

(d) Describe how DNA controls the structure of a protein.

(2)

- (e) Polydactyly and cystic fibrosis are both inherited disorders caused by faulty DNA.
- Polydactyly is caused by a dominant allele.
 - Cystic fibrosis is caused by a recessive allele.

Mother **A** has polydactyly.

Mother **B** has cystic fibrosis.

Mother **A** is more likely to have a child with polydactyly than Mother **B** having a child with cystic fibrosis.

Explain why.

Assume the fathers of the children have no alleles for polydactyly or cystic fibrosis.

You may use genetic diagrams in your answer.

(3)

(Total 13 marks)

2.

Homeostasis regulates the internal conditions of the human body.

(a) Which **two** processes are regulated by homeostasis?

Tick (✓) **two** boxes.

Controlling water output in urine

Defending the body against pathogens

How quickly you walk

Keeping cool on a hot day

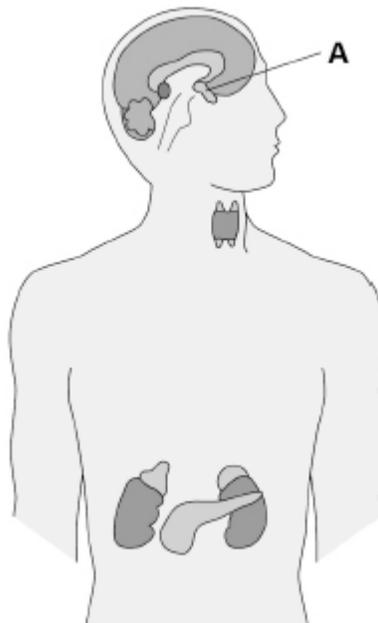
Waking up in the morning

(2)

Hormones are produced by glands in the endocrine system.

Each hormone has an effect on a target organ.

The diagram below shows glands of the endocrine system.



(b) What is the name of gland **A**?

Tick (✓) **one** box.

Pancreas

Pituitary

Thyroid

(1)

Before eating a sugar-coated cereal a person had a blood glucose concentration of 5.2 mmol/dm³

Soon after eating the cereal the person had a blood glucose concentration of 8.4 mmol/dm³

(c) Calculate the increase in the blood glucose concentration.

Increase = _____ mmol/dm³

(1)

(d) The person needed medication to decrease their blood glucose concentration.

Suggest what disorder the person has.

(1)

(e) There is a problem with the hormone control of the person.

What is the problem?

Tick (✓) **one** box.

The blood is not taking hormones to target organs.

The pancreas is not releasing insulin.

The pituitary gland is not being stimulated.

(1)

- (f) The person:
- works in an office
 - drives to work
 - is overweight
 - watches the television and reads every night
 - drinks a hot chocolate every night.

Suggest **two** lifestyle changes the person could make to help treat their disorder.

1. _____

2. _____

(2)

(Total 8 marks)

3.

Some people with diabetes do not produce enough insulin to keep their blood glucose at the correct levels.

- (a) (i) Which organ monitors blood glucose levels?

Tick (✓) **one** box.

liver

pancreas

skin

(1)

- (ii) What effect does insulin have on glucose in the blood?

Tick (✓) **one** box.

Insulin causes glucose to move into the cells.

Insulin increases the amount of glucose in the blood.

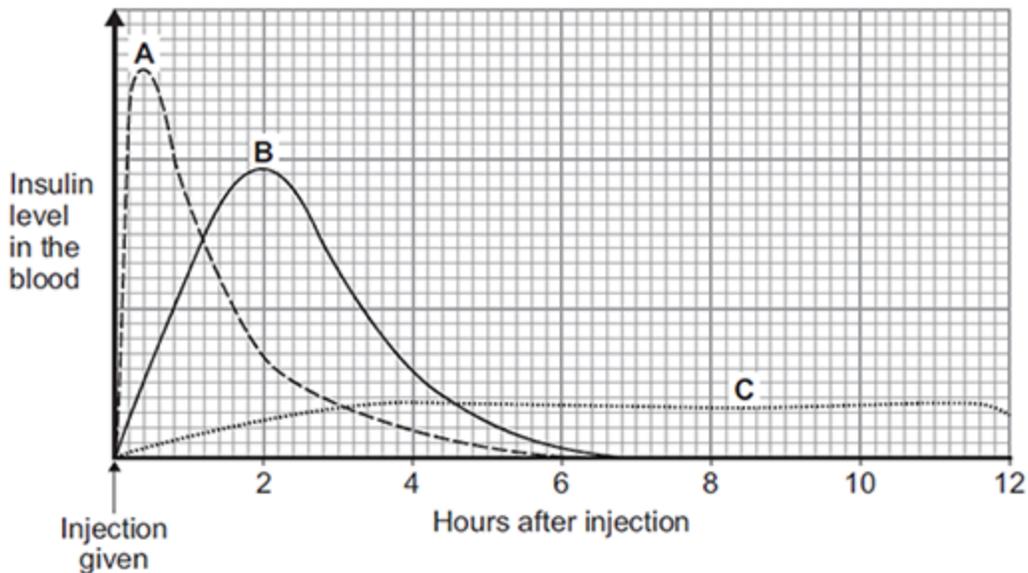
Insulin converts glucose to starch.

(1)

- (b) Some people with diabetes inject insulin several times a day.

There are different types of insulin.

The graph shows some information about three different types of insulin, **A**, **B** and **C**.



- (i) Which type of insulin, **A**, **B** or **C**, should a person with diabetes inject just before eating a meal high in carbohydrates?

Give a reason for your answer.

(2)

- (ii) A woman with diabetes has a blood glucose level of 12 mmol per dm³ of blood.

The woman's normal blood glucose level is 6 mmol per dm³.

The woman will need to inject insulin to lower her blood glucose level.

For each unit of insulin injected the blood glucose level will fall by 3 mmol per dm³.

How many units of insulin does the woman need to inject to bring her blood glucose level down to the normal level?

Number of units = _____

(1)

(c) Some people have pancreas transplants to treat diabetes.

Give **one** possible disadvantage of a pancreas transplant.

Tick (✓) **one** box.

The pancreas could be rejected.

The patient will need to inject insulin every day.

The patient's blood glucose levels may rise and fall too much.

(1)

(Total 6 marks)

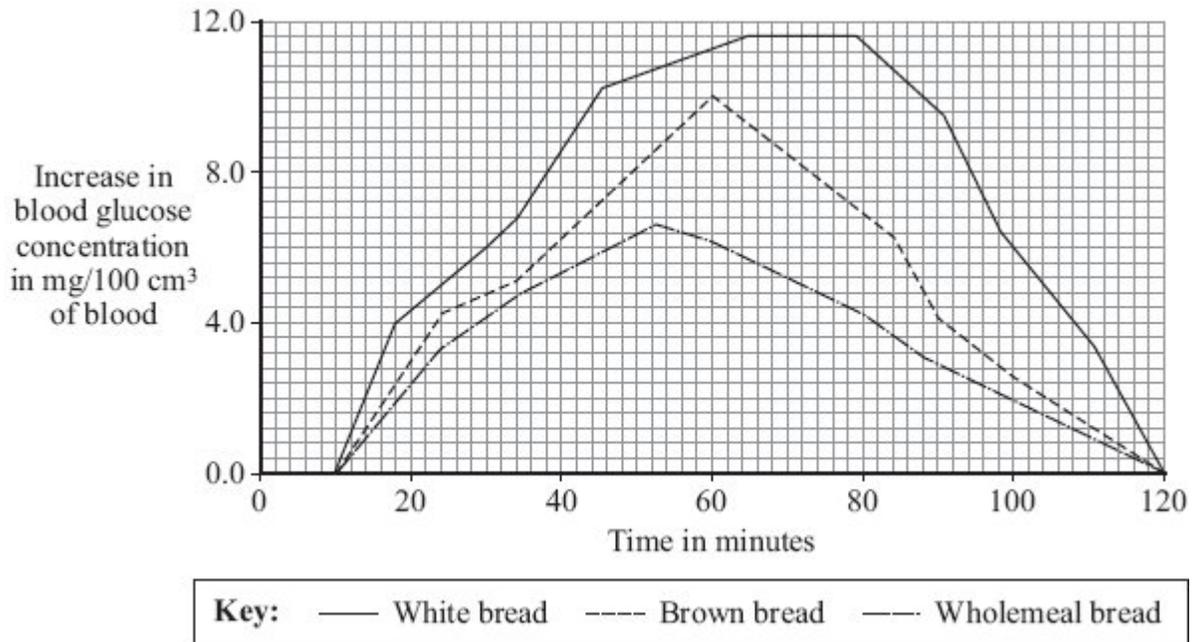
4.

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)

Mark schemes

- 1.** (a) glucagon
correct spelling only 1
- (b) if glucose too high (insulin causes) glucose to enter liver / muscle cells
or
glucose to be converted to glycogen 1
- so blood glucose levels fall 1
- when glucose gets too low (glucagon causes) glycogen breakdown in liver / muscle cells
allow ecf from part (a) 1
- so glucose enters blood and raises level again 1
- this is called negative feedback 1
- (c) any **two** from:
• polymer
• made of two strands
• (twisted) in a double helix
allow:
• *backbone of strands contains sugar and phosphate groups*
• *(cross) linked by pairs of bases*
• *correct names of four bases or base pairs* 2
- (d) contains a code 1
- for a sequence of amino acids which forms a specific protein 1

(e) mother **A** (polydactyly)

50% / half of children will have polydactyly if parent is heterozygous as it only takes one allele to show the disorder and half the sperm / ova / gametes will have faulty allele.

1

(and) all / 100% will have polydactyly if parent is homozygous as faulty gene will always be passed on

1

(but) for mother **B** (cystic fibrosis) none / 0% of children will have cystic fibrosis as it would need a second allele from the other parent before the disorder would be present

allow genetic diagram(s) if correct and offspring ratio clearly indicated.

1

[13]

2.

(a) controlling water output in urine

1

keeping cool on a hot day

1

(b) pituitary

1

(c) $(8.4 - 5.2 =) 3.2$ (mmol/dm³)

1

(d) diabetes

ignore type of diabetes

1

(e) the pancreas is not releasing insulin

1

(f) change diet

allow description of suitable diet change e.g. use sweetener in hot chocolate, eat less sugary / starchy food or stop eating sugar-coated cereal

1

take more exercise

allow description e.g. go to gym instead of reading and TV, walk / cycle to work

allow change to an active job

if no other marks awarded allow 1 mark for lose weight.

1

[8]

3.

(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]

4.

(a) (i) (wholemeal bread) 1
any **two** from:
lower maximum / peak / less change

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]