

1

- (a) Why is glucose found in the blood but not in the urine? Use your knowledge of how the kidney works to explain your answer as fully as you can.

(3)

- (b) The table shows the concentrations of dissolved substances in the urine of a healthy person and the urine of a person with one type of kidney disease.

Substance	Concentration in grams per dm ³	
	Urine of healthy person	Urine of person with kidney disease
Protein	0	6
Glucose	0	0
Amino acids	0	0
Urea	21	21
Mineral ions	19	19

- (i) Suggest an explanation for the difference in composition of the urine between the healthy person and the person with the kidney disease.

(2)

- (ii) The person with the kidney disease could be treated either by using a dialysis machine or by having a kidney transplant operation.

What are the advantages and disadvantages of having a kidney transplant operation rather than dialysis?

(4)

(Total 9 marks)

2

- (a) Describe, as fully as you can, the job of

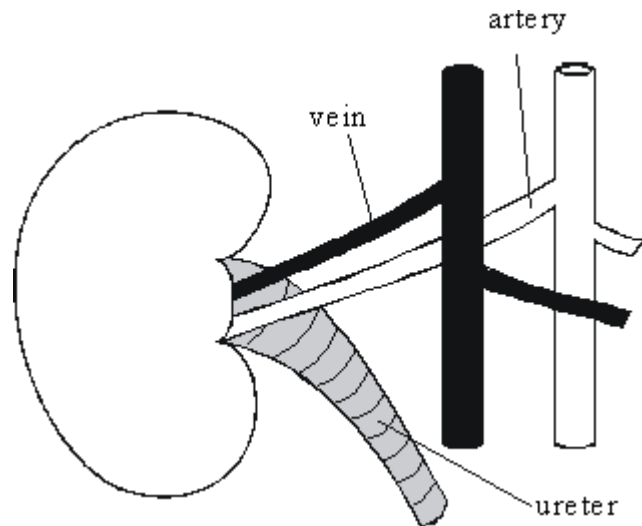
- (i) the circulatory system.

(2)

- (ii) the digestive system.

(3)

(b)

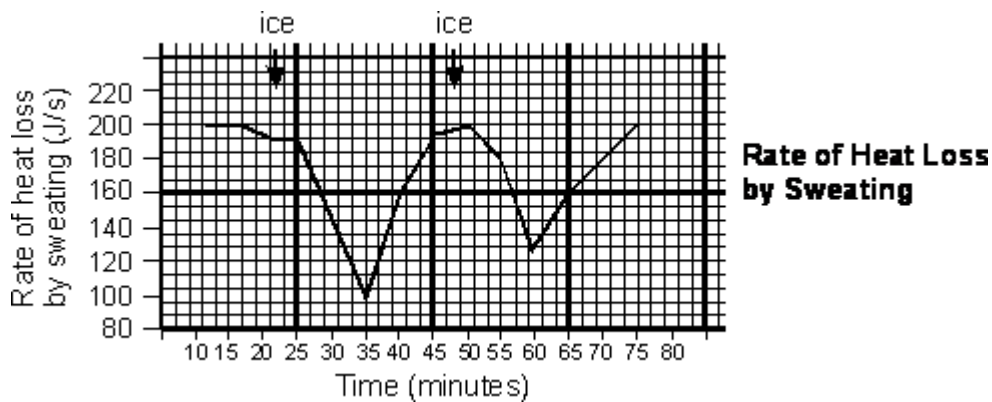
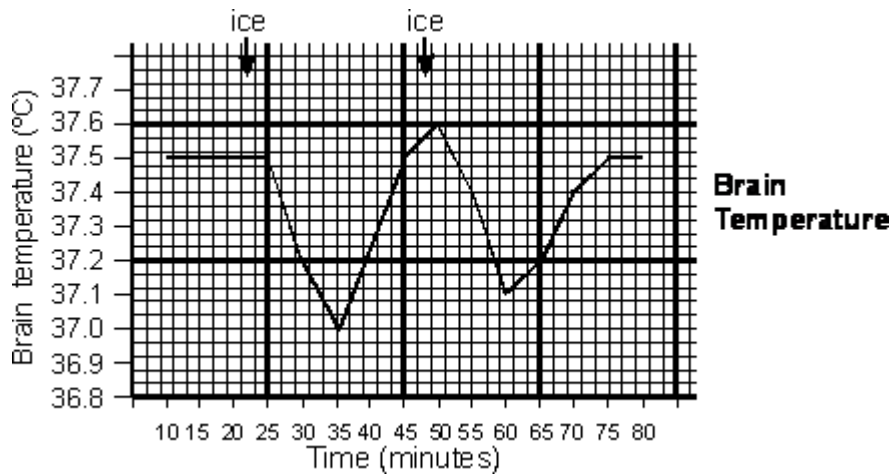
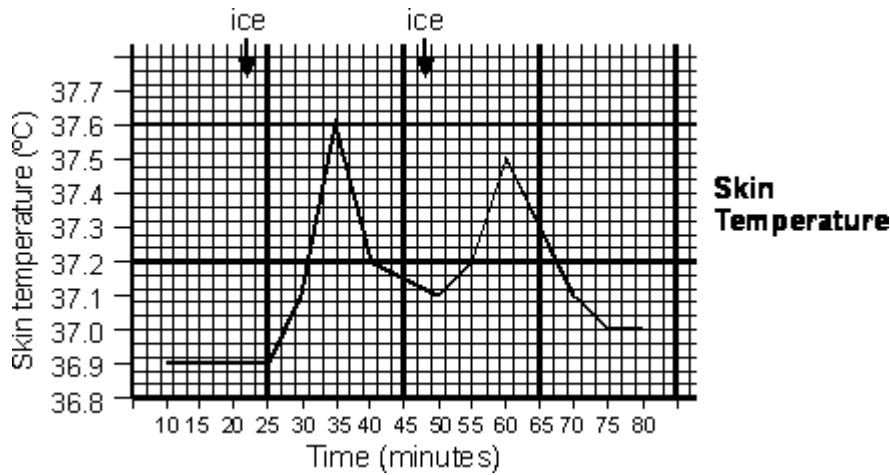


The drawing shows a kidney, its blood supply and the ureter (a tube which carries urine from the kidney to the bladder). The amount and composition of the urine flowing down the ureter change if the blood in the artery contains too much water. Describe these changes and explain how they take place.

(4)
(Total 9 marks)

3

The graphs show the results of an investigation into the control of sweating in humans. The subject was placed in a chamber where the temperature was maintained at 45°C. The subject swallowed ice at the times indicated on the graphs.



- (a) What was the relationship between swallowing ice and the subject's
- (i) skin temperature?

(1)

4 The pictures show three mammals and their average body temperature in °C.

Hamster



36.8 °C

Horse



38.0 °C

Sheep



39.2 °C

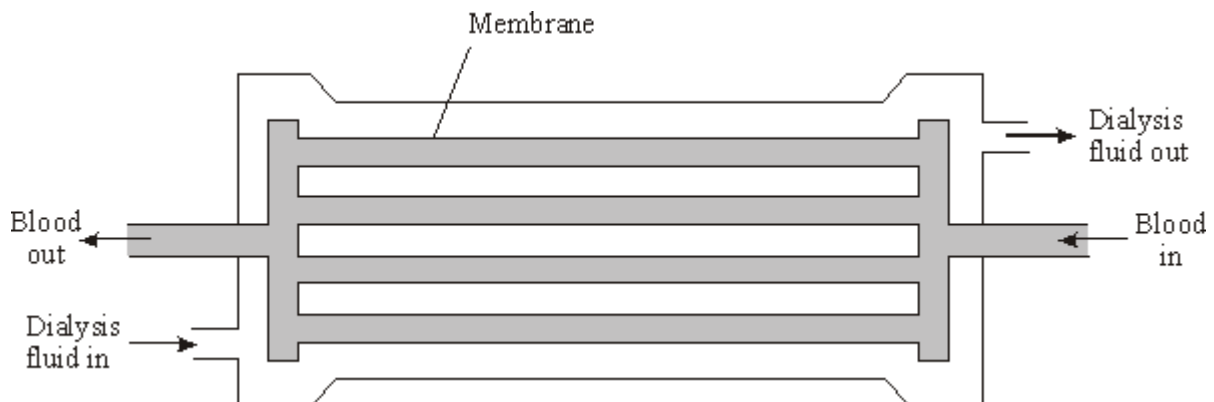
NOT TO SCALE

Describe **three** different ways by which most mammals are able to maintain a constant body temperature when the temperature of the environment falls.

(Total 6 marks)

5 A woman suffers a minor infection that affects her kidneys. She is sent to hospital for treatment with a dialysis machine.

A simplified diagram of a dialysis machine is shown below.



(a) Explain why the membrane is important in the dialysis machine.

(2)

(b) Some of the components of the woman's blood and of the dialysis fluid entering the machine are shown in the table.

Component	Woman's blood entering machine	Dialysis fluid entering machine
Blood cells	✓	✗
Glucose	✓	✓
Urea	✓	✗

Key: ✓ = present ✗ = absent

Use the information in the table to explain the composition of the dialysis fluid entering the machine.

(4)

(c) One alternative to treatment with a dialysis machine is to have a kidney transplant.

Suggest why a kidney transplant might **not** be suitable in this woman's case.

(2)

(d) Before dialysis treatment begins, the dialysis machine must be filled with blood. The woman has blood group **O**.

(i) What features of her blood make it group **O**?

(2)

(ii) Why must the blood in the dialysis machine, before her treatment begins, also be blood group **O**?

(1)

(Total 11 marks)

6

(a) Each day, a boy ate food containing 12 000 kilojoules of energy. The boy's body used 80 per cent of this energy to maintain his core temperature.

(i) Name the process which releases energy from food.

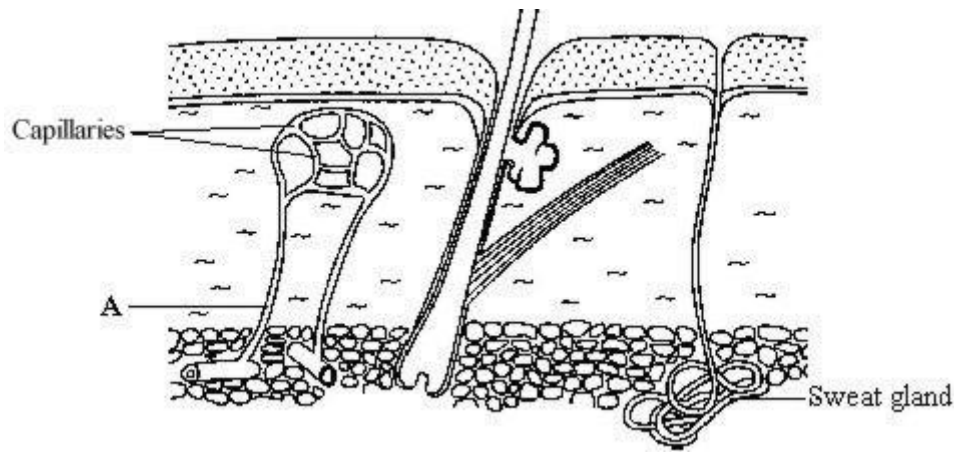
(1)

(ii) Calculate the amount of energy that the boy would use each day to maintain his core body temperature. Show clearly how you work out your final answer.

Amount of energy used each day = _____ kJ

(2)

(b) The diagram shows a section through human skin.



Explain how structure **A** helps to cool the body on a hot day.

(3)

(c) Body temperature is monitored and controlled by the thermoregulatory centre. Where in the body is the thermoregulatory centre?

(1)

(Total 7 marks)

7

The table shows the concentrations of some substances in one person's blood plasma, kidney filtrate and urine.

Substance	Concentration in grams per dm ³		
	Plasma	Filtrate	Urine
Water	900.0	900.0	950.0
Protein	78.0	0.0	0.0
Glucose	0.8	0.8	0.0
Amino acids	0.4	0.4	0.0
Urea	0.3	0.3	20.0
Sodium ions	2.8	2.8	3.5

(a) (i) Protein is **not** present in the filtrate.

Explain why.

(1)

(ii) Glucose is filtered out of the blood by the kidney and is then completely reabsorbed back into the blood.

What is the evidence for this in the table?

(2)

(iii) Glucose is reabsorbed into the blood by active transport.

Give **two** ways in which active transport differs from diffusion.

1. _____

2. _____

(2)

(b) The concentration of urea is much higher in the urine than in the filtrate.

Explain what causes this.

(1)

(Total 6 marks)

8

The table shows the concentrations of some substances in human blood plasma, in the filtrate produced by the kidney and in the urine.

Substance	Concentration in grams per dm ³		
	Blood plasma	Filtrate	Urine
Glucose	1.0	1.0	0.0
Amino acids	0.5	0.5	0.0
Urea	0.3	0.3	20.0
Protein	80.0	0.0	0.0
Ions	7.2	7.2	15.0
Water	912.0	990.0	970.0

(a) Explain why:

(i) the concentration of glucose in the filtrate is the same as in the blood plasma;

(1)

(ii) there is no glucose present in the urine.

(1)

(b) Suggest why there is no protein present in either the filtrate or the urine.

(1)

(c) The volume of water removed in the urine is variable. Explain how the human body reduces the volume of urine produced when less water is consumed.

(3)

(Total 6 marks)

Mark schemes

- 1** (a) any **three** from:
- glucose enters blood from gut / liver / glycogen
 - glucose is filtered out of the blood
ignore 'diffusion'
 - glucose is (a) small (molecule)
 - taken / etc back into the blood / reabsorbed
*allow absorbed into the blood but **not** absorbed unqualified*
 - by active transport
ignore diffusion
- 3**
- (b) (i) in a healthy person
- protein not present because proteins are large (molecules)
or because cannot pass through (filter)
- 1**
- in person with disease
- lets protein through (filter) owtte
- 1**
- (ii) advantages:
up to any **three** from:
- no build-up of toxins / keeps blood conc. \pm constant
ignore 'kidney works all the time'
 - prevent high blood pressure
 - don't need restricted diet / restricted fluid intake
or time wasted on dialysis
 - blood clots may result from dialysis
 - infection may result from dialysis
 - with dialysis, blood may not clot properly
due to anti-clotting drugs
 - cost issues (ie transplant cheaper)
- 3**

disadvantages: at least one from:

- rejection / problem finding tissue match
- use of immuno-suppressant drugs → other infections
- dangers during operation / example described

must have at least one advantage and at least one disadvantage for full marks

1

[9]

2

(a) (i) transport of substances **or** named substance **or** blood around the body
each for 1 mark

2

(ii) breaks down (**not digests**) food absorption (into blood)
each for 1 mark

3

(b) water filtered from blood
smaller proportion reabsorbed
therefore larger volume
of dilute urine produced
each for 1 mark

4

[9]

3

(a) (i) increased shortly after ingestion then drops;
(ii) decreased shortly after ingestion then rises;
(iii) decreased shortly after ingestion then rises
each for 1 mark

3

(b) 8 of:
ingestion of ice cools blood flowing in (gut wall);
brain temperature lowered;
reduced blood temperature detected by brain;
impulses sent to sweat glands;
sweat production decreased/sweat pores close;
evaporation of sweat reduced;
it is evaporation of sweat which cools skin/heat loss is less;
therefore skin temperature rises;
because external temperature greater than body temperature;
sensibly linked example;
each for 1 mark

8

[11]

4 vasoconstriction/blood vessels near surface get narrower/decreased blood supply near surface of the skin **or** closing sweat pores
any three pairs. 2 marks for each pair of features and explanations up to a maximum of 6 marks

(which) prevents the heat being lost from the blood/prevents heat lost due to evaporation

explanation must match feature to score the second mark

hair/fur stands on end **or** goosepimples

(this) increases the insulation effect

shivering/increased muscular activity/movement/increased metabolism

(this) generates heat

*do **not** accept raise body temperature*

behavioural changes/find somewhere warm/put on clothes / huddling / hibernate / grow **extra** fat / fur

(this) prevents/reduces heat loss

*do **not** accept keep warm*

[6]

5 (a) semi / selectively / partially / differentially permeable **1**

separates blood and dialysis fluid **1**

(b) any **four** from:

blood cells cannot pass through membrane

glucose retained in blood

to stop water passing into blood / osmosis

no (net) diffusion

urea removed from blood by diffusion

accept excreted

4

(c) problem may be temporary **or** has minor infection **or** problem could be cured by other means 1

operation / transplants carry risk
accept rejection 1

(d) (i) no antigens 1

on (the surface) of red blood cells 1

(ii) would cause agglutination / clumping if different
ignore clotting and coagulation 1

[11]

6 (a) (i) respiration 1

(ii) 9600
if correct answer, ignore working / lack of working

$\frac{80 \times 12000}{100}$ for 1 mark 2

(b) any **three** from:

- dilates / widens **or** muscle in wall relaxes **or** sphincter opens
do not accept expands or just gets bigger
 - more blood flows near skin surface **or** more blood through capillaries
 - heat lost by radiation / convection / conduction
ignore evaporation
 - heat loss from blood / cools blood
- 3

(c) hypothalamus / brain 1

[7]

7 (a) (i) protein is large (molecule) / too big to pass through filter 1

- (ii) glucose is present in the filtrate
ignore units 1
- or**
- 0.8 in filtrate
- no glucose is present in the urine
- or**
- 0 in urine 1
- (iii) active transport – up / against (concentration) gradient
it = active transport throughout 1
- or**
- from low to high (concentration)
- uses energy / ATP
*accept needs specific carrier / specific protein (in cell membrane)
for 1 mark* 1
- (b) water reabsorption / taken out
other substances cancel mark
- or**
- water taken into blood / body 1
- 8** (a) (i) glucose passes through the filter / from plasma to filtrate
ignore diffuses 1
- (ii) glucose is reabsorbed or glucose taken back into the blood
ignore filtered 1
- (b) protein (molecules) are (too) large (to pass through the filter) 1

[6]

(c) any **three** from:

blood becomes more concentrated / too salty / has lower water potential **or** too little water in the blood

hypothalamus detects this

release of ADH

by pituitary

increased reabsorption of water

3

[6]