



1. Which of the following statements demonstrate that plant cells carry out cell signalling?

- 1 Plants have cell surface receptors that cause the cells to respond to specific molecules.
- 2 Binding to receptors at the plasma membrane can change chemical pathways within the cell.
- 3 Plant cells respond to soluble molecules which can be carried in both the xylem and the phloem.

- A** 1, 2 and 3
- B** Only 1 and 2
- C** Only 2 and 3
- D** Only 1

Your answer

[1]

2. Which process, **A** to **D**, is a correct reason for cell signalling in multicellular organisms?

- A** homeostasis
- B** osmosis
- C** photosynthesis
- D** respiration

Your answer

[1]

3. The following advice is given to mothers of babies under 6 months:

Don't let your baby get too hot or too cold. A room temperature of 16–20°C, with light bedding or a lightweight baby sleeping bag, will provide a comfortable sleeping environment for your baby.

Which of the statements, **A** to **D**, best explains this advice?

- A** newborn babies have poorly-developed osmoregulation mechanisms
- B** newborn babies have poorly-developed thermoregulation mechanisms
- C** newborn babies have poorly-developed ectothermic mechanisms
- D** newborn babies have poorly-developed glucoregulation mechanisms

Your answer

[1]



4. During pregnancy, the hormone human chorionic gonadotrophin (hCG) is produced by the placenta. Fig. 16.1 shows how levels of hCG change throughout pregnancy.



Fig. 16.1

At birth, the production of another hormone, oxytocin, increases. Oxytocin causes rapid contractions of the uterus. These contractions cause more oxytocin to be released.

What term is used to describe this kind of interaction?

..... [1]

5. Another patient shows severe symptoms of unregulated blood glucose concentration. Under certain circumstances this condition may need to be treated with glucagon injections.

i. Under what circumstances might this patient need to be given a glucagon injection?

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 [1]



6. Fig. 11.1 shows the heat flow through the skin of an athlete during vigorous exercise. Exercise starts at 400 seconds.

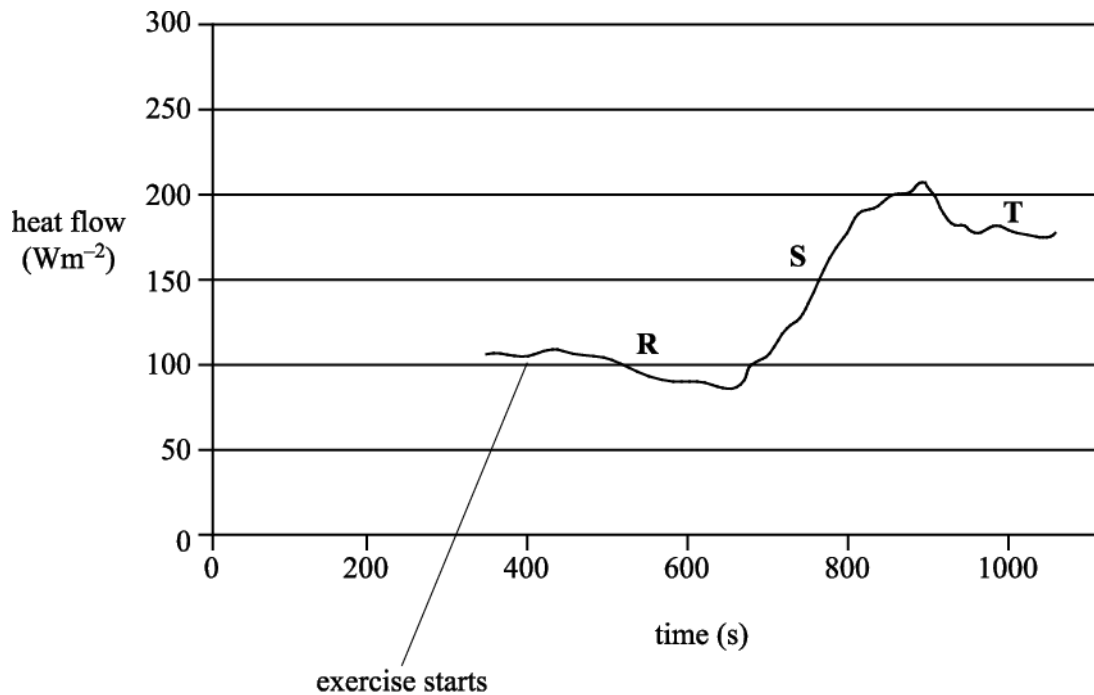


Fig. 11.1

Blood flow can be directed to those parts of the body that make the greatest demands.

Which row gives the best explanation of the stages in Fig. 11.1?

	R	S	T
A	Blood directed away from skin to avoid excess heat loss	Blood directed towards skin to release excess heat	Balance achieved between loss of excess heat and the need for oxygen in the muscles
B	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to release excess heat	Balance achieved between heat loss and excess heat created in the muscles
C	Blood directed away from skin to avoid excess heat loss	Blood directed towards skin to gain heat from the environment	Balance achieved between heat loss and excess heat created in the muscles
D	Blood directed away from skin and towards the muscles to supply more oxygen for respiration	Blood directed towards skin to gain heat from the environment	Balance achieved between loss of excess heat and the need for oxygen in the muscles

Your answer

[1]



7. A pump stands in a pond to circulate the water. In cold weather, the fish gather around the pump.

Suggest an explanation as to why the fish gather around the pump in cold weather.

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[2]

- 8(a). The presence of a pathogen in the body can cause a fever. During a fever, the body's thermoregulatory set-point (normal body temperature) rises.

- i. Fever is accompanied by sweating.

Explain the effect that this sweating will have on the body.

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[2]

- ii. Another feature of fever may be uncontrollable shivering.

Suggest why shivering occurs during fever.

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[1]



- (b). Hypothermia is a condition in which the body's core temperature is lowered. Hypothermia can affect people who take part in outdoor activities in winter without wearing suitable clothing.

Some people think that alcohol should be given to those who have hypothermia, as it makes them feel warmer. Alcohol causes vasodilation.

Explain why it is **not** a good idea to give alcohol to someone with hypothermia.

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[2]

9. Which of the options, **A** to **D**, correctly describes how an endotherm would respond to an increase in temperature?

- A dilation of arterioles near the surface of the skin
- B erector muscles contract, causing hairs to stand up
- C rapid contractions of skeletal muscles
- D sweat glands release less sweat

Your answer

[1]



10. Many insects such as moths and bumblebees are insulated with scales and hair, and are known as facultative endotherms.

Their metabolism during flight can cause the temperature of the flight muscles to increase 20–30 °C above the external temperature.

- i. Using the information provided, explain why many moths and bumblebees are described as endothermic.

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..... [1]

- ii. It is more difficult for moths and bumblebees to maintain their body temperature than for mammals and birds to maintain their body temperature.

Explain why.

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..... [2]

END OF QUESTION paper



Mark scheme

Question		Answer/Indicative content	Marks	Guidance
1		A ✓	1	
		Total	1	
2		A ✓	1	
		Total	1	
3		B	1	
		Total	1	
4		positive feedback	1	
		Total	1	
5	i	<p>1 if blood glucose falls, extremely / dangerously / too / very, low;</p> <p>2 if patient, cannot produce (enough) glucagon / produces little glucagon;</p> <p>3 idea that glucose source cannot be taken by mouth;</p>	1 max	<p>1 CREDIT hypoglycaemic / hypoglycaemia IGNORE 'below normal' alone</p> <p>2 CREDIT ref to dysfunctional, α cells / glucagon receptors</p> <p>3 CREDIT a suitable reason (e.g. fitting or in a coma)</p> <p>Examiner's Comments</p> <p>Most candidates gained a mark in this section for stating that the circumstance under which the patient would need to be given a glucagon injection would be a very low blood glucose level. Some also commented that the alpha cells may not be functioning properly, resulting in an inadequate secretion of glucagon. It was insufficient to refer to 'low blood glucose' or 'below normal blood glucose concentration'.</p>
	ii	<p>when blood glucose concentration decreases</p> <p>1 (glucagon) released by the, alpha / α, cells in, islets of Langerhans / pancreas;</p> <p>2 promotes / AW, conversion of glycogen to glucose / glycogenolysis, in, liver / muscle / effector, cells;</p> <p>3 ref gluconeogenesis / described;</p>	4 max	<p>IGNORE ref to insulin or events following an increase in blood glucose concentration</p> <p>1 DO NOT CREDIT 'alpha cells are produced'</p> <p>2 Any description must correspond correctly to term DO NOT CREDIT if glucagon converts glycogen directly</p> <p>3 Any description must correspond correctly to term IGNORE imprecise ref to glucagon <i>doing the conversion</i></p>



		<p>4 ref conversion of triglycerides to (free) fatty acids / lipolysis / increased use of fatty acids in respiration;</p> <p>5 negative feedback, reduces / inhibits, the secretion of glucagon;</p> <p>6 glucagon, reduces / inhibits, insulin secretion;</p>	<p>4 Any description must correspond correctly to term IGNORE imprecise ref to glucagon <i>doing the conversion</i></p> <p>5 DO NOT CREDIT stopping glucagon secretion</p> <p>6 DO NOT CREDIT stopping insulin secretion</p> <p>Use of three terms from:</p> <table border="1" data-bbox="981 728 1508 918"> <tr> <td>alpha,</td> <td>islet,</td> </tr> <tr> <td>pancreas,</td> <td>glycogen,</td> </tr> <tr> <td>glycogenolysis,</td> <td>effector,</td> </tr> <tr> <td>gluconeogenesis,</td> <td>negative feedback</td> </tr> </table> <p>Please insert a QWC symbol next to the pencil icon, followed by a tick (✓) if QWC has been awarded or a cross (×) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.</p> <p>Examiner's Comments</p> <p>1 The role of glucagon in the regulation of blood glucose concentration produced variable responses. Better candidates achieved all marks available for a good description of the secretion of glucagon from the alpha cells of the islets of Langerhans in the pancreas and its subsequent effects on liver or muscle cells. Most appreciated that glucagon would stimulate glycogenolysis and gluconeogenesis, or described the processes, although some failed to gain the second marking point for either failing to identify the effector cells or stating that glucagon itself would convert glycogen into glucose. Some contradicted their answers by referring to the breakdown of glycogen to glucose as glycolysis. While many also recognised that more fatty acids would be used in respiration, some simply that fats or lipids would be used. There were comparatively few references to glucagon reducing insulin secretion (most stated that insulin secretion was stopped) and hardly any to negative feedback reducing glucagon secretion once blood glucose levels had been restored to normal.</p> <p>Most candidates were awarded the QWC mark for three</p>	alpha,	islet,	pancreas,	glycogen,	glycogenolysis,	effector,	gluconeogenesis,	negative feedback
alpha,	islet,										
pancreas,	glycogen,										
glycogenolysis,	effector,										
gluconeogenesis,	negative feedback										
	ii	<p>QWC – technical terms used appropriately and spelled correctly;</p>									



					technical terms spelled correctly and used in an appropriate context.
			Total	6	
6			B	1	
			Total	1	
7			<p>1 fish are, ectotherms / ectothermic or body temperature will be similar to surrounding water;</p> <p>2 idea that pump will be generating heat / water around pump is warmer;</p> <p>3 AVP;</p>	2 max	<p>All marks to be applied in the context of warmth rather than oxygen (as the pump circulates water and does not oxygenate)</p> <p>1 CREDIT cannot control body temperature (by physiological means) DO NOT CREDIT ref to, regulating / maintaining, body temperature</p> <p>3 they are adapted for warmer conditions</p> <p>ref to (named) metabolic function (e.g. metabolic reactions occur at a faster rate / enzymes can work more efficiently)</p> <p>Examiner's Comments</p> <p>Many candidates related the presence of the pump to providing warmer water. Attempts to describe the fish as ectotherms (although a significant number used the term exotherms) were frequently contradicted by references to the fish maintaining their body temperature, some even going on to state that they did this by homeostasis. A number became side-tracked and answered in terms of obtaining more oxygen – not too much of an issue in cold conditions.</p>
			Total	2	
8	a	i	<p>1. evaporation will, have a cooling effect / reduce (body) temperature;</p> <p>2. heat, taken from / supplied by, the body / blood / skin, is, needed / used for, evaporation;</p> <p>3. idea that water has a high latent heat of, vaporisation / evaporation;</p>	2 max	<p>2. ACCEPT evaporation uses latent heat Look for a clear statement that body heat is being used for evaporation</p> <p>3. e.g. evaporation of water needs a lot of, energy / heat</p> <p>Examiner's Comments</p> <p>Whilst most answers linked evaporation to cooling of the body, a smaller proportion correctly linked this to heat being</p>



					used for evaporation. Candidates need to be precise in their use of language to ensure that the correct information is conveyed. Phrases such as 'taking with it', 'transferred' and 'absorbed' did not indicate that the body heat was used to provide the energy for evaporation. Few candidates referred to the high latent heat of vaporisation of water.
		ii	idea that to increase body temperature as it is lower than the 'new' set-point (even though body is hot);	1	e.g. as the new 'normal' body temperature is higher, the body is using shivering to raise the temperature of the internal environment. Examiner's Comments Although most candidates clearly understood the principles of shivering and its role in raising body temperature, relatively few had absorbed the information given at the start of the question. Candidates were expected to relate this to the rise in the thermoregulatory set-point during a fever.
		b	<ol style="list-style-type: none"> 1. vasodilation results in more blood nearer to the skin surface; 2. idea that will lose (even) more heat / further heat loss (from body) / body temperature decreases further; 3. (named) organ(s) will not be able to maintain, function / metabolism; 	2 max	<ol style="list-style-type: none"> 1. Vasodilation must be in correct context (arterioles). DO NOT CREDIT (large) arteries / capillaries / veins, relaxing / dilating / expanding DO NOT CREDIT blood vessels moving closer to the surface 2. just 'the body loses heat' is not enough 3. ACCEPT ref to lack of kinetic energy for enzymes ACCEPT ref to lack of enzyme activity Examiner's Comments Most candidates realised that the vasodilation would reduce the body temperature even further. However, vasodilation continues to be misunderstood. Candidates often wrote that arteries / capillaries / veins dilated or that blood vessels actually moved closer to the skin surface during the process. Consequently, mark point 1 could not be awarded. Those candidates who discussed the long-term effects of alcohol on body chemistry did not appreciate the question context.
			Total	5	
9			A ✓	1	Examiner's Comments A straightforward recall question to start the paper was accessible to all candidates across the ability range, demonstrating a clear grasp of the processes involved in endothermic responses.
			Total	1	
10		i		1 max	



			<p>scales and hair help to reduce heat loss ✓</p> <p>generate heat from, respiration / metabolism ✓</p>		<p>ALLOW generate heat internally</p> <p>IGNORE temperature</p> <p>Examiner's Comments</p> <p>Few candidates gained the mark for Q16(a)(i). Some referred to <i>production</i> of heat energy which could not be credited and others focused on the behavioural responses of ectotherms. This highlighted the need for candidates to ensure that they use the information provided in the question if asked to do so.</p>
		ii	<p>(insects are smaller and) have a, large(r) / AW, surface area to volume ratio ✓</p> <p>(insects have) <u>greater</u> rate of heat loss ✓</p> <p>mammals and birds have, more effective / thicker, insulation ✓</p> <p>ref to a method of more precise control of body temperature in birds and mammals ✓</p>	2 max	<p>Mps 1 and 2 ALLOW ora for mammals (must be comparative)</p> <p>ALLOW SA:V / surface area relative to volume</p> <p>ALLOW lose heat more, quickly / easily</p> <p>ALLOW have fat under skin</p> <p>ALLOW ora for insects (must be comparative)</p> <p>e.g. themoregulatory centre / heat gain / heat loss centre e.g. vasodilation / vasoconstriction e.g. sweating / shivering / hairs standing up</p> <p>Examiner's Comments</p> <p>In Q16(a)(ii) the most commonly awarded correct responses were for mark points one and four. Stronger candidates recalled that small organisms, such as insects, have a large(r) SA:V and recognised that they would not have mammalian methods of precise control of body temperature such as vasodilation. Mark point two was awarded less often as candidates failed to make a comparative statement that there was a greater rate of heat loss or that heat was lost more quickly. Centres are encouraged to emphasise the need to use the comparative when discussing alternatives such as that used in mark point two.</p>
			Total	3	