

A Level Biology A
H420/01 Biological processes

Practice paper – Set 1
Time allowed: 2 hours 15 minutes

You must have:

- the Insert (inserted)

You may use:

- a scientific 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.

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 The following passage has four key terms missing:

Meristem cells in plants are used to generate new plant tissues. When tissue is formed, impregnates the cell walls, making them impermeable to water. All cytoplasm is lost. When tissue is formed, cytoplasm remains, but the become elongated and lose most of their cytoplasm.

What is the correct order of missing terms?

- A sclerenchyma, phloem, lignin, xylem vessels
- B xylem, lignin, parenchyma, phloem vessels
- C phloem, collenchyma, xylem, sieve tube elements
- D xylem, lignin, phloem, sieve tube elements

Your answer

[1]

- 2 A student mixed an unknown substance with water and ethanol. A white suspension formed in the tube.

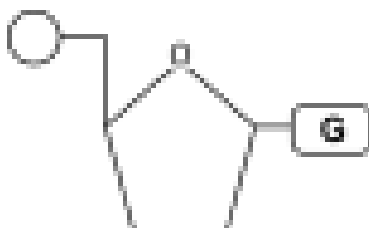
Which of the explanations, **A** to **D**, is correct?

- A lipid is present
- B non-reducing sugar is present
- C protein is present
- D reducing sugar is present

Your answer

[1]

- 3 The diagram below shows an organic molecule.



What bond is formed when the molecule is polymerised?

- A ester
- B glycosidic
- C peptide
- D phosphodiester

Your answer

[1]

- 4 The respiratory quotients (RQs) of three respiratory substrates are shown below:

carbohydrates: 1.0

lipids: 0.7

proteins: 0.9

An experiment was carried out to investigate which molecules are used as respiratory substrates in different cell types. The results are shown in the table below.

Cell type	Oxygen consumed (mm ³ min ⁻¹)	Carbon dioxide produced (mm ³ min ⁻¹)
cancerous	12.78	12.82
normal	13.45	9.40

Which of the statements, **A** to **D**, supports these results?

- A** cancer cells respire mainly carbohydrates
- B** cancer cells respire mainly lipids
- C** normal cells respire mainly carbohydrates
- D** normal cells respire mainly proteins

Your answer

[1]

- 5 The following are statements about the liver:

- 1 stores bile in the gall bladder
- 2 contains sinusoids
- 3 receives blood from the gut and heart

Which of these statements relate to the exocrine function of the liver?

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

Your answer

[1]

- 6 The table below shows a series of statements about systemic and pulmonary circulation.

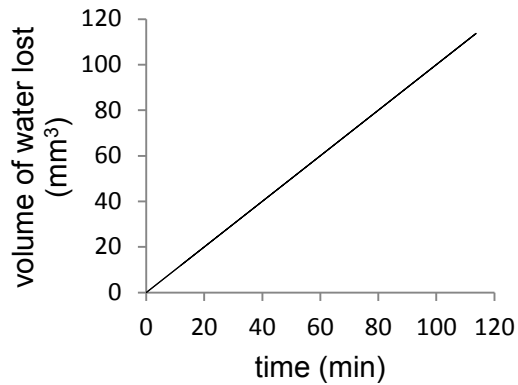
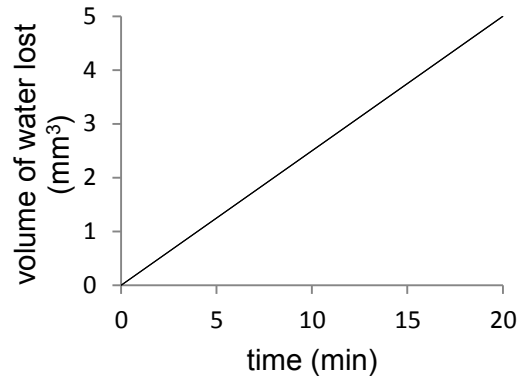
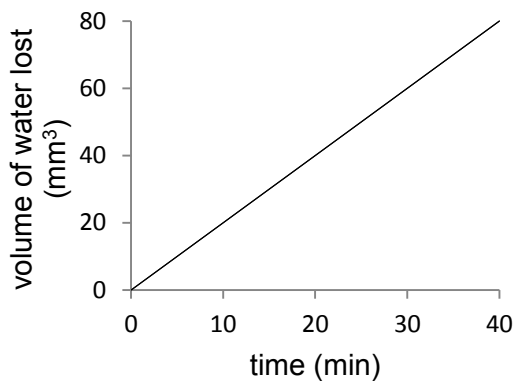
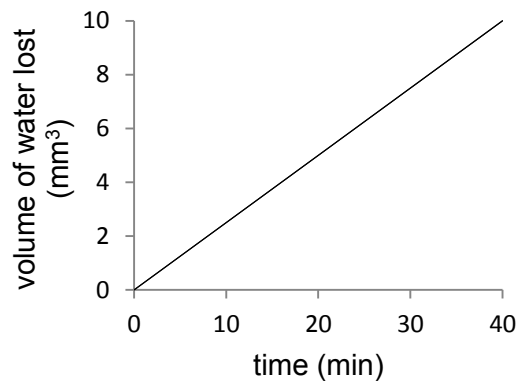
Row	Systemic circulation	Pulmonary circulation
A	higher pressure	lower pressure
B	equal pressure	equal pressure
C	lower pressure	higher pressure
D	medium pressure	absent

Which of the rows, **A** to **D**, correctly describes a closed, double circulatory system?

Your answer

[1]

- 7 The following graphs show results from an experiment to investigate the rate of transpiration of the same plant in different environments.

A**B****C****D**

Which graph, **A** to **D**, shows the results for when the plant is being grown in the least humid environment?

Your answer

[1]

- 8 The following advice is given to mothers of babies under 6 months:

Don't let your baby get too hot or too cold. A room temperature of 16-20°C, with light bedding or a lightweight baby sleeping bag, will provide a comfortable sleeping environment for your baby.

Which of the statements, **A** to **D**, best explains this advice?

- A** newborn babies have poorly-developed osmoregulation mechanisms
- B** newborn babies have poorly-developed thermoregulation mechanisms
- C** newborn babies have poorly-developed ectothermic mechanisms
- D** newborn babies have poorly-developed glucoregulation mechanisms

Your answer

[1]

- 9 The table below shows features of the five kingdoms.

Kingdom	Nerves present	Hormones present
Prokaryotae	×	×
Protoctista	×	×
Fungi	×	✓
Plantae	×	✓
Animalia	✓	✓

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

- A** only autotrophic organisms require hormones
- B** only heterotrophic organisms need to interact with their environment
- C** only multicellular organisms require hormones
- D** only unicellular organisms require nervous systems

Your answer

[1]

10 Which of the following, **A** to **D**, is a feature of **both** light microscopy **and** confocal microscopy?

- A** can be used to observe ribosomes
- B** can be used with live tissues
- C** obtain images using laser light
- D** require a great deal of training to use

Your answer

☐

[1]

11 Which of the following, **A** to **D**, is the correct summary of the net products of the Krebs cycle for **one** molecule of pyruvate?

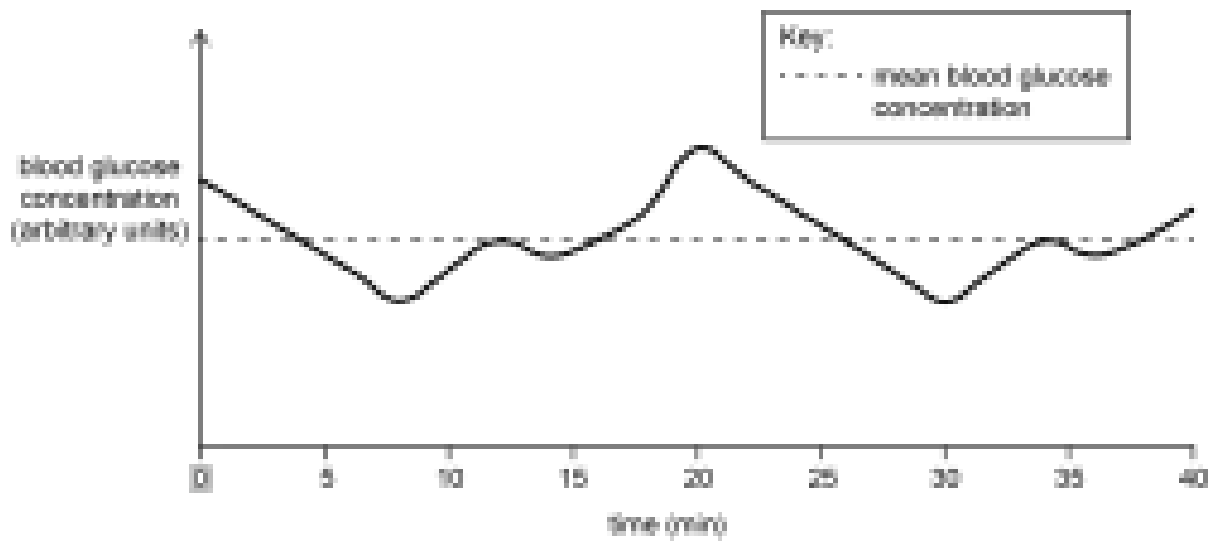
- A** 3 reduced NAD, 1 reduced FAD, 2 CO₂, 1 ATP
- B** 2 reduced NAD, 2 CO₂, 2 ATP
- C** 4 reduced NAD, 2 reduced FAD, 3 CO₂, 2 ATP
- D** 2 reduced NAD, 1 reduced FAD, 3 ATP

Your answer

☐

[1]

- 12 The graph below shows the change in glucose concentration in a rat's bloodstream over a short period of time.



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

- A** blood glucose concentration at 15 min > blood glucose concentration at 20 min
- B** blood glucose concentration at 9 min << blood glucose concentration at 20 min
- C** blood glucose concentration at 0 min < blood glucose concentration at 40 min
- D** blood glucose concentration at 5 min >> blood glucose concentration at 28 min

Your answer

[1]

- 13** LHON is an inherited mitochondrial condition that causes problems with aerobic respiration. It is the result of a mutation in mitochondrial DNA (mtDNA) and is passed from mother to child. LHON is presently incurable, but one theoretical treatment involves removing the mutation from the mother's mtDNA.

Which of the statements, **A** to **D**, correctly explains why this could be a viable treatment for LHON?

- A** enzymes involved in glycolysis are unaffected by mtDNA
- B** enzymes involved in the Krebs cycle, link reaction and electron transport chain are affected by mtDNA
- C** enzymes involved with oxidative phosphorylation are unaffected by mtDNA
- D** enzymes involved with photophosphorylation are affected by mtDNA

Your answer

[1]

14 Melvin Calvin studied the light-independent reaction (Calvin cycle) in plant cells.

He used radiolabelled $^{14}\text{CO}_2$ to measure the production of organic molecules in chloroplasts.

- He placed an aquatic plant in water.
- The plant was given light for 20 minutes.
- The light was then turned off (dark conditions) for a further 30 seconds.

He measured the radioactivity of the solutions produced and used these values to calculate the number of molecules of triose phosphate (TP) and ribulose biphosphate (RuBP) present.

The results are shown in the table below.

Molecule	Activity of ^{14}C ($\times 10^{27}$ Bq)	
	after 20 minutes light	30 seconds dark conditions
TP	5.5	10.1
RuBP	4.9	0.6

Assuming 8.5×10^{18} Bq are generated by each ^{14}C atom in the molecule, how many **new** TP molecules are produced after 30 seconds in the dark?

- A** 6.47×10^8
- B** 1.80×10^8
- C** 1.83×10^{27}
- D** 3.37×10^{27}

Your answer

[1]

15 The following terms relate to the metabolism of carbohydrates in the human body:

- 1 gluconeogenesis
- 2 glycogenesis
- 3 glycolysis

Which of these processes will be stimulated when glucagon is released into the bloodstream?

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

Your answer

[1]

- (b) At birth, the production of another hormone, oxytocin, increases. Oxytocin causes rapid contractions of the uterus. These contractions cause more oxytocin to be released.

What term is used to describe this kind of interaction?

.....[1]

- (c) Studies on the effects of hCG in humans have revealed the following information:

- Many different tissues are affected by hCG.
- Susceptible cells have glycoprotein receptors on their cell surface.
- These receptors are complementary to the shape of hCG molecules.

- (i) What can be concluded from this information?

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

- (ii) Another hormone produced during pregnancy is oestrogen. Oestrogen is lipid soluble.

Which molecule does oestrogen interact with when it changes cell activity?

.....[1]

- (d) A hydatidiform mole is a rare complication of pregnancy that can occur after implantation of the fertilised egg in the uterus. It results in excessive production of hCG and damage to the lining of the womb, leading to miscarriage.

Suggest how a hydatidiform mole could increase hCG above normal levels.

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.....[3]

17 (a) During the light-independent stage of photosynthesis, triose phosphate (TP) is synthesised in the chloroplasts of plant cells.

(i) State **two** possible uses of this molecule within the plant.

1.....

.....

2.....

.....

[2]

(ii) From which molecule is TP synthesised during the light-independent stage?

..... [1]

(b)* The light-independent stage requires coenzymes. For example, NADPH reduces molecules by adding electrons, and ATP phosphorylates molecules by adding phosphate groups.

Coenzymes are involved in other cellular processes, including respiration.

Summarise the importance of coenzymes in **respiration**. You should include details of the molecules and processes involved.

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[6]

- 18** *Heliamphora*, shown in Fig. 18.1, is a genus of carnivorous plant. Its leaves are adapted to form water-filled traps for insects. The insects are attracted by nectar, then fall into the traps and drown. The plants digest the insects and absorb the mineral ions produced. This allows *Heliamphora* to survive in soils with low mineral content.



Fig. 18.1

- (a)** Fig 18.2 shows a transverse section of part of a *Heliamphora* stem, with three tissues labelled.

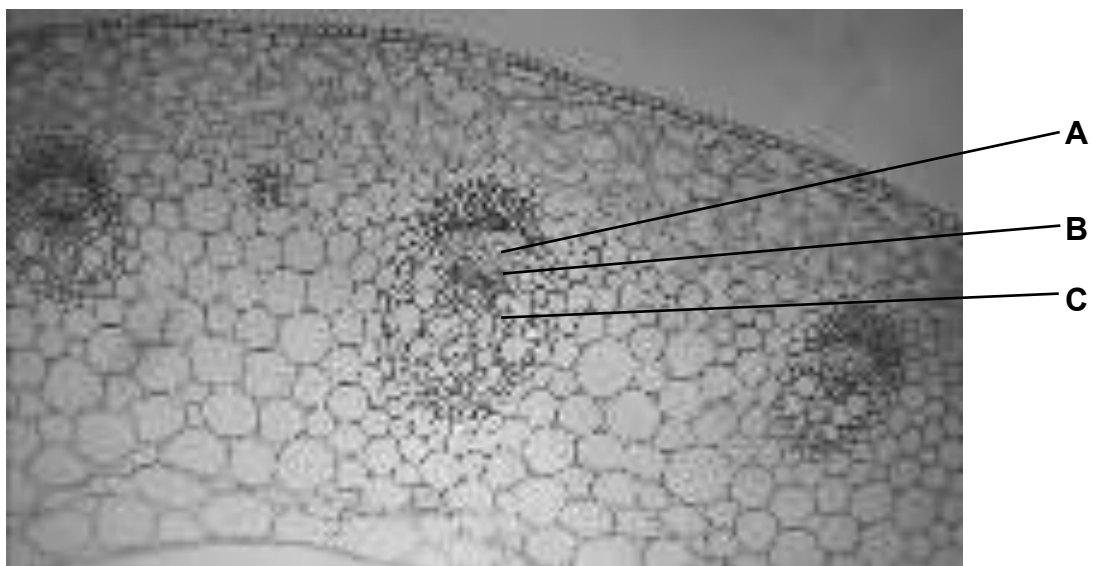


Fig. 18.2

- (i)** Identify the tissues labelled by the following letters:

A

C

[2]

- (ii)** The tissue labelled **B** is cambium.

What type of cell makes up this tissue?

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

- (b) A student prepared slides of *Heliamphora* vascular tissue for viewing under a light microscope.

The method the student used is outlined below:

1. Select a blade.
2. Cut *Heliamphora* tissue.
3. Select best pieces.
4. Place on slide.
5. Add cover slip.

- (i) Suggest **three** improvements to this method. For each improvement, explain how it would increase the **validity** of the slides produced.

Improvement 1:

.....

.....

Explanation:

.....

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Improvement 2:

.....

.....

Explanation:

.....

.....

.....

Improvement 3:

.....

.....

Explanation:

.....

.....

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[6]

- (ii) Discuss the benefits of using stains when making slides for light microscopy.

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..... [3]

- (c) Enzymes digest insects that fall into *Heliamphora* traps.

Is the mode of action of these enzymes extracellular or intracellular? Explain your answer.

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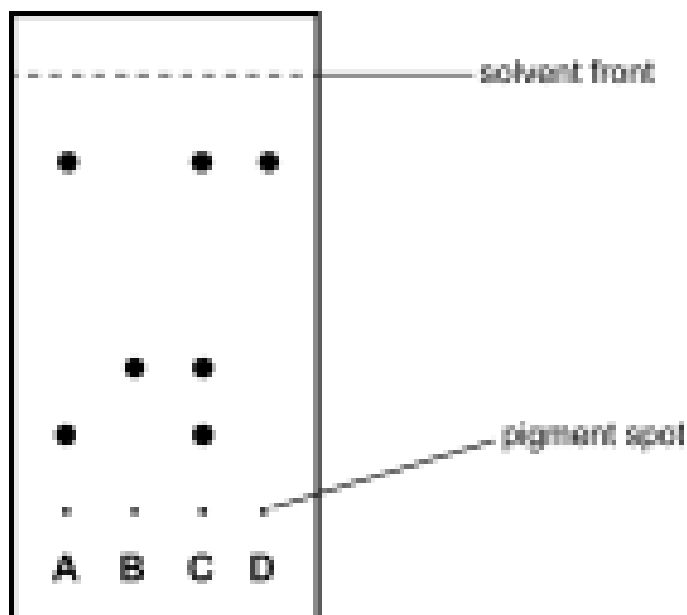
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..... [3]



(i) Using Fig. 18.3, what can you conclude about the composition of pigments **A** to **D**?

[3]

(ii) Calculate the R_f value of pigment **B**. Give your answer to **two significant figures**.

Show your working.

Answer = [2]

19 Respiration is an important metabolic process that takes place in all living cells.

(a) What is the **precise** location of the link reaction within cells?

.....[1]

(b) Fig. 19.1 is an outline of the Krebs cycle.

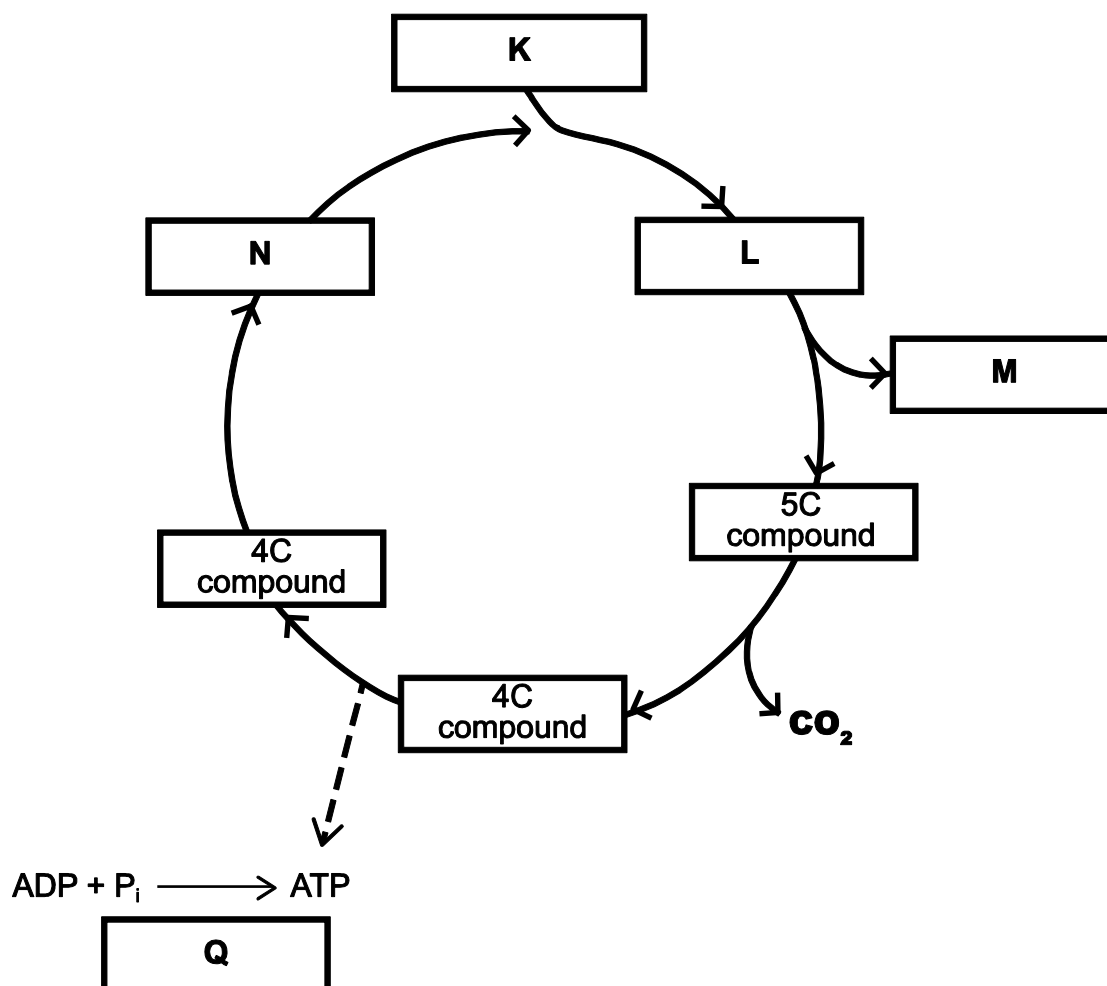


Fig. 19.1

(i) For each of the letters below write the **molecule** that is missing from the diagram.

K.....

L.....

M.....

N.....

[4]

(ii) Name the **process** represented by the letter Q.

.....[1]

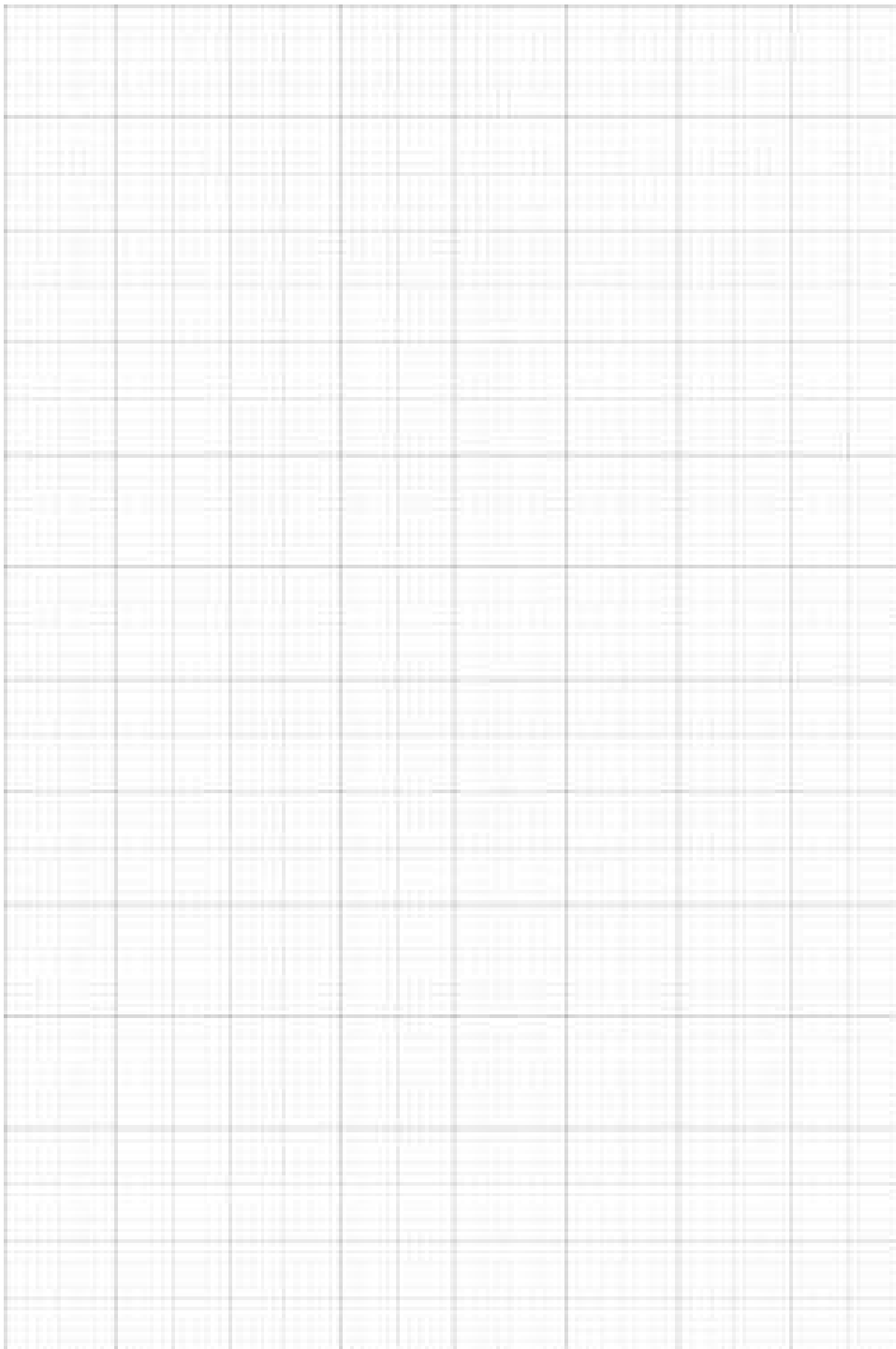
- (c) The black widow spider, *Latrodectus hesperus*, paralyses and kills its prey with venom. The venom contains a toxin known as latrotoxin. If a human is bitten, this toxin can cause serious harm by damaging heart tissue. Latrotoxin causes influx of Ca^{2+} ions, which disrupts normal cell function, including respiration.

An investigation was carried out into the effect of latrotoxin on aerobic respiration in humans.

The rate of activity of malate dehydrogenase, a mitochondrial enzyme involved in aerobic respiration, was analysed at different substrate concentrations. The substrate concentrations used were within the normal range for a living cell.

The data are shown in Table 19.1, **on the Insert**.

- (i) Use the space provided to plot a suitable graph of these data.



[4]

- (ii) Calculate the mean increase in malate dehydrogenase activity for every 1 mmol dm^{-3} increase in malate concentration between 1.0 and $10.0 \text{ mmol dm}^{-3}$.

Give your answer to **two significant figures**.

Show your working.

Answer = [3]

- (iii) The normal maximum rate of malate dehydrogenase activity is $100 \text{ mmol dm}^{-3} \text{ s}^{-1}$.

The data in Table 19.1, **on the Insert**, were obtained in the presence of latrotoxin.

What can be deduced from these results about latrotoxin's mode of action as a poison? Justify your answer.

.....

 [3]

- (d) Fig. 19.2 shows an electrocardiogram trace (ECG) of a patient's heart after a black widow spider bite.

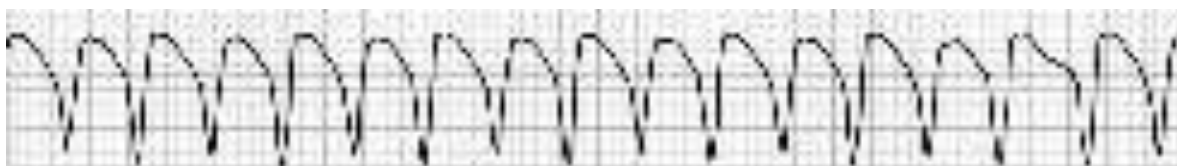


Fig. 19.2

What heart abnormality is suggested by this trace?

..... [1]

- 20** The water calthrop, *Trapa natans*, lives in lakes and other water bodies. Its leaves float on the surface of the water. Its stems trail just under the surface of the water.

(a) (i) What name is given to plants like *T. natans*, which are adapted to life in water?

.....[1]

- (ii)** Fig. 20.1 shows cells from the stem of *T. natans*. Water travels between the cells by two different pathways, **X** and **Y**.

X



Y



Fig. 20.1

Name the pathways represented by diagrams **X** and **Y**.

X

.....

Y

.....

[2]

- (b) A potometer was used to calculate the rate of transpiration from leaves of *T. natans* with different surface areas.

Table 20.1 shows the data obtained during the investigation.

Surface area of leaf (cm ²)	Time (min)	Distance moved along capillary tubing (mm)
39.6	0	0
	20	4
	40	8
	60	10
	80	12
69.4	0	0
	20	6
	40	9
	60	13
	80	18
99.2	0	0
	20	7
	40	15
	60	23
	80	38

Table 20.1

- (i) Give **two** factors that need to be controlled in this investigation in order to obtain valid data.

1.....

.....

2.....

.....

[2]

- (ii) In its natural habitat, *T. natans* has many leaves with a surface area greater than 99.2 cm^2 . Explain why this does not affect the rate of transpiration in a way which would be harmful for the plant.

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

- (c) State and explain **three** adaptations of plants like *T. natans*, which allow them to survive in water.

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

- 21** Birds and humans have similar pancreas tissues, with the same cell types contributing to exocrine and endocrine roles.

(a) (i) Fig. 21.1, **on the Insert**, shows a transverse section of pancreas tissue from a bird.

Select which letter identifies the following structures:

islet of Langerhans

.....[1]

acinus

.....[1]

- (ii) Fig 21.2, **on the Insert**, shows a high-power image of cells from the pancreas.

In the space provided below draw **five adjacent** cells, annotating them to show visible features.

[5]

- (b) Table 21.1 gives some information about the hormones produced by the different regions of the adrenal gland.

Complete the table to include the correct region, hormone and role.

Region of adrenal gland	Hormone produced	Role of hormone in body
.....	aldosterone	
medulla		Increases heart rate. Stimulates glycogenolysis.

Table 21.1

[2]

- (c)*** Growth hormone (GH) is a peptide hormone that stimulates cell reproduction and regeneration in humans and other animals. It is produced during development to increase muscle mass and increase bone size and density.

GH can also be used in farming to enhance yields from different animals.

Design an experiment to investigate the following hypothesis:

"Varying the concentration of GH injected affects the yield of meat from farmed chickens"

You must explain how you would obtain valid data.

[illegible]

[9]

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

[illegible]

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A Level Biology A
H420/01 Biological processes

Insert

Practice paper – Set 1
Time allowed: 2 hours 15 minutes



INSTRUCTIONS

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INFORMATION

- This Insert contains **Table 19.1**, **Fig. 21.1** and **Fig. 21.2**
- This document consists of **4** pages.

Concentration of malate (mmol dm ⁻³)	Rate of reaction of malate dehydrogenase (mmol dm ⁻³ s ⁻¹)
0.0	0.0
1.0	37.7
2.0	55.2
3.0	66.0
4.0	74.8
6.0	83.1
8.0	88.9
10.0	92.3
14.0	96.9
18.0	99.0

Table 19.1

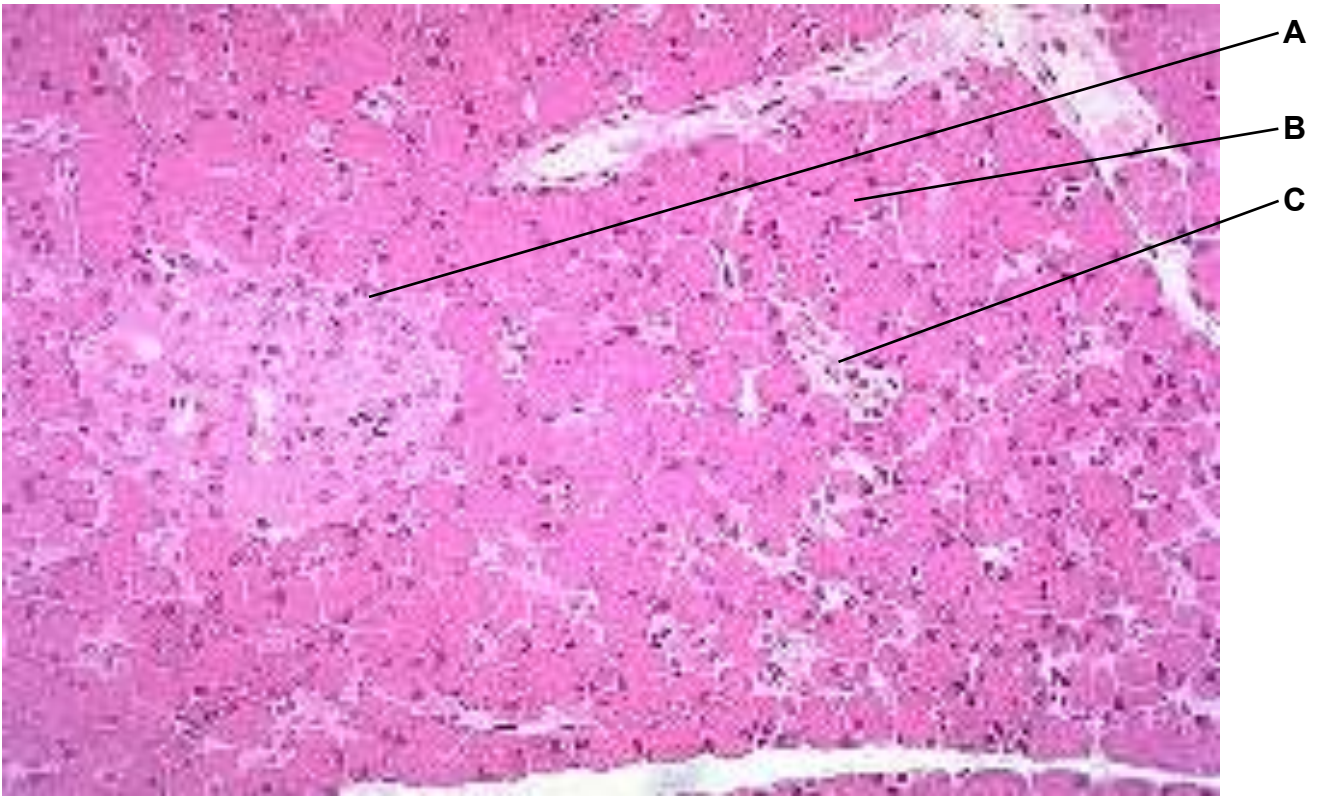


Fig. 21.1

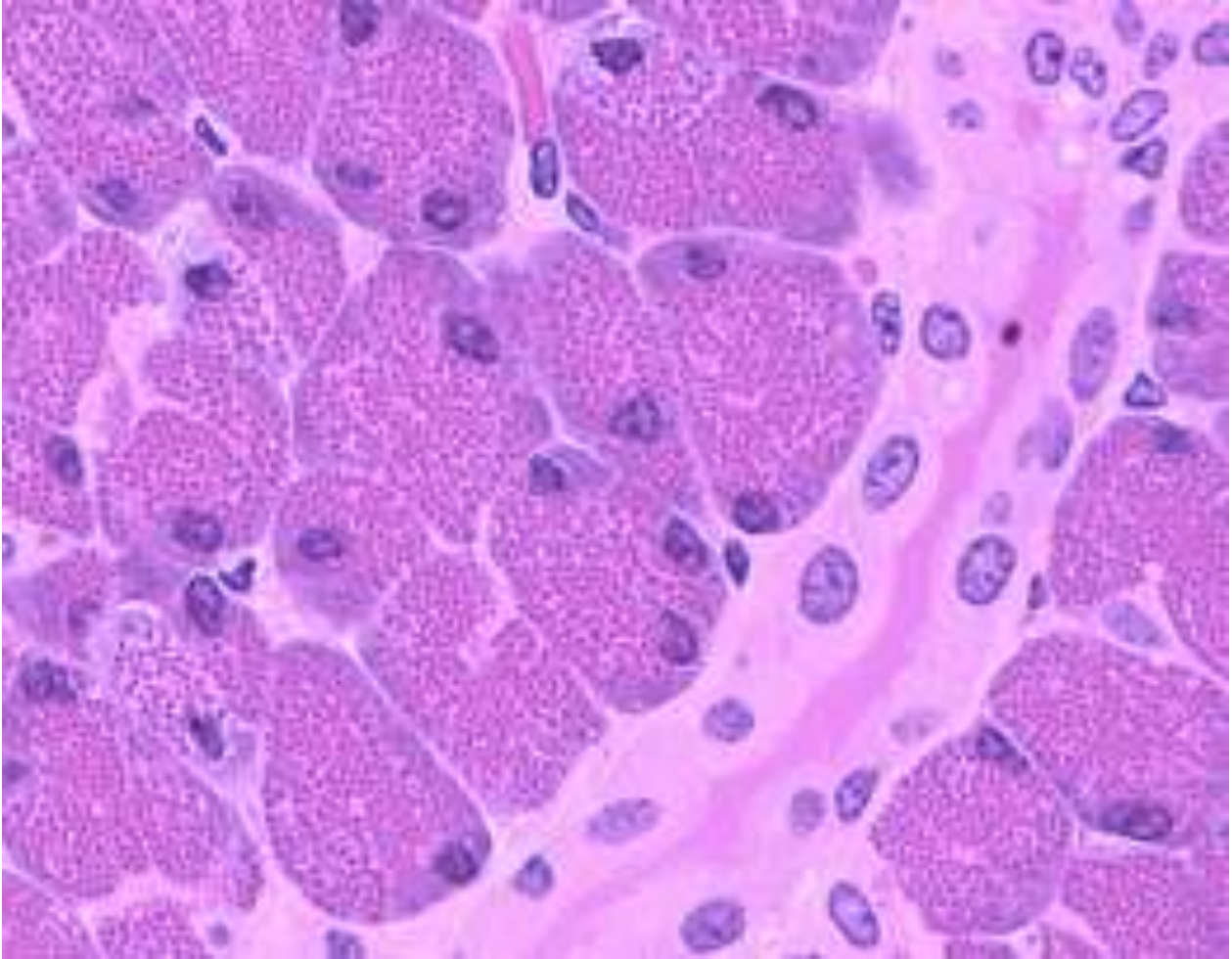


Fig. 21.2

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