

Homeostasis in mammals

Question Paper 5

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Homeostasis
Sub Topic	Homeostasis in mammals
Booklet	Theory
Paper Type	Question Paper 5

Time Allowed : 64 minutes

Score : / 53

Percentage : /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) The first diagnostic test strip using immobilised enzymes was a dip stick to estimate the concentration of glucose in urine.

The dip stick is a thin strip of plastic with a cellulose pad containing two enzymes and a colour reagent (chromogen) at one end. The pad responds with a colour change after being dipped into a sample of urine that contains glucose. The colour can be matched against a graded colour chart to give a ‘semi-quantitative’ estimate of the concentration of glucose in the sample, as shown in Fig. 2.1. The chart shows the colours of a negative reaction (–) and three increasingly positive reactions (+, ++ and +++).

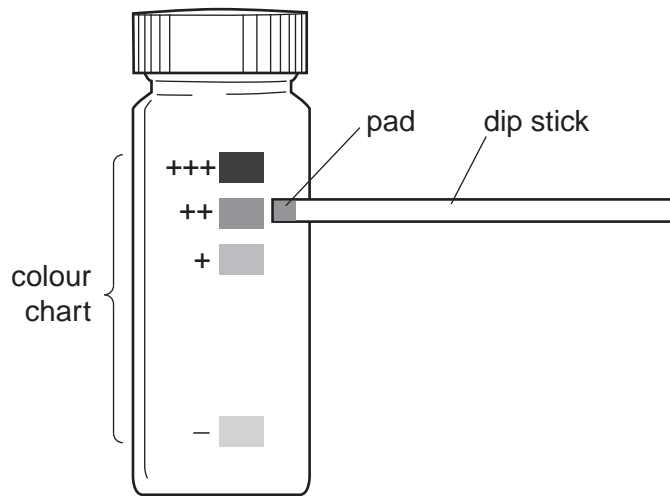


Fig. 2.1

Explain why the estimate of glucose concentration achieved by this method is only ‘semi-quantitative’.

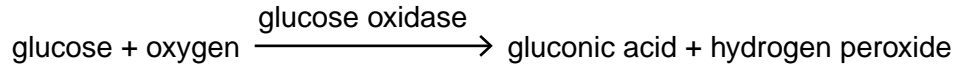
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- (b) One of the two enzymes immobilised in the cellulose pad on the test strip is glucose oxidase, which catalyses the following reaction:



This reaction does **not** result in the development of colour by the chromogen. This is achieved by the activity of the second immobilised enzyme in the pad.

- (i) Name the second immobilised enzyme in the pad.

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- (ii) Explain how the reaction catalysed by this enzyme results in the chromogen changing colour.

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- (iii) The cellulose pad on the test strip is covered by a layer of cellulose acetate, which is permeable to glucose molecules, but not to larger molecules.

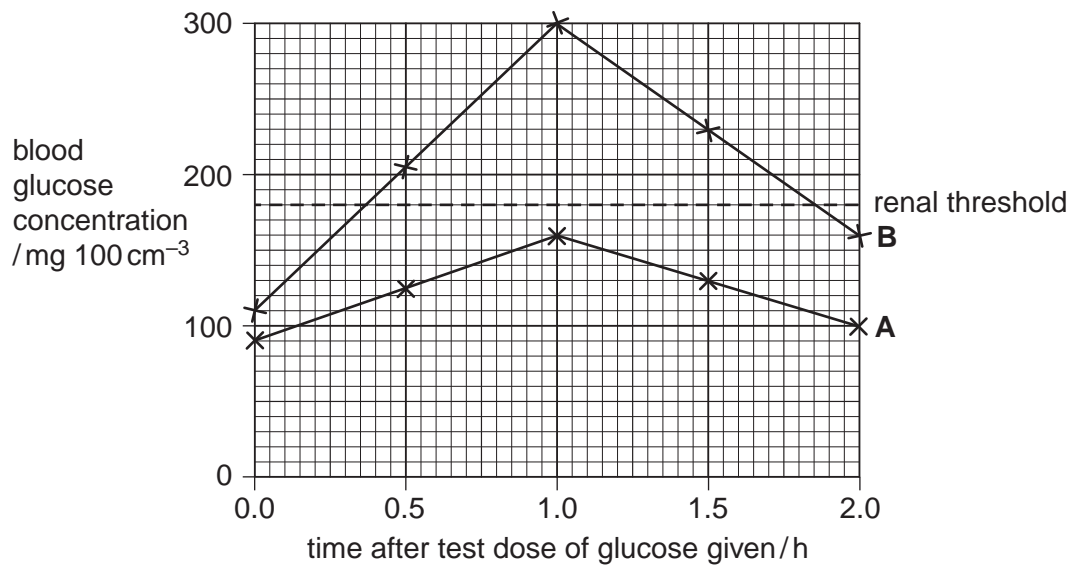
Suggest why the layer of cellulose acetate is present.

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(c) Two young men, subjects **A** and **B**, were each given a standardised test dose of glucose after fasting.

- The blood glucose concentration of each subject was then measured immediately and at 30 minute intervals for two hours.
- Samples of their urine were taken and tested at the same time intervals. The colour change of each test strip was compared with the colour chart and recorded as **–**, **+**, **++** or **+++**.

The results of the investigation are shown in Fig. 2.2.



Results of urine tests:

subject	time after test dose of glucose given/h				
	0.0	0.5	1.0	1.5	2.0
A	–	–			
B	–	+	++	++	+++

Fig. 2.2

With reference to Fig. 2.2:

- (i) explain the differences between the **blood glucose** concentrations of **A** and **B**

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- (ii) suggest what is meant by the term 'renal threshold'

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- (iii) describe the events in the kidneys, after ultrafiltration, that result in the increasing quantity of glucose in **B**'s urine.

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[Total: 15]

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- 4 (a) When a part of the body is damaged or injured, action potentials are sent to the areas of the brain responsible for the perception of pain.

Explain how the structure of a sensory neurone can enable the action potentials to reach the brain very quickly.

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- (b) The pain associated with osteoarthritis can be relieved using transcutaneous electrical nerve stimulation (TENS). It uses electrical impulses to stimulate the nerve endings at, or near, the site of the pain. Self-adhesive electrodes are stuck on the skin and attached to a small, portable power unit.

Fig. 9.1 shows a TENS machine in use.



Fig. 9.1

It is thought that TENS triggers the release of natural painkillers called endorphins, which are similar in shape to painkilling drugs such as morphine.

Fig. 9.2 shows synapses in a pain pathway from a damaged joint to the brain.

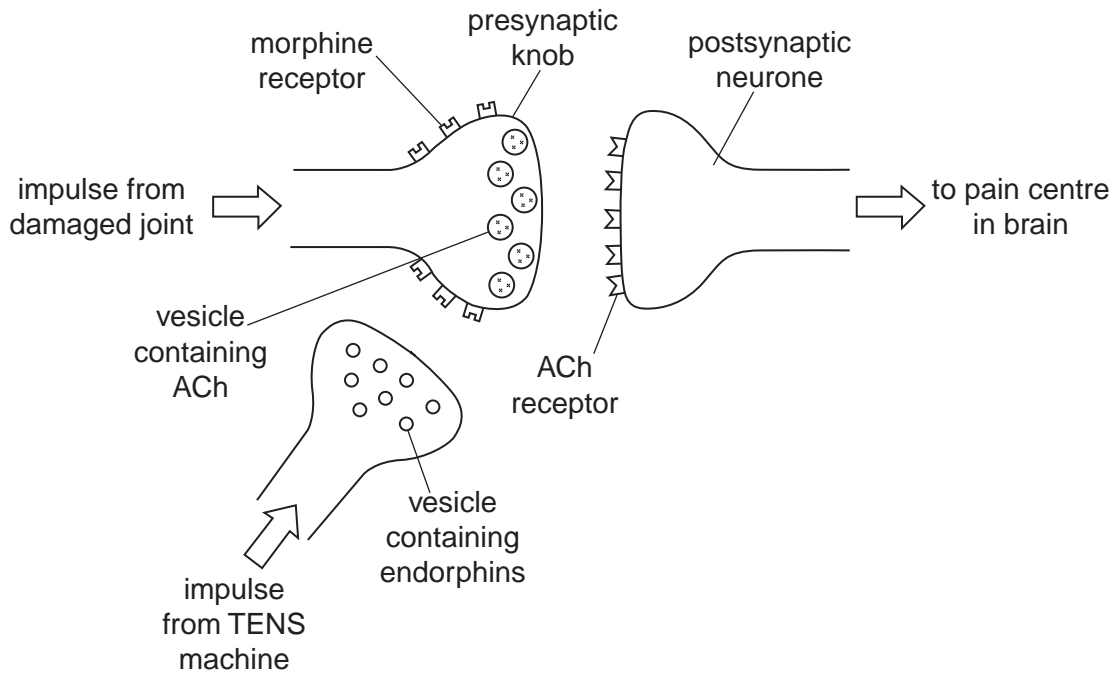


Fig. 9.2

(i) Suggest how endorphins may act to reduce pain.

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(ii) Suggest advantages of using TENS for pain relief instead of more conventional treatment.

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5 Urea is the main nitrogenous waste product in humans. It is made in the liver and excreted by the kidneys in urine.

(a) Define the term *excretion*.

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(b) The kidneys regulate the water potential of body fluids. This is known as osmoregulation and involves a negative feedback system.

Outline the role of negative feedback in osmoregulation.

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(c) Investigations have shown that when a person remains in a cold environment for more than 15 minutes there is increased urine production. This is called cold diuresis.

Suggest how exposure to cold can lead to cold diuresis.

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[Total: 8]