This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 04

27MAR2023

Do NOT write in this box. Your MARK will be placed here.

Subject :	A Level : Biology 2
Class :	12A
Teacher :	Rahmeh Hilal
Duration :	2 hours

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

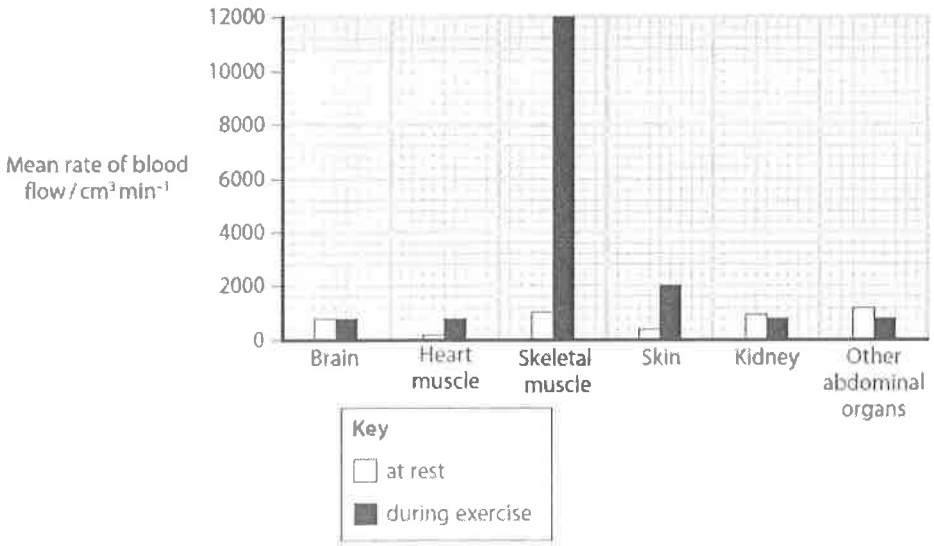
Q1.

During exercise, changes take place in the cardiac output and blood circulation.

In an investigation, the change in blood flow to different parts of the body caused by exercise was measured.

All the volunteers used in the study were healthy males of the same age.

The graph below shows the results of this investigation.



(a) (i) During exercise, the blood flow to the other abdominal organs changes.

Calculate the percentage change in blood flow to the other abdominal organs in response to exercise.

(2)

Answer ..... %

(ii) Suggest **two** other factors that should be controlled in this investigation.

(2)

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(b) Explain the changes in blood flow caused by exercise.

(5)

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* (c) Describe how the coordinated contraction of heart muscle is brought about.

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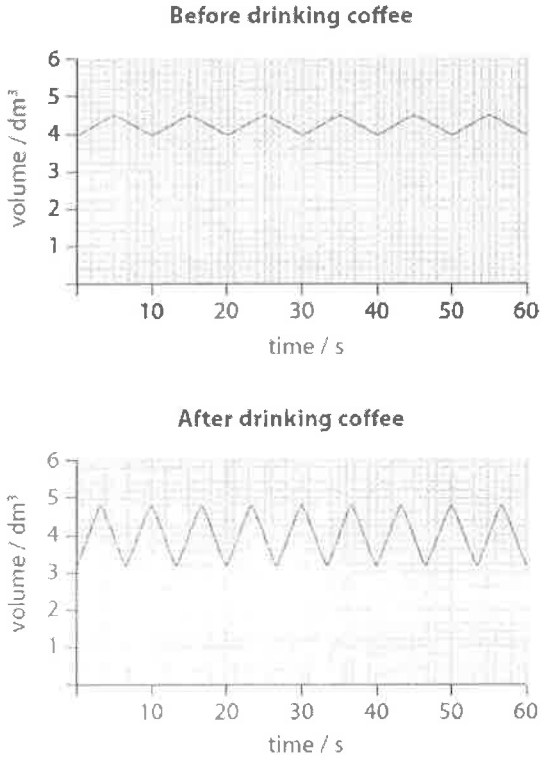
(Total for question = 15 marks)

Q2.

Asthma occurs when the airways in the lungs become narrowed, which makes breathing difficult.

It is thought that the caffeine contained in coffee might help people with asthma by increasing their breathing rate.

(a) The traces below show the breathing rate of a resting person before and after drinking coffee.



(i) Place a cross in the box ☒ next to the apparatus used to obtain these traces.

(1)

☐ **A** a peak flow meter
☐ **B** an ECG
☐ **C** a respirometer
☐ **D** a spirometer

(ii) Place a cross in the box ☒ next to the tidal volume before drinking coffee.

(1)

☐ **A** 0.5 dm^3
☐ **B** 1.0 dm^3
☐ **C** 6.0 dm^3
☐ **D** 12.0 dm^3

(iii) Place a cross in the box ☒ next to the difference in breathing rate before and after drinking coffee.

(1)

- ☐ **A** 3 breaths min^{-1}
- ☐ **B** 6 breaths min^{-1}
- ☐ **C** 12 breaths min^{-1}
- ☐ **D** 15 breaths min^{-1}

(iv) The traces suggest that caffeine affects the sensitivity of the brain to carbon dioxide. Place a cross in the box ☒ next to the statement that describes this sensitivity.

(1)

- ☐ **A** hypothalamus less sensitive to carbon dioxide
- ☐ **B** hypothalamus more sensitive to carbon dioxide
- ☐ **C** ventilation centre less sensitive to carbon dioxide
- ☐ **D** ventilation centre more sensitive to carbon dioxide

(b) The formula below shows Fick's law.

$$\text{rate of diffusion} = \frac{\text{area of diffusion surface} \times \text{difference in concentration}}{\text{thickness of surface over which diffusion takes place}}$$

Use the information in the formula to explain how the rate of diffusion is affected by asthma.

(2)

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(c) Suggest how drinking hot coffee can cause a change in the production of sweat.

(2)

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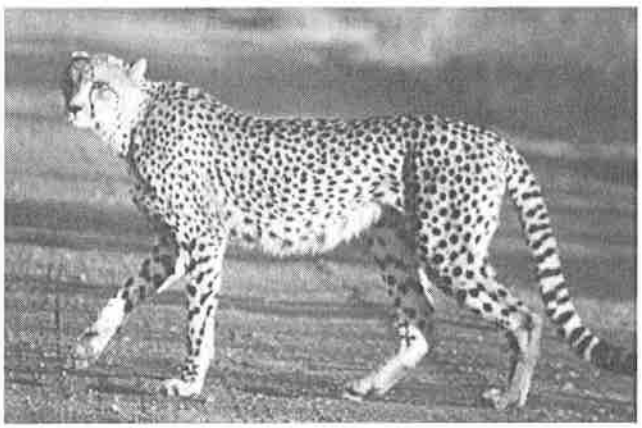
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(Total for question = 8 marks)

Q3.

The photograph below shows the African cheetah, *Acinonyx jubatus*.

The cheetah is the fastest land mammal. The cheetah needs to be within 50 m of its prey before starting to chase it.



Magnification × 0.05

A cheetah runs at 27 m s^{-1} in an attempt to catch its prey.

(a) Calculate the time it would take a cheetah to run 50 m at a speed of 27 m s^{-1}.

Show your working.

[2]

Answer .....

(b) Table 1 below shows the activity of four different enzymes in the cells of two different leg muscles of a cheetah.

Table 1

Leg muscle	Relative activity / arbitrary units			
	Anaerobic enzymes		Aerobic enzymes	
	Lactate dehydrogenase	Pyruvate kinase	Citrate synthase	3-hydroxyacyl-CoA dehydrogenase
Gastrocnemius	15.07 ± 2.8	12.91 ± 0.8	0.06 ± 0.01	0.05 ± 0.02
Vastus lateralis	19.29 ± 1.3	15.19 ± 2.0	0.07 ± 0.01	0.04 ± 0.01

Place a cross ☒ in the box next to the correct phrase that completes each of the following statements.

(i) The enzyme that has the fastest activity is

(1)

☐ **A** an aerobic enzyme in the gastrocnemius
☐ **B** an aerobic enzyme in the vastus lateralis
☐ **C** an anaerobic enzyme in the gastrocnemius
☐ **D** an anaerobic enzyme in the vastus lateralis

(ii) Following anaerobic respiration, lactate dehydrogenase converts lactate to

(1)

☐ **A** carbon dioxide and oxidised NAD to reduced NAD
☐ **B** carbon dioxide and reduced NAD to oxidised NAD
☐ **C** pyruvate and oxidised NAD to reduced NAD
☐ **D** pyruvate and reduced NAD to oxidised NAD

(c) Conservationists are concerned that keeping cheetahs in captivity may affect the percentage of slow twitch and fast twitch fibres in their muscles.

In an investigation, scientists analysed samples from the leg muscles of wild and captive cheetahs.
The results are shown in Table 2 below.

Table 2

Cheetah	Leg muscle	Percentage of muscle fibre (%)	
		Slow twitch	Fast twitch
wild	vastus lateralis	15.5 ± 3.4	84.5 ± 2.0
wild	gastrocnemius	39.4 ± 3.4	60.6 ± 3.0
captive	vastus lateralis	18.6 ± 3.0	81.4 ± 4.2

(i) Suggest the null hypothesis the scientists were testing.

(1)

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(ii) Using the data in Table 2, suggest a conclusion that can be drawn about the effect of captivity on the composition of muscle.
Give a reason for your answer.

(2)

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(d) Explain why the muscle composition of a cheetah causes it to stop running if it fails to catch its prey within 50 m.

(3)

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(Total for question = 12 marks)

Q4.

Movement at a joint involves muscle contraction that requires a supply of ATP.

(a) The diagram below shows muscles that cause movement of bones in the leg.



Place a cross ☒ in the box next to the description of the muscles in this diagram.

(1)

☐ **A** the extensor muscle is contracted and the flexor muscle is relaxed
☐ **B** the extensor muscle and the flexor muscle are both contracted
☐ **C** the extensor muscle is relaxed and the flexor muscle is contracted
☐ **D** the extensor muscle and the flexor muscle are both relaxed

(b) The ATP needed for muscle contraction is produced by glycolysis, the Krebs cycle and oxidative phosphorylation.

(i) Place a cross ☒ in the box next to the final product of glycolysis.

(1)

☐ **A** acetyl CoA
☐ **B** citrate
☐ **C** glucose
☐ **D** pyruvate

(ii) Place a cross ☒ in the box next to products of the Krebs cycle.

(1)

☐ **A** ADP, ATP and oxidised NAD
☐ **B** ADP, oxidised NAD and reduced FAD
☐ **C** ATP, reduced NAD and oxidised FAD
☐ **D** ATP, reduced NAD and reduced FAD

(iii) Place a cross ☒ in the box next to the coenzyme involved in the Krebs cycle.

(1)

☐ **A** ATP
☐ **B** lactate
☐ **C** NAD
☐ **D** pyruvate

(iv) Place a cross ☒ in the box next to the location of glycolysis and the Krebs cycle in a muscle cell.

(1)

		Glycolysis	Krebs cycle
A	☐	cytoplasm	mitochondria
B	☐	cytoplasm	cytoplasm
C	☐	mitochondria	mitochondria
D	☐	mitochondria	cytoplasm

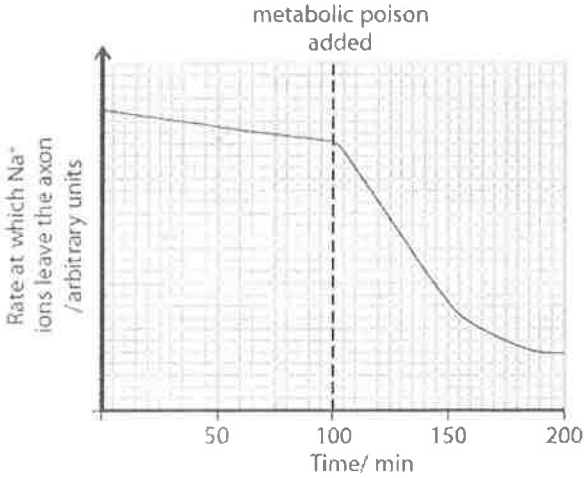
(v) Place a cross ☒ in the box next to the number of carbon dioxide molecules formed in the Krebs cycle from the oxidation of one glucose molecule.

(1)

☐ **A** two
☐ **B** three
☐ **C** four
☐ **D** six

(c) Muscle contraction is stimulated by neurones. The axon of a neurone requires a supply of ATP to maintain the resting potential.

In an investigation, the rate at which sodium ions leave a resting axon was measured for a period of 200 minutes.
At 100 minutes, a metabolic poison was added. This poison inhibits oxidative phosphorylation.
The graph below shows the rate at which sodium ions (Na^+) left the axon during this investigation.



(i) Suggest how sodium ions leave the axon between 0 and 100 minutes.

(2)

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(ii) Suggest an explanation for the effect of the metabolic poison on the rate at which sodium ions leave the axon.

(3)

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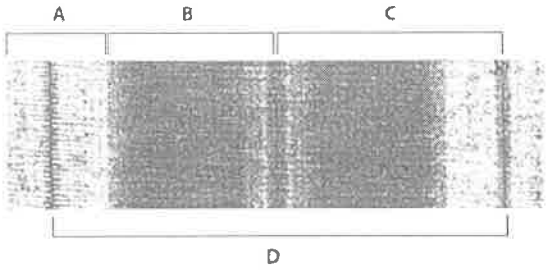
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(Total for question = 11 marks)

Q5.

Skeletal muscles contain fast twitch and slow twitch muscle fibres. These are important in the movement of the body.

The electron micrograph below shows part of a muscle fibre.



Magnification ×50 000

(a) Calculate the actual length of the part labelled D.

Give your answer in millimetres in standard form.

(2)

..... mm

(b) Put a cross (☒) in the box that completes each statement about this muscle fibre.

(i) The sarcomere is the part labelled

(1)

☐ **A**
☐ **B**
☐ **C**
☐ **D**

(ii) The region containing actin but not myosin is the part labelled

(1)

☐ **A**
☐ **B**
☐ **C**
☐ **D**

(iii) When this muscle fibre contracts, the length of

(1)

	part A	part B
☐ A	decreases	decreases
☐ B	decreases	stays the same
☐ C	stays the same	decreases
☐ D	stays the same	stays the same

(c) Put a cross (☒) in the box that completes the statement about muscle fibres.

Fast twitch muscle fibres have

(1)

☐ **A** few mitochondria and few capillaries
☐ **B** few mitochondria and many capillaries
☐ **C** many mitochondria and few capillaries
☐ **D** many mitochondria and many capillaries

(d) Describe the role of calcium ions, in muscle cells, in muscle contraction.

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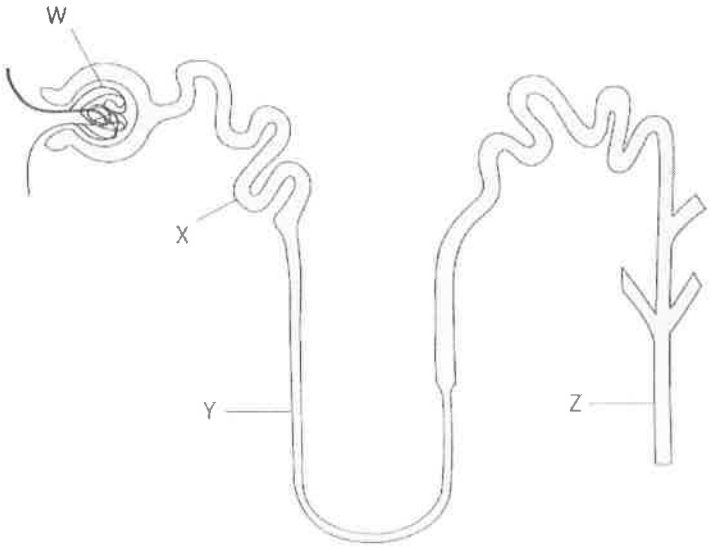
(Total for question = 9 marks)

Q6.

The kidney is an organ involved in the excretion of waste materials and in the regulation of blood volume and plasma concentration.

(a) The functional unit of the kidney is the nephron.

The diagram shows a single nephron.



(i) In which part of the kidney are structures W and X located?

(1)

- ☐ **A** cortex
- ☐ **B** inner medulla
- ☐ **C** outer medulla
- ☐ **D** renal pelvis

(ii) In which structure does ultrafiltration take place?

(1)

- ☐ **A** W
- ☐ **B** X
- ☐ **C** Y
- ☐ **D** Z

(iii) Which structures form part of the loop of Henle?

(1)

- ☐ **A** X only
- ☐ **B** X and Y
- ☐ **C** Y only
- ☐ **D** Y and Z

(b) Urea is a toxic substance that is excreted from the body.

Explain how ultrafiltration removes urea from the blood.

(2)

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(c) The kidney controls blood volume and plasma concentration by regulating the loss of water in urine.

Some mammals have adaptations to their kidneys that enable them to live in different habitats. The table shows information about two small mammals.

Mammal	Urine concentration / mOsmol dm^{-3}	Relative number of mitochondria in the thick ascending loop of Henle	Sodium ion concentration of extracellular fluid in the medulla / mmol dm^{-3}
brown rat	2900	3.6	45
kangaroo rat	5500	5.5	95

Deduce why the kangaroo rat is more successful than the brown rat at living in desert habitats.

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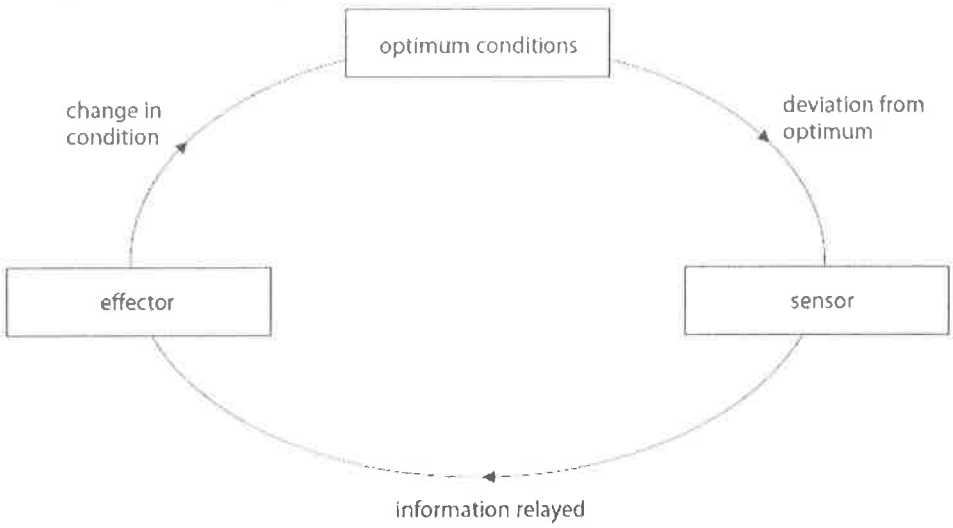
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(Total for question = 8 marks)

Q7.

(a) Negative feedback is important in maintaining homeostasis.

Control of the ventilation rate is an example of negative feedback.
The diagram summarises negative feedback.



(i) Which row of the table shows the sensor and the location of the sensor involved in the control of ventilation?

(1)

	sensor	location of sensor
☐ A	baroreceptor	hypothalamus
☐ B	baroreceptor	medulla oblongata
☐ C	chemoreceptor	hypothalamus
☐ D	chemoreceptor	medulla oblongata

(ii) Explain why the control of ventilation rate is an example of negative feedback. Use the information in the diagram to support your answer.

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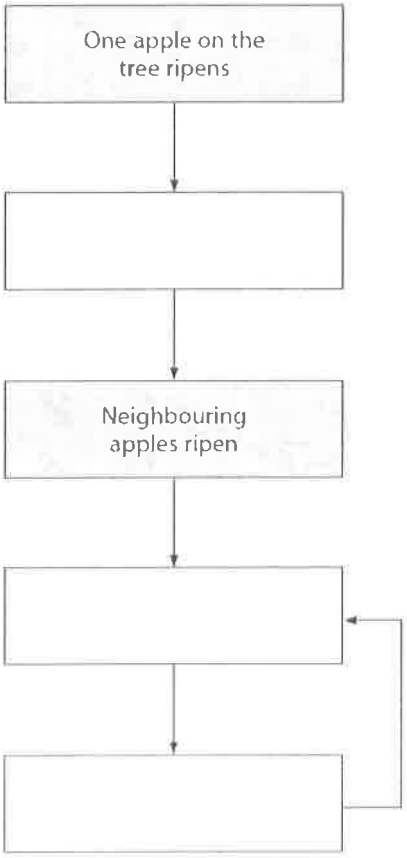
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(b) The ripening of apples is an example of positive feedback.

Ethene is a gas that causes apples to ripen. Ripe apples release ethene.
Complete the diagram to show positive feedback in the ripening of apples.

(3)



(Total for question = 8 marks)

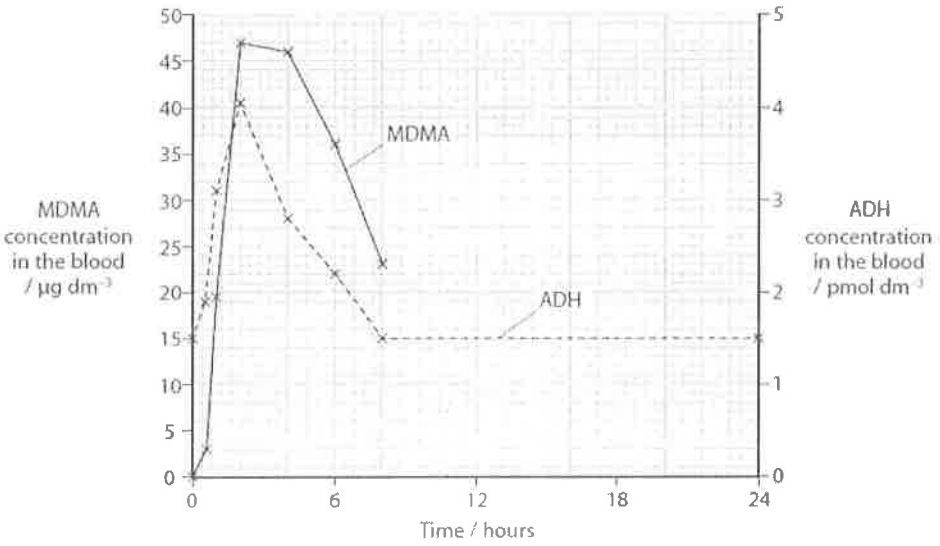
Q8.

Ecstasy (MDMA) is a recreational drug that can have serious toxic effects.

(a) The effect of MDMA on ADH concentration in blood has been studied.

In one study, each person in a group of volunteers was given MDMA. The MDMA and ADH concentrations in the blood were measured.

The graph shows the results of this study.



(i) Estimate how long it takes the MDMA concentration in the blood to become 0.0 μg dm^{-3}.

(1)

Answer ..... hours

(ii) Calculate the rate of removal of ADH from the blood between 4 and 8 hours.

(2)

Answer .....

*(b) Taking MDMA causes a person to be very thirsty. This can lead to swelling of the brain, which can be fatal.

The table shows some laboratory results for one case in which a person suffered swelling of the brain.

Time since taking MDMA / hours	ADH concentration / pmol dm^{-3}	Sodium ion concentration in the blood / mmol dm^{-3}	Appearance of the brain in computed tomography (CT)
9	4.5	112	Swollen
96	1.2	131	Normal

Comment on the role of ADH in MDMA-induced brain swelling.
Use the information in the graph and table as well as your own knowledge to support your answer.

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(Total for question = 9 marks)

Q9.

Heart rate and body temperature are controlled in mammals.

The photograph below shows a wood mouse, *Apodemus sylvaticus*, which is a small mammal.



(Source: British Wildlife Guide)

Magnification ×1.5

(a) (i) Place a cross ☒ in the box next to the tissue in the heart that controls resting heart rate.

(1)

- ☐ **A** atrioventricular node
- ☐ **B** bundle of His
- ☐ **C** Purkyne tissue
- ☐ **D** sinoatrial node

(ii) Place a cross ☒ in the box next to the term that describes what is measured by an electrocardiogram (ECG).

(1)

- ☐ **A** blood pressure
- ☐ **B** cardiac output
- ☐ **C** electrical activity
- ☐ **D** stroke volume

(iii) Name the part of the brain that controls heart rate.

(1)

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(b) Suggest how the wood mouse maintains a constant body temperature when in a cold environment.

(6)

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(Total for question = 9 marks)

Q1.

Question Number	Answer	Additional Guidance	Mark
(a)(i)	(1200 – 800) = 400 ; 33 (%) ;	**Correct answer with no working shown gains both marks** **ALLOW** 33.3% / 33.33%	(2)

Question Number	Answer	Additional Guidance	Mark
(a)(ii)	1. length of exercise; 2. {type / intensity} of exercise; 3. fitness of volunteers; 4. (ambient) temperature; 5. food / drug consumption (during the study);	**IGNORE** gender / age **3. ACCEPT** BMI / mass / weight **4. IGNORE body temperature** **5. IGNORE** diet	(2)

Question Number	Answer	Additional Guidance	Mark
(b)	1. cardiac output increases; 2. (to) increase blood flow to muscles; 3. to provide {oxygen / glucose} for (increased) respiration in muscles; 4. increased blood flow to skin for {heat loss / thermoregulation}; 5. (because exercise causes) increased heat production /eq; 6. decreased flow to {abdominal organs / kidney} to allow blood to be diverted to other tissues / eq; 7. blood flow to the brain does not change as the brain requirements for oxygen does not change / eq;	**1.ACCEPT** increased heart rate /stroke volume increases **2. and 3. ACCEPT** reference to heart or skeletal muscle **3. ACCEPT** to meet increased demand for oxygen 5. **ACCEPT** increase in body temperature 6. **ACCEPT** idea of more oxygen reaching other tissues if diverted away from abdominal organs	(5)

Question Number	Answer	Additional Guidance	Mark
*(c)	QWC 1. cardiac {muscle / tissue } is myogenic / eq; 2. impulses from cardiovascular (control) centre / 3. eq; regulate the rhythm of the SAN; 4. wave of {depolarisation / excitation} from the SAN; 5. (which) causes {atria to contract / atrial systole}; 6. AVN delays conduction (to ventricles): 7. (wave of depolarisation) passes to the {bundle of His / Purkyne tissue}; 8. (which) causes { contraction of ventricles / ventricular systole } ;	**QWC emphasis is on logical sequence** **1. ACCEPT** 'heart' for 'cardiac', cardiac cells are myogenic **IGNORE** SAN is myogenic **2.IGNORE** medulla **3. ACCEPT** control the SAN **4.IGNORE** impulses **7. ACCEPT** Purkyne fibres for tissue **ACCEPT** Purkinje	**(6)**

Q2.

Question Number	Answer	Mark
(a)(i)	D - a spirometer	(1)

Question Number	Answer	Mark
(a)(ii)	A - 0.5 dm^3	(1)

Question Number	Answer	Mark
(a)(iii)	A - 3 breaths min^{-1}	(1)

Question Number	Answer	Mark
(a)(iv)	D - ventilation centre more sensitive to carbon dioxide	(1)

Question Number	Answer	Additional guidance	Mark
(b)	1. idea that (rate of) diffusion reduced ; 2. idea that { difference in concentration / concentration gradient } is reduced ; 3. idea of smaller { surface / area } (of aveoli) ;		(2)

Question Number	Answer	Additional guidance	Mark
(c)	1. idea that { core / blood / body } temperature increases ; 2. reference to { hypothalamus / heat loss centre / thermoregulation centre / thermoreceptors / temperature receptors } ; 3. idea that nerves send { impulses / action potentials } to sweat glands ;		(2)

Q3.

Question Number	Answer	Additional guidance	Mark
(a)	Correct answer gains TWO marks 1. 1.85 ; 2. units as s / seconds / secs ;		(2)

Question Number	Answer	Mark
(b)(i)	**D** an anaerobic enzyme in the vastus lateralis	(1)

Question Number	Answer	Mark
(b)(ii)	**C** pyruvate and oxidised NAD to reduced NAD	(1)

Question Number	Answer	Additional guidance	Mark
(c)(i)	idea that there is no (significant) difference in the proportion of fast and slow twitch fibres in (wild and captive) cheetahs ;	**IGNORE** correlation	(1)

Question Number	Answer	Additional guidance	Mark
(c)(ii)	1. idea that there is no difference in percentage of muscle fibre type / the difference is not {significant} ; 2. idea of overlap between standard deviation of muscle fibre type (in vastus lateralis) ;	**1. ALLOW** the null hypothesis is accepted **2. ALLOW** idea of range / error bars / eq linked to overlap	(2)

Question Number	Answer	Additional guidance	Mark
(d)	1. idea that muscles have more fast twitch fibres ; 2. idea of {fewer capillaries / less myoglobin } ; 3. idea of less oxygen supply ; 4. (less) aerobic respiration / (more) anaerobic respiration ; 5. idea of fewer mitochondria / less ATP made ; 6. idea that lactate produced / low pH produced ;	5. **IGNORE** less energy **Max 5**	(5)

Q4.

Question Number	Answer	Mark
(a)	C ; the extensor muscle is relaxed and the flexor muscle is contracted	(1)

Question Number	Answer	Mark
(b)(i)	D ; pyruvate	(1)

Question Number	Answer	Mark
(b)(ii)	D ; ATP, reduced NAD and reduced FAD	(1)

Question Number	Answer	Mark
(b)(iii)	C ; NAD	(1)

Question Number	Answer	Mark
(b)(iv)	A ;	(1)

Question Number	Answer	Mark
(b)(v)	C ; four	(1)

Question Number	Answer	Additional Guidance	Mark
(c)(i)	1. reference to active transport ; 2. using { pump / carrier protein } ;	2. **ALLOW** sodium pump / sodium potassium pump **IGNORE** channel protein	(2)

Question Number	Answer	Additional Guidance	Mark
(c)(ii)	1. idea that rate falls ; 2. idea of less ATP production ; 3. idea that sodium pump inhibited ;	2. **ACCEPT** less phosphorylation of ADP	(3)

Q5.

Question Number	Answer	Additional Guidance	Mark
(a)	1. 90 (mm) ÷ 50 000 ; 2. 1.8×10^{-3} mm ;	**ALLOW** 91 / 9 / 9.1	(2)

Question Number	Answer	Mark
(b)(i)	**The only correct answer is D** *A is not correct because D shows a sarcomere* *B is not correct because D shows a sarcomere* *C is not correct because D shows a sarcomere*	(1)

Question Number	Answer	Mark
(b)(ii)	**The correct answer is A** *B is not correct because it contains myosin and actin* *C is not correct because it contains regions with both actin and myosin* *D is not correct because it contains regions with both actin and myosin*	(1)

Question Number	Answer	Mark
(b)(iii)	**The correct answer is B -** decreases / stays the same *A is not correct because part B stays the same* *C is not correct because part A decreases and part B stays the same* *D is not correct because part D decreases*	(1)

Question Number	Answer Additional Guidance	Mark
(c)	**The correct answer is A – few mitochondria and few capillaries** *B is not correct because fast twitch fibres have few capillaries* *C is not correct because fast twitch fibres have few mitochondria* *D is not correct because fast twitch fibres have few mitochondria and few capillaries*	(1)

Question Number	Answer	Additional Guidance	Mark
(d)	1. calcium ions {are released from sarcoplasmic reticulum / enter the sarcoplasm } ; 2. calcium ions bind to troponin ; 3. (change in shape of troponin) moves tropomyosin away from myosin binding site ; 4. allowing myosin (heads) to attach to actin ; 5. (contraction as) actin is pulled past the myosin / reference to sliding filament theory ;	**MP3 ALLOW** this exposes the myosin binding site	(3)

Q6.

Question number	Answer	Additional guidance	Mark
(a)(i)	A cortex		**Computer** (1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	A W		**Computer** (1)

Question number	Answer	Additional guidance	Mark
(a)(iii)	C Y only		**Computer** (1)

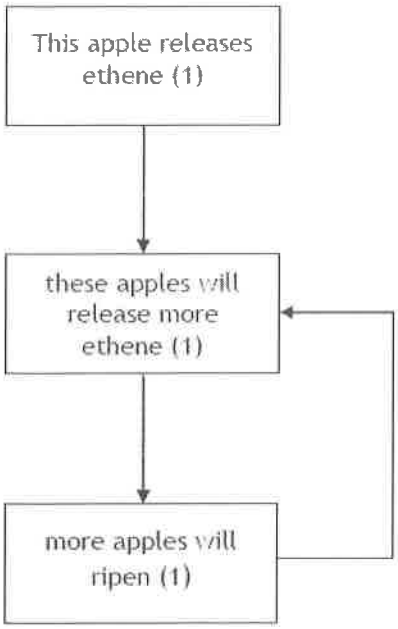
Question number	Answer	Additional guidance	Mark
(b)	An answer that includes the following points: • (urea) forced out by high pressure (of the blood) (1) • caused by afferent blood vessel greater diameter than efferent blood vessel in the glomerulus (1) • through pores in the (basement) membrane (1)	IGNORE any other mechanism other than ultrafiltration ALLOW arteriole NOT artery ALLOW reference to podocytes /glomerular fenestrations	**Expert** **(2)**

Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • less water available in deserts (1) • (Kangaroo rat conserves water) by producing more concentrated urine (1) • needs to actively transport more sodium ions into (the extracellular fluid of) medulla (1) • therefore needs more mitochondria to produce more ATP (1)	ALLOW Less water available for kangaroo rat ALLOW (more water reabsorbed / filtered out) producing more concentrated urine IGNORE sodium	**Expert** **(3)**

Q7.

Question number	Answer	Mark
(a)(i)	D chemoreceptor, medulla oblongata	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes any four of the following points: • an increase in blood carbon dioxide decreases the pH of the blood (1) • the pH of the blood needs to be kept within narrow limits (1) • therefore the ventilation rate has to increase (1) • nerve impulse sent from {respiratory centre / medulla} to intercostal muscles (1) • when inspiratory centre is stimulated, the expiratory centre is inhibited (1)	Accept cells have to be supplied with sufficient oxygen / carbon dioxide has to be removed Accept converse	(4)

Question number	Answer	Mark
(b)	An answer that includes the following points: 	(3)

Q8.

Question number	Answer	Additional guidance	Mark
(a)(i)	An answer between 8 and 18 (hours) (1)		**Graduate** **(1)**

Question number	Answer	Additional guidance	Mark
(a)(ii)	An answer showing the following steps: • correct values read from y-axis and subtracted **(1)** • gradient calculated and appropriate units given (1)	2.8 -1.5=1.3 1.3 ÷ 4 = 0.325 pmol dm^{-3} $hour^{-1}$ ALLOW 0.33 Conversion to other units will also need checking ALLOW 325fmol in place of 0.325pmol h^{-1} / H^{-1} for $hour^{-1}$	**Expert** **(2)**

Question number	Answer	Mark
(b)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** Graph shows • as MDMA concentration in blood increases ADH concentration increases Table shows • after 9 hours of taking MDMA ADH levels still high / 3x that at 96 hours • as ADH concentration increases sodium ion concentration in the blood decreases • brain swelling is associated with lower sodium ion concentration in the blood From own knowledge ADH increases water reuptake by the kidney Deduction Increased water retention is to dilute the blood More water leaves blood by osmosis into brain tissue Resulting in swelling of the brain	**Expert** **(6)**

Level	Marks	Descriptor
	0	No awardable content.
1	1-2	Limited number of the most important or relevant scientific factors from the data/information provided are synthesised. No judgement is made.
2	3-4	Some of the most important or relevant scientific factors from the data/information provided are synthesised. A straightforward but accurate judgement is made.
3	5-6	Most of the important or relevant scientific factors from the data/information provided are synthesised. A detailed and accurate judgement is made.

Q9.

Question Number	Answer	Mark
(a)(i)	D ; sinoatrial node	(1)

Question Number	Answer	Mark
(a)(ii)	C ; electrical activity	(1)

Question Number	Answer	Additional Guidance	Mark
(a)(iii)	medulla (oblongata) / cardiovascular centre ;		(1)

Question Number	Answer	Additional Guidance	Mark
(b)	1. receptors in the { skin / hypothalamus } ; 2. idea of (nerve) impulses to { hypothalamus / heat gain centre / thermoregulatory centre } ; 3. arterioles { constrict / vasoconstriction } so less blood to { skin / superficial capillaries } **OR** shunt vessels { dilate / widen / eq } so less blood to { skin / superficial capillaries } ; 4. idea that hair erector muscles contract to { trap air / insulate } ; 5. idea of less heat loss by { radiation / convection } ; 6. idea that heat generated by { shivering / muscle contraction / increase in metabolic rate / increase in respiration } ; 7. idea of { less sweating / inhibition of sweat glands } ; 8. idea of less heat loss by evaporation ;	2. **ALLOW** wave of depolarisation / action potentials 4. **IGNORE** trap heat	(6)