

APOLLO

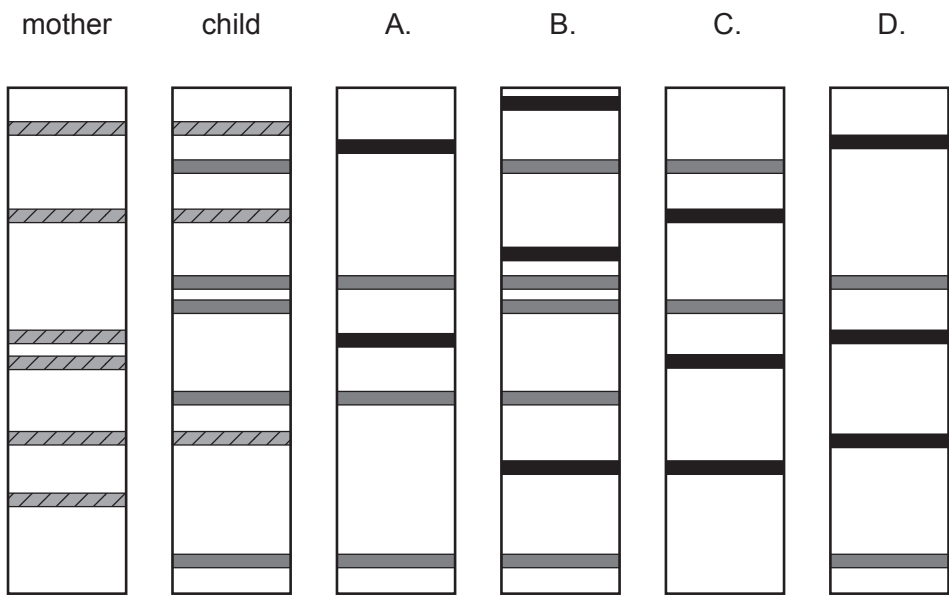
Inheritance SL

Biology

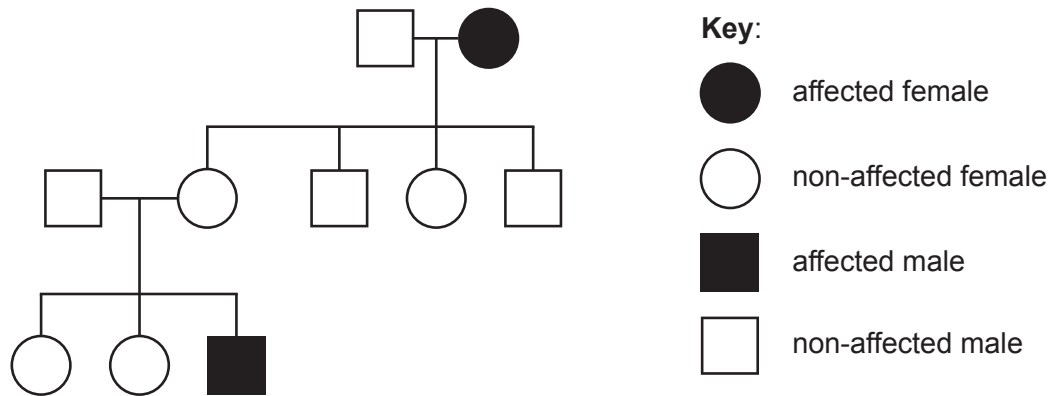
First assessment 2025

10 questions | questions

7. The DNA profile from a paternity test shows six profiles. Who is the child's father?



13. A pedigree chart is shown.



What is the most likely pattern of inheritance?

- A. Sex-linked recessive
- B. Sex-linked dominant
- C. Autosomal recessive
- D. Autosomal dominant

Turn over

- 20.** A *Mirabilis jalapa* plant with red flowers was crossed with one with white flowers. All plants in the F1 generation had pink flowers. What phenotype ratio would be expected in the F2 generation?
- A. 100 % pink
 - B. 50 % red and 50 % white
 - C. 25 % white, 50 % pink and 25 % red
 - D. 75 % red and 25 % white

- 20.** Pink flowers arise from the incomplete dominance between red and white flowers in the four o'clock flower (*Mirabilis jalapa*). A pink-flowering variety is crossed with a white-flowering variety.



What could be the possible phenotypes of the offspring?

- A. White flowers only
- B. Pink and white flowers
- C. Red and white flowers
- D. Pink flowers only

21. When white flowers of the species *Mirabilis jalapa* are fertilized by pollen from red flowers, the resulting plants produce pink flowers. What is the pattern of inheritance and the reason for this?

	Inheritance	Reason
A.	incomplete dominance	offspring show both parental phenotypes
B.	codominance	offspring show both parental phenotypes
C.	incomplete dominance	offspring show a blended phenotype of the parents'
D.	codominance	offspring show a blended phenotype of the parents'

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.

8. Hereditary information is stored in nucleic acids and passed on to offspring.
- (a) Outline how mitosis allows for the same hereditary information to be passed on to new cells. [3]
 - (b) Describe the importance of DNA in speciation. [4]
 - (c) Explain the genetic basis of inheritance patterns in organisms that reproduce sexually. [8]



Turn over

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References:

1. Image Asian shore crab: Silver, C., 2019. *Creature Feature – Asian Shore Crab*. [online] Available at: <https://www.blueoceansociety.org/blog/creature-feature-asian-shore-crab/> [Accessed 13 March 2024]. Source adapted.

Image amphipod: Brutto SL, Iacofano D. A taxonomic revision helps to clarify differences between the Atlantic invasive *Ptilohyale littoralis* and the Mediterranean endemic *Parhyale plumicornis* (Crustacea, Amphipoda). *Zookeys*. 2018 Apr 30; (754): 47–62. doi: 10.3897/zookeys.754.22884. PMID: 29740225; PMCID: PMC5938321.

Image blue mussel: Emőke Dénes. https://commons.wikimedia.org/wiki/File:Broadstairs_-_Mytilus_edulis_2.jpg. CC BY-SA 4.0 <https://creativecommons.org/licenses/by-sa/4.0>.

Graphs: Spilmont, N. and Seuront, L., 2023. Aliens eating aliens: an introduced amphipod as a potential prey of an invasive rocky shore crab in laboratory experiments. *Aquatic Invasions* 18(2), pp. 163–177. <https://doi.org/10.3391/ai.2023.18.2.106252>. Source adapted.
2. Image by macrovector on Freepik. https://www.freepik.com/free-vector/colored-purebred-dogs-icon-set_4329617.htm#fromView=search&page=1&position=2&uuid=afab0859-2246-4637-abc5-a733503d42d3&query=%40macrovector+dogs.
3. Adobe Stock / Andrea Danti.
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5. Image by brgfx on Freepik. https://www.freepik.com/free-vector/diagram-showing-stem-root-cell_18973458.htm#fromView=search&page=1&position=16&uuid=26e1a0ae-56b5-4aab-ae64-64cf6e2b7928&query=plant+vascular+xylem. Source adapted.
6. Holly Cheng. https://commons.wikimedia.org/wiki/File:Sylvilagus_audubonii_2.jpg. Licensed under CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>. Source adapted.



Please **do not** write on this page.

Answers written on this page
will not be marked.



Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

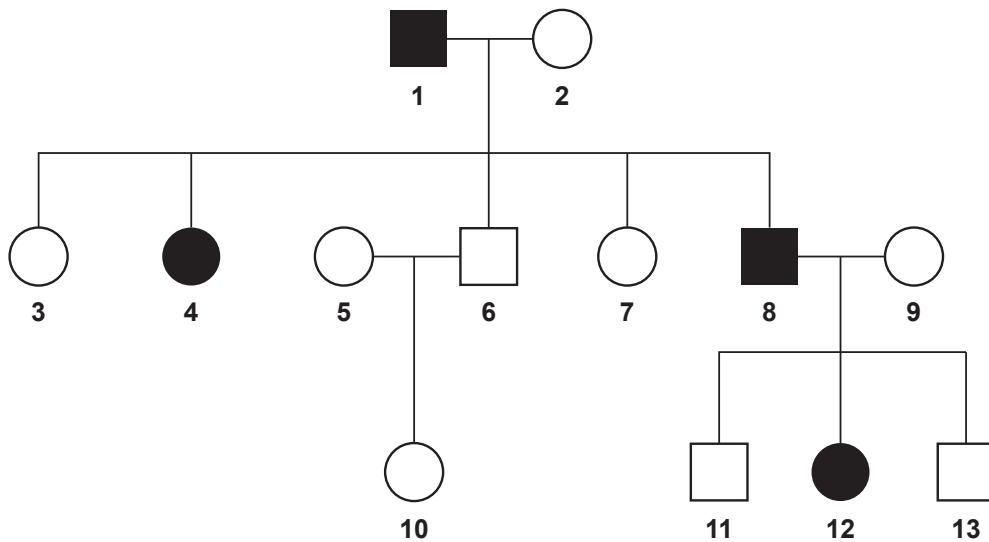
4. (a) Define the term genotype.

[1]

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PKD (polycystic kidney disease) is an inherited disorder that causes the kidneys to become enlarged and lose function over time. PKD is caused by a dominant allele, **D**, which is **not** sex-linked.

The pedigree chart shows the inheritance of PKD in a family.



Key:



(This question continues on the following page)



(Question 4 continued)

(b) (i) Calculate the probability of individuals **1** and **2** having a child with PKD. [1]

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(ii) Explain how the pedigree chart shows that the dominant allele causing PKD is **not** on the X chromosome. [2]

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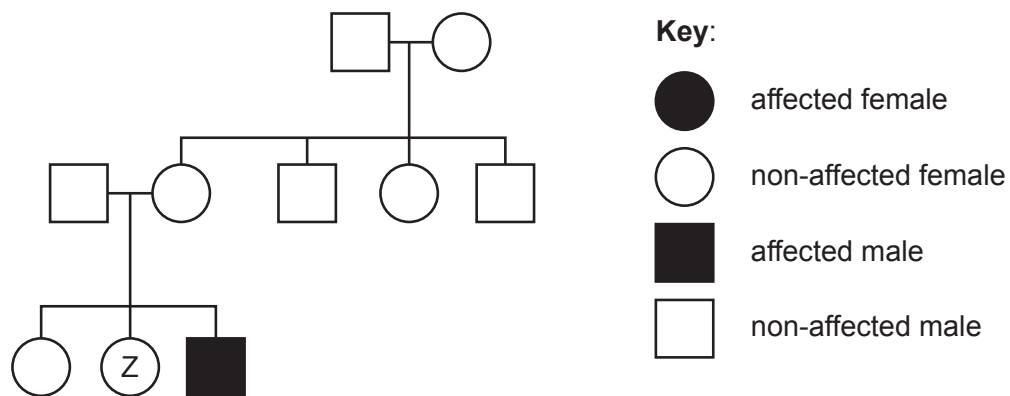
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Turn over

20. The pedigree chart shows the incidence of colour blindness in three generations of a family. Colour blindness is caused by a sex-linked recessive allele.



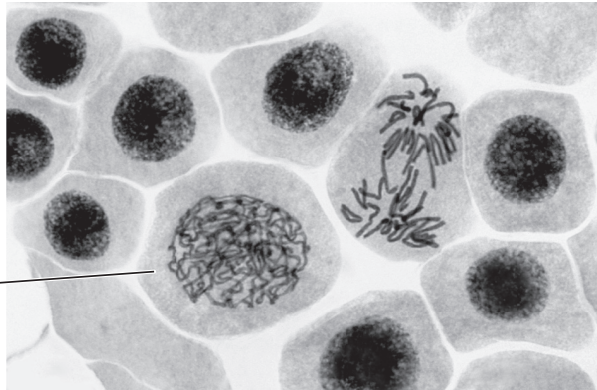
What could the genotype of individual Z be?

- A. $X^B X^B$ only
- B. $X^B X^b$ only
- C. $X^B X^B$ or $X^B X^b$
- D. $X^b X^b$ or $X^B X^b$

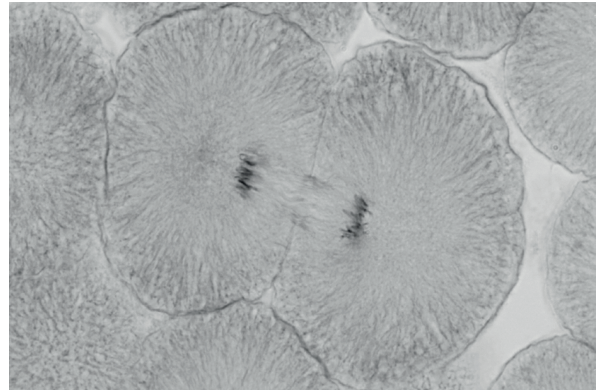
4. Both the genome and the environment of an organism affect its growth and development. Variation between individuals of a species can be continuous or discrete (discontinuous). Mitosis produces identical cells for growth and meiosis allows for variation.

The micrographs show onion and whitefish cells in mitosis.

Onion (*Allium cepa*)



Whitefish (*Coregonus lavaretus*)



- (a) Identify the phase of mitosis labelled X.

[1]

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- (b) The process of cytokinesis is occurring in the whitefish embryo cells. Explain how cytokinesis occurs in this animal cell.

[2]

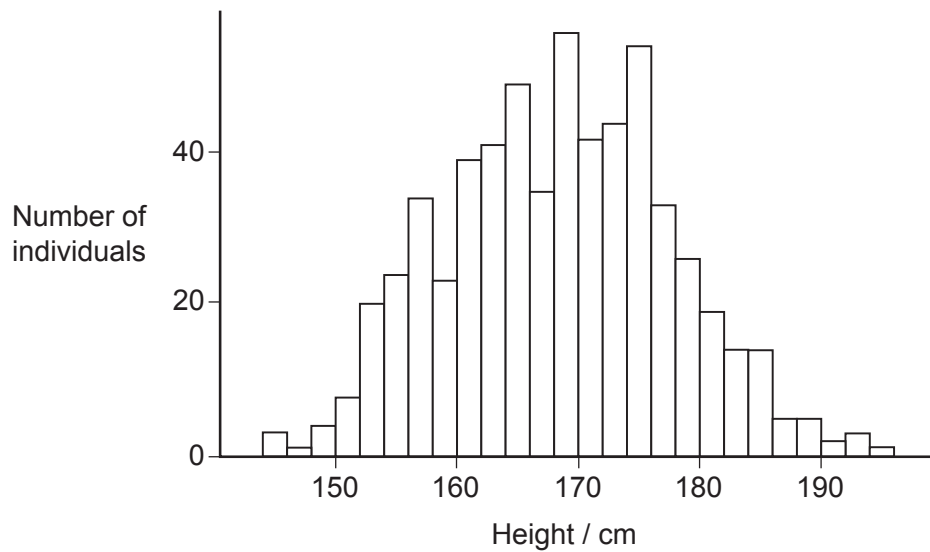
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(Question 4 continued)

The National Health and Nutrition Examination Survey in the USA measured heights of individuals aged 21–79. Height is an example of continuous variation.



(c) State the range of heights that is the mode.

[1]

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(d) Blood group in humans is an example of discrete (discontinuous) variation. Explain the inheritance of ABO blood groups in humans.

[3]

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References:

- 1.a** Nikon's MicroscopyU, n.d. *Buccal epithelial cells*. [image online] Available at: <https://www.microscopyu.com/gallery-images/buccal-epithelial-cells> [Accessed 23 October 2024]. Source adapted.
- 2.a** Du, B., Liu, C., Kang, H., Zhu, P., Yin, S., Shen, G., Hou, J. and Ilvesniemi, H., 2014. *Figure 2*. [image online] Available at: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0086440> [Accessed 23 October 2024]. Reference redacted. Source adapted.
- 3.** Antoniou, E., 2010. *Illustration of life cycle of jellyfish*. [image online] Available at: <https://www.gettyimages.co.uk/detail/illustration/illustration-of-life-cycle-of-jellyfish-royalty-free-illustration/95644630?searchscope=image%2Cfilm&adppopup=true> [Accessed 23 October 2024]. Source adapted.
- W.carter, 2020. *Three moon jellyfishes captured by a lion's mane jellyfish 1*. [image online] Available at: https://en.wikipedia.org/wiki/File:Three_moon_jellyfishes_captured_by_a_lion%27s_mane_jellyfish_1.jpg Licensed under the Creative Commons CC BY-SA 4.0 license: <https://creativecommons.org/licenses/by-sa/4.0/>. [Accessed 6 November 2025]. Source adapted.
- Reprinted from *Journal of Experimental Marine Biology and Ecology*, Volume 459, 2014, by Gambill, M. and Peck, M.A., Respiration rates of the polyps of four jellyfish species: Potential thermal triggers and limits, pages 17–22. Available at: https://www.sciencedirect.com/science/article/pii/S0022098114001245?ref=pdf_download&fr=RR-2&rr=8c9306260f77cdaf [Accessed 23 October 2024]. Source adapted.
- 4.a** Reischig, J., 2014. *Mitosis (261 14)*. [image online] Available at: [https://commons.wikimedia.org/wiki/File:Mitosis_\(261_14\)_Pressed;_root_meristem_of_onion_\(cells_in_prophase,_anaphase\).jpg](https://commons.wikimedia.org/wiki/File:Mitosis_(261_14)_Pressed;_root_meristem_of_onion_(cells_in_prophase,_anaphase).jpg). Licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license: <https://creativecommons.org/licenses/by-sa/3.0/deed.en>. [Accessed 23 October 2024]. Source adapted.
- Reschke, E., 2012. *Whitefish mitosis*. [image online] Available at: <https://www.gettyimages.co.uk/detail/photo/whitefish-mitosis-whitefish-embryo-royalty-free-image/139814315?adppopup=true> [Accessed 23 October 2024]. Reference redacted. Source adapted.
- 4.c** National Health and Nutrition Examination Survey, 2017. *Height of NHANES subjects ages 2179*. [image online] Available at: <https://thomaseelove.github.io/431notes-2017/dataviz.html> [Accessed 23 October 2024]. Source adapted.



Section A

Answer **all** questions. Answers must be written within the answer boxes provided.

6. In humans, sex is determined genetically and human populations have approximately equal numbers of males and females in each generation.

(a) Outline how sex is determined in humans. [2]

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(b) Explain how sexual reproduction gives rise to genetic variation. [2]

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