



IG.B2 Asexual Reproduction and Its Comparison With Sexual Reproduction

EDEXCEL 4BI1 · Calculator allowed · about 50 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Define the term 'asexual reproduction' as it is used for single-celled and multicellular organisms in biology.

(Total for Question 1 is 1 mark)

- 2** Give one example of a microorganism that reproduces by binary fission and name the process occurring in the parent cell.

(Total for Question 2 is 2 marks)

- 3** State one example of asexual reproduction in yeast and name the visible feature of the parent cell that shows this process.

(Total for Question 3 is 1 mark)

- 4** Describe vegetative propagation in plants, using runners, bulbs or tubers as a named example and stating how the offspring relate genetically to the parent.

(Total for Question 4 is 2 marks)

- 5 Describe briefly how mitosis is involved in asexual reproduction in multicellular organisms such as plants forming new shoots from a bulb.

(Total for Question 5 is 2 marks)

- 6 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 6 is 2 marks)

- 7 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 7 is 3 marks)

- 8 Suggest one reason why asexual reproduction may make a population more vulnerable to a disease outbreak, using the idea of genetic similarity in your explanation.

(Total for Question 8 is 2 marks)

- 9 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 9 is 2 marks)

- 10** 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 10 is 3 marks)

- 11** 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 11 is 2 marks)

- 12** 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 12 is 2 marks)

- 13** Give one clear biological reason why asexual reproduction may be favoured by organisms that live in isolated or extreme habitats, and give one named organism that uses asexual reproduction in those conditions.

(Total for Question 13 is 1 mark)

- 14** State briefly what is meant by a clone in biology and give one example from plants produced by asexual reproduction.

(Total for Question 14 is 1 mark)

- 15** 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 15 is 6 marks)

Mark scheme · IG.B2 Asexual Reproduction and Its Comparison With Sexual Reproduction

Question 1

- **B1** a form of reproduction involving one parent producing offspring genetically identical to the parent, usually without fusion of gametes (involves mitosis)
- **Answer: Reproduction from one parent producing genetically identical offspring, without fusion of gametes, usually by mitosis.**

Question 2

- **B1** names a valid microorganism, e.g. Escherichia coli or other bacterium
- **B1** names the process in the parent cell, binary fission involving replication of DNA then cell division
- **Answer: Example: Escherichia coli (a bacterium). Process: binary fission, where the DNA replicates and the cell splits into two.**

Question 3

- **B1** budding in yeast and the visible feature is a small bud forming on the parent cell
- **Answer: Budding in yeast, shown by a small bud forming on the parent cell.**

Question 4

- **B1** names a method with an example, e.g. runners in strawberry, bulbs in tulip, or tubers in potato
- **B1** describes that new plants grow from those structures and are genetically identical to the parent
- **Answer: Vegetative propagation, e.g. runners in strawberry or tubers in potato: new plants grow from those structures and are genetically identical clones of the parent.**

Question 5

- **B1** states that mitosis produces new cells with the same number of chromosomes
- **B1** links to growth of new shoots or structures from the bulb composed of genetically identical cells
- **Answer: Mitosis makes new body cells with the same chromosome number; these identical cells form the new shoot or plant part that develops from the bulb.**

Question 6

- **B1** 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
- **Answer: Fast population increase, allowing rapid colonisation; and lower energy cost since no gamete production or finding mates is needed.**

Question 7

- **M1** forms the fraction 48/60
- **M1** multiplies by 100 to make percentage
- **A1** 80% cao
- **Answer: 80%**

Question 8

- **B1** states that offspring are genetically identical
- **B1** explains that if one individual is susceptible to a pathogen, many will be susceptible so disease spreads rapidly
- **Answer: Because offspring are genetically identical, if one is susceptible to a pathogen many others will be too, so a disease can spread quickly through the population.**

Question 9

- **B1** 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
- **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 10

- **B1** 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
- **Answer: Natural: runner in strawberry. Artificial: cuttings or grafting or tissue culture. Reason: to produce many identical plants with desired traits quickly.**

Question 11

- **B1** 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
- **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 12

- **B1** states lack of genetic variation as a disadvantage
- **B1** explains that lack of variation reduces chance of individuals having traits to survive new conditions
- **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 13

- **B1** valid reason and organism, e.g. it allows reproduction without mates so a single coloniser can establish a population; example: hydra by budding or some bacteria by binary fission
- **Answer: Reason: allows reproduction without a mate so a single coloniser can found a population; example: hydra (budding) or bacteria (binary fission).**

Question 14

- **B1** a clone is an organism genetically identical to another; example: potato plants grown from tubers are clones
- **Answer: A clone is a genetically identical individual; example: potato plants from tubers are clones.**

Question 15

- **Level 1** (1-2): Basic points about one or two differences are made, with minimal linkage. Statements are short and lack development.
- **Level 2** (3-4): Several clear comparisons are made, covering at least two of the required factors, with some explanation of implications. A simple conclusion is stated.
- **Level 3** (5-6): 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.
- **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