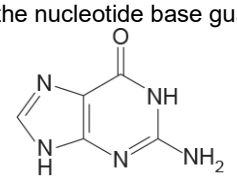
Excretion (The Liver)

1. The image below shows the structure of the nucleotide base guanine.



Bird droppings are known as *guano* because they contain a high proportion of guanine. Unlike mammals, birds excrete nitrogenous waste as guanine instead of urea. Guanine is synthesised from ammonia in the liver.

The following statements relate to guanine:

1 ammonia is more toxic than guanine
2 urea is more soluble in water than guanine
3 guanine has a high proportion of nitrogen

Which of the statements correctly explains why birds excrete guanine?

A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

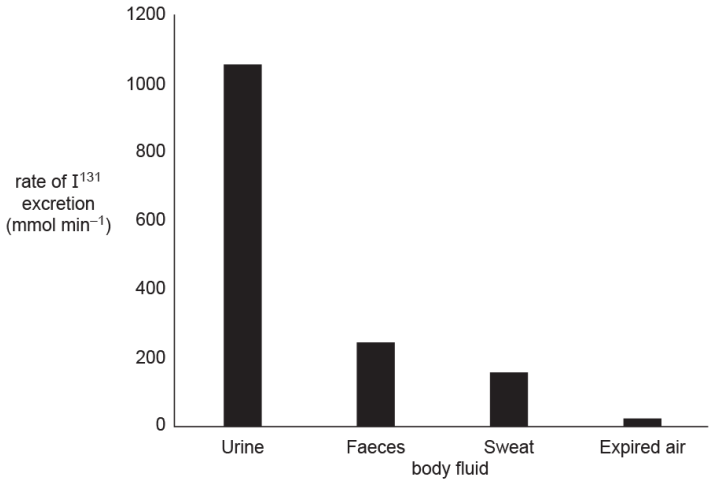
Your answer ☐

[1]

2. One treatment for thyroid cancer is radioactive iodine. The radioisotope I^{131} is used.

The thyroid gland absorbs any iodine that enters the body, so the radioactive isotope kills the cancerous cells in the thyroid gland. The I^{131} is then excreted from the body.

Different body fluids excrete different proportions of I^{131}, as shown in the following graph.



Which of the following, **A** to **D**, correctly explains the different proportions of I^{131} in each body fluid?

A I^{131} is very soluble in water.
B I^{131} is able to cross capillary walls.
C The kidneys are more efficient at excreting I^{131} than the lungs.
D The thyroid gland is well supplied with blood.

Your answer ☐

[1]

3(a). Fig. 17.1 is a diagram of the external view of a mammalian liver.

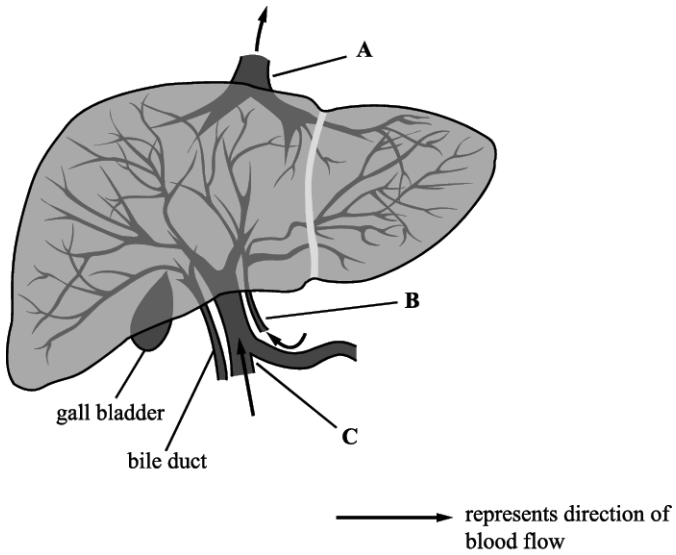


Fig. 17.1

Identify, with reasons, each of the blood vessels labelled **A** – **C** in **Fig. 17.1**.

A _____

_____

B _____

_____

C _____

_____

[3]

(b). One of the main functions of the liver cells is the formation of urea by the ornithine cycle, an outline of which is shown in **Fig. 17.2**.

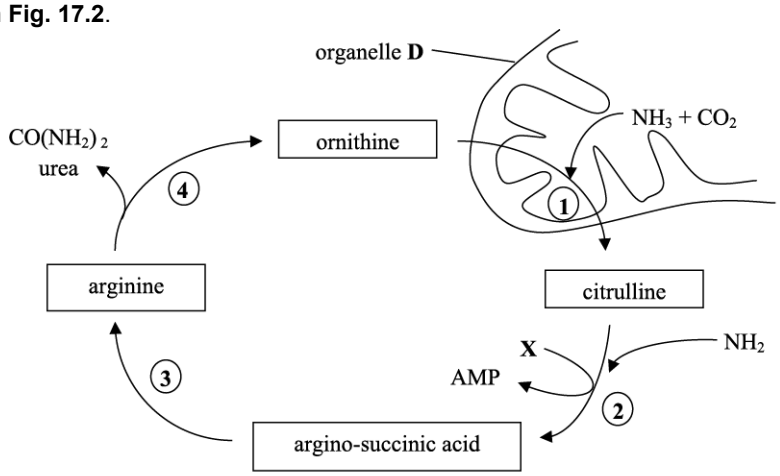


Fig. 17.2

i. Step **1** of the cycle takes place in the organelle represented by **D**.

Identify organelle **D**.

---

[1]

ii. During the cycle ornithine moves into organelle **D** and citrulline moves out of the organelle.

Suggest the method by which these molecules move into and out of the organelle during the cycle. Give reasons for your choice.

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[2]

iii. How has the ammonia that is used in step **1** been formed?

---

[1]

iv. Identify the compound labelled **X** in **Fig. 17.2**.

---

[1]

(c). Liver cells have a high metabolic rate. Hydrogen peroxide is a metabolic product produced in significant quantities in liver cells. It needs to be removed in order to prevent serious damage to the liver cells.

Hydrogen peroxide is detoxified by the enzyme catalase:

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

Catalase has a very high turnover number. A single catalase molecule can catalyse the breakdown of approximately 6 million hydrogen peroxide molecules every minute. Catalase is found in peroxisomes inside the liver cells. Peroxisomes are organelles surrounded by a single membrane.

The activity of catalase was investigated in a laboratory, using chopped liver tissue and dilute hydrogen peroxide. When the chopped liver was added to the hydrogen peroxide large quantities of froth as bubbles of oxygen were produced in the liquid.

Fig. 17.3 shows the effect of increasing enzyme concentration on the rate of the reaction.

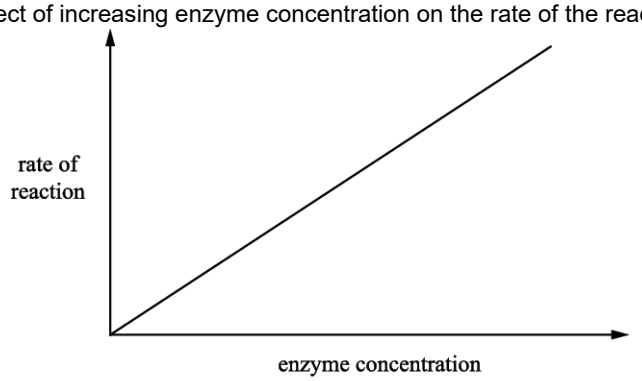


Fig. 17.3

i. Identify **two** variables that would need to be controlled in this laboratory investigation.

1_ _

2_ _

[1]

ii. How could you control **one** of the variables that you identified in **(i)** in the laboratory investigation?

---

[1]

iii. * Using the information, deduce why and how catalase activity is regulated inside the liver cells.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[6]**

4. Part of the body's response 'fight or flight' is to run away from the threat. Prolonged vigorous exercise puts high demands on the body's metabolism.

The muscle cells require an adequate supply of oxygen for respiration. If insufficient oxygen is available, the cells must respire anaerobically.

Fig. 20.2 outlines the process of anaerobic respiration in muscle cells.

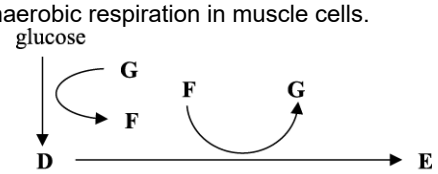


Fig. 20.2

i. Identify the compounds labelled **D** and **E** in **Fig. 20.2**.

D _____

E _____

[2]

ii. What is the role of compound **D** in anaerobic respiration?

---

[1]

iii. Why is it important that compound **G** is formed during the reaction in which compound **D** is converted into compound **E** in anaerobic respiration?

---

[2]

iv. Compound **E** is toxic and is removed from the muscle cell. It is transported to an organ in the body.

Which organ is compound **E** transported to **and** how does it reach this organ?

---

[1]

5. The following passage describes the use of alternative substrates in respiration. Complete the passage by writing in the missing words.

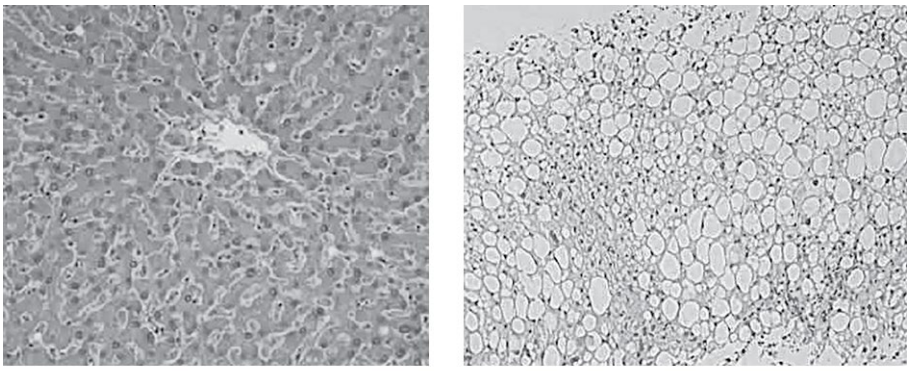
Glucose is not the only substrate that can be used for respiration in cells. Fats are hydrolysed to fatty acids and glycerol during digestion. Glycerol is converted to ……, which can then be decarboxylated to produce an acetyl group which is combined with coenzyme A and can then enter the …… cycle. Fatty acids are also converted to acetyl coenzyme A. Proteins need to be converted into amino acids which must then be deaminated in the …… . The resulting molecule can then be converted to pyruvate which enters the …… reaction. Because energy is required for these processes, the respiration of protein gives a lower yield of …… than the respiration of carbohydrates.

[5]

6. One very popular indoor bonsai tree is the Sago palm, *Cycas cirinalis*. It is common for domestic pets to chew and accidentally ingest poisonous leaves from *C. cirinalis*.

C. cirinalis leaves contain the toxin cycasin, which causes liver damage in dogs.

Fig. 22 shows slides of normal liver tissue from a dog and liver tissue damaged by cycasin.



normal damaged

Fig. 22

Describe **two** ways in which the liver tissue damaged by cycasin is different from normal liver tissue.

1 _____

_____

_____

2 _____

_____

_____

[2]

7. Fig. 17.2 is an image of a Kupffer cell from the liver.

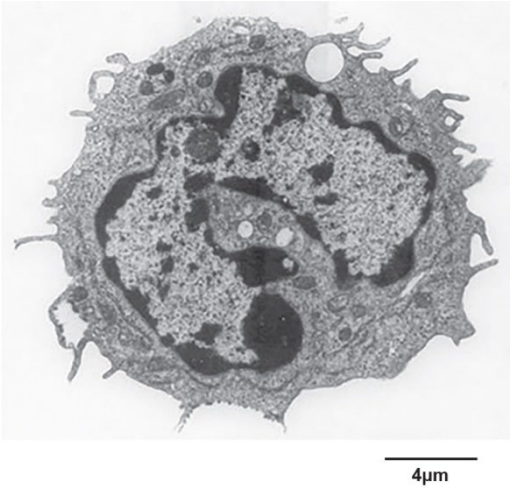


Fig. 17.2

i. The diameter of the Kupffer cell in the image is 9.1 cm. Assuming it is spherical, calculate the actual volume of this cell.

Give your answer to **four** significant figures. Show your working.

Answer = ... **[3]**

ii. Which type of microscope has been used to obtain this image? Explain your answer.

---

[2]

8. Glucose and other carbohydrates are present in respiring cells. The concentrations of carbohydrate molecules vary between tissues.

A student conducted tests on three tissues, **A, B** and **C**. Table 2 shows the results of these tests.

Tissue	Colour after Benedict's test	Colour after treatment with HCl and Benedict's test	Colour after iodine test
A	red	red	yellow
B	yellow	red	black
C	orange	orange	black

Table 2

Two of the tissues were known to be phloem tissue and liver tissue.

Use the evidence in Table 2 to identify which tissue, **A**, **B** or **C**, is phloem and which tissue is liver. Explain your answer.

Tissue _____ must be phloem because _____

_____

_____

Tissue _____ must be liver because _____

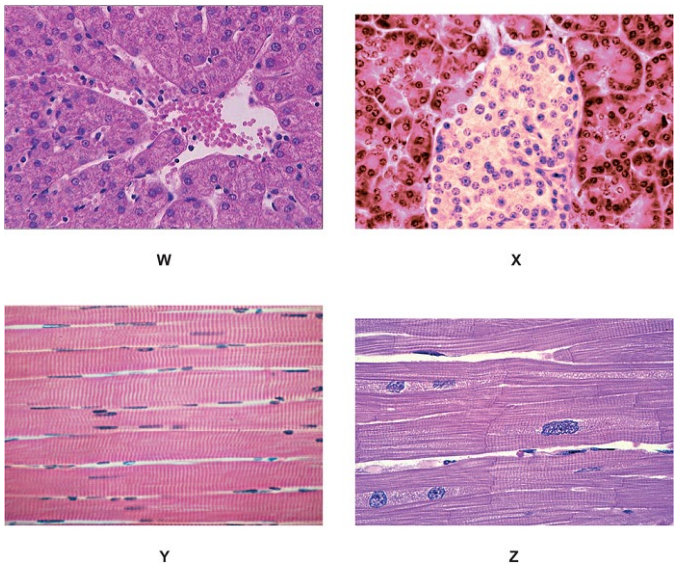
_____

_____

[3]

9. A student looked at slides of different tissues under a light microscope.

The four viewed images are labelled **W**, **X**, **Y** and **Z** in Fig. 23.1, below and **on the insert** H420/01, Biological processes (AS/A level), June 2018.



Identify tissues **W**, **X** and **Y**.

W ---

X ---

Y ---

[2]

10. When old red blood cells are broken down, each haem group is converted to a molecule called bilirubin. Bilirubin passes through the digestive system. Bilirubin gives faeces their characteristic colour.

Explain why bilirubin production and processing is an example of excretion.

---

[2]

11. Which of the options is **not** a function of the liver?

A production of urea in the ornithine cycle
B removal of amino groups from amino acids
C storage of excess amino acids as protein
D storage of glucose as glycogen

Your answer ☐

[1]

12. The liver is an organ with a wide variety of functions.

Fig. 18.1, **in the insert**, shows a light micrograph of a section of normal human liver.

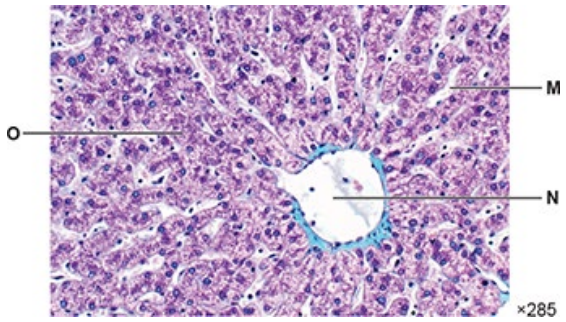


Fig 18.1

i. Identify the structures labelled **N** and **O** in **Fig. 18.1**.

N

O
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[2]

ii. The walls of the structure labelled **M** in **Fig. 18.1** are lined with cells.

Suggest and explain how these cells are adapted to carry out their function.

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[2]