1. Nov/2019/Paper_41/No.1

(a) ADH is a hormone that is released into the blood of a mammal when changes occur in the internal environment.

(i) State **one** change in the internal environment of a mammal that leads to the release of ADH.

..... [1]

(ii) Name the part of the body that releases ADH into the blood.

..... [1]

(b) Fig. 1.1 shows a cell of one of the collecting ducts of the kidney.

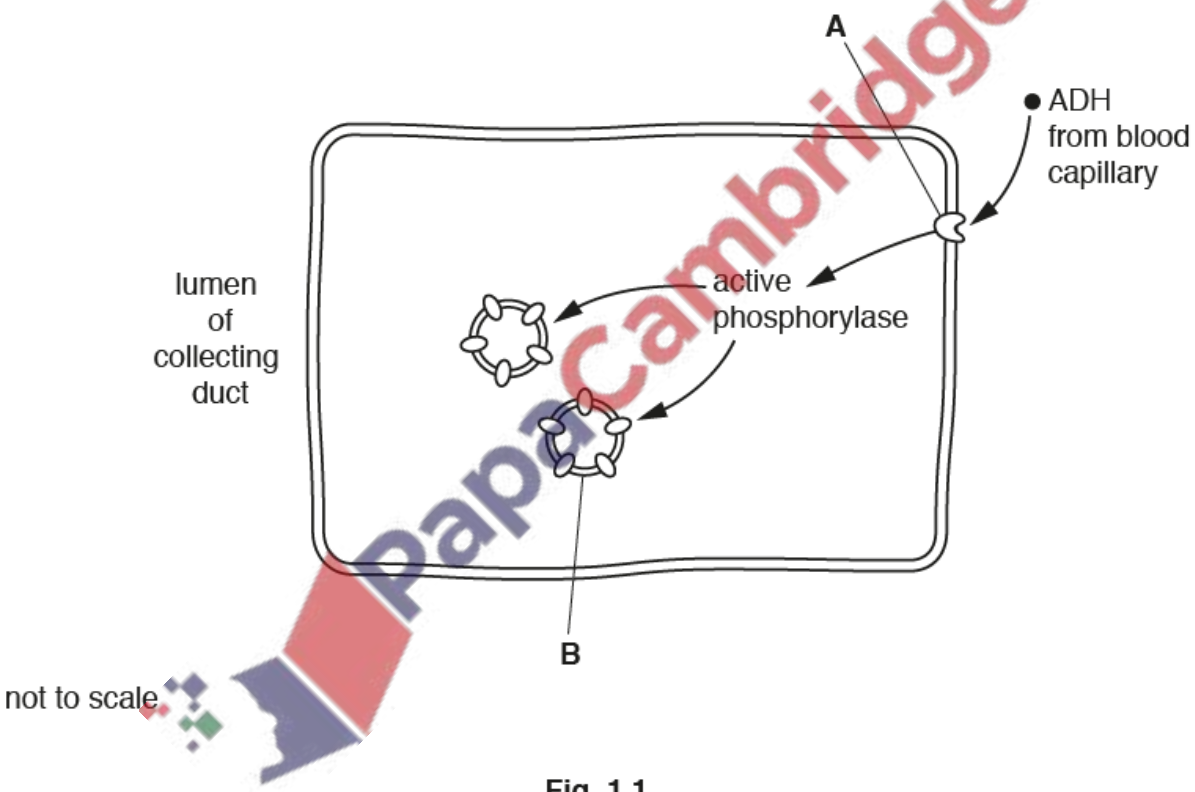

Fig. 1.1

Name membrane protein **A** and cell structure **B**.

A .....

B ..... [2]

(c) The phosphorylase enzyme stimulates structure **B**.

Describe the response of structure **B** to this stimulation **and** describe the consequences of this response.

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..... [4]

[Total: 8]

2. Nov/2019/Paper_42/No.1

(a) ADH is a hormone that is released into the blood of a mammal when changes occur in the internal environment.

(i) State **one** change in the internal environment of a mammal that leads to the release of ADH.

..... [1]

(ii) Name the part of the body that releases ADH into the blood.

..... [1]

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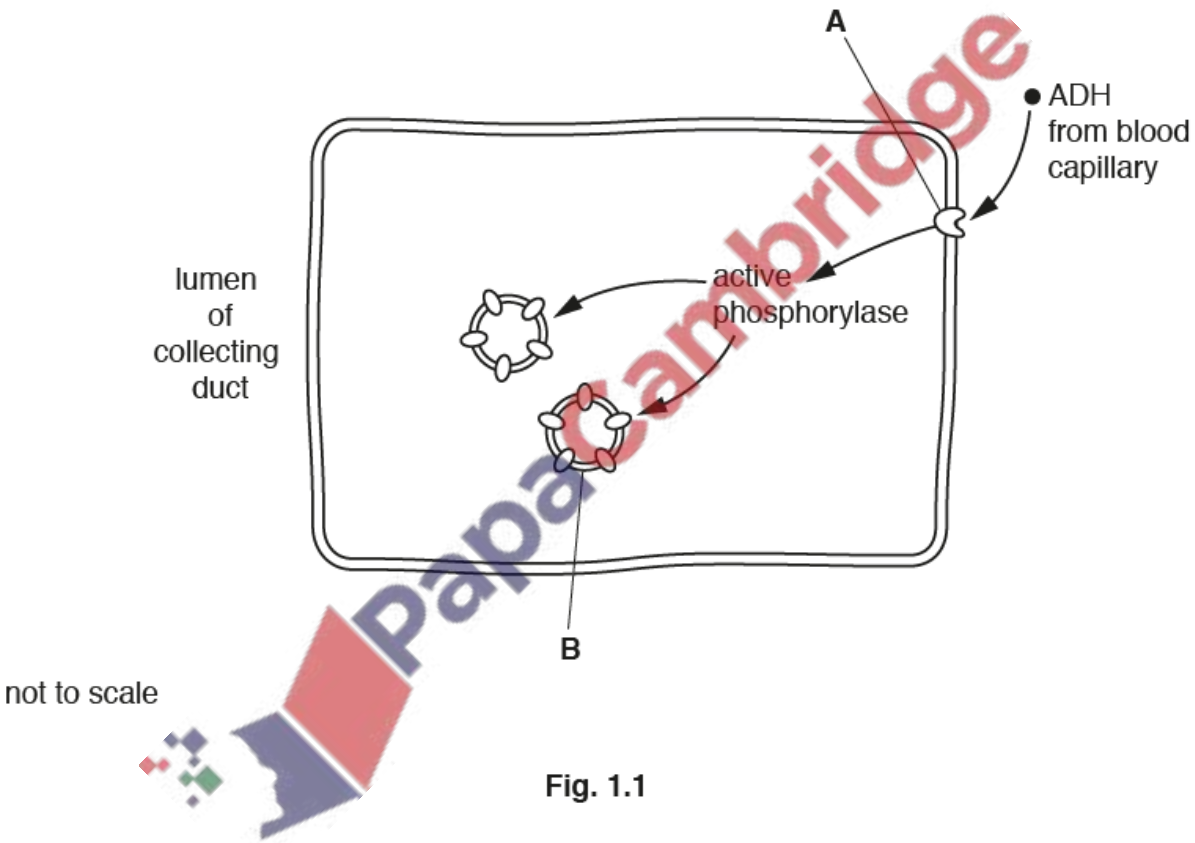

Fig. 1.1

Name membrane protein **A** and cell structure **B**.

A .....

B ..... [2]

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Describe the response of structure **B** to this stimulation **and** describe the consequences of this response.

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..... [4]

[Total: 8]

3. Nov/2019/Paper_43/No.1

(a) Fig. 1.1 shows part of a guard cell.

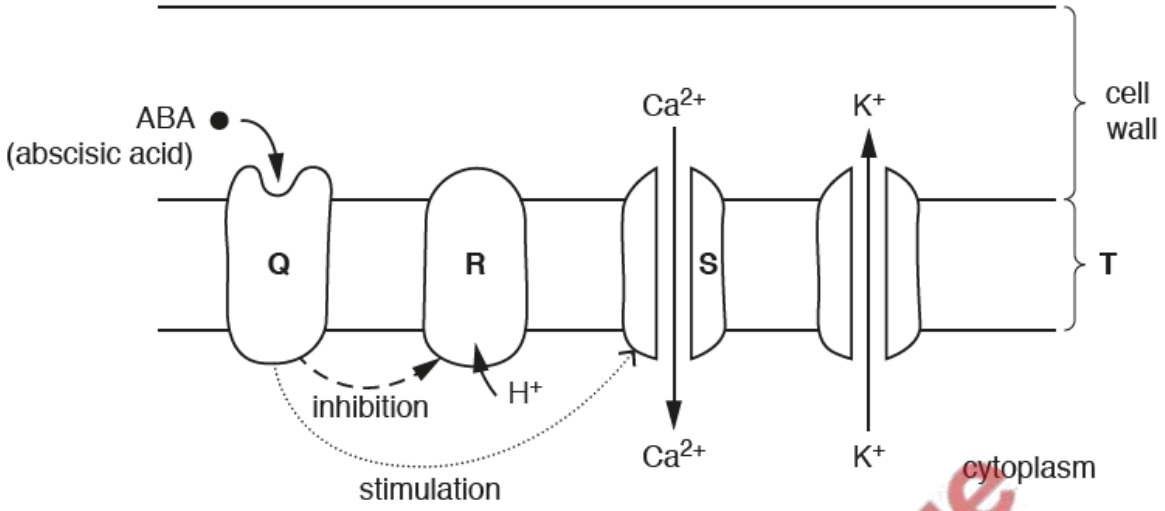

Fig. 1.1

(i) State the **type** of protein represented by **Q**.

..... [1]

(ii) Proteins **R** and **S** are transport proteins.

Identify **R** and **S**.

R.....

S..... [2]

(iii) Name cell structure **T**.

..... [1]

(b) With reference to Fig. 1.1, outline the events that occur in a guard cell during times of water stress.

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..... [5]

[Total: 9]

4. June/2019/Paper_41/No.7

(a) Some people have a condition called diabetes. In type 1 diabetes the pancreas does not produce enough insulin.

Fig. 7.1 shows the blood glucose concentrations of a type 1 diabetic person and a non-diabetic person, at regular intervals after drinking a glucose drink.

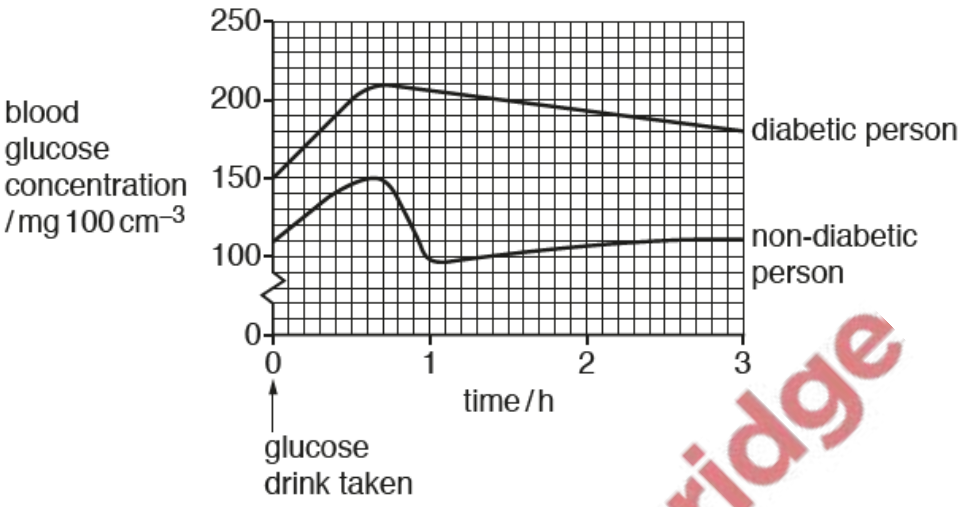

Fig. 7.1

(i) Describe the results shown in Fig. 7.1.

.....

.....

.....

.....

.....

.....

..... [3]

(ii) Name the location of the receptors in a non-diabetic person that detect a change in blood glucose concentration.

..... [1]

(iii) Name the homeostatic mechanism by which blood glucose concentration is maintained.

..... [1]

(b) The urine of a non-diabetic person does not contain glucose. A person with type 1 diabetes will excrete glucose in urine.

A reading of the concentration of glucose in the urine can be estimated using a dipstick.

Fig. 7.2 outlines how a dipstick works.

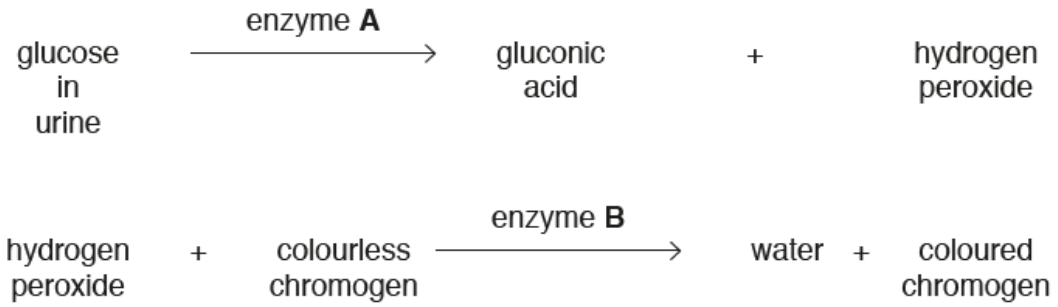

Fig. 7.2

The higher the concentration of glucose in the urine, the darker the colour on the dipstick.

(i) Name enzymes **A** and **B**.

A .....

B .....

[2]

(ii) An electronic biosensor can be used to measure the glucose concentration in a drop of blood.

Suggest **one** advantage of using a biosensor and **one** advantage of using a dipstick to measure glucose concentration.

biosensor .....

.....

dipstick .....

.....

[2]

(c) Describe the role played by insulin in the control of blood glucose concentration.

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..... [5]

[Total: 14]

5. June/2019/Paper_42/No.5

(a) Fig. 5.1 is a photomicrograph of part of the cortex of a kidney.

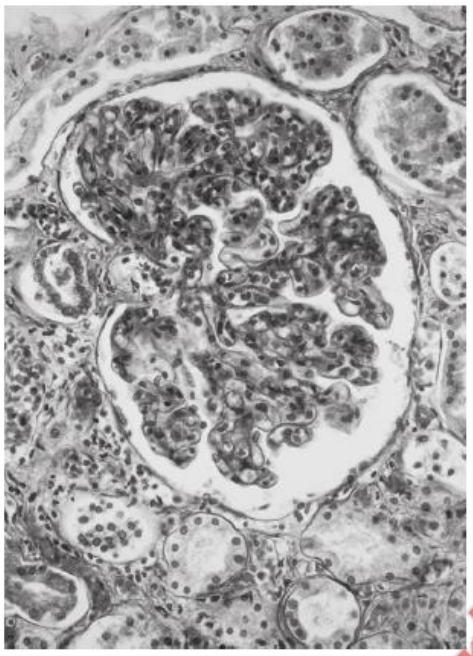

Fig. 5.1

(i) On Fig. 5.1, use label lines and letters to label:

G – the glomerulus

L – the lumen of the Bowman's (renal) capsule.

[2]

(ii) During ultrafiltration, components of blood in the glomerulus with a relative molecular mass greater than 68 000 are prevented from passing into the Bowman's capsule.

Name the structure that acts as this filtration barrier.

..... [1]

(b) The glomerular filtration rate (GFR) is the rate of flow of filtered fluid through the kidneys per unit time.

The afferent arterioles supply blood to the glomerulus of each nephron within the kidney and the efferent arterioles take blood away from each glomerulus. The lumen diameters of the afferent and efferent arterioles have a large effect on the GFR. Normally the lumen diameters of the afferent and efferent arterioles are different, but they can change to increase or decrease the normal GFR in response to changing conditions.

Complete Table 5.1 to indicate whether the GFR is normal, increased, or decreased for each combination of arteriole diameters shown.

The first row has been completed for you.

Table 5.1

afferent arteriole lumen diameter	efferent arteriole lumen diameter	GFR
normal	normal	normal
decreased	normal	.....
normal	increased	.....

[2]

(c) After leaving the Bowman's capsule, the glomerular filtrate passes through the proximal convoluted tubule, where selective reabsorption occurs.

Describe **and** explain how all of the glucose in the glomerular filtrate is reabsorbed back into the blood.

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..... [5]

(d) State **and** explain **three** features of a proximal convoluted tubule cell that adapt it to its function.

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.....

.....

.....

.....

..... [3]

[Total: 13]

6. June/2019/Paper_43/No.5

(a) Fig. 5.1 is a photograph of a section through a kidney.

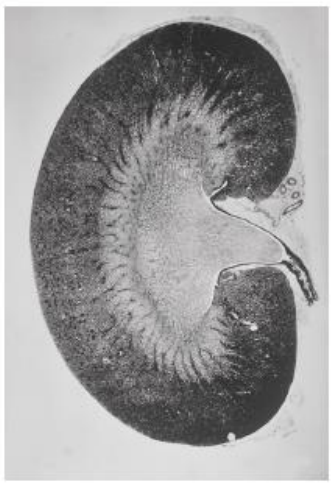

Fig. 5.1

On Fig 5.1, use label lines and letters to label the regions of the kidney where the following are located:

L – loop of Henlé

D – distal convoluted tubule

P – podocyte cells.

[3]

(b) In a cold environment, people urinate more frequently. This condition is called cold diuresis.

In a cold environment, homeostatic mechanisms keep heat loss to a minimum. Blood is diverted away from the skin so that more blood circulates around the main body organs, including the kidney.

Suggest **and** explain why cold diuresis occurs.

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..... [4]

(c) The water potential of the blood is maintained at a constant level by a mechanism called negative feedback.

With reference to the maintenance of the water potential of the blood, explain what is meant by negative feedback.

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..... [5]

(d) ADH affects the number of water channel proteins, aquaporins, in the cell surface membranes of the cells of the distal convoluted tubule.

State what happens to the water potential **and** volume of the urine if cells in the distal convoluted tubule have more aquaporins in their cell surface membranes.

water potential .....

volume of urine .....

[1]

[Total: 13]

7. Feb/2019/Paper_42/No.2

(a) The hormone glucagon is an example of a cell signalling molecule. Table 2.1 lists the mair events that occur when the blood glucose concentration decreases below the set point.

The events are **not** listed in the correct order.

Table 2.1

event	description of event
A	adenylyl cyclase enzyme is activated
B	cyclic AMP activates an enzyme cascade
C	glycogen stored in liver cells is broken down to glucose
D	blood glucose concentration increases
E	glucagon is secreted by α cells in the pancreas
F	conformational change to glucagon receptor causes G-protein activation
G	active adenylyl cyclase acts on ATP to produce second messenger
H	glucagon signal is amplified
I	glucose diffuses out of liver cells through GLUT transporter proteins
J	glucagon binds to receptors in the cell surface membranes of liver cells
K	cyclic AMP is formed

Complete Table 2.2 to show the correct order in which these events occur.

Three of the events have already been placed in their correct order.

Table 2.2

correct order	letter of event
1	E
2	
3	
4	
5	
6	K
7	
8	
9	
10	
11	D

[4]

(b) An investigation was carried out to measure the rate at which glucose is provided for respiration from three different sources of glucose:

- a meal
- glycogenolysis – the breakdown of glycogen
- gluconeogenesis – production of glucose from non-carbohydrate molecules.

After a person ate a meal, the rates at which glucose was provided for respiration from the three different sources were measured at regular intervals over a 24-hour period. During this period, no food was eaten.

Fig. 2.1 shows the results of this investigation.

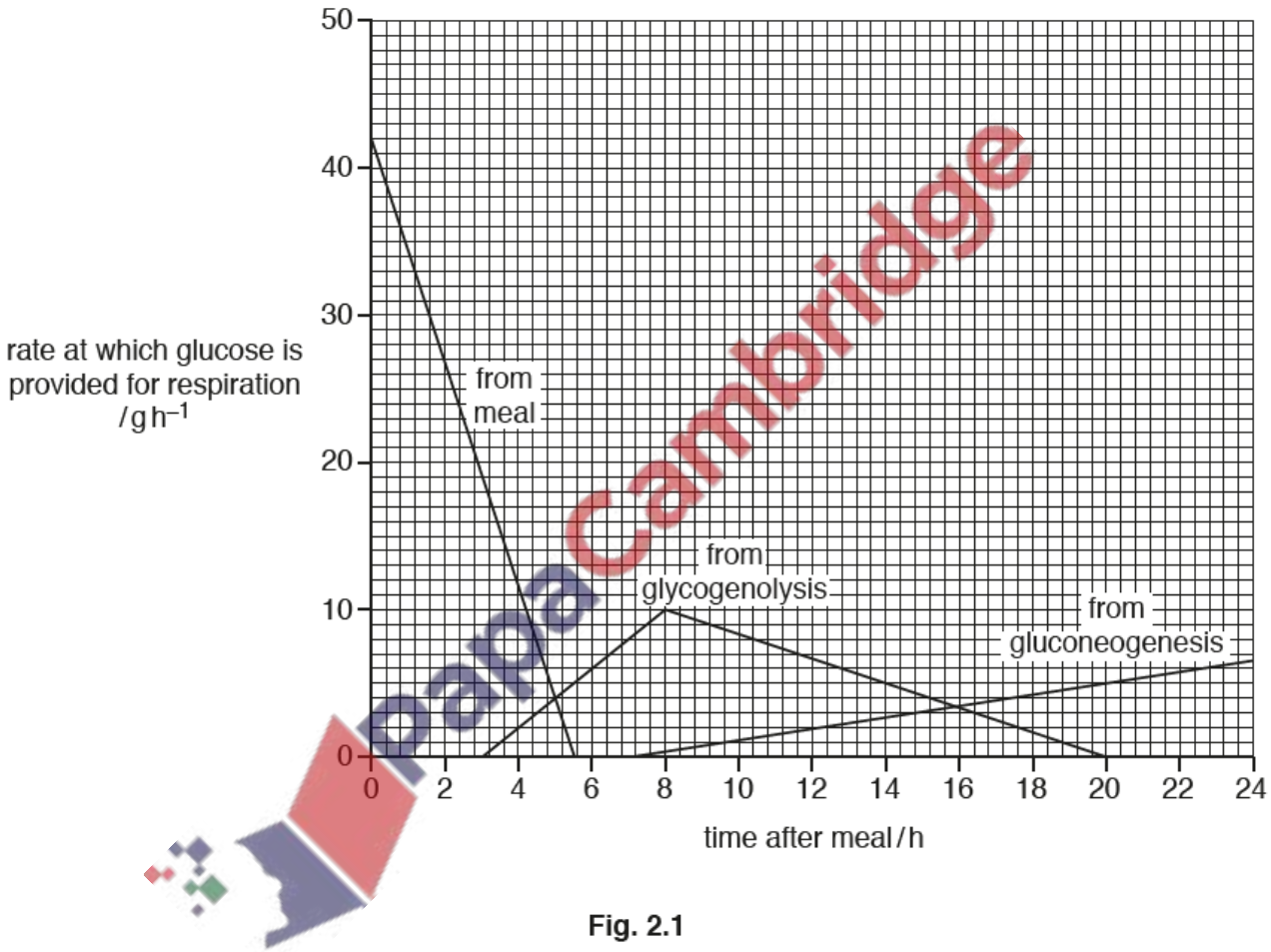

Fig. 2.1

(i) State the time after the meal when the rate at which glucose was provided from the meal for respiration was the same as the rate at which glucose was provided from glycogenolysis for respiration.

..... [1]

(ii) State the first time after the meal when **all** of the glucose for respiration was provided by gluconeogenesis.

..... [1]

(iii) Name the homeostatic mechanism by which blood glucose concentration is maintained at a set point.

..... [1]

(iv) In humans, carbohydrates such as glucose are not the only respiratory substrates.

Name **two** non-carbohydrate respiratory substrates in humans.

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..... [2]

[Total: 9]