Question: 1

The pancreas contains endocrine tissue. Fig. 1.1 shows an electronmicrograph of a section of pancreatic endocrine tissue.

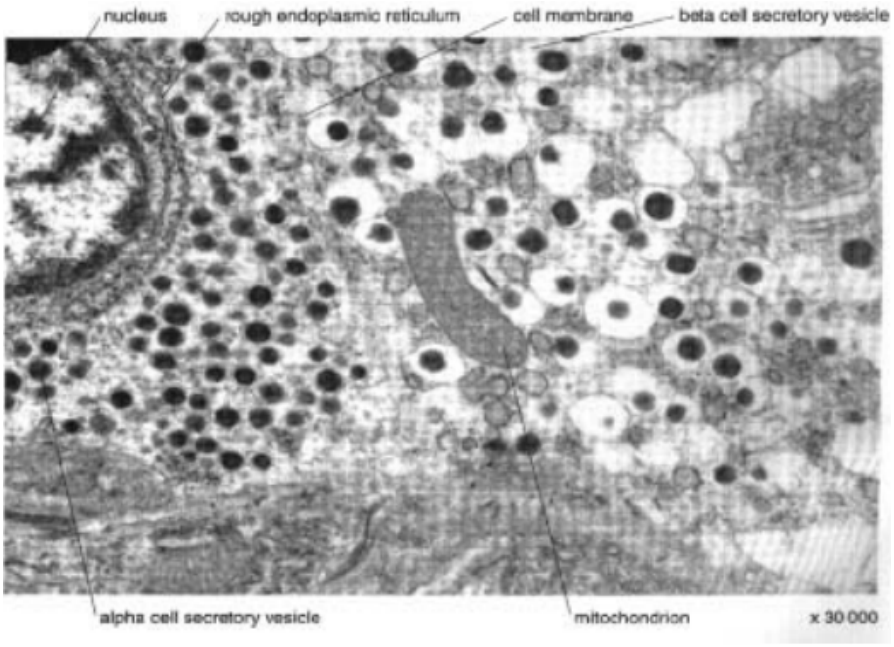

Fig. 1.1

(a) Name the endocrine tissue shown in Fig. 1.1.

_____

_____

_____

_____

_____

[1]

(b) Name the hormone present in the secretory vesicles of alpha cells.

_____

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[1]

(c) During vigorous exercise, the blood glucose concentration falls.

Describe the changes that take place to make sure that the blood glucose concentration does not fall to a dangerous level.

In your answer, you should use appropriate technical terms, spelled correctly.

_____

_____

_____

_____

_____

[6]

[Total: 8]

Question: 2

The light-dependent stage of photosynthesis takes place on thylakoid membranes in chloroplasts. These membranes surround the thylakoid space (lumen) and are arranged into stacks known as grana. Fig. 2.1 is a diagram showing the arrangement of photosystems in the thylakoid membrane, and summarising the processes that take place there.

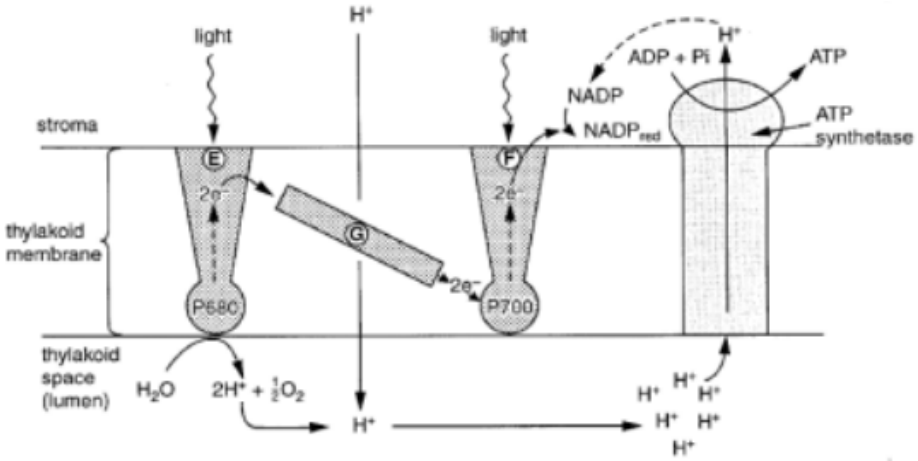

Fig. 2.1

(a) (i) Name the pigment represented by P680 and P700.

[1]

(ii) Name the type of molecule represented by G.

[1]

(b) Explain, using the information in Fig. 2.1, why the pH of the thylakoid space (lumen) is lower than that of the stroma and what significance this has for ATP production.

[4]

(c) Herbicides (weedkillers) interfere with electron transport by accepting electrons.

Suggest how this causes plants to die.

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_____

_____

_____

_____

[3]

[Total: 9]

Question: 3

(a) Define the term excretion.

_____

_____

_____

_____

_____

[2]

(b) Table 3.1 shows the mass of different substances excreted by a volunteer during two 24 hour periods. During the first 24 hour period, the volunteer was fed a protein-deficient diet; during the second 24 hour period, the volunteer was fed a protein-rich diet. All other variables were kept constant.

Table 3.1

	mass of substance excreted / g	
substance excreted	protein-deficient diet	protein-rich diet
urea	2.20	14.70
uric acid	0.09	0.18
ammonium ions	0.04	0.49
creatinine	0.60	0.58

(i) Calculate the percentage increase in urea excreted when the volunteer switched from a protein-deficient to a protein-rich diet. Show your working.

.....%

_____

_____

_____

_____

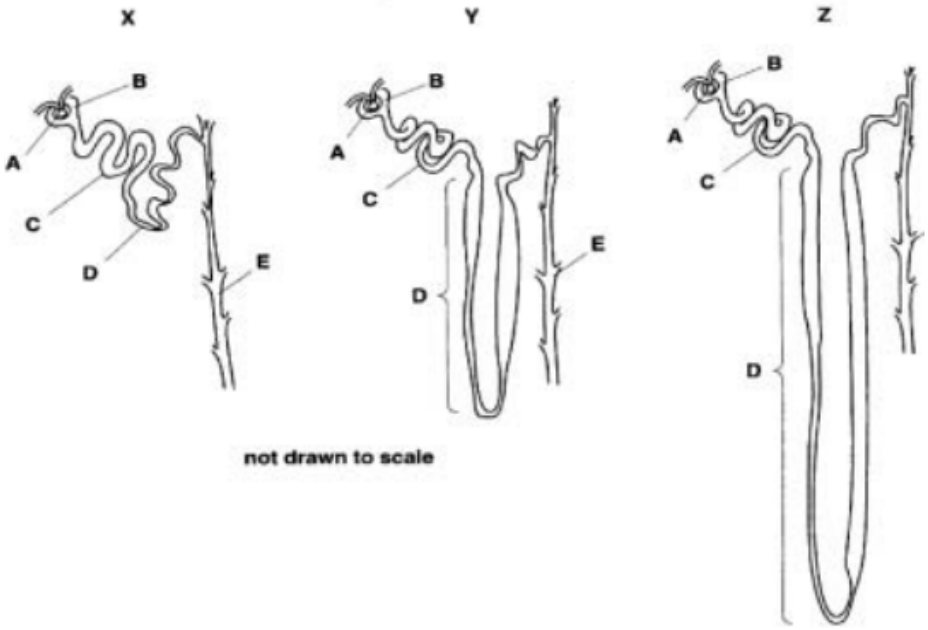
_____

[2]

(ii) Describe how excess protein is converted into urea.

[3]

Fig. 3.1 shows diagrams of nephrons from the kidneys of three different mammals, X, Y and Z.



	X	Y	Z
name of mammal	beaver	house mouse	desert living gerbil
water potential of urine	high	low	very low

Fig. 3.1

(c) Explain the relationship between the length of the section D in the nephrons and the water potential of the urine each mammal produces.

[3]
[Totel: 10]

Question: 4

Fig. 4.1 shows the relationship between various metabolic processes in yeast

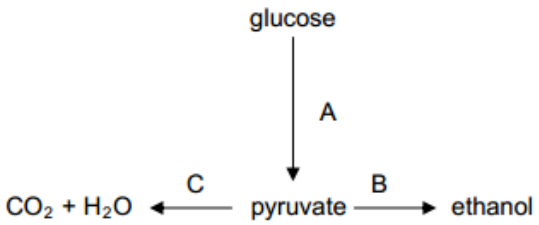


Fig. 4.1

(a) (i) Identify the three metabolic processes.

A .....

B .....

C .....

[3]

(ii) State the letter of the pathway in which acetyl coenzyme A is required.

[1]

(iii) State the letter of the pathway in which ATP is utilised.

_____

_____

_____

_____

_____

[1]

(b) In an investigation yeast cells were homogenised (broken up) and the resulting homogenate centrifuged. Portions containing only nuclei, ribosomes, mitochondria and cytosol (residual cytoplasm) were each isolated. Samples of each portion, and of the complete homogenate, were incubated in four ways:

1 With glucose.
2 With pyruvate.
3 With glucose and cyanide.
4 With pyruvate and cyanide.

Cyanide inhibits carriers in the electron transport chain, such as cytochromes.

After incubation, the presence or absence of carbon dioxide and lactate in each sample was determined.

The results are summarised in Table 4.2.

✗ = absent ✓ = present ✓ = a little

Table 4.2

	samples of homogenate									
	complete		nuclei only		ribosomes only		mitochondria only		cytosol	
	carbon dioxide	ethanol	carbon dioxide	ethanol	carbon dioxide	ethanol	carbon dioxide	ethanol	carbon dioxide	ethanol
1 glucose	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓
2 pyruvate	✓	✓	✗	✗	✗	✗	✓	✗	✓	✓
3 glucose and cyanide	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓
4 pyruvate and cyanide	✓	✓	✗	✗	✗	✗	✗	✗	✓	✓

(i) Explain why more carbon dioxide is produced when the complete homogenate is incubated with just glucose or pyruvate than when cyanide is present.

_____

_____

_____

_____

_____

[3]

(ii) Explain why carbon dioxide is produced when mitochondria are incubated with pyruvate but not when incubated with glucose.

[3]

(iii) Explain why, in the presence of cyanide, ethanol production can still occur.

[3]
[Total: 14]

Question: 5

(a) Fig. 5.1 is a diagram of a neurone.

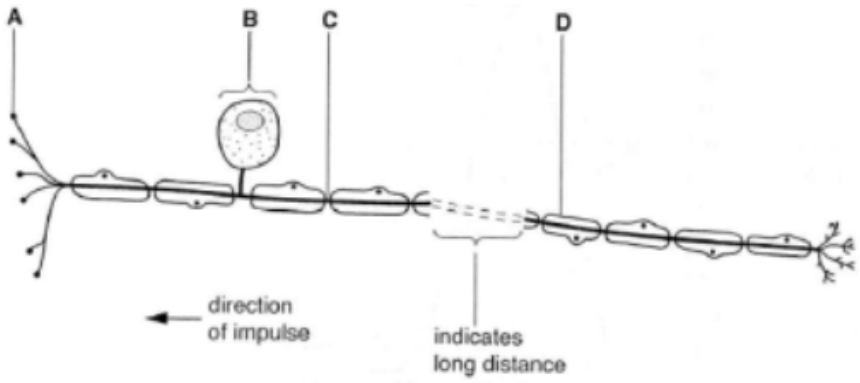


Fig. 5.1

Name the structures A and B.

A .....

_____

_____

_____

_____

_____

B .....

_____

_____

_____

_____

_____

[2]

Fig. 5.2 shows a recording of the potential difference across the membrane of an axon as an action potential is transmitted.

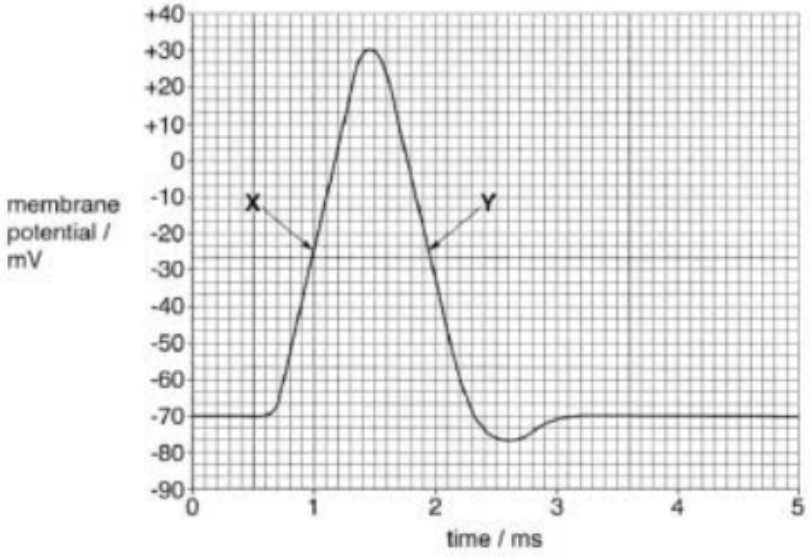

+40
+30
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
membrane potential / mV
X
Y
0
1
2
3
4
5
time / ms

Fig. 5.2

(b) Describe the events taking place in the neurone during stages X and Y.

_____

_____

_____

_____

_____

[4]

Table 5.3 shows how the speed of conduction of an action potential varies with the diameter of myelinated and non-myelinated axons in different organisms.

Table 5.3

organism	type of axon	axon diameter / μm	speed of conduction / ms^{-1}
crab	non-myelinated	30	5
squid	non-myelinated	500	25
cat	myelinated	20	100
frog	myelinated	16	32

(c) Describe the effect of myelination on the rate of conduction of an action potential and explain how this effect is achieved.

In your answer, you should use appropriate technical terms, spelled correctly.

_____

_____

_____

_____

_____

[5]
[Total: 11]

Question: 6

(a) (i) State what is meant by the term respiratory substrate.

[1]

The equation below shows aerobic respiration of compound A.

$C_{55}H_{100}O_6 + 77O_2 \rightarrow 55CO_2 + 50H_2O$
compound A

The respiratory quotient (RQ) is defined as:

$$RQ = \frac{\text{volume of } CO_2 \text{ released}}{\text{volume of } O_2 \text{ absorbed}}$$

(ii) Calculate the RQ for this reaction. Show your working.

[2]

(iii) Compound A is a fat.

Suggest what the RQ of a carbohydrate, such as glucose, might be.

[1]

(b) Fig. 6.1 is a diagram of a respirometer. A respirometer can be used to measure the oxygen uptake of living organisms.

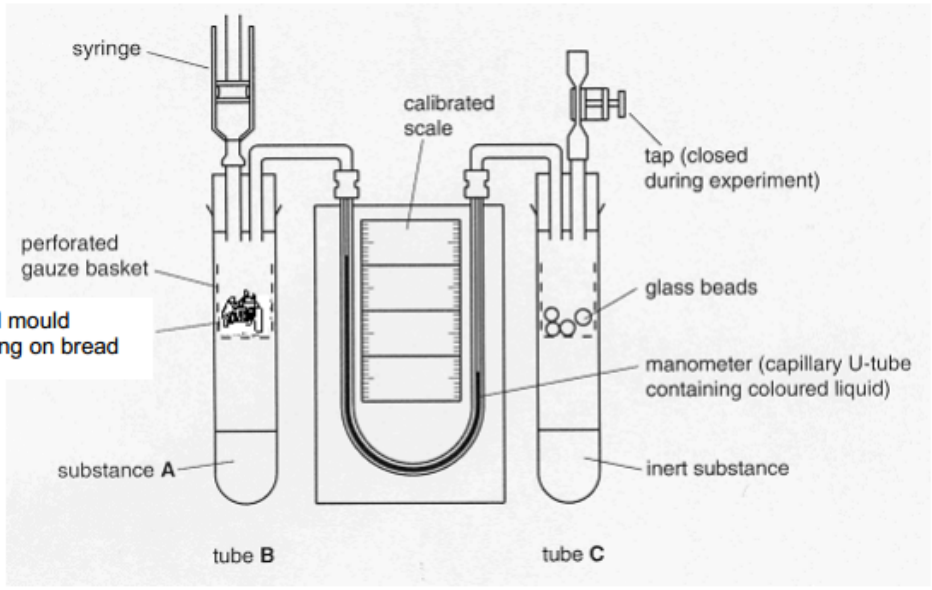


Fig. 6.1

Describe how the apparatus shown in Fig. 6.1 could be used to determine the rate of respiration of the bread mould, *Mucor*.

_____

_____

_____

_____

_____

[4]

[Total: 8]