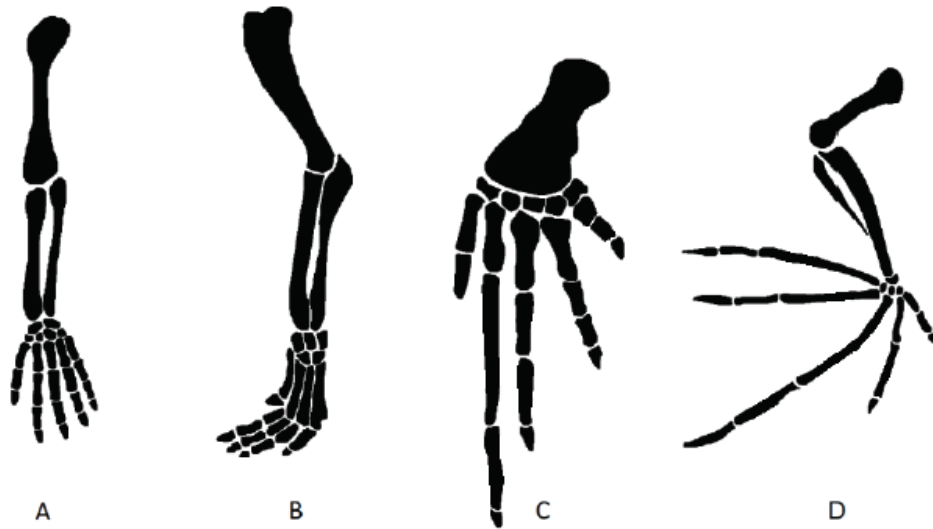


# Exam Prep 5 *[111 marks]*

1. Which pentadactyl limb is adapted for flight?

*[1 mark]*



[Source: adapted from Volkov Vladislav Petrovich,  
[https://en.wikipedia.org/wiki/Homology\\_\(biology\)#/media/File:Homology\\_vertebrates-en.svg](https://en.wikipedia.org/wiki/Homology_(biology)#/media/File:Homology_vertebrates-en.svg) and Zebra.element,  
[https://en.wikipedia.org/wiki/File:Bat\\_mouse\\_forelimbs.png](https://en.wikipedia.org/wiki/File:Bat_mouse_forelimbs.png)]

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2. Which are examples of homologous structures? *[1 mark]*
- A. The wings of bats and butterflies
  - B. The fins of fish and whales
  - C. The hindlimbs of frogs and grasshoppers
  - D. The forelimbs of primates and penguins

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3. Which is an example of natural selection? *[1 mark]*
- A. A giraffe stretching its neck to reach higher leaves
  - B. A juvenile bird learning to sing
  - C. Development of antibiotic resistance in bacteria
  - D. Selective breeding of tail-less cats

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4. The image shows an organism belonging to the Kingdom Animalia.

[1 mark]



[Source: Titan beetle male. Locality: "RK4,5 route Cacao", French Guiana  
© 2011, Didier Descouens <https://creativecommons.org/licenses/by-sa/4.0/>]

What feature does this organism have in common with all members of the phylum chordata?

- A. Legs and wings
- B. Mouth but no anus
- C. Bilateral symmetry
- D. Chitinous exoskeleton

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5. What is required for natural selection to occur?

[1 mark]

- I. Acquired characteristics
  - II. Advantageous characteristics
  - III. Genetic variation
- A. I only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

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6. If seeds of an unknown species of plant are discovered, what assumption [1 mark] can be made about the species?

- A. Its male gametes are contained within pollen.
- B. Its seeds are contained within fruits.
- C. It is in the domain archaea.
- D. It is in the phylum angiospermophyta.

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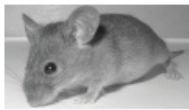
7. The images show a guinea pig, a mouse, a horse and a whale.

[1 mark]



Guinea pig  
(*Cavia porcellus*)

[Source: pixabay]



Mouse  
(*Mus musculus*)

[Source: Roger McLassus/  
Wikimedia. Image licensed  
under CC BY-SA 3.0 ([https://  
creativecommons.org/licenses/  
by-sa/3.0/](https://creativecommons.org/licenses/by-sa/3.0/))]



Horse  
(*Equus caballus*)

[Source: pixabay]



Whale  
(*Orcinus orca*)

[Source: pixabay]

Which features support the classification of these four species in the same class?

- A. All are warm-blooded and breathe air.
- B. All have evolved from primates.
- C. All have hair or fur and feed their young with milk.
- D. All have a notochord, vertebrae and give birth to live young.

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8a. Isolated communities in rural Finland, Hungary and some of the Scottish [3 marks]  
islands have a high incidence of red-green colour blindness. Describe the  
inheritance of red-green colour blindness.

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[7 marks]

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[1 mark]

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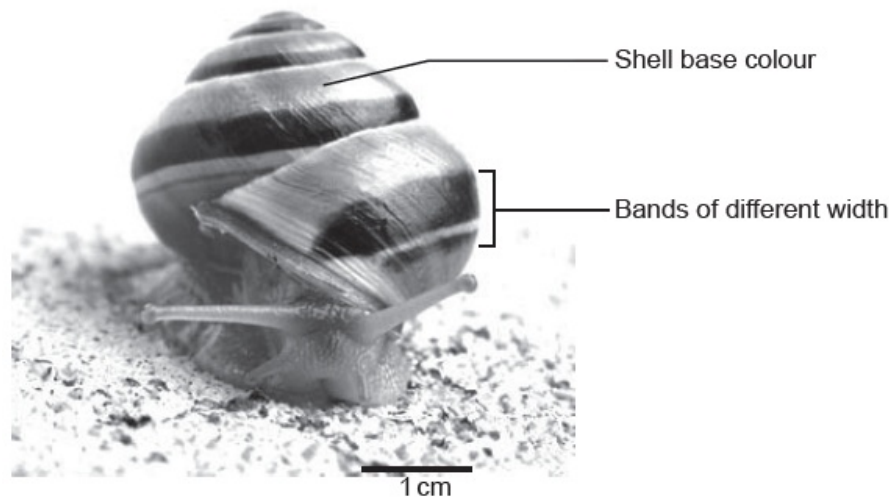
9b. State the plant phylum which is characterised by the absence of vascular [1 mark]  
tissue.

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9c. *C. nemoralis* (pictured below) is a mollusc. Identify **two** external [2 marks]  
features that distinguish this snail from an arthropod.



[Source: © International Baccalaureate Organization 2018]

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9d. Outline the role of plant pigments in the process of photosynthesis. [3 marks]

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The diagram shows a leaf from *Dryopteris arguta*.



[[https://commons.wikimedia.org/wiki/File:E20161208-0001%E2%80%94Dryopteris\\_arguta\\_\(Reverse\)%E2%80%94RPBG\\_\(30698925004\).jpg](https://commons.wikimedia.org/wiki/File:E20161208-0001%E2%80%94Dryopteris_arguta_(Reverse)%E2%80%94RPBG_(30698925004).jpg)]  
E20161208-0001—Dryopteris arguta (Reverse)—RPBG Source: [https://www.flickr.com/photos/john\\_d\\_rusk/30698925004/](https://www.flickr.com/photos/john_d_rusk/30698925004/) Author: John Rusk from Berkeley, CA, United States of America, licensed under Creative Commons licence: <https://creativecommons.org/licenses/by/4.0/legalcode>]

10a. State the phylum of this plant. [1 mark]

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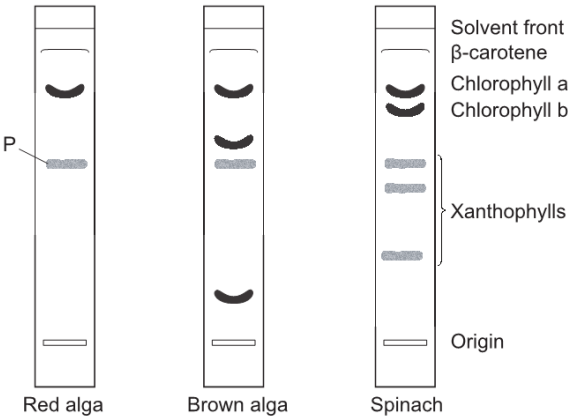
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10b. State **two** characteristics of plants from the phylum you stated in (a)(i). [2 marks]

10c. Outline why the number of trophic levels is limited in a food chain. [1 mark]

Thin-layer chromatography was carried out on red and brown algae to discover what photosynthetic pigments they contained. The results were compared with the known pigments found in spinach leaves.



11a. Identify pigment labelled P. [1 mark]

11b. State a suitable solvent for extracting photosynthetic pigments from plant tissue. [1 mark]

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11c. Explain how the pigments in the chromatogram of spinach are identified. [3 marks]

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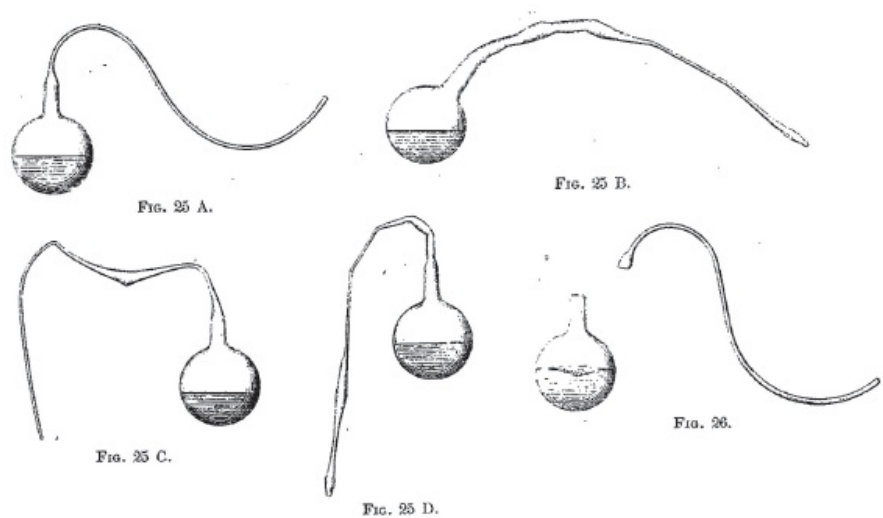
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12a. Pictured below are Louis Pasteur's original drawings of swan-necked flasks. [3 marks]



[Source: L Pasteur and L Pasteur Vallery-Radot, (1922), *Œuvres de Pasteur*, Vol II Fermentations et générations dites spontanées, pages 260–261]

Describe how Pasteur's experiments provided convincing evidence to falsify the concept of spontaneous generation.

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12b. State the function of life in *Paramecium* that is carried out by: [1 mark]  
cilia.

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[1 mark]

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*[3 marks]*

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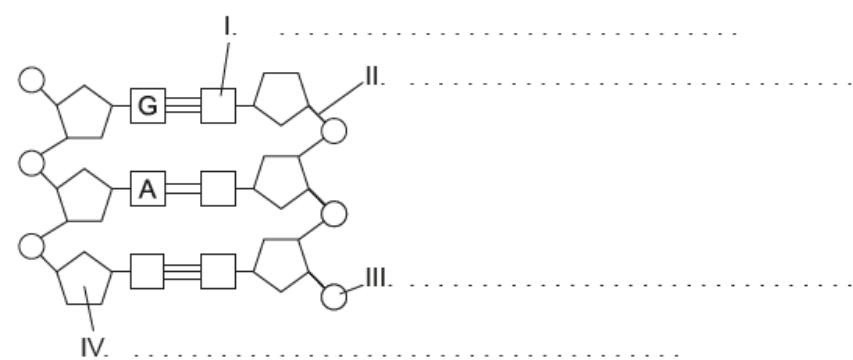
12e. Explain the role of decomposers in an ecosystem. [2 marks]

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13a. Label the parts of the DNA diagram indicated by I, II, III and IV. [2 marks]



[Source: © International Baccalaureate Organization 2018]

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13b. Explain how model making helped Watson and Crick to establish the structure of DNA. [2 marks]

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13c. Distinguish between the chromosomes of eukaryotic cells and prokaryotic cells.

[1 mark]

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13d. Outline the role of the enzyme helicase in replication.

[1 mark]

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13e. Outline the role of the enzyme DNA polymerase in replication.

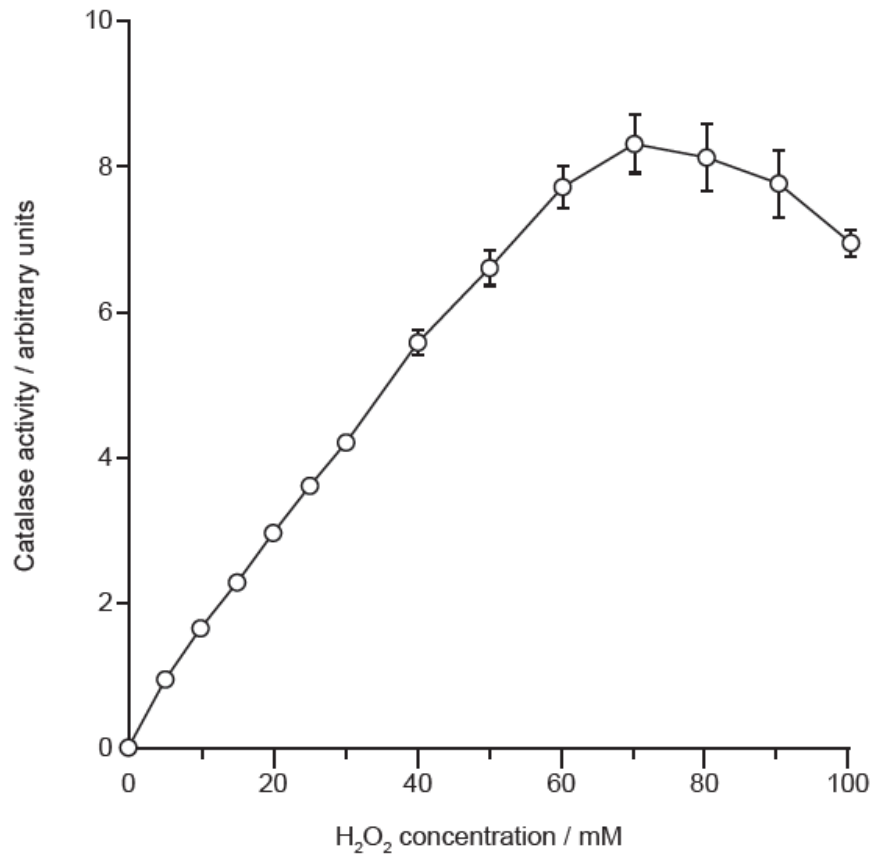
[2 marks]

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A study was carried out on the activity of catalase in bacteria living in extreme environments. Catalase decomposes hydrogen peroxide ( $\text{H}_2\text{O}_2$ ). The data were obtained for a strain of bacteria called *Vibrio rumoiensis* which exhibits high catalase activity.



[Source: *Journal of Bacteriology*, 2000, 182, 1903-9, amended with permission from American Society for Microbiology.]

14a. Describe the relationship between increasing  $\text{H}_2\text{O}_2$  concentration and catalase activity. [2 marks]

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14b. Identify **two** factors that would need to be controlled in generating these data. [1 mark]

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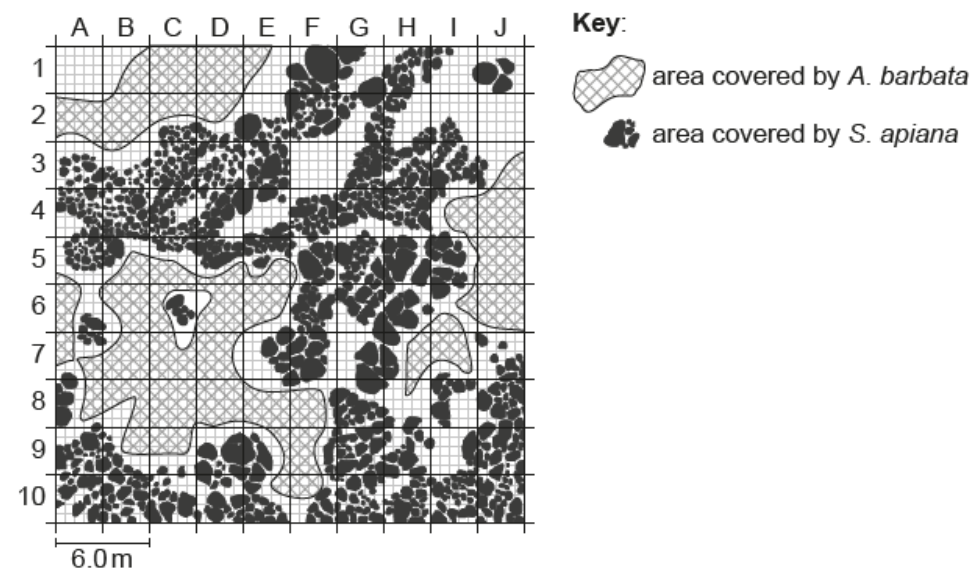
14c. Evaluate the claim that, based on the data, the optimum H<sub>2</sub>O<sub>2</sub> concentration for catalase is 70 mM. [2 marks]

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White sage (*Salvia apiana*) is a native Californian shrub. Slender oat (*Avena barbata*) is a grass, originally from the Mediterranean, which was introduced to California. The map shows the distribution of the two species in relation to one another in an area near Santa Ynez, California.



[Source: Adapted from <http://web.csulb.edu>. Reproduced with permission from Christine M. Rodrigue, Ph.D.]

15a. Using the scale bar, determine the area of quadrat A1, giving the units. [1 mark]

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15b. Outline how chi-squared can be used to test for an association between *[3 marks]* the distributions of the two species.

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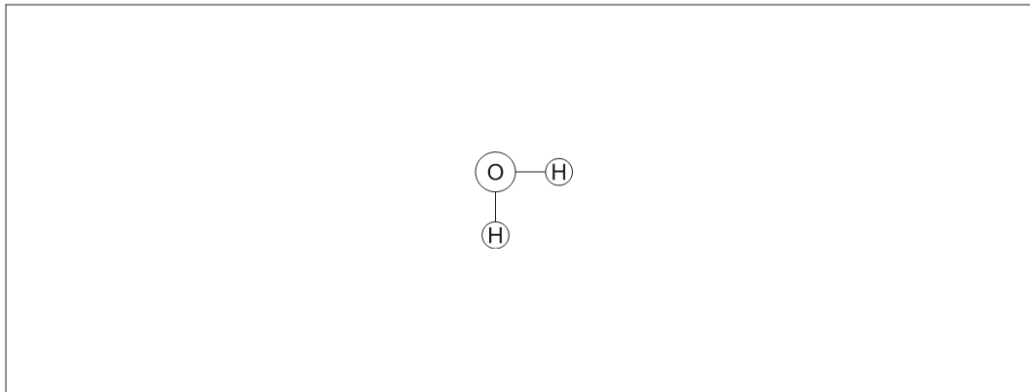
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16a. The figure represents a water molecule.

*[2 marks]*



Draw a second water molecule to show how bonds can form between water molecules, including the name of the bond.

16b. Water has important solvent properties. Explain these properties using *[3 marks]* an example to illustrate your answer.

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Although simple in structure, bacteria as a group show a wide range of diversity.

17a. Outline the roles bacteria play in the carbon cycle.

*[3 marks]*

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17b. Describe the evolution of antibiotic resistance in bacteria.

*[4 marks]*

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17c. Explain the process of genetically modifying bacteria.

*[8 marks]*

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins or other markings on the paper.

18a. Outline the process of gas exchange necessary for aerobic respiration in a unicellular eukaryotic organism. [3 marks]

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18b. Explain how the process of evolution occurs.

[8 marks]

In ecosystems, energy is used to convert inorganic compounds into organic matter. Energy enters ecosystems through producers.

19a. Explain the processes by which energy enters and flows through ecosystems.

*[8 marks]*

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

19b. Producers extract phosphates and nitrates from soil. Outline how these *[3 marks]* ions are used in the synthesis of organic molecules.

19c. Draw a labelled diagram of a pyramid of energy. *[4 marks]*

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