

1 One group of scientists is working in a hot desert and another group is working in a tropical rainforest.

The table shows information about the scientists and the conditions in the desert and the rainforest.

Information	Hot desert	Rainforest
Mean core body temperature of scientists in °C	37.3	38.9
Air temperature in °C	36.0	35.5
Mean percentage concentration of moisture in the air	9.0	92.0
Mean wind speed at ground level in metres per second	12.0	3.0

(a) Both groups of scientists are doing similar jobs. The jobs cause the scientists to sweat a lot.

Use information from the table to explain the difference in the mean core body temperature of the two groups of scientists.

(2)

(b) Changes to blood vessels in the skin help to decrease body temperature.

Explain how.

(2)

(Total 4 marks)

2

A person had diseased kidneys.

The table shows the concentrations of dissolved substances in this person's urine.

Substance	Concentration in grams per dm ³
Protein	6
Glucose	0
Amino acids	0
Urea	21
Mineral ions	19

(a) One of the substances found in this person's urine would **not** be found in the urine of a healthy person.

(i) Name this substance. _____

(1)

(ii) Explain why this substance would **not** be found in the urine of a healthy person.

(2)

(b) A person with diseased kidneys may be treated by dialysis.

Explain how dialysis treatment restores the concentrations of dissolved substances in the blood to normal levels.

(4)
(Total 7 marks)

3 A walker falls through thin ice into very cold water.



The walker's core body temperature falls. He may die of hypothermia (when core body temperature falls too low).

(a) (i) Which part of the brain monitors the fall in core body temperature?

(1)

(ii) How does this part of the brain detect the fall in core body temperature?

(2)

(b) While in the water the walker begins to shiver.

Shivering helps to stop the core body temperature falling too quickly.

Explain how.

(2)

(c) The walker had been drinking alcohol.

Alcohol causes changes to the blood vessels supplying the skin capillaries, making the skin look red.

(i) Describe the change to the blood vessels.

(1)

(ii) The walker is much more likely to die of hypothermia than someone who has not been drinking alcohol.

Explain why.

(2)

(Total 8 marks)

4

Urine consists of water, ions and other substances such as urea.

Urine is formed in the kidney by filtering the blood.

The diameter of the pores in the filter is about 6 nanometres.

The table shows the diameters of the molecules of some of the substances in the blood.

Substance	Diameter of molecule in nanometres
A	10 to 20
B	1.0
C	0.6
D	0.5
E	0.2

Use information from the table and your own knowledge to answer the questions.

(a) (i) Which substance, **A**, **B**, **C**, **D** or **E**, is protein?

(1)

(ii) Explain why protein is **not** found in the urine of a healthy person.

(1)

(b) Haemolytic anaemia is a disease in which some of the red blood cells burst open.

Small amounts of haemoglobin may be found in the urine of a person suffering from haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nanometres.

Haemoglobin is **not** found in the urine of a healthy person, but can be found in the urine of a person with haemolytic anaemia.

Explain why.

(3)

(Total 5 marks)

5

The temperature in a sauna is much hotter than core body temperature.

A woman sits in a sauna.

The high temperature of the sauna causes the woman's core body temperature to rise.

(a) When the woman's core body temperature rises, the woman's rate of sweating increases.

Explain why.

(2)

- (b) The woman comes out of the sauna.
The woman's skin looks redder than when she went into the sauna.

Describe what happened to the blood circulation in her skin to cause this change in colour.

(2)

- (c) After coming out of the sauna the woman gets into a bath of icy water.
This makes the woman shiver.

- (i) What process brings about shivering?

(1)

- (ii) Shivering increases body temperature.

Explain how.

(2)

(Total 7 marks)

6

Blood plasma is a solution of glucose, and many other substances, in water.

The urine of a healthy person contains water but does not contain glucose.

- (a) Name **two** more substances found in the urine of a healthy person.

1. _____

2. _____

(2)

- (b) (i) Describe what happens to the glucose in the blood of a healthy person when the blood enters the kidney.

(3)

- (ii) A diabetic person's blood often contains a high concentration of glucose.

The urine of a diabetic person may contain glucose.

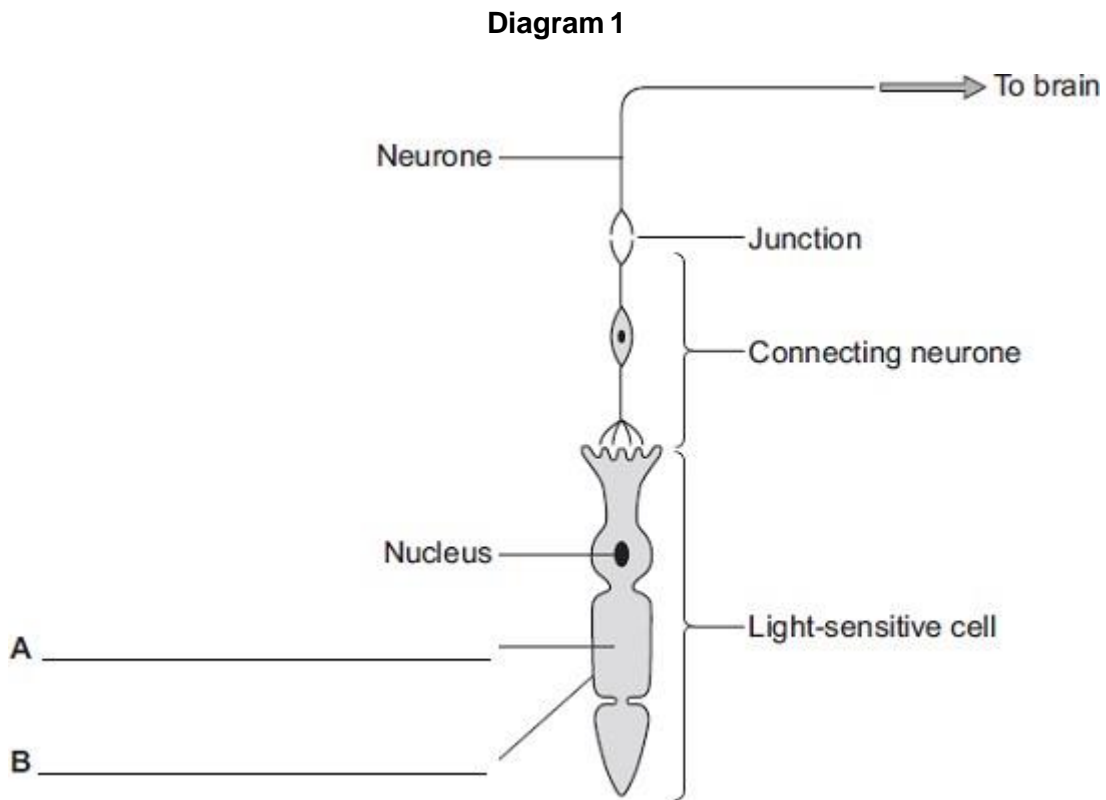
Suggest an explanation why.

(2)

(Total 7 marks)

7

Diagram 1 shows cells from the light-sensitive layer in the eye.



(a) On **Diagram 1**, add labels to name part **A** and part **B** of the light-sensitive cell.

(2)

(b) There is a junction between the connecting neurone and the neurone carrying the impulse to the brain.

(i) What name is given to the junction?

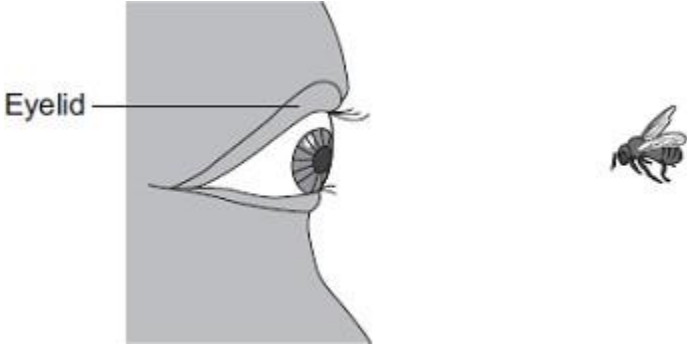
(1)

(ii) In what form is information passed across the junction?

(1)

(c) **Diagram 2** shows a bee flying towards a man's eye.

Diagram 2



In the *blink reflex* , light from the bee reaches the light-sensitive cell in the eye. The muscles in the eyelid shut the man's eye before the bee hits the eye.

Describe the pathway taken by the nerve impulse in the *blink reflex*.

(4)
(Total 8 marks)

8

Use your knowledge of how the kidney works to answer the following questions.

- (a) Blood plasma contains mineral ions, glucose, urea and proteins.

Explain why urine contains mineral ions and urea, but **no** glucose or protein.

(4)

- (b) A man ate and drank the same amounts of the same substances and he did the same amount of exercise on two different days. On one of the two days the weather was hot and on the other day the weather was cold.

The man's urine contained a higher concentration of mineral ions and urea on the hot day than on the cold day.

Explain why.

(4)

(Total 8 marks)

9

Humans maintain an almost constant body temperature.

(a) Describe the role of blood vessels in the control of body temperature.

(4)

(b) An athlete can run a marathon in 2 hours 15 minutes on a dry day in outside temperatures up to 35 °C.

If the air is dry, his body will **not** overheat.

In humid conditions the same athlete can run the marathon in the same time. However, in humid conditions, if the outside temperature goes over 18 °C then his body **will** overheat.

Suggest an explanation for the athlete overheating in humid conditions.

(3)

(Total 7 marks)

Mark schemes

- 1** (a) in rainforest:
accept converse
- (water from) sweat does not evaporate (as much)
max 1 if not clear whether desert or rainforest
- 1**

any **one** from:

- (due to) less wind / higher moisture / humidity
- less cooling effect

ignore references to temperature

1

- (b) blood vessels supplying capillaries dilate / widen **or** vasodilation
*do **not** award mark if candidate refers only to blood vessels dilating
or to capillaries dilating.*
*accept 'arteries' or 'arterioles' for 'blood vessels supplying,
capillaries' but do **not** accept 'veins'.*
ignore expand / get bigger / relax / open
*do **not** accept idea of blood vessels moving*

1

more blood (through skin / surface capillaries) leads to greater heat loss

1

[4]

- 2** (a) (i) protein
- 1**
- (ii) (protein molecules too) large
- 1**
- cannot pass through filter **or** can't leave blood **or** can't pass into kidney tubule /
named part
- NB holes in the filter are too small = 2 marks*
- 1**

- (b) any **four** from:
- use of partially permeable membrane **or** only small molecules can pass through membrane
 - dialysis fluid has 'ideal' concentrations of solutes
allow correct named example
 - diffusion of waste substances out of blood
accept named example – eg urea
- or**
waste passes from high to low concentration
- reference to equilibrium (between plasma & dialysis fluid)
accept reference to counterflow to maintain concentration gradient

4

[7]

3

- (a) (i) thermoregulatory centre
allow thermoregulation centre
allow hypothalamus
- 1
- (ii) it has receptors
ignore receptors in skin
- 1
- reference to temperature of blood
allow plasma for blood
- 1
- (b) muscles contract
ignore relax / expand
- 1
- increased respiration **or** more heat released
allow more heat produced
if more not given allow respiration releases / produces heat
- 1
- (c) (i) (blood vessels / arteries / arterioles) dilate / widen
do not accept capillaries dilate
ignore blood vessels get bigger / expand
do not accept idea of blood vessels moving
- 1
- (ii) more blood close to / near surface
allow blood is closer to the surface
do not accept idea of blood vessels moving
- 1

more heat lost **or** heat lost faster **or** cools faster
do not allow for idea of evaporation

1

[8]

4 (a) (i) A

1

(ii) (protein molecule is) too large to pass
through the filter / cannot pass through the filter

1

(b) RBC is too big to / cannot pass through filter

1

haemoglobin released when RBC bursts
or
haemoglobin inside RBC in a healthy person

1

haemoglobin is small enough to / can pass through filter
or
haemoglobin diameter < pore diameter
or
haemoglobin only 5.5 nanometres

1

[5]

5 (a) any **two** from

- reference to role of thermoregulatory centre detecting rise in temperature (of blood or skin) **or** / causing increase in sweating

- more evaporation

*need to refer to more at least once to gain **both** marks*

- more cooling / heat loss

without reference to more only award max 1 mark if both ideas given, eg cooling alone gets no marks

2

(b) blood vessels supplying (skin) capillaries
do not accept capillaries / veins

1

or

arteries

or

arterioles

1

dilate / widen

allow vasodilation

do not accept idea of blood vessels moving

note: marks are awarded independently

accept shunt vessels close for 2 marks

1

(c) (i) muscle contraction

ignore relaxing

*do **not** allow vasoconstriction*

1

(ii) respiration

(respiration) releases / produces heat

reference to respiration is required for this mark

1

[7]

6

(a) any **two** from:

allow 2 correctly named substances for 2 marks

ignore water

- urea
- ions / salt(s) / correct named example
ignore minerals
- second correct named example
- hormones / named example
- allow ammonia
- allow creatinine
- allow uric acid
- allow bile pigment

2

(b) (i) glucose filtered (into kidney tubule)

accept Bowman's capsule

1

glucose reabsorbed **or** glucose taken back into blood

1

all glucose taken back into blood / all reabsorbed

1

(ii) not all glucose reabsorbed

1

because not enough time / length **or** too high
a concentration in tubule / not enough carriers

1

[7]

- 7** (a) **A** cytoplasm
in this order only 1
- B** (cell) membrane
*do **not** accept (cell) wall* 1
- (b) (i) synapse 1
- (ii) (as) chemical
accept neurotransmitter or named
ignore references to how the chemical is passed
*do **not** accept electrical* 1
- (c) (from light-sensitive cell to connecting neurone) to sensory neurone
ignore references to synapses accept 'nerve cell' for neuron(e)
throughout penalise 'nerve' for neurone once only 1
- (sensory neurone) to brain / CNS
allow (sensory neurone) to relay neurone / spinal cord 1
- (brain / CNS) to motor neurone
allow (relay neurone / spinal cord) to motor neurone 1
- (motor neurone) to (eyelid) muscle
ignore effector 1

[8]

- 8** (a) proteins are not filtered 1
- glucose is filtered and (re)absorbed
allow glucose (completely) reabsorbed 1
- ions are filtered and some (re)absorbed
allow some ions are reabsorbed 1
- urea is filtered [and some / none (re)absorbed]
allow some / no urea is reabsorbed 1

- (b) more / a lot of sweating occurred
accept converse arguments for cold day 1
- more / a lot of water loss (by sweating) 1
- more / a lot of water reabsorption / more water absorption by the kidney 1
- lower volume of urine
allow less urine / less water in urine 1

[8]

- 9 (a) if body temperature too high blood vessels supplying skin (capillaries) dilate / widen
*do **not** accept capillaries / veins dilate/constrict* 1
- if body temperature is too low blood vessels supplying skin (capillaries) constrict / narrow
*do **not** accept idea of blood vessels moving (through skin)* 1
- ignore expand*
accept arteries / arterioles for 'blood vessels'
if no reference to skin allow blood vessels dilate and blood vessels constrict for one mark
- so more / less blood flows through skin (capillaries) or nearer the surface of the skin
must correctly relate to dilation or constriction 1
- so more / less heat is lost (from the skin by radiation)
must correctly relate to dilation or constriction 1
- (b) sweat released 1
- cannot evaporate because of high humidity / all the water vapour in the air 1
- so less heat lost / less cooling
- or**
- it is evaporation of sweat that cools the body 1

[7]