1.2 Asexual Reproduction and Its Comparison With Sexual Reproduction: 30-minute Pack

EDEXCEL 4BI1 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Name one natural example and one artificial example of vegetative propagation used in horticulture, and give one brief reason why horticulturists use artificial vegetative propagation.

(Total for Question 1 is 3 marks)

2 A nursery uses tissue culture to grow plantlets from leaf pieces of source plants A and B. A DNA comparison shows that A and B are genetically different. Assume no mutations occur. Predict the genetic similarity within the plantlets from A and between plantlets from A and B. Explain each prediction.

(Total for Question 2 is 2 marks)

3 A gardener propagates potato plants from tubers. In a sample of 60 tubers planted, 48 produce healthy plants. Calculate the percentage success rate of propagation and show working.

(Total for Question 3 is 3 marks)

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4 State one disadvantage of asexual reproduction when a species needs to adapt to a changing environment, and explain briefly why this is a disadvantage.

(Total for Question 4 is 2 marks)

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5 In an illustrative investigation, genetically identical grass plants are grown in fresh water or slightly salty water. Both groups survive, but plants in salty water grow more slowly. A student concludes that clones must die whenever conditions change. Give one observation that contradicts this conclusion and explain why the growth difference does not by itself show genetic variation.

(Total for Question 5 is 2 marks)

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6 In an illustrative nursery trial, cuttings from one parent all produced striped leaves, while plants grown from seeds included both striped and plain leaves. A customer needs a batch with striped leaves; another grower wants variation to select new leaf patterns. Suggest which method suits each aim, using the observations.

(Total for Question 6 is 2 marks)

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7 Give two advantages of asexual reproduction for a plant species in a stable, favourable environment, naming why each advantage helps the population.

(Total for Question 7 is 2 marks)

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8 Compare speed of reproduction and genetic variation between asexual reproduction by runners and sexual reproduction by seeds in plants, giving one point about each factor.

(Total for Question 8 is 2 marks)

9 Describe one control variable and one improvement to reliability a student should use when comparing the speed of root growth from bulb offsets versus seed-grown bulbs in a laboratory investigation.

(Total for Question 9 is 2 marks)

10 In an illustrative school investigation, four strawberry plants grown from runners and four grown from seeds are compared. After four weeks, the new-leaf counts for individual plants were runners: 8, 9, 7, 8; seeds: 4, 6, 5, 5. Calculate both means, state which method had the greater mean, and give one limitation of this evidence.

(Total for Question 10 is 3 marks)

11 Compare asexual reproduction and sexual reproduction, giving advantages and disadvantages of asexual reproduction compared with sexual reproduction in terms of speed, energy cost, genetic variation and survival in changing environments. Use the comparison to reach a reasoned conclusion about which method is better for a species living in a stable habitat versus a changing habitat.

(Total for Question 11 is 6 marks)

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Mark scheme · 1.2 Asexual Reproduction and Its Comparison With Sexual Reproduction: 30-minute Pack

Question 1

natural example: runner in strawberry or bulb in tulip or tuber in potato **B1**

artificial example: cuttings, grafting or tissue culture **B1**

reason: to produce many genetically identical plants with desired traits quickly and reliably **B1**

Answer: Natural: runner in strawberry. Artificial: cuttings or grafting or tissue culture. Reason: to produce many identical plants with desired traits quickly.

Question 2

plantlets from A are genetically identical to each other because mitosis copies the genetic information of the same source plant **B1**

plantlets from A are genetically different from those from B because they retain genetic information from genetically different source plants **B1**

Answer: Plantlets from A are genetically identical to each other because mitosis copies genetic information from the same source plant. Plantlets from A differ genetically from those from B because their source plants have different genetic information.

Question 3

forms the fraction 48/60 **M1**

multiplies by 100 to make percentage **M1**

80% cao **A1**

Answer: 80%

Question 4

states lack of genetic variation as a disadvantage **B1**

explains that lack of variation reduces chance of individuals having traits to survive new conditions **B1**

Answer: Disadvantage: lack of genetic variation. Explanation: without variation there is less chance of individuals with useful mutations surviving new environmental stresses, so the population may decline.

Question 5

the plants in salty water survived despite the changed conditions **B1**

the different water conditions can affect growth without any difference in genetic information, so growth differences alone do not establish genetic variation **B1**

Answer: The plants in salty water survived, contradicting the claim that clones must die when conditions change. The salty water can reduce growth without changing genetic information, so slower growth alone does not show genetic variation.

Question 6

cuttings for the customer because all the observed plants from cuttings retained the striped leaves **B1**

seeds for the grower because the seed-grown plants showed varied leaf patterns to select from **B1**

Answer: Use cuttings for the customer because all plants from cuttings had striped leaves. Use seeds for the grower because the seed-grown plants showed varied leaf patterns for selection.

Question 7

advantage 1: fast population increase, because many offspring are produced quickly from each parent **B1**

advantage 2: less energy required than sexual reproduction, because no gametes or mating required **B1**

Answer: Fast population increase, allowing rapid colonisation; and lower energy cost since no gamete production or finding mates is needed.

Question 8

asexual by runners is faster because new plants are produced directly from parent and do not require gamete fusion or seed development **B1**

sexual by seeds gives more genetic variation because it combines genes from two parents **B1**

Answer: Runners produce new plants faster because no seed formation is needed; seeds from sexual reproduction give greater genetic variation by combining genes from two parents.

Question 9

control variable: same soil type, same temperature, same light or same number of bulbs per pot **B1**

improvement to reliability: use several replicates of each treatment and take the mean, or repeat the experiment **B1**

Answer: Control variable: use the same soil, temperature and light for both treatments. Improvement: use several replicates for each method and calculate a mean to improve reliability.

Question 10

runner mean = (8 + 9 + 7 + 8)/4 = 8 leaves **M1**

seed mean = (4 + 6 + 5 + 5)/4 = 5 leaves and identifies runners as greater **M1**

one limitation, such as only four plants per method, short four-week period, or leaf count alone does not measure overall health **B1**

Answer: Runners: (8 + 9 + 7 + 8)/4 gives a mean 8 leaves. Seeds: (4 + 6 + 5 + 5)/4 gives a mean 5 leaves. Runners had the greater mean. A limitation is that only four plants were measured in each group.

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Question 11

Level 1 Basic points about one or two differences are made, with minimal linkage. Statements are short and lack development. **1-2**

Level 2 Several clear comparisons are made, covering at least two of the required factors, with some explanation of implications. A simple conclusion is stated. **3-4**

Level 3 A coherent comparison covers speed, energy cost, genetic variation and survival implications. Explanations link causes to consequences and the answer reaches a clear, justified conclusion about preferred method in stable versus changing habitats. **5-6**

Indicative content:

- Asexual reproduction is usually faster than sexual reproduction, because it produces offspring directly from one parent without gamete formation or fertilisation
- Asexual reproduction has lower energy cost than sexual reproduction since no mate searching, courtship or gamete production is needed
- Asexual reproduction produces genetically identical offspring, so genetic variation is low compared with sexual reproduction which mixes parental genes
- Low genetic variation means asexual populations are less able to adapt to changing environments and are more vulnerable to new diseases or environmental change
- In a stable, favourable environment asexual reproduction is advantageous because it quickly produces many well adapted clones and conserves successful genotypes
- In a changing or unpredictable environment sexual reproduction is advantageous because higher genetic variation increases the chance some offspring will survive new conditions
- Balanced conclusion might state that asexual reproduction is better for rapid colonisation and stable conditions, whereas sexual reproduction is better when adaptability to change is important

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