two** assumptions the scientists made when they decided to record this movement.

1

2

(2)

(d) The pigment in the throat feathers of the male birds that reflects UV light is a protein.
This protein arose by a gene mutation.
Explain how a gene mutation could result in a new protein.

(3)

Use **Resources A and B** to answer Question (e).

(e) A student who read both resources concluded that female bluethroats are attracted to the blue throat feathers of males when selecting a mate.
Do these data support this conclusion? Give reasons for your answer.

(4)

(Total 12 marks)

Q11.

The table shows the taxons and the names of the taxons used to classify one species of otter. They are **not** in the correct order.

	Taxon	**Name of taxon**
J	Family	Mustelidae
K	Kingdom	Animalia
L	Genus	Lutra
M	Class	Mammalia
N	Order	Carnivora
O	Phylum	Chordata
P	Domain	Eukarya
Q	Species	lutra

(a) Put letters from the table above into the boxes in the correct order. Some boxes have been completed for you.

		O	M			L	Q

(1)

(b) Give the scientific name of this otter.

_____

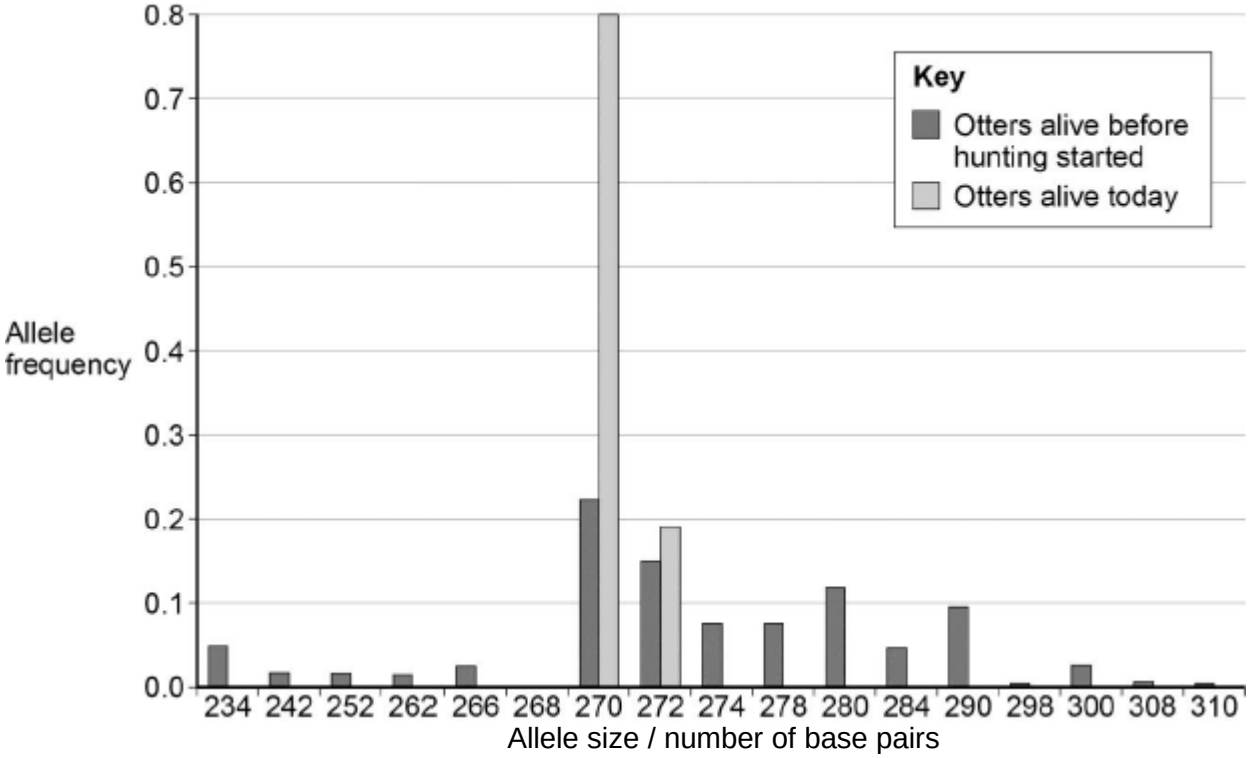
(1)

Scientists investigated the effect of hunting on the genetic diversity of otters. Otters are animals that were killed in very large numbers for their fur in the past.

The scientists obtained DNA from otters alive today and otters that were alive before hunting started.

For each sample of DNA, they recorded the number of base pairs in alleles of the same gene. Mutations change the numbers of base pairs over time.

The figure below shows the scientists' results.



(c) The scientists obtained DNA from otters that were alive before hunting started.

Suggest **one** source of this DNA.

_____

_____

(1)

(d) What can you conclude about the effect of hunting on genetic diversity in otters? Use data from the figure above to support your answer.

_____

_____

_____

_____

(2)

(e) Some populations of animals that have never been hunted show very low levels of genetic diversity.

Other than hunting, suggest **two** reasons why populations might show very low levels of genetic diversity.

1. _____

_____

2. _____

_____

(2)

(Total 7 marks)

Q12.

Iodine has many uses. One use is as an antiseptic to kill bacteria and another is helping apple farmers decide when to harvest their apples.

Iodine solution has been used as an antiseptic on wounds for over 150 years. At first, its use in hospitals was limited because it irritated people's skin. In the 1950s, iodine solution was made into providone iodine that caused less skin irritation. A surgeon investigated how effective providone iodine was at killing bacteria on skin.

The surgeon treated the forearms of 25 people in 4 ways.

Treatment **A** − no washing
Treatment **B** − washed with soap and water only
Treatment **C** − washed with soap and water then rubbed with Hex scrub for 5 minutes (Hex scrub was the treatment the surgeon used at that time to wash a patient's skin before surgery)
Treatment **D** − washed with soap and water then rubbed with providone iodine for 5 minutes

After each treatment, the surgeon collected bacteria by rubbing each person's skin with a sterile cotton swab. He put the swab into sterile liquid agar. He then poured the agar into a Petri dish and allowed it to set. He incubated the Petri dish and when bacterial colonies had grown, he counted them.

The surgeon's results are shown in the table below.

Treatment	Mean number of bacterial colonies (± standard deviation)
A	401.6 (±96.4)
B	191.4 (±63.7)
C	25.9 (±15.6)
D	0.7 (±1.5)

(a) Suggest **three** factors the surgeon kept constant when sampling from the skin and growing the bacterial colonies.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(b) Calculate the percentage difference in mean number of bacterial colonies for Treatment **D** compared with Treatment **A**. Show your working.

Answer _____ %

(2)

(c) Treatment **D** produced a mean of 0.7 colonies and a standard deviation of ±1.5. What does this suggest about the number of colonies on the Petri dish?

_____

_____

_____

(1)

(d) After this investigation, the surgeon wanted to test the effectiveness of providone iodine when used on patients who were about to have surgery.
In this new investigation, the test group was given Treatment **D**.
Suggest and explain the treatment that he should give to the control group to ensure that this is an ethical investigation.

_____

_____

_____

_____

_____

(2)
(Total 8 marks)

Feedback	Mark (out of)	Score
Skill	**Strength**	**Could improve**
Knowledge		
Understanding		
Evaluation		
Application		
Calculation		
Data analysis		
How science works		
To improve		
Student response		

Q1.

(a) 1. Chromosome is formed of two chromatids;
2. (Because) DNA replication (has occurred);
3. (Sister) chromatids held together by centromere.

3

(b) 1. Chromosomes in homologous pair;
2. One of each into daughter cells / haploid number.

2

(c) Separation of (sister) chromatids / division of centromere.

1

(d) 1. Independent segregation (of homologous chromosomes);
Accept random assortment
2. Crossing over / formation of chiasmata.

2

[8]

Q2.

(a) 1. Degenerate: more than one (base) triplet for each amino acid;

2. Non-overlapping: each base is part of only one triplet.
Accept codon (as would be applicable to mRNA code)

2

(b) A = adenine

C = cytosine

G = guanine

U = uracil

All four correct = 2
One error = 1
Two or more errors = 0

2 max

(c) AGT;

1

[5]

Q3.

(a) 1. Change / mutation in base / nucleotide sequence (of DNA / gene);
Q.
Ignore: references to changing base-pairing
Accept: affect for change, if in correct context
Accept: changes triplets / codons

2. Change in amino acid sequence / primary structure (of enzyme);

Accept: different amino acid(s) coded for

Q *Reject: different amino acids produced / formed / made*

3. Change in hydrogen / ionic / disulfide bonds;

Accept: references to sulfur bonds

4. Change in the tertiary structure / shape;

Neutral: alters 3D structure / 3D shape

5. Change in active site;

6. Substrate not complementary / cannot bind (to enzyme / active site) / no enzyme-substrate complexes form.

Accept: no E S complexes form

6

(b) 1. Non-SR strain falls more / SR strain falls less / up to 10(µg / cm−3);

Must include 10 but only required once in either MP1 or MP2

Ignore: units or absence of

This must be a comparative statement

2. Above 10(µg / cm^{-3}), SR strain levels out / off and non-SR strain continues to decrease;

3. Greater difference between strains with increasing concentration of antibiotic.

This must be a comparative statement

2 max

(c) 1. Division stopped (of both strains by scientist);

Reject: references to mitosis stopping

2. SR strain still more resistant / fewer die / none die (at higher concentrations of antibiotic).

Accept: SR strain and non-SR strain would be similar if resistance is due to only stopping division

Need some comparison with non-SR

2

(d) 1. Make a competitive / non-competitive inhibitor;

Mark in pairs

either MP1 and MP2 OR MP3 and MP4

2. Competitive competes with / blocks active site / non-competitive inhibitor affects / changes active site;

Do not mix and match

OR

3. (Make a drug) that inhibits / denatures / destroys enzyme / stringent response;

Accept: drug that 'knocks out' / destroys enzyme

4. Give at the same time as / before an antibiotic.

2 max

(e) (SR strain)

1. Fewer free radicals (than non-SR);
Note: has to be comparative statement

2. Produces more catalase (than non-SR);
Accept converse statements for non-SR.

3. Catalase (might be) linked to production of fewer free radicals / breaking down / removing free radicals.
Accept: hydrolysis of radicals by catalase.

3

[15]

Q4.

(a) (During prophase)

1. Chromosomes
coil / condense / shorten / thicken / become visible;

2. (Chromosomes) appear as (two sister) chromatids joined at the centromere;

(During metaphase)

3. Chromosomes line up on the equator / centre of the cell;

4. (Chromosomes) attached to spindle fibres;

5. By their centromere;

(During anaphase)

6. The centromere splits / divides;

7. (Sister) chromatids / chromosomes are pulled to opposite poles / ends of the cell / separate;

(During telophase)

8. Chromatids / chromosomes
uncoil / unwind / become longer / thinner.
No marks for naming the stages
Reject references to homologous chromosomes / pairing of chromosomes
Ignore references to spindle formation during prophase

5 max

(b) 1. Homologous chromosomes pair up;

2. Independent segregation;

3. Maternal and paternal chromosomes are re-shuffled in any combination;

4. Crossing over leads to exchange of parts of (non-sister) chromatids / alleles between homologous chromosomes;

5. (Both) create new combinations of alleles;

5

[10]

Q5.

(a) Quaternary (structure);

Accept phonetic spelling eg quarternary/quarternery /4°

Award no mark for quaternary as part of a list

1

(b) 423;

1

(c) 1. Oxyhaemoglobin formed/ haemoglobin is loaded/ uptakes/associates/binds with oxygen in area of higher ppO_2 / in gas exchange surface/lungs/gills;

Reference to "react with" = max 1

Accept: reversible interaction with oxygen

Ignore: haemoglobin is carried / contained in red blood cells

2. (oxygen) unloaded/dissociates from/released (in area of lower ppO_2 / in capillaries/to cells/tissues);

2

(d) (i) 56(%);

Accept responses in the range 54-58(%)

1

(ii) 1. (Anaemia curve shifted to right) haemoglobin has lower affinity for oxygen / binds less tightly;

Assume reference is to haemoglobin of anaemia unless stated

2. releases more oxygen / oxygen is released quicker / oxygen dissociates/ unloads more readily to muscles/tissues/cells;

3. (For) respiration;

Accept: even with a lower haemoglobin concentration / meet demand for ATP/energy;

3

[8]

Q6.

(a) 1. (It shows) smaller groups within larger groups / larger groups containing smaller groups;

Accept groups within groups

2. With no overlap (between groups);

2

(b) Family;

Accept phonetic spellings

1

(c) 1. Sine song is (very) similar / same length (for both, so closely related).

2. (But) have different peaks / pulses (in pulse song);

Must give a difference, not just state they are different

Accept suitable differences eg number / length / amplitude / interval

2

(d) 1. (Three) peaks (in pulse song) occur at the same time (since both female) / songs identical / male peaks are different;

Accept suitable differences in male peaks eg number / length / amplitude / interval

2. (Therefore) no male (song) to stimulate / cause mating;
OR
Nothing to stimulate / cause mating;

2

[7]

Q7.

(a) (i) Reliable / representative / for statistical tests;

Accept: identify anomalies

Neutral: accurate / valid / bias

1

(ii) 1. Find coordinates (on a grid) / split area into squares / number the sites;

1. Ignore references to tape measures, metre rulers etc

2. Method of generating / finding random numbers eg calculator / computer / random number generator / random numbers table;

2. Accept: numbers out of a hat / use of dice

2

(iii) 1. Breeding (of lizards);

Neutral: weather / climate / hurricanes / hibernation / migration / emigration / immigration

2. Food source / prey;

3. Predator;

4. Variation in malarial infection;

5. Temperature variation;

6. Availability of water eg drought / ‘rainy season’

2 max

(b) 1. Number in sample varies;

2. Allow a (valid) comparison;

2

(c) 1. (Overall) positive correlation (for either / both species);

Neutral: only one study / no repeats

2. Reference to (site) 5 / 300 metres;

3. Limited results for *A. wattsi* / small sample / number / percentage

infected for *A. wattsi*;.

2 max

(d) (i) 1. Fewer *A.wattsi* infected / more *A. gingivinus* infected;

2. Higher number of *A.wattsi* present when higher percentage / number of *A.gingivinus* infected / no *A.wattsi* present when *A.gingivinus* has zero infection;

2

(ii) 1. Reduced immunity / increased susceptibility to disease;

1. Accept: idea that energy / resources are used to combat malaria

2. Reduced oxygen transport / uptake / respiration / reduced activity / movement;

2

(iii) 1. There is a <u>probability</u> of less than 1% / 0.01;

1. Reject: probability is / equal to 1% / 0.01;

1. Reject 0.01% / 5% / 0.05 / 0.05%

2. That result(s) / correlation / it is due to chance;

2. Allow correct interpretation using above (incorrect) figures eg there is a probability of less than 5% that the results are due to chance =1 mark

OR

3. There is a <u>probability</u> of more than 99% / 0.99;

4. That result(s) / correlation / it is not due to chance;

Note: there is a probability of more than 5% that the results are due to chance =0 marks

3. Reject: probability is / equal to 99% / 0.99;

3. Reject 0.99% / 95% / 0.95 / 0.95%

4. Allow correct interpretation of above figures ie 0.99% / 95% / 0.95 / 0.95% but reject if less than

2

[15]

Q8.

(a) 1. Number of (individuals of) each species;

Accept: 'population' for 'number'

2. Total number of individuals / number of species;

Accept: 'species richness'

MP2 allows for other types of diversity index

2

(b) (i) (Shows) results are due to the herbicide / are not due to another factor / (to) compare the effect of using and not using the herbicide / shows the effect of adding the herbicide;

Neutral: allows a comparison

Neutral: ensures results are due to the independent variable

Reject: 'insecticide'

Accept: 'pesticide'

1

(ii) 1. (More) weeds killed **so** more crops / plants survive / higher yield / less competition;

2. High concentrations (of herbicide) harm / damage / kill / are toxic to crops / plants;

Accept: 'pesticide'

Neutral: 'insecticide'

Accept: use of figures (eg 400+)

2

(iii) 1. Reduced plant diversity / fewer plant species / fewer varieties of plant;

Accept: 'weed' for 'plant'

Neutral: fewer plants

Accept: only one crop species remains

2. Fewer habitats / niches;

Q *Neutral: fewer homes / shelters*

3. Fewer food sources / varieties of food;

Neutral: less food

3

[8]

Q9.

(a) 1. Type of feed affects (antibiotic) resistant bacteria (in animals);

Accept: null hypotheses

Accept predictions, for example

More antibiotic resistant bacteria form in animals fed with antibiotics in their food

2. (Antibiotic) resistant resistant infect /are passed on to animals/farmer / resistant resistant are passed between animals;

Accept: bird to bird/bird to human/human to human

Accept: a link (exists) between (antibiotic) resistance in animals and their keepers/farmers – as lowest level QWC

3. Incidence of (antibiotic) resistant resistant differs in chickens and turkeys;

Accept: a comparison, eg 'more resistant bacteria in chickens than turkeys'

4. Incidence of (antibiotic) resistant resistant differs in chicken farmers and turkey farmers;

Accept: a comparison, eg 'more resistant bacteria in chickens than turkeys'

Max 2

(b) (i) 1. Large(r) percentage of resistant bacteria in turkeys/low(er) percentage of resistant bacteria in

chickens;

Accept: E coli for bacteria

Ignore: number, eg. ignore 'more'/'fewer' turkeys/chickens

2. Large(r) percentage of <u>resistant</u> bacteria in turkey farmers/low(er) percentage of <u>resistant</u> bacteria in chicken farmers;

2

(ii) 1. (More) antibiotic in turkey feed kills (more) non-resistant bacteria / resistant bacteria survive;

Accept: antibiotic creates selection pressure

Survive must be explicit, not implied by 'reproduce'

2. (Resistant bacteria) reproduce / pass on gene for resistance;

2

(c) (Human) faeces contain pathogens;

Accept: harmful organisms

1

(d) 1. Large number of farms / farmers (surveyed) / 46;

'Reliable' is used in the question stem

2. So results are (likely to be) representative / can identify anomalous results;

Ignore: reproducible / accurate / valid / reliable

Accept valid explanation of replicates minimising effects of chance

2

(e) 1. (DNA) hybridisation (of gene for resistance in bacteria taken from bird and farmer);

2. (Identical) strands separate at high(est) temperature;

OR

3. Compare base/nucleotide sequence (of gene for resistance in bacteria taken from bird and farmer);

4. (Identical strains) have identical/same base sequences

Mark in pairs, do not mix and match.

Accept: bacteria in bird and farmer/both types of bacteria have identical base sequences = 2 marks

2

(f) 1. (Antibiotic use has) increased cases of bacterial resistance;

Accept: number

2. Transfer/horizontal transmission of (resistance) gene to pathogens/harmful bacteria;

Accept: conjugation

3. (Antibiotic) resistant bacteria cause harm / medical treatments less effective;

Accept: superbug

4. Avoids side effects on animals;
5. Increased demand for organic food;
6. Antibiotic/resistant bacteria could be present in human food;

7. High cost of antibiotics;
8. Legislation has controlled antibiotic use;

Accept: EU/government guidelines

4 max

[15]

Q10.

(a) 1. (So) age not a factor in female choice;

2. (So) will attract a mate;

3. (So similar) sexual maturity;

4. (So) have the correct feathers;

4. Accept 'have blue feathers'

2 max

(b) Number the birds, then numbers out of hat / random number generator;

Both aspects needed for mark

1

(c) 1. That movement was not related to some other factor (than the male);

2. That movement (towards the male) indicated mating behaviour;

3. (Females) only respond to throat feathers (of the male) / do not respond to other visual display / sounds / calls (by the male);

2 max

(d) 1. Change in sequence of bases / nucleotides;

2. (As a result of a) deletion / substitution;

3. Change in amino acid sequence / primary structure;

4. Change in tertiary structure of protein;

1. Do not accept 'change in the DNA sequence'

2. Accept e.g. addition / inversion / duplication / translocation

3

(e) **Yes**

1. (From resource A) birds can detect UV light;

2. (From resource B) difference between UVR and NR significant / not due to chance;

3. As error bars do not overlap;

*3 max if only **No** marks awarded*

2. Reject idea that 'results' in resource B are significant / not due to chance, must include idea of 'difference'

3. Reject 'as standard deviations do not overlap'

No

4. UV light may not be involved in mating / other factors may be involved in mating;

5. Some birds in UVR group were attractive to females;

6. (Experiment in resource B) carried out in artificial conditions / only 40 birds used / small sample size;

6. Neutral: idea that this is only one study / that there are no repeats

4 max

[12]

Q11.

(a) PKNJ.

1

(b) *Lutra lutra.*

1

(c) Bone / skin / preserved remains / museums.

1

(d) 1. (Hunting) reduced population size(s), so (much) only few alleles left;

Accept bottleneck

2. Otters today from one / few surviving population(s);

Accept founder effect

3. Inbreeding.

*Allow any **two***

2 max

(e) 1. Population might have been very small / genetic bottleneck;
2. Population might have started with small number of individuals / by one pregnant female / founder effect;
3. Inbreeding.

*Allow any **two***

2 max

[7]

Q12.

(a) 1. Size of cotton swab;

2. Dampness of cotton swab;

3. Size of area of skin;

4. Time rubbed on skin;

5. Part of the body / skin sampled;

6. Volume of agar / nutrient concentration of agar;

7. Incubation time;

8. Incubation temperature;

3 max

(b) 99.8;

OR

57 271;

1 mark for writing out correct calculation: (401.6 – 0.7)/401.6 × 100 ***OR*** *(401.6 – 0.7)/0.7 x 100*

1 mark max for incorrect rounding

Accept answers to any number of significant figures as long as rounding is correct

2

(c) 1. Spread here greater above the mean than below;

2. Some / many Petri dishes had no colonies;

Accept idea that data are not normally distributed / is skewed.

1 max

(d) 1. Treatment **C** / treatment normally used at the time;

2. (Because) using untreated / soap and water / treatment **A** / treatment **B** would have too great a risk of infection;

Accept C has least / lower risk of infection

Accept description of 'infection'

2

[8]