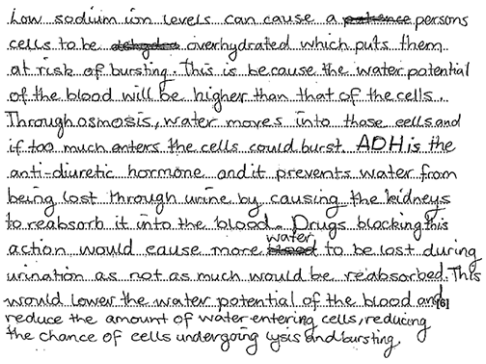
Mark scheme – Maintaining Internal Environments (H)

Question			Answer/Indicative content	Marks	Guidance
1			A ✓	1 (AO2.1)	
			Total	**1**	
2			D	1 (AO 1.1)	
			Total	**1**	
3			C	1 (AO 2.1)	
			Total	**1**	
4			D ✓	**1 (AO 2.1)**	
			Total	**1**	
5			C ✓	**1 (AO 2.1)**	
			Total	**1**	
6	a	i	Yes (no marks) cooler than black/grey skin **OR** Yes (no marks) lighter skin is cooler **OR** No (no marks) zebra skin was similar temperature to the other barrels **OR** No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	1 (AO3.2a)	argument must support decision
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours **OR** idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	**ALLOW** use painted towels to cover barrels **ALLOW** for same type of skin e.g. hair-free skin
	b	i	**Any two from:** zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓	2 (AO2x3.1a)	**ALLOW** insect bites for insects **IGNORE** length of stripe

			stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓		**ALLOW** width range between 5-10cm for least number of insects / most number of insects is 22-27cm
		ii	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1 (AO3.2a)	**ALLOW** width tolerance between 7-9cm and least number of insects (on tape)
		iii	**Any three from:** stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3 (AO3 x 2.1)	**ALLOW** some more striped than others **ALLOW** offspring produced / breed together **IGNORE** selective breeding **ALLOW** pass on advantageous gene **IGNORE** trait is passed on / genes are passed on **IGNORE** over time
			Total	**8**	
7		i	polymers ✓ monomers ✓	2 (AO2 x 1.1)	
		ii	(**A** has) less ADH released/present ORA ✓ so less/no reabsorption of water / permeability of collecting duct is lower/has not changed ✓	2 (AO2 x 2.1)	**ALLOW** ADH release is inhibited in A / lack of ADH production in **A** **IGNORE** less movement of water out of the tubule (must state reabsorption)
		iii	**Any two from:** (low) water potential/(decreased) water levels are detected by hypothalamus ✓ will cause the release of ADH/ increased ADH levels ✓ increased permeability of collecting duct/kidney tubules / increased reabsorption of water (into blood) / decreased urine production / urine will become more concentrated ✓	2 (AO2 x 2.1)	**IGNORE** brain

			Total	**6**	
8			<table><tr><td>Bowman's capsule</td><td>**1**</td></tr><tr><td>Collecting duct</td><td>**5**</td></tr><tr><td>Proximal convoluted tubule</td><td>**2**</td></tr><tr><td>Loop of Henlé</td><td>**3**</td></tr><tr><td>Second coiled region</td><td>**4**</td></tr></table> ✓✓✓	3 (AO3 x 1.1)	5 before 2 ✓ 2 before 3 ✓ 3 before 4 ✓
			Total	**3**	
9			cells absorb water ✓ by osmosis ✓ (red blood) cells/cytoplasm swells / increased pressure in the cell/on the cell membrane / <u>cell membrane</u> ruptures/bursts ✓	3 (AO3 x 1.1)	**IGNORE** references to water potential **IGNORE** just cell bursts
			Total	**3**	
10		i	The higher the BMI then the higher the mass of urea (in urine) / ORA ✓	1 (AO2.1)	**ALLOW** positive correlation **IGNORE** they are directly proportional **IGNORE** linear relationship
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.0016 (g/cm^3) award 2 marks** 1.6 ÷ 1000 ✓ = 0.0016 (g/cm^3) ✓	2 (AO2.2)	**ALLOW** 1.6 x 10^{-3}
		iii	idea that there is a greater increase in mass of urea as BMI increases in Fig 17.2/second graph ✓ idea that first graph/17.1 has stronger correlation / more points closer to line of best fit / less spread of data ✓	2 (AO2 x 3.2b)	**ALLOW** larger mass of urea per BMI gained **ALLOW** line is steeper/higher gradient in Fig17.2 **IGNORE** higher BMI for greater mass of urea **ALLOW** second graph does not follow the line of best fit so closely
			Total	**5**	
11	a		glucagon ✓	1 (AO 1.1)	
	b	i	(person) **C** ✓	1 (AO 3.2a)	**<u>Examiner's Comments</u>** A significant number of candidates thought that

					candidate A had type 2 diabetes. Others confused type 1 with type 2 and so chose option B.
		ii	insulin is produced/released / insulin level is high ✓ idea that ability to control glucose levels is reduced ✓	2 (AO 2.1)	mark independently of (d)(i) **ALLOW** idea that body is resistant to insulin **Examiner's Comments** Confusion between type 1 and type 2 diabetes was seen in a number of the candidates' responses. Some however explained type 2 diabetes clearly and concisely and so scored both marks. This is shown in exemplar 5. **Exemplar 5** Insulin is being produced due to the high levels of glucose however because the person is resistant to insulin glucose levels don't rapidly decrease when Insulin falls [2]
	c		embryonic stem cells are able to differentiate into any cell / totipotent / adult stem cells are limited / pluripotent ✓ **therefore insulin producing cells** are easier to develop from embryonic stem cells/adult stem cells are not ✓	2 (AO 1.1) (AO 2.1)	**IGNORE** adult stem cells are already specialised **ALLOW** difficult to locate adult stem cells **IGNORE** embryonic stem cells can repair all parts **Examiner's Comments** The majority of candidates correctly explained the totipotent nature of embryonic stem cells but few candidates went on to explain the consequences of this in replacing pancreatic cells. Exemplar 6 shows an example of a common answer that only scores the first marking point. **Exemplar 6** embryonic stem cells can specialise to become any type of cell whereas adult stem cells can only specialise to become a cell from their own tissue [2]
			Total	**6**	
12			Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Detailed explanation of how low levels of Na^+ affects the blood and how this can affect cells. **AND** Explains the effect of blocking ADH and suggests how this can correct the condition. *There is a well-developed line of*	6 (AO 3 x 1.1 3 x 2.1)	**AO1.1 Demonstrates knowledge and understanding of scientific ideas to explain how low levels of Na^+ affects the blood** • blood is hypotonic / less concentrated / higher water potential **AO2.1 Applies knowledge and understanding of scientific ideas to explain how low levels of Na^+ affects cells**

			reasoning which is clear and logically structured. The information presented is relevant and substantiated. **Level 2 (3–4 marks)** Explains how low levels of Na^+ affects the blood or how this can affect cells **AND** explains the effect of blocking ADH or suggests how this can correct the condition **OR** Explains how low levels of Na^+ affects the blood and how this can affect cells. **OR** Explains the effect of blocking ADH and suggests how this can correct the condition. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Describes how low levels of Na+ affects water potentials. **OR** Describes the effect of blocking ADH. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*		• water enters cells by osmosis / as cells are more concentrated / lower water potential than the blood • cell membrane becomes overstretched / lysis may happen / cells will burst **AO1.1 Demonstrates knowledge and understanding of scientific ideas to explain the effect of blocking ADH** • blocking ADH makes the kidney tubule less permeable/less water reabsorbed • blocking ADH increases the volume of water lost from the body/present in urine / urine becomes more dilute **AO2.1 Applies knowledge and understanding of scientific ideas to suggest how blocking ADH can correct the condition** • blood concentration is increased / water potential lowered / water would move out of cell / water will not move into cells • eventually blood and cells are isotonic/same concentration/same water potential/same sodium ion concentration **Examiner's Comments** A number of candidates did not commit themselves as to whether the body cells would lose or take up water and explained both possibilities. Incorrect references to turgidity were also seen. There was also confusion regarding the role of ADH, with a number of candidates stating that it makes the body pass out more water. Exemplar 4 shows a clear, correct Level 3 answer. **Exemplar 4**  low sodium ion levels can cause a ~~patience~~ persons cells to be ~~dehydrated~~ overhydrated which puts them at risk of bursting. this is because the water potential of the blood will be higher than that of the cells. Through osmosis, water moves into those cells and if too much enters the cells could burst. ADH is the anti-diuretic hormone and it prevents water from being lost through urine by causing the kidneys to reabsorb it into the blood. Drugs blocking this action would cause more ~~blood~~ water to be lost during urination as not as much would be reabsorbed. This would lower the water potential of the blood and reduce the amount of water entering cells, reducing the chance of cells undergoing lysis and bursting. [6]
			Total	**6**	

13			(Diagram B) because vasodilation ✓ (blood vessels) release **more** heat / energy (to environment) ✓ sweat being released to <u>evaporate</u>	**3 (AO 1.1) (AO 2 × 2.1)**	**if A chosen award no marks** **ALLOW** blood vessels/arterioles have widened / dilated idea of more heat released must be linked to blood vessels **IGNORE** cools down more **ALLOW** sweat not evaporated due to humidity preventing evaporation **<u>Examiner's Comments</u>** This was a well answered question, with many candidates gaining three marks. The lack of reference to sweat evaporating to cool the skin down was the most common omission.
			Total	**3**	
14	a	i	loop of Henlé✓	**1 (AO 1.1)**	**<u>Examiner's Comments</u>** The name of this part of the tubule was correctly recalled by many of the higher ability candidates.
		ii	collecting duct✓	**1 (AO 1.1)**	**ALLOW** DCT **IGNORE** collection duct **<u>Examiner's Comments</u>** Fewer candidates could answer correctly in part ii), often stating the glomerulus as their answer.
	b		**Any four from:** glucose (in filtrate but) not in urine so must be reabsorbed✓ sodium chloride low**er** in urine so reabsorbed✓ urea (much) high**er** in urine so not reabsorbed✓ others high**er** in urine so not reabsorbed✓ waste products high**er** in urine so not reabsorbed but useful substances reabsorbed✓	**4 (AO 3.2b)**	**IGNORE** unqualified responses e.g. glucose is reabsorbed If no other mark awarded **ALLOW** some substances reabsorbed but others are not

					Examiner's Comments This question differentiated quite well. Some candidates used data from the two pie charts to back up their answers, whereas less successful candidates answered in general terms.
	c		Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Explains more than one body response to different temperature **and** osmotic challenges. **AND** applies knowledge and understanding to identify a drink requirement both pre-race **and** post-race **AND** analyses information and ideas to explain which sports drink is best for pre-race **and** for post-race. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Explains a body response to different temperature **or** to osmotic challenges **AND** applies knowledge and understanding to identify a drink requirement for pre-race **or** for post-race. **AND** analyses information and ideas to explain which sports drink is best for pre-race **or** for post-race. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** demonstrates knowledge and understanding of **one** body response to different temperature and osmotic challenges **OR** applies knowledge and understanding to identify a drink requirement either pre-race **or** post-race.	**6** **(AO 2 × 1.1)** **(AO 2 × 2.1)** **(AO 2 × 3.2a)**	**AO1.1 Demonstrate knowledge and understanding of scientific ideas of responses of body to different temperature and osmotic challenges.** • exercise causes loss of water through sweating • will use up much of the sugar for energy/respiration/exercise • exercise causes loss of salts through sweating **AO2.1 Apply knowledge and understanding of scientific ideas to identify drink requirements pre-race and post-race** • pre-race drink needs to provide the body with sugar needed for exercise • post-race drink will need to replace salts lost / replace sugars used up **AO3.2b Analyse information and ideas to make judgements about which sports drink is best for pre-race and post-race.** • hypertonic is best for pre-race as it contains the highest levels of sugars / is taken 60 minutes before race as takes time to be absorbed / absorbed slowly so it's effects last for the race • isotonic drink after the race will not change / dilute / increase the concentration of the blood / will match the concentration of body fluids **Examiner's Comments** This is the Level of Response question on this paper. For a level three answer, examiners were looking for an explanation of why the water, salt and sugar levels would change during the race. This should then be coupled with the function of the drinks before and after the race. An explanation for the timing and choice of the drinks should also be included. Exemplar 4 shows a level 2 answer, which does not explain the choice of the isotonic drink after the race.

			OR analyses information and ideas to explain which sports drink is best for either pre-race **or** for post-race *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*		**Exemplar 4** L2 The race causes him to sweat which releases water and salt, leaving him with less whilst running his body would have respired using glucose stores that decrease his sugar levels. The HYPertonic drink contains more sugars which provide him with more energy, it is also absorbed over a longer time which will help him through the 10 Long race. After the race he drinks an Isotonic drink which regulates his sugar levels to the optimum. this is done over a quicker period of time as he will not be using as much energy needing [6]
			Total	**12**	