

Interactive Example Candidate Responses

Paper 4 (May/June 2016), Question 7

Cambridge International AS & A Level Biology 9700

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Your
Mark

7(a)

5(b)(i)

7(b)(ii)

7(b)(iii)

7(c)

7 (a) An important function of control systems in mammals is homeostasis.

Explain what is meant by the term *homeostasis*.

Maintaining a stable internal environment of an organism near to a set value. [1]

(b) Insulin plays a part in homeostasis. It affects muscle and liver cells to bring about a decrease in blood glucose concentration, particularly after a meal.

(i) Insulin is composed of two polypeptides which are made in β cells in the pancreas.

State precisely where in β cells polypeptide molecules are synthesised.

ribosomes on rough endoplasmic reticulum [1]

(ii) Name the process by which insulin is secreted from β cells.

exocytosis [1]

Q7	Mark scheme
(a)	maintaining a constant internal environment ; AW R external / body conditions [1]
(b)(i)	ribosomes / rough endoplasmic reticulum / RER ; [1]
(b)(ii)	exocytosis ; [1]
(b)(iii)	causes glucose uptake / increases permeability to glucose ; adds transport proteins to cell (surface) membrane ; A in sarcolemma A GLUT(4), proteins / channels / carriers more glucose respired / increase in respiration rate ; glucose converted to glycogen / glycogenesis ; [max 3]
(c)	accept stimulates / stimulated, for activates / activated throughout 1 (adrenaline) receptor shape change ; 2 G-proteins activated ; A description of G protein releases (α) subunit 3 adenylyl cyclase activated ; A adenylyl(ate) cyclase 4 cyclic AMP made ; 5 (cAMP is) second messenger ; 6 activates / phosphorylates, kinase ; 7 ref. to enzyme cascade / cascade of reactions ; 8 glycogenolysis / hydrolysis of glycogen, stimulated / AW ; A break down glycogen 9 AVP ; gluconeogenesis / ref. to glucose transport proteins A description / glucose from, amino acids / lipids A GLUT(2) channels / carriers [max 5] [Total: 11]

(iii) Describe the effects of insulin on muscle cells.

Insulin stimulates muscle cells to increase their uptake of glucose from blood, and to increase their rate of respiration using glucose as substrate. ~~They~~ Insulin also stimulates muscle cells to convert glucose to glycogen in glycogenesis.

[3]

(c) During periods of stress or extreme exercise more glucose needs to be released into the blood. The hormone adrenaline is released and binds to receptors on the cell surface membranes of liver cells.

Describe how the effect of adrenaline on liver cells results in an increase in blood glucose concentration.

Adrenaline binds to receptors on cell surface membranes of liver cells activating a G protein. G protein activates a membrane bound enzyme that converts ~~(ATP to)~~ ATP to cyclic AMP. cyclic AMP activates kinase enzyme. Kinase enzymes activates a series of enzyme cascade that eventually activates glycogen phosphorylase enzyme which catalyses break down of glycogen to glucose. glucose diffuses out of liver cells into the blood increasing blood glucose concentration.

[5]

[Total: 11]

Your
Mark

7(a)

5(b)(i)

7(b)(ii)

7(b)(iii)

7(c)

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Your
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7(a)

5(b)(i)

7(b)(ii)

7(b)(iii)

7(c)

7 (a) An important function of control systems in mammals is homeostasis.

Explain what is meant by the term *homeostasis*.

to maintain body temperature constant.

[1]

(b) Insulin plays a part in homeostasis. It affects muscle and liver cells to bring about a decrease in blood glucose concentration, particularly after a meal.

(i) Insulin is composed of two polypeptides which are made in β cells in the pancreas.

State precisely where in β cells polypeptide molecules are synthesised.

pancreas

[1]

(ii) Name the process by which insulin is secreted from β cells.

exocytosis

[1]

Q7	Mark scheme
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(iii) Describe the effects of insulin on muscle cells.

insulin bind to receptors on the cell
surface membrane receptors activate the
glucose transporter protein to merge with
the cell surface membrane to allow
glucose to enter to the cell

[3]

(c) During periods of stress or extreme exercise more glucose needs to be released into the blood. The hormone adrenaline is released and binds to receptors on the cell surface membranes of liver cells.

Describe how the effect of adrenaline on liver cells results in an increase in blood glucose concentration.

Adrenaline bind to receptor on liver cells
which activate G-protein and a G protein
activate enzyme to catalyse ATP to cyclic
AMP which will activate protein kinase
which will the activate cascade protein
that activate glucose phosphorylase to
break down glycogen to glucose

[5]

[Total: 11]

Your
Mark

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5(b)(i)

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7 (a) An important function of control systems in mammals is homeostasis.

Explain what is meant by the term *homeostasis*.

The maintenance of a constant internal environment.
.....
..... [1]

(b) Insulin plays a part in homeostasis. It affects muscle and liver cells to bring about a decrease in blood glucose concentration, particularly after a meal.

(i) Insulin is composed of two polypeptides which are made in β cells in the pancreas.

State precisely where in β cells polypeptide molecules are synthesised.

Islets of Langerhans.
..... [1]

(ii) Name the process by which insulin is secreted from β cells.

Glucagonogenesis.
..... [1]

Q7	Mark scheme
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(iii) Describe the effects of insulin on muscle cells.

When there is a decrease increase of blood glucose concentration, insulin is secreted by the β -cells. Insulin binds to receptors in the cell membrane of muscle cells, which activate a G-protein.

[3]

(c) During periods of stress or extreme exercise more glucose needs to be released into the blood. The hormone adrenaline is released and binds to receptors on the cell surface membranes of liver cells.

Describe how the effect of adrenaline on liver cells results in an increase in blood glucose concentration.

β -cells secrete insulin to lower the increase of blood glucose concentration.

[5]

[Total: 11]

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7(b)(i)

7(b)(ii)

7(b)(iii)

7(c)

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Cambridge Assessment International Education
The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA, United Kingdom
t: +44 1223 553554 f: +44 1223 553558
e: info@cambridgeinternational.org www.cambridgeinternational.org

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