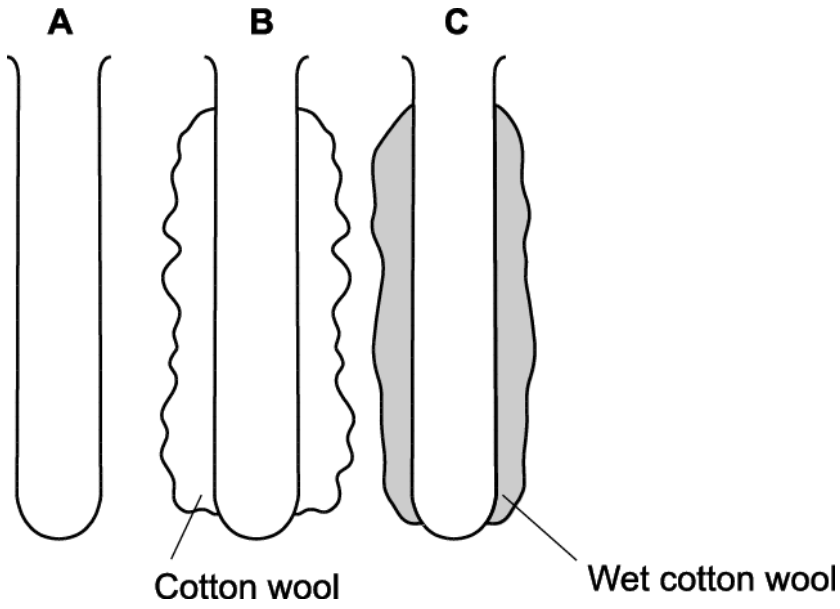
1(a). Zak's results suggest that being wrapped in wet clothes would be the least effective way of staying warm on a mountain.

Explain what happens in this situation.

[2]

(b). Zak is investigating the most effective method for staying warm on a mountain. He sets up test tubes as below.



Test tube A has no insulation. Test tube B is wrapped in cotton wool. Test tube C is wrapped in wet cotton wool.

Describe an investigation that Zak could carry out to find out more about the most effective conditions for staying warm on a mountain.

He also has access to thermometers, hot water and stopwatches.

Include information about what data will be collected, how it will be recorded and how it will be made valid.

---

[4]

(c).

(i) If a person was wrapped in wet clothes on a mountain, their skin would appear pale.

Explain why.

---[2]

(ii) If a person has an infection, caused by bacteria or a virus, they may have a fever. This means the internal temperature control mechanisms are no longer working correctly.

Suggest why this might be an advantage to a person suffering from a bacterial or viral infection.

---[1]

2(a). Marty drinks a large glass of water.

The water is absorbed into his blood.

The hormone ADH helps to control the water balance in Marty's body.

Which part of the body secretes ADH?

Draw a (ring) around the correct answer.

blood

heart

kidney

pituitary gland

[1]

(b). Explain how the regulation of water in Marty's blood plasma is achieved using ADH.

---

[4]

3. In 1774 a scientist called Sir Charles Blagden designed an experiment to test the effect of high temperatures on the human body.

The temperature of the human body is 37 °C.

Blood boils just above 100 °C.

He entered a room where the air temperature was above 127 °C.

He placed an egg and a piece of meat in the room.

The egg was cooked in 15 minutes and the meat in 35 minutes.

A student predicted that Sir Charles Blagden's body temperature would rise and he would die very quickly.

Do you think the student's prediction is correct?

Justify your answer.

---

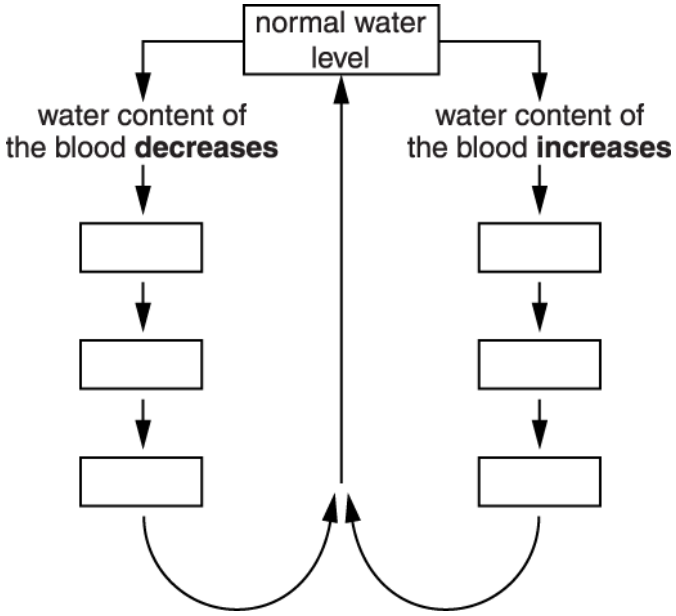
[3]

4. This question is about regulating water content in animals.

Negative feedback is used to control the water content of the human body.
These statements show stages in this process.

A The kidney produces more urine.
B More ADH is released from the pituitary gland.
C The kidney reabsorbs less water from the urine.
D The kidney reabsorbs more water from the urine.
E Less ADH is released from the pituitary gland.
F The kidney produces less urine.

Write the letters, **A**, **B**, **C**, **D**, **E** and **F**, in the correct boxes.



[3]

5. The human body responds to changes so that it can maintain a constant internal environment.

* When temperature receptors in the skin and hypothalamus detect a drop in temperature, the hormone adrenaline is released from the adrenal gland.

Explain how the release of adrenaline could help the body to raise its core temperature back to normal.

[6]

6. This question is about regulating water content in animals.

The gerbil is an animal adapted to living in deserts.
It feeds on plants.
The gerbil can go for very long periods of time without drinking water.
Suggest how the gerbil manages to survive on so little water.

---

[4]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a		Water next to the skin will evaporate ✓ Taking heat away from the skin, cooling the person ✓	2	
	b		**Any four from** Place same amount of hot water in each test tube ✓ Take temperature of water with thermometer ✓ Take temperature of water in each tube each minute / set time period ✓ For 10 minutes / specified time period ✓ Record in a table ✓	4	
	c	i	**Any two from** Vasoconstriction ✓ Muscles in artery walls contract ✓ Reduction in blood flow through capillaries supplying the skin ✓	2	
		ii	Raised temperature helps to kill the microorganism ✓	1	
			Total	**9**	
2	a		pituitary gland	1	**Examiner's Comments** Most candidates could identify that the pituitary glands secretes ADH.
	b			4	**Assume the candidate's answer refers to returning water level to normal after drinking water** **UNLESS the candidate clearly states that there is not enough water in the blood / blood plasma is more concentrated / less dilute, then the following reverse arguments can be credited:**

Question			Answer/Indicative content	Marks	Guidance
			?any 4 from: blood (plasma) is less concentrated / blood (plasma) is more dilute; (this is detected by) receptors in the brain / (receptors in the) hypothalamus; less / no ADH is secreted; less water is reabsorbed from the urine by the kidney; large(r) quantity of (more) dilute urine produced;		blood (plasma) is more concentrated / less dilute; (this is detected by) receptors in the brain / hypothalamus; (more) ADH is secreted; (more) water is reabsorbed from the urine by the kidney; small(er) quantity of (more) concentrated urine produced **a candidate may switch from one side to the other, but do not credit** the reverse argument for a marking point that has already been awarded Examiner's Comments The best responses could explain in detail the logical sequences of stages involved in the regulation of water.
			Total	5	

Question			Answer/Indicative content	Marks	Guidance
3			*Do not credit Yes or No* **Any three from:** hairs lie flat; sweating; evaporates / removes (latent) heat; idea of vasodilation; denaturing of enzymes	3	**ignore** cooling down **Examiner's Comments** As credit was not given for yes or no answers, approximately one third of candidates failed to score on this question. Irrespective of whether candidates thought that Sir Charles Blagden would die, credit was given for how his body would respond. Good answers included reference to sweating, loss of heat by evaporation (references to cooling down were not credited), vasodilation and denaturing of enzymes.
			Total	**3**	
4			B E; D C; F A;	3	if LHS and RHS reversed = 1 mark max Only mark what is inside box unless box contents are crossed out and then mark anything outside of box. **Examiner's Comments** Most candidates found this a difficult question with a lotof candidates scoring no points. Candidates who incorrectly transposed the left hand side with the right hand side, but were otherwise correct, were awarded one mark.
			Total	**3**	

Question			Answer/Indicative content	Marks	Guidance
5			*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 in detail the effects of adrenaline and links this to the benefits of these effects and to the mechanisms that warm the body. *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 the effects of adrenaline **and** the effects of adrenaline to cellular respiration. **OR** Explains the effects of adrenaline and mechanisms that warm the body. **OR** Explains the effects of adrenaline to cellular respiration and mechanisms that warm the body. *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 thermoregulation mechanisms that warm the body but does **not** consider adrenaline. **OR** Demonstrates knowledge of the effects of adrenaline **OR** The effects of adrenaline to cellular respiration. *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.*	6 (AO 1.1 × 4) (AO 2.1 × 2)	**AO1.1 Demonstrating knowledge of the effects of adrenaline** For example: • adrenaline causes heart rate to increase • adrenaline causes breathing rate to increase • adrenaline causes liver to break down stored carbohydrate/glycogen • adrenaline causes muscle contraction/vasoconstriction/decreases blood flow to skin and digestive organs/diverts blood flow to muscles • contraction of erector pili muscles **AO2.1 Applying synoptic knowledge to link the effects of adrenaline to cellular respiration required for thermoregulation** For example: • increased heart rate pumps more oxygen and glucose around the body to supply cells, and removes waste products (carbon dioxide, lactic acid) more quickly • increased breathing rate provides more oxygen, and removes carbon dioxide more quickly • breakdown of carbohydrate/glycogen in liver provides glucose • all of these enable increased cellular respiration • cellular respiration provides ATP/energy for muscle contraction • cellular respiration is an exothermic process/heats the body **AO1.1 Demonstrating knowledge of thermoregulation mechanisms that warm the body** For example: • shivering / muscles rapidly contract • vasoconstriction / muscles in walls of arteries supplying the skin contract

Question			Answer/Indicative content	Marks	Guidance
					• goosebumps / erector muscles in skin contract to raise hairs (and trap air) Examiner's Comments This was a high demand question requiring clear links between the effects of adrenaline on the body, how this effects cellular respiration and how thermoregulation mechanisms warm the body. Candidates responded well with approximately 80% credited Level 2/3. A common misconception concerning vasoconstriction, involved candidates talking about blood vessels/capillaries moving away from the surface of the skin.
			Total	6	
6			*any four from:* store water; gets water from food; more ADH so (keeps more water) / kidneys reabsorb more water; gets water from respiration; does not sweat / no sweat glands; cool underground / nocturnal behaviour; produces more concentrated urine / smaller volume of urine; produces dry faeces / reabsorption of water in colon;	4	**ignore** all reference to adaptation and evolution Examiner's Comments This question required the candidates to suggest solutions to a problem. Only the most able candidates scored full marks on this question. Most candidates managed to score one or two marks. Good answers included getting water from food, producing more ADH, water from respiration, not sweating, producing more concentrated urine, or staying in the cool (underground) during the day.
			Total	4	