

## Unit 3 Biology

### Revision Booklet 4 – Solutions

#### 2011 – Question 6

##### Question 6a.

Marks	0	1	2	Average
%	53	34	13	0.6

Either of:

- passage along nerves is electrical/faster than this type of transport
- this transport of hormones is chemical/slower than electrical transmission along a neuron.

##### Question 6b.

Marks	0	1	2	Average
%	33	20	46	1.1

- **receptor** detects CRH or cortisol
- **effector** secretes ACTH

A vague answer such as 'detects hormones' and contradictory answers such as 'the effector receives CRH and releases ACTH' did not gain any marks.

##### Question 6c.

Marks	0	1	2	3	Average
%	45	31	15	9	0.9

All of:

- cortisol stimulates the liver to release glucose into the blood
- a high level of cortisol leads to negative feedback
- lower levels of cortisol lead to decreased release of glucose.

#### 2011 – Question 3

##### Question 3a.

Marks	0	1	Average
%	32	68	0.7

Either of:

- abscisic acid
- ethylene.

The named hormone had to be identifiable and unambiguous.

##### Question 3b.

Marks	0	1	2	Average
%	14	33	53	1.4

##### Question 3bi.

*Physalis pubescens* or Species 1

##### Question 3bii.

The plant's leaves are lower to the ground, making it easier for larvae to reach other leaves.

##### Question 3c.

Marks	0	1	2	Average
%	26	43	32	1.1

##### 3ci.

A pheromone is a signalling molecule that affects the behaviour of another member of the same species.

##### Question 3cii.

Moths would be attracted to the trap, where they would be caught and would therefore not attack the crop.

This question illustrated students' misconceptions, such as:

- plants produce pheromones
- pheromones kill animals
- pheromones work on many different species.

## 2006 – Question 2

### Question 2a.

Marks	0	1	Average
%	54	46	0.5

The most common answer was 'hormone' or the name of a specific hormone. Other acceptable answers included glucose, glucagon, insulin and neurotransmitter compound.

Because steroid hormones pass readily through cell membranes to receptors within the cytosol, answers involving these were not accepted.

### Question 2b.

Marks	0	1	Average
%	54	46	0.5

Students were required to comment on the specificity of the relationship between molecule M and the receptor; for example, specificity of structures.

### Question 2c.

Marks	0	1	Average
%	64	36	0.4

Answers could have been specific examples such as cyclicAMP (cAMP), or more general responses such as different proteins, different enzymes or secondary messenger molecules.

### Question 2d.

Marks	0	1	Average
%	64	36	0.4

An answer to this question had to be consistent with the answer already given in part a. For example, if glucagon was given in part a., the expected answer to part d. would be 'conversion of glycogen into glucose'.

A general answer in part a. usually resulted in a broader answer to part d. General answers that were accepted included ideas such as increase/decrease in production of mRNA and increase/decrease in protein synthesis.

## 2010 – Question 1

### Question 1a.

Marks	0	1	Average
%	76	24	0.3

A hormone is a chemical messenger produced by a cell and (one of):

- triggers a specific response
- attaches to specific receptors.

Students were asked to give the general function of a hormone. Many students incorrectly described a hormone instead of outlining the general function of a hormone. Poorly worded responses such as 'a chemical messenger sent to a specific receptor' were incorrect as hormones generally can move throughout the whole organism.

### Question 1b.

Marks	0	1	2	3	Average
%	23	35	29	12	1.3

**Question 1bi.**

Name of female: Emily

Explanation: Emily’s blood glucose level has a greater initial increase and takes longer/five hours to decrease.

To be awarded the marks for this question students were required to make a **comparative** statement as shown above or to compare Emily’s result to Grace’s. A common incorrect answer was ‘Emily’s blood sugar level initially was high and then returned to normal’, since this was the same situation for Grace.

No marks were awarded for giving the name of the female.

**Question 1bii.**

Either of:

- the rise was due to her body converting glycogen to glucose
- there are corrections of small overshoots.

Answers which stated that Grace had eaten a snack or a meal were not awarded the mark. For this to be a valid method to indicate the failure of the blood-glucose homeostatic mechanism, both subjects needed to be in identical conditions.

Many students understood the homeostatic mechanisms of blood glucose and correctly identified the role of glucagon in this process; however, this was not required. Some students did not gain the mark for this question as their spelling of the words ‘glycogen’ and ‘glucagon’ was difficult to decipher.

**Question 1c.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Average</b>
<b>%</b>	8	30	28	34	<b>1.9</b>

**Question 1ci.**

Decreased fertility or decreased sperm production

Some careless errors occurred here and students are advised to answer the question rather than to give extra information that is not required.

**Question 1cii.**

Effect: Rise in production

Explanation: Less testosterone is produced and negative feedback does not occur, so GnRH continues to be produced.

There were many confused answers to this question. Many students did not understand that negative feedback of testosterone to the hypothalamus inhibits the production of GnRH, and incorrectly stated that a lack of negative feedback inhibits the production of GnRH.

Many students who incorrectly identified a fall in production could still gain the first mark for the explanation.

**2010 – Question 5**

**Question 5a.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Average</b>
<b>%</b>	6	7	13	23	51	<b>3.1</b>

**Question 5ai.**

Organelle M: golgi (complex)

Function: packages protein/material for export from the cell

**Question 5aii.**

Organelle N: mitochondria

Function: site of aerobic respiration

These questions were very well answered. Students generally have a sound understanding of cellular respiration; however, it was disappointing that vague statements such as ‘mitochondria: site of energy production’ were given. Answers which stated that mitochondria is the ‘powerhouse’ of the cell were not awarded the mark for the function.

**Question 5b.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	24	76	<b>0.8</b>

Q was the most obvious answer; however, M was also accepted as there was no information that the material would not have reached M in 3 minutes.

Students were required to give the appropriate letter and not give the name of the organelle.

**Question 5c.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	55	21	24	<b>0.7</b>

Both of:

- if the hormone is lipid soluble it will pass through the cell membrane and bind to a receptor in the cytosol
- if the hormone is protein based it will bind to a membrane receptor.

Many students gave good descriptions but stated that the receptor for the steroid hormone was within the cell.

**2008 – Question 7****Question 7a.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	75	25	<b>0.3</b>

Positive phototropism

**Question 7b.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	20	29	51	<b>1.4</b>

7bi.

Any of:

- temperature
- number of seeds
- nutrients.

Some students incorrectly stated the type of seeds/plant. The stem of the question states 'a sample of seeds from the same plant', so this was not correct. More careful reading of the question would have prevented this error.

7bii.

The amount of light

**Question 7c.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	18	82	<b>0.9</b>

T

**2009 – Question 5****Question 5a.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	31	69	<b>0.7</b>

Via the bloodstream

**Question 5b.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	56	44	<b>0.5</b>

A system where the response to a particular stimulus reverses the direction of that stimulus – the mechanism of homeostasis

**Question 5ci-ii.**

Marks	0	1	2	Average
%	27	34	39	1.1

**Question 5ci.**

T

**Question 5cii.**

TSH is a protein-based hormone which is unable to pass directly through the plasma membrane and as a consequence requires a membrane receptor.

To adequately answer this question students were required to provide information that was not already given in the stem of the question.

**Question 5d.**

Marks	0	1	Average
%	52	48	0.5

The cells in these organs lack the **appropriate** receptors for thyroxine.

A common mistake made by students was to refer to TSH rather than thyroxine.

**2008 – Question 8**

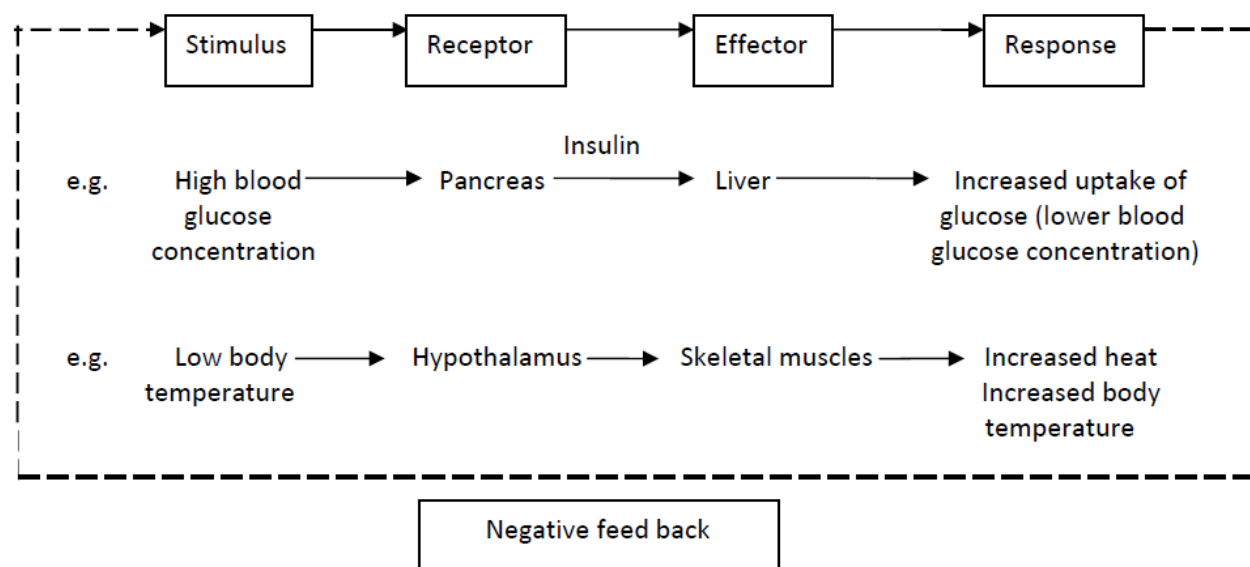
**Question 8a.**

Marks	0	1	2	3	Average
%	38	20	21	21	1.3

Students needed to name a suitable homeostatic system, such as regulation of blood glucose concentration, ion concentration in the blood or body temperature.

One mark was awarded for the name of the stimulus and an appropriate example, one mark for the name of a suitable effector and response, and one mark for an indication of negative feedback.

Below are some examples of appropriate responses.



**Question 8b.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	50	50	<b>0.5</b>

High or low copper concentrations in the cell

**Question 8c.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	80	20	<b>0.2</b>

Either of:

- too much copper may be toxic to the cell
- copper is a co-factor required by enzymes.

Most students wrote general comments such 'copper is needed by the cells' or 'too much copper would damage/harm a cell'. These responses did not gain a mark.

**2007 – Question 1****Question 1a.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	9	91	<b>0.9</b>

Pheromones

**Questions 1b.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	43	57	<b>0.6</b>

The cell which responded had receptors specific for that particular hormone.

It was important that students made the link that receptors are specific; too often students used the term 'active site' to describe a receptor. Some students also incorrectly stated that the target (organ) lacked receptors, rather than relating their answer to the cell. These students were not awarded the mark.

**Question 1c.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>Average</b>
<b>%</b>	14	10	28	27	21	<b>2.4</b>

A variety of hormones were provided in response to this question, and marks were awarded if the information given was correct.

It is important that students read the whole question before answering any part. In this question, many students realised part way through that, for the hormone given in part i., they were not able to give suitable answers to parts ii. and iv. It was disappointing that some students discussed plant hormones (plant growth regulator substances) when the question clearly asked for a hormone which travels through the blood. These students could not score for parts i., ii. or iv.

The table below lists some of the more common answers for parts i., ii. and iv. Part iv. specifically asked for an outcome at the cellular level, but many students failed to answer with reference to the cellular level.

<b>ci. Hormone</b>	<b>cii. Tissue or gland that produces the hormone</b>	<b>civ. Outcome in the target cells</b>
Insulin	(Beta cells of) pancreas	Liver/skeletal muscles take up more glucose
Glucagon	(Alpha cells of) pancreas	Liver cells release glucose or break down glycogen
ADH	Hypothalamus	Cells in kidney tubule reabsorb more water

**ciii.**

Signal transduction refers to the series of events that occur after the receipt of a specific signal and which result in a **response**.

This part was poorly answered. The concept of signal transduction underpins many of the processes discussed in Unit 3. It highlights, at the **molecular** level, the transfer of information from one form into another, which is then understood by the cell to produce a **response**. Many students failed to mention the generation of a response at the cellular level.

## 2006 – Question 5

### Question 5

This question involved the principles of homeostasis. It was expected that the example chosen would be unfamiliar to most, if not all, students. However, students were expected to have gained an understanding of the principles of homeostasis through the study of exemplar situations and to be able to apply them to the unfamiliar situation given.

Few students were able to answer the question with homeostatic principles in mind. In addition, many were hampered by a lack of basic biological knowledge.

### Question 5a.

Marks	0	1	Average
%	90	10	0.1

Either of:

- because of high solubility in water, carbon dioxide is more readily removed by fish (or some other statement referring to the greater availability of water for fish than mammals)
- because carbon dioxide is more difficult to remove by breathing/air (or some other statement explaining that mammals have less water to remove carbon dioxide than fish).

Many answers repeated the statements within the question, and many students' language was inappropriate; for example, 'fish breathing'.

### Question 5b.

Marks	0	1	2	Average
%	74	23	3	0.3

An increase in blood pH indicates that the blood is becoming more alkaline. Homeostatic mechanisms would operate to reduce the blood pH; that is, to increase the acidity of the blood. This would be achieved with an increase of carbon dioxide in the blood, hence appropriate answers were:

- heart as the effector would reduce the rate of beating to reduce carbon dioxide loss
- intercostal muscles, diaphragm, rib cage or lungs as the effector would reduce the rate of ventilation/breathing to reduce carbon dioxide loss.

Many students incorrectly assumed that an increase in pH meant an increase in acidity.

### Question 5c.

Marks	0	1	Average
%	64	36	0.4

This question could have been answered in the context of the pearl divers hyperventilating either before or after they dive.

**If writing about prior to dive,** hyperventilation increases carbon dioxide loss, therefore reduced levels of carbon dioxide reduce the urge to breathe, therefore it allows divers to remain under water for longer, as it takes longer for carbon dioxide to build up in the blood.

**If writing about after the dive,** because of rapid deep breathing to restore oxygen levels or to reduce carbon dioxide levels.

Many incorrect statements were given that incorporated ideas such as the divers 'breathing under water'. Breathing must be done out of water. Students should think about appropriate experiences in their own day-to-day living in order to help them to better understand a particular/unfamiliar situation.

### Question 5d.

Marks	0	1	Average
%	73	27	0.3

A lower level of carbon dioxide reduces the urge to breathe, resulting in a person running out of oxygen before carbon dioxide builds up to a level to stimulate breathing.