

PEARSON EDEXCEL A-LEVEL BIOLOGY B • 9B10

BIOLOGY



EXAM QUESTION PACK

TOPIC 9: CONTROL SYSTEMS

OSMOREGULATION AND TEMPERATURE REGULATION

SCORE

/98

PERCENTAGE

%

STEMUP

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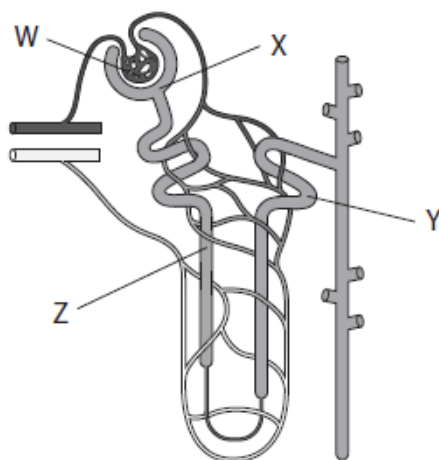
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Q1.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The diagram shows a nephron.



Which labelled parts of this nephron would normally contain glucose?

(1)

- ☒ **A** W only
- ☒ **B** W and X
- ☒ **C** W, X, and Y
- ☒ **D** W, X, Y, and Z

(Total for question = 1 mark)

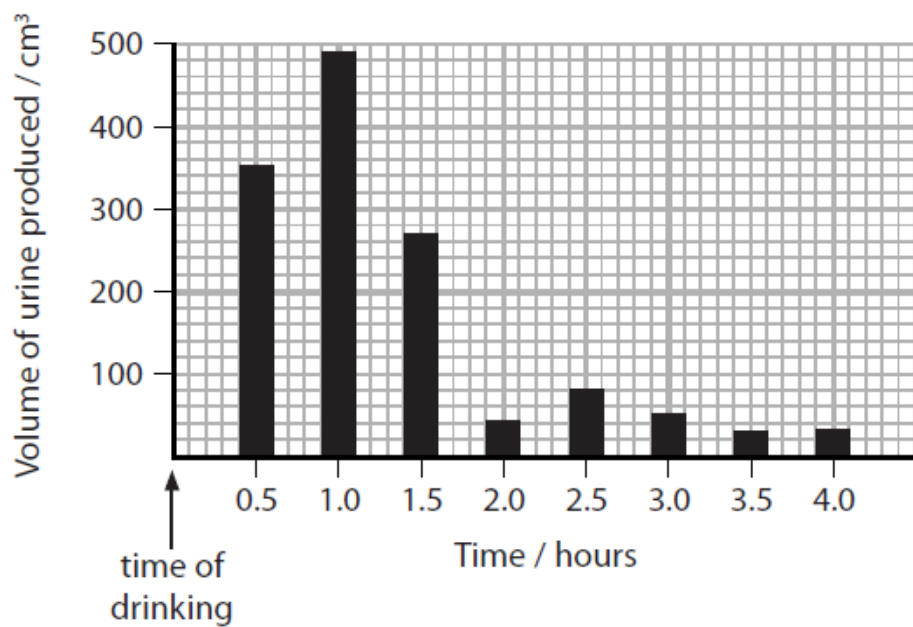
Q2.

Negative feedback control of blood plasma concentration is an example of homeostasis.

A student investigated the effect of drinking water on the volume of urine produced.

The student drank one dm^3 of water and waited for half an hour. The student then collected the urine produced every 30 minutes for four hours.

The graph shows the results of this investigation.



- (i) Determine the total volume of urine produced during the first two hours.

(1)

Answer cm^3

- (ii) Explain the role of negative feedback in the control of blood plasma concentration during the first hour after drinking water.

(4)

[illegible]

(Total for question = 5 marks)

Q3.

Mammals produce urea as a nitrogenous waste product.

The table shows the concentrations of molecules and ions in the blood plasma of the kidney, in the filtrate produced in Bowman's capsule and in the bladder.

Molecule or ion	Blood plasma of kidney (%)	Filtrate produced in Bowman's capsule (%)	Urine in the bladder (%)
Water	90 to 93	94 to 96	96
Protein	7 to 9	0.0	0.0
Glucose	0.10	0.10	0.0
Urea	0.03	0.03	2.0
Sodium	0.32	0.32	0.30 to 0.35
Chloride	0.37	0.37	0.60

(i) Name the process by which this filtrate is produced in Bowman's capsule.

(1)

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(ii) Analyse the data to explain the difference between the protein and the other molecules or ions in the filtrate in Bowman's capsule.

(3)

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(iii) Urea and chloride ions both become more concentrated as they pass from Bowman's capsule to the urine in the bladder.

(3)

(2)

(5)

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(Total for question = 14 marks)

Q4.

A scientist investigated the oxygen consumption of four different mammals.

The table shows the results of this investigation.

Mammal	Body mass / kg	Oxygen consumption / dm ³ h ⁻¹	Oxygen consumption / dm ³ kg ⁻¹ h ⁻¹
Shrew	0.002	0.0216	1.08×10^1
Cat	3	1.5	5.00×10^{-1}
Human	80	24	3.00×10^{-1}
Elephant	4000	50	

(i) Calculate the oxygen consumption of the elephant.

Convert your answer into standard form.

(2)

Answer dm³ kg⁻¹ h⁻¹

(ii) Explain the relationship between body mass and oxygen consumption in these mammals.

(4)

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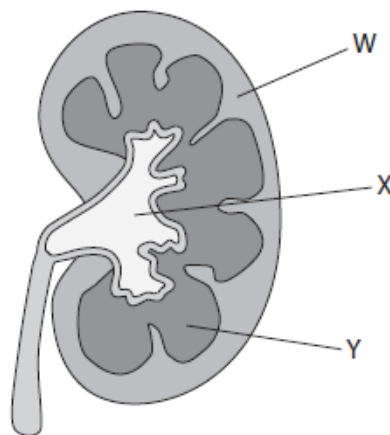
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(Total for question = 6 marks)

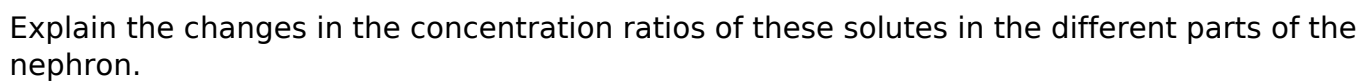
Q5.

The diagram shows a section through a mammalian kidney.



* The renal (Bowman's) capsule is part of each nephron found in the kidney.

The graph shows the concentration ratios of three solutes in different parts of the nephron compared with their concentrations in the renal capsule.

[illegible]

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(Total for question = 6 marks)

Q6.

Mammals produce urea as a nitrogenous waste product.

Describe how urea is produced in mammals.

(2)

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(Total for question = 2 marks)

Q7.

Answer the questions with a cross in the boxes you think are correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

(i) Which of the following statements about facilitated diffusion are correct?

(1)

1. substances move through membrane proteins
2. substances move against a concentration gradient
3. substances move down a concentration gradient
4. substances move between phospholipids

☐ **A** 1 and 2

☐ **B** 1 and 3

☐ **C** 2 and 3

☐ **D** 2 and 4

(ii) The collecting duct is also part of the nephron.

Which of the following are the effects of increased release of antidiuretic hormone (ADH)?

(1)

☐ **A** decreased permeability of the collecting duct to water, producing more concentrated urine

☐ **B** decreased permeability of the collecting duct to water, producing more dilute urine

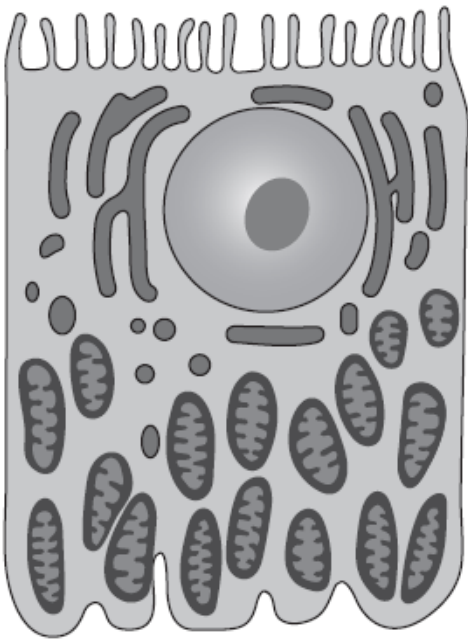
☐ **C** increased permeability of the collecting duct to water, producing more concentrated urine

☐ **D** increased permeability of the collecting duct to water, producing more dilute urine

(Total for question = 2 marks)

Q8.

The diagram shows a cell from the proximal convoluted tubule of the nephron.



Explain how the features shown in the diagram enable this cell to carry out its function.

(4)

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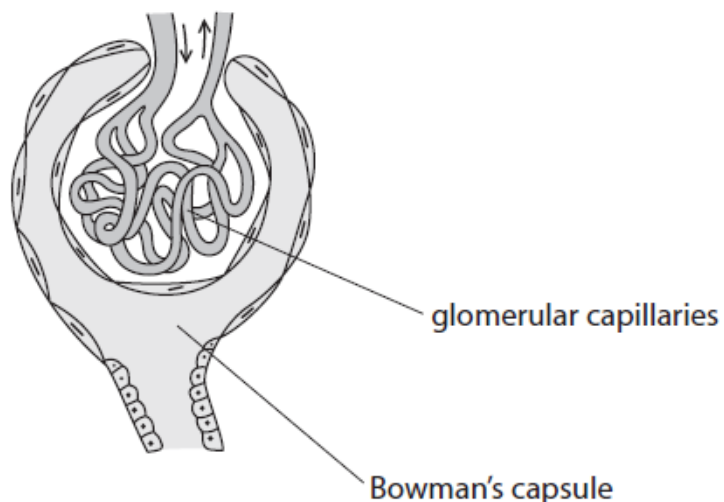
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(Total for question = 4 marks)

Q9.

If untreated, high blood pressure can cause kidney damage.

The diagram shows a Bowman's capsule and the glomerular capillaries in a human's kidney.



The table shows the hydrostatic pressure in the glomerular capillaries and in the Bowman's capsule. It also shows the oncotic pressure of the blood in the glomerular capillaries.

Pressure and location in kidney	Pressure / kPa
hydrostatic pressure in glomerular capillaries	+9.2
hydrostatic pressure in Bowman's capsule	+2.0
oncotic pressure in glomerular capillaries	-4.0

Use the data from the table to explain why glomerular filtrate is produced.

(2)

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Q10.

The photograph shows a wood mouse, *Apodemus sylvaticus*.



(Source: © Eric Isselee/Shutterstock)

A scientist measured the population size of these mice living in a woodland habitat.

The scientist used the capture-mark-recapture method (CMR) to sample the population.

This is the CMR method used by the scientist:

- randomly place mammal traps in the woodland for one day
- put a coloured band on a leg of each captured mouse (S1)
- release these marked mice
- after one week place mammal traps in the woodland again for one day
- count the number of mice captured (S2)
- count the number of mice with leg bands in this second sample (L).

Wood mice are small mammals.

They cannot maintain their body temperature and will die if left in the trap for a long period of time.

Explain why wood mice cannot maintain their body temperature if left in the trap.

(4)

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(Total for question = 4 marks)

Q11.

Mammals produce urea as a nitrogenous waste product.

Bowman's capsule (renal capsule) in the kidney is involved in the excretion of urea in mammals.

Name the cluster of blood capillaries enclosed by Bowman's capsule.

(1)

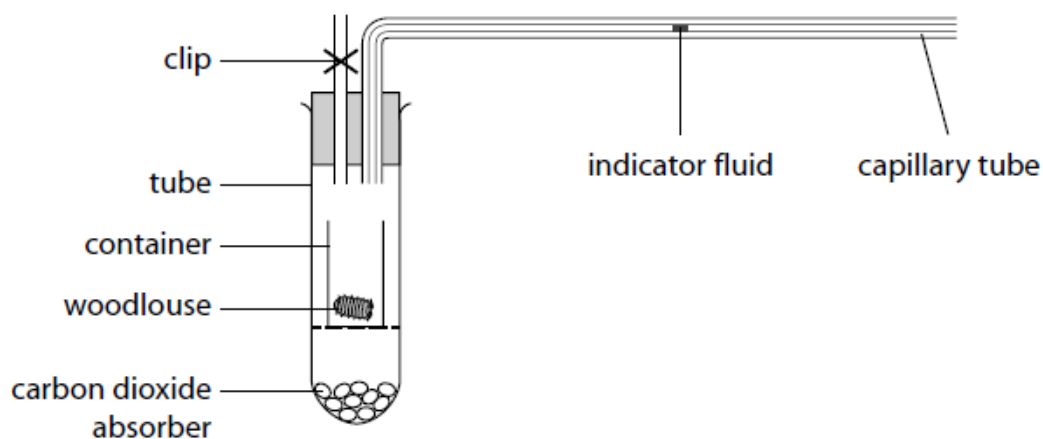
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(Total for question = 1 mark)

Q12.

The diagram below shows a simple respirometer used by a student to measure the rate of respiration of a small invertebrate called a woodlouse.

The rate was measured by observing the distance the indicator fluid moved in a known time.



(a) Give one way in which the student could modify the procedure to obtain a better measurement of the rate of respiration.

(1)

(ii) Comment on how the results you would expect to obtain for a mouse would differ from the results for a woodlouse.

(2)

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(Total for question = 12 marks)

Q13.

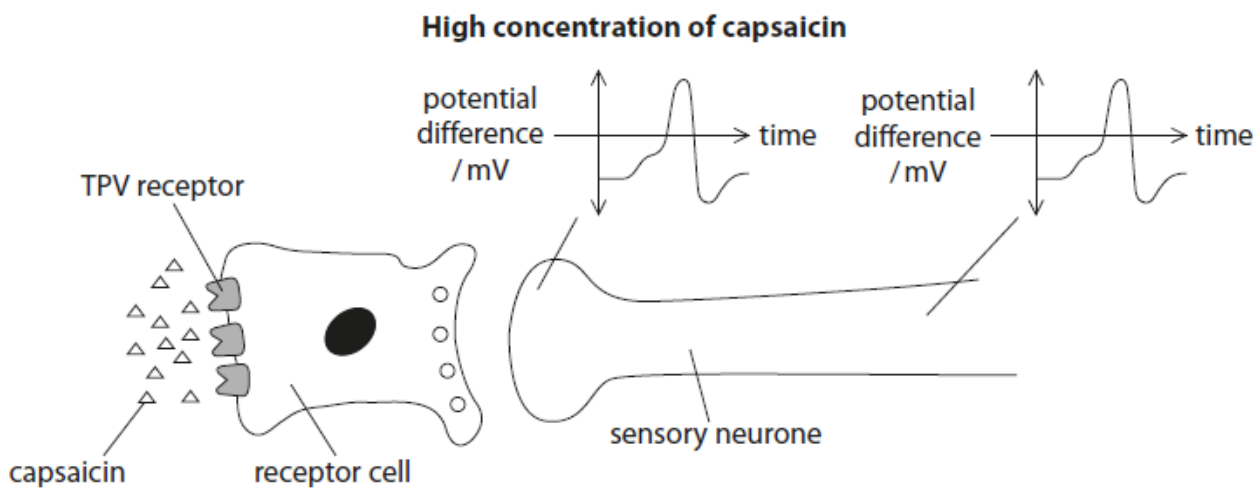
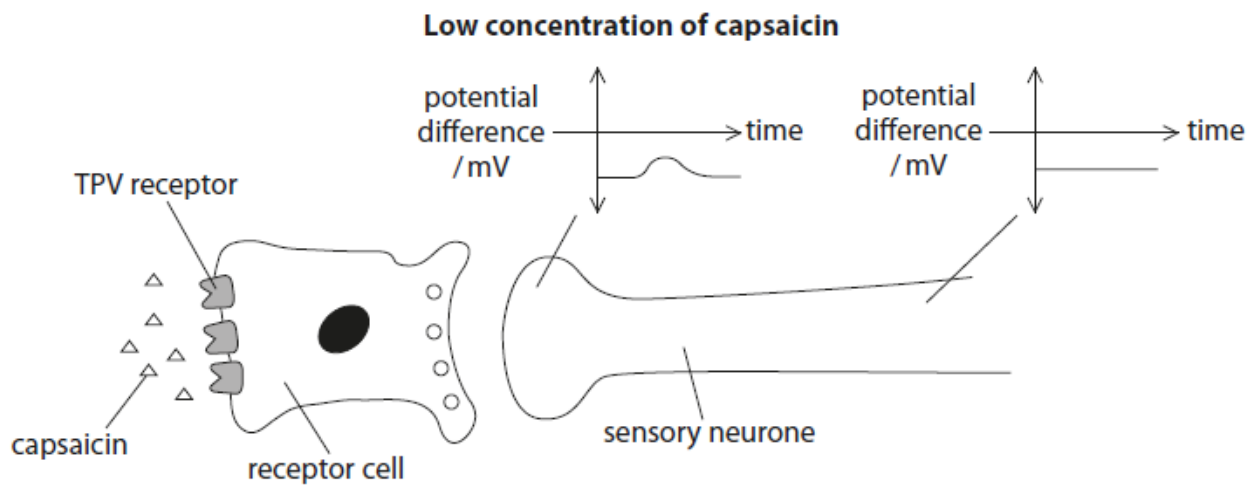
Acetylcholine is a neurotransmitter released by neurones in the autonomic nervous system.

Capsaicin is a substance found in chilli plants that makes them taste 'hot.'

Capsaicin binds to temperature receptor proteins called TPV receptors. This stimulates impulses along sensory neurones that send impulses to the brain.

The effect of capsaicin on the depolarisation of the membrane of a sensory neurone was investigated. The potential difference across the membrane was measured at two places on the sensory neurone after adding capsaicin.

The results for a high concentration and a low concentration of capsaicin are shown in the diagram.



(i) Explain the effect of capsaicin on the depolarisation of the sensory neurone.

(3)

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*(ii) Capsaicin affects sweat production. It has been suggested that capsaicin could be used to lower the temperature of people with fevers.

The effect of three different doses of capsaicin on sweat production was investigated.

Five students took one 10 mg tablet of capsaicin each day, for one week.

The mass of sweat produced from a 10 cm² area of skin was measured one hour after taking each tablet of capsaicin.

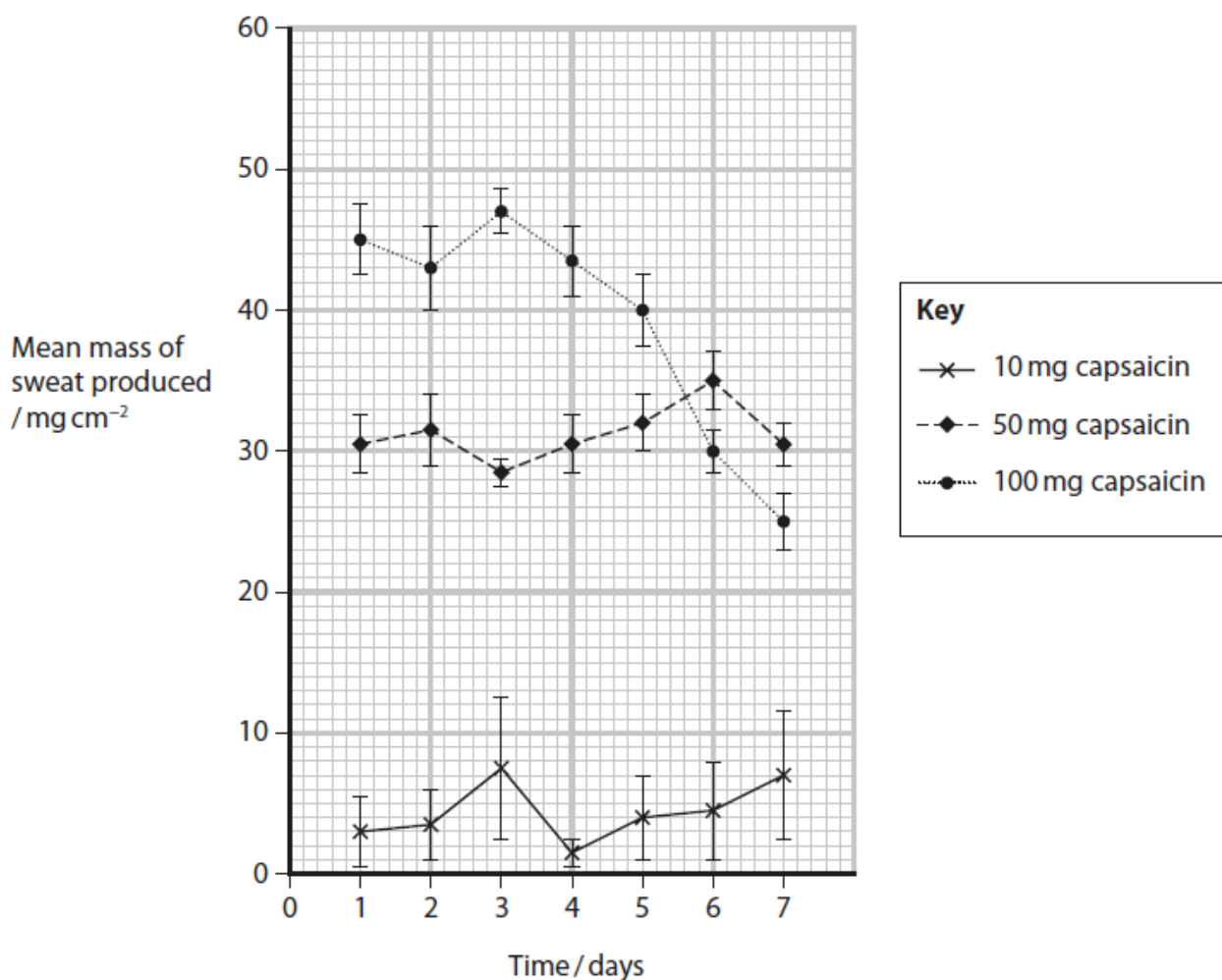
The mean mass of sweat per square centimetre of skin for the group of students was calculated for each day.

This was repeated with different groups of students taking 50 mg of capsaicin and taking 100 mg of capsaicin.

Most of the students who were given 100 mg of capsaicin reported a burning sensation and redness of the skin.

The results are shown in the graph.

Error bars represent standard deviations.



Analyse the data to discuss the use of capsaicin to lower the temperature of people with fevers.

(6)

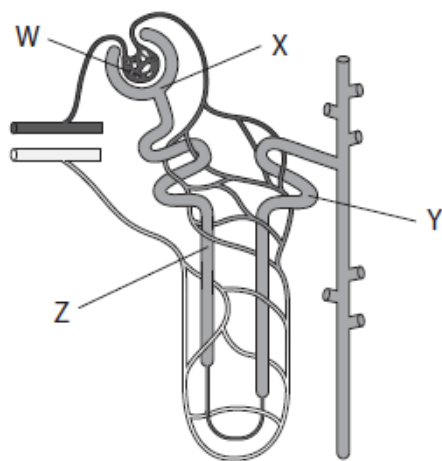
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[illegible]

Q14.



Oedema is an accumulation of tissue fluid. This is due to less tissue fluid being returned to the blood capillaries.

(i) Explain how tissue fluid is returned to capillaries.

(3)

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(ii) Furosemides are drugs that are used to reduce oedema. They are diuretics that increase urine production.

Furosemides reduce the active transport of sodium ions by the loop of Henle.

Explain how furosemides cause an increase in urine production.

(4)

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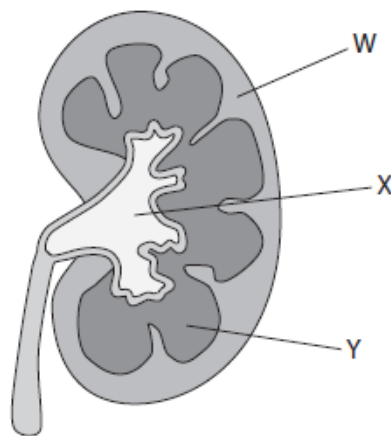
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(Total for question = 7 marks)

Q15.

The diagram shows a section through a mammalian kidney.



Which row of the table names the parts of the kidney labelled in the diagram?

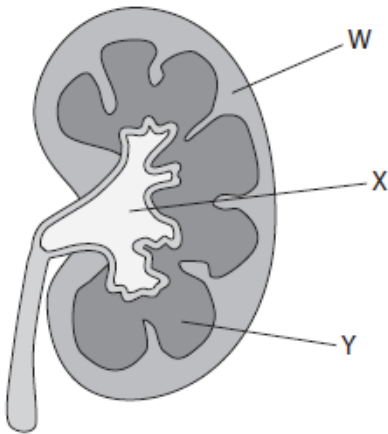
(1)

	W	X	Y
☐ A	cortex	medulla	pelvis
☐ B	cortex	pelvis	medulla
☐ C	medulla	pelvis	cortex
☐ D	medulla	cortex	pelvis

(Total for question = 1 mark)

Q16.

The diagram shows a section through a mammalian kidney.



The table shows information about substances found in the blood and in the filtrate in the renal (Bowman's) capsule.

Substance	Relative molecular mass	Ratio of concentration in the filtrate in the renal (Bowman's) capsule : concentration in blood
sodium ions	23	1.00
water	18	1.00
urea	60	1.00
glucose	180	1.00
myoglobin	17 000	0.75
plasma proteins	69 000	<0.01

Analyse the data to explain the ratios of these substances.

(3)

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(Total for question = 3 marks)

Q17.

The photograph below shows a desert mammal.



(Source: <http://www.ardea.com>)

Some desert mammals do not drink water. They obtain water from the food they eat and from respiration.

(a) Explain how water is formed in respiration.

(2)

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(b) The table below shows the percentage of plant roots and insects in the diet of two different species of desert mammal.

Food	Percentage of food in diet (%)	
	<i>M. hurrianae</i>	<i>T. indica</i>
Plant roots	40	20
Insects	10	25

(i) The desert mammals eat 8 g of food in one day. Calculate how many more grams of insects are eaten by *T. indica* than by *M. hurrianae*.

(2)

Answer g

(ii) Which species has kidneys that will produce the most concentrated urine?
Justify your answer.

(2)

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(c) Which row of the table below shows the correct changes to the concentration of sodium ions as fluid moves along the descending and ascending loop of Henle?

(1)

	Concentration of sodium ions (Na ⁺) in descending loop of Henle	Concentration of sodium ions (Na ⁺) in ascending loop of Henle
☐ A	increases	increases
☐ B	increases	decreases
☐ C	decreases	increases
☐ D	decreases	decreases

(d) The concentration of urine is controlled by osmoreceptors and the secretion of ADH.

Which row of the table below shows the location of the osmoreceptors and the correct level of ADH secretion in a desert mammal that produces concentrated urine?

(1)

	Location of osmoreceptors	Level of ADH
☐ A	carotid body	high
☐ B	carotid body	low
☐ C	hypothalamus	high
☐ D	hypothalamus	low

(e) Explain how the nephrons of desert mammals enable them to survive in a dry environment.

(4)

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(Total for question = 12 marks)

Q18.

Which of the following is correct when an individual becomes dehydrated?

(1)

- ☐ **A** decreased secretion of ADH and decreased permeability of the collecting duct
- ☐ **B** decreased secretion of ADH and increased permeability of the collecting duct
- ☐ **C** increased secretion of ADH and decreased permeability of the collecting duct
- ☐ **D** increased secretion of ADH and increased permeability of the collecting duct

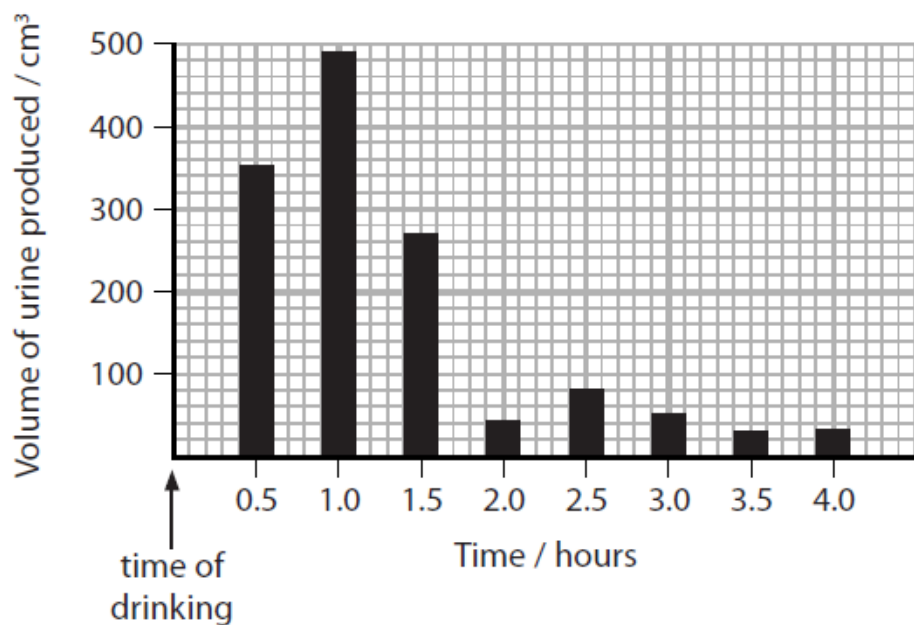
Q19.

Negative feedback control of blood plasma concentration is an example of homeostasis.

A student investigated the effect of drinking water on the volume of urine produced.

The student drank one dm³ of water and waited for half an hour. The student then collected the urine produced every 30 minutes for four hours.

The graph shows the results of this investigation.

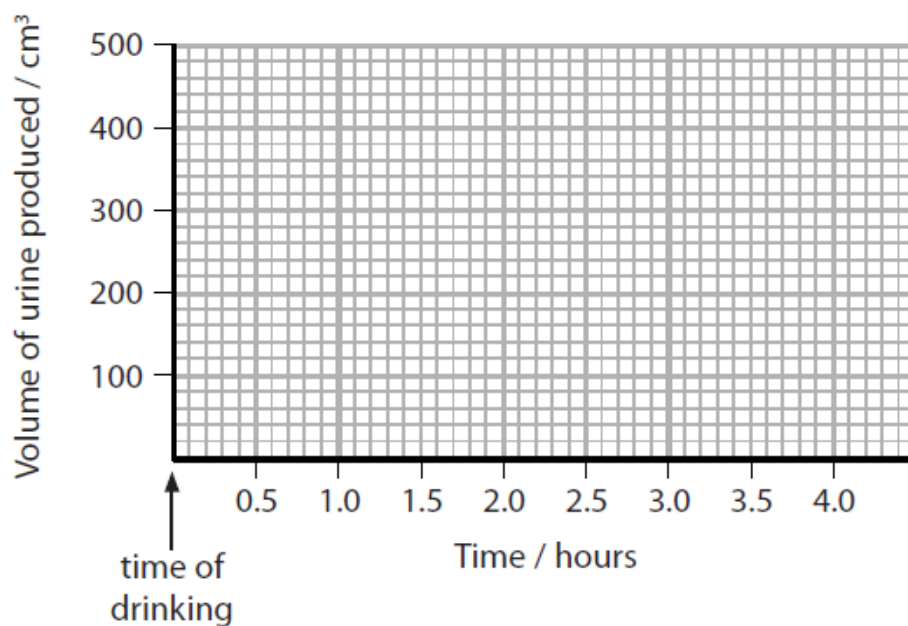


The next day the student drank one dm^3 of dilute salt solution with the same water potential as blood plasma.

The student waited half an hour and collected the urine produced every 30 minutes for four hours.

Sketch a graph to predict the results.

(1)



(Total for question = 1 mark)

A student investigated the effect of the concentration of sodium chloride solution on blood.

The student set up six test tubes, each with a different concentration of sodium chloride solution.

Five drops of blood were added to each test tube.

The appearance of the solutions was then recorded.

Samples of each solution were observed using a light microscope.

The table shows the results of this investigation.

Concentration of sodium chloride (%)	Appearance of solution after blood was added	Observation with light microscope
3.0	very cloudy	cells seen with shrunken edges
1.0	very cloudy	cells seen
0.9	very cloudy	cells seen
0.7	slightly cloudy	cells seen
0.5	cloudy at first, then went clear	no cells seen
0.3	clear	no cells seen

(i) State the part of the brain responsible for osmoregulation.

(1)

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(ii) Explain how, on a very hot day, the brain ensures that the water potential of the blood remains constant.

(4)

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(Total for question = 5 marks)

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	The only correct answer is B W and X A is incorrect because glucose passes out of the glomerulus C is incorrect because glucose is absorbed in the PCT D is incorrect because glucose is absorbed in the PCT		1 comp

Q2.

Question Number	Answer	Mark
(i)	(350 + 490 + 270 + 40 =) 1146 to 1150	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of the following: • {blood / plasma} concentration {low / decreased / dilute / high(er) water potential / hypotonic} (1) • detected by {osmoreceptors / hypothalamus} (1) • therefore {no/less} ADH released by pituitary (1) • collecting duct is less permeable / impermeable (1) • therefore less/no {reabsorption} of water (1)	DO NOT ACCEPT higher concentration of water ACCEPT baroreceptors ACCEPT fewer aquaporins	(4)

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	• ultrafiltration		(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • proteins are too big to pass through (1) • concentrations of the other molecules or ions are the same in both filtrate and plasma (1) • because they are small enough to pass through (1)		(3)

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to the following: • calculation of increase in concentration of urea (1) • calculation of increase in concentration of chloride (1) • calculation of how many more times concentrated urea is compared to chloride (1)	<u>Example of calculation</u> $2.0 \div 0.03 = 66.7 / 66.67$ $0.6 \div 0.37 = 1.6 / 1.62$ $66.67 \div 1.62 = 41.2 / 41.15$ times more $66.7 \div 1.6 = 41.7 / 41.69$ times more Correct answer with no working gains full marks ecf allowed for Mp3 if number in Mp 1 or Mp2 inappropriate rounding	(3)

Question Number	Answer	Additional Guidance	Mark
(iv)	An explanation that makes reference to two of the following: • glucose has been (selectively) reabsorbed (1) • by {active transport / against a concentration gradient} (1) • in the proximal tubule (1)	Do not accept absorbed	(2)

Question Number	Answer	Additional Guidance	Mark
(v)	An explanation that makes reference to five of the following: • {sodium / chloride} ions are moved out of the ascending limb by active transport (1) • ascending limb is impermeable to water (1) • this results in a {high(er) concentration / low(er) water potential} in medulla (1) • (loop of Henlé) acts as a counter-current multiplier (1) • the collecting ducts are permeable to water (1) • therefore water moves out (of the collecting ducts) by osmosis (1)		(5)

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	- divide oxygen consumption by body mass (1) - express answer in standard form (1)	<u>Example of calculation</u> $50 \div 4\,000 = 0.0125$ 1.25×10^{-2} Correct answer gains full marks, with no working shown ACCEPT one mark in working for 0.0125	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of the following: {small(er) mammals / small(er) body mass} consume more oxygen (per kg) (1) - mammals are endotherms / maintain body temperature / regulate body temperature (1) - small mammals have larger surface area to volume ratio (1) - therefore lose more heat (1) - heat by respiration (1)	ACCEPT large(r) mammals consume more oxygen in $\text{dm}^3 \text{h}^{-1}$ ACCEPT converse for Mps 1, 3 and 4 and 5	(4)

Q5.

Question Number	Indicative content
*	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Indicative content: Proximal convoluted tubule: (P) • glucose is all reabsorbed • by active transport / use of energy / use of ATP • urea concentration rises as water is reabsorbed • sodium ions absorbed because concentration does not increase (despite less water) Loop of Henle: (L) • urea concentration rises • sodium ion concentration rises in descending limb • water reabsorbed from descending limb • by osmosis • sodium ion concentration falls in ascending limb • sodium ions actively pumped out of ascending limb • reference to countercurrent multiplier Distal tubule and collecting duct: (C) • urea and sodium ion concentration rise • water is reabsorbed • by osmosis • ADH affects permeability

Level	Marks	
0	0	No awardable content
1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context. Any number of descriptions from graph = 1 point Answer with description only and no explanation max 1 1 REGION and at least one explanation = 2
2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented. Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows some linkages and lines of reasoning with some structure. 2 REGIONS and 3 to 4 points

3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented. Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured. 3 REGIONS and 5 plus points with no MAJOR errors e.g. urea moving into nephron, sodium ions moving into the nephron
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Q6.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to two of the following: - removal of amino group from amino acids / deamination (1) - ammonia combines with carbon dioxide (1) - the ornithine cycle produces urea (1)		(2)

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	B ☒ B 1 and 3 <i>A is incorrect because facilitated diffusion does not move substances against a gradient</i> <i>C is incorrect because facilitated diffusion does not move substances between phospholipids</i> <i>D is incorrect because facilitated diffusion does not move substances against a gradient</i>		1

Question Number	Answer	Additional Guidance	Mark
(ii)	C increased permeability of the collecting duct to water, producing more concentrated urine <i>A is incorrect because ADH increases the permeability of the collecting duct</i> <i>B is incorrect because ADH increases the permeability of the collecting duct</i> <i>D is incorrect because ADH results in more concentrated urine</i>		1

Q8.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • large numbers of mitochondria (1) • to provide ATP for active uptake of {glucose / salts / amino acids} (1) • microvilli providing large surface area (1) • for many carrier proteins for {glucose / salts / amino acids} (1)	Accept correct named minerals	4

Q9.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • overall net filtration pressure is 3.2 (1) • so fluid will be forced from the glomerulus into the Bowman's capsule (1)	<u>Example of calculation</u> $9.2 - 2.0 = 7.2$ $7.2 - 4.0 = 3.2$	(2)

Q10.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to four of the following: - mice have large surface area to volume ratio (1) (therefore) {lose a lot of heat / lose heat quickly} (1) - heat generated by {metabolism / respiration} (1) - insufficient food to {maintain (high) metabolic rate / release enough energy} (1) - no bedding {for insulation / to prevent heat loss} (1)		(4)

Q11.

Question Number	Answer	Additional Guidance	Mark
	glomerulus	Do not accept incorrect spelling	(1)

Q12.

Question Number	Correct Answer	Additional guidance	Mark
(a)	An answer that makes reference to the following: measure volume by use of {formula / three way tap and syringe} (1)		(1)

Question Number	Correct Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following: - the indicator fluid movement would move to the left (1) - because there is lower pressure (1) - because there is respiration but no photosynthesis (1) - therefore the pressure is reduced because the carbon dioxide produced is absorbed (1)		(4)

Question Number	Correct Answer	Additional guidance	Mark
(c)(i)	An explanation that makes reference to five of the following: • use of a larger container because mice are bigger (1) • need to use more carbon dioxide absorber to ensure all carbon dioxide is absorbed (1) • convert readings into units per gram for each animal (1) • attach a syringe to enable {repeat measurements / volume measurements}(1) • abiotic variables such as light / temperature to be same as in the woodlouse experiment (1) • barrier to protect mouse from carbon dioxide absorber / do not leave mouse in the container for a long time (1)		(5)

Question Number	Correct Answer	Additional guidance	Mark
(c)(ii)	An answer that makes reference to the following: • mouse rate of respiration greater than woodlouse (1) • because mice are endotherms / metabolic rate greater / need to maintain body temperature because of heat loss (1)		(2)

Q13.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three from: • capsaicin binds to (TPV) receptors in membrane of receptors cells (1) • this causes neurotransmitter (from receptors) to be released onto sensory neurone {generating an epsp / opening sodium channels / causing sodium ions to flow in} (1) • high concentrations of capsaicin generate an epsp that) overcomes threshold to form an {action potential} (1) • action potential moves along the neurone by (opening sodium channels) (1)	Allow low concentrations does not overcome threshold Allow high concentrations opens voltage gated sodium channels	3

Question Number	Indicative content	
(ii)	Answers will be credited according to candidate's deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Descriptions • 100 mg / 50 mg / higher doses / of capsaicin increase mass of sweat produced D • sweat production from 100 mg decreases after 5 days D • 10 mg has less effect D • 10 mg / 50mg have same effect for all seven days D • 100 mg effect decreases after 3/4/5 days D • 100 mg generates less sweat than 50 mg after 5/6 days D Explanation / Optimal Dose • increased sweating and evaporation of water E • evaporation of water requires heat energy E • latent heat of vaporisation is high for water so sweating removes a lot of heat energy E • 50 mg is optimal dose E • because there 100 mg begins to lose effect after 3/4/5 days E • and 100 mg produces more side effects / burning sensations / red rash E Validity of data • 50 mg dose has consistent sweat production as error bars all overlap V • 100 mg and 50 mg are significantly higher than 10 mg as error bars do not overlap V • 10 mg has a high variation between responses of volunteers V	6

		- no control experiment has been carried out V - sample size is small V - capsaicin may interfere with other medicines / may make illness worse / no tests done on illpeople V	
Level	Marks		
Level 0	Marks	No awardable content	
Level 1	1-2	Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made. Basic description of the effects of each dose one mark: any one from D, E, V two marks: 3D, 2D + 1E, 2D + 1V	
Level 2	3-4	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made. Detailed description and either E or V three marks: at least four points from D + E or D + V four marks: at least five points from D + E or D + V	

Level 3	5-6	A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made. Must have elements of D, E and V. five marks: at least six points from D, E and V six marks: at least seven points from D, E and V AND must refer to standard deviations	
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Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following points: - there is more protein in plasma than tissue fluid (1) - because plasma proteins are too large to pass out of the capillary (1) - and oncotic pressure generated by (plasma) proteins (1) (so fluid moves in) as {oncotic / osmotic} pressure is greater than hydrostatic pressure (1)	Accept converse Accept converse	3 exp

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of the following points: - sodium ions are not removed from the ascending limb (1) - so the water potential of medullary fluid is higher (1) - therefore less water is removed from the descending limb (1) - and less water is removed from the {collecting duct / distal tubule} (1) (a higher volume of) {dilute / low concentration} urine is produced (1)	Accept less negative water potential Accept water potential gradient is lower Accept osmotic gradient is lower	4 exp

Q15.

Question Number	Answer	Mark
	The only correct answer is B <i>A is not correct because X is the pelvis</i> <i>C is not correct because W is the cortex</i> <i>D is not correct because W is the cortex</i>	(1)

Q16.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: (substances) with higher (relative molecular) mass have a {lower ratio / ratio less than 1.00} (1) - small(er) substances pass through / large substances do not pass through (1) - because of the size of the pores in the {glomerulus / capillary / renal capsule / (basement) membrane} (1)	ACCEPT a ratio of 1.00 means substance passes through / a ratio less than 1.00 means not all substance passes through ACCEPT substances with a mass lower than 180 pass through	(3)

Q17.

Question Number	Correct Answer	Additional guidance	Mark
(a)	An explanation that makes reference to the following: - reference to electron transport chain (1) - oxygen as final proton and electron acceptor (1)		(2)

Question Number	Correct Answer	Additional guidance	Mark
(b)(i)	25% of 8 g = 2 g and 10% of 8 g = 0.8 g (1) 2 g – 0.8 g = 1.2 g (1)		(2)

Question Number	Correct Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to the following: <i>T. indica</i> because eats fewer plant roots (1) - plant roots contain more water than insects (1)		(2)

Question Number	Correct Answer	Additional guidance	Mark
(c)	B		(1)

Question Number	Correct Answer	Additional guidance	Mark
(d)	C		(1)

Question Number	Correct Answer	Additional guidance	Mark
(e)	An explanation that makes reference to the following: - desert mammals have long loops of Henle (1) - which allows for a greater counter current multiplier effect (1) - therefore a higher concentration of solute / sodium chloride at base of the medulla (1) - which causes greater amounts of water to be reabsorbed from collecting ducts (1)		(4)

Q18.

Question Number	Acceptable Answer	Additional Guidance	Mark
	D (increased secretion of ADH and increased permeability of the collecting duct)		(1)

Q19.

Question Number	Answer	Additional Guidance	Mark
	line or bars at 100 cm ³ or below for total duration		(1)

Q20.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following: hypothalamus		(1)
(ii)	An explanation that makes reference to four of the following: - sweating occurs causing loss of water from the blood (1) - therefore the water potential of the blood falls (1) - osmoreceptors are stimulated (1) - causing the pituitary gland to secrete {antidiuretic hormone /ADH} (into the blood) (1) - causing the {collecting ducts / kidney tubules} in the kidney to reabsorb more water (into the blood) (1)		(4)