

1 Hormones can be used as contraceptives.

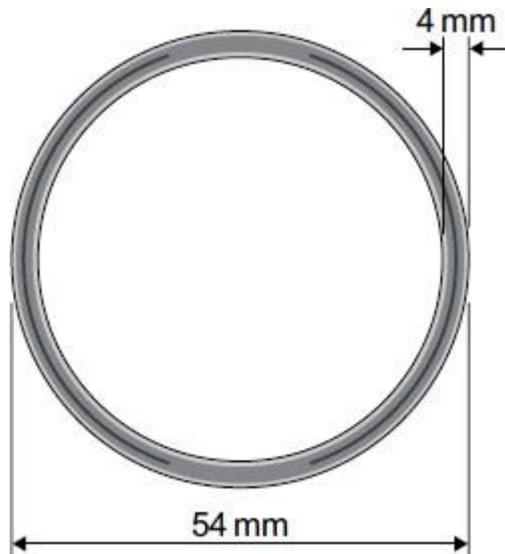
(a) Explain **one** way in which a hormone can prevent conception (pregnancy).

(2)

- (b) Two methods of giving contraceptive hormones to a woman are the vaginal ring and the hormone implant.

Vaginal ring

The vaginal ring is a flexible ring 54 mm in diameter containing hormones.



The woman puts in and takes out the vaginal ring herself; there is no 'wrong' way to put the ring in.

Each ring is designed for one cycle of use, which is three weeks of continuous ring use, followed by one week without the ring.

About 0.3 % of women become pregnant in the first year of ring use.

4 % of women stop using the ring because of vaginal discomfort.

Hormone implant

A health professional puts the hormone implant under the skin of the woman's arm.

The implant releases contraceptive hormones for three years before the implant needs to be replaced.

The hormone implant is 100 % effective.

About 2 % of women stop using the hormone implant, mainly because of irregular menstrual bleeding.

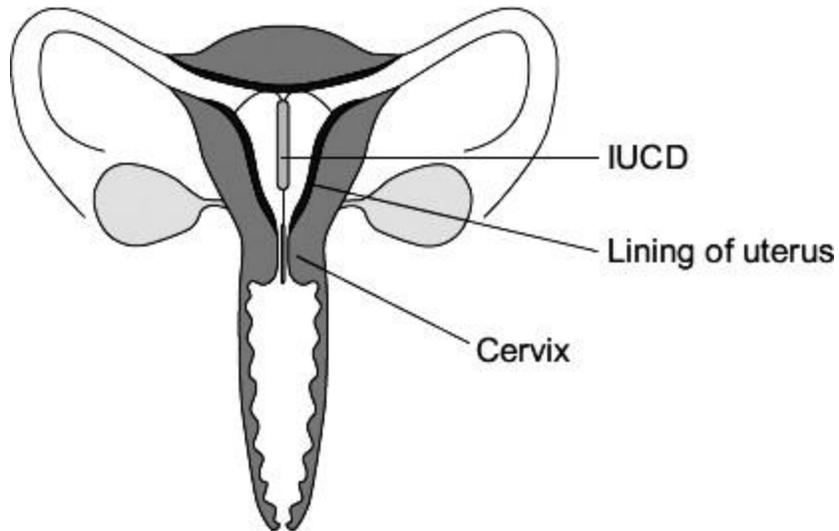
Evaluate the use of the vaginal ring compared with the hormone implant.

Remember to give a conclusion to your evaluation.

(4)
(Total 6 marks)

2

The diagram shows an intra-uterine contraceptive device (IUCD).



The IUCD is put inside the uterus (womb). The IUCD contains a hormone. The hormone diffuses directly into the uterus. The supply of hormone in the IUCD lasts for about five years.

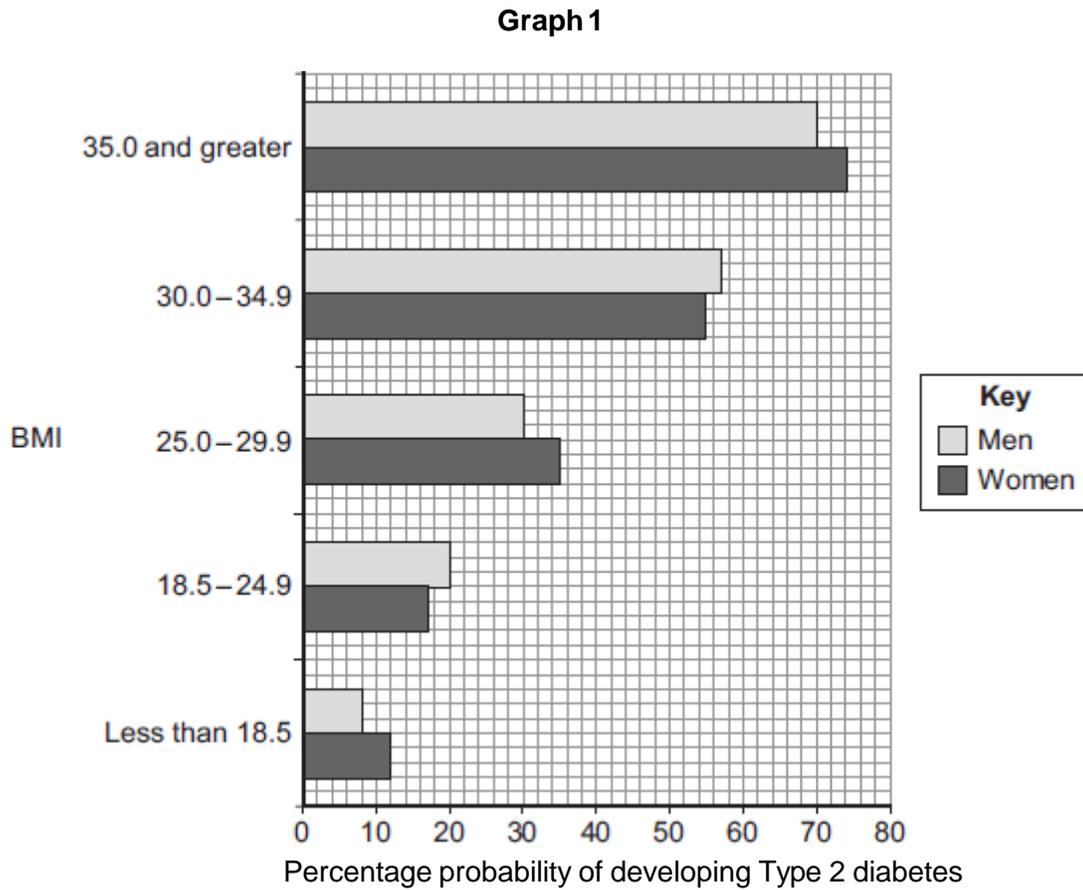
The hormone works by:

- causing the cervix to produce a thick plug of mucus
- causing the lining of the uterus to become very thin.

For every 1000 women using the IUCD for one year about 2 women become pregnant. There are about 10 pregnancies for every 1000 women using the contraceptive pill for one year.

(c) Body mass index (BMI) is a person's body weight divided by the square of his or her height.

(i) **Graph 1** shows the relationship between BMI and the percentage probability of developing Type 2 diabetes.

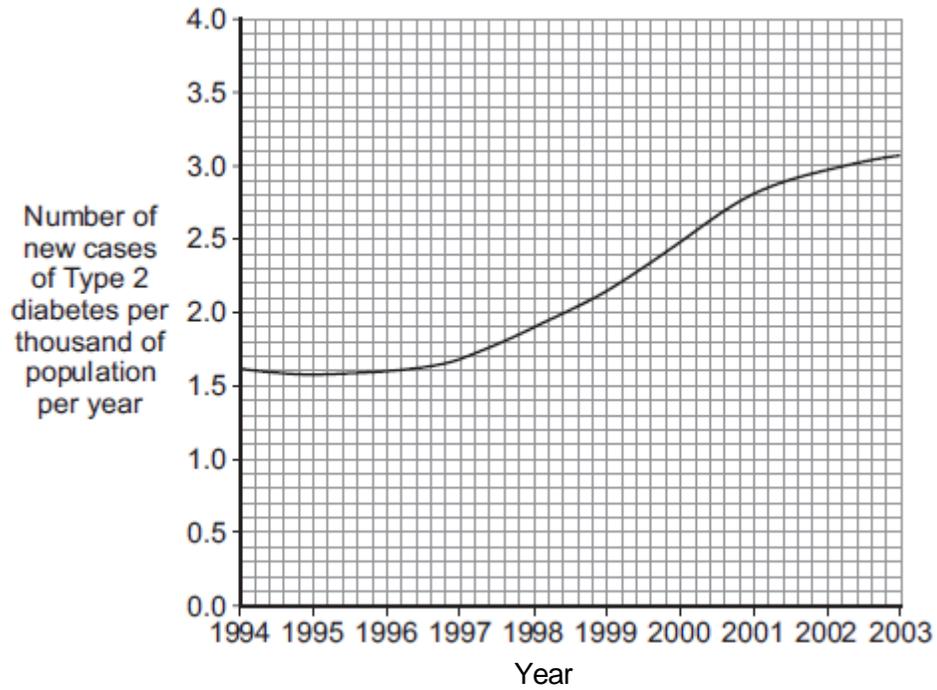


Suggest an explanation for the relationship between BMI and the risk of developing Type 2 diabetes.

(2)

(ii) **Graph 2** shows changes in the number of new cases of Type 2 diabetes in the UK.

Graph 2



Suggest explanations for the trend shown by the data in **Graph 2**.

(3)
(Total 12 marks)

4

Drinking after exercise to replace the water lost in sweat is called rehydration. Scientists at a Spanish university investigated rehydration after exercise.

- 24 students took part in the investigation.
- All the students ran on a treadmill in a temperature of 40 °C until they were exhausted.
- 12 of the students were each given half a litre of beer to drink.
- The other 12 students were each given half a litre of tap water to drink.
- Both groups of students were then allowed to drink as much tap water as they wanted.
- The scientists measured how quickly each student rehydrated.
- The students who had been given beer rehydrated 'slightly better' than the ones given only water.

A newspaper reported the investigation.

The headline was



The newspaper headline was **not** justified.

Explain why.

(Total 3 marks)

5

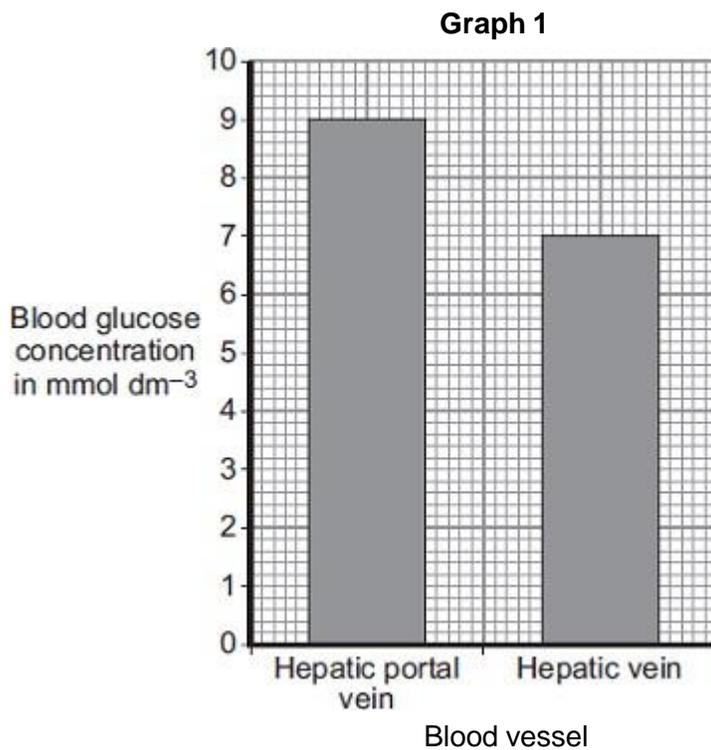
The pancreas and the liver are both involved in the control of the concentration of glucose in the blood.

The liver has two veins:

- the hepatic portal vein taking blood from the small intestine to the liver
- the hepatic vein taking blood from the liver back towards the heart.

Scientists measured the concentration of glucose in samples of blood taken from the hepatic portal vein and the hepatic vein. The samples were taken 1 hour and 6 hours after a meal.

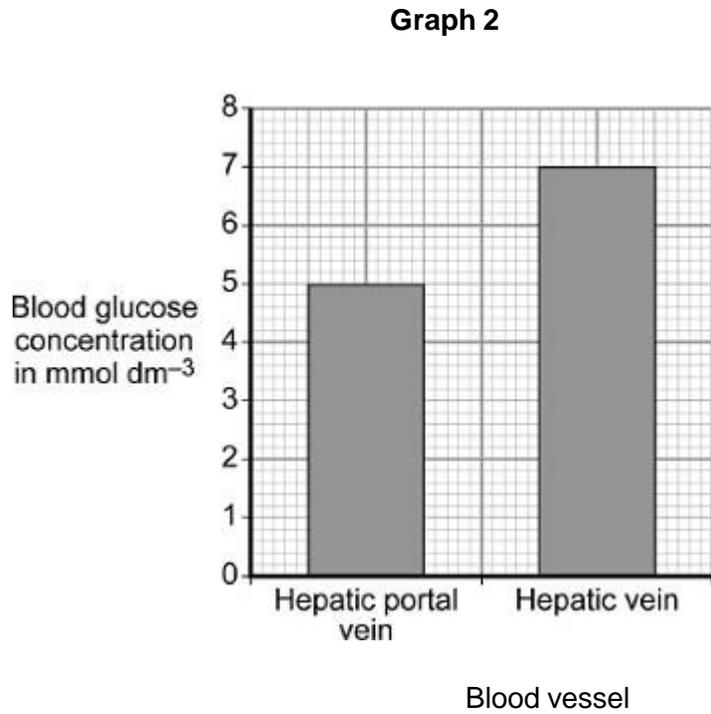
Graph 1 shows the concentration of glucose in the two blood vessels 1 hour after the meal.



- (a) The concentration of glucose in the blood of the two vessels is different. Explain why.

(3)

- (b) **Graph 2** shows the concentration of glucose in the two blood vessels 6 hours after the meal.



- (i) The concentration of glucose in the blood in the hepatic portal vein 1 hour after the meal is different from the concentration after 6 hours.

Why?

(1)

(ii) The person does **not** eat any more food during the next 6 hours after the meal.

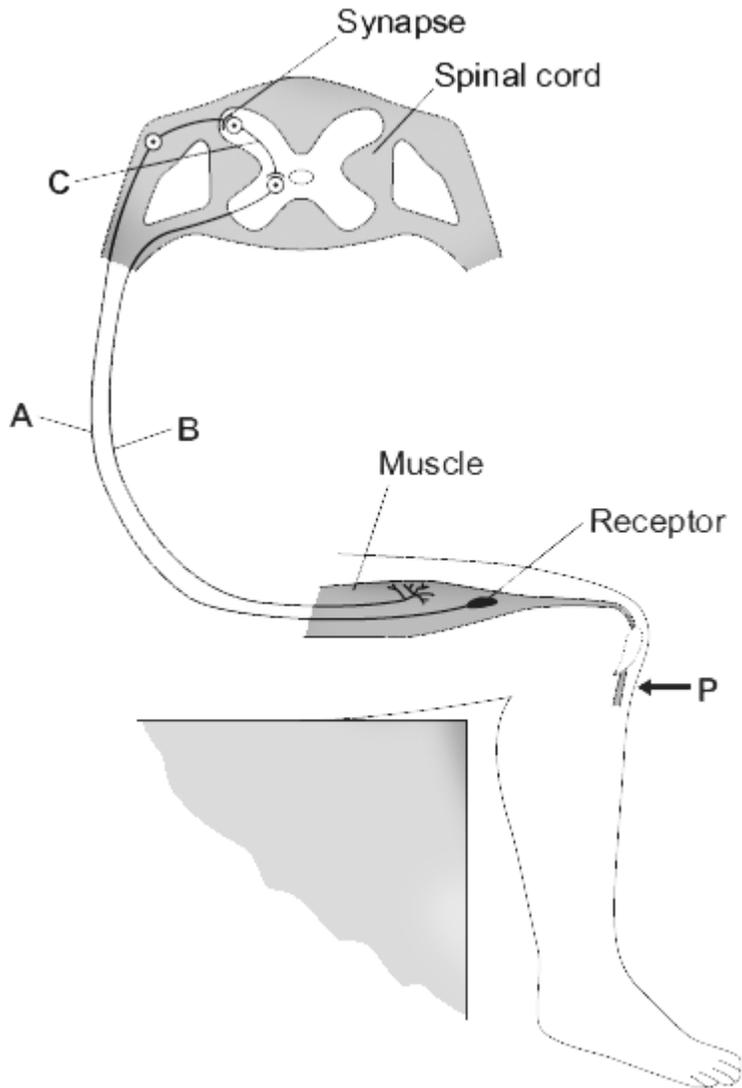
However, 6 hours after the meal, the concentration of glucose in the blood in the hepatic vein is higher than the concentration of glucose in the blood in the hepatic portal vein.

Explain why.

(3)

(Total 7 marks)

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



- (a) Name neurones **A**, **B** and **C**.

A _____

B _____

C _____

(3)

- (b) The receptor in the muscle in the leg is sensitive to a stimulus.

Suggest the stimulus.

(1)

(c) Describe what happens at the synapse during this reflex.

(3)
(Total 7 marks)

7 Phenylketonuria (PKU) is an inherited condition. PKU makes people ill.

(a) PKU is caused by a recessive allele.

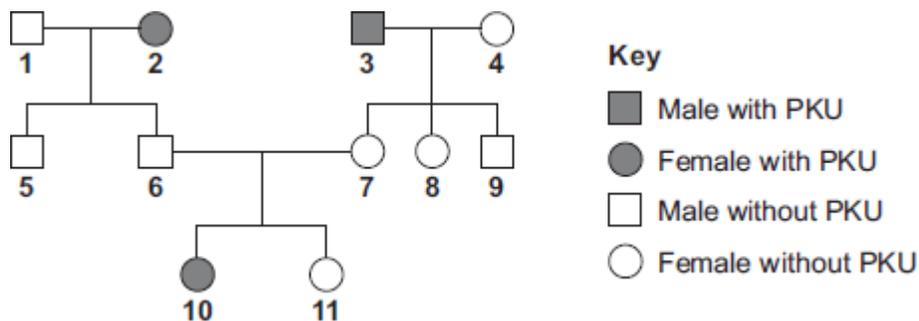
(i) What is an allele?

(1)

(ii) What is meant by recessive?

(1)

(b) The diagram below shows the inheritance of PKU in one family.



(i) Give **one** piece of evidence from the diagram that PKU is caused by a recessive allele.

(1)

- (ii) Persons **6** and **7** are planning to have another child.
Use a genetic diagram to find the probability that the new child will have PKU.

Use the following symbols in your answer:

N = the dominant allele for **not** having PKU

n = the recessive allele for PKU.

Probability = _____

(4)

- (c) Persons **6** and **7** wish to avoid having another child with PKU.

A genetic counsellor advises that they could produce several embryos by IVF treatment.

- (i) During IVF treatment, each fertilised egg cell forms an embryo by cell division.

Name this type of cell division.

(1)

- (ii) An embryo screening technique could be used to find the genotype of each embryo.

An unaffected embryo could then be placed in person **7**'s uterus.

The screening technique is carried out on a cell from an embryo after just three cell divisions of the fertilised egg.

How many cells will there be in an embryo after the fertilised egg has

divided three times?

(1)

- (iii) During embryo screening, a technician tests the genetic material of the embryo to find out which alleles are present.

The genetic material is made up of large molecules of a chemical substance.

Name this chemical substance.

(1)

- (d) Some people have ethical objections to embryo screening.

- (i) Give **one** ethical objection to embryo screening.

(1)

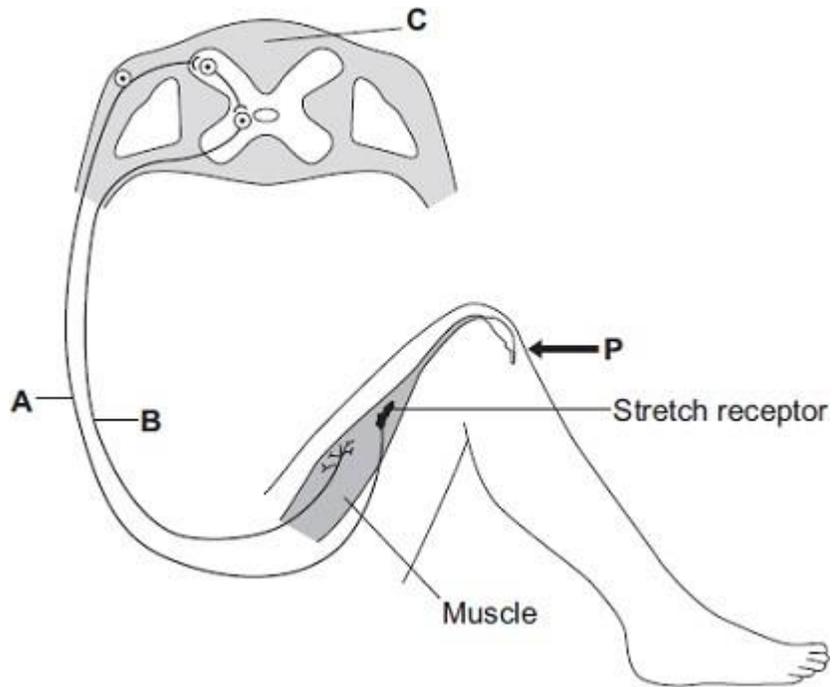
(ii) Give **one** reason in favour of embryo screening.

(1)

(Total 12 marks)

8

The diagram shows the structures involved in the knee-jerk reflex. When the person is hit at point **P**, the lower leg is suddenly raised.



(a) Name the structures labelled **A**, **B** and **C**.

A _____

B _____

C _____

(3)

(b) How is information passed across a synapse?

(1)

(c) What is the effector in this response?

(1)

(Total 5 marks)

Mark schemes

- 1** (a) inhibit FSH production
ignore LH production
ignore wrong hormone 1
- so egg does not mature
ignore egg production / egg release / egg development 1
- (b) any **three** comparisons: eg
- ease of insertion compared ie ring easily inserted by woman whereas implant needs professional **or** no damage to skin with ring
*comparisons must be made ie two separate lists will gain no marks unless the lists are linked by eg whereas / however / on the other hand **and** the points are made in the same order in both lists*
 - length of delivery compared eg 3 weeks for ring whereas 3 years for implant **or** delivery longer for implant
or
woman has to remember to insert ring whereas does not have to remember to insert implant
ignore cost
 - effectiveness compared eg 0.3 % failure with ring whereas nil for implant **or** implant more effective
 - number giving up compared eg 4 % for ring whereas 2 % for implant **or** fewer women give up using implant
or ring might cause vaginal discomfort whereas implant may cause irregular menstrual bleeding 3
- reasoned conclusion (normally at the end)
ie must state 'better because...' 1
- 2** any **three** from:
*max 2 if only advantages **or** only disadvantages discussed*
ignore 'side effects' unqualified
ignore side effects produced by hormones

[6]

advantages of IUCD over pill eg

- can't forget to take it / have to take pill every day
do not allow last 5 years unless qualified
- effect much longer than pill
- more effective in preventing pregnancy
do not allow reference to figures unless qualified
- stops sperm entering uterus

disadvantages of IUCD over pill eg

- pain / uncomfortable / risk of infection / may damage uterus
- prevents fertilised egg developing / 'embryo rights'
allow kills embryo
- needs replacement by doctor / nurse / professional
or access to IUCD is more difficult than pill
or IUCD is harder to come off than pill

3

argued conclusion

*must include a preference and a reference to both advantages and disadvantages
or one is better in a given situation but the other is better in a different situation*

1

[4]

3

(a) any **six** from:

- hormone(s) / named produced by pancreas
- if blood glucose levels are too high, insulin is produced / released
- allowing glucose to move from the blood into the cells / named eg liver
- glucose is converted to glycogen
- if blood glucose levels fall, glucagon is produced / released
- glycogen is converted to glucose
- causing glucose to be released into the blood

6

(b) diabetes that occurs when the body (cells) do not respond / are less responsive to insulin

1

(c) (i) higher BMIs due to increase in mass / weight (relative to height) / obesity

1

obesity / being overweight / being fat is a (significant) risk factor for Type 2 diabetes

allow causes Type 2 diabetes

1

(ii) any **three** from:

- related to described change in diet eg fastfoods
- and less exercise
- which increases the chance of obesity / increases BMI
- increased awareness has helped to slow the increase

3

[12]

4 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]

5 (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]

6

(a) *ignore nerve / neuron(e) throughout*

A sensory

accept afferent

1

B motor

accept efferent

1

C relay

accept intermediate

1

(b) stretch

allow pressure / pull / tension (in muscle)

allow a hit at (point) P

ignore pain

1

(c) any **three** from:

- chemical (release)

accept neurotransmitter / acetylcholine

- diffuses (across the gap / synapse)

- transmits impulse / information (across synapse)

allow transmits signal / message

- between neurones / nerve cells / named

if named, must be either sensory / A to relay / C or relay / C to motor / B

allow 'to the next neurone'

3

[7]

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) **A** sensory (neurone)

ignore nerve

1

- B** motor (neurone)

ignore nerve

1

- C** spinal cord / central nervous system / white matter

accept grey matter

1

- (b) by chemical / substance

allow transmitter

1

- (c) muscle

allow extensor

ignore muscle names

1

[5]