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^3)

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

allow LH stimulates release of egg

1

progesterone (release from ovary) inhibits FSH **and** LH production

allow (release from corpus luteum)

1

oestrogen **and** progesterone maintain the uterus lining

*allow oestrogen **and** progesterone build up the uterus lining*

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

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

2

(e) diffusion

1

(f) protein

1

(molecules too) large

this mark may only be awarded if mp1 is correct or not attempted
allow pores in membrane are too small

1

(g) 3

allow three

1

(h) increases

ignore numbers

1

(i) any **two** from:

*allow converse points for person **A** / dialysis*

- has a low(er) concentration of urea
- constant urea concentration / level

allow substance (if named must be correct)

- less time attached to machine **or** fewer hospital visits
- no / less restriction on travel
- not piercing skin repeatedly
- less chance of infection / blood clots
- cheaper in the long term

ignore cheaper unqualified

- no restrictions on diet

2

[13]

Q5.

(a) pituitary

1

(b) ADH

1

(c)

*allow ecf for name of hormone from part **(b)***
ignore name of gland

high(er) concentration of blood **causes** (more) ADH / hormone

release

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*

1

(and hormone / ADH causes) increased permeability of kidney tubules (to water)

allow increased permeability of collecting duct / distal convoluted tubule

1

(so) increased water reabsorption

allow more water taken back into blood
ignore reference to urine

1

(d)

allow converse if clearly describing dialysis
explanation must match reason

changes in concentrations / levels of substances / urea are minimised

allow no change in concentration / level of substances / urea
allow correctly named substances

1

(so) less / no chance of causing damage to body cells / tissues

allow eg less / no osmotic stress ***or*** *not poisoned by urea*

1

not repeatedly puncturing skin **or** blood not in contact with machine

allow blood does not leave the body

1

(so) less / no chance of infection **or** less / no chance of blood clots **or** no need to take anti-clotting drugs

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

1

[9]

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 <u>glucose</u> to enter cells / liver / muscles

1

(insulin causes) <u>glucose</u> conversion to glycogen

1

*allow <u>glucose</u> 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 <u>glucose</u>

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) <u>pancreas</u> to release more insulin

allow more insulin is released from <u>pancreas</u> 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

consumed before

- other health conditions **or** other drugs being taken
  allow may not have followed drug-taking regime beforehand

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:

- Met + A gives larger (%) reduction (in blood glucose) than Met alone
- so statement is supported

- Met + B gives larger (%) reduction (in blood glucose) than Met alone
- so statement is supported

- Met + A SD does not overlap with Met SD
- so difference is significant

Con:

- Met + B SD overlaps with Met SD
- so difference is not significant
- difference in results could be due to chance

- number of people used is not very large
- number of people in each group is different
- so may not be representative **or** may not be repeatable / reproducible
- so anomalies will have a bigger impact on smaller groups

- 30 minute / starting levels of blood glucose are different
- all 30 minute / starting levels are higher in the 2-drug trial
- so may cause different % reductions

- 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

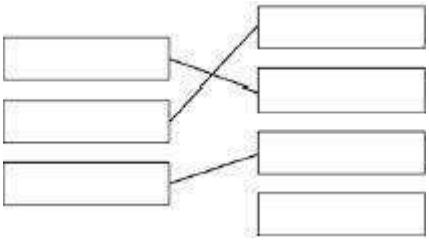
(c) 13 / 14 / 15 / 16

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)

allow denatured (by acid)

1

(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:

- (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

1

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

allow examples of exercise

1

[10]

Q9.

(a) 2400 **and** 2280
or
500 **and** 380

1

120

1

*an answer of 120 scores **2** marks*

(b) respiration of glucose

1

(c) (more) sweating

ignore reference to vasodilation / vasoconstriction

1

(because) exercise releases heat
or
need to cool the body
or
need to lose heat
or
need to maintain body temperature

*do **not** accept energy being produced*

1

(d) more energy needed

*do **not** accept energy production*
*do **not** accept energy needed for respiration*

1

(so) more (aerobic) respiration

1

(so) increased breathing (rate / depth) (to supply oxygen **or** remove carbon dioxide / water)

1

'more' does not need to be stated a second time to gain marking point 1 and marking point 2

[8]

Q10.

(a) **A**

1

(b) **E**

1

(c) 28

allow 27–29

1

(d) progesterone

1

(e) any **two** from:

- inhibits FSH production / release
- prevents egg maturation

  allow prevents egg growth
- prevents ovulation

  allow prevents egg release

  ignore prevents egg production

2

(f) oestrogen

1

testosterone

allow in this order only

1

[8]

Q11.

(a) (molecules are) (too) large

1

cannot pass through (filtration) membrane / (holes in) filter

allow 'is not filtered out of the blood'

1

(b) glucose is reabsorbed

ignore 'is absorbed' unless qualified by 'into blood'

1

all of it

1

(c) (molecules / ions) small so pass through filter

or

not all is reabsorbed

allow the body needs to maintain the right balance of ions and urea in the blood

ignore 'are filtered' unqualified

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 wbcs / 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^3)
- 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^3) 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^3 (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 <u>insulin</u> released from pancreas

1

so glucose is moved into cells

allow glucose is stored

1

if too low, <u>glucagon</u> is released (from pancreas)

1

causes glycogen to be converted to glucose <u>and</u> 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]

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

do not allow to increase oestrogen levels

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

*do **not** allow use of incorrect figures*

1

(ii) As age increases % of women (having a baby) decreases

1

(d) (i) 33

allow 1 mark for $\frac{66}{2}$

if no answer / wrong answer

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

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

[8]