

APOLLO

Mutation and gene editing SL

Biology

First assessment 2025

7 questions | questions

17. Azithromycin is an antibiotic commonly used to treat pneumonia, an infection of the lungs caused by *Streptococcus pneumoniae*. A patient was diagnosed for the second time with pneumonia, but the same antibiotic was ineffective this time. What biological explanation might there be for this?
- A. *S. pneumoniae* had mutated.
 - B. *S. pneumoniae* had developed antibodies for the antibiotic.
 - C. The patient was immune to the antibiotic.
 - D. The patient had antibiotic remaining from the first treatment.

29. Mutations and sexual reproduction both play a role in generating variation, upon which natural selection acts. What describes how variation is generated?

- I. Mutations generate new alleles.
 - II. Mutations generate new combinations of alleles.
 - III. Sexual reproduction generates new alleles.
- A. I only
 - B. III only
 - C. II and III only
 - D. I and III only

Turn over

8. What is a feature of mutations?
- A. They occur randomly.
 - B. They only occur in germ cells.
 - C. The frequency cannot be increased by external factors.
 - D. They only occur in certain base sequences of the genome.

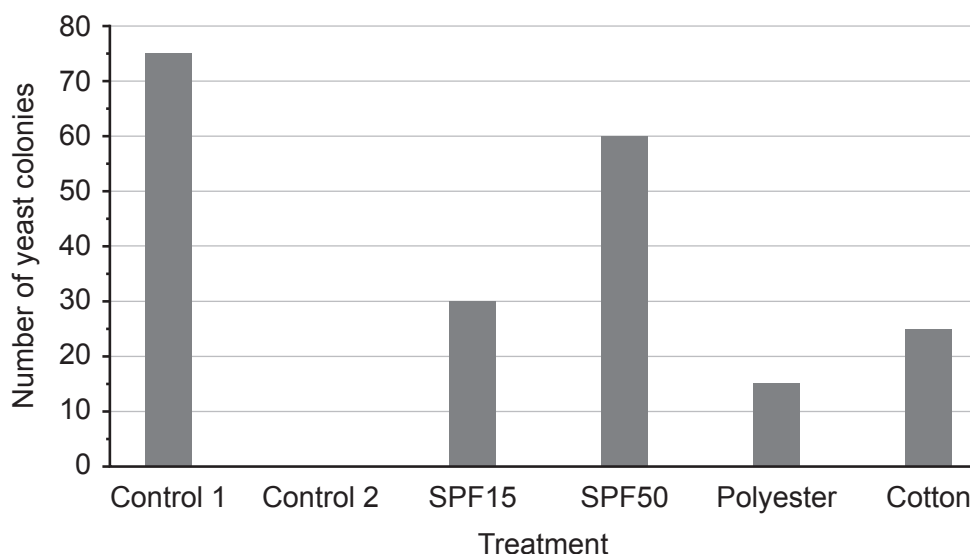
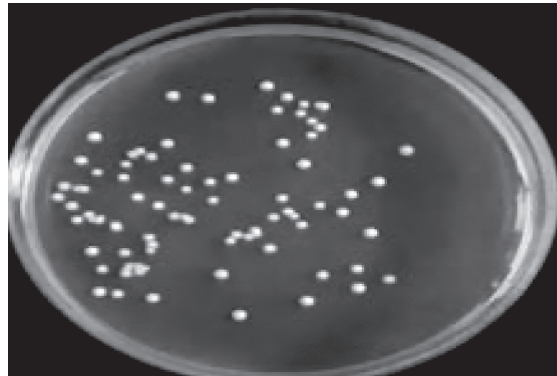
Turn over

7. A mutation in which type of cell could be inherited?

- A. Beta cell in the pancreas
- B. T-cell in the lymph
- C. Sperm cell in the testis
- D. Skeletal muscle cell in the diaphragm

4. Ultraviolet (UV) light can penetrate cells, causing DNA damage. This effect can be reduced by using sunscreens or covering skin with clothing.

In an experiment to look at the effect of different treatments to reduce UV damage to DNA, yeast fungus (*Saccharomyces cerevisiae*) was used as the test organism. Six Petri dishes with agar were inoculated with yeast in sucrose solution. The Petri dishes were labelled according to the treatment applied to the lid, with sunscreen (Sun Protection Factors SPF15 or SPF50), cloth (polyester or cotton) or control (no treatment). Control 1 was placed in the dark and all the other Petri dishes were placed in direct sunlight for 6 hours. The dishes were then incubated for three days. The image shows yeast colonies that grew on the agar in one of the Petri dishes. The bar graph shows the number of yeast colonies present per Petri dish.



- (a) Describe how yeast cells reproduce.

[2]

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(Question 4 continued)

(b) Identify **one** type of mutation that can be induced by UV light. [1]

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(c) State **one** role of sucrose in this experiment. [1]

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(d) Suggest a possible reason for the difference in number of yeast colonies

(i) between Control 1 and Control 2. [1]

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(ii) between SPF15 and SPF50. [1]

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(e) Using the experimental results, evaluate the use of cotton clothing instead of polyester in humans. [2]

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References:

1. Lucas, M. and Wallace, I., 1973. Chromosomes of *Gorilla gorilla gorilla* J. Zool. 169, pp. 403–407. Available at: <https://zslpublications.onlinelibrary.wiley.com/doi/abs/10.1111/j.1469-7998.1973.tb04565.x>. Source adapted.
2. Cavagnaro, J.B., 1988. Distribution of C₃ and C₄ grasses at different altitudes in a temperate arid region of Argentina. *Oecologia* 76(2), pp. 273–277. <https://doi.org/10.1007/bf00379962>. Source adapted.
3. Ionescu, A., Aprodu, I. and Pascaru, G., 2008. Effect of papain and bromelain on muscle and collagen proteins in beef meat. *The annals of the University Dunarea de Jos of Galati. Fascicle VI- Food Technology*, Year II (XXXI), pp. 9–16. Source adapted.
4. Alhamdy, T. and Al-Sowayan, N.S., 2020. The Effect of Sunscreens on Yeast to Prevent Ultraviolet Damage. *Advances in Bioscience and Biotechnology* 11, pp. 111–122. <https://doi.org/10.4236/abb.2020.114009>. Licensed under the Creative Commons Attribution 4.0 International Deed license: <https://creativecommons.org/licenses/by/4.0/deed.en>.



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8. A strand of DNA containing four codons with base sequence ACT GTA CTC TAC mutates, changing the base sequence to ACT ATG CTC TAC. What type of mutation has occurred?
- A. Insertion
 - B. Substitution
 - C. Deletion
 - D. Degeneracy

Section B

Answer **one** question. One additional mark is available for the construction of your answer. Answers must be written within the answer boxes provided.

7. Mutations have a range of consequences for organisms.

- (a) Outline how mutation can lead to cancer. [4]
- (b) Outline **one** example of a human disease caused by an autosomal recessive allele. [4]
- (c) Explain the role of mutations in evolution. [7]