



## Mark schemes

Q1.

(a) A 1

(b) D 1

(c) liver 1

(d) glycogen 1

(e) 2.6  
*allow answers in the range 2.5 to 2.7* 1

7.6 (mmol/dm<sup>3</sup>)  
*allow a correctly calculated value using  
student's value from graph + 5* 1

(f) 30 (minutes)  
*allow ½-hour or 0.5 hour* 1

(g) points too far apart  
or  
no reading between 30 and 50 mins  
*allow no reading at 40 mins*  
or  
points joined by straight lines  
or  
values could have fallen to zero change before 50 mins  
*allow not a curve of best fit* 1

(h) higher values of y than given line 1

returning to(wards) zero change later than given line 1

[10]

Q2.

(a) response / reaction  
*ignore examples*  
*ignore action* 1

- automatic or no thinking or not conscious or involuntary  
*ignore reference to brain*  
*ignore quick* 1
- (b) receptor (in skin of finger / hand) detects stimulus / temperature change  
*allow receptor detects heat ignore pain* 1
- (electrical) impulses pass along neurones  
*allow electrical signals pass*  
*along nerve cells*  
*ignore messages* 1
- (impulses pass from) sensory to relay to motor neurones 1
- synapse between neurones where chemical crosses gap  
*allow neurotransmitter / acetylcholine*  
*for chemical*  
*allow by diffusion* 1
- (synapses) in spinal cord / CNS  
*ignore brain* 1
- muscle contraction (to pull hand away)  
 or effector is a muscle 1
- (c) coordination by endocrine system is:  
*allow converse points if clearly*  
*indicating nervous co-ordination*  
*answers must be comparative*
- slower 1
- longer-lasting 1
- (chemical / hormone) via blood instead of electrical / impulse / neurones 1
- (d) FSH (release from pituitary) stimulates maturation of egg / ovum / follicle  
*ignore reference to days of menstrual cycle*  
*allow FSH stimulates development / growth of egg*

	1
oestrogen (release from ovary) inhibits FSH production and stimulates LH production	1
LH (release from pituitary) stimulates ovulation <i>allow LH stimulates release of egg</i>	1
progesterone (release from ovary) inhibits FSH and LH production <i>allow (release from corpus luteum)</i>	1
oestrogen and progesterone maintain the uterus lining <i>allow oestrogen and progesterone build up the uterus lining</i>	1
	[16]

Q3.

(a)

$$\frac{1430}{2600} \times 100$$

1

55 (%)

1

(b) (volume) increases

*allow (volume) goes up*

1

(c) drink (a lot / more)

1

(d) filtration

1

reabsorption

1

excretion

*this order only*

1

(e) Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

3-4

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1-2

No relevant content

0

Indicative content

Advantages of kidney transplant

- no need for regular / long hospital visits or is a long-term solution
- flexible lifestyle, such as can go on holidays
- may not live near a hospital or reference to transport costs
- no risk of infection from frequent needles / treatment
- less / no need to control diet
- maintains correct concentration of substances in blood / body
- cheaper long term for NHS / hospital

Disadvantages of kidney transplant

- may be rejected
- have to keep taking anti-rejection drugs or immunosuppressants
- (suitable) donor may not be available or need for tissue matching
- risk from surgery (e.g. anaesthesia or infection)
- recovery from surgery will take a long time
- does not last forever (therefore further surgery needed)

For Level 2, answers must refer to both advantages and disadvantages

[11]

Q4.

(a) protein

1

(b) urea is a waste (product)

*allow toxic / poisonous or may damage cells or denatures proteins*  
*ignore harmful / dangerous*

1

(c)

*in this order*

respiration

1

breathing

1

(d)

*in this order*

least

medium

most

	<i>3 correct = 2 marks 1 or 2 correct = 1 mark</i>	2
(e)	diffusion	1
(f)	protein	1
	(molecules too) large <i>this mark may only be awarded if mp1 is correct or not attempted allow pores in membrane are too small</i>	1
(g)	3 <i>allow three</i>	1
(h)	increases <i>ignore numbers</i>	1
(i)	any two from: <i>allow converse points for person A / dialysis</i> <ul style="list-style-type: none"> <li>• has a low(er) concentration of urea</li> <li>• constant urea concentration / level <i>allow substance (if named must be correct)</i></li> <li>• less time attached to machine or fewer hospital visits</li> <li>• no / less restriction on travel</li> <li>• not piercing skin repeatedly</li> <li>• less chance of infection / blood clots</li> <li>• cheaper in the long term <i>ignore cheaper unqualified</i></li> <li>• no restrictions on diet</li> </ul>	2
		[13]
Q5.		
(a)	pituitary	1
(b)	ADH	1
(c)	<i>allow ecf for name of hormone from part (b) ignore name of gland</i>  high(er) concentration of blood causes (more) ADH / hormone	

<p>release</p> <p><i>allow low(er) water potential of blood causes (more) ADH / hormone release allow alternative descriptions in terms of – eg low(er) water concentration / level or high(er) osmotic pressure or high(er) solute concentration / level</i></p>	<p>1</p>
<p>(and hormone / ADH causes) increased permeability of kidney tubules (to water)</p> <p><i>allow increased permeability of collecting duct / distal convoluted tubule</i></p>	<p>1</p>
<p>(so) increased water reabsorption</p> <p><i>allow more water taken back into blood ignore reference to urine</i></p>	<p>1</p>
<p>(d)</p> <p><i>allow converse if clearly describing dialysis explanation must match reason</i></p>	
<p>changes in concentrations / levels of substances / urea are minimised</p> <p><i>allow no change in concentration / level of substances / urea allow correctly named substances</i></p>	<p>1</p>
<p>(so) less / no chance of causing damage to body cells / tissues</p> <p><i>allow eg less / no osmotic stress or not poisoned by urea</i></p>	<p>1</p>
<p>not repeatedly puncturing skin or blood not in contact with machine</p> <p><i>allow blood does not leave the body</i></p>	<p>1</p>
<p>(so) less / no chance of infection or less / no chance of blood clots or no need to take anti-clotting drugs</p> <p><i>allow less / no chance of microorganisms entering body allow only one operation so less chance of infection for 2 marks allow dialysis requires anti-clotting drugs and so may lose more blood if cut for 2 marks</i></p>	<p>1</p>
	<p>[9]</p>

Q6.

- (a)
- ignore incorrect organ secreting insulin / glucagon*
- (blood glucose increases after meal causing) insulin secretion *allow (blood glucose increases after meal causing) insulin increase* 1
- insulin causes glucose to enter cells / liver / muscles 1
- (insulin causes) glucose conversion to glycogen 1
- allow glucose converted to glycogen in cells / liver / muscles for 2 marks*
- (so) blood glucose decreases causing glucagon secretion *allow increase in glucagon when blood glucose is low* 1
- glucagon causes glycogen to be converted to glucose 1
- (b) cells / liver / muscles absorb less glucose
- allow cells / liver / muscles convert less glucose to glycogen*
- do not accept no absorption / conversion of glucose* 1
- (so) glucose concentration in blood remains high
- allow (so) glucose concentration in blood does not decrease* 1
- (high blood glucose stimulates / causes) pancreas to release more insulin
- allow more insulin is released from pancreas to 'try' to reduce blood glucose* 1
- (c) any three from:
- age
  - height and mass  
*allow BMI*
  - proportion of males and females or group size  
*allow sex of the participants*
  - (same) severity of diabetes
  - (same) activity (during investigation)
  - (same) type of meal
  - dose of drug
  - (similar) blood glucose concentrations at start  
*allow how much / type of food / drink*

	<i>consumed before</i>	
	<ul style="list-style-type: none"> <li>• other health conditions or other drugs being taken <i>allow may not have followed drug-taking regime beforehand</i></li> </ul>	3
(d)	Mean = 177.2 + 15.4	1
(e)	Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4
	Level 1: Relevant points are made. They are not logically linked.	1–2
	No relevant content	0
	Indicative content	
	Pro:	
	<ul style="list-style-type: none"> <li>• Met + A gives larger (%) reduction (in blood glucose) than Met alone</li> <li>• so statement is supported</li> </ul>	
	<ul style="list-style-type: none"> <li>• Met + B gives larger (%) reduction (in blood glucose) than Met alone</li> <li>• so statement is supported</li> </ul>	
	<ul style="list-style-type: none"> <li>• Met + A SD does not overlap with Met SD</li> <li>• so difference is significant</li> </ul>	
	Con:	
	<ul style="list-style-type: none"> <li>• Met + B SD overlaps with Met SD</li> <li>• so difference is not significant</li> <li>• difference in results could be due to chance</li> </ul>	
	-----	
	-----	
	<ul style="list-style-type: none"> <li>• number of people used is not very large</li> <li>• number of people in each group is different</li> <li>• so may not be representative or may not be repeatable / reproducible</li> <li>• so anomalies will have a bigger impact on smaller groups</li> </ul>	
	<ul style="list-style-type: none"> <li>• 30 minute / starting levels of blood glucose are different</li> <li>• all 30 minute / starting levels are higher in the 2-drug trial</li> <li>• so may cause different % reductions</li> </ul>	



- no information about control variables or named e.g.
- concentration of drugs not given / may differ
- so results may not be valid

for level 3 an inclusion of a discussion of significance is required

[18]

Q7.

(a) to allow implantation of the embryo

1

(b) oestrogen

1

(c) 13/14/15/16

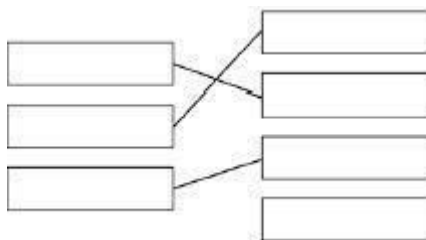
*allow any number in range 13 to 16*

*allow any range within these values e.g.*

*14-16*

1

(d)



*extra line from a method cancels the mark*

1

1

1

(e) more reliable than diaphragm / spermicidal cream

*allow fewer pregnancies than*

*diaphragm / spermicidal cream*

1

low chance of pregnancy

*allow only 1 more pregnancy than the pill (per 100 women per year)*

*allow almost as good as the pill*

*allow reference to one named example*

1

no side effects

*allow easy to get / buy*

*allow easy to use*

*allow prevent / reduce spread of STDs / gonorrhoea / HIV*

*ignore cost*

1

[9]

Q8.

- (a) pancreas 1
- (b) liver 1
- glycogen 1
- in this order*
- (c) would be digested / broken down (by enzymes / protease / pepsin / acid or to amino acids) 1  
*allow denatured (by acid)*
- (d) use of 14.2 and 6.8 1
- 7.4  
*allow an answer of 7.2 or 7.3 (using 14.1 and / or 6.9) for 1 mark* 1  
*an answer of 7.4 scores 2 marks*
- (e) any one from: 1
- (person A's) results are higher  
*ignore A peaks at a higher level than B*
  - (A) increases for a longer time or peaks later
  - (A) takes longer to decrease or takes longer to return to normal  
*allow other correct comparisons*  
*allow a description using pairs of figures from graph at a given time*
- allow converse comparisons with person B as the subject*
- (f) a negative correlation 1
- (g) less carbohydrate / sugar / fat in diet  
*allow go on a diet*  
*allow eat less*  
*allow balanced / healthy diet*
- or  
 lose weight or maintain a healthy weight  
*ignore diet unqualified*

		1
	(more) exercise	
	<i>allow examples of exercise</i>	
		1
		[10]
Q9.		
	(a) 2400 and 2280	
	or	
	500 and 380	
		1
	120	
		1
	<i>an answer of 120 scores 2 marks</i>	
	(b) respiration of glucose	
		1
	(c) (more) sweating	
	<i>ignore reference to vasodilation / vasoconstriction</i>	
		1
	(because) exercise releases heat	
	or	
	need to cool the body	
	or	
	need to lose heat	
	or	
	need to maintain body temperature	
	<i>do not accept energy being produced</i>	
		1
	(d) more energy needed	
	<i>do not accept energy production</i>	
	<i>do not accept energy needed for respiration</i>	
		1
	(so) more (aerobic) respiration	
		1
	(so) increased breathing (rate / depth) (to supply oxygen or remove carbon dioxide / water)	
		1
	<i>'more' does not need to be stated a second time to gain marking point 1 and marking point 2</i>	
		[8]
Q10.		

- |     |   |     |
|-----|---|-----|
| (a) | A   | 1   |
| (b) | E   | 1   |
| (c) | 28<br><i>allow 27–29</i>  | 1   |
| (d) | progesterone  | 1   |
| (e) | any two from: <ul style="list-style-type: none"> <li>• inhibits FSH production / release</li> <li>• prevents egg maturation<br/><i>allow prevents egg growth</i></li> <li>• prevents ovulation<br/><i>allow prevents egg release</i><br/><i>ignore prevents egg production</i></li> </ul> | 2   |
| (f) | oestrogen   | 1   |
|     | testosterone<br><i>allow in this order only</i>   | 1   |
|     |   | [8] |

Q11.

- |     |  |   |
|-----|--|---|
| (a) | (molecules are) (too) large  | 1 |
|     | cannot pass through (filtration) membrane / (holes in) filter<br><i>allow 'is not filtered out of the blood'</i>   | 1 |
| (b) | glucose is reabsorbed<br><i>ignore 'is absorbed' unless qualified by 'into blood'</i>  | 1 |
|     | <u>all</u> of it   | 1 |
| (c) | (molecules / ions) small so pass through filter or<br>not all is reabsorbed<br><i>allow the body needs to maintain the right balance<br/>of ions and urea in the blood</i><br><i>ignore 'are filtered' unqualified</i> | 1 |

more water reabsorbed on a hot day

1

due to more water lost in sweat

*'more' needed at least once to gain both marks*

1

(d) Level 3 (5-6 marks):

A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

Level 2 (3-4 marks):

A judgement, supported by some relevant reasons is given.

Level 1 (1-2 marks):

Relevant points are made. If there is a judgement, this is asserted, but not logically linked to the points made.

No relevant content (0 marks)

Indicative content

pro transplant:

- (dialysis requires repeated treatments to prevent) build-up of toxins or to prevent raised blood pressure between sessions
- inconvenience of dialysis, e.g. long sessions of immobility or repeated hospital visits
- (dialysis requires restricted diet) to prevent build-up of urea / ions
- there is a greater risk of infection with dialysis e.g. repeated puncturing of skin or use of non-sterile equipment allows entry of microorganisms
- there is a risk of blood clots with dialysis
- dialysis more expensive in the long term / 2+ years or examples given e.g. 2 yrs dialysis = £60 000 compared with 2 yrs after transplant  
= (£51 000 + £5 000) = £56 000
- transplant is a long term treatment or may remain healthy for many years

con transplant:

- shortage of kidney donors leading to long waiting time
- requires death of another person or live donation leaving a person with just one kidney
- exploitation of poor people for donor kidneys (paying for organs)
- need to match tissue type
- rejection – role of wbc's / lymphocytes
- need immunosuppressant drugs – susceptibility to infection
- dangers of surgery – physical damage / infection / brain damage from anaesthetic
- high initial cost – limited funding (either personal or NHS / CCG)

[13]

Q12.

(a) any three from:

- a (chemical) messenger  
or  
an organic substance  
*allow correct named example – e.g. protein /  
modified amino acid / catecholamine / steroid*
- made by the endocrine system / an endocrine gland / endocrine organ  
*allow made by / released from a (ductless) gland*
- affects (a) specific / target organ(s) / tissue(s)
- released into the blood  
*allow carried by the blood*

3

(b) insulin and glucagon

*both required for 1 mark correct spelling only for  
glucagon*

1

(c) Level 2 (3-4 marks):

Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

Level 1 (1-2 marks):

Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.

No relevant content (0 marks)

Indicative content

- (0–0.5 h: ) glucose from meal enters blood or increase in blood glucose (to 6.5 mmol / dm<sup>3</sup>)
- glucose detected by pancreas
- pancreas secretes insulin
- (insulin causes) glucose to move (out of blood) into cells / liver
- liver converts glucose to glycogen
- causing a fall in blood glucose (after 0.5h)
- low blood glucose (< 5.0 mmol / dm<sup>3</sup>) detected by pancreas
- pancreas releases glucagon
- liver converts glycogen to glucose (which enters blood)
- blood glucose rises (after 1 h or to 5.2 mmol / dm<sup>3</sup> (at 1.5 h))

[8]

Q13.

(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]

Q14.

- (a) A – pituitary 1  
B – adrenal 1
- (b) ovary 1
- (c) diaphragm  
*allow phonetic spelling* 1
- (d) condom 1

- (e) Level 2 (3–4 marks):  
A detailed and coherent evaluation is provided which considers a range of advantages and disadvantages and comes to a conclusion consistent with the reasoning.

Level 1 (1–2 marks):

An attempt to describe the advantages and disadvantages is made, which may not come to a conclusion. The logic may be inconsistent at times.

0 marks:

No relevant content.

Indicative content

advantages of the plastic IUD:

- is effective for longer than the copper IUD
- does not need to be replaced as often as the copper IUD
- although the pain of periods are more severe, the pain with the copper IUD is likely to be worse
- can reduce the bleeding during a period
- most of the possible side effects are not serious, eg feeling sick,

acne and headaches.

disadvantages of the plastic IUD:

- needs to be implanted for a period of time before it is effective ie not emergency contraception
- can make the pain of period more severe
- can cause more side effects than the copper IUD
- can cause some more severe side effects such as cysts on the ovaries

an understanding that the side effects are only possible and may not necessarily occur

additional examiner guidance:

- pupils should add value to the points in the table and should not just be copies verbatim
- credit can also be given for other correct advantages and disadvantages from the candidates' own knowledge and understanding
- allow converse points if clearly made

4

[9]

Q15.

- (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  $3.999 \times 10^6$  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
- (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
- (f) (patient A)  
no mark for identifying A

1

1

glucose level much higher (than B) 1

and remains high / does not fall 1

[15]

Q16.

- (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]

Q17.

- (a) (i) follicle stimulating hormone / FSH 1
- (ii) oestrogen 1
- (b) (i) any one from:
- to help them have a baby / get pregnant  
*ignore to make them fertile*
  - to stimulate egg production / release / maturation
  - own levels of FSH / LH / hormone (too) low  
*allow to increase hormone / FSH / LH levels*

	<i>do not allow to increase oestrogen levels</i>	1	
	(ii) through the bloodstream	1	
	(c) oestrogen	1	
	progesterone	1	
			[6]
Q18.			
	(a) ovary	1	
	(b) 46	1	
	(c) (i) does not fit the pattern or it is higher than the 3rd value / it should be lower than the 3rd value / it should be between the 3rd and 5th values <i>do not allow use of incorrect figures</i>	1	
	(ii) As age increases % of women (having a baby) decreases	1	
	(d) (i) 33		
	$\frac{66}{2}$ <i>allow 1 mark for</i> <i>if no answer / wrong answer</i>	2	
	(ii) low success rate	1	
	more likely to have a baby with health problems / abnormalities / a faulty chromosome	1	
			[8]
Q19.			
	(a) (i) pancreas	1	
	(ii) Insulin causes glucose to move into cells.	1	
	(b) (i) A	1	

	rapid rise or fastest	1
(ii)	2	1
(c)	The pancreas could be rejected.	1
		[6]
Q20.		
(a)	immune system	
	<i>allow white blood cells / lymphocytes</i>	
	<i>ignore phagocytes</i>	1
	produces antibodies	1
	(which) attack the antigens on the transplanted organ / pancreas	
	<i>allow transplanted organs have foreign antigens at start of explanation and linked to attacking the organ</i>	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	
	<i>allow (liver) converts glucose to glycogen</i>	1
	<i>max 2 if no ref. to artificial pancreas</i>	
(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	
	<i>ignore continuous and automatic unqualified</i>	1
		[8]