

Mark schemes

- 1** (a) if too high insulin released from pancreas 1
- so glucose is moved into cells
allow glucose is stored 1
- if too low, glucagon is released (from pancreas) 1
- causes glycogen to be converted to glucose and released into the blood 1
- (b) type 1 not enough / no insulin produced 1
- whereas type 2 cells do not respond to insulin 1
- type 1 is treated with injections of insulin 1
- whereas type 2 is treated with diet and exercise
- or**
loss of weight
or
drugs 1
- (c) $(3.45 \times 10^6) + (5.49 \times 10^5) = 3.999 \times 10^6$
or
 $3\,450\,000 + 549\,000 = 3\,999\,000$
*allow 3.999×10^6 **or** $3\,999\,000$ with no working shown for 1 mark* 1

$$\frac{3.999 \times 10^6}{6.5 \times 10^7} \times 100$$

or

$$\frac{3\,999\,000}{65\,000\,000} \times 100$$

= 6.15

allow 6.15 with no working shown for 2 marks

allow for 1 mark for a calculation using either:

$$\frac{3.45 \times 10^6}{6.5 \times 10^7}$$

or

$$\frac{3\,450\,000}{65\,000\,000}$$

or

$$\frac{5.49 \times 10^6}{6.5 \times 10^7}$$

or

$$\frac{549\,000}{65\,000\,000}$$

1

6.2

allow 6.2 with no working shown for 3 marks

1

allow ecf from second step correctly rounded for 1 mark

(d) could be other reasons for glucose in urine

or

blood test gives current / immediate result, urine levels might be several hours old

or

not always glucose in urine

1

(e) results not affected by glucose from food

or

8 hours is sufficient time for insulin to have acted on any glucose from food eaten

or

so that there is a low starting point to show the effect

1

(f) (patient **A**)

*no mark for identifying **A***

glucose level much higher (than **B**)

1

and remains high / does not fall

1
[15]

2

(a) Too much thyroxine is released into the blood

1

which raises BMR

1

causing increase in formation of glycogen / lipids / proteins

or

increase in rate of respiration

or

increase in breakdown of excess proteins

1

(b) FSH causes eggs to mature and stimulate ovaries to produce oestrogen

1

LH stimulates the egg to be released

1

(c) (missing a dose causes a) dip / drop in progesterone levels

1

(therefore) FSH is not inhibited anymore

1

(therefore) LH is not inhibited anymore

1

(and consequently) an egg is matured and released

allow (and consequently) an egg is available to be fertilised

1

[9]

3

(a) immune system

allow white blood cells / lymphocytes

ignore phagocytes

1

produces antibodies

1

(which) attack the antigens on the transplanted organ / pancreas

*allow transplanted organs have foreign antigens at start of explanation **and** linked to attacking the organ*

1

(b) (i) change / rise detected by the sensor

1

information used to calculate how much insulin she is going to need (bring her blood glucose back to normal)

1

(pump delivers) insulin into the blood

1

(causing) glucose to move into cells

allow (liver) converts glucose to glycogen

1

max 2 if no ref. to artificial pancreas

(ii) any **one** from:

- it is more accurate **or** less chance of human error
- (glucose) level will remain more stable **or** no big rises and falls in blood sugar levels
- you don't forget to test and / or inject insulin
- if ill or in coma insulin is still injected

ignore continuous and automatic unqualified

1

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4

(a) (i) has the least amount of glucose

*allow least amount of fat **or** no fat*

1

(to) transfer energy (for the run)

allow (to) release energy (for the run)

*do **not** allow produces energy*

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

1

(ii) any **one** from:

- cells will work inefficiently
- absorb too much water / swell / overhydrate
- lose too much water / shrink / dehydrate

ignore turgid / flaccid

cells burst is insufficient

allow cramp in muscle.

1

(b) any **three** from:

- thermoregulatory centre
- (has temperature) receptors
- (which) monitor blood temperature (as it flows through the brain)
- (temperature) receptors in the skin
- (receptors) send impulses to the brain

ignore vasoconstriction / vasodilation / sweating

allow hypothalamus

impulses sent to the thermoregulatory centre = 2 marks.

3

(c) (i) (sports drinks) contain a lot of glucose

1

(a person with diabetes) does not produce insulin **or** does not produce enough insulin

allow (person with diabetes) has cells which do not respond to insulin

*do **not** allow insulin produced by liver*

1

so blood glucose / sugar levels will rise too high **or** to a dangerous level

1

(ii) inject insulin

or

have an insulin pump (fitted)

*do **not** allow swallow insulin*

accept exercise

accept inhale insulin

*accept take metformin **or** other correctly named drug*

allow pancreatic transplant

1

[10]

5

(a) (the kidney) filters the blood

ignore refs to hormones and drugs

1

(and then) reabsorbs all of the glucose

1

reabsorbs some of the ions

allow salts

ignore minerals

1

reabsorbs some of the water

1

releases urea (in urine)

1

- (b) (i) should fall from 28 (to the end of dialysis)
ignore any line drawn after end of dialysis
allow + / - 0.5 square
graph line must fall to / below
below 15 1
- (ii) should stay level at about 6 throughout
ignore slight variations
allow + / - 1 square
ignore any line drawn after end of dialysis 1
- (c) (i) immune system
allow white blood cells / lymphocytes 1
- (produces) antibodies 1
- (which) attack the antigens (on the transplanted kidney)
non-matching antigens insufficient 1
- (ii) any **one** from:
 - tissue typing (to find match)
 - treating with drugs that suppress the immune system*accept treat with immunosuppressants.* 1

[11]

6

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 refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

There is a brief description of kidney function including a mention of pituitary gland **or** hormones but roles may be confused.

Level 2 (3 – 4 marks)

There is a clear description of kidney function in relation to fluctuations in blood water levels and the roles of the pituitary gland **or** hormone is mentioned with correct role.

Level 3 (5 – 6 marks)

There is a clear and detailed scientific description of kidney function in relation to fluctuations in blood water levels and of the roles of the pituitary gland and ADH.

examples of biology points made in the response:

- if water content too low, ADH released
- from pituitary gland
- into the blood
- (causing) kidney reabsorbs more water
- more concentrated / small volume urine produced
- if water content too high, ADH lowered / not produced
- less water reabsorbed by kidney
- more dilute / larger volume urine produced

full marks may be awarded for detailed description of either water loss or gain

[6]

7

- (a) (i) one form of a / one gene
*do **not** allow 'a type of gene'*
allow a mutation of a gene

1

- (ii) not expressed if dominant / other allele is present / if heterozygous

or

only expressed if dominant allele not present / or no other allele present
allow need two copies to be expressed / not expressed if only one copy / only expressed if homozygous

1

- (b) (i) two parents without PKU produce a child with PKU / **6 and 7 → 10**
allow 'it skips a generation'

1

- (ii) genetic diagram including:
accept alternative symbols if defined

Parental gametes:

6: **N** and **n**
and 7: **N** and **n**

1

derivation of offspring genotypes:

NN Nn Nn nn

allow genotypes correctly derived from student's parental gametes

1

identification: **NN** and **Nn** as non-PKU

OR nn as PKU

allow correct identification of student's offspring genotypes

1

correct probability only: 0.25 / $\frac{1}{4}$ / 1 in 4 / 25% / 1 : 3

do not allow 3 : 1 / 1 : 4

do not allow if extra incorrect probabilities given

1

- (c) (i) mitosis

correct spelling only

1

- (ii) 8

1

- (iii) DNA

allow deoxyribonucleic acid

do not allow RNA / ribonucleic acid

1

- (d) (i) may lead to damage to embryo / may destroy embryos / embryo cannot give consent

allow avoid abortion

allow emotive terms – eg murder religious argument must be qualified

allow ref to miscarriage

allow idea of avoiding prejudice against disabled people

allow idea of not producing designer babies

1

(ii) any **one** from:

- prevent having child with the disorder / prevent future suffering / reduce incidence of the disease
ignore ref to having a healthy child
ignore ref to selection of gender
- embryo cells could be used in stem cell treatment
allow ref to long term cost of treating a child (with a disorder)
allow ref to time for parents to become prepared

1
[12]

8

- (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]

9

- (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 respiration **or** more muscle 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]

10

(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]