

## Mark scheme - Communication and Homeostasis

Question			Answer/Indicative content	Marks	Guidance
1			B	1	
			<b>Total</b>	<b>1</b>	
2			B	1	
			<b>Total</b>	<b>1</b>	
3			C	1	
			<b>Total</b>	<b>1</b>	
4			B	1	
			<b>Total</b>	<b>1</b>	
5			D	1	
			<b>Total</b>	<b>1</b>	
6			A ✓	1	
			<b>Total</b>	<b>1</b>	
7			A ✓	1	
			<b>Total</b>	<b>1</b>	
8			A ✓	1	<p><b>Examiner's Comments</b> 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.</p>
			<b>Total</b>	<b>1</b>	
9			C ✓	1	<p><b>Examiner's Comments</b> Option <b>A</b> provided a distractor and common incorrect response to the correct option <b>C</b> in this question, as statement 1 relating to the cells synthesising ecdysone, would not form part of an explanation for the site of action of the hormone.</p>
			<b>Total</b>	<b>1</b>	

10		A ✓	1 (AO2.5)	<p><b>Examiner's Comments</b></p> <p>Many candidates were able to correctly identify nucleic acids (option A) here, demonstrating knowledge of the composition of some organic polymers. Some candidates opted for B which, although providing the correct elements present in carbohydrates, the approximate percentage mass for each of these elements could not be true for carbohydrates.</p>
<b>Total</b>			<b>1</b>	
11	i	<p>can be used with , living cells / thick samples ✓</p> <p>AVP ✓</p>	1 max (AO2.3)	<p><b>Mark first response</b></p> <p>e.g. high resolution</p> <p>e.g. can see distribution of molecules within cells</p> <p>e.g. can control depth of field</p> <p>e.g. sharper / less blurred image</p>
	ii	<p><b>conclusion is valid because:</b></p> <p><b>1</b> concentration of Ca<sup>2+</sup> is proportional to strength of stimulus ✓</p> <p><b>2</b> Ca<sup>2+</sup> change from low to , medium / high , causes increase in (membrane) potential ✓</p> <p><b>3</b> action potential in , presynaptic neurone / synaptic bulb, leads to , opening of Ca<sup>2+</sup> channels / entry of Ca<sup>2+</sup> ✓</p> <p><b>4</b> Ca<sup>2+</sup> , causes / AW , release of (named) neurotransmitter ✓</p> <p><b>5</b> (named) neurotransmitter causes , Na<sup>+</sup> / sodium ion , channels to open in (post-synaptic) neurone ✓</p> <p><b>6</b> if threshold is exceeded this causes , action potential in (postsynaptic) neurone / depolarises (postsynaptic) membrane ✓</p> <p><b>conclusion may not be valid because:</b></p>	4 max (AO2.4) (AO3.2)	<p><b>ALLOW</b> calcium ions for Ca<sup>2+</sup> throughout</p> <p><b>DO NOT ALLOW</b> Ca<sup>+</sup> / calcium but penalise once then ECF</p> <p><b>ALLOW</b> reference to +40 mV as alternative to action potential throughout</p> <p><b>IGNORE</b> ref to fluorescence / FURA-2</p> <p><b>MP 1 ALLOW e.g.</b> the greater the strength of stimulus the greater the Ca<sup>2+</sup> concentration</p> <p><b>MP2 ALLOW</b> figs go from -60 to +40mV</p> <p><b>MP8 ALLOW</b> figs stay at + 40mV</p>

		<p>7 changes in Ca<sup>2+</sup> concentration may not be the cause of (postsynaptic) action potential ✓</p> <p>8 Ca<sup>2+</sup> change from medium to high but no change in (membrane) potential ✓</p>		
		<b>Total</b>	<b>5</b>	
12	i	<p>scales and hair help to reduce heat loss ✓</p> <p>generate heat from, respiration / metabolism ✓</p>	<b>1 max</b>	<p><b>ALLOW</b> generate heat internally <b>IGNORE</b> temperature</p> <p><b>Examiner's Comments</b></p> <p>Few candidates gained the mark for <b>Q16(a)(i)</b>. 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) greater rate of heat loss ✓</p> <p>mammals and birds have, more effective / thicker, insulation ✓</p> <p><i>ref to a method</i> of more precise control of body temperature in birds and mammals ✓</p>	<b>2 max</b>	<p><b>Mps 1 and 2 ALLOW</b> ora for mammals (must be comparative) <b>ALLOW</b> SA:V / surface area relative to volume</p> <p><b>ALLOW</b> lose heat more, quickly / easily</p> <p><b>ALLOW</b> have fat under skin <b>ALLOW</b> ora for insects (must be comparative)</p> <p>e.g. thermoregulatory centre / heat gain / heat loss centre e.g. vasodilation / vasoconstriction e.g. sweating / shivering / hairs standing up</p> <p><b>Examiner's Comments</b></p> <p>In <b>Q16(a)(ii)</b> the most commonly awarded correct responses were for mark points one and four. Stronger</p>

					<p>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>
			<b>Total</b>	<b>3</b>	
13	i	<p>naked mole rats, have a <u>lower</u> body temperature / AW ✓</p> <p>naked mole rats use, <b>more</b> behavioural responses / use <b>fewer</b> physiological responses (to thermoregulate) / described ✓</p> <p>(core) body temperature of naked mole rats, is not maintained within a narrow(er) range / changes (with environmental temperature) ✓</p> <p>no fur / hair , to trap layer of (insulating) air / for insulation ✓</p>	2 max (AO2.1)	<p><i>Assume 'they' or 'it' refers to naked mole rats</i></p> <p><b>ORA</b> for other mammals</p> <p><b>IGNORE</b> 'mammals are endotherms and mole rats are ectotherms'</p> <p><b>ALLOW</b> 'most mammals are 37°C and naked mole rats are 30-32°C'</p> <p>e.g. 'they huddle together when temperature falls whilst mammals shiver' or 'they move to cooler parts when temperature rises whilst mammals sweat'</p> <p><b>IGNORE</b> 'naked mole rats body temperature matches environmental temperature'</p> <p><b>IGNORE</b> ref to no subcutaneous fat layer / no sweat glands</p> <p><b>ALLOW</b> 'no hair so cannot trap heat'</p> <p><b><u>Examiner's Comments</u></b></p> <p>Candidates were asked for two comparisons but sometimes did not adequately compare naked mole rats with other mammals by using comparative terms such as 'more' or 'less'. Also they didn't describe each</p>	

					<p>mammal in turn, such as mole rats having behavioural means of regulation and other mammals having physiological means. It was common for candidates to refer inappropriately to ectotherms and endotherms in their answer. However, they rarely compared the actual core body temperatures, with other mammals being higher than mole rats, or the degree of stability achieved, with other mammals maintaining a more constant temperature. References to presence or absence of fur or hair often did not relate to insulation or the prevention of heat loss. A general issue was candidates quoting stimulus material from the paper without adding any insight into it. For example, many candidates missed the idea of the mole rat changing temperature with the environment and simply stated that its temperature was 'dependent on' or 'stayed the same as' or 'was similar to' the environmental temperature.</p>
		ii	<p>positive feedback, is when an initial (biological) change is, increased further / exaggerated / AW ✓</p> <p>lower temperature reduces kinetic energy (of molecules) ✓</p> <p>enzyme activity, slowed / reduced ✓</p> <p>respiration rate / metabolism, slowed / reduced ✓</p> <p>less (metabolic / internal) heat generated ✓</p> <p>(so that body) temperature drops further ✓</p>	4 max (AO2.5)	<p>e.g. 'it is when a change causes system to go further from, norm / optimum'</p> <p>'it is when a decrease leads to a further decrease'</p> <p><b>ALLOW</b> fewer successful collisions / fewer ESCs formed</p> <p><b>IGNORE</b> enzymes stop working / no enzyme activity</p> <p><b>ALLOW</b> the rate of reactions (in the body) is, reduced / slowed down</p> <p><b>IGNORE</b> respiration stops</p> <p><b>ALLOW</b> less heat, produced / created</p> <p>'change causes system to go further from, norm / optimum and so a decrease in temperature leads to further decrease' = mp1 and 6</p>

					<p><b><u>Examiner's Comments</u></b></p> <p>Answers often described the principle of positive feedback correctly and stated that the temperature would continue to fall, but few showed correct reasoning as to why this would occur. Generally candidates suggested inappropriate physiological responses such as sweating when a mammal was getting colder. Some candidates correctly related a decrease in core body temperature to lower kinetic energy, lower enzyme activity, leading to a lower metabolic rate and less heat release. Some candidates believed that a decrease in temperature would lead to enzymes denaturing which gained no credit.</p>
		iii	<p>False True True False</p> <p>✓✓</p>	<p>2 (AO1.1)</p>	<p><b>ALLOW T and F for True and False</b> <b>ALLOW</b> ticks and crosses for True and False (when unambiguous)</p> <p>All correct ✓✓ 2 or 3 correct ✓</p> <p><b><u>Examiner's Comments</u></b></p> <p>Candidates generally gained one or 2 marks. Candidates didn't answer well for lines 3 and 4 of the table (role of the hypothalamus and medulla oblongata). The rubric asked candidates to write 'true' or 'false' in the table, but many wrote 'T' and 'F' instead, although on this occasion abbreviations were credited.</p>
			<b>Total</b>	<b>8</b>	