

## Mark schemes

1

- (i) 1. Identical twins show genetic influence / differences between them show environmental influence;

*Neutral: allows a comparison*

*It must be clear which set of twins is being referred to*

2. Non-identical twins (also) show an environmental / non-genetic influence;

*It must be clear which set of twins is being referred to*

*Do not credit repetition of bullet points in stem*

2

- (ii) Genes play a greater role / environment plays a lesser role;

*Must be comparative*

*Neutral: genes are involved*

*Neutral: involves genes and the environment*

1

- (iii) Any suitable suggestion for a maximum of two marks e.g.:

*Neutral: 'environment' as in question stem*

*Neutral: unqualified ideas such as health / lifestyle*

1. Age;
2. Sex (non-identical twins);
3. Family / medical history (of mental illness);
4. No use of recreational drugs;
5. Ethnic origins;

2 max

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2

- (a) 1. Large number of eggs / offspring / flies (therefore) improves reliability / can use statistical tests / are representative / large sample (size) / reduces sampling error;

*Each mark point requires a feature linked in mark scheme (by therefore) to an explanation*

*Do not accept a large number of eggs produces a large number of flies unless the term sample is used*

*Ignore references to accuracy or precision*

2. Small size / (breed) in small flasks / simple nutrient medium (therefore) reduces costs / easily kept / stored;

*Accept small size so can be kept in small flasks*

3. Size / markings / phenotypes (therefore) males / females easy to identify;

*Answers must relate to size, markings or use the term phenotype*

4. Short generation time / 7 - 14 days / develop quickly / reproduce quickly (therefore) results obtained quickly / saves times / many generations;

2 max

- (b) (i) 1.  $X^R X^R$  and  $X^r Y$ ;

*All marking points are completely independent. Allow crosses from the following parents for a possible three marks:*

*$X^R X^R$  and  $X^r -$*

*$X^R X^R$  and  $X^r Y$ ;*

*$RR$  and  $rY / rY^-$*

*$RR$  and  $r-$  or  $RR$  and  $r$*

2.  $X^R$  and  $X^R$  plus  $X^r$  and  $Y$ ;

3.  $X^R X^r$  and  $X^R Y$ ;

**OR**

1.  $X^R X^r$  and  $X^r Y$ ;

**OR**

*$X^R X^r$  and  $X^r -$*

*$X^R X^r$  and  $X^r Y$ ;*

2.  $X^R$  and  $X^r$  plus  $X^r$  and  $Y$ ;

*$Rr$  and  $rY / rY^-$*

*$Rr$  and  $r-$  or  $Rr$  and  $r$*

*Accept different symbols e.g.  $W$  and  $w$*

*2. Accept gametes in a punnet square*

3.  $X^R X^r$  and  $X^R Y$ ;

3

- (ii) Fertilisation is random / fusion of gametes is random / small / not large population / sample / selection advantage / disadvantage / lethal alleles;  
*Mutation = neutral*  
*Random mating = neutral*  
*Accept fertilisation / fusion of gametes is due to chance*

1

- (c) 1. Males have one allele;  
*Answers should be in context of alleles rather than chromosomes*
2. Females need two recessive alleles / must be homozygous recessive / could have dominant and recessive alleles / could be heterozygous / carriers;

2

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3

- (a) 1. Decrease in (percentage cover) of bare ground / water linked to more plants / species / increase in plant coverage;

*Allow **one maximum mark** for answers which describe all three changes **without** a suitable explanation for any change*

*Must be idea of more / increase not just change in species / plants*

2. Change in diversity / number of plant / species / named (species) as abiotic conditions altered / due to competition / more soil / less hostile;

*Accept pioneer species replaced due to competition*

*Accept description of change in species*

*Accept 'more suitable' = less hostile*

3. Increase in depth of soil as plants die / humus formed;

3

- (b) 1. Greater variety of food / more food sources;

*'More food' = neutral*

2. More / variety of habitats / niches;

*Ignore 'more homes' or reference to 'shelters'*

2

- (c) (i) 1. Marking is not removed / marking does not affect survival / predation;

2. Limited / no immigration / emigration;

*Accept 'migration' and descriptions of immigration / emigration*

*2. and 4. Increase / decrease in population is not sufficient – there must be a reason*

3. Sufficient time for (marked) individuals to mix (within the population);

*Accept – 'For mixing to occur between samples'*

4. No / little births / deaths / breeding;

5. Sampling method is the same;

*Ignore 'random sampling'*

2 max

(ii) Correct answer of ...34 = 2 marks;

**Allow one mark** for an answer of 51 as candidate has misinterpreted the second sample as being = 30

Incorrect answer but shows correct formula in words or numbers  
e.g.  $17 \times 20 \div 10$ ;

*Reject correct formula multiplied by 100*

2

[9]

4

(a) 0.8;

1

(b) (i) 1. Aerobic respiration;

1. Allow description e.g. respiration using oxygen

1. Accept 'oxidative phosphorylation'

2. Increase in uptake (of oxygen) with growth / reproduction / division of yeast cells;

3. Glucose / nutrients / oxygen decreases / becomes limiting / cells die / ethanol / toxins form / heat produced / anaerobic respiration occurs;

3. Ignore any reference to time

3. Accept decrease in oxygen being linked to oxygen being 'used up' or equivalent

3

(ii) 1. (Ethanol produced) by anaerobic respiration / from pyruvate in anaerobic conditions;

1. 'Fermentation' is not enough on its own

2. (Ethanol / anaerobic respiration) increases as oxygen (uptake / concentration) decreased / decreases as glucose is used up / ethanol kills cells;

2

(c) 1. Oxygen uptake decreases / stopped;

2. Oxygen is final (electron) acceptor / combines with electrons (and protons);

3. Ethanol produced sooner / more ethanol produced;

3. Accept ethanol produced at any specified time before 16 hours

3

[9]

5

- (a)
1. Chlorophyll absorbs light energy;  
*Accept light energy 'hits' chlorophyll*  
*Accept photon for light energy*
  2. Excites electrons / electrons removed (from chlorophyll);  
*Accept higher energy level as 'excites'*
  3. Electrons move along carriers / electron transport chain releasing energy;  
*Accept movement of H<sup>+</sup> / protons across membrane releases energy*
  4. Energy used to join ADP and Pi to form ATP;  
*Negate 'produces energy' for either mark but not for both*  
*Accept energy used for phosphorylation of ADP to ATP*  
*Do not accept P as Pi*
  5. Photolysis of water produces protons, electrons and oxygen;  
*3. and 4.*
  6. NADP reduced by electrons / electrons and protons / hydrogen;  
*Accept NADP to NADPH (or equivalent) by addition of electrons / hydrogen*  
*Do not accept NADP reduced by protons on their own*

5 max

- (b)
1. Variation / variety;
  2. Mutation;  
*Do not accept answers which suggest the mutation is caused by copper*
  3. Some plants have allele to survive / grow / live in high concentration of copper / polluted soils;  
*Reference to immunity disqualifies this mark*  
*Do not disqualify mark for references to allele providing resistance to copper*
  4. (Differential) reproductive success / adapted organisms reproduce;
  5. Increase in frequency of allele;
  6. No interbreeding (with other populations) / separate gene pool / gene pool differs (from other populations);  
*Accept reproductive isolation*

5 max

[10]

6

- (a) Crabgrass;  
*Reject: grass or grassland*  
*Reject: crabgrass if another organism is also included*

1

- (b) 1. Species / plants / animals change the environment / conditions / add humus / nutrients etc. / less hostile (habitat);

*Accept 'they' for species / plants in mark points 1 and 2*

2. Species / plants better competitors;

2

- (c) (Only) plants which can photosynthesise with less light (remain);

*Accept converse but do not award mark for idea that plants cannot photosynthesise and die because there is no light*

*Answers must be in context of being or not being able to photosynthesise with less light*

1

[4]

7

- (a) Is always expressed / shown (in the phenotype);

*Reject 'is always present' without further qualification*

1

- (b)  $C^B C^B$ ,  $C^B C^P$  and  $C^B C^Y$ ;

*All three are required for the mark*

Or

- $C^B C^B$ ,  $C^P C^B$  and  $C^Y C^B$ ;

*Accept  $C^B C^B$ ,  $C^B C^P$ ,  $C^B C^Y$ ,*

*$C^Y C^B$  and  $C^P C^B$*

*Accept BB, BP and BY or*

*BB, BP, BY, YB and PB*

1

- (c) 1. Two genotypes (as parents) shown as  $C^P C^Y$

*Award **one mark maximum** for candidates who have misread the question and complete a correct genetic cross between a pink snail,  $C^P C^Y$  and a yellow snail,  $C^Y C^Y$  to give pink and yellow offspring*

Or

Two sets of gametes shown as  $C^P$  and  $C^Y$ ;

2. Genotypes of offspring shown as  $C^P C^Y$ ,  $C^P C^P$  and  $C^Y C^Y$ ;

3. Above genotypes of offspring correctly linked to phenotypes i.e. pink and yellow;

*Accept ratio (or equivalent) of 3 pink: 1 yellow for mark point 3*

3

- (d) 1. Correct answer of 42% = 3 marks  
*Answer of 0.42 = 2 marks*  
 Award **one mark maximum** for answer of  
 49.9 / 49.98 / 50% or 0.49 / 0.5
2.  $q^2 = 0.49 / 49\%$  **OR**  $q = 0.7 / 70\%$   
 Award **one mark maximum** for answer of 40.8 / 41% or 0.41
3. Shows understanding that  $2pq =$  heterozygotes / carriers / shows answer is derived from  $2pq$ ;  
 Accept:  $b^2 = 0.49 / 49\%$  or  $b = 0.7 / 70\%$  for mark point 2

3

[8]

8

- (a) All / group of species / all / group of populations / all the organisms;  
 Accept equivalent terms for group.  
 Answers which only refer to organisms must have idea of **all** the organisms not just a group of organisms  
 Reject answers which include 'environment' or abiotic factors as part of the definition

1

- (b) (i) 7.2 - 8.4 (metres);  
 Accept answer of 1.2

1

- (ii) 1. Food / prey / oxygen;  
 Do not accept 'resource' for mark point 1 unless this is qualified as food / prey / oxygen
2. Less / no competition;  
 Reference to light and  $CO_2$  as a resource negates mark point 2  
 Ignore intraspecific / interspecific for mark point 2

2

- (c) 1. Increase in depth linked to decrease in temperature / decrease in depth linked to increase in temperature;  
*Accept increase or decrease in temperature is related to 'higher depth' or 'lower depth' due to ambiguity of these terms*
2. Correlation / relationship between temperature and fish distribution does not indicate a causal effect;  
*Ignore any reference to correlation unless it is clearly in context of temperature and fish distribution*
3. Overlap in ranges / different fish / species occupy same depth;  
*Temperature does not determine fish distribution is not sufficient for idea of causal effect*
4. Other abiotic / biotic / named factor involved;  
*Reject: 'casual' for mark point 2*  
*Reject 'other factors' for mark point 4 unless further qualified*

3 max

[7]

9

- (a) 1. Quadrats placed at intervals along transect;
2. Number of seeds counted per quadrat to calculate seeds per m<sup>2</sup>;
- (b) (i) 1. Wind from North East;  
*Accept blowing to South West*
2. Seeds blown further;
- (ii) 1. Seeds have different distances to fall / seeds have different times in air;
2. Blown by wind a different amount;
3. (Candidates investigation) shows that seeds travel further when dropped from higher;  
*Supported by reference to candidate's investigation*
- (c) (i) 1. Produces large number of seeds / produces seeds blown by wind;
2. Greater probability (of colonising);  
*Accept greater chance*

2

2

2 max

2

- (ii) 1. Small size;
- 2. Too little food in seed to become established;
- 3. Not enough light for photosynthesis;

2 max

[10]

10

- (a) (i) Each treatment occurs in each row and each column;  
*Ignore references to random*

1

- (ii) 1. Different environments or different variables in the field / in different plots / variables change across rows / down columns / from one side to another;
- 2. Minimises / removes the effect of variables;

2

- (b) Standardising any two relevant factors, for example:

*To gain credit here, factor must be something that the scientists could do and must relate to field conditions*

- 1. Water;
- 2. Fertiliser / manure / soil nutrient;
- 3. Weed killer;
- 4. Soil pH;

*Reject answers such as keep light / carbon dioxide / temperature constant*

2 max

- (d) (i) 1. Survival falls as time increases;
- 2. Survival falls as sowing density increases;
- 3. Up to 15 / 25 seeds per m<sup>2</sup> all survive / above 250 seeds per m<sup>2</sup> survival falls rapidly;

3

- (ii) 1. Intraspecific competition / competition between bean / soya plants / for water / nutrients / light;
- 2. Greater as plants grow / increase in size;

2

[10]

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- (a) 1. Competition (from) parent tree;
- 2. (From) large number of seeds;
- 3. For light / nutrients / water;

3

- (b) 1. Few seeds / young plants;
2. Interspecific competition / unsuitable conditions means not all survive;

2

[5]