Mark scheme – Maintaining Internal Environments (F)

Question			Answer/Indicative content	Marks	Guidance
1			A	1 (AO 2.1)	
			Total	**1**	
2			D	1 (AO 2.1)	
			Total	**1**	
3			A ✓	**1** (**AO** 1.1)	**Examiner's Comments** Although some candidates identified diet and exercise, most candidates chose an option that included insulin. Candidates need to be careful to take note of emboldened words in the question.
			Total	**1**	
4			A ✓	**1** (**AO** 1.1)	
			Total	**1**	
5		i	use Benedicts (reagent) ✓ heat / boil ✓ no change in colour / stays blue / does not go red ✓	3 (AO3 x 1.2)	
		ii	Yes (no mark) blood sugar levels will be controlled/not rise ✓ idea of a sugar replacement ✓	2 (AO1 x 3.2a) (AO1 x 2.1)	If No chosen = 0 marks **IGNORE** blood sugar levels will decrease **ALLOW** less sugar eaten
			Total	**5**	
6		i	Yes (no marks) cooler than black/grey skin **OR** Yes (no marks) lighter skin is cooler **OR** No (no marks)	1 (AO3.2a)	argument must support decision

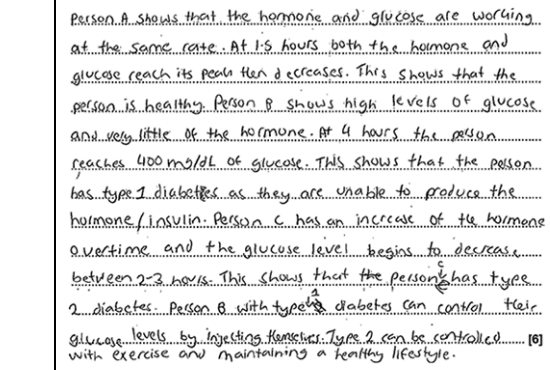
			zebra skin was similar temperature to the other barrels **OR** No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓		
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours **OR** idea to make sure that thicknesses/SA/V /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
			Total	**2**	
7			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**	
8	a	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** 1.6×10^{-3}

		iii	idea that there is a greater increase in mass of urea as BMI increases in Fig 22.2/second graph ✓ idea that first graph/22.1 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 Fig22.2 **IGNORE** higher BMI for greater mass of urea **ALLOW** second graph does not follow the line of best fit so closely
	b		<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	**8**	
9		i	**Any two from:** idea it affects enzymes (action/structure) ✓ high temperature causes active site to change shape / active site denatures ✓ stops them working ✓	2 (AO1.1)	**ALLOW** enzymes are heat sensitive/denature **ALLOW** enzymes cannot bind to substrate molecules **IGNORE** cells denature **ALLOW** enzymes no longer catalyse reaction
		ii	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Demonstrates	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1a)	**AO1.1 Demonstrate knowledge and understanding of skin and homeostasis** • need to keep constant internal temperature, despite the different external temperatures • person A needs to lose heat to the environment / person B needs to reduce heat lost to the environment • person A gains heat from the environment / person B loses heat to the environment

			knowledge of homeostasis. **AND** Applies knowledge of a skin mechanism for maintaining body temperature in different environments. **AND** Analyses information to comment on the effect of exposing skin. *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)** Demonstrates knowledge of homeostasis **and** applies knowledge of a skin mechanism for maintaining body temperature in different environments. **OR** Demonstrates knowledge of homeostasis **and** analyses information to comment on the effect of exposing the skin. **OR** Applies knowledge of a skin mechanism for maintaining body temperature in different environments **and** analyses information to comment on the effect of exposing skin. *There is a line of reasoning presented*		• person A will be in danger of overheating / person B will be in danger of becoming too cold. **AO2.1 Apply knowledge and understanding of the mechanisms in skin for maintaining body temperature in different environments** • cold environment reduces sweating /decreases blood flow to the skin (vasoconstriction) / shivering / body hairs rise • warm environment increases sweating / increases blood flow to the skin (vasodilation) / body hairs on skin lie flat **AO3.1a Analyse information and ideas to interpret the effect of exposing / covering skin in different environments** • person A body less covered/more exposed skin in warmer conditions increases heat loss/allows sweat to evaporate • person B body covered/less exposed skin in colder conditions reduces heat loss/stops sweat evaporating

			with some structure. The information presented is relevant and supported by some evidence. **Level 1 (1–2 marks)** Demonstrates knowledge of homeostasis. **OR** Applies knowledge of a skin mechanism for maintaining body temperature in different environments. **OR** Analyses information to comment on the effect of exposing skin. *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.*		
			Total	**8**	
10	a		kidney ✓	1 (AO 1.1)	**Examiner's Comments** Candidates in the main were able to identify the kidney in this AO1.1 question. However, examples were seen where the liver, bladder and pancreas had been identified.
	b		**Any two from:** drugs shape is same as substrate ✓ blocks the active site ✓ denature the enzyme ✓ change (shape of) active site ✓	2 (AO 2.1)	**ALLOW** drug is competitive/non-competitive inhibitor **ALLOW** competes with enzyme for active site **NOT** kill the enzyme **ALLOW** drug deforms enzyme/active site **ALLOW** substrate doesn't fit the active site/not complimentary **ALLOW** key doesn't fit the lock **Examiner's Comments**

					This AO2.1 question was answered well by higher ability candidates. Most candidates realised the enzyme could denature. Some went further to describe what this meant in terms of the shape of the enzyme.
	c	i	insulin ✓	1 (AO 1.1)	**Examiner's Comments** This AO1.1 question was answered correctly by many candidates, but a number of candidates did not respond.
		ii	**Any two from:** secreted / released from glands/endocrine cells ✓ travel in blood(stream) ✓ affect target organs / cells ✓	2 (AO 1.1)	**ALLOW** named gland **ALLOW** hormones bind to specific receptors **Examiner's Comments** Another AO1.1 question that proved challenging for many. Where candidates did provide responses, many wrote about examples of what hormones can do but not how. There was a big focus on hormones affecting either puberty or fight/flight responses, but these did not gain any marks as they only wrote in their responses 'hormones make you emotional' or 'adrenaline gets you ready for action' and had not identified where they were produced, or how they got to different parts of the body.
		iii	*Please refer to the marking instructions of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Correctly compares differences in insulin and glucose levels and identifies each person with evidence from the graphs. **AND** Describes the treatment for Type 1 **and** Type 2 diabetes. *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)** Correctly identifies at least one of the people who are	6 (AO 2x 1.1) (AO 2x 2.1) (AO 2x 3.2a)	**AO1.1 Demonstrates knowledge and understanding of scientific ideas to describe how diabetes is controlled** • Type 1 diabetes needs insulin injections • Type 2 diabetes needs a carefully managed diet/avoid high sugar intake/regular exercise/take diabetic medication/pills **AO2.1 Applies knowledge and understanding of scientific ideas in describing the differences in the glucose and insulin levels** • In person A the insulin levels increase and return the glucose levels to normal • In person B insulin levels remain low and glucose levels are very high and not reduced • In person C insulin is produced (but slowly) and glucose levels are slow to be reduced/do not return to normal • Persons B and C have higher resting glucose levels **AO3.2a Analyse information and ideas to make judgements and draw conclusions about the type of diabetes each person has** • Person A is healthy • Person B and C have diabetes • Person B has Type 1 diabetes • Person C has Type 2 diabetes **Examiner's Comments**

			diabetic/healthy **AND** Describes the treatment for Type 1 **or** Type 2 diabetes. **OR** Correctly compares differences in insulin and glucose levels in at least one person. **AND** Describes the treatment for Type 1 **or** Type 2 diabetes. *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)** Correctly identifies at least one of the people who are diabetic/healthy. **OR** Correctly compares differences in insulin and glucose levels in at least one person. **OR** Describes the treatment for Type 1 **or** Type 2 diabetes. *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.*		This question covering AO1, AO2 and AO3 discriminated well. Most candidates gained at least L1, by identifying at least one person or describing a treatment. Many got L2, by identifying and describing the patterns on the graphs and identifying the treatments/people. Relatively few candidates got up to L3, as there was often a mistake in identifying which person was healthy, Type 1 or Type 2. Many thought the third graph was the healthy person due to the correlation in pattern. **Exemplar 2**  Person A shows that the hormone and glucose are working at the same rate. At 1.5 hours both the hormone and glucose reach its peak then decreases. This shows that the person is healthy. Person B shows high levels of glucose and very little of the hormone. At 4 hours the person reaches 400 mg/dL of glucose. This shows that the person has type 1 diabetes as they are unable to produce the hormone / insulin. Person C has an increase of the hormone overtime and the glucose level begins to decrease between 2-3 hours. This shows that the person has type 2 diabetes. Person B with type 1 diabetes can control their glucose levels by injecting themselves. Type 2 can be controlled with exercise and maintaining a healthy lifestyle. [6] Here, the candidate has identified all people, with good evidence from graph for each. Treatments have been given for both types, but Type 1 does not specify what to inject. So L3 5 marks as treatment for type 1 lacked full communication but there was sufficient communication of Type 2 with exercise & healthy lifestyle being identified.
			Total	**12**	
11	a	i	cortex✓	**1** **(AO 1.1)**	**Examiner's Comments**

					The question assessed recall AO1.1 for structure of the kidney. Few candidates could identify the cortex, although some did mix it up with the medulla. Most referred to just the kidney or membrane. Many candidates put no answer.
		ii	urine✓	**1 (AO 1.1)**	**Examiner's Comments** This tested recall, AO1.1, of the function of the ureter. Some candidates were able to identify urine as the liquid flowing through the ureter. However, common incorrect responses were water, blood and urea.
		iii	arrow on diagram points downwards from kidney in same line as ureter✓	**1 (AO 2.1)**	**ALLOW** arrow pointing downwards even if not on ureter **Examiner's Comments** Candidates could apply their knowledge of direction of flow of urine. The flow in the ureter was well understood by most candidates. There were some candidates however, that had the flow back into, and in some cases, around the kidney.
	b	i	Patient A = 2900 & Patient B = 2700 ✓	**1 (AO 2.2)**	**Mark answer line first but if nothing on answer line check table for correct answer** **Examiner's Comments** Mathematical skills were assessed in this question. Most candidates got the correct calculations. Occasionally the correct calculations were seen in the table but then candidates wrote 900 and 700 on the answer line and did not gain the mark.
		ii	(Patient A) total output of patient A is 2900/exceeds total input / patient B input matches output✓ patient A is losing too much water (from the kidneys)✓	**2** **(AO 2.1)** **(AO 3.2a)**	No marks if Patient B identified **ALLOW** input output is imbalanced in patient A **ALLOW** patient A loses more water than normal **Examiner's Comments** The question required analysis and evaluation to provide a successful response. Most candidates selected Patient A and many then went on to gain at least 1 mark. This was usually for input less than output. Some also then explained that this would lead to water imbalance. Occasionally, candidates would not gain marks even though they had selected the correct patient because they compared the water output to Patient B. **Exemplar 2** They are losing more water in the form of urine than patient B because Papatient A total output is 2900 where as patient B total output is 2700. [2]

					In this case the candidate implies that they have decided Patient A needs treatment but haven't said it specifically. This would not prevent the candidate gaining marks but their explanation is comparing water output to Patient B which is incorrect. The correct explanation needs candidates to compare the input and output for each patient separately. This highlights the need for candidates to gain a greater understanding that homeostasis is about maintenance of an individual's internal environment and data should be considered within that same individual and not across others as well.
	c	i	Bowman's capsule✓	**1 (AO 1.1)**	**Examiner's Comments** The majority of candidates found this recall AO1.1 question very challenging.. A small number of candidates correctly identified the Bowman's capsule. Some candidates put glomerulus, presumably using one of the labels as a memory prompt, but many no responses were seen.
		ii	glucose present in filtrate but not in urine / more sodium chloride in filtrate than urine / urea/others levels much higher in urine ✓ glucose/sodium chloride must be reabsorbed✓ urea/others excreted in urine✓	**3 (AO 2.2)** **(AO 2 x 3.2b)**	**ALLOW** urea/others removed from body **Examiner's Comments** This question assessed both AO2 and AO3 assessment objectives. This is key to how successful candidates were in their response. Candidates often limited themselves to only one mark due to just stating what happened to the different substances in the filtrate or collecting duct as evidenced in the pie charts. The question required candidates to make conclusions based on the evidence and only a few higher ability candidates linked these changes to reabsorption and excretion.  This highlights a lack of awareness in candidates for what is required from a question asking them to draw conclusions from data. Many just described the data.
			Total	**10**	
12			idea that it is a sign of the extent of the disease (1) temperatures far away from normal can be dangerous (1)	1 1	

			Total	**2**	
13		i	Tim's and Lucy's genotypes Nn (1)	1	**allow** correctly completed punnet square
		i	correct genotypes of offspring (NN, Nn, Nn, nn) (1)	1	
		ii	baby may be nn (1)	1	
		ii	one in four chance of baby being affected (1)	1	
		ii	pancreas produces insulin (1)	1	
		ii	insulin controls blood glucose level (1)	1	
			Total	**6**	
14			B	1	
			Total	**1**	
15			A	1	
			Total	**1**	
16			C	1	
			Total	**1**	
17			kidney (1)	1	
			higher volume / less concentrated (1)	1	
			Total	**2**	