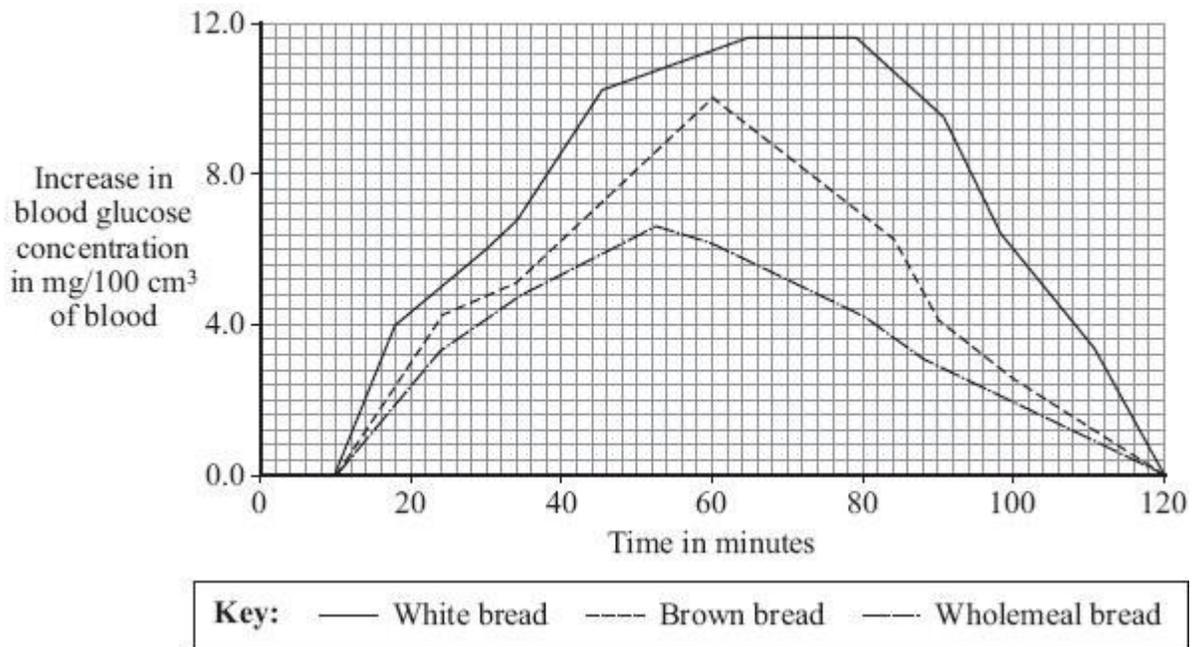


1 Insulin controls blood glucose concentration.

(a) The rate at which blood glucose concentration changes is affected by the food eaten.

In an experiment a person who does not have diabetes ate two slices of white bread. The change in her blood glucose concentration was recorded over the next 120 minutes. The experiment was repeated; first with two slices of brown bread and then with two slices of wholemeal bread.

The graph shows the results of the three experiments.



(i) Which type of bread would be most suitable for a person with diabetes?

Type of bread _____

Give **two** reasons for your answer.

1. _____

2. _____

(2)

- (ii) Explain, as fully as you can, the reasons for the changes in blood glucose concentration when the person ate the brown bread.

(4)

- (b) *Pancreatic-cell transplantation* is a new treatment for diabetes. Insulin-making cells are taken from up to three dead donors. The cells are kept alive before being injected into the diabetic in a small operation. The cells soon begin to make insulin.

In one recent study 58 % of recipients of pancreatic-cell transplants no longer needed insulin injections.

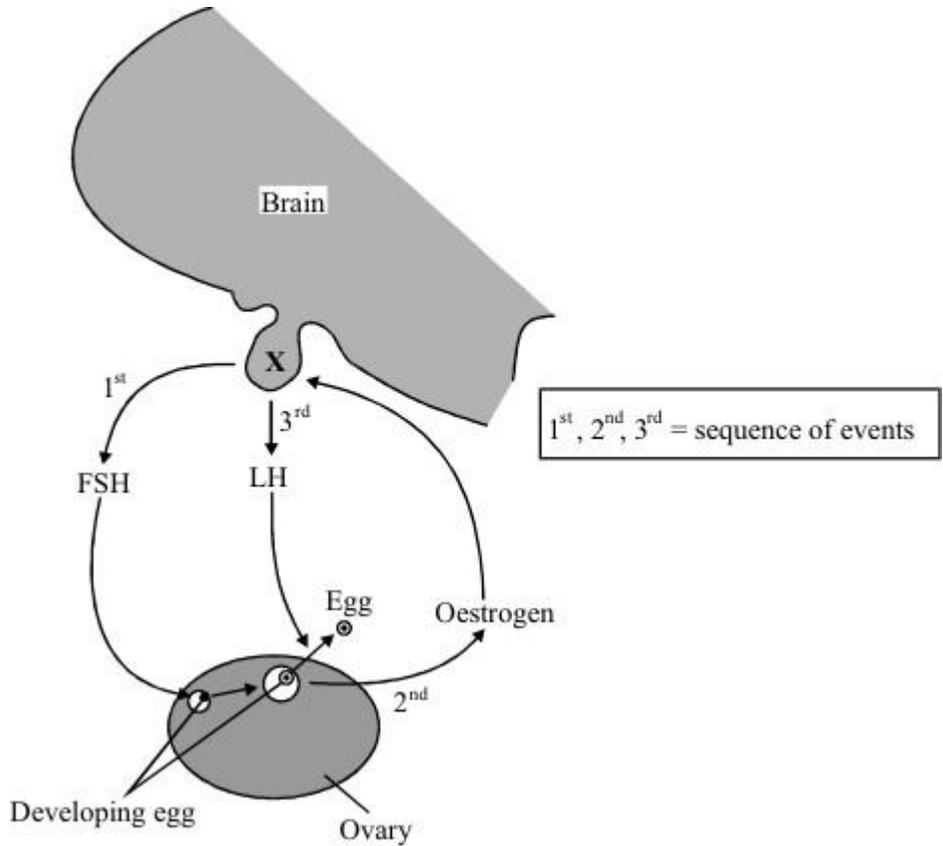
Give the advantages and disadvantages of the new treatment for diabetes compared with using insulin injections.

(3)

(Total 9 marks)

2

The diagram shows how three hormones, FSH, LH and oestrogen, work together in a woman's body.



(a) Name the part of the brain labelled X.

(1)

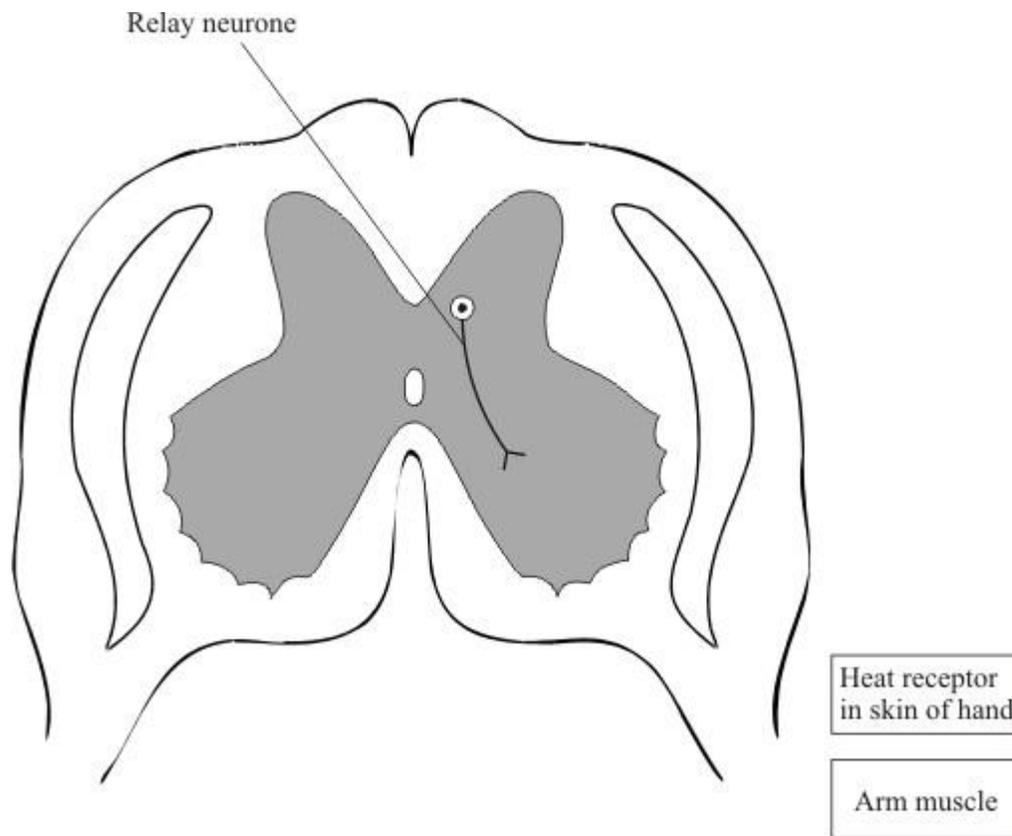
(b) Use information from the diagram and your own knowledge to explain why some oral contraceptive pills contain oestrogen.

(3)

(Total 4 marks)

3

The diagram shows a section through the spinal cord.



(a) Coordination of a reflex movement of the arm, in response to the hand touching a hot object, involves three neurones. One of these, the relay neurone, is shown in the diagram. Complete the nerve pathway between the receptor and the muscle on the diagram by drawing and labelling:

- (i) the sensory neurone;
- (ii) the motor neurone.

(2)

(b) The nerve pathway linking the heat receptor in the hand with the arm muscle is about 1.5 metres in length. It would take the nervous impulse 0.02 seconds to travel this distance along a neurone. However, it takes about 0.5 seconds for the arm to start moving during the reflex response to the heat stimulus.

Explain the difference.

(2)

(Total 4 marks)

- 4** The doctor is testing the child's nervous system by tapping the tendon just below the knee.
This pulls cells which are sensitive to stretching.



- (a) What are cells which are sensitive to stimuli called?

(1)

- (b) These cells send information to the spinal cord.

In what form is this information sent?

(2)

- (c) The healthy response to the stimulus is the straightening of the leg.

What is the effector in this response?

(1)

(d) This response is one example of a reflex action.

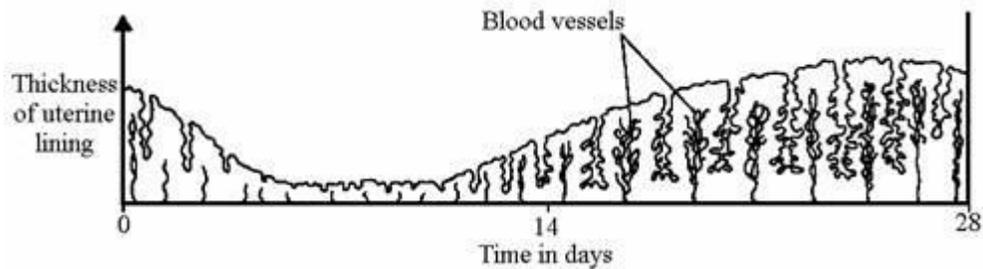
Describe **one other** example of a reflex action in terms of:

stimulus → *receptor* → *coordinator* → *effector* → *response*

(5)
(Total 9 marks)

5

(a) The diagram shows changes in the uterus lining during 28 days of a menstrual cycle.



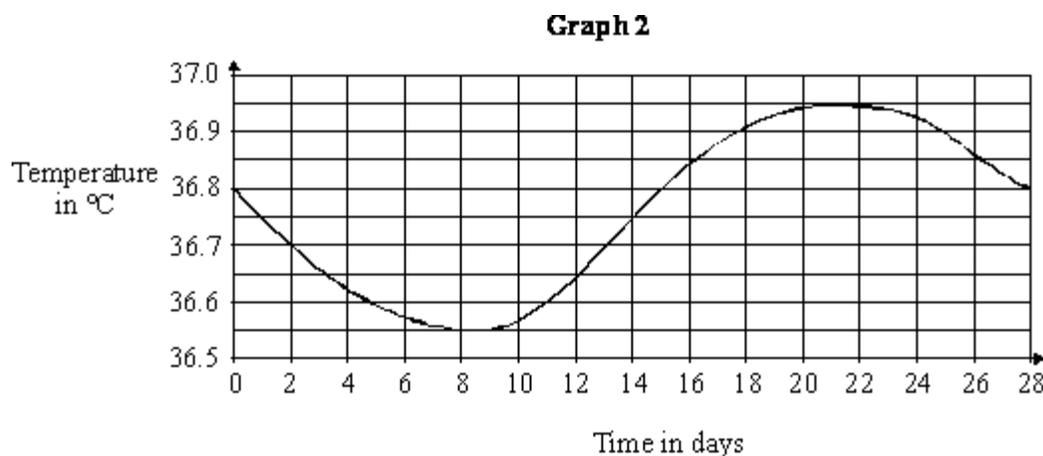
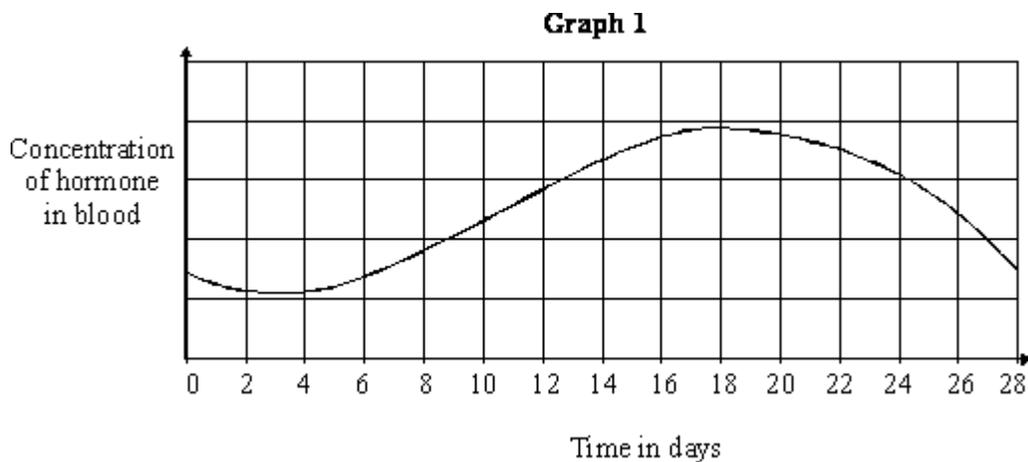
Describe how changes in the lining shown in the diagram adapt it for its function if an egg is fertilised.

(3)

- (b) The concentration of a certain hormone in the blood of a woman was measured during her menstrual cycle. The woman's temperature was also measured each day during this cycle.

Graph 1 shows the results obtained for the measurement of the concentration of the hormone.

Graph 2 shows the results obtained for the measurement of her body temperature.



- (i) What evidence is there that changes in the concentration of the hormone may be connected with changes in body temperature?

(1)

- (ii) What is the difference between the minimum and maximum temperatures shown by **Graph 2**? Show your working.

(2)

(Total 6 marks)

6 Marathon runners are recommended to have a high carbohydrate diet prior to a race. Three athletes tried out three dietary regimes prior to a marathon race.

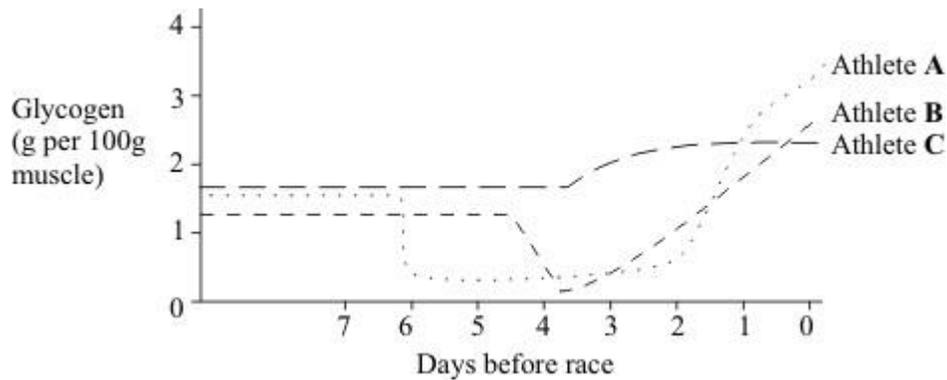
These three dietary regimes were as follows.

Athlete A Up to 7 days before the race - Normal mixed diet
7 days before the race - Prolonged extreme physical activity
6-3 days before the race - Protein and fat diet; no carbohydrate
2 and 1 days before the race - Large carbohydrate intake

Athlete B Up to 5 days before race - Normal mixed diet
5 days before the race - Prolonged extreme physical activity
4-1 days before the race - Large carbohydrate intake

Athlete C Up to 4 days before the race - Normal mixed diet
4-1 days before the race - Large carbohydrate intake

The graph below shows the effect of each of these dietary regimes on glycogen levels in the athletes' muscles



(a) (i) What is the immediate effect of extreme physical activity on the glycogen content of muscles?

(1)

(ii) Describe how this effect occurs.

(3)

(b) (i) Evaluate the three regimes as preparation for a marathon race.

(3)

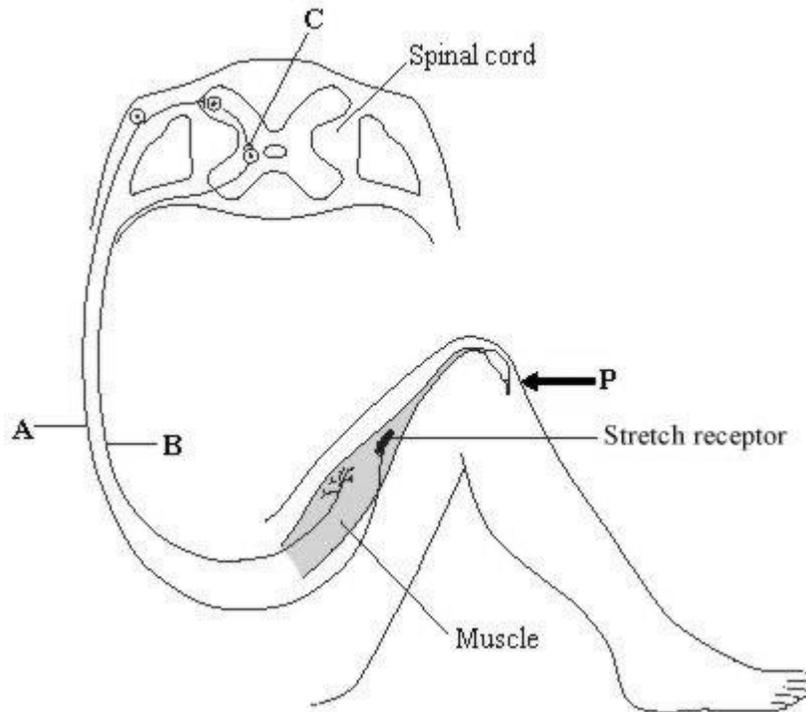
(ii) Suggest a possible explanation for the different effects of the three regimes.

(2)

(Total 9 marks)

7

The diagram shows the nervous pathway which is used to coordinate the knee-jerk reflex. When the person is hit at point **P**, the lower leg is suddenly raised.



(a) (i) Name the type of neurone labelled **A**. _____

(1)

(ii) **On the diagram**, draw arrows next to the neurones labelled **A** and **B** to show the direction in which an impulse moves in each neurone.

(1)

(b) How is information passed across the synapse at **C**?

(1)

(c) **On the diagram**, label the effector with the letter **X**.

(1)

(Total 4 marks)

- 8 Oestrogen, luteinising hormone (LH) and follicle stimulating hormone (FSH) work together to coordinate the menstrual cycle. A woman will be infertile if her pituitary gland does not release enough follicle stimulating hormone (FSH).

Explain how injections of FSH could increase her chances of having a baby.

(Total 3 marks)

- 9 The hormone insulin is a protein. Insulin is produced in the pancreas and controls blood glucose concentration.

(a) Which organ in the body monitors blood glucose concentration?

(1)

(b) We now know that a lack of the hormone insulin causes diabetes. In the early twentieth century there was no known cure for diabetes.

Frederick Banting and Charles Best carried out a number of experiments on dogs.

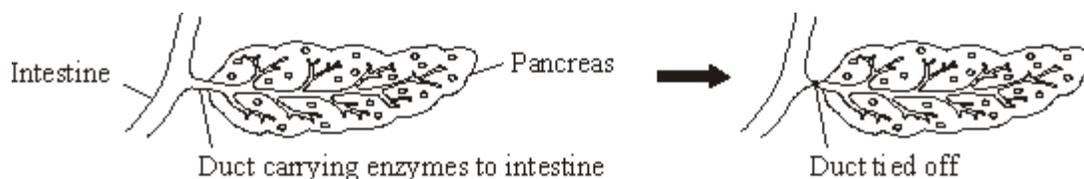
In the first experiment they removed part of the pancreas from a healthy dog (dog **A**). They ground up the pancreas tissue and injected an extract into dog **B**, whose pancreas had been removed to make it diabetic. Dog **B**'s diabetes was **not** cured.

Banting thought that an enzyme produced in the pancreas of dog **A** had digested the hormone before it was injected.

Name the enzyme that might have been responsible for digesting the hormone.

(1)

(c) In the second experiment with another healthy dog, Banting and Best tied off the duct which normally carries digestive enzymes out of the pancreas. This did **not** kill the dog.



- (i) The dog survived even though enzymes from the pancreas could not digest food in the intestine.

Explain why the dog survived.

(1)

- (ii) As a result of these experiments, a method was developed to extract insulin from the pancreas.

Insulin is used to treat humans with diabetes.

The amount of insulin injected needs to be carefully controlled.

Explain why.

(1)

- (d) Evaluate the use of dogs in experiments of this type.

Remember to include a conclusion to your evaluation.

(3)

(Total 7 marks)

10 Hormones are used in contraceptive pills.

(a) Explain how a contraceptive pill works.

(2)

Mark schemes

- 1** (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]

2

(a) pituitary (gland / body)

1

(b) oestrogen inhibits the release of FSH

ignore references to LH

1

FSH stimulates follicle development / causes egg to develop
or no follicle / egg development if high oestrogen

accept growth / maturing / ripening for development

1

no ovulation / no egg release

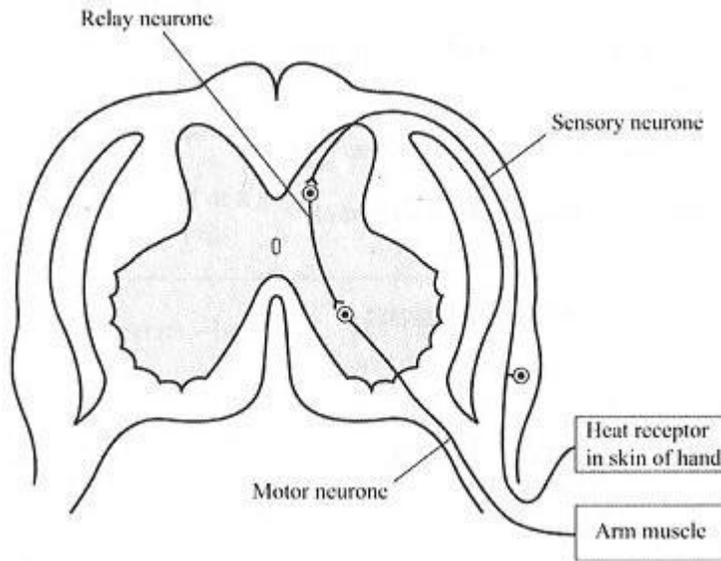
*do **not** accept no egg to be fertilised*

1

[4]

3

(a)



sensory neurone correctly drawn **and** labelled

from receptor + via dorsal root + cell body in ganglion + synapse to relay neurone

1

motor neurone correctly drawn **and** labelled

to muscle + via ventral root + same shape as relay neurone + synapse with relay neurone

OR correct pathways for both neurones given (ie without synapse or cell bodies) **and** labelled, **or** correctly drawn but unlabelled = 1 mark for this part)

1

(b) any **two** from:

reference to synapses / gaps between neurones

extra time for release / movement of chemical

extra time for development of muscle 'tone' / tension

2

[4]

4

(a) receptors

for 1 mark

1

(b) electrical/nerve signals/impulses

for 1 mark each

2

(c) muscle

for 1 mark

1

- (d) correct description of:
 stimulus
 receptor
 co-ordinator
 effector
 response

for 1 mark each

5

[9]

5

- (a) any **three** from

increased thickness **or** build up for
 attachment of zygote **or** so zygote can
 implant;

allow gives more room for blood vessels

3

increased blood vessels to provide
 nutrients for zygote;

*allow embryo **or** fetus **or** baby
or egg for zygote*

becomes thicker to form placenta;

increased surface area for attachment
 of zygote;

increased glands for secretion;

- (b) (i) rise in hormone corresponds with rise
 in temperature;

*allow peak of hormone at same time as increased temperature **or**
 when hormone high, temperature is high
 allow change in hormone concentration followed by change in
 temperature **or** when hormone rises followed shortly by rise in
 temperature **or** graphs follow same pattern **or** graphs are nearly the
 same*

1

- (ii) maximum 36.90 °C

1

minimum 36.55 °C;

0.35 °C;

*allow **both** marks for correct answer **or one** mark for 0.35 if clearly
 round up **or** round down allow one mark for working if correct*

1

[6]

- 6** (a) (i) reduced sharply
for 1 mark 1
- (ii) converted to glucose which is respired to produce energy
(allow answers in terms of glucagon)
gains 3 marks 3
- (b) (i) athlete A's was most effective
since resulted in highest muscle glycogen level on day of race
for energy release during race
for 1 mark each 3
- (ii) e.g. excess carbohydrate stored as glycogen rather than fat in short term
particularly if glycogen stores depleted
for 1 mark each 2

[9]

- 7** (a) (i) sensory / afferent 1
- (ii) on diagram:
arrow (next to neurone **A**) pointing towards spinal cord
and
arrow (next to neurone **B**) pointing towards muscle 1
- (b) chemical (released) **or** neurotransmitter
or by diffusion
accept correct named example of a neurotransmitter 1
- (c) on diagram:
X labelling muscle **or** motor end plate
do not accept on stretch receptor 1

[4]

- 8** any **three** from:
- FSH stimulates growth / maturing of follicle(s) / eggs
 - FSH stimulates oestrogen release
 - oestrogen stimulates development of uterus lining
 - oestrogen stimulates LH release / production
 - LH stimulates ovulation / egg release

[3]

- 9**
- (a) pancreas 1
 - (b) protease 1
 - allow proteinase*
 - (c) (i) (same) enzymes / named enzymes produced in other parts /
named parts of digestive system 1
 - if named, enzymes and part must be correct*
 - (ii) diet / activity varies / amount of glucose in blood varies 1
 - accept too much insulin leads to coma / hypo / low blood sugar*
 - accept too little insulin leads to coma / hyper / high blood sugar*
 - (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]

10	<p>(a) inhibits FSH (production / secretion)</p> <p>(therefore) no eggs <u>mature</u> / <u>released</u> <i>if no other marks gained allow 1 mark for no eggs produced</i></p> <p>or</p> <p>effect of FSH on ovary described <i>references to LH are neutral</i></p>	<p>1</p> <p>1</p>
	<p>(b)</p> <p><i>maximum 4 marks if no conclusion</i></p> <p>Pros max 2marks from 4 marks e.g.</p> <ul style="list-style-type: none"> • large scale trial gave better results • chose uneducated women so that if these women could use it correctly, women elsewhere would be able to cons max 3 marks from 4 marks e.g. • used pill with high dose of hormone – either so results not valid for general use of hormone or dangerous • side effects ignored • women not told pill was experimental / pill might have side effects • no placebo • should have tried a range of doses • should have done pre-trial to check for side effects <p>conclusion 1 mark e.g. trials flawed therefore cons outweigh pros</p> <p>accept reverse e.g. trials flawed but pros outweigh cons</p>	<p>4</p> <p>1</p>

[7]