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BIOLOGY (US)

0438/43

Paper 4 Theory (Extended)

May/June 2017

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **18** printed pages and **2** blank pages.

- 1 Fig. 1.1 is a diagram of the human heart. The diagram shows the phase during the heart beat when the atria contract. The blood vessels that carry blood to and from the heart are labeled **A** to **F**.

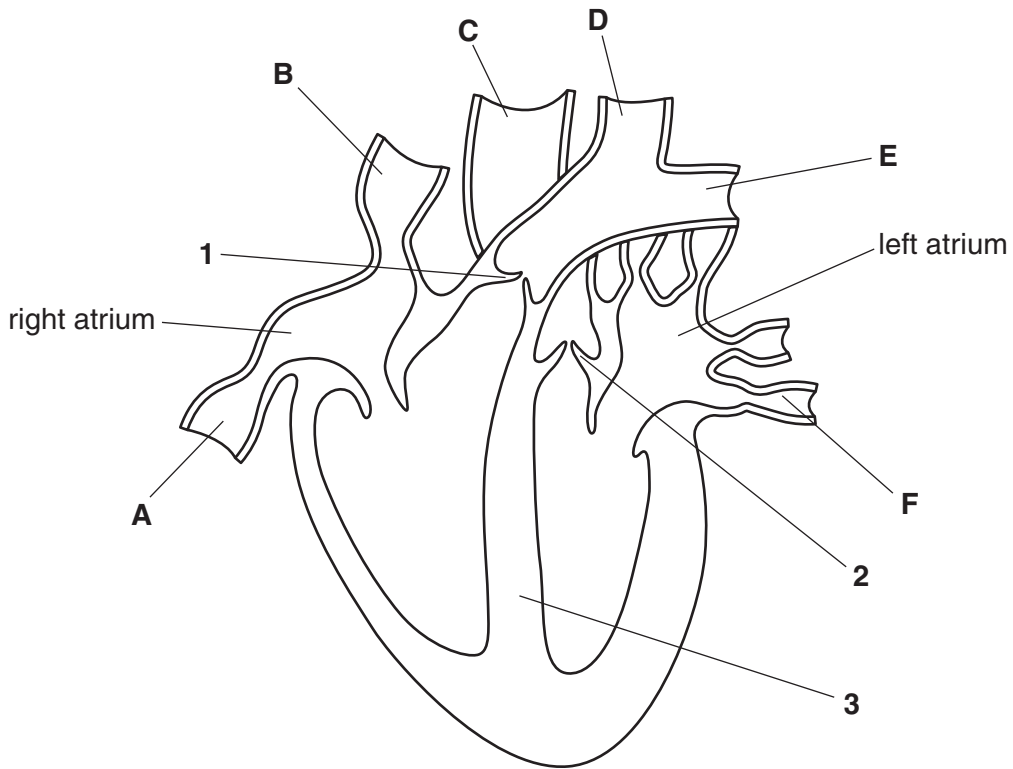


Fig. 1.1

- (a) (i) Draw **one** arrow on Fig. 1.1 to show the pathway taken by blood from a vein into the **right ventricle**. [1]
- (ii) Identify the letter of the blood vessel that carries blood at the highest pressure and state its name.
 letter
 name of the blood vessel [1]
- (b) (i) Suggest what causes the valves at **1** and **2** to close during a heart beat.

 [1]
- (ii) State the function of valves **1** and **2** in the heart.
 [1]

- 2 Quinoa, *Chenopodium quinoa*, is a dicotyledonous plant that produces seeds that resemble those of cereals, such as rice.

(a) State one feature shown by **all** dicotyledonous plants.

.....
[1]

(b) During seed development, amino acids are converted into storage proteins and proteases.

Protease molecules become active when the seed absorbs water at the start of germination.

Fig. 2.1 shows the formation of a storage protein and a protease in developing quinoa seeds and the action of protease on the storage protein during germination.

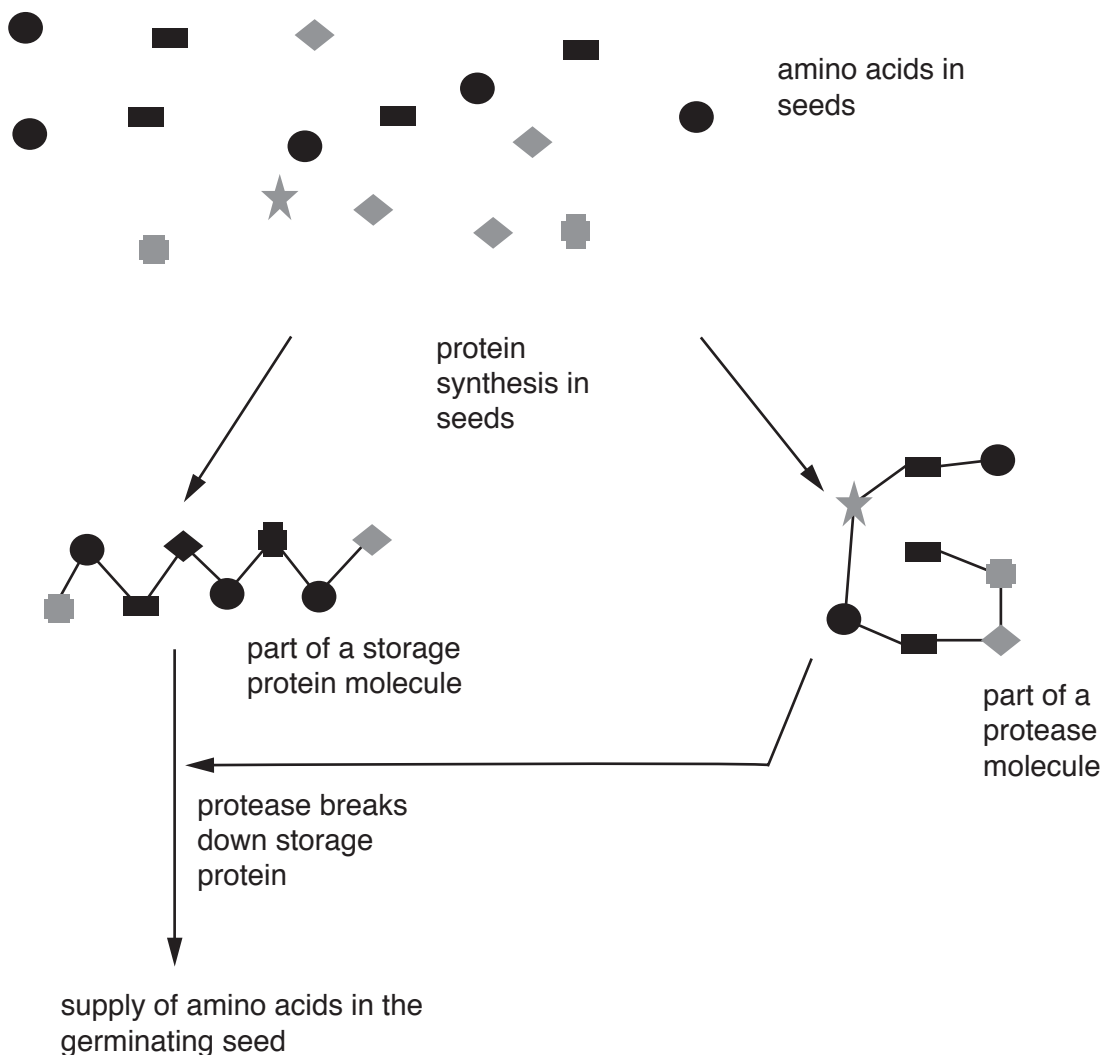


Fig. 2.1

(i) During seed development in quinoa some genes are 'switched on'.

Define the term *gene*.

.....
.....
.....[2]

(ii) Describe the differences in structure between the storage protein and the protease shown in Fig. 2.1.

.....
.....
.....
.....
.....[2]

(c) State the roles of mRNA and ribosomes in protein synthesis.

mRNA
.....
ribosome
.....
[2]

(d) Researchers investigated the effect of pH on the activity of the protease in quinoa seeds.

The results are shown in Fig. 2.2.

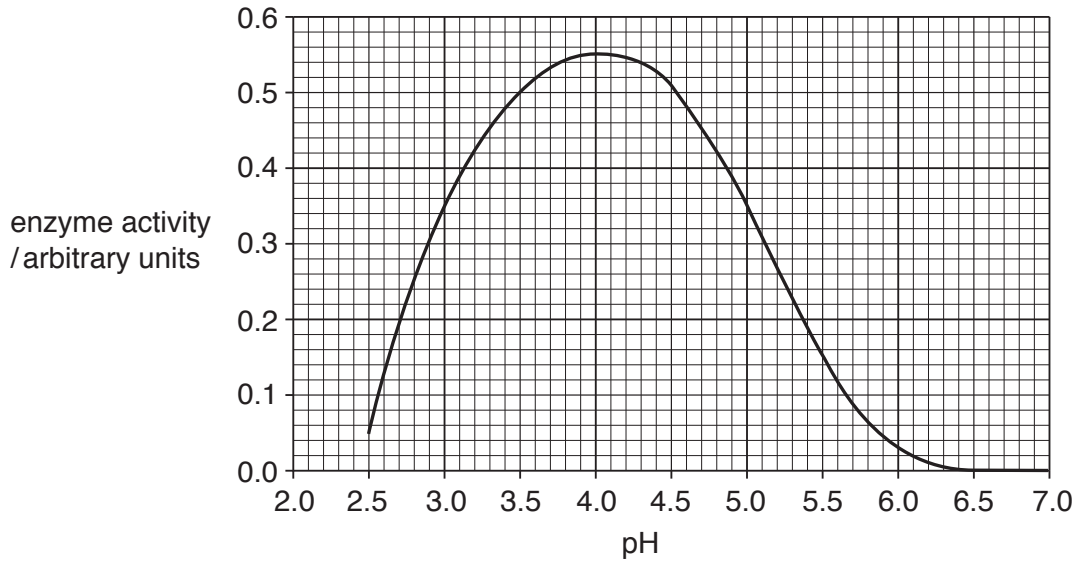


Fig. 2.2

(i) State **two** factors other than pH that would affect enzyme activity.

- 1
 - 2
- [2]

(ii) Describe the effect of increasing pH on the activity of the protease in quinoa seeds.

-
 -
 -
 -
 -
 -
 -
 -
 -
 -
- [3]

3 Red blood cells in humans are produced from stem cells.

Fig. 3.1 shows how a red blood cell is produced and becomes specialized.

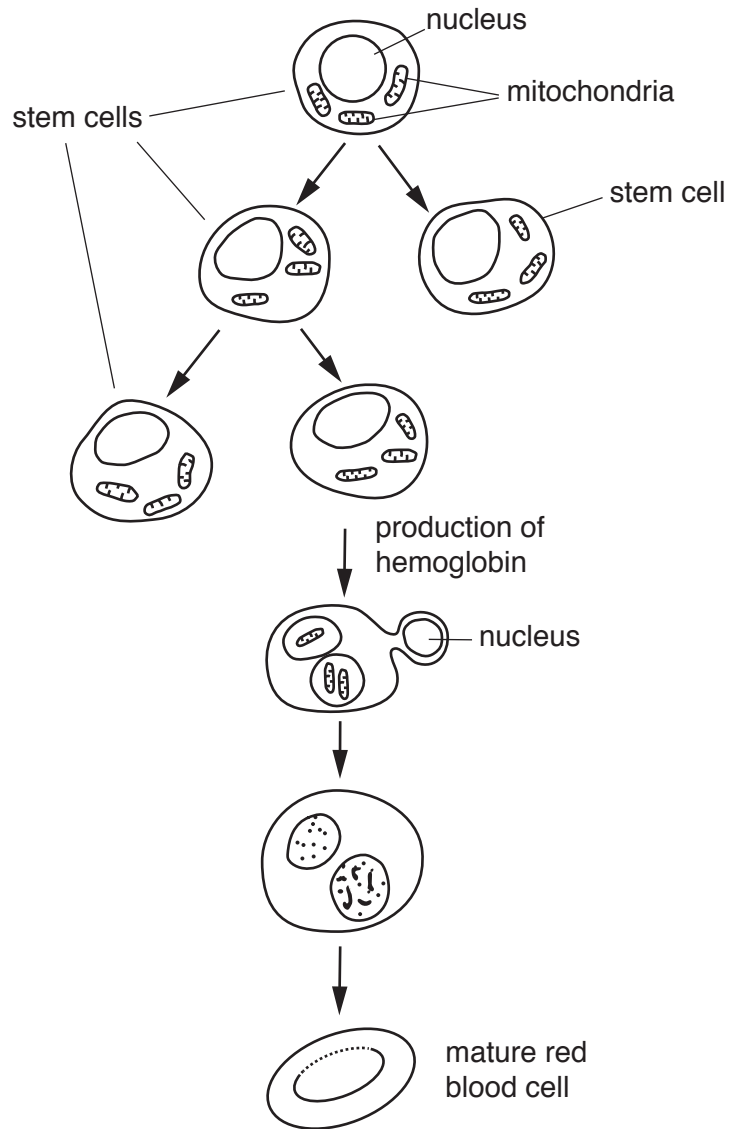


Fig. 3.1

- 4 Fig. 4.1 is a photograph of a yellow-shouldered Amazon, *Amazona barbadensis*, a species of parrot found along the Venezuelan coast of the Caribbean.



Fig. 4.1

- (a) State the vertebrate group that includes *A. barbadensis* and give **two** features that are used to classify animals into this group.

vertebrate group

feature 1

feature 2

[2]

- (b) This species is subdivided into several populations on the mainland and on the islands of Margarita and Bonaire. Scientists believe that yellow-shouldered Amazons rarely travel between these places.

Explain what biologists mean when they refer to *populations* of animals, such as *A. barbadensis*.

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.....
.....
.....
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.....
.....
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.....
.....[3]

- (c) The number of yellow-shouldered Amazons on Margarita Island had decreased to 700 parrots by 1989. The population then increased to 1600 parrots by 2009.

Part of this increase was due to the release of captive-bred parrots on the island. This is one of the few successful release programs of parrots. A similar release program in Arizona in the 1980s of a different species of parrot was not successful.

Suggest why release programs for captive-bred parrots were **not** successful.

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..... [2]

- (d) Some captive breeding programs involve very small numbers of animals.

Outline the disadvantages of such programs.

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..... [3]

5 An investigation studied the effect of fertilizers on grass yield and species diversity in a grassland ecosystem.

Some plots within the grassland were treated with fertilizers containing nitrogen, magnesium and phosphate.

The control plots did not have any added fertilizer.

The average yields were:

- plots with fertilizer $1733 \text{ g m}^{-2} \text{ year}^{-1}$
- plots without fertilizer (control plots) $1009 \text{ g m}^{-2} \text{ year}^{-1}$

(a) (i) Calculate the difference between the average yields of the two plots within the field as a percentage of the average yield of the control plots.

Show your working and give your answer to the nearest whole number.

..... %
[2]

(ii) Explain why the average yield increased as a result of adding the fertilizer.

.....
.....
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.....
.....
.....
.....
.....
.....
.....[3]

(iii) State the name of the process that occurs when fertilizer washes off land into rivers and causes an algal bloom.

.....[1]

6 Meningitis is a transmissible disease. One form of the disease is caused by the bacterium *Neisseria meningitidis*.

(a) Define the term *transmissible disease*.

.....
.....
.....
..... [2]

(b) One effect of meningitis is a slowing down of nerve impulses.

State what is meant by a *nerve impulse*.

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.....
..... [2]

(c) The spread of meningitis can be controlled by using vaccines.

(i) Explain how vaccination provides active immunity.

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.....
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..... [4]

(ii) If meningitis disappears from a country, explain why the vaccine should continue to be used in that country.

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..... [2]

(d) People who have meningitis are treated with injections of antibodies to give them passive immunity.

(i) Suggest why the antibodies must be injected rather than taking them by mouth.

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.....[2]

(ii) Explain why passive immunity does not give long-term protection against diseases, such as meningitis.

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.....
.....[2]

[Total: 14]

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