OCR A-LEVEL BIOLOGY A · H420

BIOLOGY



EXAM QUESTION PACK

5.1.1 COMMUNICATION AND HOMEOSTASIS

SCORE	PERCENTAGE
/33	%

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Answer **all** the questions.

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

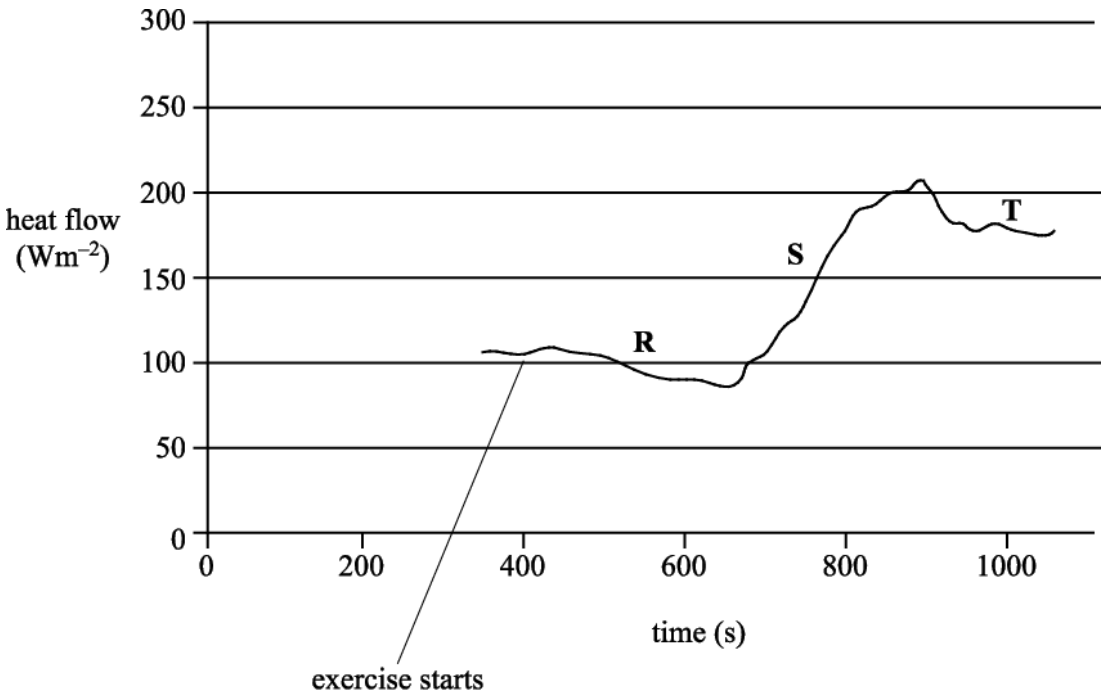


Fig. 11.1

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	Blood directed towards skin to gain heat from the environment	Balance achieved between loss of excess heat and the need for

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	supply more oxygen for respiration		oxygen in the muscles

Your answer

[1]

2. 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]

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3. The table below shows features of the five kingdoms.

Kingdom	Nerves present	Hormones present
Prokaryotae	×	×
Protoctista	×	×
Fungi	×	☐
Plantae	×	☐
Animalia	☐	☐

Which of the statements, **A** to **D**, is correct?

A only autotrophic organisms require hormones
B only heterotrophic organisms need to interact with their environment
C only multicellular organisms require hormones
D only unicellular organisms require nervous systems

Your answer ☐

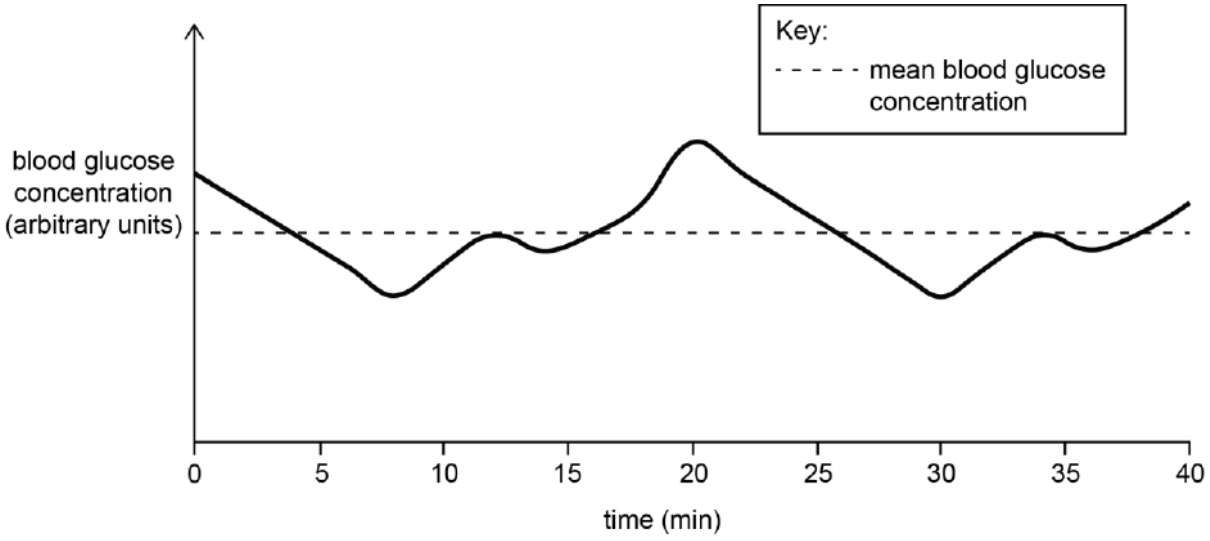
[1]

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4. The graph below shows the change in glucose concentration in a rat's bloodstream over a short period of time.



Which of the statements, **A** to **D**, is correct?

A blood glucose concentration at 15 min > blood glucose concentration at 20 min

B blood glucose concentration at 9 min << blood glucose concentration at 20 min

C blood glucose concentration at 0 min < blood glucose concentration at 40 min

D blood glucose concentration at 5 min >> blood glucose concentration at 28 min

Your answer ☐

[1]

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5. The following terms relate to the metabolism of carbohydrates in the human body:

1 gluconeogenesis
2 glycogenesis
3 glycolysis

Which of these processes will be stimulated when glucagon is released into the bloodstream?

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

Your answer ☐

[1]

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6. 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.

[2]

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7. A 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?

---**[1]**

(ii) Describe how glucagon is involved in the regulation of blood glucose concentration in a person who is able to regulate their blood glucose concentration correctly.

In your answer, you should use appropriate technical terms, spelled correctly.

---**[5]**

8(a). This question considers some similarities and differences in plant and animal biology.

(i) Describe two **similarities** in the action of plant and animal hormones **in cell signalling**.

1 _____

_____

_____

2 _____

_____

_____ **[2]**

(ii) Asexual reproduction and the ability to produce natural reproductive clones is common in plants but rare in animals.

Explain why plants are more able to form **natural** reproductive clones than animals.

_____

_____

_____

_____

_____

_____

_____ **[2]**

(iii) Polyploidy is the possession of more than two sets of chromosomes in the nucleus.
Polyploidy is common in plants.

Suggest an explanation for the significance of polyploidy in forming new species of plant such as bread wheat, *Triticum aestivum*.

_____

_____

_____

_____

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---**[2]**

(b). A student setting up an experiment to investigate the effect of light on cress plant seedlings accidentally shone the bright light onto one side of the face of another student. He noticed that the student immediately responded by raising her hand to shield her eye from the light.

The response of the cress seedlings to light shining from one direction was slower, but after 24 hours the cress seedlings had grown towards the light.

Describe the mechanisms that produced the responses to light in the cress seedlings **and** in the human.

cress seedlings

---

human

---**[7]**

9(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.

[2]

(ii) Another feature of fever may be uncontrollable shivering.

Suggest why shivering occurs during fever.

[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.

[2]

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10. 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]

11. 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]

END OF QUESTION PAPER

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Question			Answer/Indicative content	Marks	Guidance
1			B	1	
			Total	**1**	
2			B	1	
			Total	**1**	
3			C	1	
			Total	**1**	
4			B	1	
			Total	**1**	
5			D	1	
			Total	**1**	
6			1 fish are, ectotherms / ectothermic **or** body temperature will be similar to surrounding water; 2 *idea that* pump will be generating heat / water around pump is warmer; 3 AVP;	2 max	All marks to be applied in the context of warmth rather than oxygen (as the pump circulates water and does not oxygenate) 1 **CREDIT** cannot control body temperature (by physiological means) **DO NOT CREDIT** ref to, regulating / maintaining, body temperature 3 they are adapted for warmer conditions ref to (named) metabolic function (e.g. metabolic reactions occur at a faster rate / enzymes can work more efficiently) **Examiner's Comments** 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.

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Question			Answer/Indicative content	Marks	Guidance
			Total	**2**	

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Question			Answer/Indicative content	Marks	Guidance
7		i	**1** if blood glucose falls, extremely / dangerously / too / very, low; **2** if patient, cannot produce (enough) glucagon / produces little glucagon; **3** *idea that* glucose source cannot be taken by mouth;	1 max	**1 CREDIT** hypoglycaemic / hypoglycaemia **IGNORE** 'below normal' alone **2 CREDIT** ref to dysfunctional, α cells / glucagon receptors **3 CREDIT** a suitable reason (e.g. fitting or in a coma) **Examiner's Comments** 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'.

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Question			Answer/Indicative content	Marks	Guidance
		ii	*when blood glucose concentration decreases* **1** (glucagon) released by the, **alpha** / α, cells in, **islet**s of Langerhans / **pancreas**; **2** promotes / AW, conversion of **glycogen** to glucose / **glycogenolysis**, in, liver / muscle / **effector**, cells; **3** ref **gluconeogenesis** / described; **4** ref conversion of triglycerides to (free) fatty acids / lipolysis / increased use of fatty acids in respiration; **5 negative feedback**, reduces / inhibits, the secretion of glucagon; **6** glucagon, reduces / inhibits, insulin secretion;	4 max	**IGNORE** ref to insulin or events following an increase in blood glucose concentration **1 DO NOT CREDIT** 'alpha cells are produced' **2 Any description must** correspond correctly to term **DO NOT CREDIT** if glucagon *converts* glycogen directly **3 Any description must** correspond correctly to term **IGNORE** imprecise ref to glucagon *doing the conversion* **4 Any description must** correspond correctly to term **IGNORE** imprecise ref to glucagon *doing the conversion* **5 DO NOT CREDIT** stopping glucagon secretion **6 DO NOT CREDIT** stopping insulin secretion

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Question			Answer/Indicative content	Marks	Guidance
		ii	**QWC** – technical terms used appropriately and spelled correctly;	1	Use of **three** terms from: **alpha, islet,** **pancreas, glycogen,** **glycogenolysis, effector,** **gluconeogenesis, negative feedback** **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.** **Examiner's Comments** 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. Most candidates were awarded the QWC mark for three technical terms spelled correctly and used in an appropriate context.

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Question			Answer/Indicative content	Marks	Guidance
			Total	**6**	

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Question			Answer/Indicative content	Marks	Guidance
8	a	i	1 (hormone) binds to <u>receptor</u>; 2 causing, cascade of events / enzyme reactions; 3 may involve switching, on / off, genes; 4 only, present / needed, in small, concentrations / quantities (to have an effect); 5 may have effect on more than one, location / target tissue; 6 *idea that* effect may involve interaction of more than one hormone;	2 max	**IGNORE** prompt lines and mark as prose **1 ACCEPT** (hormone) complementary shape to <u>receptor</u> **1 ACCEPT** attach **1 IGNORE** fit **3 CREDIT** ref to changing gene expression **Examiner's Comments** This question discriminated well, with only the most able candidates gaining full marks. The most common correct answer given was for saying that hormones bind to receptors on target cells, gaining 1 mark. Several answers gave descriptions of how hormones are transported in animals and plants as a similarity, or generic statements about being released and affecting a target tissue, which gained no credit. Those gaining full marks described how hormones bind to receptors, leading to a series of enzyme reactions taking place inside the target cell.

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Question			Answer/Indicative content	Marks	Guidance
		ii	1 (most) plant cells retain ability to differentiate / <u>totipotent</u>; 2 plants have, meristems / meristematic tissue; 3 *idea that* plant cells can de-differentiate and then differentiate into a different cell type; 4 (most) animal cells are, differentiated / not totipotent / not pluripotent / only able to differentiate into the same type(s) of cell / are multipotent;	2 max	**2 ACCEPT** named meristematic tissue e.g. shoot apex / root apex / cambium **4 ACCEPT** 'stem cells found in few (named) tissues' 'bone marrow cells only differentiate into blood cells' **Examiner's Comments** Candidates seemed to find this question a challenge with only a few gaining marks for recalling that plants have meristematic tissue. Good answers would then go on to describe this tissue as totipotent with higher-scoring candidates demonstrating a clear understanding of the need for meristem / undifferentiated cells in asexual reproduction. A few candidates correctly described the role of stem cells in animals. Several answers gave long extended descriptions of vegetative propagation which gained no credit. However, some candidates still struggle to understand that because most animal cells have become specialised they are unable to reproduce asexually. Many incorrect answers referred to animals only being able to reproduce sexually without giving explanations or reasons of why this was the case. A few candidates confused self-fertilization with clones, describing self pollination in plants as a type of asexual reproduction.
		iii	1 (inter-species / triploid) hybrids, are sterile / cannot reproduce sexually;	2 max	**1 CREDIT** hybrid from named examples e.g. einkorn (wheat) ×, wild / goat, grass emmer (wheat) × wild grass

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Question	Answer/Indicative content	Marks	Guidance
	2 polyploidy (in the hybrid) provides duplicate of each chromosome;		**2 IGNORE** ref to 'more than two sets of chromosomes' as this is given in Q
	3 (polyploidy) allows the hybrid to, carry out meiosis / form gametes **or** (polyploidy) restores fertility / overcomes sterility;		**3 ACCEPT** 'chromosome number doubling restores fertility' **3 ACCEPT** can reproduce sexually
	4 (hybrids are) <u>reproductively isolated</u> (from other species);		**4 ACCEPT** gametes incompatible with other species
	5 increased, cell size / grain size, increases yield;		**5** seed size
	6 sterile hybrids expensive for farming (especially in developing countries);		
	7 (plants) stronger / more vigorous / healthier;		**7** must be a comparative statement **7 ACCEPT** less prone to disease / greater hybrid vigour **7 IGNORE** pest resistance **Examiner's Comments** Again this question posed a real challenge to candidates and showed a poor understanding of the term polyploidy. A sizeable number of candidates made no attempt to answer. Where candidates did gain a mark, this was generally for grains / cells being of increased size and therefore giving a higher yield. Very few candidates seemed to appreciate the role of polyploidy in overcoming hybrid sterility by facilitating meiosis (so failed to score MP1, 2, 3 or 4). Many candidates concentrated on dubious consequences arising from cells having more genes / alleles (such as masking undesirable recessive traits) or were side-tracked into brief accounts about artificially selected characteristics.

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Question			Answer/Indicative content	Marks	Guidance
	b		*cress seedlings* **C1** apical cells / apex / tip(of shoot), produce, auxin / IAA; **C2** diffusion / active transport (down shoot / through parenchyma); **C3** greater auxin (concentration) on shaded side of stem; **C4** auxin causes cell <u>wall</u> loosening; **C5** auxin causes cell, elongation / expansion; **C6** further detail of changes in cell **wall**; *Human* **H1** retina / rods / receptors, detect light / AW; **H2** action potentials / depolarisation / nervous impulse, along sensory neurone (membrane); **H3** intermediate neurone (in brain) / (somatic) motor neurone / neuromuscular junction; **H4** correct ref to detail of synaptic transmission; **H5** depolarisation / contraction, of muscle fibre(s); **H6** correct ref to detail of muscle contraction;	7 max	**C1 ACCEPT** secretes /releases **C2 CREDIT** PIN (polar auxin transport) **C3 ACCEPT** auxin, moves to / collects on, shaded side **C3 IGNORE** found on shaded side **C4 ACCEPT** cell <u>walls</u> become, stretchy / less rigid **C4 IGNORE** weakened cell <u>walls</u> **C6** e.g. H^+ ions pumped into cell wall / low pH to allow enzymes to work / bonds broken within cellulose in wall **H1 IGNORE** ref to cones **H2 / H3 DO NOT CREDIT signals / messages** **H2 IGNORE** ref to optic nerve **H3 CREDIT** ref to relay neurone **H5 ACCEPT** muscle cell **H6** e.g. actin and myosin slide over each other **Examiner's Comments** This question produced a wide range of marks, and was generally a well - answered question with most candidates having a good attempt at both parts. Candidates lost marks by failing to focus on the mechanisms required to produce the responses to light in both plants and humans.

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Question			Answer/Indicative content	Marks	Guidance
					Cress seedlings Many candidates scored well here and it was good to see many answers including details of cell elongation and the mechanism of cell wall loosening. Many candidates scored marking points 3, 4, 5 and 6. Interestingly, fewer candidates scored marking point 1, forgetting to say that auxin is produced in the tip or to mention the diffusion of the auxin, for marking point 2. *Human* Many candidates did not score as well on this part. Many lost marks by the imprecise use of terminology, such as the terms signal / message or impulse instead of action potential for marking point H2. Very few linked this question to the detail of muscle contraction. A minority of students mentioned contraction of muscle cells or muscle fibres with the majority just saying muscle, which did not get marking point H5. A significant number of candidates concentrated on the role of the autonomic nervous system and benefit of reflex actions in preventing injury, and were awarded no marks at all. Creditable answers generally scored H1 with fewer scoring H2 and / or H3.
			Total	**13**	

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Question			Answer/Indicative content	Marks	Guidance
9	a	i	1 evaporation will, have a cooling effect / reduce (body) temperature; 2 heat, taken from / supplied by, the body / blood / skin, is, needed / used for, evaporation; 3 *idea that* water has a high latent heat of, vaporisation / evaporation;	2 max	2 **ACCEPT** evaporation uses latent heat Look for a clear statement that body heat is being ***used*** for evaporation 3 e.g. evaporation of water needs a lot of, energy / heat **Examiner's Comments** Whilst most answers linked evaporation to cooling of the body, a smaller proportion correctly linked this to heat being *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.

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Question			Answer/Indicative content	Marks	Guidance
	b		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	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**	
10			A ☐	1	
			Total	**1**	
11			A ☐	1	
			Total	**1**	

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