A-Level Edexcel

BIOLOGY

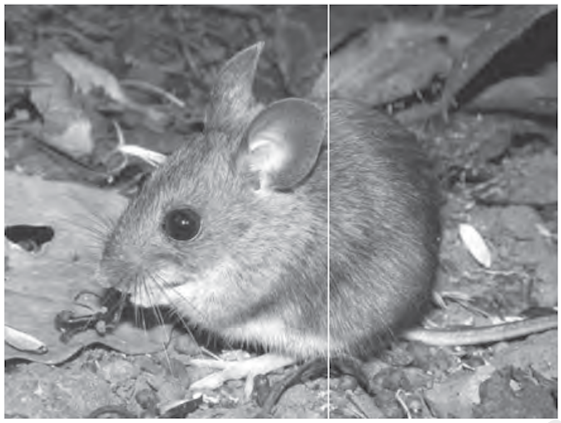
UNIT 5(IAL)

2015 — 2019

1 - (BI0-S 2015-Unit 5(IAL)-Q2) - *Molecules, Transport and Health*

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)

.....

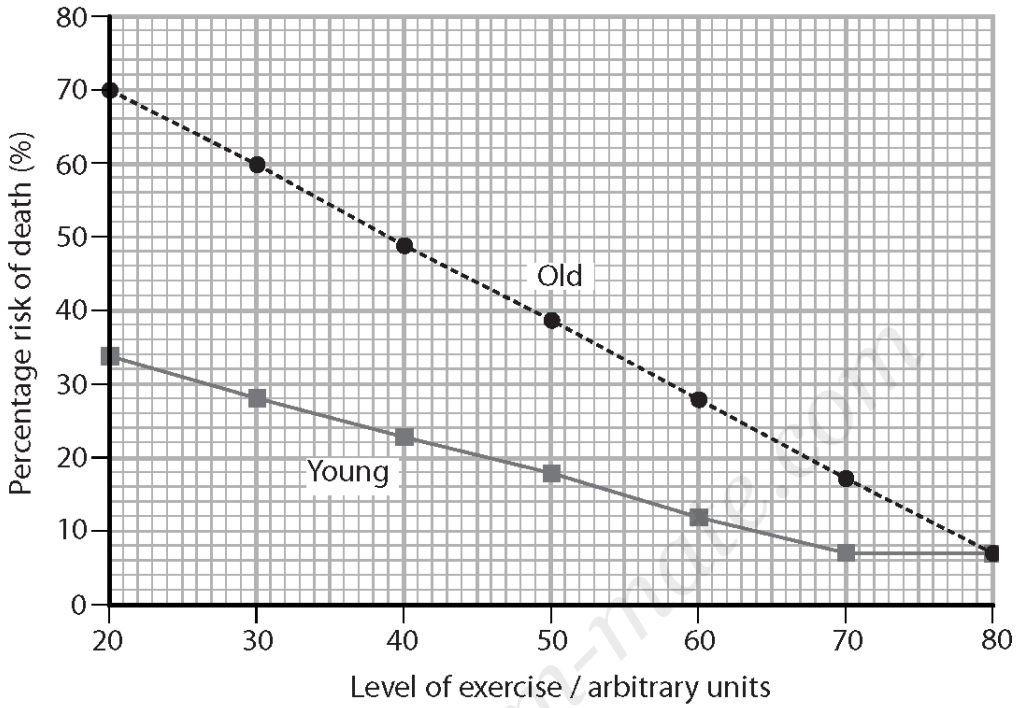
(b) Suggest how the wood mouse maintains a constant body temperature when in a cold environment.

(6)

2 - (BI0-W 2015-Unit 5(IAL)-Q4) - *Molecules, Transport and Health*

Exercise is important for human health.

The graph below shows how level of exercise changes the risk of death in young and old people.



(a) Use the information in the graph to describe the effect of level of exercise on the percentage risk of death.

(3)

(b) State the effect of exercise on each of the following.

(i) The risk of having diabetes and being obese.

(1)

(ii) The immune system.

(1)

(c) Exercise has an effect on the risk of having coronary heart disease (CHD).
In people with CHD the heart muscle cells receive less oxygen.

*(i) Describe how heart muscle cells make ATP when less oxygen is available.

(6)

(ii) A person will suffer a pain called angina if heart muscle cells receive less oxygen.

Suggest how lack of oxygen in heart muscle cells can cause angina.

(2)

.....

.....

.....

.....

.....

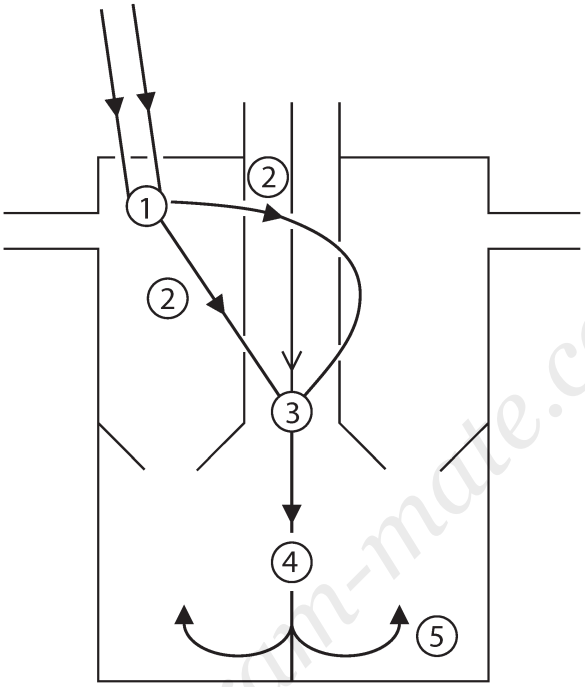
.....

3 - (BI0-S 2016-Unit 5(IAL)-Q1) - *Molecules, Transport and Health*

The heart rate at rest changes during exercise.

The diagram below shows different stages in the passage of electrical activity through the heart during one heartbeat.

The arrows and numbers represent the different stages.



(a) Place a cross ☒ in the box next to the correct number or word to complete each of the following statements.

(i) The number in the diagram that represents the bundle of His is

(1)

☒ **A** 1

☒ **B** 3

☒ **C** 4

☒ **D** 5

(ii) There is a delay of 0.13 s between atrial systole and ventricular systole.
The number in the diagram that represents where this delay occurs is

(1)

☒ **A** 1

☒ **B** 2

☒ **C** 3

☒ **D** 4

(iii) The arrows in the diagram represent a wave of

(1)

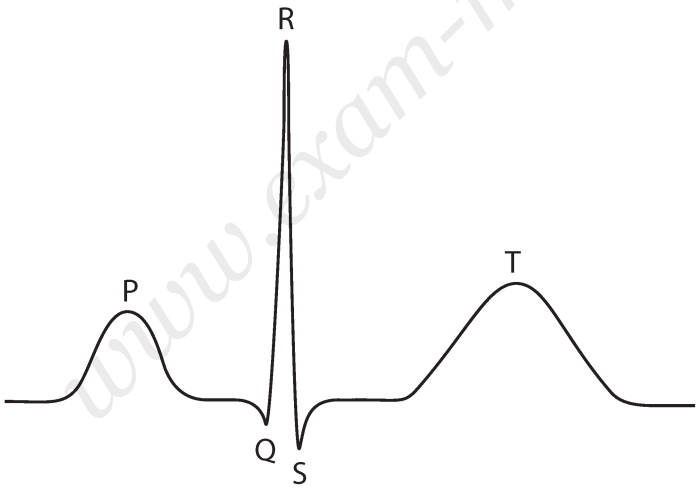
☒ **A** depolarisation

☒ **B** hyperpolarisation

☒ **C** polarisation

☒ **D** repolarisation

(iv) A normal electrocardiogram (ECG) is shown below.



The letter on the ECG that represents stage 2 in the diagram is

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** T

(b) Nervous and hormonal control can increase the heart rate during exercise.

(i) Describe how the heart rate can be increased by nervous control during exercise.

(4)

(ii) Give **one** similarity and **one** difference between hormonal and nervous control of the heart rate.

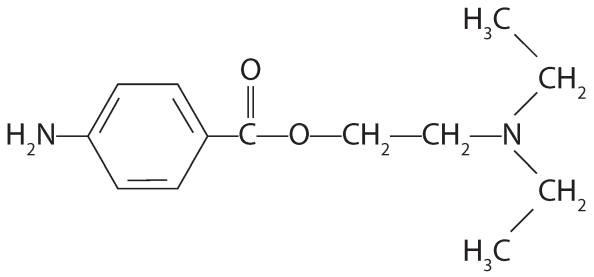
(2)

4 - (BI0-S 2016-Unit 5(IAL)-Q3) **-** *Molecules, Transport and Health, Coordination, Response and Gene Technology*

Pain is felt when nerve impulses travel along neurones to the pain centre in the brain.

Dentists inject an anaesthetic drug into a patient's gum to provide pain relief.

(a) The diagram below shows the structure of an anaesthetic drug.



(i) Draw a circle around the part of this drug that is an amine group.

(1)

(ii) This anaesthetic drug works by binding to channel proteins in the axons of neurones. These neurones normally transmit impulses that the brain interprets as pain.

Explain how this anaesthetic drug prevents the patient feeling pain.

(4)

(iii) The injection for pain relief contains the anaesthetic drug and a chemical that causes vasoconstriction.

Suggest the advantage of including a chemical that causes vasoconstriction.

(2)

.....

.....

.....

.....

.....

.....

(b) A different anaesthetic drug works by binding to calcium ion channels when an impulse arrives at a synapse.

Suggest how this anaesthetic drug reduces pain.

(4)

.....

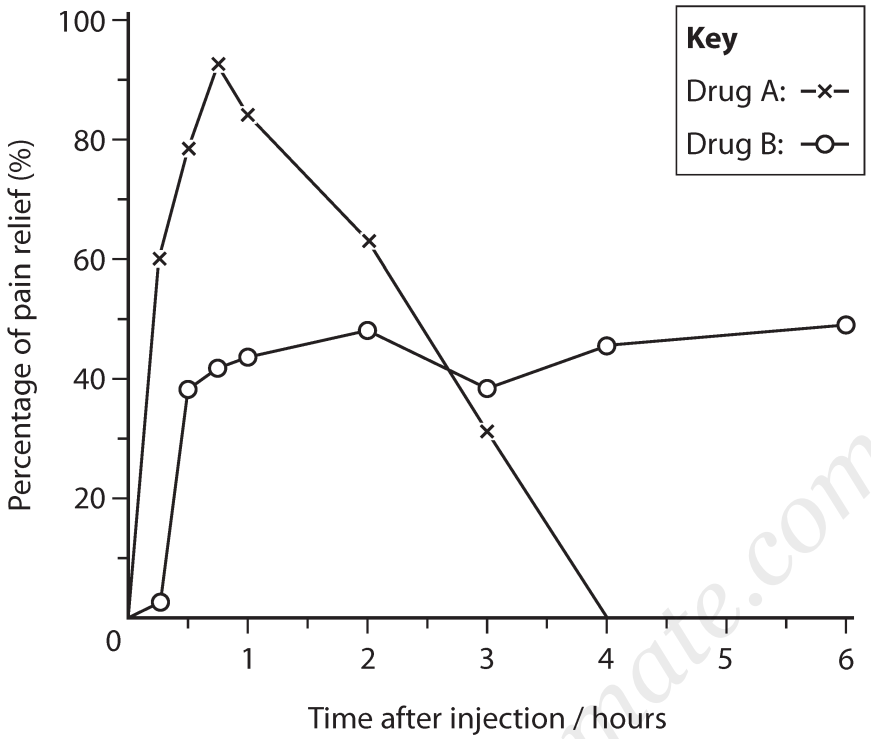
.....

.....

.....

.....

(c) The graph below shows the pain relief provided by two different anaesthetic drugs, A and B.



Suggest how a dentist could use this data when deciding which anaesthetic drug to use.

(3)

5 - (BI0-S 2016-Unit 5(IAL)-Q7) **-** *Molecules, Transport and Health*

The scientific article you have studied is adapted from the book called *Biology of Disease*, published by Taylor and Francis in 2007.

(a) The article suggests that there is a relationship between ageing and the development of coronary heart disease (paragraph 1).

Describe how this relationship could be regarded as a correlation.

(1)

.....

.....

.....

(b) Suggest why a decrease in the elasticity of the lungs of older people will reduce gas exchange (paragraph 6).

(2)

.....

.....

.....

*(c) The article suggests that a loss of individual muscle fibres results in a decreased capacity for work (paragraph 5).

To perform work, the sarcomeres of a muscle fibre must be able to contract.

Explain how a sarcomere is able to contract.

(6)

(d) Suggest **one** reason why atherosclerosis could be responsible for increased wound healing times in older people (paragraph 9).

(1)

(e) Explain the consequences of 'a decline in the function of T lymphocytes' with age (paragraph 10).

(3)

(f) The error-catastrophe theory suggests that random errors in transcription result in the production of abnormal proteins (paragraph 19).

Explain how random errors in transcription can result in the production of an abnormal protein.

(4)

(g) The population in the United Kingdom is 65 million.

Calculate the **maximum** number of people who develop Alzheimer's disease between the ages of 65 and 80 as a result of genetic inheritance (paragraphs 34 to 36).

Show your working.

(2)

Answer .....

(h) In Alzheimer's disease (AD), part of the brain responsible for feeling emotions does not function.

Suggest how a brain imaging technique (paragraph 39) could be used to diagnose this loss of function.

(2)

.....

.....

.....

.....

.....

.....

(i) Suggest how drugs that inhibit the degradation of acetylcholine can alleviate the symptoms of Alzheimer's disease (AD) (paragraph 40).

(3)

.....

.....

.....

.....

.....

(j) The article describes an investigation about the effect of calorie restriction on the development of age-related diseases (paragraph 41).

The results of the investigation suggest that calorie restriction allows rats to live longer.

The description of the design of the investigation lacks the detail needed to have confidence in the validity of this conclusion.

Suggest the additional detail needed to have confidence in the validity of this conclusion.

(2)

(k) Explain why a high calorie diet lacking vitamin E is likely to promote ageing (paragraphs 16, 17 and 44).

(4)

6 - (BI0-S 2017-Unit 5(IAL)-Q7) - *Molecules, Transport and Health, Coordination, Response and Gene Technology*

The article you have studied has been adapted from two websites, sciencedaily.com and journal.frontiersin.org.

Use the information from the article and your own knowledge to answer the following questions.

(a) The article states that there have been studies that have examined the use of e-cigarettes in helping people to quit smoking normal cigarettes (paragraph 8).

State a null hypothesis these studies were testing.

(1)

.....

.....

.....

(b) The article states that 'the lack of long-term randomized placebo-controlled studies has been problematic' (paragraph 9).

These studies are needed to assess the effectiveness of e-cigarettes in helping people to quit smoking normal cigarettes.

Suggest why long-term randomised placebo-controlled studies are needed.

(3)

.....

.....

.....

.....

.....

*(c) Nicotine is known to stimulate heart rate (paragraph 40).

(i) Nicotine increases heart rate by stimulating adrenaline secretion from cells in the adrenal gland.

The sequence of events leading to this adrenaline secretion involves a similar sequence of events that lead to the release of neurotransmitters at a synapse.

Use this information and your own knowledge to suggest how nicotine stimulates an increase in heart rate.

(6)

(ii) The article states that nicotine increases the risk of developing atherosclerosis (paragraph 14).

Explain how nicotine increases the risk of developing atherosclerosis.

(3)

(d) Conklin stated that there are 'limitations of one experiment performed on mice' (paragraph 15).

Suggest why Conklin made this statement.

(2)

(e) The article states that cinnamaldehyde-containing e-liquids 'compromise the function of immune cells such as macrophages' (paragraph 21).

Explain how reducing the function of these cells might affect the health of an e-cigarette smoker.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

(f) Using the information in paragraph 34, calculate the number of students that were aware of e-cigarettes who had actually tried e-cigarettes.

Show your working.

(2)

Answer .....

(g) Suggest why nicotine from e-cigarettes may be less addictive than nicotine from burned tobacco products (paragraph 45).

(3)

(h) The article states that nicotine may have an ameliorating effect on Parkinson's disease (paragraph 43).

It is thought that nicotine stimulates the release of the neurotransmitter involved with Parkinson's disease.

Suggest how this might reduce the symptoms of Parkinson's disease.

(3)

(i) The article refers to FEV1, FVC and FEV1 / FVC ratio (paragraph 48).

FEV1 is the volume of air that can forcibly be blown out in one second, after full inspiration.

FVC is the maximum volume of air that can be forced out of the lungs, after full inspiration.

(i) Put a cross ☒ in the box to complete the following sentence.

The FVC for a person includes the

(1)

☒ **A** air left in the lungs after full expiration

☒ **B** breathing rate during inspiration

☒ **C** concentration of carbon dioxide

☒ **D** tidal volume during expiration

(ii) The FEV1 / FVC ratio is expressed as a percentage.

The normal ratio is 70 to 80%.

The FVC value is less likely to change in people who smoke.

Using the information in paragraph 50, suggest why the FEV1 / FVC ratio is significantly reduced after smoking tobacco.

(2)

(j) Sketch a graph to show the relationship between hESC cytotoxicity, and the concentration of chemicals used to flavour e-cigarette refill fluids (paragraph 53).

(1)

7 - (BI0-S 2019-Unit 5(IAL)-Q1) - *Molecules, Transport and Health*

The heart pumps blood through the circulatory system.

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

(i) The term myogenic means

(1)

☐ **A** contraction initiated in a muscle cell

☐ **B** contraction initiated in a nerve cell

☐ **C** nerve impulse initiated by a muscle cell

☐ **D** nerve impulse initiated by a nerve cell

(ii) The greatest force of contraction in the heart takes place in the wall of the

(1)

☐ **A** left atrium

☐ **B** left ventricle

☐ **C** right atrium

☐ **D** right ventricle

(iii) Cardiac output is the

(1)

☐ **A** volume of blood ejected from the left ventricle in each beat divided by the heart rate

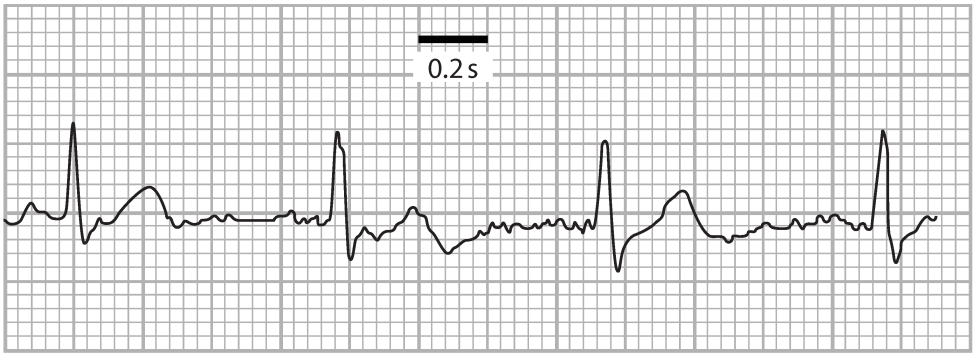
☐ **B** heart rate divided by the volume of blood ejected from the left ventricle in each beat

☐ **C** volume of blood ejected from the left ventricle in each beat multiplied by the heart rate

☐ **D** number of breaths per minute multiplied by the breathing rate

(b) Electrocardiograms (ECGs) provide useful information about heart function.

The trace below shows the ECG for a healthy person.



(i) Calculate the **mean** heart rate for this person.

(2)

..... beats per minute

(ii) State how the ECG for a person with a very fast heart rate would differ from the ECG shown.

(1)

.....

.....

(c) Describe the role of the sinoatrial node (SAN) in controlling heart rate.

(3)

8 - (BI0-W 2019-Unit 5(IAL)-Q2) - *Molecules, Transport and Health*

Breathing and heart rate are controlled and can respond to changes in the demand for oxygen.

(a) Put a cross ☒ in the box that completes each statement.

(i) The part of the brain involved in controlling the heart rate is the

(1)

☒ **A** cerebellum

☒ **B** cerebral hemisphere

☒ **C** hypothalamus

☒ **D** medulla oblongata

(ii) Changes in blood pH are detected by chemoreceptors in the

(1)

☒ **A** coronary arteries

☒ **B** medulla oblongata

☒ **C** skin

☒ **D** vena cava

(b) The breathing of a person is affected by altitude, the height of the location above sea level.

The table below shows the responses of a group of 12 adults to changing altitude.

Altitude / m	Available oxygen concentration (%)	Mean breathing rate / breaths min^{-1}	Mean tidal volume / dm^3
0 (sea level)	21.0	16.0	0.50
2000	16.0	16.0	0.51
4000	12.5	16.2	0.54
6000	11.0	17.8	0.70

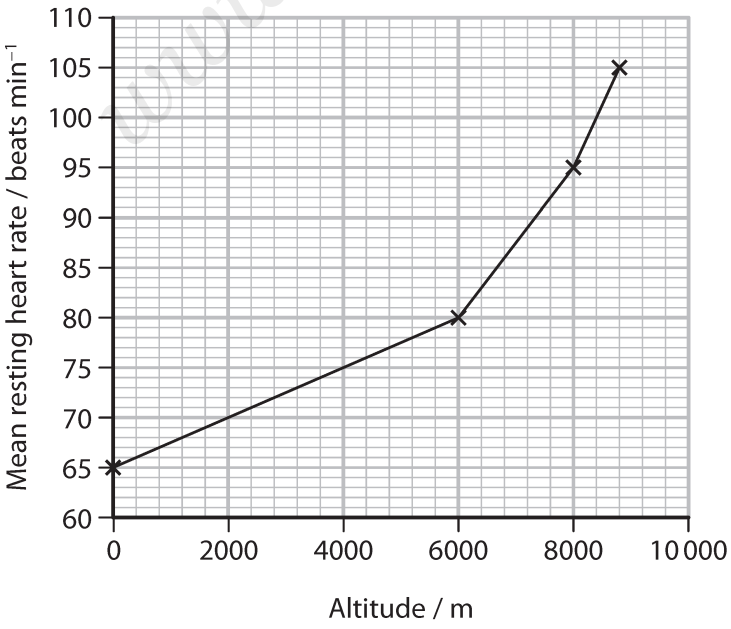
(i) Describe the effect of altitude on breathing.

(2)

(ii) Explain how an increase in altitude from 4000 m to 6000 m will cause these changes in breathing.

(3)

(c) The graph below shows the effect of altitude on the mean resting heart rate for another group of adults.



(i) Calculate the increase in heart rate per metre as the altitude increases from 6000 m to 8000 m.

Include appropriate units with your answer.

(2)

Answer .....

(ii) Explain why the resting heart rate changes as the altitude increases from 6000 m to 8000 m.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....