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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4518800444

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **May/June 2016**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre 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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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

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1 All mammals have a double circulatory system. Fig. 1.1 shows part of the human double circulatory system.

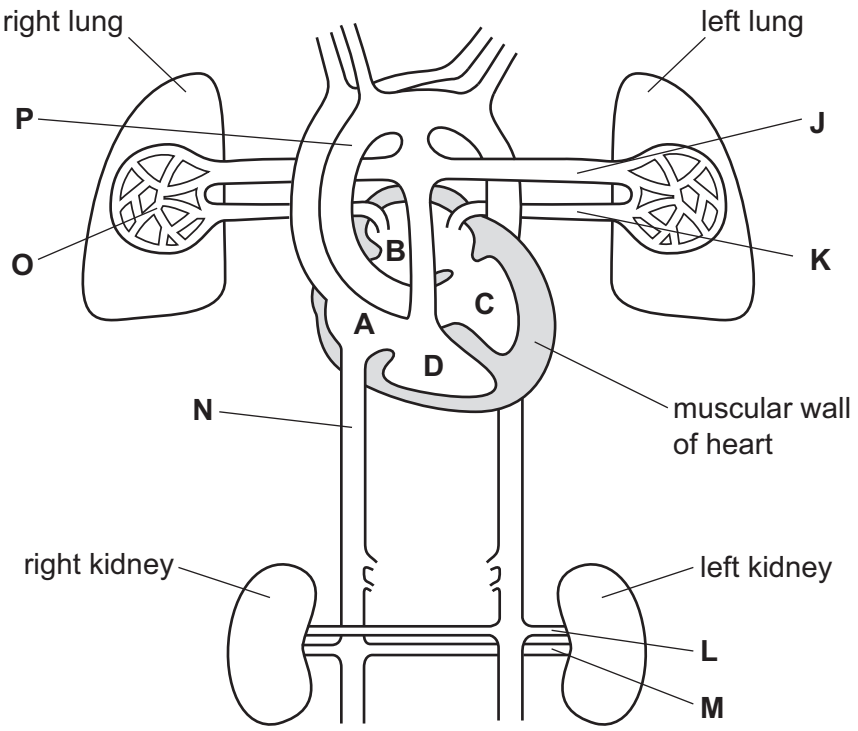


Fig. 1.1

(a) Name the muscular wall that separates the left and right sides of the human heart.

..... [1]

(b) **(i)** Describe what is meant by the term *double circulation.*

.....

.....

..... [1]

(ii) State **one** advantage of a double circulation.

.....

.....

..... [1]

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(c) Table 1.1 describes some of the structures of the human circulatory system shown in Fig.1.1.

Complete the table.

One row has been done for you.

Table 1.1

description	name of structure	letter on Fig. 1.1
heart chamber with the thickest muscular wall		
blood vessel that carries oxygenated blood to the heart		
blood vessel that carries oxygenated blood away from the heart		
blood vessel that carries blood away from the kidneys		
blood vessel with the largest lumen	vena cava	**N**

[4]

(d) Describe how blood is transported from the vena cava to the lungs. You may use the letters on Fig. 1.1 in your description.

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..... [4]

(e) **(i)** Doctors recommend that a healthy diet can reduce the risk of coronary heart disease.

Give **one** other lifestyle improvement patients can make that can reduce the risk of coronary heart disease.

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..... [1]

(ii) Sometimes surgery is required to treat coronary heart disease.

Describe **one** named example of surgery that can treat coronary heart disease.

.....

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.....

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..... [2]

[Total: 14]

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2 Fig. 2.1 is an electron micrograph showing the bacteria, *Vibrio cholerae*.



Fig. 2.1

(a) **(i)** Bacteria are prokaryotes.

State **two** distinguishing features of all prokaryotes.

1 .....

2 .....

[2]

(ii) The bacteria shown in Fig. 2.1 each have a flagellum.

Suggest the function of the flagellum in bacteria.

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..... [1]

(b) *V. cholerae* is the pathogen that causes cholera. Vaccination is used to control the spread of cholera during an outbreak.

Explain how vaccination can control the spread of diseases.

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..... [4]

(c) Many years ago scientists discovered that *V. cholerae* secretes a toxin. Fig. 2.2 shows the results of an experiment to measure the flow of chloride ions out of human cells with and without the toxin.

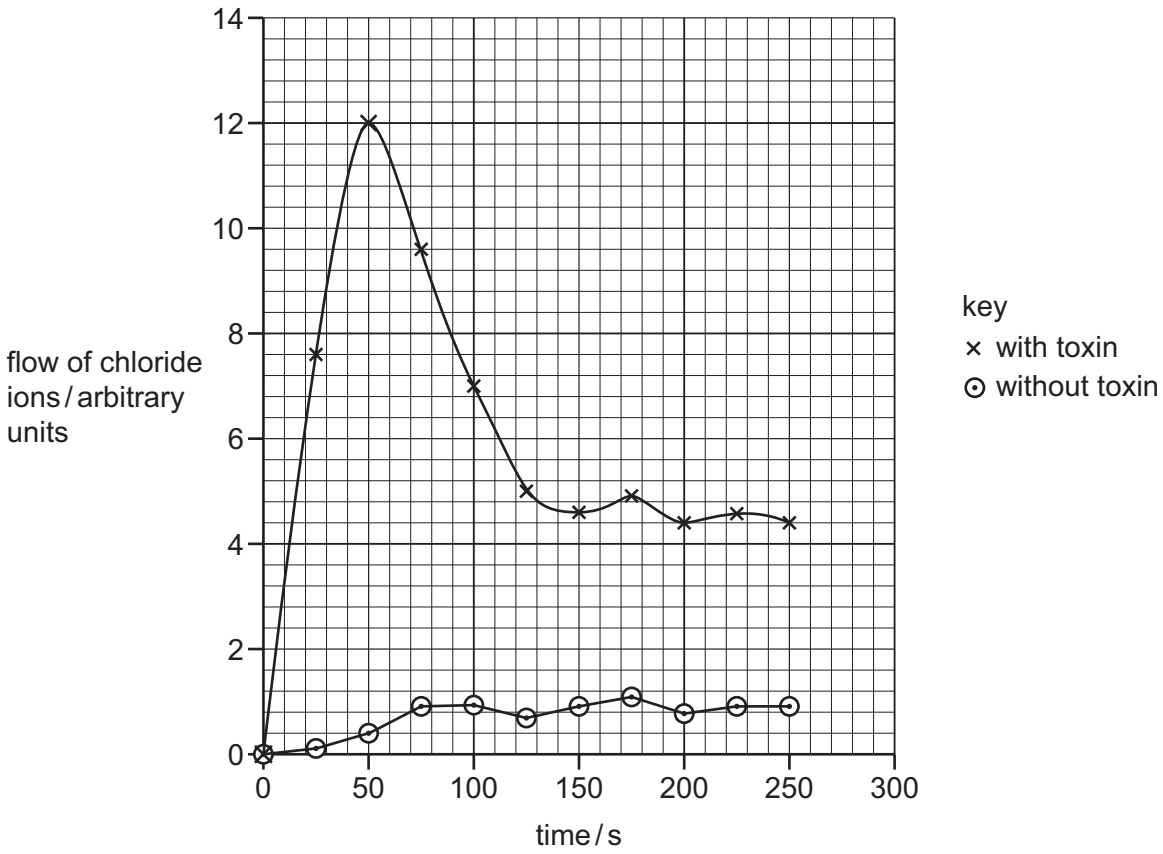


Fig. 2.2

(i) Calculate the difference in flow of chloride ions between the cells with the toxin and the cells without the toxin at 50 seconds.

Show your working and state the units in your answer.

..... [2]

(ii) Use the data in Fig. 2.2 to describe the effect of the toxin on the flow of chloride ions out of the cells.

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..... [3]

(iii) Chloride ions cannot move out of cells by simple diffusion.

Suggest **and** describe how chloride ions could move out of cells.

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..... [3]

(d) The loss of chloride ions from cells causes diarrhoea and dehydration in patients with cholera.

(i) State which organ in the alimentary canal is affected by the cholera toxin.

..... [1]

(ii) Describe the treatment for cholera.

.....

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..... [2]

[Total: 18]

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3 Anthocyanin is a red pigment found in carnation flowers. Some carnation plants have a gene for making anthocyanin.

(a) **(i)** A flower grower bred red carnations.

Describe how growers selectively breed plants.

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..... [3]

(ii) Explain the disadvantages of using sexual reproduction to breed red carnations.

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..... [2]

(b) Meiosis is necessary for sexual reproduction of carnation plants.

Define the term *meiosis*.

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..... [2]

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(c) Carnation plants show co-dominance for the anthocyanin gene. There are two alleles:

- $\mathbf{F^A}$ – allele for anthocyanin pigment (red flowers)
- $\mathbf{F^N}$ – allele for no anthocyanin pigment (white flowers)

(i) State the genotype of a carnation plant that is heterozygous for this gene.

..... [1]

(ii) Describe the phenotype of a heterozygous carnation plant for this gene.

.....

..... [1]

(iii) The breeder crossed a $\mathbf{F^AF^N}$ carnation plant with a $\mathbf{F^AF^A}$ carnation plant. Predict, using a genetic diagram, the proportion of pure breeding carnation plants in the offspring.

parental genotypes $\mathbf{F^AF^N}$ × $\mathbf{F^AF^A}$

gametes .... + ...

Punnett square

offspring genotypes .....

offspring phenotypes .....

proportion of *pure breeding* carnation plants .....

[4]

[Total: 13]

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4 Some students investigated osmosis in raw potato sticks.

(a) Define the term *osmosis*.

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..... [3]

(b) The students measured the mass of four of the potato sticks using an electronic balance.

Fig. 4.1 shows an electronic balance.



Fig. 4.1

The students left each potato stick in one of four different liquids for 5 hours:

- distilled water
- 0.1 mol per dm^3 sodium chloride solution
- 0.5 mol per dm^3 sodium chloride solution
- 1.0 mol per dm^3 sodium chloride solution.

After 5 hours they measured the mass again and calculated the change in mass.

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(i) Predict which of the liquids would cause the largest decrease in mass of a potato stick.

..... [1]

(ii) The students dried the potato sticks with paper towels before putting them on the electronic balance.

Suggest why.

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..... [1]

(c) After the experiment the students noticed that the potato stick with the lowest mass was soft and floppy.

Explain why the potato stick had become soft and floppy.

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..... [3]

(d) The students followed the same experimental procedure with boiled potato sticks and found no overall change in mass in any of the solutions.

Suggest why the mass of the boiled potato sticks remained the same.

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..... [2]

[Total: 10]

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5 Hormones are secreted by glands or made artificially by drug companies.

(a) **(i)** Name the gland that secretes testosterone.

..... [1]

(ii) State why testosterone can improve sporting performance.

.....

.....

..... [1]

(iii) Describe the role of progesterone in the menstrual cycle.

.....

.....

..... [1]

(iv) Synthetic progesterone is found in oral contraceptives.

Name **one** other hormone often found in oral contraceptives.

..... [1]

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[Turn over

Water entering two sewage works, **A** and **B**, was tested for the presence of four hormones.

The testing was repeated on water that left the sewage works to flow into lake **A** and lake **B**.

The results of the tests on the water samples are shown in Table 5.1.

Table 5.1

hormone	concentration of hormones at sewage works / ng per dm^3			
	A		**B**	
	before sewage treatment	after sewage treatment including ozone and chlorine	before sewage treatment	after sewage treatment including chlorine alone
oestrogen	not measurable	not measurable	0.1	not measurable
synthetic progesterone	8.5	8.0	4.5	4.6
natural progesterone	2.5	2.8	2.4	2.7
testosterone	15.6	3.7	2.7	3.1

(b) Explain which water sample was most polluted with hormones **before** sewage treatment. Use data from Table 5.1 to support your answer.

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..... [3]

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(c) One reason for treating sewage is to reduce the concentration of hormones in the environment.

(i) Chlorine was used in the sewage treatment of both lakes.

Describe the effect that chlorine had on the hormone concentrations in the water. Use data from Table 5.1 to support your answer.

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..... [2]

(ii) State the main purpose of chlorine in sewage treatment.

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..... [1]

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(d) Describe the negative consequences of letting untreated sewage flow into lake ecosystems.

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..... [6]

[Total: 16]

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6 Fig. 6.1 shows the changes in glucose concentration of the blood.

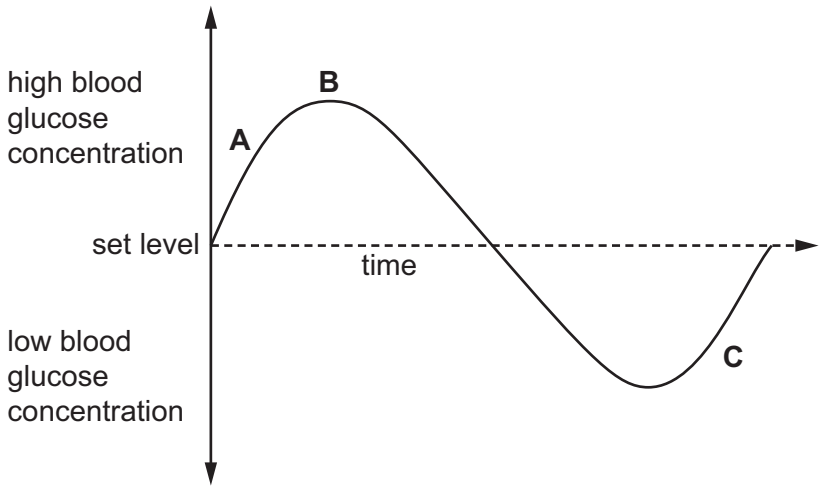


Fig. 6.1

(a) Name the process that maintains blood glucose concentration within set limits.

..... [1]

(b) **(i)** Name the hormone that would be secreted in response to the increasing blood glucose concentration at **A** in Fig. 6.1.

..... [1]

(ii) Name an organ that is responsible for the decrease in blood glucose concentration after **B** in Fig. 6.1.

..... [1]

(iii) Name the compound that is converted to glucose at **C** in Fig. 6.1.

..... [1]

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(c) Describe the symptoms **and** treatment of Type 1 diabetes.

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..... [5]

[Total: 9]

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