This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 02

26MAR2025

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

Subject :	A Level : Biology 2
Class :	12A
Teacher :	Miss Rahmeh Hilal
Duration :	2 hours
You are to answer the questions to this exam on : This exam paper	

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.

Aerobic respiration and anaerobic respiration produce ATP in cells.

(a) It is thought that 32 ATP molecules are produced from one molecule of glucose in aerobic respiration.

Place a cross in the box ☒ next to the description of where most of these ATP molecules are produced.

(1)

☐ **A** glycolysis in the cytoplasm

☐ **B** glycolysis in the mitochondria

☐ **C** oxidative phosphorylation in the cytoplasm

☐ **D** oxidative phosphorylation in the mitochondria

(b) During anaerobic respiration lactate is produced.

The table below shows the lactate concentration in the blood of a person who is an athlete and in a person who is not an athlete (non-athlete), at increasing levels of exercise.

Level of exercise / arbitrary units	Blood lactate concentration / mmol dm^{-3}	
	Athlete	Non-athlete
0	1.0	1.5
60	1.1	2.2
120	1.4	3.7
180	3.2	6.2
240	6.4	10.0

(i) Explain the change in blood lactate concentration with an increasing level of exercise in the non-athlete.

(3)

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(ii) Suggest an explanation for the difference between the blood lactate concentration of the athlete and the non-athlete.

(2)

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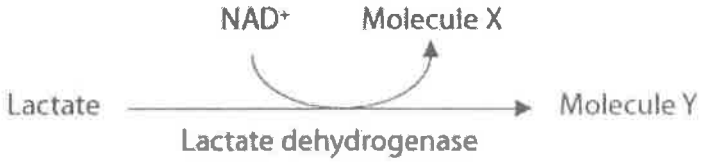
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(c) The diagram below shows the fate of lactate after exercise.



(i) Name molecule X.

(1)

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(ii) Describe what happens to molecule Y.

(2)

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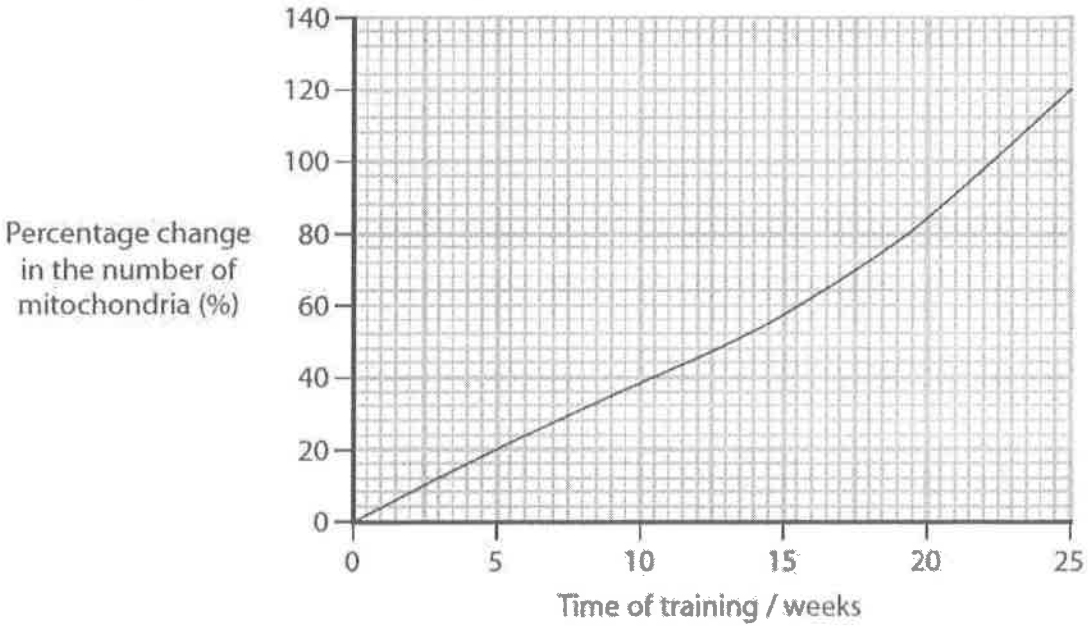
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(Total for question = 9 marks)

Q2.

Endurance training changes the number and size of mitochondria in muscle tissue.

The graph below shows the percentage change in the number of mitochondria found in muscle tissue during 25 weeks of endurance training.



(a) Use the graph to describe the changes in the number of mitochondria in muscle tissue during this 25 week training period.

(2)

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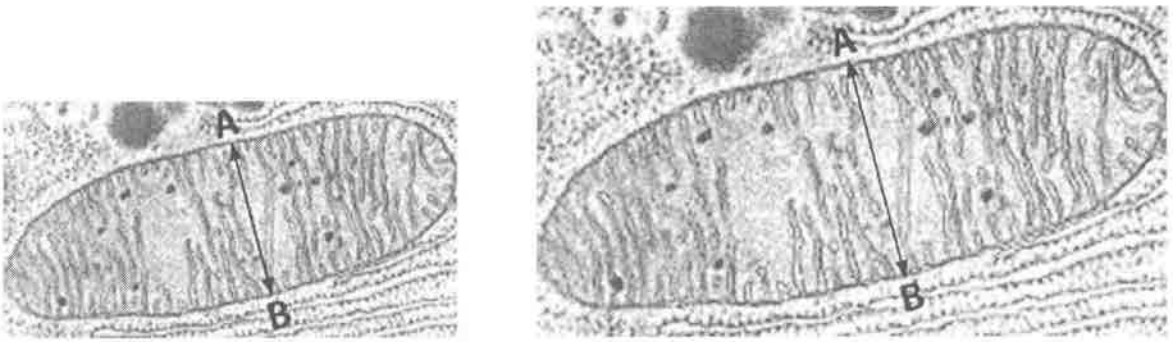
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(b) The electron micrographs below show a typical mitochondrion in muscle before and after training.

Before training **After training**



Magnification ×10000

(i) The width of each mitochondrion is shown by the line A to B.
Calculate the percentage change in the width of the mitochondrion after training. Show your working.

(2)

Answer ..... %

*(ii) An increase in the width of mitochondria increases the surface area of membranes inside mitochondria.

Explain how an increase in the surface area of these membranes will affect the synthesis of ATP in the muscle tissue of an athlete.

(6)

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(Total for question = 10 marks)

Q3.

Energy can be released from organic molecules by cellular respiration.

(a) Cellular respiration involves a number of chemical reactions.

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

(i) The energy stored in ATP is released by

(1)

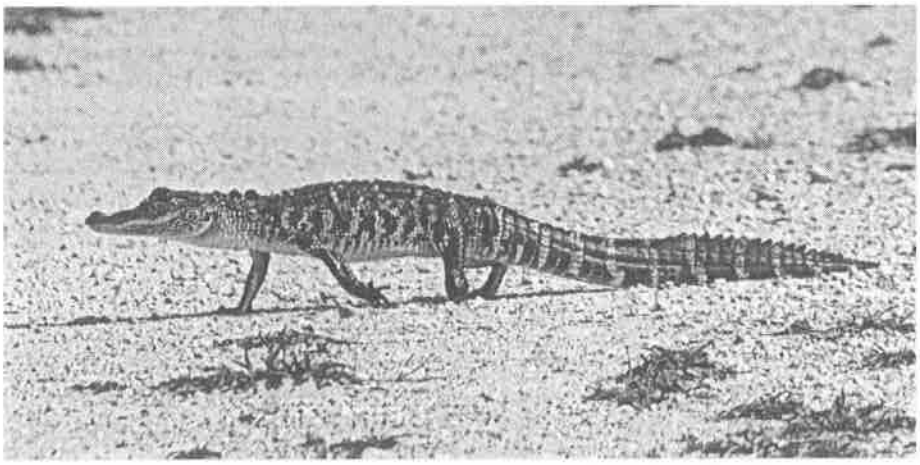
- ☐ **A** hydrolysis of ADP
- ☐ **B** hydrolysis of ATP
- ☐ **C** phosphorylation of ADP
- ☐ **D** phosphorylation of ATP

(ii) In cellular respiration

(1)

- ☐ **A** NAD accepts electrons in glycolysis and in the Krebs cycle
- ☐ **B** reduced NAD accepts electrons in glycolysis and in the Krebs cycle
- ☐ **C** NAD accepts electrons in the Krebs cycle only
- ☐ **D** reduced NAD accepts electrons in the Krebs cycle only

(b) The photograph below shows an alligator.



© Patrick Lynch / Alamy Stock Photo

Magnification ×0.05

Alligators use anaerobic respiration as their main source of energy during short periods of activity.

An investigation was carried out to study respiration in an alligator.

The table below shows the data collected in this investigation.

Duration of activity / s	Rate of lactate production / mmol kg^{-1} min^{-1}	Rate of ATP production / mmol kg^{-1} min^{-1}	Mass of glycogen used / g kg^{-1}
10	34.6	51.8	0.5
30	11.8	17.7	0.9
60	10.7	16.0	1.4
120	6.4	9.5	1.9
270	0.3	0.4	2.0

* (i) Describe and explain the results of this investigation.

(6)

(ii) After stopping exercise the oxygen consumption of the alligator increases.
Explain why the oxygen consumption of an alligator increases after a short period of activity.
(3)

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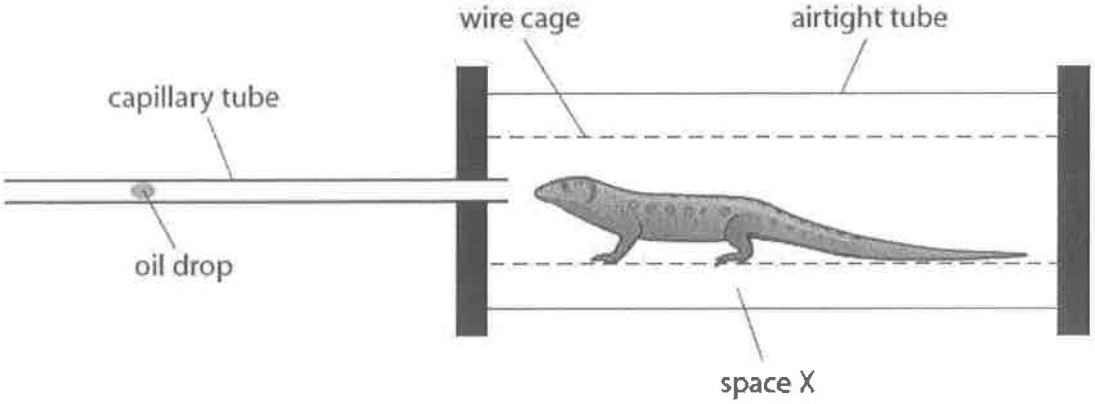
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(Total for question = 11 marks)

Q4.

The tissues of some animals can carry out aerobic and anaerobic respiration.

(a) The apparatus shown below can be used to investigate the respiration of a sand lizard.



(i) Name a chemical that should be added in space X to allow the measurement of aerobic respiration.

(1)

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(ii) Describe how this apparatus could be used to calculate the rate of respiration of the sand lizard.

(2)

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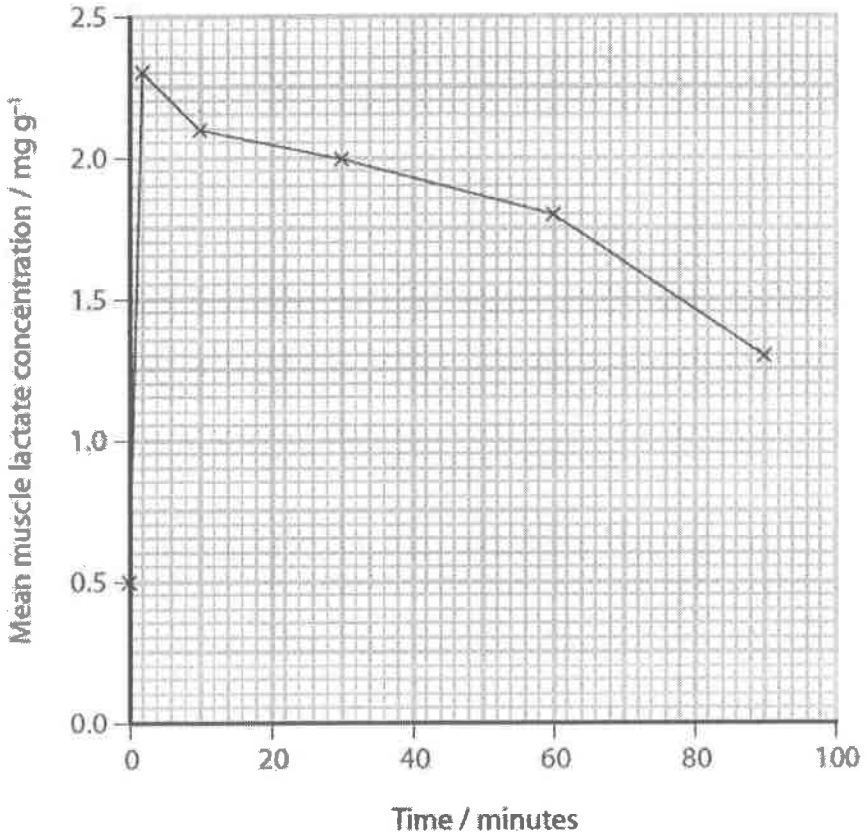
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(b) An experiment was carried out to measure the concentration of lactate (lactic acid) in the muscles of sand lizards before and after they exercised for two minutes.

The results are shown in the graph below.



(i) Calculate the percentage increase in mean muscle lactate that takes place during the two minutes of exercise.

Show your working.

(2)

Answer ..... %

(ii) Explain the change in mean muscle lactate concentration during the exercise.

(3)

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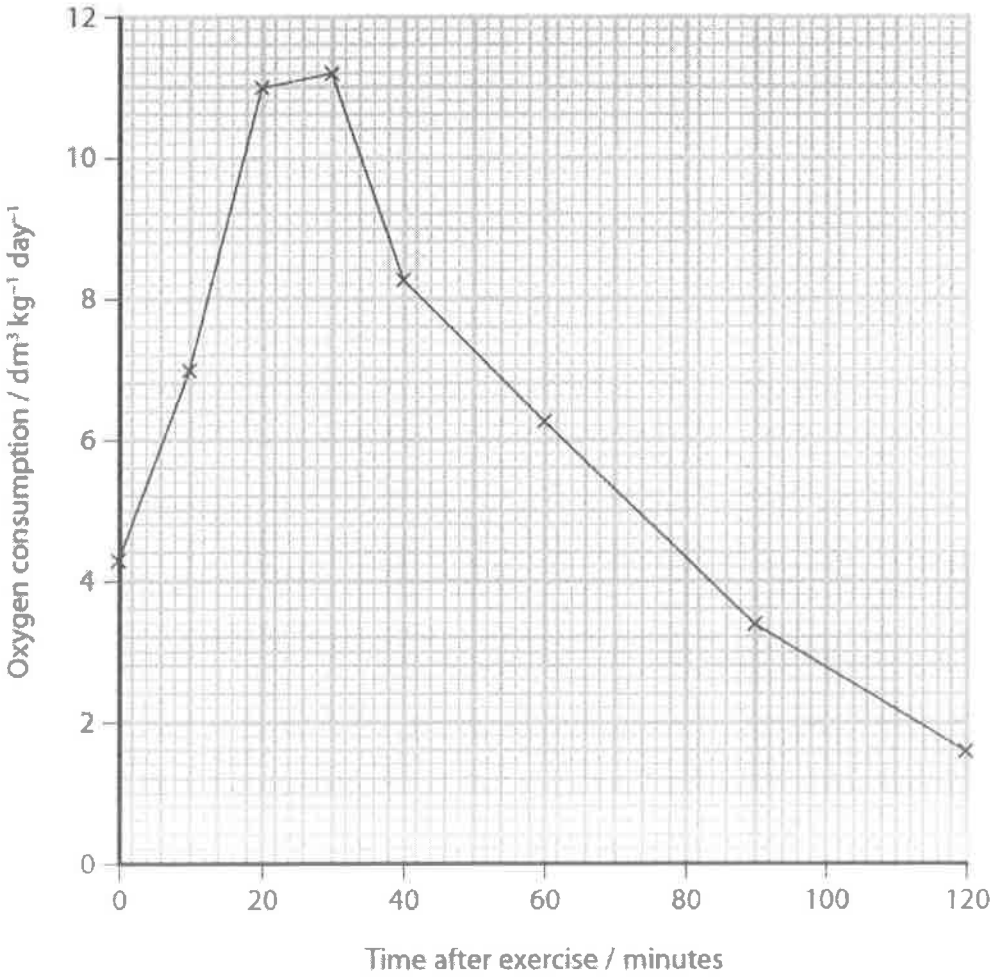
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(c) In another experiment, the oxygen consumption of a sand lizard, after a period of exercise, was measured.

The results are shown in the graph below.



Explain the changes in the oxygen consumption of this sand lizard.

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(Total for question = 12 marks)

Q5.

Cells produce ATP using anaerobic and aerobic respiration.

(a) In aerobic respiration, organic molecules are oxidised in the Krebs cycle.

Describe how the products of the Krebs cycle are used in the production of ATP.

(5)

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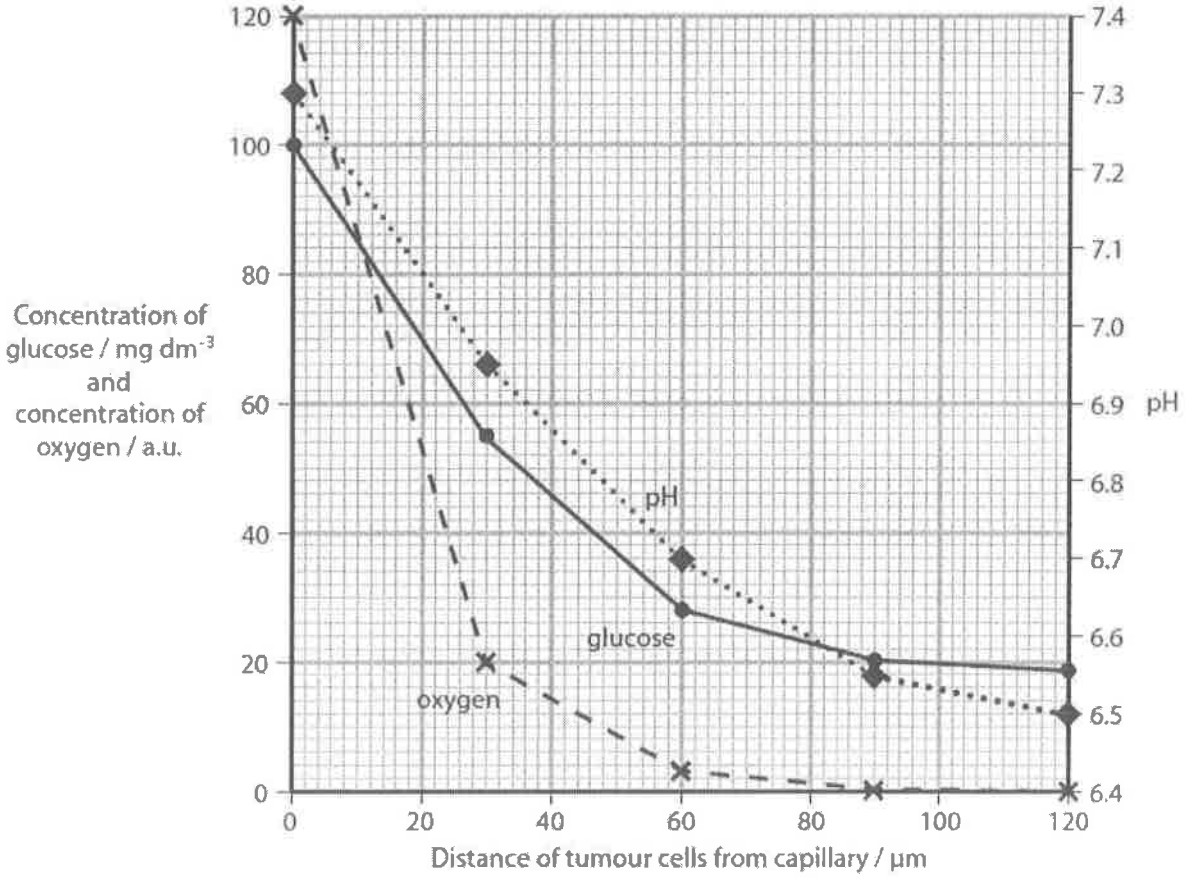
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(b) In some tumours, cells grow rapidly and obtain nutrients from capillaries.

In one study, the concentration of glucose, the concentration of oxygen and the pH of fluid around tumour cells was investigated.

The graph below shows some of the results of this study.



(i) Calculate the percentage decrease in oxygen concentration when the glucose concentration has fallen by 50% of its highest concentration.

(3)

Answer.....%

(ii) Explain the changes in pH recorded in this study.

(3)

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(Total for question = 11 marks)

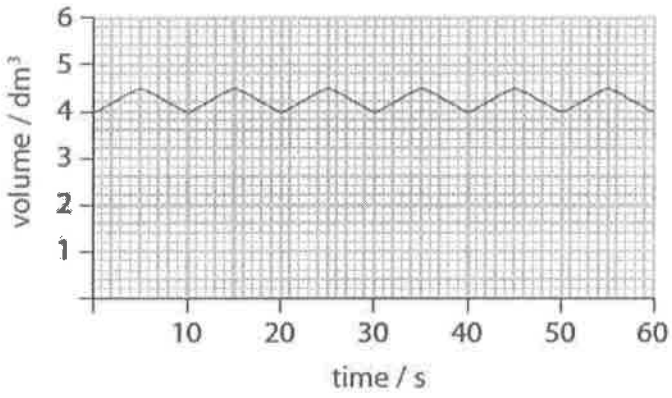
Q6.

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

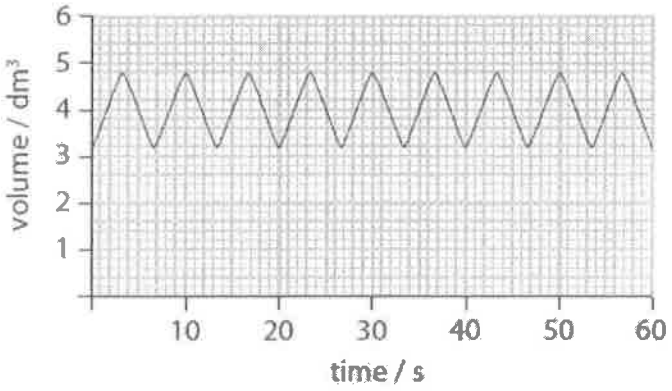
It is thought that the caffeine contained in coffee might help people with asthma by increasing their breathing rate.

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

Before drinking coffee



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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(Total for question = 8 marks)

Q7.

Core body temperature in a person is kept constant by mechanisms of thermoregulation.

(a) Put a cross ☒ in the box next to the part of the brain that controls body temperature.

(1)

☐ **A** cerebellum

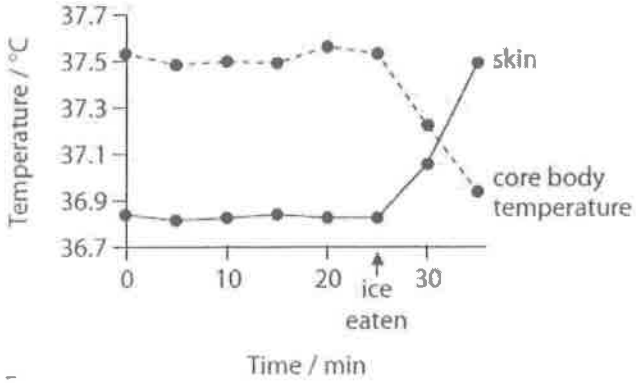
☐ **B** cerebral hemispheres

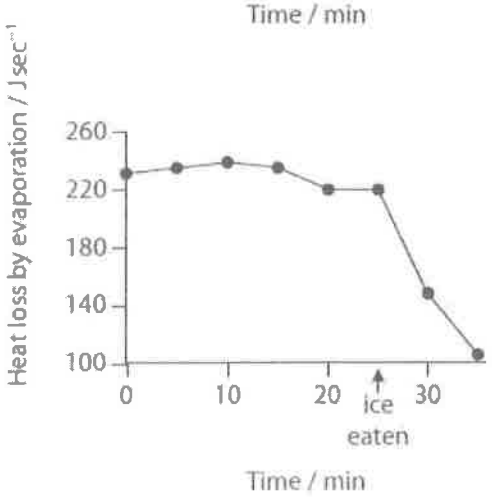
☐ **C** hypothalamus

☐ **D** medulla oblongata

(b) In an investigation, the core body temperature, skin temperature and heat loss by evaporation of a person was measured for 25 minutes.

The person then ate some ice and the measurements were repeated for a further 10 minutes.
The graphs below show the results of this investigation.





(i) Using the information given, compare the changes in the core temperature and the skin temperature.

(2)

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(ii) Explain the change in heat loss by evaporation after eating the ice.

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(c) Prolonged exposure to cold temperatures causes hypothermia.

Hypothermia lowers the core body temperature which reduces the rate of metabolic processes, such as chemiosmosis, in cells.
Explain how hypothermia reduces the synthesis of ATP by chemiosmosis.

(5)

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(Total for question = 12 marks)

Q8.

Some mammalian hormones are synthesised from amino acids.

(a) (i) Put a cross (☒) in the box next to the structure where translation of messenger RNA and protein synthesis take place.

(1)

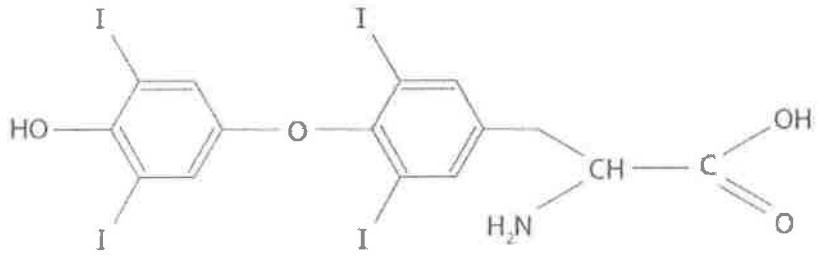
- ☐ **A** Golgi apparatus
- ☐ **B** lysosome
- ☐ **C** rough endoplasmic reticulum
- ☐ **D** smooth endoplasmic reticulum

(ii) Put a cross (☒) in the box next to the structure where modification of proteins to form glycoproteins takes place.

(1)

- ☐ **A** Golgi apparatus
- ☐ **B** lysosome
- ☐ **C** nucleolus
- ☐ **D** ribosome

(b) The diagram below shows the structure of thyroxine, a hormone involved in the regulation of respiration in cells. Thyroxine is synthesised from two amino acids and iodine.



(i) Draw a circle round the carboxyl group.

(1)

(ii) Thyroxine increases the body's sensitivity to hormones such as adrenaline.
Thyroxine can also inhibit nerve impulses.
Compare the mechanisms used in hormonal and nervous coordination in mammals.

(3)

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(iii) Cell membranes contain transporter proteins that enable thyroxine to enter the cell. This results in a change in the activity of transcription factors.

Suggest how thyroxine is able to increase the secretion of adrenaline from cells in the adrenal glands.

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(Total for question = 10 marks)

Q9.

Movement of the skeleton requires the coordinated activity of muscles.

(a) The diagram below shows the arrangement of some muscles around the human knee joint.



(i) Put a cross (☒) in the box next to the row that correctly describes the hamstring and quadriceps muscles when flexing (bending) the knee.

(1)

		hamstring	quadriceps
☐	A	contracting	contracting
☐	B	contracting	relaxing
☐	C	relaxing	contracting
☐	D	relaxing	relaxing

(ii) Put a cross (☒) in the box next to the structure that attaches muscles to bones.

(1)

☐ **A** fast twitch fibres
☐ **B** ligaments
☐ **C** slow twitch fibres
☐ **D** tendons

(b) Movement at a joint is produced by muscle contraction.

The sliding filament theory is used to explain muscle contraction.

(i) The sliding filament theory describes the interactions of a number of proteins.
Put a cross (☒) in the box to complete the following sentence.
The formation of proteins involves

(1)

☐ **A** transcription of DNA in the nucleus
☐ **B** transcription of genes on ribosomes
☐ **C** translation of DNA in the nucleus
☐ **D** translation of genes on ribosomes

(ii) Describe the role of calcium ions in the sliding filament theory of muscle contraction.

(3)

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(c) Damage to joints can result in a condition called osteoarthritis.

Osteoarthritis is a condition in which the cartilage is broken down in a joint.
In one study, the relationship between physical activity and the development of osteoarthritis was investigated.
The results are shown in the table below.

Heavy physical activity / hours per day	Number of individuals	Number of cases of osteoarthritis	Mean body mass index (BMI)
0	264	8	26.0 ± 4.1
1	107	5	26.0 ± 3.9
2	59	4	25.7 ± 4.3
3	23	2	25.1 ± 5.0
4 or more	17	2	26.2 ± 3.9

(i) State the relationship between heavy physical activity and the frequency of cases of osteoarthritis.

(1)

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(ii) Explain why the scientists were able to suggest that BMI does not affect the frequency of cases of osteoarthritis in this study.

(2)

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(iii) One treatment for osteoarthritis is to replace the damaged cartilage in a joint with cartilage taken from an undamaged joint of the same person.

This procedure is carried out using keyhole surgery.

State **two** advantages of using keyhole surgery to carry out this procedure.

(2)

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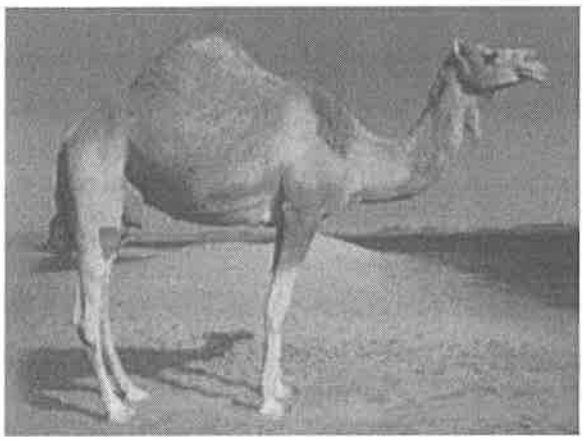
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(Total for question = 11 marks)

Q10.

The photograph below shows a camel. Camels are large mammals adapted to a desert environment.



(a) A desert environment has a wide temperature range. A camel maintains a nearly constant body temperature by the process of negative feedback.

Explain what is meant by the term **negative feedback**.

(2)

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(b) The table below shows the daily heat loss from a camel that had been given water to drink and the daily heat loss from a camel that had not been given water to drink.

Camel	Daily heat loss / kJ
given water to drink	20920
not given water to drink	8368

Using the data in the table, calculate the percentage increase in the heat loss of the camel given water to drink.
Show your working.

(2)

Answer ..... %

* (c) Temperatures in the desert may rise above 50 °C.

The camel is able to maintain an internal body temperature within a range of 38 °C to 40 °C. One of the methods used is increased sweat production.

Using the information in this question, as well as your knowledge of thermoregulation and osmoregulation, describe the role of ADH in regulating the effects of the above on the volume and concentration of urine produced.

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(Total for question = 10 marks)

Q1.

Question Number	Answer	Mark
(a)	D - oxidative phosphorylation in the mitochondria	(1)

Question Number	Answer	Additional guidance	Mark
(b)(i)	1. idea of insufficient oxygen supply ; 2. reference to **glycolysis** ; 3. idea that reduced NAD is produced ; 4. idea that pyruvate is converted to lactate ; 5. idea that conversion of pyruvate involves oxidation of reduced NAD ;		(3)

Question Number	Answer	Additional guidance	Mark
(b)(ii)	1. idea of { increased oxygen supply / more aerobic respiration / less anaerobic respiration } ; 2. idea of increased { stroke volume / cardiac output / capillarisation / myoglobin level / increased blood flow / better blood supply / heart pumps more blood / more red blood cells } ; 3. idea of increased { ventilation / gas exchange / vital capacity } ;	**Allow** converse 'more oxygenated blood' gains Mp1 and Mp2	(2)

Question Number	Answer	Additional guidance	Mark
(c)(i)	NADH / reduced NAD / eq ;	Allow NADH + H^+ $NADH_2$	(1)

Question Number	Answer	Additional guidance	Mark
(c)(ii)	1. (molecule Y is) pyruvate ; 2. converted to acetyl CoA / enters link reaction / enters Krebs cycle / converted to carbon dioxide and water ; 3. converted to glucose ;		(2)

Q2.

Question Number	Answer	Additional guidance	Mark
(a)	1. idea of increase in number of mitochondria ; 2. idea that the increase is greater with more weeks of training ;	1. **Allow** positive correlation	(2)

Question Number	Answer	Additional guidance	Mark
(b)(i)	1. difference between high and low value divided by low value ; 2. answer between 36.36 and 47.61 ;	Correct answer with no working gains TWO marks 1. **Allow** correct method with incorrect values	(2)

Question Number	Answer	Additional guidance	Mark
* (b)(ii)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. reference to **cristae** ; 2. reference to **oxidative phosphorylation** ; 3. reference to **electron transport chain**; 4. idea of electrons passed along carriers ; 5. idea that { hydrogen ions / H^+ / protons } moved to intermembrane space ; 6. idea of { hydrogen ions / H^+ / proton / electrochemical / concentration } gradient produced ;	**(QWC emphasis on logical sequence)** 3. **Allow** ETC	(6)
	7. reference to { chemiosmosis / stalked particles / ATPase } ; 8. idea that more ATP synthesised ;		

Q3.

Question Number	Answer	Mark
(a)(i)	B hydrolysis of ATP The only correct answer is B *A is not correct because the question asks about the energy stored in ATP not ADP* *C is not correct because phosphorylation of ADP requires energy* *D is not correct because ATP is not phosphorylated*	(1)

Question Number	Answer	Mark
(a)(ii)	A NAD accepts electrons in glycolysis and in the Krebs cycle The only correct answer is A B *is not correct because it is NAD not reduced NAD that accepts electrons* C *is not correct because NAD is an electron acceptor in both glycolysis and Krebs cycle* D *is not correct because it is NAD not reduced NAD that accepts electrons and because NAD is an electron acceptor in both glycolysis and Krebs cycle*	(1)

Question Number	Answer	Additional Guidance	Mark
* (b)(i)	**QWC – emphasis is clarity of expression** 1. rate of lactate production decreased with duration of activity / eq ; 2. rate of ATP production decreased with duration of activity / eq ; 3. glycogen used increases with duration of activity /eq ; 4. as glycogen is converted to glucose ; 5. glucose is converted to lactate / eq ; 6. after 120 seconds glycogen used levels off / eq ; 7. anaerobic respiration { decreases / stops } ; 8. because glycogen has been (completely) used up ;		(6)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. lactate produced during anaerobic respiration (accumulates in the blood) ; 2. oxygen is required to convert lactate back to { pyruvate / glucose } (after period of activity) ; 3. so that glycogen stores are replenished (in muscles) ; 4. oxygen is used in aerobic respiration ; 5. oxygen is used to oxidise reduced NAD (to produce water and NAD) ; 6. reference to other correct requirement for oxygen ;	**MP5 Allow** oxygen used in oxidative phosphorylation to regenerate NAD **MP6** e.g. repay oxygen debt / reoxygenate myoglobin / aerobic respiration of breathing muscles / aerobic respiration of breathing muscles / increased metabolic rate	(3)

Q4.

Question Number	Answer	Additional Guidance	Mark
(a)(i)	soda lime ;	**ACCEPT** sodium hydroxide / potassium hydroxide / carbon dioxide absorber / NaOH / KOH	(1)

Question Number	Answer	Additional Guidance	Mark
(a)(ii)	1. measure distance moved by drop oil ; 2. divide (volume / distance) by time taken ;		(2)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. 2.3 and 0.5 or 1.8 ; 2. 360 (%) ;	Correct answer no working gains full marks.	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. muscles using oxygen faster than it can be delivered ; 2. anaerobic respiration is taking place ; 3. pyruvate is converted to lactate ; 4. and reduced NAD is oxidised / eq ;	**ALLOW** not enough oxygen (available to the muscle) **ALLOW** reoxidising NADH	(3)

Question Number	Answer	Additional Guidance	Mark
(c)	1. { during exercise / first 2 minutes } muscles use anaerobic respiration ; 2. oxygen consumption is increased to {repay oxygen debt / oxidise lactate / re-oxygenate myoglobin} ; 3. { during recovery / once exercise has finished } anaerobic respiration stops ; 4. oxygen uptake decreases as oxygen debt decreases / eq ;	**ALLOW** produce lactate **ALLOW** lactate has been converted back to pyruvate myoglobin has been re-oxygenated	(4)

Q5.

Question Number	Answer	Additional Guidance	Mark
(a)	1. reference to {reduced NAD / reduced FAD / reduced coenzymes} ; 2. transport {hydrogen atoms / (protons and) electrons} tothe electron transport chain ; 3. electrons move along electron transport chain (in series ofredox reactions) ; 4. energy (released) is used to pump {protons / H^+ / hydrogenions} into the inter-membrane space ; 5. protons {diffuse/move} (down electrochemical gradient) through {ATP synthase / ATPase / stalked particle} (back into the matrix) ; 6. (catalysing the) formation of ATP from ADP and Pi ;	ALLOW electrons move along cytochromes ALLOW reference to chemiosmosis ALLOW phosphorylating ADP orequation ADP + Pi -> ATP IGNORE producing ATP	(5)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. oxygen concentration at 50% glucose concentration = 17 (a.u.); 2. change in concentration of oxygen = 120 - 17 = 103 (a.u.) ; 3. (103 ÷ 120) x 100 = 85.8 (%) ;	ALLOW ecf from value used in 1 in mp2 and 3 ALLOW 86 (%) / 85.8 (%) Correct answer with no working gains all 3 marks	(3)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. idea that the pH decreases as distance (from the capillary) increases ; 2. (aerobic) respiration produces carbon dioxide (whichreduces the pH) ; 3. (at low oxygen concentrations) tumour cells respireanaerobically ; 4. {lactic acid / lactate} is produced (from pyruvate) ;	ALLOW negative correlation	(3)

Q6.

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)

Q7.

Question Number	Answer	Mark
(a)	The correct answer is C - hypothalamus A is incorrect because the cerebellum is involved in the co-ordination of movement B is incorrect because the cerebrum is involved in thinking/learning D is incorrect because the medulla oblongata is involved in the control of heart rate	1

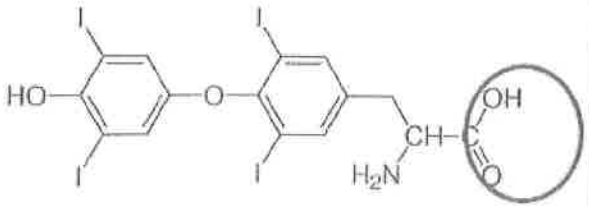
Question Number	Answer	Additional guidance	Mark
(b) (i)	1. core body temperature higher (than skin temperature) before eating ice / eq ; 2. core body temperature falls **and** skin temperature rises **after** eating ice ;	**MP1 ACCEPT** converse	2

Question Number	Answer	Additional guidance	Mark
(b)(ii)	1. heat loss decreases (after eating ice) ; 2. ice reduces core body temperature ; 3. (reduced) temperature detected by { hypothalamus / thermoregulatory centre / heat gain centre } ; 4. nerve impulses / eq (from hypothalamus / eq) ; 5. sweat glands { inhibited / produce less sweat } ; 6. less evaporation of water ; 7. reference to latent heat of {vaporisation / evaporation } ;	**MP6 DNA** sweat	4

Question Number	Answer	Additional guidance	Mark
(c)	1. idea of reduction in { activity of enzymes / kinetic energy } ; 2. idea that hypothermia affects { active transport / pumping } of { protons / H^+ / hydrogen ions } ; 3. out of matrix / through inner membrane / to intermembrane (space) ; 4. chemiosmosis requires a {concentration / electrochemical / pH / proton} gradient ; 5. idea that hypothermia reduces diffusion (down this gradient) ; 6. less energy released by movement of { protons / eq } ; 7. through { ATP synthase / stalked particles } ;	**MP4 ACCEPT** eq to protons	5

Q8.

Question Number	Answer	Mark
(a)(i)	C - rough endoplasmic reticulum The only correct answer is C *A is not correct because protein synthesis takes place on the ribosomes associated with the rough ER* *B is not correct because protein synthesis takes place on the ribosomes associated with the rough ER* *D is not correct because protein synthesis takes place on the ribosomes associated with the rough ER*	(1)
(a)(ii)	**A** - Golgi apparatus The only correct answer is A *B is not correct because modification of proteins to form glycoproteins takes place in the Golgi apparatus* *C is not correct because modification of proteins to form glycoproteins takes place in the Golgi apparatus* *D is not correct because modification of proteins to form glycoproteins takes place in the Golgi apparatus*	(1)

Question Number	Answer	Additional Guidance	Mark
(b)(i)	carboxyl group correctly encircled		(1)

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>(b)(ii)</td><td>
<table>
<tr><th></th><th>hormonal</th><th>nervous</th></tr>
<tr><td>1</td><td>chemical</td><td>impulse / electrical ;</td></tr>
<tr><td>2</td><td>transported in blood</td><td>carried by { nerves / neurones } ;</td></tr>
<tr><td>3</td><td>slow speed (of transmission)</td><td>fast speed ;</td></tr>
<tr><td>4</td><td>long-lasting response</td><td>short-lived response ;</td></tr>
<tr><td>5</td><td>widespread effect</td><td>localised effect ;</td></tr>
</table>
</td><td>A comparison is required for each marking point

3 ACCPET slower/ faster in correct context
4 ACCPET longer / shorter in correct context
5 ACCPET more localised / more widespread in correct context</td><td>(3)</td></tr>
<tr><td>(b)(iii)</td><td>1. thyroxine binds to receptors ;

2. { enters / moves to } the nucleus ;

3. activates transcription factors / stimulates transcription / eq ;

4. increased { protein / enzyme } synthesis / eq ;

5. synthesis of (more) adrenaline / eq ;</td><td>1 IGNORE binds to second messengers

3 ACCEPT acts as a transcription factor

4 must be in the correct context.

4 IGNORE increased adrenaline synthesis</td><td>(4)</td></tr>
</table>

Q9.

Question Number	Answer	Mark
(a)(i)	**B** - contracting | relaxing The only correct answer is B *A is not correct as these muscles are an antagonistic pair – one must contract and one relax* *C is not correct as the hamstring is the flexor muscle* *D is not correct as these muscles are an antagonistic pair – one must contract and one relax*	**(1)**

Question Number	Answer	Mark
(a)(ii)	**D** – tendons *The only correct answer is D* *A is not correct as fast twitch fibres are muscles fibres* *B is not correct as ligaments connect bones to bones* *C is not correct as slow twitch fibres are muscles fibres*	**(1)**

Question Number	Answer	Mark
(b)(i)	A - transcription of DNA in the nucleus *The only correct answer is A* *B is not correct because transcription takes place in the nucleus* *C is not correct because mRNA is not translated in the nucleus* *D is not correct because mRNA is translated not the gene*	**(1)**

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. calcium ions bind to troponin ; 2. changing the shape of troponin ; 3. { troponin / tropomyosin } move away (from actin filaments) ; 4. to allow the myosin head to bind to actin / eq ;	**ALLOW** move away from myosin binding sites **ALLOW** to allow actin myosin bridges to form	(3)

Question Number	Answer	Additional Guidance	Mark
(c)(i)	the greater the number of hours of physical activity the greater the frequency of osteoarthritis / eq ;	**ALLOW** positive correlation **DO NOT ACCEPT** the greater the number of hours of physical activity the greater the number of cases of osteoarthritis	(1)

Question Number	Answer	Additional Guidance	Mark
(c)(ii)	1. (mean) BMI for each group was { similar / the same / eq } ; 2. ranges overlap / eq ;	**IGNORE** unqualified reference to no statistical difference **ALLOW** error bars, SD or SE overlap	(2)

Question Number	Answer	Additional Guidance	Mark
(c)(iii)	1. idea that procedure is less invasive ; 2. idea of less pain after operation ; 3. idea of fast { healing / recovery } ; 4. idea that there will be { less scarring / eq } ; 5. idea of reduced risk of infection ; 6. less blood loss ;	**e.g.** small incision	(2)

Q10.

Question Number	Answer	Additional Guidance	Mark
(a)	1. idea that a change in one direction causes a change in the opposite direction ; 2. to ensure a constant value / set point / narrow range of values / eq ;	e.g 'mechanism that returns a change away from normal value back to normal value' e.g. 'keeping a constant value'	(2)

Question Number	Answer	Additional Guidance	Mark
(b)	1. correct difference ; 2. divided by original value x 100 = 150 (%) ;	20 920 – 8 368 = 12 552 (12 552 ÷ 8 368) x 100 = 150 Correct answer with no working shown gains 2 marks	(2)

(c)

- Sweat decreases body temperature b evaporation
- This means the camel will be losing more water through sweat
- This will be detected by osmorceptors in the hypothalamus
- Which will increase ADH production
- And secretion from the pituitary into the blood
- ADH will bind to its receptors on ells of the distal tubule and collecting duct
- Which will increase their permeability to water
- By increasing the amount of vesicles containing water channels fusing with the cell membranes
- More water will be reabsorbed back into the blood
- This resulted in the production of a smaller volume of more concentrated urine