AQA, OCR, Edexcel

A Level

A Level Biology

Inheritance, Ecology and Succession Answers

Name:

M M E

Mathsmadeeasy.co.uk

Total Marks:

M1.(a) Both alleles are expressed / shown (in the phenotype).

Accept: both alleles contribute (to the phenotype)

Neutral: both alleles are dominant

1

(b) Only possess one allele / Y chromosome does not carry allele / gene / can't be heterozygous.

Accept: only possess one gene (for condition)

Neutral: only 1 X chromosome (unqualified)

1

(c) 1. X^GX^B, X^BX^B, X^GY, X^BY;

Accept: equivalent genotypes where the Y chromosome is shown as a dash e.g. X^G-, or is omitted e.g. X^G

Reject: GB, BB, GY, BY as this contravenes the rubric

2. Tortoiseshell female, black female, ginger male, black male;

3. (Ratio) 1:1:1:1

2 and 3. Award one mark for following phenotypes tortoiseshell, black, (black) ginger in any order <u>with</u> ratio of 1:2:1 in any order.

*Allow one mark for answers in which mark points 1, 2 and 3 are not awarded but show parents with correct genotypes i.e. X^GX^B and X^BY **or gametes as** X^G, X^B and X^B, Y*

3. Neutral: percentages and fractions

3. Accept: equivalent ratios e.g. for 1:1:1:1 allow 0.25 : 0.25 : 0.25 : 0.25

3

(d) (i) Correct answer of 0.9 = 2 marks;

Incorrect answer but shows $q^2 = 0.81$ = one mark.

Note: 0.9% = one mark

2

(ii) Homozygous dominant increases and homozygous recessive decreases.

1

[8]

M2.(a) (Genes / loci) on same chromosome.

1

(b) 1. GN and gn linked;
2. GgNn individual produces mainly GN and gn gametes;
3. Crossing over produces some / few Gn and gN gametes;
4. So few(er) Ggnn and ggNn individuals.

4

(c) (Grey long:grey short:black long:black short) =1:1:1:1

1

(d) 1. Chi squared test;
2. Categorical data.

2

[8]

M3.(a) (Recessive) allele is always expressed in females / females have one (recessive) allele / males need two recessive alleles / males need to be

homozygous recessive / males could have dominant and recessive alleles / be heterozygous / carriers;

Accept: Y chromosome does not carry a dominant allele. Other answers must be in context of allele not chromosome or gene.

1

b) (i) 1. 1, (2) and 5;

Accept: for 1 mark that 1 and 2 have slow (feather production) but produce one offspring with rapid (feather production).

Neutral: any reference to 3 being offspring of 1.

2. 1 must possess / pass on the recessive allele / 1 must be a carrier / heterozygous / if slow (feather production) is recessive all offspring of (1 and 2) would be slow (feather production) / if rapid (feather production) was dominant 1 would have rapid (feather production);

Reject: both parents must be carriers / possess the recessive allele.

Reject: one of the parents (i.e. not specified) must be a carrier / heterozygous. **2**

ii) 5 = X^fY / X^fY^- / f / f- / fY ;

7 = X^FX^f **and** X^FX^F (either way round) /

or X^fX^F **and** X^FX^F (either way round) /

or X^FX^f, X^fX^F **and** X^FX^F(in any order);

Note: allow 5 = X^fY, X^fY.

Accept: for both 5 and 7 a different letter than F. However, lower case and capital letter must correspond to that shown in the answer. For example accept 7 = X^RX^r and X^RX^R. **2**

(iii) X^FX^f **and** X^fY **or** X^fX^F **and** X^fY

or X^FX^f **and** X^fY^- or X^fX^F **and** X^fY^- /

or Ff **and** fY /

or Ff **and** fY^- /

or Ff **and** f- /

or Ff **and** f;

Accept: a different letter than F. However, lower case and capital letter must correspond to that shown in the answer.

Accept: each alternative either way round. **1**

(c) Correct answer of 32 (%) = 3 marks;;;

Accept: 0.32 = 2 marks

If incorrect answer, allow following points

1. p^2 / q^2 = 4% / 0.04 / or p / q = 0.2;

2. Shows understanding that 2pq = heterozygotes / carriers;

Accept: answer provided attempts to calculate 2pq. This can be shown mathematically i.e. 2 x two different numbers 3 **[9]**

M4.(a) 0.32.

Correct answer = 2 marks
Accept 32% for 1 mark max
Incorrect answer but identifying 2pq as heterozygous = 1 mark

2

(b) 1. Mutation produced *KDR minus* / resistance allele;
2. DDT use provides selection pressure;
3. Mosquitoes with *KDR minus* allele more likely (to survive) to reproduce;
4. Leading to increase in *KDR minus* allele in population.

4

c) 1. Neurones remain depolarised;
2. So no action potentials / no impulse transmission.

2

(d) 1. (Mutation) changes shape of sodium ion channel (protein) / of receptor (protein);
2. DDT no longer complementary / no longer able to bind.

2

[10]

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

[6]

M6.(a) 1. Allows (valid) comparison;

2. Number / sample size may vary; **2**

(b) 1. Increased chance of (severe malaria) with blood group A / decreased chance of (severe malaria) with sickle cell;

Accept: converse for mild malaria i.e. increased chance of mild malaria with sickle cell / decreased chance of mild malaria with blood group A.

Accept: if answer is comparative e.g. greatest risk of severe malaria with blood group A.

2. One mark for one of the following:

almost equal chance with blood group O / slightly greater chance of mild malaria with O / slightly lower chance of severe malaria with O / 2.5 x / 2.48 x / more than twice the chance of severe with blood group A / (almost) 50% / half the chance of severe malaria with sickle cell / twice the chance of mild malaria with sickle cell;

Neutral: answers which only refer to or use ratios.

2

(c) 1. Individuals with the **Hb**^{C} (allele) reproduce;

2. Pass on **Hb**^{C} (allele) which increases in frequency;

3. **Hb**^{A} **Hb**^{A} individuals less likely to survive / reproduce / frequency of **Hb**^{A} (allele) decreases;

3

[7]

M7. (a) Mutation / (spontaneous) change in a gene / change in DNA;

1

(b) (i) Correct answer: 0 / 6;; 2 marks
OR
Use of 56 and $\frac{176}{2}$ or 88 / 56 × 2 or 112 and 176; 1 mark

max 2

(ii) 64;

1

(c) (i) Correct answer = 42%;;; (only if $q^2 = 0.49$) 3 marks
OR 0.42;; 2 marks
OR
$p + q = 1$ / $p^2 + 2pq + q^2 = 1$ / $p = 1 – 0.7$ / $q^2 = 0.49$ / $q = 0.7$;

Answer = 2pq / use of appropriate numbers; 2 marks

max 3

ii) 1. Parental genotypes correct: both **W**^{R}**W**^{S}
(ACCEPT 'RS')

AND

W^{S} (*ACCEPT 'S'*) / gamete from each parent;

2. **W**^{S}**W**^{S} (*ACCEPT 'SS'*) / offspring formed and identified as susceptible;
If different symbols:
– defined : max 2 marks
– not defined max 1 mark (= pt.2) **2**

(iii) 1. Description: decrease + rate of decrease slows with time;

Explanation: Any **three** from:

2. Resistant rats / rats with W^R allele survive
OR susceptible / W^SW^S rats killed

3. (more likely) to pass on W^R allele to offspring / less likely to pass on W^S / higher proportion of next generation has W^R allele / lower proportion has W^S;

4. Chance of mating with W^SW^S is reduced / W^SW^S becomes rare;

5. Rate of selection against W^S slows because W^S allele is in heterozygotes;

max 4

(iv) No selective advantage / All genotypes equally fertile;
Large population;
Random mating; (IGNORE 'random fertilisation')
No mutation;
No emigration / immigration;

max 2

[15]

M8. (a) breed together;
if fertile offspring, then same species;

2

(b) isolation of two populations;
variation already present due to mutations;

different environmental conditions / selection pressures leading to selection of different features and hence different alleles;
different frequency of alleles;
separate gene pools / no interbreeding;

4

(c) selection of mate dependent on colour pattern;
prevents interbreeding / keeps gene pools separate;

2

[8]

M9. (a) mutations;
which are different / at different positions in the gene;

2

(b) (i) either dominant or recessive allele;

1

(ii) a^ha^h BB, a^haBB, a^ha^h Bb, a^haBb;;
(allow 1 mark for 2 or 3 correct answers)

2

(iii) temperature lower at extremities;
enzyme active / not denatured;

2

(c) if allele A is present (normal) tyrosinase / enzyme is produced, so it does not matter what other allele is present / explanation of why heterozygote is same phenotype as double dominant in terms of enzyme produced;
phenotype / rabbit is black as both have alleles A and B; **2** **[9]**

M10. (a) 1 4 year cycles;
2 predator / stoat peaks after prey / lemming;
3 lemmings increase due to low numbers of stoats / available food;
4 more food for stoats so numbers increase;
5 increased predation reduces number of lemmings;
6 number of stoats decreases due to lack of food / starvation;

6

(b) smaller populations have fewer different alleles / more homozygosity / less heterozygosity / smaller gene pool / lower genetic variability;
migrants bring in new alleles / increase gene pool;

2

(c) geographical isolation of populations;
variation present in population(s);
different environmental conditions / different selection pressures / different phenotypes selected;
change in genetic constitution of populations / gene pools / allele frequency;

4

[12]

M11. (a) 1. Expression / appearance / characteristic due to genetic constitution / genotype / allele(s);

1. Accept: named characteristic

1. Accept: homozygous / heterozygous / genes / DNA

1. Neutral: chromosomes

2. (Expression / appearance / characteristic) due to environment;

2

(b) (i) 1. 3 and 4 and 9 / 11 / affected offspring;

1. Accept: 9 / 11 and their parents

1. Accept: unaffected parents have affected children

2. Both 3 and 4 are carriers / heterozygous;

2. Accept: if 3 and 4 are unaffected all their children will be unaffected

OR

If dominant at least one of 3 and 4 would be affected;

2

(ii) 1. 11 is affected, 3 is not;

1 Accept: 3 / unaffected father / parents produce an affected daughter

1. Accept: 3 and 4 would only produce unaffected females

2. 3 / father of 11 does not have a recessive allele on his X chromosome / X^t;

2. Answers must be in context of alleles

OR

(If on X) 11 / affected female would not receive the recessive allele on X chromosome / X^t from 3 / father;

Reject: recessive / dominant chromosomes

OR

(If on X) 3 / father (of 11) would pass on the dominant allele on his X chromosome / X^T;

2

(c) (i) Answer in range of 5.8 − 6.2% = 3 marks;;;

Answers in range of 0.058 - 0.062 = 2 marks

If incorrect answer, then 2 max of following points

1. q^2 / p^2 / tt = 0.001 or 1 divided by 1000;

2. p / q / T = 0.968 − 0.97;

3. Understanding that heterozygous = 2pq;

3. This can be shown mathematically ie 2 × two different numbers

3. Accept: answer provided attempts to calculate 2pq

3 max

ii) Affected individuals (usually) do not reproduce / die during childhood / do not pass on allele / genetic screening;

1

[10]

M12.(a) (i) (Organisms that) can breed together / interbreed **and** produce fertile offspring;

Need both aspects. Reject 'inbreed'

Reject viable offspring

1

(ii) Same number (of organisms) in each region / (organisms) equally spread;

Allow other ways of expressing 'region' or 'equally spread', eg not clumped together, same number per unit area

1

(b) $P = \frac{AS}{R}$;;

2 marks for correct answer

*1 mark for having **A** on top of equation (recognises that total population related to total area)*

Note:

P = A × S / R or
P = A / R × S

are also correct.

Allow 1 mark for $\frac{S}{P} = \frac{R}{A}$

2

(c) (i) *In mark–release-recapture (technique)*

Accept converse by considering assumptions of

proportional sampling

1. No assumption that organisms are uniformly distributed;

2. Size of total area / size of sampled region not required;
Marking point 1 or marking point 2 do not have to start with the same technique
In this case, allow difference by implication i.e. do not penalise if the two techniques are not compared

2

(ii) Animals are from / all part of the same population;

1

[7]

M13. (a) 10
(reject: 9.76)

1

(b) isolation (on islands);
variety of habitats / conditions different from origin / other islands;
differing pathways of natural selection;
leading to organisms too different to interbreed.

3 max

[4]

M14. (a) there is no difference between the number of lichens growing on the walls (facing different directions);

1

(b) 36, 36, 36;

1

(c) 2;

1

d) p less than 0.05 so reject the null hypothesis;
the difference is not due to chance / significant difference;
the direction the wall faces does have an effect on the population of lichens;

3 max

e) algae photosynthesise / produce organic molecules / named;
fungus anchors the lichen / absorbs water which is available to the algae / prevents dehydration of alga / absorbs mineral ions / phosphates / nitrates;

2

[8]

M15. (a) (i) transect line may not go through representative areas / may avoid certain areas;

1

(ii) large sample;
how random coordinates are generated / how random places chosen; **2**

b) (i) spread of values around the mean height of the plant; **1**

(ii) smaller plants at higher altitude;
greater the altitude the lower the standard deviation ;
reference to figures to make a comparison; **2 max**

(iii) the plants measured were grown under uniform conditions;

1

[7]

M16. (a) use of random numbers to place quadrats;
number of individuals counted in large number of quadrats;
little variation random, large variation - clustered;

3

(b) less competition;
for water / nutrients;

2

[5]

M17.(a) (i) Unit of energy / mass, per area, per year.

1

(ii) 1. Less light / more shading / more competition for light;
Neutral: references to animals

2. Reduced photosynthesis.
Accept: no photosynthesis

2

b) 1. Pioneer species;
2. Change in abiotic conditions / less hostile / more habitats / niches;
Accept: named abiotic change or example of change e.g. formation of soil / humus / organic matter / increase in nutrients
Neutral: reference to change in environment unqualified
Neutral: more hospitable / habitable / homes / shelters

3. Increase in number / amount / diversity of species / plants / animals.
Accept: other / new species (colonise)

3

c) 1. Net productivity = gross productivity minus respiratory loss;
2. Decrease in gross productivity / photosynthesis / increase in respiration.

2

(d) 1. Conserving / protecting habitats / niches;
2. Conserving / protecting (endangered) species / maintains / increases (bio) diversity;
3. Reduces global warming / greenhouse effect / climate change / remove / take up carbon dioxide;
4. Source of medicines / chemicals / wood;
5. Reduces erosion / eutrophication.
Accept: tourism / aesthetics / named recreational activity

1 max

[9]

M18. (a) (Increase in) dead organisms / humus / decomposition;

Leading to (increase in) nitrification / ammonia to nitrate / activity of nitrifying bacteria;

2

b) (i) Bare soil temperatures fluctuate;
Reject: environmental temperature
Accept: converse

More bare soil, early / at start of succession / when few plants;

2

ii) Plant will grow / survive in the shade / when overshadowed (by taller plants) / when receiving less light;

Effect on plant with reason for effect
Ignore reference to competition

1

c) (Grassland consists of) small / annual plants which will be replaced by / outcompeted by woody plants;

Must be in the context of grassland
Need idea of replaced not just an increase in percentage cover

So these (woody plants) must be removed / have growth checked / grazed;

2

[7]

M19.(a) 1. Quadrats placed at intervals along transect;

2. Number of seeds counted per quadrat to calculate seeds per m^2;

2

b) (i) 1. Wind from North East;
Accept blowing to South West

2. Seeds blown further;

2

(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

2 max

c) (i) 1. Produces large number of seeds / produces seeds blown by wind;

2. Greater probability (of colonising);
Accept greater chance

2

ii) 1. Small size;

2. Too little food in seed to become established;

3. Not enough light for photosynthesis;

2 max

[10]

20. (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]

M21.(a) 1. No / few consumers / pests / pathogens;

Accept: No / few predators.

Accept: description of competition for a named resource with reference to 'other species'.

Accept: More resistance to disease.

2. Outcompetes / better competitor for resources / light / CO_2 / abiotic factor / ideal niche;

Neutral: competition for food.

2

(b) 1. (Cost of) control / removal;

2. (Cost of) restoring habitat / conservation;

3. (Loss of income) from fishing;

4. (Loss of income) from boating / tourism / recreation;

Accept: any valid recreational activity e.g. canoeing.

2 max

c) (i) 1. Removes water;

2. Water content can vary in sample / plant;

Note: Reweighing / constant mass indicates all water removed = 2 marks. ;

2

(ii) 1. 0.5 is not effective / has little effect / 1.0 is less effective (than 5.0) / concentrations below 5.0 less effective;

Accept: for first 3 mark points effect on growth / biomass as a measure of effectiveness.

Accept: references to 'this concentration' = 5.0.

Accept: 5.0 is the minimum effective concentration.

1. and 2. 5.0 is the minimum effective concentration that reduces growth = 2 marks.

2. At 5.0 biomass / growth is reduced;

3. Small difference between using 5.0 and 25.0;

4. Using 5.0 is cost effective / using 25.0 is expensive / high concentrations may affect the environment / other organisms / chemical may remain in habitat / bioaccumulation;

Accept: any impact on the habitat e.g. contaminate water supply.

4

(d) (i) To compare / see effect with / without fungus / fluridone / control agent / s;

Neutral: for comparison on its own.

Neutral: to see effect of variables / results / treatments / factors without further qualification.

1

(ii) 1. Is specific / grows / survives in Hydrilla / habitat;

Accept: 'known to work'

2. Can reproduce / only one application required;

3. Does not become a pest;

2

iii) 1. Fluridone / chemical acts quickly / quickly reduces Hydrilla;

2. Fungus / biological control keeps Hydrilla in low numbers / fungus / biological control works over a long time / can reproduce / resistance does not develop against fungus / biological control;

2

[15]