



Oxford Cambridge and RSA

A Level Biology A

H420/01 Biological processes

Practice paper – Set 2

Time allowed: 2 hours 15 minutes

You must have:

- the Insert (inserted)

You may use:

- a scientific or graphical calculator
- a ruler (cm/mm)

First name

Last name

Centre
number

Candidate
number

INSTRUCTIONS

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

INFORMATION

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [].
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **32** pages.

2
SECTION A

You should spend a maximum of 20 minutes on this section.

Write your answer to each question in the box provided.

Answer **all** the questions.

- 1** Which structure, **A** to **D**, is **not** an example of a surface that is specialised for the purpose of gas exchange?
- A** alveolus of a mammal
 - B** plasma membrane of a unicellular protocista
 - C** leaf of a tobacco plant
 - D** trachea of an insect

Your answer

[1]

- 2** Which of the processes, **A** to **D**, describes the formation of cellulose?
- A** condensation polymerisation of amino acid molecules
 - B** condensation polymerisation of β -glucose molecules
 - C** hydrolysis polymerisation of α -glucose molecules
 - D** hydrolysis polymerisation of deoxyribose molecules

Your answer

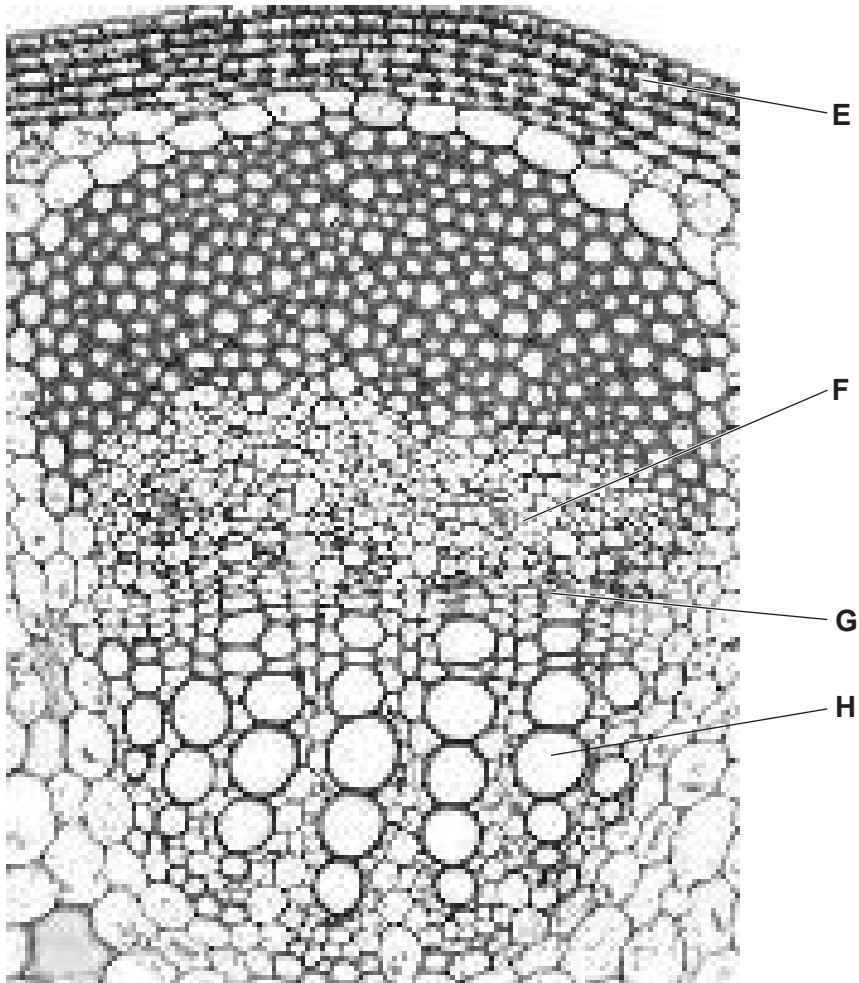
[1]

- 3** Which of the statements, **A** to **D**, shows that the genetic code is degenerate?
- A** CCA and CCT code for proline
 - B** rRNA is manufactured in the nucleolus
 - C** tRNA is not complementary to DNA
 - D** uracil is not found in DNA

Your answer

[1]

- 4 Below is a light microscope image of a transverse section of part of a plant stem.



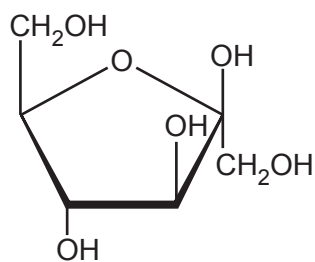
Which row, **A** to **D**, lists the correct labels for this image?

	E	F	G	H
A	xylem	meristem	epidermis	phloem
B	epidermis	phloem	cambium	xylem
C	meristem	phloem	xylem	root hair
D	xylem	cambium	phloem	meristem

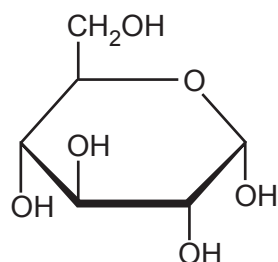
Your answer

[1]

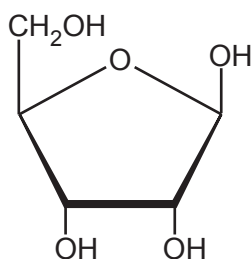
5 Which of the molecules, **A** to **D**, is a pentose sugar?



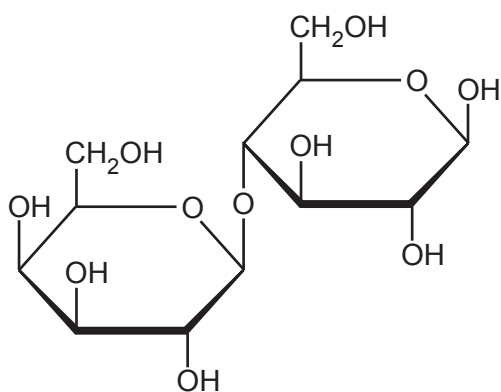
A



B



C



D

Your answer

[1]

6 Which of the statements, **A** to **D**, correctly explains why tissue fluid forms from plasma in capillaries?

- A** hydrostatic pressure > oncotic pressure
- B** oncotic pressure > hydrostatic pressure
- C** osmosis > muscle contractions
- D** solute potential < osmotic pressure

Your answer

[1]

- 7 Many enzymes require cofactors, prosthetic groups and coenzymes to function.

Which of the statements, **A** to **D**, is correct?

- A** Cl^- acts as a coenzyme for amylase
- B** Cl^- acts as a cofactor for carbonic anhydrase
- C** Zn^{2+} acts as a prosthetic group for amylase
- D** Zn^{2+} acts as a prosthetic group for carbonic anhydrase

Your answer

[1]

- 8 Which process, **A** to **D**, is a correct reason for cell signalling in multicellular organisms?

- A** homeostasis
- B** osmosis
- C** photosynthesis
- D** respiration

Your answer

[1]

- 9 The image below is a scanning electron micrograph of part of a sperm cell.



The actual diameter of the sperm head is $5.1\text{ }\mu\text{m}$. The diameter of the sperm head in the image is 1.9 cm .

Which row, **A** to **D**, correctly describes the resolution and magnification of the image above?

	Resolution	Magnification
A	5 nm	3725
B	37250	$1\text{ }\mu\text{m}$
C	0.1 mm	26840
D	2684	50 nm

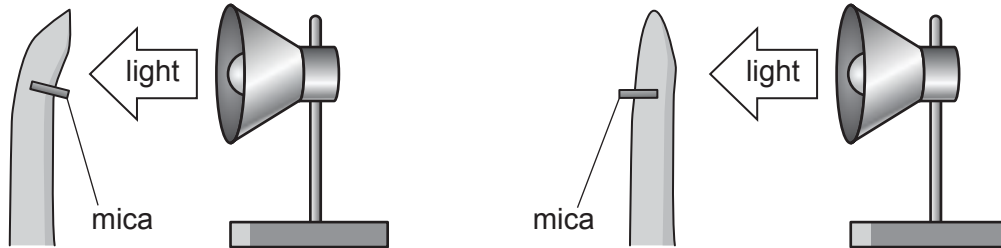
Your answer

[1]

10 In 1913, scientist Peter Boysen-Jensen investigated phototropism in plants.

He inserted mica plates into growing shoots illuminated from one side only. Mica allows electrical impulses to pass through, but does not allow soluble molecules to pass through.

The diagram below summarises Boysen-Jensen's results.



Which of the following statements correctly explains these results?

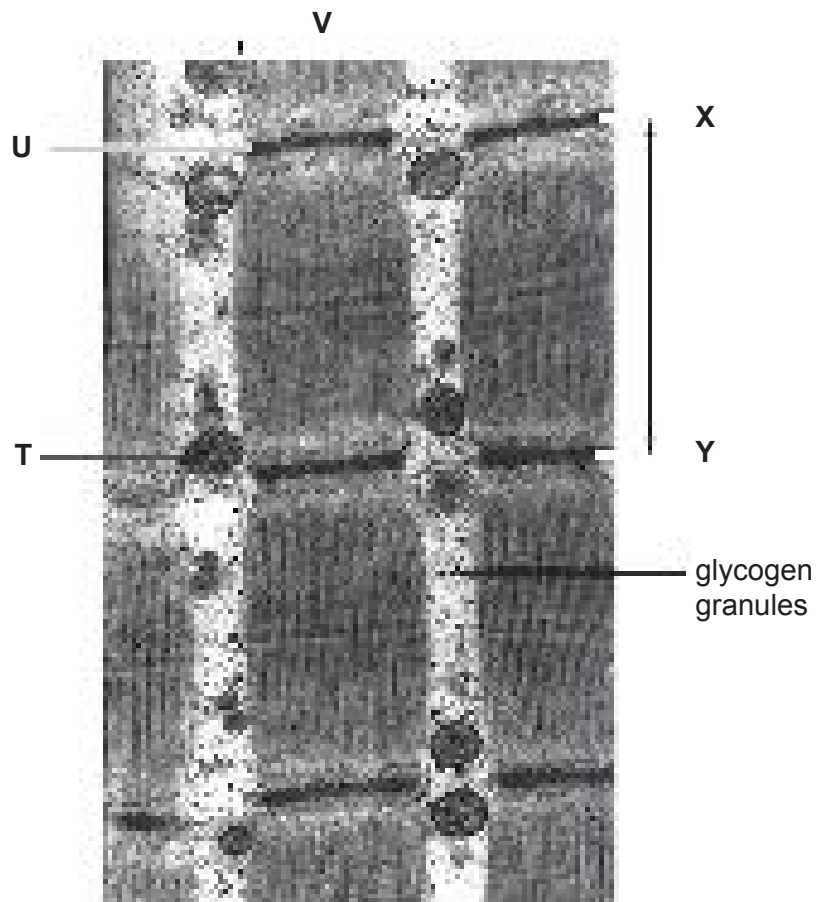
- 1 The factor causing phototropism moves away from the tip.
- 2 The factor causing phototropism is not an electrical impulse.
- 3 The factor causing phototropism moves away from light.

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

Your answer

[1]

- 11 The image below is a transmission electron micrograph of a section of skeletal muscle.



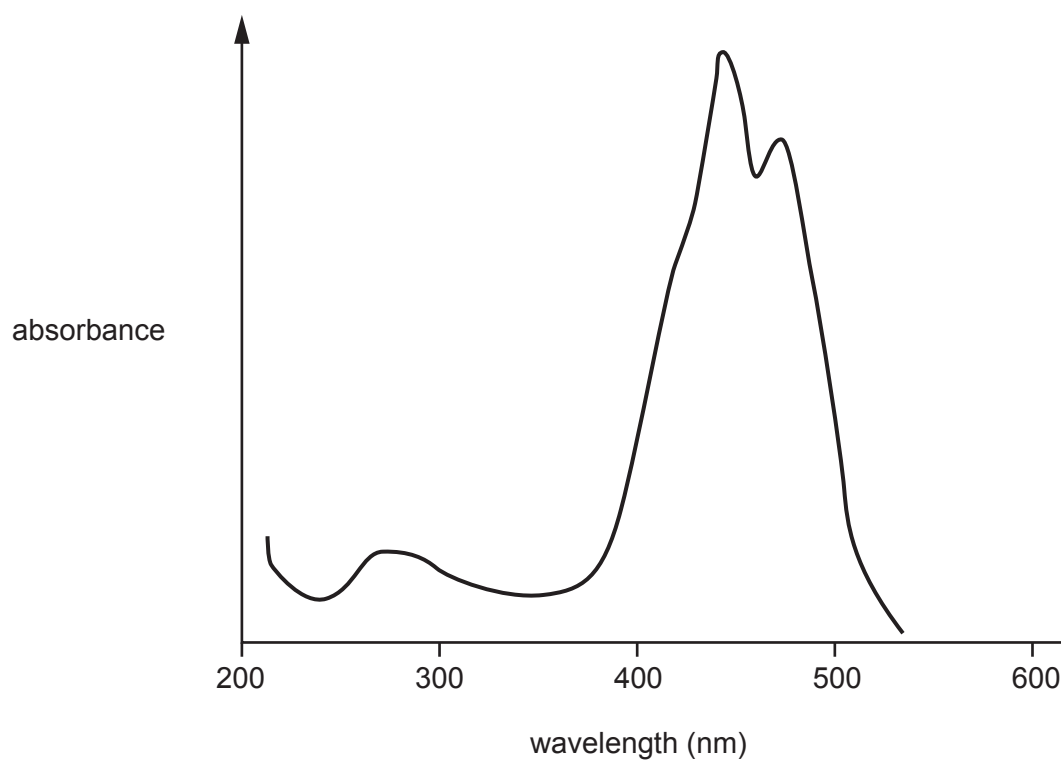
Which row, **A** to **D**, shows the correct labels?

	Organelle T	Region U	Region V	Region between X and Y
A	Golgi body	I-line	actin	Z-band
B	mitochondrion	Z-line	myofibril	sarcomere
C	sarcoplasmic reticulum	A-band	collagen	I-band
D	mitochondrion	I-band	myosin	sarcoplasmic reticulum

Your answer

[1]

12 The following graph shows the absorbance spectrum of an accessory pigment.



Which of the following statements explains why this pigment is orange-red to the human eye?

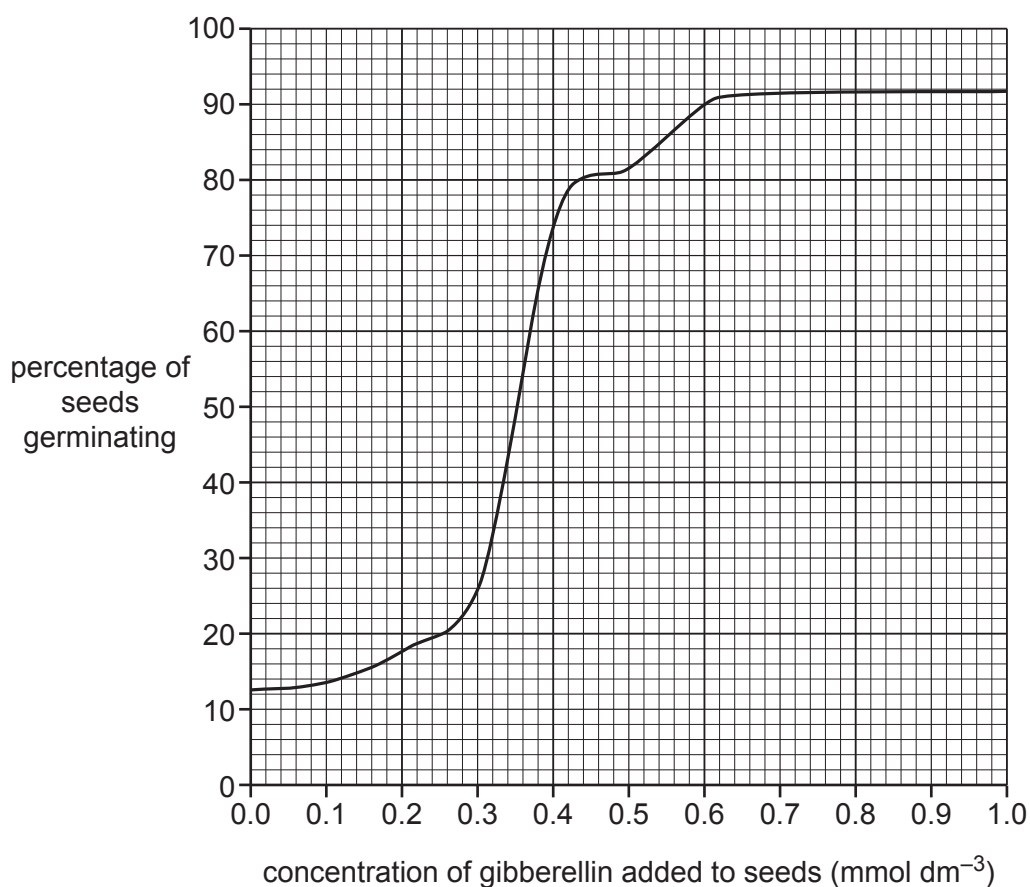
- 1 The pigment absorbs green and blue light.
- 2 The pigment has an absorption peak at 500 nm.
- 3 The pigment passes photons to the primary pigment reaction centre.

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

Your answer

[1]

- 13 The following graph shows the results of a study into the effects of gibberellin concentration on the germination of seeds.



Which of the following statements correctly describes the data in the graph?

- 1 13% of cells germinate without the addition of extra gibberellin.
- 2 Gibberellin concentrations of greater than 0.5 mmol dm⁻³ do not result in seed germination greater than 84%.
- 3 Concentration of gibberellin has the biggest effect on seed germination between 0.21 mmol dm⁻³ and 0.35 mmol dm⁻³.

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

Your answer

[1]

- 14** The serial endosymbiotic theory suggests that some eukaryotic organelles came about as a result of close associations between early unicellular organisms.

The following statements describe oxidative phosphorylation in bacteria:

- 1 The enzymes involved in electron transport and oxidative phosphorylation are on the inner layer of the bacterial membrane.
- 2 The inner layer of the membrane is folded, increasing its surface area.
- 3 The membrane contains cytochromes and ATP-synthase complexes.

Which of the statements above demonstrates a link between bacterial cells and the mitochondria of eukaryotes?

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

Your answer

☐

[1]

- 15** Which of the following statements demonstrate that plant cells carry out cell signalling?

- 1 Plants have cell surface receptors that cause the cells to respond to specific molecules.
- 2 Binding to receptors at the plasma membrane can change chemical pathways within the cell.
- 3 Plant cells respond to soluble molecules which can be carried in both the xylem and the phloem.

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

Your answer

☐

[1]

SECTION B

Answer **all** the questions.

- 16** A student investigated the relationship between height and vital capacity.

The student used a spirometer to measure vital capacity of 10 boys and 10 girls in their year group at school.

- (a)** List two variables the student should control to ensure validity in this investigation?

1

2

[2]

- (b)** Fig. 16 is a graph of the student's results.

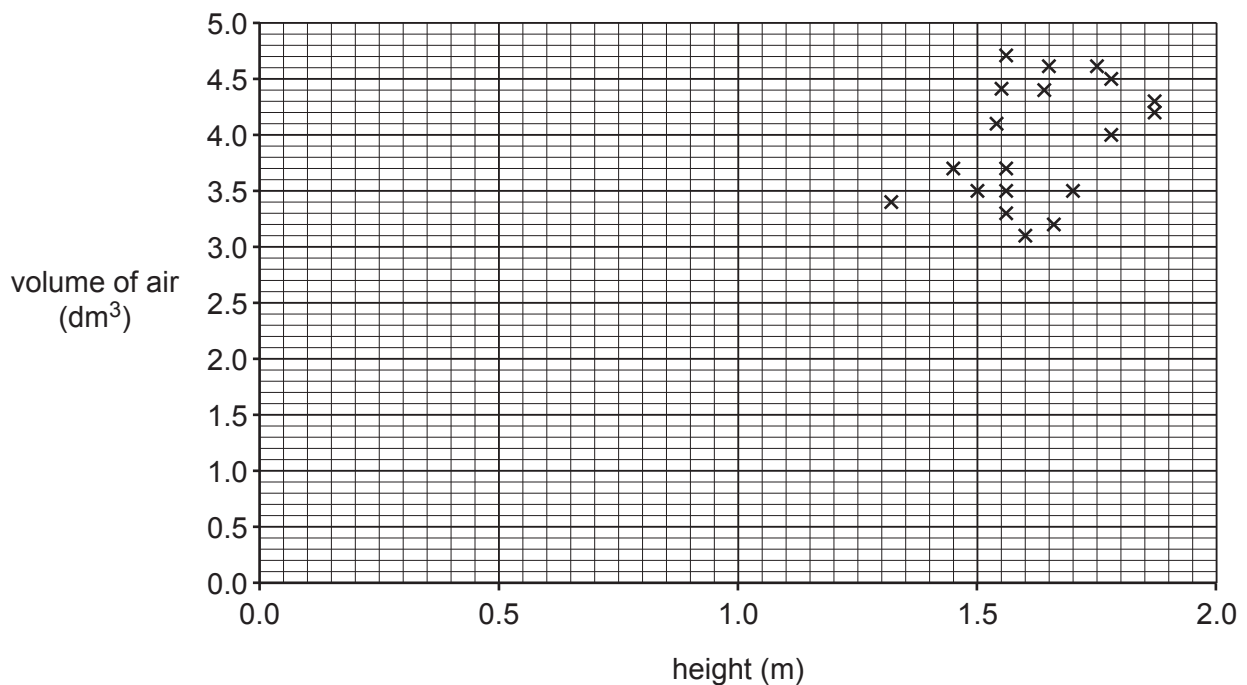


Fig. 16

The student made the following comment about their results:

I think there is no relationship between height and vital capacity.

- (i) Using Fig. 16, explain whether you agree with the conclusion the student made.

..... [2]

- (ii) The student planned to measure tidal volume for the **same 20 students**.

Circle a region on Fig. 16 where you would see these data if the student plotted them on the same graph.

[Answer on Fig. 16]

[2]

- (c)*** Outline the structures involved in the mammalian gaseous exchange system.

For each structure, explain how it increases the efficiency of gaseous exchange.

[6]

- 17 (a) 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]

- (b) (i) Different foods contain different respiratory substrates, so have different energy content. Food labels often give the energy content of foods in kcal.

Table 17 describes the typical energy content of different foods.

Food	Energy content per 100 g (kcal)
Chocolate	478
Pasta	567
Fish	145
Apple	68
Cheese	831

Table 17

How much energy per unit mass does the highest energy food in Table 17 contain compared to the lowest energy food in Table 17?

Express the answer as a percentage to **three** significant figures.

Answer = % [2]

(ii) The following facts relate to energy release from foods during respiration:

- The energy required for the synthesis of one mole of ATP is 30.5 kJ
- 1 kcal is equal to 4.18 kJ
- 1 mole is equal to 6.02×10^{23} molecules.

Calculate the theoretical yield of ATP molecules from the respiration of a 35g chocolate bar. Show your working. Give your answer in standard form to **three** significant figures.

Answer = [3]

(iii) Suggest and explain why cheese has the highest energy content of the foods in Table 17.

.....
.....
.....
.....
..... [2]

18 Oxidative phosphorylation is a stage in aerobic respiration, which occurs in mitochondria.

Fig. 18 is a diagram of part of a mitochondrion, showing components, regions and processes involved in oxidative phosphorylation.

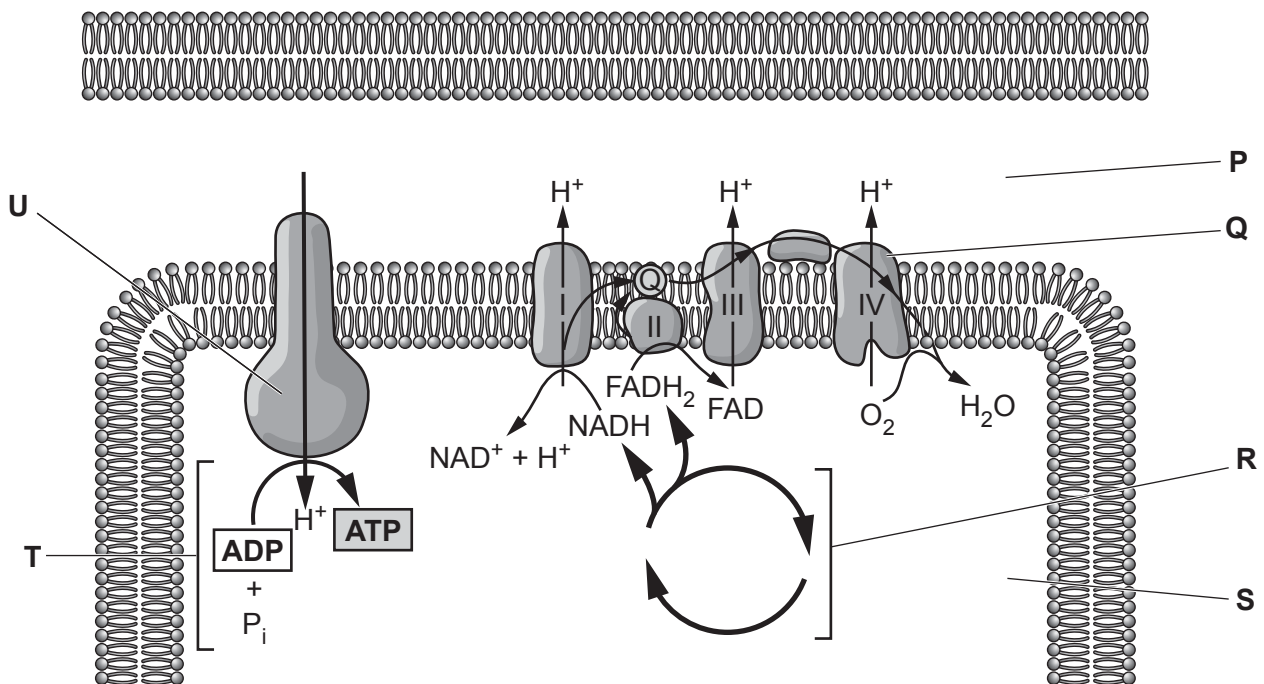


Fig. 18

(a) (i) Name the **components** labelled **U** and **Q**.

U

Q

[2]

(ii) Name the two **regions** labelled **P** and **S**.

P

S

[2]

(iii) Name the two **processes** labelled **R** and **T**.

R

T

[2]

- (b) (i) What properties of the mitochondrial inner membrane allow chemiosmosis to occur?

.....

.....

.....

.....

..... [2]

- (ii) Describe **two** quantitative changes in region **P** which occur as a result of oxidative phosphorylation.

.....

..... [1]

Question 18(c) begins on page 18

- (c)*** Some individuals can eat large quantities of fatty and carbohydrate-rich food without putting on weight. One possible hypothesis that could explain this is related to the mitochondrial inner membrane.

Scientists have suggested that some individuals may have a larger number of proton pores in their inner mitochondrial membrane than normal.

Explain how having a larger number of proton pores in the inner mitochondrial membrane would result in a person being less likely to gain weight.

[6]

19 Fig. 19.1 is a diagram of a nephron from a mammalian kidney.

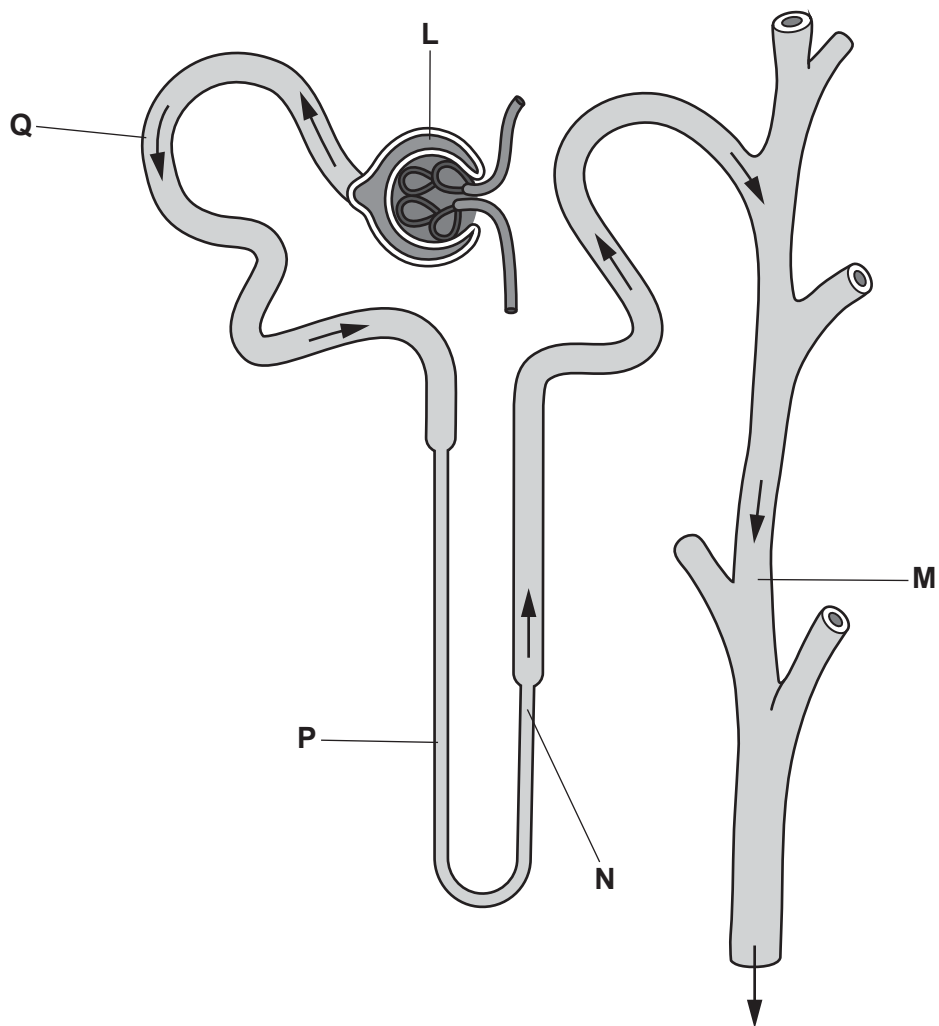


Fig. 19.1

(a) Which letter or letters label areas of the nephron which are directly affected by ADH?

..... [1]

- Fig. 19.2 is a graph of the results.



Explain, with reference to Fig. 19.2, why some foods affect urine production.

..... [4

(c) Fig. 19.3 is a light microscope image of kidney tubule cells.



Fig. 19.3

(i) State **three** structures within the tubule cells that are **not** visible in this image.

1

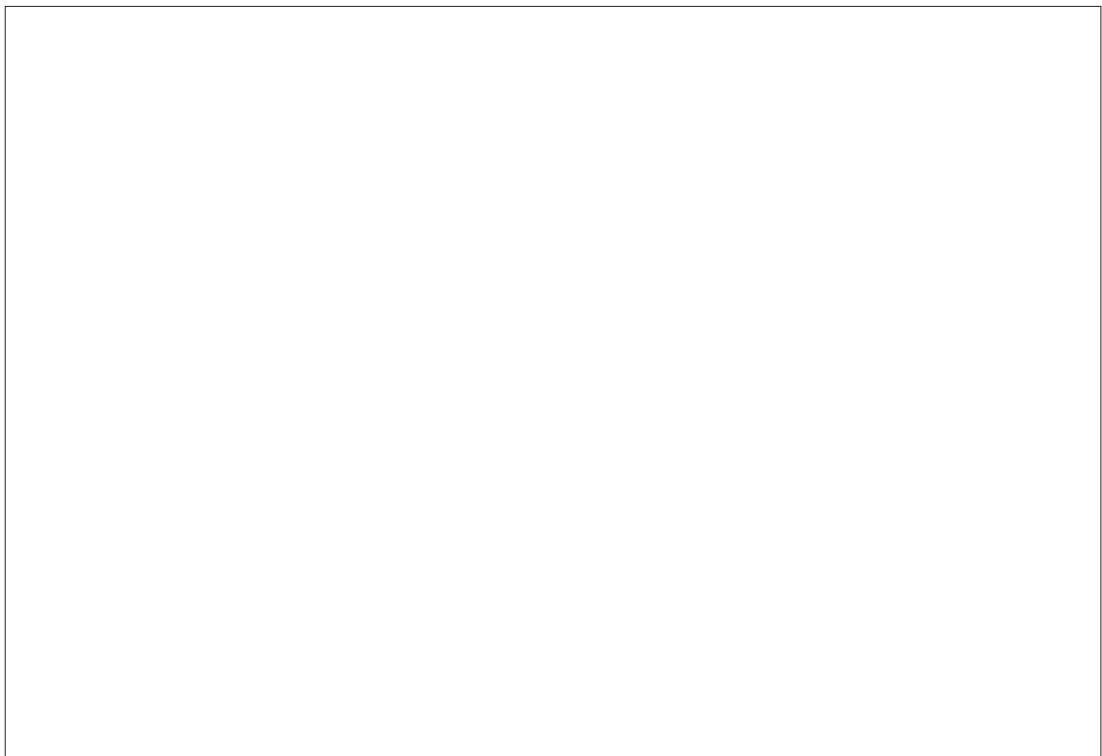
2

3

[3]

(ii) Draw **one** of the cells from Fig. 19.3 in the space below.

Label your diagram to show any visible features.



[4]

- 20** A student carried out an investigation into the effect of different concentrations of sucrose on tissue from different vegetables.

Four different vegetables were cut into slices. The slices were placed into solutions containing different concentrations of sucrose. The change in mass of the slices was measured after a set period of time.

The results are shown in Table 20, **on the insert**.

- (a)** **(i)** The student has made an error with one calculation from the potato samples. Calculate the correct value. Show your working.

Answer = **[3]**

- (ii)** Estimate the concentration of sucrose in the cytosol of swede cells.

..... **[1]**

- (iii)** What other factor will change as the concentration of the sucrose solutions changes?

..... **[1]**

- (b) Describe how the student should represent the data from Table 20 as a graph **and** explain why this is the correct way to represent these data.

.....

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..... [3]

- (c) Considering the data in Table 20, suggest **three** improvements to the design of this experiment. For each improvement explain how it will increase the validity of the data collected.

improvement 1:

.....

.....

explanation:

.....

.....

improvement 2:

.....

.....

explanation:

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.....

improvement 3:

.....

.....

explanation:

.....

.....

[6]

- (d) Root vegetables require sulfate ions (SO_4^{2-}) in order to grow to a normal size. The plant uses the sulfur atoms to synthesise biological molecules during growth.

Sulfur atoms are required for the synthesis of which type of biological molecule?

..... [1]

- 21** Some companies offer snack foods that contain a higher protein content than usual. 'Protein cookies' are an example of this kind of food. Some protein cookies contain up to 37 g of protein per cookie.

A student examined these foods by measuring the respiratory quotient (RQ) of maggots that were fed different types of cookie.

The student measured the oxygen consumption and carbon dioxide production of maggots when they were fed protein cookies and normal cookies.

The cookies were powdered and treated to remove all fat before being fed to the maggots.

Table 21 is a summary of the results.

Cookie	Carbon dioxide produced (cm ³ min ⁻¹)	Oxygen absorbed (cm ³ min ⁻¹)
1	13.29	13.56
2	13.04	13.87

Table 21

- (a)** Use the information in Table 21 to deduce which of the two cookies is the protein cookie. Explain your choice.

.....

.....

.....

.....

..... **[3]**

- (b) The student then changed the experiment to investigate whether respiration of the cookies by yeast was different from respiration of the cookies by maggots.

The student planned to allow yeast cells and maggots to respire the cookie powder in anaerobic conditions and measure the RQ over 2 minutes.

State and explain **one** problem with the student's method.

.....

.....

.....

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.....

.....

..... [3]

- (c) Once the experiment had been completed, the maggots developed into adult flies.

Adult flies have a very different body structure from that of maggots.

- Flies have complex and well-developed exchange surfaces and transport systems.
- Maggots have only a small number of tracheae and a small volume of tracheal fluid.

Suggest why maggots do not need such well-developed exchange surfaces and transport systems.

.....

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.....

.....

.....

..... [3]

- 22 (a)** Bonsai trees are miniature versions of full-sized trees grown in small pots. Bonsai trees can be grown from a range of different woody plants. They are carefully grown and cut to give the desired shape.

The following observations have been made about the growth of bonsai trees:

- Removing the top growing tip encourages a bushier shape.
- Allowing the tip to grow encourages a more conical shape.
- Allowing the tip to grow prevents the lower stems from growing evenly.

A student drew the following conclusion for these observations:

These observations suggest that a plant hormone plays an important part in the growth of bonsai trees.

Using your knowledge of plant growth, evaluate the student's conclusion.

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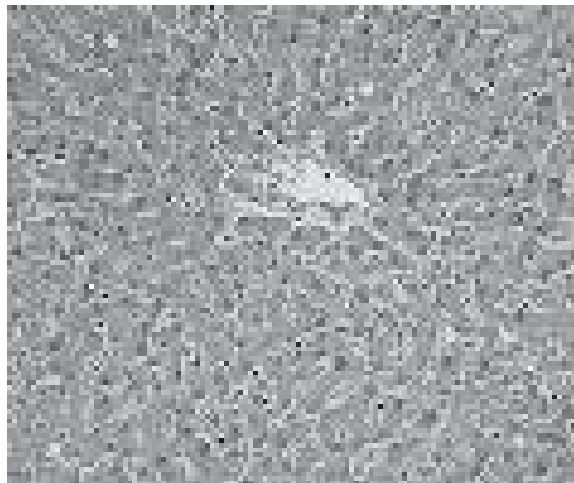
.....

..... [3]

- (b) 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]

- (c) (i) Another result of cycasin poisoning can be kidney damage. Increasing numbers of pet owners in the USA and Asia are using dialysis to treat animals with damaged kidneys.

There are two types of dialysis: peritoneal dialysis and haemodialysis. Both of these dialysis methods remove waste from the blood.

- Peritoneal dialysis occurs within the abdominal cavity and uses active transport as well as diffusion.
- Haemodialysis involves a dialysis machine and relies on simple diffusion.

Explain why peritoneal dialysis can use active transport and diffusion while haemodialysis relies on diffusion alone.

.....

.....

.....

.....

..... [2]

- (ii) Suggest **one** advantage and **one** disadvantage of a kidney transplant compared to dialysis.

advantage

.....

.....

disadvantage

.....

..... [2]

- (d) Cancer of the bladder or kidneys can now be detected using a simple procedure.

Suggest a non-invasive method that could be used to test for these cancers.

.....

.....

..... [1]

END OF QUESTION PAPER

[illegible]

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Oxford Cambridge and RSA

A Level Biology A

H420/01 Biological processes

Insert

Practice paper – Set 2

Time allowed: 2 hours 15 minutes

INSTRUCTIONS

- Do not send this Insert for marking; it should be retained in the centre or recycled.
- Please contact OCR Copyright should you wish to re-use this document.

INFORMATION

- This Insert contains **Table 20**.
- This document consists of **2** pages.

Vegetable	Concentration of sucrose (mol dm ⁻³)	Mass at start (g)	Mass at end (g)	Change in mass (%)
Potato	0.0	3.56	4.38	23.03
	0.5	4.76	4.81	1.05
	1.0	2.93	2.81	-4.10
	1.5	4.56	3.99	-12.50
	2.0	3.44	2.78	-28.77
Butternut squash	0.0	6.34	6.36	0.32
	0.5	4.32	4.21	-2.55
	1.0	3.54	3.10	-12.43
	1.5	2.98	2.02	-32.21
	2.0	3.77	2.36	-37.40
Swede	0.0	4.01	5.23	30.42
	0.5	5.76	6.34	10.07
	1.0	4.33	4.56	5.31
	1.5	3.98	3.94	-1.01
	2.0	5.09	4.74	-6.88
Parsnip	0.0	6.66	6.69	0.45
	0.5	4.56	4.57	0.22
	1.0	5.67	5.66	-0.18
	1.5	3.99	3.77	-5.51
	2.0	4.81	4.00	-16.84

Table 20

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