Q1.

(a) less sweating so less water loss

1

(as) no / little water available in desert

1

(b) (fat store) can be metabolised / respired to water

1

(little urine…) conserve water

1

(hard mouth) not damaged by spines on plants / on food
or
not damaged by hard / dry food

1

(c) dromedary / *C.dromedarius*
and bactrian / *C. bactrianus*
no mark for the names, but must be identified
because
same genus
ignore 'both are Camelus'

1

(d) any **two** from:

- the fossil record
- oldest fossils in N. America
  or
- newer fossils in S. America / in Asia / in Africa
  *allow numbers for ages (45 Mya **and** 3 Mya / 6 Mya)*

- chemical / DNA analysis of living species
  allow radioactive dating of fossils

2

(e) isolation of separate camel populations by sea
or
by mountains

1

habitat variation / described between populations
allow examples – biotic (e.g. food / predators) or abiotic

1

genetic variation / mutation in each population

1

45 million years is sufficient time to accumulate enough mutations

1

natural selection
or
better adapted survive to reproduce

1

pass on favourable allele(s)

allow gene(s)

1

[14]

Q2.

(a) liver

1

(b) insulin

*do **not** accept glucagon*

1

(c) kidney

1

(d) to replace water / ions / salt

1

(that is) lost in sweat

1

[5]

Q3.

(a) (i) 2400 cm^3

1

(ii) 1400 (cm^3)

*allow **2** marks for ecf of correct answer to [answer given in (a)(i) – 1000]*

*allow **1** mark for 2400 – (600 + 400) or equivalent with no or incorrect answer*

*allow **1** mark for ecf of answer given in (a)(i) – 1000 or equivalent with no or incorrect answer*

2

(b) (i) sweat(ing)

allow evaporation

allow perspiration

1

(ii) any **one** from:

- for cooling
- to maintain body temperature

1

(c) (i) More water was lost through the skin.

1

(ii) decrease

1

[7]

Q4.

(a) (i) receptor cells

1

(ii) eye(s)

accept retina

1

(b) (i) any **one** from:

- gender / sex
- quality of eyesight

eg wearing glasses

- eg of factor that might affect reaction times

eg alcohol consumption / distractions / tiredness / health / time of day / amount of practice (at this test)

do not allow time / age

1

(ii) 182

allow 182.0

1

(iii) Any anomalies can be identified.

1

(iv) reaction time (too) long **or** reactions (too) slow

1

allow reaction time (too) slow

*allow examples of data quoted **or** derived from the table, eg (mean) reaction time for 90 year olds is 162 ms longer than for 75 year olds*

(so) more likely to have / cause an accident

1

[7]

Q5.

(a) (i) The person started running a race.

1

(ii) 2300

1

(iii) drinking (water / sports drink)
or
through eating

1

(b) (i) brain

1

(ii) receptors

1

(c) cools us down

allow evaporates

1

[6]

Q6.

(a) (i) any **one** from:

- glucose
- oxygen
- carbon dioxide
- urea
- water

allow hormones

allow named example of a product of digestion

1

(ii) (cardiac) muscle

allow muscular

1

(b) (i) **B**

1

(ii) **D** atrium / atria

ignore references to left or right

1

E ventricle(s)

ignore references to left or right

1

(c) (i) a vein

1

(ii) an artery

1

(iii) keeps artery open / wider

allow ecf from part cii

1

(so) blood / oxygen can pass through (to the heart muscle)

1

[9]

Q7.

blood vessels supplying skin

1

constrict

allow vasoconstriction

*do **not** allow capillaries /veins constricting*

*do **not** allow moving blood vessel*

1

less blood flow (to / through capillaries / to skin)

allow blood flows further away from skin surface

1

so less energy is lost (to the surroundings)

allow less heat is lost

1

'shivering' by muscle (contraction)

allow muscles contract (and relax) rapidly

1

releasing energy **or** respiring (more)

allow 'heat produced'

*do **not** allow energy produced / made*

*do **not** allow energy **for** respiration*

allow sweating stops / reduces

ignore hair erection

1

[6]

Q8.

(a) detect changes in surroundings **or** detect stimuli

allow any named stimulus for skin

1

convert information to impulse

allow send impulse to sensory neurones / brain

1

(b) (i)

muscle	contract(ion)
gland	release / secrete / produce chemical / hormone / enzyme

***1** mark for each effector*

***1** mark for each response*

response must match type of effector (if given)

ignore examples

ignore relax(ation) / movement for contraction

*do **not** allow expansion for muscles*

4

(ii) any **one** from:

- (maintain temperature at which) enzymes work best
- so chemical reactions are fast(est)
- prevent damage to cells / enzymes

allow prevent enzymes being denatured (by temperature

being too high)

1

[7]

Q9.

Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 – 2 marks)
There is a description of thermoregulation **or** at least one correct mechanism (skin, sweat glands or muscles) but roles may be confused.

Level 2 (3 – 4 marks)
There is a description of thermoregulation **or** some correct mechanisms (sweating, shivering, blood flow in the skin).

Level 3 (5 – 6 marks)
There is a clear description of thermoregulation by TC or skin **and** some correct control mechanisms.

examples of biology points made in the response:

full marks may be awarded for detailed description of what happens if the core temperature is <u>either</u> too high <u>or</u> too low

- temperature receptors in TC
- the TC detects (core) body / blood temperature
- temperature receptors in the skin send impulses to the TC, giving information about skin temperature
- if the core body temperature is too high: blood vessels / arterioles supplying the skin capillaries dilate / vasodilation

  ***do not** accept refs to veins instead of arterioles or answers that imply blood vessels have moved up / down through the skin.*
- so that more blood flows (through the skin) and more heat is lost
- sweat glands release more sweat to cool the body
- by evaporation
- if the core body temperature is too low: blood vessels supplying the skin capillaries constrict
- to reduce the flow of blood (through the skin) and less heat is lost

  allow idea of blood diverted to vital organs in extreme cold
- muscles may shiver to release (heat) energy
- from respiration, some of which is lost as heat

[6]

Q10.

(a) (i) 400

*correct answer = **2** marks with or without working*

2600 – (1500 + 600 + 100)

or

2600 – 2200
*for **1** mark*

2

(ii) LHS: glucose
accept $C_6H_{12}O_6$ / C6H12O6 / sugar

1

RHS: carbon dioxide
accept CO_2 / CO2
*do **not** accept CO^2 / CO*

1

(iii) (sweat) increase

1

(urine) decrease

1

(b) (i) 66.7 / 66.67 / $66\frac{2}{3}$ / $66.\dot{6}$ / 67
accept answers in range
*correct answer = **2** marks with **or** without working*
or
$\frac{20}{0.3}$ *for **1** mark*

or 66 / 66.6 / 66.66 / 66.6$\dot{7}$ / 67.0 for 1 mark
*(penalise excessive number of sig. figs. –**1** mark) (eg no more than 2 decimal places)*

2

(ii) reabsorption of water by the kidney

1

(iii) (protein) (too) big

1

cannot pass through filter / stays in blood / cannot enter kidney tubule

1

(glucose) small / can pass through filter

1

all taken back into blood / all reabsorbed
allow the glucose is reabsobed

1

(c) any **four** from:

- transplant is permanent / dialysis is repetitive treatment / dialysis only short term
- kidney works all the time / dialysis intermittent
- concentrations in blood kept (±) constant / substances build up in blood between dialysis sessions

- poisoning / damage to body by build-up of substances (with dialysis)
- danger of infection / damage to blood vessels by needles (with dialysis)
- risk of blood clots with dialysis or anticlotting drugs (can lead to blood loss)
- long term expense of dialysis / excessive use of health service resources
- social point – inconvenience of dialysis described – can eat or drink without constraint with transplant

4

[17]

Q11.

(a) microorganisms

allow microbes / bacteria / fungi / decomposers

1

(microorganisms) respire

*do **not** allow dead plants respire*

1

(respiration / decay / microorganisms) releases (thermal) energy / 'heat'

ignore produce 'heat'

*do **not** allow produce energy*

*do **not** allow dead plants release 'heat'*

1

(b) (i) any **three** from:

- (opening) allows oxygen in
- microorganisms / eggs need oxygen

  allow air for oxygen
- oxygen needed for respiration
- (opening) allows release of carbon dioxide (from microorganisms / respiration / eggs)

  allow gaseous exchange (1 mark) of / for microorganisms / eggs (1 mark) if none of first four points given
- (opening) allows energy / 'heat' to escape
- (closing) retains energy / 'heat' if too cool / at night

  *if no mark awarded for either of these points allow 1 mark for vents open in the day to prevent overheating **and** close at night to prevent it getting too cold*
- (closing) retains moisture

  allow (opening) releases moisture

3

(ii) any **one** from:

- maintains sex balance

  e.g. equal / best / correct numbers of male and female
- (survival of species depends on there being) males and females in population

  allow so the offspring are not all the same sex

1

[7]

Q12.

(a) brain

in correct order only

1

blood

1

sweat

1

(b) (i) A

1

(ii) to replace ions lost (in sweat)

accept salts

allow named examples, eg. prevent cramps

1

(iii) any **one** from:

- there is too much glucose / sugar in the sports drink
- they shouldn't have too much glucose / blood sugar
- it would cause their blood glucose / sugar to rise (too high)

1

[6]

Q13.

(a) (i) (37C is the same as human) body temperature

1

(ii) any **one** from:

- urea
- glucose
- sodium

ignore water

1

(iii) (as they are) small enough to pass through (the membrane)

allow because there is a high concentration in the fake blood and a low concentration in the water (so will diffuse across)

1

(iv) glucose

1

(b) any **two** from:

- don't have to go to hospital **or** done at home rather than hospital
- less effect on lifestyle / can be mobile
- always filtering urea out

continuous is insufficient

- don't need a medical professional (to do it for you)

allow takes a shorter time

allow does not have to be connected to blood vessels
ignore 'less painful'

2

[6]

Q14.

(a) (i) defence against **or** destroy pathogens / bacteria / viruses / microorganisms

*do **not** allow 'destroy disease'*
accept engulf pathogen / bacteria / viruses / microorganism
accept phagocytosis
accept produce antibodies / antitoxins
allow immune response

1

(ii) they are small fragments of cells

1

(b) liver

in this order only

1

kidney(s)

1

(c) any **two** from:

- that it doesn't cause an immune response **or** isn't rejected / damaged by white blood cells
- whether it is a long lasting material / doesn't decompose / corrode / inert
- if it is strong (to withstand pressure)
- it will open at the right pressure
- that it doesn't cause clotting
- that it doesn't leak **or** it prevents backflow
- non toxic

ignore correct size

2

[6]

Q15.

(a) (i) 1 hour 15 mins / 1.25 hours / 75 mins

allow 1:15
ignore 1.15 hours

1

(ii) increase in (core / body) temperature

ignore numbers

1

(due to an) increase in <u>respiration</u> **or** more <u>muscle</u> contraction

1

releasing energy (as a waste product)

allow produces 'heat'

*do **not** allow making energy*

1

skin temperature decreases

1

(because there is) sweating

1

(which) evaporates and cools the skin

ignore references to vasodilation or vasoconstriction

1

(iii) (there is) dilation of vessels (supplying skin capillaries)

allow vasodilation

allow blood vessels widen

ignore expand

*do **not** accept dilating capillaries or moving vessels*

1

(so) more blood flows (near skin) (surface) **or** blood is closer (to the skin)

ignore ref to heat

1

(c) pancreas detects (low) blood glucose

1

produces glucagon

*do **not** allow glucagon made in the liver*

1

(so) glycogen is converted to glucose

allow adrenaline released which increases conversion of glycogen to glucose

or

reduced insulin production so less glucose into cells / less glucose converted to glycogen

for 1 mark

1

[12]

Q16.

(a) (i) **A** – pituitary

allow hypothalamus

1

B – ovary / ovaries

1

(ii) in blood (stream)

accept in plasma

ignore dissolved

1

(b) (i) FSH and Luteinising Hormone (LH)

1

(ii) fertilised
OR
reference to sperm

1

form embryos / ball of cells or cell division

1

(embryo) inserted into mother's womb / uterus
allow (fertilised egg) is inserted into mother's womb / uterus

1

(iii) any **one** from:

- multiple births lead to low birth weight
- multiple births cause possible harm to mother / fetus / embryo / baby / miscarriages
  allow premature
  ignore reference to cost / ethics / population

1

(c) (i) any **one** from:

- almost identical
  allow S (slightly) more successful
- both approximately 20%

1

(ii) larger numbers (in clinic R) (in 2007)
allow only 98 (in S) (compared to 1004 (in R))

1

results likely to be more repeatable (in 2008)
allow more reliable
*do **not** accept more reproducible / accurate / precise*

1

[11]

Q17.

(a) pancreas
apply list principle

1

(b) (i) protein
apply list principle

1

(ii) any **one** from:

- (controlling / changing) diet

accept sugar(y foods) / named eg
ignore references to starch / fat / protein / fibre

- exercise
  accept example, eg go for a run
- pancreas transplant
  accept named drug eg metformin

1

(c) (i) increase
ignore reference to women

1

then fall

1

relevant data quote (for male)
eg max at ages 65–74 ***or*** *starts at 10 (per thousand)* ***or*** *max at 130 (per thousand)* ***or*** *ends at 120 (per thousand)*
accept a difference between any pairs of numbers in data set
accept quotes from scale eg '130' or '130 per thousand' but ***not*** *'130 thousand'; to within accuracy of +/- 2 (per thousand)*

1

(ii) (between 0 and 64) more females (than males) **or** less males (than females)
ignore numbers
allow eg females more diabetic than males

1

(over 65) more males (than females) or less females (than males)
allow eg males more diabetic than females

1

[8]

Q18.

(a) Pancreas
allow phonetic spelling

1

(b) any **three** from:
max 2 *if any one process goes on in wrong organ*

- (amino acids) broken down
- (amino acids) form urea
- (amino acids broken down / converted **or** urea formed) in liver
- (urea / broken down amino acids) removed / filtered by kidney
  do ***not*** *allow amino acids filtered / removed by kidney*
- (urine / urea / broken down amino acids) stored / held in bladder

*do **not** allow amino acids stored / held in bladder*

3

[4]

Q19.

(a) a higher concentration would be difficult to stir

1

(b) (i) methane

1

(ii) 60

100 - (5 + 35) but incorrect answer allow 1 mark

2

(c) (i) aerobic respiration

1

(ii) oxygen

1

[6]

Q20.

(a) (i) water

1

(ii) small

1

(iii) 3.15

1

(b) (i) 21 000

1

(ii) 2 years

1

(iii) prevent rejection

1

[6]

Q21.

(a) (i) without <u>oxygen</u>

ignore reference to 'air'

1

(ii) otherwise difficult to stir / to pump / to transfer

allow prevent 'clogging' owtte

1

(iii) need to stir / pump / heat

1

(b) (i) rises then falls

1

then levels / slight rise

1

quantitative descriptor
- e.g. to 80% / max. on day
4 / min. on day 16

accept other valid quantitative descriptor

allow accuracy ± ½ small square

1

(ii) 16 (15.5 to 16.4)

1

(c) any **two** from:

- oxygen present
- (CO_2 produced) by aerobic respiration

  or not much anaerobic respiration
- **not** much methane / CH_4 produced

2

[9]

Q22.

(a) (i) **A**

1

(ii) (protein) molecule is large

ignore letters

1

cannot pass through filter

(protein is) too big to get through the filter = 2 marks

1

(b) **B** is taken back into the blood **or**
B is reabsorbed

1

reabsorbed completely

or reabsorbed after filtration

1

(c) RBC is too big to pass through filter

1

Haemoglobin is inside red blood cells
or haemoglobin released when RBC bursts

1

Haemoglobin is small enough to pass through filter

or haemoglobin diameter

1

[8]

Q23.

(a) (i) kidney

1

(ii) bladder

1

(iii) liver

1

(iv) lung(s)

1

(v) skin

1

(b) (i) 3000

allow 2970 to 3030

*correct answer gains **2** marks with or without working*

*if answer incorrect allow **1** mark for evidence of 1550 + 450 + 1000 (allow tolerance of + or – ½ square on each)*

2

(ii) 1600

allow 1570 to 1630

1

(iii) 1400

allow (b)(i) – (b)(ii)

1

(iv) correct plot from (b)(iii)

tolerance ½ square ignore width

1

(v) cells swell / overhydrated / damaged

accept poisoned (by urea)

1

[11]

Q24.

(a) pancreas

allow phonetic spelling

1

(b) (i) A

1

shortest / quicker time (to work)

1

(ii) D

1

acts for longest time

mark dependent on D

allow D will last until 09.00 / breakfast / 24 hours

1

(iii) diet / exercise

if 'diet' is qualified, then will need correct qualification, e.g. 'less carbohydrate / sugar'

accept pancreas transplant / stem cell treatment

1

[6]

Q25.

(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]

Q26.

(a) (concentration high) in the hepatic portal vein is blood with glucose absorbed from the intestine

1

concentration is lower in the hepatic vein because insulin

1

(has caused) glucose to be converted into glycogen

1

or

allows glucose into liver cells

(b) (i) (after 6 hours) most of the glucose has been absorbed from the intestine **or** from food into the blood

1

(ii) because glucagon (made in the pancreas) causes

if biological terms incorrectly spelt they must be phonetically accurate

*do **not** accept glucagon made / produced by the liver*

1

glycogen to be converted into glucose

1

glucose released into blood

allow the liver maintains the correct / constant level of glucose in the blood

1

[7]

Q27.

(a) (i) any **one** from:

- chemical messenger / message
  allow substance / material which is a messenger
- chemical / substance produced by a gland
  allow material produced by a gland
- chemical / substance transported to / acting on a target organ
- chemical / substance that controls body functions

1

(ii) gland / named endocrine gland

brain alone is insufficient

allow phonetic spelling

1

(iii) in blood / plasma **or** circulatory system **or** bloodstream

accept blood vessels / named

*do **not** accept blood cells / named*

1

(b) *each hormone must be linked to correct action*
apply list principle
ignore the gland producing hormone

FSH stimulates oestrogen (production) / egg maturation / egg ripening
ignore production / development of egg

1

oestrogen inhibits FSH
allow oestrogen stimulates LH / build up of uterine lining

1

LH stimulates egg / ovum release / ovulation
accept LH inhibits oestrogen
accept LH controls / stimulates growth of corpus luteum
ignore production of egg

1

[6]

Q28.

(a) Y - spinal cord / central nervous system / CNS
*do **not** accept spine*
ignore nerve / nervous system / coordinator
ignore grey / white matter

1

W - receptor / nerve ending
ignore sensory / neurone / stimulus

1

X - effector / muscle
allow gland

1

(b) any **two** from: eg
accept reverse argument for each marking point

- reflex action quicker
- effect of reflex action over shorter period
- hormone involves blood system and reflex involves neurones / nerve cells
ignore nervous system / nerves
- reflex involves impulses and hormone involves chemicals
- reflex action affects only one part of the body
ignore involves brain
ignore outside / inside stimuli

2

[5]

Q29.

(a) (i) the lower the temperature the shorter the time

a trend is required

accept reverse

or

the lower the temperature the more chance of frostbite

accept the lower the temperature the faster you get frostbite

*accept positive correlation but **not** directly proportional*

ignore wind speed

1

(ii) any value from 5 to below 10

*do **not** accept 10*

*allow less than 10 **or** < 10*

1

(b) Muscles 'shiver'

*if more than two boxes ticked deduct **1** mark for each additional tick*

1

Blood vessels supplying the skin capillaries constrict

1

[4]

Q30.

(a) B

1

less / no insulin (produced) **or** insulin produced in pancreas

allow pancreas can't monitor (blood) sugar (level)

ignore pancreas can't control (blood) sugar (level)

allow increased glucagon production

*allow A as liver stores less glucose / sugar for **2** marks only*

1

(b) (i) (it / protein / insulin) digested / broken down

if ref to specific enzyme must be correct (protease / pepsin)

ignore denatured

*do **not** accept digested in mouth / other incorrect organs*

1

(ii) any **two** from:

ignore injections

- (attention to) diet

*accept examples, eg eat less sugar(y food) **or** eat small regular meals*

allow eat less carbohydrate / control diet

ignore cholesterol or balanced / healthy diet

- exercise
  ignore keep fit / healthy
- (pancreas) transplant / stem cells / genetic engineering

2

[5]

Q31.

(a) 0.18

award both marks for correct answer irrespective of working
if no answer or incorrect answer
*allow **1** mark for 45 × 100 / 25000*

2

(b) heat / thermal

allow heat <u>from</u> respiration

1

(c) energy / mass / biomass lost / not passed on **or** energy / mass / biomass is used **or** not enough energy / mass / biomass left

ignore reference to losses via eg respiration / excretion / movement / heat

1

a sensible / appropriate use of figures including heron

*eg <u>only</u> **2** from frog / to heron*
ignore units

1

(d) any **three** from:

accept marking points if candidate uses other terms for microorganisms

- (microorganisms) decay / decompose / digest / breakdown / rot
  ignore eat
- (breakdown) releases minerals / nutrients / ions / salts / named
  ignore food
- (microorganisms) respiration
  ignore other organisms respiring
- (microorganisms / respiration) release of carbon dioxide

3

[8]

Q32.

(a) (i) (too) big

1

cannot fit / pass through filter / through (pores) in membrane / cannot be filtered

*too big to be filtered = **2** marks*

1

(ii) water

1

(iii) partially permeable

1

(b) any **two** from:

- hazards of operation / named eg
- may be rejected **or** need to use immunosuppressant drugs / long term drug use **or** transplant may need to be replaced
- susceptible to other infections
- shortage of donors
- high <u>initial</u> cost

2

[6]

Q33.

(a) proteins are not filtered

1

glucose is filtered and (re)absorbed

allow glucose (completely) <u>re</u>absorbed

1

ions are filtered and some (re)absorbed

allow some ions are <u>re</u>absorbed

1

urea is filtered [and some / none (re)absorbed]

allow some / no urea is <u>re</u>absorbed

1

(b) <u>more / a lot of</u> sweating occurred

accept converse arguments for cold day

1

<u>more / a lot of</u> water loss (by sweating)

1

<u>more / a lot of</u> water reabsorption / <u>more</u> water absorption by the kidney

1

lower volume of urine

allow less urine / less water in urine

1

[8]

Q34.

(a) too cold / very cold **or** oxygen / microbes cannot reach it

allow not enough energy / heat / warmth

ignore frozen

1

for microorganisms / microbes / bacteria / fungi / enzyme / reaction (to work)

ignore other consumers

1

(b) no longer exist
or no more left
or died out / all died

ignore died unqualified

1

(c) (i) egg cell

1

(ii) nucleus

1

(iii) given an electric shock

1

(iv) womb

1

(d) has mammoth genes / chromosomes

accept genetic information / DNA / alleles / nucleus
accept converse

1

[8]

Q35.

(a) any **one** from:

- (in) food / named

allow eating

- (from) respiration

*do **not** allow breathing*

1

(b) (i) the greater / heavier the body mass the more water (should be drunk)

ignore references to hot / cold day
accept positive (relationship)
ignore figures unqualified

1

(ii) 2200

1

(iii) 400

*award **2** marks for correct answer, irrespective of working*
*allow ecf from b(ii) for **2** marks*
*if no answer or incorrect answer: 2200 - 1800 **or** b(ii) - 1800 gains **1** mark*

2

(c) need to replace water lost / prevent dehydration / keep hydrated

idea of balancing input and output

1

from / by (more) sweat

ignore other losses

1

(d) kidney

1

[8]

Q1.

(a) (i) insulin

accept glucagon (correct spelling only)

1

(ii) pancreas

accept phonetic spelling

allow pancrease

1

(b) (i) 11(.0)

accept in range 10.5-11 (.0)

1

(ii) any **two** from:

ignore numbers unless comparative

- high(er) concentration (of blood glucose) (anywhere / any time)
  accept 115 <u>not</u> 88
  139 <u>not</u> 99
- large(r) increase (in concentration after the drink)
  accept increase by 24 <u>not</u> 11 / their b(i)
- fast(er) / steep(er) rise
  accept it takes 3 hours <u>not</u> 1 ¼ hours to get back to original level
  accept it takes a long time to get back to normal
- slow(er) fall

2

(iii) any **one** from:

- insulin present / produced
  accept glucagon not produced
- (used in) respiration
  allow exercise
- taken into cells
  allow converted to glycogen
  allow taken into liver (cells) / muscle (cells)
  allow produce / make energy

1

[6]

Q2.

(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 <u>heat loss</u>

1

[4]

Q3.

(a) (i) 94.9

correct answer with or without working

*if answer is incorrect 100 - (2.5 + 2.6) gains **1** mark*

2

(ii) protein molecules in the plasma cannot pass through the filter in the kidney

1

(b) (i) partially permeable

1

(ii) the same as

1

(c) any **one** from

- hazards of operation / named example
- may be rejected / need to use immunosuppressant drugs / need to find (tissue) match

allow long term drug use

- not enough donors

allow a long waiting list

- transplants have a limited life

1

[6]

Q4.

(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]

Q5.

(a) (i) lung

1

(ii) kidney

1

(iii) bladder

1

(b) (i) more

1

the same

1

less

allow synonyms

1

(ii) cools / reduces temperature

or

prevent overheating

ignore reference to sweat

1

[7]

Q6.

(a) pancreas

allow phonetic spelling

1

(b) 4(.0) to 7.2 **or** 7.2 to 4(.0)

1

(c) 13 – 7 = 6

*working shows 6 = **1** mark*

1

6/2 = 3 units

*accept the correct answer to the calculation, 3 units, for **2** marks, irrespective of working*

1

increase (dose)

accept indication of increase, eg extra / more / + could be in working lines

1

[5]

Q7.

(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]

Q8.

(a) in table, in sequence:

allow descriptions for increase / decrease

decrease

1

increase

1

(b) **No**

older have lower % / less chance of rejection (than younger) (1)

allow figures

older have higher % / more chance of still working (after 5 years than younger)

allow figures

allow in older patients kidney works for longer

1

or

Yes

*allow max **1** mark if Yes*

older have lower % / less chance of surviving (at least 10 years than younger)

allow older people are more likely to die

1

[4]

Q9.

(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]

Q10.

(a) insulin

extra ring drawn cancels the mark

1

(b) pancreas

extra ring drawn cancels the mark

1

(c) diabetes

extra ring drawn cancels the mark

1

[3]

Q11.

(a) 1800

allow - / minus 1800

1

(b) 3200

award both marks for correct answer irrespective of working

allow - / minus 3200

*award **2** marks for 200 or -200 irrespective of working*

allow ecf from part (a) for both routes to 2 marks

*if no answer **or** incorrect answer then indication of addition of 1800 **or** their (a), 1000 and 400 gains **1** mark*

2

(c) drink more / take in more from food & drink

allow ecf from (b), ie if answer to (b) is less than 3000 then accept drink less

if answer to (b) is exactly 3000 accept do nothing

1

200 (cm^3)

accept ecf from (b) answer should be difference between (b) and 3000 if answer to (b) is 3000 accept they are the same

***NB** drink / take in 3200 (cm^3) of water = **1** mark*

*drink / take in 200 (cm^3) of water = **2** marks*

ignore references to exercise / sweat

1

[5]

Q12.

(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]

Q13.

(a) (protein molecules too) big **or** larger than pore size

allow cannot fit through the pores / hole / gaps

1

(b) (i) diffusion

1

(ii) high to low concentration

ignore along gradient / across gradient

or high concentration in blood, low concentration in dialysis fluid

allow there is none in dialysis fluid

or down concentration gradient

or correct use of numbers

1

(c) any value between 3.15 and 3.25 (inclusive)

1

(d) (i) any **two** from:

- kidney works all the time **or** dialysis works for short time

  ignore enables an active life

  or

  dialysis needs regular trips to hospital / regular treatment / long term treatment

  accept kidney transplant is one off treatment

- kidney maintains correct concentration all the time **or** no build-up as between dialysis sessions
- no need to regulate diet **or** correct example – eg low salt / low protein / low fluid intake as with dialysis
- cheaper in the long term

2

(ii) any **two** from:

- rejection / described **or** need to use immunosuppressants **or** need to take drugs for life

allow may need later replacement

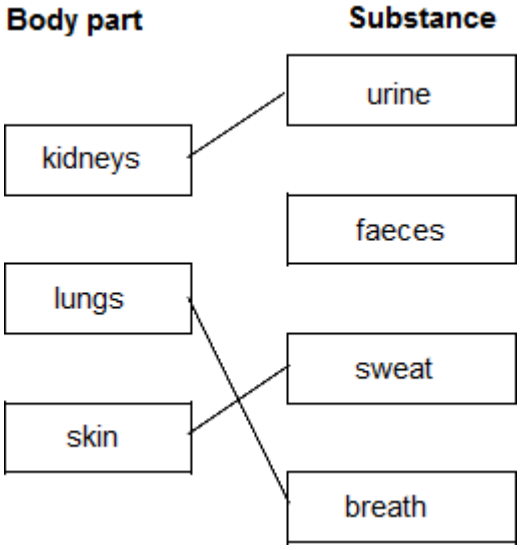
- susceptible to other infections
- hazards of operation / anaesthetic
- shortage of donors / match
- high initial cost

2

[8]

Q14.

(a)



1 *mark per correct line*
extra line from a body part cancels the mark

3

(b) (i) 1800 cm^3

1

(ii) decreases

1

(iii) any **one** from:

- less / no sweat
- less / no cooling (needed)
- less / reduce / no heat loss / keep warm

1

(c) increases

1

[7]

Q15.

(a) pancreas

1

(b) the diabetic should get more energy from fat

1

the diabetic should get less energy from carbohydrate

1

(c) (use) insulin

allow pancreas / stem cell transplant

*do **not** allow injection / transplant /stem cells / tablets alone*

ignore exercise

1

[4]

Q16.

(a) three layer triangular pyramid

either way up (as blocks or triangle)

1

(soya / beans / food – trout / fish – people / human (in sequence)

ignore reference to producers /herbivores / consumers

*award **1** mark only for a correct food chain with 2 correct arrows showing energy flow*

1

(b) the trout release energy when they respire

1

some energy will be lost in waste from the trout

1

(c) any **one** from eg

- easy / easier to catch / more caught

  allow easy / easier to monitor

- easy / easier to feed

  allow control food

- no / less predation

  allow less fishing / poaching

- less energy loss

  allow grow faster

- less movement

  ignore less space to move

  *do **not** allow easier to farm*

1

(d) any **two** from:

- microorganisms / bacteria /decomposers / microbes / fungi /detritus feeders
- decay / rot / decompose / digest /break down
  ignore biodegrade
- (microorganisms) respire
  *do **not** award this mark if response implies the trout respire*
- turned into fossil fuels / named fossil fuels
- carbon dioxide / CO_2 released

2

[7]

Q17.

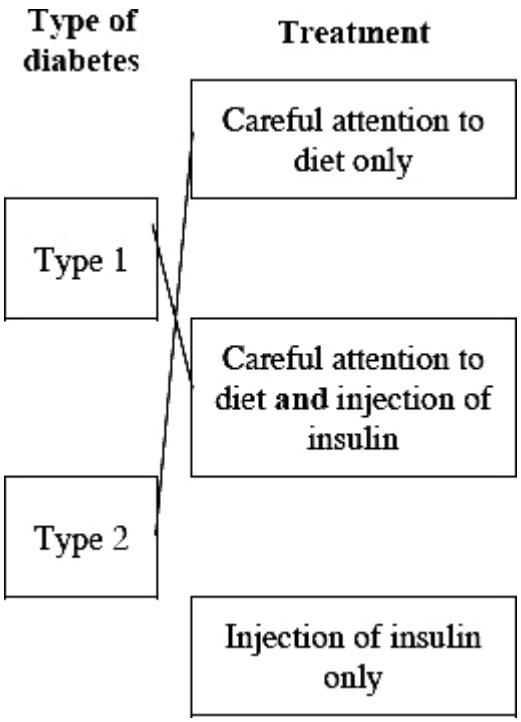
(a) (i) pancreas
allow phonetic spelling

1

(ii) (increases movement of) glucose into cells / organs / named
allow (glucose) converted to glycogen / fat
allow (glucose) used in (increased) respiration
*do **not** allow hybrid spellings of glycogen*

1

(b)



***1** mark per correct line*
extra line from a type of diabetes cancels the mark

2

(c) (i) protein

1

(ii) gene / allele

1

(iii) any **three** from:

*max **2** if any one process goes on in the wrong organ*

- (amino acids) broken down /converted
- (amino acids) form / into urea
- (break down / convert / urea formed) in liver
- (urea / broken down amino acids) removed / filtered by kidney
- (urea / broken down amino acids) in urine
- (urine / urea / broken down amino acids) stored / held in bladder

3

[9]

Q18.

(a) (i) water

1

(ii) small

1

(iii) 3.15

1

(b) (i) 21 000

1

(ii) 2 years

1

(iii) prevent rejection

1

[6]

Q19.

(a) (i) protein

1

(ii) (protein molecules too) large

1

cannot pass through filter **or** can't leave blood **or** can'it 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]

Q20.

only 24 students tested **or** only one test **or** reference to lack of controls eg gender / age

1

students could drink as much water as they wanted

or

some students drank more water than others

or

some students drank water and beer

1

differences only slight
ignore effects of beer or promotion of beer drinking

1

[3]

Q21.

(a) pancreas

1

(b) any **one** from

- (controlling / changing) diet
  accept descriptions as to how diet could be changed eg eat less sugar(y foods) ignore reference to fat / protein
- exercise
  accept example eg go for a run
- pancreas transplant
  accept named drug eg metformin

1

(c) (i) increase

ignore reference to women

1

then fall

1

relevant data quote (for male)

max at ages 65 - 74

eg starts at 10 (per thousand) ***or*** *max at 130 (per thousand)* ***or*** *ends at 120 (per thousand)*

accept a difference between any pairs of numbers in data set

quoting of scale or per thousand but not 'thousands'

accuracy ± 2

1

(ii) *ignore numbers*

(between 0 and 64) more females (than males) / less males

allow eg females more diabetic than males

1

(over 65) more males (than females) / less females

1

[7]

Q22.

(a) (i) liver

1

(ii) kidney

allow urethra / bladder

ignore ureter

1

(iii) (excess) protein / named / amino acids

accept amino / ammonia

1

(b) less / no sweating

allow ideas of how sweat glands change in order to reduce sweating

1

less heat lost / evaporation

1

(c) (i) become narrower / constrict

allow contract / get smaller etc

allow less blood flows through vessels

do ***not*** *allow capillaries become narrower* ***or*** *reference to movement of vessels*

1

(ii) reduced / no heat loss

allow heat gained from room

1

[7]

Q23.

(a) (i) too large to pass through the filter

1

(ii) passed through the filter, then reabsorbed into blood

1

(iii) water is reabsorbed from the filtrate into the blood

1

(iv) water, urea and sodium ions

1

(b) (i) less urine

1

(ii) more concentrated

1

[6]

Q24.

(a) (i) movement of atoms / molecules / ions

accept particles

allow dissolved substances

ignore reference to membranes

1

(substance) moves from high to low concentration

allow down the gradient ignore across / along / with a gradient

1

(ii) any **two** from:

- movement of molecules / ions

  accept particles

  allow dissolved substances this point <u>once</u> only in (a)(i) and (a)(ii)

- from low to high concentration

  allow up / against the gradient

  ignore across / along / with a gradient

- requires energy / respiration

  accept requires ATP

2

(b) • **<u>filtration</u>** of blood **or**

described re small (molecules)through / large not

ignore diffusion

1

max **four** from:

- **reabsorption** / substances taken back into blood
- (reabsorption) of all of the sugar / glucose
- (reabsorption) of some of ions / of ions as needed by body
- (reabsorption) of some of water / of water as needed by the body
- urea present in urine

  accept urea not reabsorbed
- reabsorption of water by osmosis / diffusion **or** reabsorption of sugar / ions by active transport

4

[9]

Q25.

(a) respiration

clear indication eg tick, underlining, others crossed out

1

(b) lungs

1

(c) liver

1

(d) amino acids

1

[4]

Q26.

(a) the sun / light / sunshine / solar

allow radiation from the sun
ignore photosynthesis / respiration
apply list principle
*do **not** allow water / minerals / heat*

1

(b) 2.5 (:1)

correct answer with or without working

ignore rounding with correct working
*do **not** allow other equivalent ratios for both marks*
*evidence of selection of 10(insects) **and** 4(frogs) **or** 50 **and** 20 **or** 1 **and** 0.4 for **1** mark*

if no other working allow **1** mark for 0.4:(1) on answer line

2

(c) any **two** from:

*allow for insects **or** frogs*

allow energy for biomass

- some parts indigestible / faeces
- waste / examples of waste eg urea / nitrogenous compounds / urine / excretion
- movement / eg of movement

  allow keeping warm
- heat
- not all eaten / eg of not all eaten
- respiration

  do not accept energy for respiration

2

(d) any **four** from:

- (bodies) consumed by animals / named / scavengers / detritus feeders
- microorganisms / bacteria / fungi / decomposers
- reference to enzymes
- decay / breakdown / decompose / rot

  ignore digest(ion)
- respiration
- carbon dioxide produced
- photosynthesis
- sugar / glucose produced

  accept other organic molecules
- fossilisation / fossil fuels / named
- combustion / burning

  must be linked with fossilisation / fossil fuels
- (burning) produces carbon dioxide

  allow carbon dioxide produced once only

4

[9]

Q27.

(a) (i) pancreas

allow phonetic spelling

1

(ii) glucose into cells / liver / muscles

allow any named organ / cell

allow turned into / stored as glycogen

but

*do **not** allow hybrid spellings for glycogen*

allow increases respiration

allow stored as / turned into fat

1

(b) (i) reference to "98.6% of all people who used Diacure reported an improvement in their condition".

*allow claim **1** / **1** / the first one*

1

(ii) (only) 30 patients **or** not enough / not many patients

*allow only one trial **or** only done once **or** not repeated*

ignore bias

1

(iii) little effect / difference

allow no effect

allow only drops by 4 (±1)

1

suggest drug is not effective (in long term)

allow wouldn't persuade people to take it

1

(iv) avoid bias / owtte

eg company could change / ignore results / might lie

ignore fair / accurate / reliable / valid

1

[7]

Q28.

(a) respiration

*allow muscle contraction **or** muscle movement **or** exercise of muscles*

allow metabolism / chemical reactions

1

(b) (i) any **two** from:

- less / no water (available) for sweat

allow dehydrated so less sweat

allow converse if evident that response refers to athletes who have drunk liquid

- less / no heat lost / less / no cooling
  only need to refer to less / no once
- less / no evaporation (of sweat)

2

(ii) **either**

blood vessels supplying the skin **or**
blood vessels in skin

*do **not** allow first mark if implied that skin capillaries dilate*

1

dilate / widen / muscles relax

ignore enlarge / open
*vasodilation in skin = **2** marks*
*allow hairs lie flat for **1** mark*
*allow less insulation for **1** mark if linked to hairs*
*allow more blood in skin for **1** mark if no other marks awarded*

1

(c) (i) cold / 15°C cools the body / blood (more)

***or** reverse argument*
ignore reference to values for body temperature derived from graph

1

(ii) any **two** from:

- cools slower at 15°C cold / 15°C
  allow converse arguments
- cold / 15°C causes reduced blood flow to surface / skin
  ignore reference to capillaries
- blood not cooled as much / as quickly
- cold / 15°C causes shivering
- muscles contract / more respiration / heat made

2

[8]

Q29.

(a) 178

ignore working or lack of working
*correct working: 180 – 2 but no answer / wrong answer = **1** mark*

2

(b)

Man A	Man B
higher	lower
lower	higher
lower	higher

all 4 cells correct = **2** marks
2 or 3 cells correct = **1** mark
0 or 1 cells correct = **0** mark

2

[4]

Q30.

(a) (i) **A**

1

(ii) (protein) molecule is large
ignore letters

1

cannot pass through filter
*(protein is) too big to get through the filter = **2** marks*

1

(b) **B** is taken back into the blood **or B** is reabsorbed

1

reabsorbed completely
or reabsorbed after filtration

1

(c) RBC is too big to pass through filter

1

Haemoglobin is inside red blood cells
or haemoglobin released when red blood cell bursts

1

Haemoglobin is small enough to pass through filter
or haemoglobin diameter < pore diameter

1

[8]

Q31.

(a) $\frac{1}{5}$ / 20% / 1 in 5 / 1 : 4 / 0.2 /
any correct proportion
ignore working
*do **not** allow 1 : 5*

$\frac{600}{3000}$ / 600 : 2400 / 600 in 3000

*award **1** mark for*
*selection of 3000 **and** 600*

2

(b) (i) sweat / sweating / perspiring

allow cooling / for cooling / to lose heat / to cool

1

(ii) the volume of water in the urine decreases.

1

the volume of water taken as food or drink increases.

1

(c) (i) liver

apply list principle

1

(ii) kidney

apply list principle

1

(iii) bladder

apply list principle

1

[8]

Q32.

(a) (i) 50

*award **2** marks for correct answer irrespective of working*
*award **1** mark for selection of 60 **and** 10*

2

(ii) any **two** from:

- increases
- (then) decreases
- highest at 65 – 74 (years old) **or** maximum 112 (per thousand)

allow peaks at 65 - 74
ignore comparisons with men

2

(b) (i) stomach

1

(ii) any sensible reference to diet **or** carbohydrate intake **or** pancreas / stem cell transplant

*eg eat less / no sugary food **or** eat more fibre **or** go on a diet **or** watch what you eat*
ignore eat more protein

*do **not** accept reduce salt*

1

[6]

Q33.

(a) mineral ions

1

water

*each extra box ticked cancels **1** mark*

1

(b) (i) blood plasma

1

(ii) dialysis fluid

1

(iii) diffusion

1

(iv) partially permeable

1

(v) small

1

(c) drug treatment is needed to suppress the immune system

1

[8]

Q34.

(a) (i) (wholemeal bread)
any **two** from:

lower maximum / peak / less change

1

slower rise / change
*ignore references to rate of fall **or** first to peak*

need to take less insulin / less likely to hyper
*no mark for identifying the type of bread but max **1** mark if not identified*

1

(ii) any **four** from:

- amylase / carbohydrase
- starch to sugar
  allow starch to glucose
- (sugar) absorbed / diffused / passes into blood

- correct reference to pancreas
  allow once only as rise or fall
- insulin produced
- glucose (from blood) into cells / tissue / organ **or** named tissue / organ
  allow glucose to glycogen
- glucose used in respiration / for energy
  max 3 for explaining rise
  max 3 for explaining fall

4

(b) any **three** from:

advantages (compared to insulin injections):

- (may be) permanent / cure
- no / less need for self monitoring
- no / less need for insulin / injections
  ignore reference to cost
- no / less need for dietary control

disadvantages (compared to insulin injections):

- low success rate
- (may) still need insulin / dietary control
- operation hazards
- risk of infection from donor
- rejection / need for drugs to prevent rejection
  *max **2** if only advantages **or** only disadvantages discussed*
  can give converse if clear that it relates to insulin injections

3

[9]

Q35.

(a) (i) no effect / little effect

1

(ii) reduced
ignore reference to later increase

1

(b) (i) more (re)absorption
do not allow if extra incorrect reference to filtration made

1

or more (material) taken into blood

of water

*allow **only** if linked to reabsorption*
*do **not** accept water if in a list of substances*

1

(ii) ions in blood diluted

1

or concentration of ions decreases

increased water reabsorption

do not allow if extra incorrect reference to filtration made

or more water present in blood

accept sensible alternative suggestion
eg reabsorption of ions disrupted

1

[6]

Q1.

(a) (i) lungs

1

(ii) skin

1

(iii) kidneys

1

(b) (i) (as sweat lost,) performance falls

1

(ii) drink water / sports drink

ignore antiperspirant

1

[5]

Q2.

(a) 4000

*award **both** marks for correct answer, irrespective of working*

*1500 + 2000 + 500 gains **1** mark*

2

(b) day 2 (no mark)

any **two** from:

*max **1** mark if correct day not identified or if no day given*

- more (water in) breath / breathing
- more (water in) sweat / sweating

accept a lot of sweating

- less (water in) urine

*if no other marks awarded allow **1** mark for more water lost on day 2*

2

(c) (i) respiration

1

(ii) cools / removes heat owtte

ignore 'maintains body temperature' unqualified

1

(iii) osmosis

1

[7]

Q3.

(a) any **two** from:

- amylase / carbohydrase
- protease
  allow trypsin
- lipase

2

(b) (i) high / above normal blood sugar
or cannot control blood sugar
allow other symptoms
*eg frequent / plentiful urination **or** sugar in urine **or** thirst **or** weight loss **or** coma*
ignore consequential effects eg blood pressure / circulation / glaucoma / tiredness

1

(ii) any **one** from:

- small / regular meals
- low sugar (meals) or low GI / GL **or** carbohydrates as starch
  allow high fibre
  ignore reference to low carbohydrate

1

(iii) any **one** from:

- keep constant(blood) sugar **or** prevent high (blood) sugar **or** reduces surge / rush of sugar into blood
- reduce the need for insulin

1

(iv) (take) insulin
allow pancreas transplant

1

(c) protein / hormone / enzyme synthesis **or** synthesis of named example **or** combine amino acids

1

[7]

Q4.

(a) (i) thermoregulatory centre (in brain)
accept hypothalamus

1

(receptors sensitive to/measures) temperature of <u>blood</u>

1

(ii) any **one** from:

- receptors (in skin)
- (skin) sends information / signals / impulses / messages to brain / thermoregulatory centre

1

(b) any **three** from:

(cold conditions)

- muscle (X) contracts when cold
- no / less blood through capillaries
- no / less heat lost / radiated
- no / less sweat produced

(hot conditions)

- muscle (X) relaxes/does not contract when hot

  NB X contracts when cold and relaxes when hot = ***2 marks***
- (more) blood through capillaries
- more heat lost / radiated
- more sweat produced

  all other points must be clearly identified by correct conditions

  max ***2*** *if idea of capillaries moving but ignore capillaries dilate*

3

[6]

-

Q5.

(a) (i) bladder

1

(ii) glucose

1

protein

extras – CANCEL

1

(b) (i) any **two** from:

- kidney functions all the time / not just 3 × 8 h sessions a week

allow direct quotation of correct points from the list

- can eat high-protein foods / high salt foods
  allow can eat anything
- cheaper
- waste of time

2

(ii) have to take (immunosuppressant) drugs / consequence of this
eg catch infections / may suffer brain damage / possible rejection of kidney **or** become ill more easily
or
risk of brain damage (due to anaesthetic)
allow direct quotation of correct points from the list

1

(c) (i) urea

1

(ii) 4.2

1

[8]

Q6.

(a) any **three** from:

- glucose enters blood from gut / liver / glycogen
- glucose is <u>filtered out</u> 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) <u>in a healthy person</u>

protein not present because proteins are large (molecules)
or because cannot pass through (filter)

1

<u>in person with disease</u>

lets protein through (filter) owtte

1

(ii) <u>advantages</u>:
up to any **three** from:

- no build-up of toxins / keeps blood conc. ± 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]

Q7.

(a) (i) 1400

*award **2** marks for correct answer if no working shown*
*2400 – (300 + 600 + 100) or equivalent for **1** mark*

2

(ii) $\frac{1}{3}$

1

(b) **A**: chemical reactions

B: food

C: drinking

*all **three** required for **1** mark*

1

(c) cools / reduces temperature

allow 'maintaining body temperature' owtte
*do **not** allow regulate unqualified*
ignore reference to urea
numerical references to temperature should be correct

1

(d) more sweat produced

1

less urine produced

1

[7]

Q8.

(a) pancreas

1

(b) protease

allow proteinase

1

(c) (i) (same) enzymes / named enzymes produced in other parts / named parts of digestive system

if named, enzymes and part must be correct

1

(ii) diet / activity varies / amount of glucose in blood varies

accept too much insulin leads to coma / hypo / low blood sugar

accept too little insulin leads to coma / hyper / high blood sugar

1

(d) any **two** from:

pros

- less / no experimentation on humans
- dogs (more) similar to humans (than lower / named organisms)
- it allows us to find a treatment **or** improves medical understanding

accept allows us to find a cure

cons

- harmful / cruel to dogs

accept kills dogs

- dogs may not be (metabolically) like humans

2

conclusion justified by argument

1

[7]

Q9.

(a)

glucose	☑
urea	☑
water	☑
sodium ions	☑
protein	☐

*all 3 correct = **2** marks*
*2 correct = **1** mark*
*0 or 1 correct = **0** marks*

max 2

(b) (i) protein cannot pass through filter

or

protein (too) large

or

protein stays in the blood

1

(ii) reabsorbed

1

(c) (i) less

1

(ii) more

1

[6]

Q10.

(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

[6]

Q11.

(a) 94.8

1

(b) (i) to cool (the body) / maintain (body) temperature

*do **not** accept let out heat*

1

(ii) water **and** ions

1

(iii) water ignore CO_2, and vapour

1

(c) any **two** from:

used in respiration

provides energy

(energy) needed for movement / running / muscle action

2

[6]

Q12.

(i) dialysis (machine) or kidney machine

1

(ii) (specially chosen kidney) similar tissue type

accept same blood group

1

(irradiation of bone marrow) to stop white cell <u>production</u>

allow any named white blood cell

1

(treated with drugs) suppress immune system

1

(sterile conditions) avoid exposure to pathogens / infection

1

[5]

Q13.

(a) (i) 6

1

(ii) 4

1

(b) (i) pancreas

ignore islets of langerhans

1

(ii) 'X' anywhere between >1 and ≤ 2 hours

anywhere in that column

1

(c) any **four** from:

<u>water</u> movement

*do **not** accept solution*

<u>out</u> of cells

dilute to concentrated solution

accept reference to correct gradient -
*high Ψ to low Ψ **or** high to low 'water concentration'*
*must be unambiguous – i.e. **not** 'high to low concentration'*
accept low to high concentration

reference to partially / selectively permeable membranes **or** described

cells shrink / get smaller

allow crenated
ignore plasmolysed / flaccid / floppy
etc

4

[8]

Q14.

(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

(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 **re**absorption of water

3

[6]

Q15.

(a) urea

1

(b) any **four** from:

- suitable for short term

  accept reverse arguments with respect to transplants
- no long term drug treatment
- no rejection chance
- no / less risk during surgery

  accept risk of anaesthetic
- operations unsuitable / risky for weakness / old age
- risk of infection
- no (suitable) kidneys available for transplant / long waiting list /
- ess painful

4

[5]

Q16.

(a) (i) any **one** from:

- chemical messenger
- chemical / substance released in one part to have effect elsewhere in body
- chemical / substance which affects another / target organ / tissues / cells
  allow chemical from endocrine gland

1

(ii) in blood / circulatory system / any named part including plasma
extra wrong answer would cancel example
***not** red blood cells*

1

(b) **Quality of written communication**:
correct use of at least two relevant scientific term**s** spelt phonetically
e.g. pregnancy, ovulation, FSH, oestrogen, progesterone, ovary, follicle, circulation, thrombosis, feminisation, sperm count, STD
Q ✓ or Q ✗

1

any **three** from:

Oral contraceptives:

(benefit)

- prevent (unwanted) pregnancy **or** prevent egg release
- regulate menstrual cycle / periods

(problems)

- prolonged use may prevent later ovulation / cause infertility
- named side-effect on female body
  e.g. circulatory problems / weight gain / nausea / headache / breast cancer / mood swings
- increased promiscuity / increase in STD's / STI's
- named side-effect on environment
  e.g. feminisation of fish **or** lowered sperm count in human males

Fertility drugs:

(benefit)

- can enable woman to have children **or** to become pregnant
  or stimulates egg release

(problem)

- multiple births

*for full marks must score at least **one** re contraceptives **and** at least **one** re fertility drugs*

*if unclear which type of hormone maximum **2** marks from 3*

3

[6]

Q17.

(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]

Q18.

(a) aerobic

1

respiration

*'anaerobic respiration' = **1** mark*

1

(b) any **five** from:

- glucose is a small molecule
- glucose passes through filter **or** glucose is filtered out of blood **or** glucose enters the capsule / kidney tubule / Q
- glucose reabsorption **or** glucose taken (back) into blood
  *do **not** accept 'filtered' into blood / out of tubule*
- cells lining tubule have microvilli / shape described **or** cells lining tubule have large surface area

- active transport
- up concentration gradient
- use of energy / ATP
- long tubule for more reabsorption

5

[7]

Q19.

(a) (i) (predator) lion

1

(prey) antelope

1

(ii) light

accept other positive indications

1

(iii) in sequence (top to bottom):

lion
antelope
grass

1

(b) (i) bacteria / fungi / saprotrophs

accept moulds / decomposers / microorganisms / microbes / saprophytes / saprobionts

1

(ii) aerobic

1

moist

1

warm

accept other positive indications1

1

(iii) carbon dioxide

1

mineral salts

1

[10]

Q20.

(a) 345 to 350

ignore working or lack of working
use of 355 to 360 ***and*** *10 for* ***1*** *mark*

2

(b) any **two** from:

more sweating (at 37.6 °C)
'more' at least once in the first 2 points

more water loss **or** dehydration occurs
*do **not** accept prevents dehydration only*

blood becomes (more) concentrated / (more) salty **or** need to replace water

stimulation of the hypothalamus

2

(c) any **three** from:

evaporation

of water
*do **not** accept just water loss unqualified*

cools skin **or** uses heat from skin

cools blood / heat from blood (passing through skin)
related to sweating
cooling the blood
ignore vasodilation

3

[7]

Q21.

(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]

Q22.

(a) water content (within the body/blood) is kept constant/ regulated/within very narrow limits/kept right

*do **not** accept general definition of homeostasis*

1

(b) because optimum conditions are needed for processes within the body / enzyme reactions
or
because there is a need to maintain a steady internal environment

1

(c) excretion is the removal from the body of waste **products**

n.b. faeces is not an excretory product but may be neutral

1

because waste products would (build up and) **become** toxic/poisonous/harmful

*do **not** accept makes us ill*
*do **not** accept block up system*
*do **not** accept unwanted products*

1

[4]

Q23.

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]

Q24.

(a) (i) endocrine glands **or** endocrine system

allow a specific named gland

1

(ii) (dissolved) in the blood(stream) **or** plasma

1

(b) (i) pancreas **or** islets of Langerhans

1

(ii) (it **or** insulin) lowers blood sugar level [1]

(by) (speeding up **or** increasing) conversion of glucose to glycogen [1]

in the liver [1]

(and) speeding up **or** increasing uptake of glucose by body cells [1]

4

[7]

Q25.

(i) liver

1

(ii) liver **or** B stores glycogen **or** pancreas **or** D makes insulin

1

clear description of link

1

[3]

Q26.

(a) (i) squirrels eat nuts;

each for 1 mark

owls eat squirrels

(2 marks for energy flow)

2

(ii) hazel tree

gains 1 mark

1

(iii) 1 squirrel population would decrease;
because fewer nuts available as food

each for 1 mark

2

2 owl population would decrease;
because fewer squirrels available as food

each for 1 mark

2

(b) (i) digested/broken down;

(ii) by microbes/reference to worm action;

each for 1 mark

2

(iii) March
warmer/increased activity of worms/microbes;

each for 1 mark

2

[11]

Q27.

(a) oxygen;)
carbon dioxide;) *allow symbols*
water)

each for 1 mark

3

(b) graph with reasonable vertical scales;
accurate plotting of all points (ignore lines) and labelling lines
histogram – must be coded

gains 3 marks

3

(c) 6 of:
during exercise the level of CO_2 (in the blood) rises;
increased breathing to remove excess CO_2;
increased oxygen supply to muscles;
or increased breathing takes in more O_2
or increased heart rate takes more O_2 to muscles;
increased supply of sugar to muscles;
increased respiration rate;
enable faster rate of energy release;
reference to lactic acid (allow even though not on syllabus)/O_2 debt;
to avoid cramp;
anaerobic reference;
reference to removal of 'heat';

6

(d) high carbon dioxide concentration;
brain/central nervous system;
heart muscles (both)

3

[15]

Q28.

(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]

Q29.

(a) (i) vole/small bird/beetle

gains 1 mark

1

(ii) oak trees are large organisms;
therefore their biomass is large; but their numbers are small

each for 1 mark

3

(b) 8 of:
energy stored in chemicals in cells/tissues/growth;
passed up food chain;
less energy stored at each stage in food chain/pyramid level;
because only part of energy taken in used for growth;
some lost in waste;
some used for repair;
used to main body systems;
some lost in respiration;
some converted into other forms of energy;
e.g. movement;
much lost as heat;

by time detritus feeders have used remains;
all returned to environment

each for 1 mark

8

c1 → animals
c2 → decomposers

2 marks for sequencing and organising the information

2

[14]

Q30.

(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]

Q31.

(a) water filtered from blood
smaller proportion reabsorbed therefore larger volume of dilute urine produced

each for 1 mark

4

(b) (i) use of dialysis machine which restores concentrations of substances in blood to normal levels
transplant of healthy kidney **or** compatible kidney

each for 1 mark

4

(ii) 5 of e.g.:
dialysis needs much time attached to machine
consequent effect on lifestyle (qualified) need for special diet
transplant gives 'normal' life (qualified)
transplant cheaper in long term
risk attached to transplant operation
shortage of donors etc.

each for 1 mark

5

[13]

Q32.

8 of e.g.:
muscles release energy as heat
blood flowing through muscles heated increased blood temperature sensed by centre in brain
impulses to skin blood vessels
particularly overlying muscles used in exercise to dilate
increased surface flow in these regions
gives pattern shown on thermographs

each for 1 mark

[8]

Q33.

(i) 2500 – 1000
= 1500

for 1 mark each

2

(ii) 3 of
filter blood
reabsorb water
in sufficient quantities to keep body water content constant
produce dilute urine if water content of body high/reverse argument

any 3 for 1 mark each

3

[5]

Q34.

(a) (i)
- blood sugar rises because
- insufficient insulin secreted by body

for 1 mark each

2

(ii)
- increase in rate of conversion
- of glucose to glycogen
- in liver

for 1 mark each

3

(iii)
- muscles use more glucose from blood
- in respiration
- to release energy needed for exercise

for 1 mark each

3

(b) 3 of
sugar soluble
therefore absorbed
quicker than starch
which has to be digested

any 3 for 1 mark each

3

(c)
- increased secretion of glucagons

- by pancreas
- results in increases rate of conversion of glycogen into glucose

for 1 mark each

3

(d) 3 of e.g.

higher blood sugar level results in increased secretion of insulin
effect of insulin is to lower blood sugar
which in turn reduces rate of insulin secretion
overall result is to keep fluctuations in sugar level to a minimum

any 3 for 1 mark each

3

[17]

Q35.

(a) urine

for 1 mark

1

(b) (i) protein

for 1 mark

1

(ii) e.g. molecules too large

for 1 mark

1

(c) reabsorbed into blood

for 1 mark

1

(d) e.g. most of water reabsorbed but little urea

for 1 mark

1

[5]

Q1.

(a) (i) protein

for 1 mark

1

(ii) e.g. molecules too large

for 1 mark

1

(b) e.g. most of water reabsorbed, but little urea

for 1 mark

1

(c) (i) restores concentration of dissolved substances, to normal level,
wastes pass into dialysis fluid

for 1 mark each

3

(ii) the same (0.35) or slightly below (<0.35),
so that concentration of salts in blood remains constant

for 1 mark each

2

[8]

Q2.

(a) more energy needed,
for increased muscular activity

for 1 mark each

2

(b) increased sweat production,
evaporation of sweat cools body,
vasodilation OWTTE,
more heat loss (by radiation)

for 1 mark each

4

[6]

Q3.

(i) *idea that* reduce water loss (in dry area) / conserve water

for 1 mark

1

(ii) ideas of evaporation (of moisture) uses energy / heat
or
large surface area of blood vessels / dilation of blood vessels
for evaporation / radiation

each for 1 mark

2

(iii) ideas of large surface area of (small) vessels / intertwining results in close

contact of vessels idea that cool venous blood cools arterial blood

each for 1 mark

2

[5]

Q4.

(a) (i) more
less
the same
(*accept* appropriate numbers)

for 1 mark each

3

(ii) sweating / evaporation / perspiration

for 1 mark

1

(b) in food / named solid food / eating
from respiration

for 1 mark each

2

[6]

Q5.

(a) all sectors correctly plotted – 2 marks one plotting error only – 1 mark
2 **or** more plotting errors 0 marks

breath = 3 sectors
urine = 6 sectors
sweat = 10 sectors

2

all sectors labelled

allow 2 labelled only

1

(b) respiration

1

breath

1

amino acids

1

urine

1

[7]

Q6.

(a) (i) all plots correct

Tolerance ± $\frac{1}{2}$ square
allow 1 mark for 2 correct plots

2

(ii) 6

correct answer with no working = 2
allow 1 mark for (60 ÷ 100) × 10
N.B. correct answer from incorrectly recalled relationship / substitution = 0

2

(b) lungs

1

liver

1

kidneys

1

[7]

Q7.

(a) 180 **or** 179.9

1

(b) 99.4

1

[2]

Q8.

any **three** from:

heat produced by muscles

during exercise

accept when working

by respiration

(skin) temperature over muscles rises / more blood to skin over muscles

*allow vasodilation **or** arterioles dilate over muscles*
reject capillaries dilate
sweating neutral

[3]

Q9.

(a) 850

1

(b) (i) more

because exercise makes us sweat **or** work harder

accept to cool the body
do not credit body hotter or giving off more heat

2

(ii) more

because she respires more

*accept she breathes (in and out) more **or** heavier **or** faster*

2

(iii) less

because (more) water has been lost by sweating **or** breathing out **or** other methods

accept arguments about conservation of water

2

(c) kidney

1

[8]

Q10.

(a) (i) in blood **or** the circulation system **or** plasma

*accept arteries and veins **or** blood vessels*
*do not accept slowly **or** in blood cells*

1

(ii) glands

*accept endocrine glands **or** endocrine*
do not accept a named gland

1

(b) the pancreas

accept islets of Langerhans

1

any **one** from

does not produce (sufficient) insulin
(blood) sugar is not (properly) controlled

1

insulin injections **or** inhalers

*accept diet **or** tablets to make the pancreas produce insulin*

1

[5]

Q11.

(a) increases

gains 1 mark

but
70 × more (concentrated)

gains 2 marks

2

(b) *idea that*
water is reabsorbed;
urea is not reabsorbed (as much)
each for 1 mark

(credit (much) more water reabsorbed
than urea)
gains 2 marks

2

[4]

Q12.

ideas that
internal cooling/cooling of brain causes reduction in sweating and of blood flow to skin
less sweating = less loss of heat from skin (= X)
less blood flow = less heat supplied to skin (= Y)
X > Y (so temperature rises)
each for 1 mark

[4]

Q13.

(a) warmth/heat
oxygen/air
moisture
microbes/micro-organisms/fungi/moulds/bacteria
any three for 1 mark each

3

(b) do not rot
for 1 mark

1

[4]

Q14.

(a) *idea:*
filtered
for 1 mark

reabsorbed
gains 1 mark

but
all reabsorbed
gains 2 marks

correct reference to blood
for 1 mark

4

(b) (i) *evidence of* $\frac{170 - 1.5}{170} \times 100$

gains 1 mark

but
99(.1)(%)
gains 2 marks

2

(ii) *idea:*
more urine
for 1 mark

body dries out/dehydrates
or
needs to drink more
for 1 mark

2

(c) no effect for first half hour/until 1 hour
rises to 210cm³/to 3x level after 1 hour
rises to 280cm³/to 4x level after 1½ hour
reference to 280cm³/1½ hour as maximum level
falls to (near) normal after 2½ hours
comparison of rates of change e.g. rapid then slower rise and/or steady fall
not all of 800cm³ excreted (extra to normal)
each for 1 mark to max. of 5
(do not credit simply rises then falls)

5

[13]

Q15.

idea:
glucose level rises
pancreas releases insulin
glucose → glycogen (in liver)/removes xs glucose
glucose level falls/returns to normal
for 1 mark each

[4]

Q16.

1 sector correct
gains 1 mark

but all sectors correct B = 2 S = 9 U = 8
gains 2 marks

all sections labelled correctly (w.r.t. sector size)
for 1 mark

[3]

Q17.

- cost of dialysis and transplant <u>compared</u>

- *idea that* both expensive and may need to balance cost against other medical priorities
- restricted diet/movement with dialysis

and

- no restriction/independence for transplant

each for 1 mark

- *idea* that donated kidney may not be available
- transplant may be rejected/dialysis consistently reliable

[Credit problem of finding body access points for repeated dialysis over the long term]

[5]

Q18.

(a) *idea:*
more (fossil) fuel burned (do not credit simply more people/cars/industry)
deforestation = less photosynthesis
deforestation = more respiration/burning

each for 1 mark

3

(b) *idea*:
climate change

for 1 mark

warmer/colder/drier/wetter
food production affected/starvation
mayor ecosystems destroyed/damaged

any two for 1 mark each

6

<u>sea level rise</u>

for 1 mark

low land flooded
less food grown/starvation
homes/factories flooded

any two for 1 mark each

Allow
polar ice caps melt
sea water expands

[9]

Q19.

(a) sweat – 6 squares high

urine – 15 squares high

each to < half a square for 1 mark each

2

(b) for *hot day (assumed unless otherwise stated)*

- same in breath
- same total
- more in sweat* / sweats more
- less in urine* / urinates less
- correct quantification of either * eg **x**cm^3 more / less or **n** times more / less
  250 cm^3 more sweat 6 × more sweat
  250 cm^3 less urine ¼ / 25% less urine
  any four • for 1 mark each
  [Do not allow just figures quoted from the table]

4

(c) *ideas that*

- you sweat more **<u>to keep cool</u>** on a hot day
- urine adjusted (by kidneys) to keep balance / to keep same total loss
  each for 1 mark
  [Accept "more sweat therefore less urine"]
  [Credit ideas from (c) if given in (b)]

2

[8]

Q20.

(a) breath same + sweat more* + urine less* (*All <u>three</u> needed)*
<u>or</u>
total same but split differently

for 1 mark

**either change correctly quantified eg*
x cm^3 more/less or **n** times more/less

for 1 further mark

sweat 250 more 6 x more
urine 250 less ¼/25%less

2

(b) *ideas that*

- you sweat (more) <u>to keep cool</u> on a hot day
- urine adjusted (by kidneys) to keep balance / to keep same total loss
  each for 1 mark

(NB credit these answers if in (a) candidates have answered more fully than expected)

2

(c) *ideas that*

- when blood water normal/100% / steady kidney re-absorbs water at low/steady rate
- when blood water percentage falls, the rate at which kidney re-absorbs water rises
- when blood water percentage rises again, is high/normal the rate at which
  kidney re-absorbs water falls
- 97 / 97.5% / 98% (of normal) blood water is the point at which the kidney's reabsorption rate starts to increase / decrease

each for 1 mark

[allow idea that there is delay between blood water percentage changing and rate of re-absorption changing]

4

(d) *any reference to* hormone(s) / pituitary (gland)

gains 1 mark

but
ADH or hormone(s) from pituitary (gland)

gains 2 marks
(do not allow 'brain)

2

[10]

Q21.

(a) 1

for 1 mark

1

(b) (i) there will be less / no sodium (per day) (in her urine)

for 1 mark

1

(ii) *idea that*
she should take in more (sodium (chloride) / salt)
(*allow* stay indoors / in shade **or** be less active)

for 1 mark

1

(c) active transport / uptake
(*do not allow* diffusion / osmosis)
the concentration / gradient

for 1 mark each

2

[5]