Mark schemes

Q1.

(a) 1. Different primary structure/amino acid sequence;

2. Different tertiary structure/shape of active site;

3. Enzyme-substrate complexes more likely (with enzyme from AD^F allele);

Accept converse for AD^S

Accept is more complementary

3

(b) Avoids bias

OR

Results (likely to be) reliable/repeatable;

1

(c) 1. Flies with AD^F/allele have selective advantage (in presence of alcohol);

Accept converse for AD^S

Accept description of selective advantage

2. So insects (with AD^F more likely to) reproduce;

3. Pass on ADF (allele/gene);

4. (So) <u>allele</u> frequency increases;

4

(d) Answer = Directional selection

1

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Q2.

(a) Histogram

1. Linear scale for y axis;

2. Linear scale for x axis;

3. Correct bar widths **and** touching;

4. All bar heights plotted accurately;

OR

Bar chart accept for 3 marks,

5. Linear scale for y axis;

6. Labelled bars of equal width **and** not touching;

7. All bar heights plotted accurately;

OR

Graph accept for 2 marks,

8. Linear scale for y axis;

9. All co-ordinates plotted accurately for frequency density;

Reject answers where data for frequency density and birth mass not used

4

(b) Correct answer for **2 marks** = 20 000;;

Accept for 1 mark, rearranged equation (eg number of babies = frequency density × range of mass)

2

(c) 1. Survival increases as the birth mass increases;

2. Survival decreases with smoking;

3. Effect of smoking (on number) similar at all birth masses;

3

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Q3.

(a) **Type of selection**

1. Directional;

Reason:

2. One extreme selected/removed/favoured/chosen
OR
One extreme allowed to breed;

Ignore references to adaptations/natural selection

Accept large fish/small fish for 'extreme'

2

(b) 1. As a baseline/control;

2. To show effect of no selection
OR
To show what happens in a normal population/naturally
OR
To show effect of/compare with tank A/tank C;

Ignore reference to type of selection

Accept not removing/not catching/not fishing for 'selection'

Accept genetic drift for 'no selection'

Accept no fishing/no selection/no caught fish for 'normal

population'
Accept to compare with other results

2

(c) Correct answer for 2 marks

(How much greater) 1.6 to 1.7;;

Accept for 1 mark,
1.2 : 1 **and** 2 : 1

Accept for 1 mark,
4.1 : 3.4 **and** 4.8 : 2.4

Accept $\frac{5}{3}$ *for 2 marks*

2

(d) **Not supported because**

1. (Sea) fishing reduces (mean) mass of fish;

2. Because large fish removed
OR
Because small fish escape/put back
OR
Because fishing (model) like Tank C;

But

3. Information from (only) one species
OR
Sea fishing catches other/different (types of) species;

4. No statistical test;

5. Size of tank may affect fish growth;

6. Fish in tanks are all same age/sea fish not all the same age;

7. No measure of number of fish (removed)/ only measured mean mass
OR
No measure of (total) yield of fish
OR
No measure of reproductive success of fish;

8. Removal of 90% of population is unlikely to be replicated in the sea fishing;

9. Sea fish do not have life cycle of one year
OR
Sea fish do not reproduce all at the same time;

2 max for "But"

3 max

[9]

Q4.

(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]

Q5.

(a) 1. LP due to mutation
OR
Allele due to mutation;

Reject mutation caused by drinking milk.

Reject (LP) gene

2. Milk provides named nutrient;

Accept any correct named nutrient e.g. glucose, galactose, protein

Ignore 'sugar' 'lactose' as named nutrient

3. Individuals with LP more likely to survive **and** reproduce
OR
Individuals with advantageous allele more likely to survive **and** reproduce;

Reject (LP) gene

Accept 'individuals who produce lactase' for 'LP individuals'

Accept 'pass on allele/LP/characteristic' for reproduce.

4. Directional selection;

5. Frequency of allele increases (in the offspring/next generation);

*Accept description of increasing frequency of allele e.g. 'higher proportion', 'more common' but ignore increase in **number** of allele*

4 max

(b) 1. Dominant allele;

2. (Always) expressed/shown (when present in phenotype/offspring)
OR
Expressed when only one (dominant allele) present;

2

(c) 1. Mutation in promoter (DNA/gene) for transcription factor
OR
Mutation in promoter (region/DNA) for the gene
OR
Mutation in gene for transcription factor;
Accept mutation in an epistatic gene

2. Lactase gene continues to be transcribed/active;

2

[8]