



Dr. Bbosa Science

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O-level biology

Homeostasis

This is the keeping internal environment constant. This is important because enzymes work best within narrow ranges of blood sugar, temperature, pH and salt concentration.

The homeostasis of blood sugar

The concentration of blood sugar is $90\text{g}/100\text{cm}^3$. If blood sugar increases beyond this value, the excess sugar may be lost in urine and too low blood sugar cannot sustain life.

How is blood sugar kept constant?

When the concentration of glucose increases in blood, the pancreas produces a hormone called *insulin*. This facilitates liver cells to convert the excess glucose to glycogen and fats.

If blood sugars fall below the normal value, the pancreas produce less insulin and more glucagon which cause the liver to covert glycogen, fats and/or proteins to glucose.

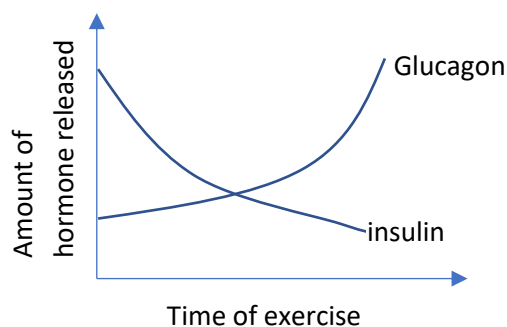
This type of control mechanism of glucose where the concentration of end product stimulates changes that leads to its regulation is called **negative feedback mechanism**.

NB. In negative feedback mechanism, a change in the value of the controlled factor initiates a series of processes that bring back the factor to normal.

Failure of the pancreas to produce enough insulin causes **diabetes mellitus**, a condition in which glucose is lost in urine. And a person suffering from diabetes mellitus will have his urine changing from blue to green to yellow to orange when boiled with Benedict's or Fehling's solution.

Exercise

1. A man's urine gave a positive test with Benedict's solution. What is the best deduction about this man?
A. He had been eating a lot of sugar B. There was too much insulin in blood
C. There was too much insulin in his blood D. He was suffering from diabetes
2. A sample of urine from a woman was boiled with Benedict's solution and the mixture turned orange in color. Which of the following is the best deduction about the condition of the person?
A. He has a deficiency of insulin in his blood
B. There is a lot of glycogen in his blood
C. His diet has a lot of sugar
D. His kidney were damaged
3. Glucose is not contained in the urine of a healthy person because
A. All the glucose pass back into the blood stream
B. The glomerulus is impermeable to glucose
C. Glucose is used for respiration before reaching the kidney
D. Kidney convert glucose to urea
4. Which one of the following hormones is most likely to be secreted in an individual as a result of not eating food for a day?
A. insulin
B. Glucagon
C. Thyroxine
D. Adrenaline
5. How does the human body restore a low level of glucose in the blood to normal levels?
6. The figure below is a graph showing the effect of prolonged exercise on the secretion of insulin and glucagon hormones in a human being.



- (a) Explain the variation in insulin and glucagon during the exercise
(i) Insulin (05 marks)
(ii) Glucagon
- (b) Suggest how the concentration of the two hormones would vary if the individual swallowed much glucose after the exercise
(i) Insulin (03marks)

- (ii) Glucagon (03marks)
 - (c) Explain why it is important for the human body to secrete the insulin and glucagon (04mark)
7. (a) State the organ in human that secretes insulin hormone (01mark)
- (b) Explain why a person suffering from diabetes
 - (i) has to be given regular doses of insulin (03marks)
 - (ii) has to eat more frequently (02marks)
 - (c) Glucose and not sucrose is recommended to be given to an athlete after a race. Explain this observation (04marks)

Marking guide

1. D 2. A 3. A 4. B

5. If blood sugars is below the normal value, the pancreas produce less insulin and more glucagon which cause the liver to covert glycogen, fats and/or proteins to glucose.
6. (a) (i) The amount of insulin released decrease as the exercise goes on to promote the conversion of glycogen, fats and or proteins into glucose used for respiration.
- (ii) The amount of glucagon produced increases as the exercise goes on to promote conversion of glycogen, fats and proteins into glucose to restore used glucose.
- (b)(i) The amount of insulin released would increase to enable the liver to convert excess glucose into glycogen and/or fat.
- (ii) The amount of glucagon increases to enable the body convert excess glucose to glycogen or fat.
- (c) Insulin enables the liver cells to convert excess glucose to glycogen or fat for future use
- Glucagon enables the liver cells to convert glycogen and/or fats into glucose when its level falls.
7. (a) pancreas
- (b) (i) insulin injection compensates for declining insulin production by the pancreas in order to control sugar levels.
- (ii) Diabetic's body is not able to adjust the amount of insulin produced according to sugar level. Eating the same amount of food into small frequent portions helps the body to control blood glucose.
- (c) Glucose is the immediate carbohydrate used for respiration. Sucrose would delay energy supply since it has to be digested.