

Answers to examination-style questions

Answers	Marks	Examiner's tips
<p>1 a) i) maintaining a constant internal environment</p>	1	Ensure you refer to the internal environment in your definition.
<p>ii) For example: temperature / pH; optimum for enzymes / effect of pH / temperature on enzyme activity; <i>or</i> water potential / blood glucose; effect of osmotic / blood glucose imbalance on cells;</p>	2 max.	One mark would be awarded for naming a factor which is kept constant. The other mark is for explaining the importance of maintaining this factor within a narrow range.
<p>b) i) hypothalamus (contains the thermoregulatory centre); has receptors which detect temperature changes of blood; receives impulses from receptors in skin; nerve impulses transmitted (from hypothalamus / brain); results in vasoconstriction / constriction of arterioles / dilation of shunt vessels; diversion of blood to core / specified organ / less blood to skin; muscular contraction / shivering generates heat via respiration; release of thyroxine / adrenaline; increase in metabolic rate / respiration; correct reference to negative feedback mechanisms;</p>	7 max.	As this response is occurring in water any references to hairs being raised are not relevant. However, there are several important points to remember. Capillaries do not move and they do not contract or constrict. Blood flow is restricted to the capillaries near the skin surface by constriction of arterioles as the smooth muscle in their walls contracts. Shunt vessels under the skin also dilate to divert blood away from these capillaries. Don't simply state that 'shivering generates heat'. Explain how heat is released during respiration when muscles contract.
<p>ii) larger surface area to volume ratio; less insulation / steeper thermal gradient; more heat loss by conduction;</p>	2 max.	Answers referring only to 'larger surface area' would not obtain the first mark. Again, as this is occurring in water, most heat loss is via conduction.
<p>2 a) any <b>two</b> from: enzymes at optimum temperature; metabolic reactions proceed more quickly; more independent of environment / better able to survive in different environment;</p>	2 max.	Endotherms are less affected by changes in the environmental temperature and can maintain an optimum temperature for metabolic reactions.

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<p>b) i) range just shows highest and lowest / SD shows spread of majority; extreme values give false impression of variation / SD less affected by extreme values;</p>	2	
<p>ii) allows comparison of animals with different masses; increased mass / increased body size means increased heat generation;</p>	2	Animals of greater mass will have more cells generating heat from metabolic reactions.
<p>iii) both increase proportionally up to 25°C; then heat generation increases faster;</p>	2	
<p>iv) any <b>two</b> from: body will 'overheat' in very hot environments; as will generate more heat than they can lose; no physiological cooling mechanism;</p>	2 max.	The high environmental temperature is causing a rapid rise in metabolic heat generation as a result of increased enzyme activity.
<p>c) i) relationship is inverse / equivalent</p>	1	As the mammal obtains heat from its environment it reduces heat generation from metabolic reactions. Heat loss via evaporation increases as a cooling mechanism (latent heat of vaporisation).
<p>ii) sweating increases / panting</p>	1	
<p>iii) any <b>three</b> from: reduced metabolic rate; reduced respiration / energy release; reduced thyroxine secretion; reduced activity of brown fat cells / body core / liver cells; reduced physical activity;</p>	3 max.	Most of the heat generated during metabolic reactions is from respiratory activity. Many of these processes either directly or indirectly involve respiration.

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<p><b>3 a)</b> increase in blood sugar, (more) insulin secreted; binds to (specific) receptors on (liver / muscle) cells; leads to more glucose entering cells / activates carrier proteins / opens protein channels / increased permeability to glucose; glucose leaves the blood; insulin activates enzymes (in liver); glucose entering cell converted to glycogen / glycogenesis;</p> <p><b>b)</b> keeps glucose in muscle cells / glucose phosphate cannot cross cell membranes; muscle cells need glucose for respiration;</p> <p><b>c)</b> sympathetic nervous system active, so adrenaline released; adrenaline binds to receptors / acts on muscle cell; causing increased glycogen phosphorylase activity; more glucose (phosphate) for respiration; calcium ions enter muscle cells and glycogen broken down / increase in phosphorylase activity; lower blood sugar as glucose used by muscles; glucagon released and binds to receptors / acts on liver cells; causes glycogen to be broken down to glucose / glycogen breakdown increases;</p>	<p>4 max.</p> <p>2</p> <p>6 max.</p>	<p>Remember insulin is a hormone not an enzyme. It does not convert glucose to glycogen. Insulin activates enzymes to convert glucose to glycogen.</p> <p>You can obtain four of these marks by using the information provided in the stem of the question and in Figures 1 and 2. Recalling your own knowledge of the breakdown of glycogen should provide the other marks.</p>
<p><b>4 a)</b> glucose is used in cell respiration / as energy source / in metabolism; glucose enters cells / converted to glycogen in cells; glucose is excreted / in urine;</p> <p><b>b)</b> line from 80 mg, increasing but keeping below line for diabetic, dropping to 80 mg</p>	<p>2 max</p> <p>1</p>	<p>Usually all the glucose is reabsorbed in the kidneys and no glucose is present in urine. However, this individual is a diabetic and when the concentration of blood glucose is high, glucose may be excreted in urine.</p> <p>The line will stabilise at, or fluctuate around, 80 mg.</p>

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c) i) fast-acting insulin reduces blood glucose from breakfast; slow-acting insulin reduces blood glucose from other meals before the evening meal / eliminates the need to inject at lunch;	2	To show you fully understand the advantage of using both types of insulin your answer should refer to meals which would cause an increase in blood glucose. One mark will be awarded if neither type of insulin is referred to, but a clear reference is made to glucose conversion to glycogen.
ii) glucagon is still active; glycogen converted to glucose / glycogenolysis; insulin injected at breakfast causes cells to take up glucose too slowly for levels to become dangerously low; respiration;	1 max.	You would not gain credit for suggesting he consumed a large breakfast!