CHEMISTRY

UNIT 5(IAL)

2020 — 2025

1 – (WCH11/5(IAL)_Summer_2020_Q1) – *Transition Metals And Organic Nitrogen Chemistry*

The heart is required for mass transport in mammals.

(a) Describe how the electrical activity of the heart controls the cardiac cycle.

(3)

(b) Explain how electrocardiograms (ECGs) could be used to diagnose some forms of cardiovascular disease.

(2)

(c) The human growth factor FGF-I has been used to treat some patients with cardiovascular disease (CVD).

Describe how microorganisms could be genetically modified to produce human FGF-I.

(4)

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2 – (WCH11/5(IAL)_Summer_2020_Q2) – *Transition Metals And Organic Nitrogen Chemistry*

The eye is a sensory organ found in mammals.

(a) Light is detected using photoreceptors located in light-sensitive cells.

Put a cross ☒ in the box that completes each statement about photoreceptors.

(i) Light-sensitive cells are located in the

(1)

☒ **A** lens

☒ **B** optic nerve

☒ **C** pupil

☒ **D** retina

(ii) The photoreceptor in light-sensitive cells is located in

(1)

☒ **A** membrane bound organelles in the outer segment

☒ **B** membrane bound organelles in the synaptic region

☒ **C** the cytoplasm of the outer segment

☒ **D** the cytoplasm of the synaptic region

(iii) The pigment that forms the photoreceptor in the mammalian eye is

(1)

☒ **A** auxin

☒ **B** cytochrome

☒ **C** phytochrome

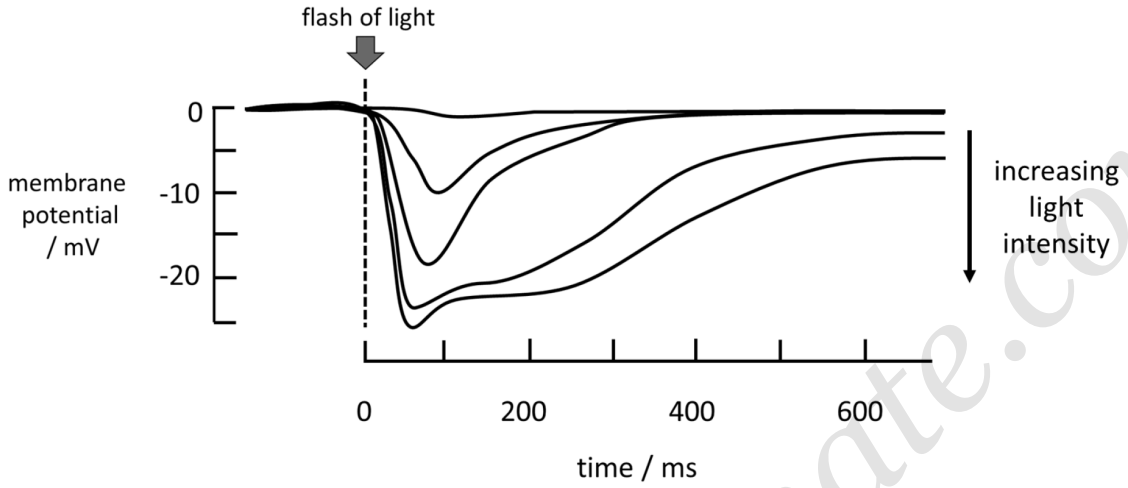
☒ **D** rhodopsin

(b) When stimulated by light, the light-sensitive cells become hyperpolarised.

In one investigation, the effect of a flash of light on membrane polarisation of light-sensitive cells was studied.

The graph below shows the results of this investigation.

Each line shows the response to a different light intensity.



(i) Using the information in the graph, describe the effect of light intensity on these light-sensitive cells.

(2)

(ii) Explain how increasing hyperpolarisation of light-sensitive cells results in impulses that can be interpreted by the brain.

(3)

3 – (WCH11/5(IAL)_Summer_2020_Q3) – *Transition Metals And Organic Nitrogen Chemistry*

Thermoregulation is a process that mammals use to regulate their body temperature.

(a) Thermoregulation is regulated by the central nervous system.

Put a cross ☒ in the box that completes each statement about thermoregulation.

(i) Thermoregulation is an example of

(1)

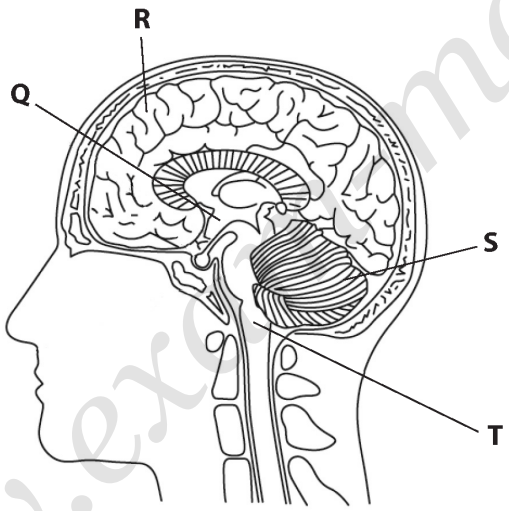
☒ **A** habituation

☒ **B** homeostasis

☒ **C** photoperiodism

☒ **D** respiration

(ii) The diagram shows a section through a human brain.



The structure that coordinates thermoregulation is labelled

(1)

☒ **A** Q

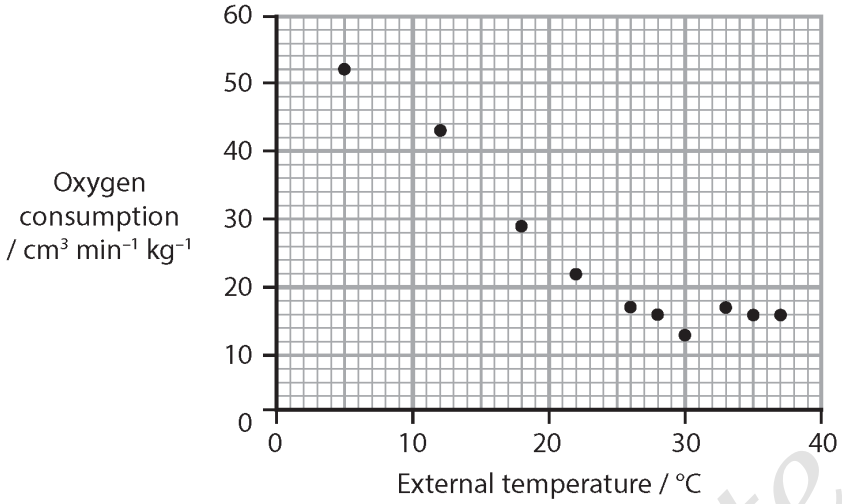
☒ **B** R

☒ **C** S

☒ **D** T

(b) The relationship between oxygen consumption and external temperature has been investigated using mice.

The graph below shows the results of this investigation.



(i) Describe the relationship between oxygen consumption and external temperature.

(2)

(ii) Explain the effect of external temperature on oxygen consumption.

(3)

(iii) Explain how the results would change if the investigation used a larger mammal.

(2)

ANSWERS

1 – (WCH11/5(IAL)_Summer_2020_Q1) – *Transition Metals And Organic Nitrogen Chemistry*

Question Number	Answer	Additional Guidance	Mark
(a)	1. SAN initiates wave of depolarisation 2. idea that electrical impulses spreads across the atria/causes atria to contract ; 3. (wave of depolarisation) is delayed by AVN ; 4. wave of depolarisation spreads across ventricles/causes ventricles to contract ; 5. frequency at which heart muscle fibres contract is regulated by the frequency of electrical impulses arriving at the SAN / speed at which electrical impulses spread across the heart determines the length of the cardiac cycle} ;	**ALLOW** impulse	**(3)**

Question Number	Answer	Additional Guidance	Mark
(b)	1. an ECG is a recording of the electrical activity of the heart ; 2. decreased frequency of ECG peaks suggest a decrease in heart rate ; 3. change in/iregular distance between named parts of ECG trace suggest a change in the cardiac cycle ;	**ALLOW** converse e.g. longer time between Q and T suggests heart takes longer to recover between heart beats	**(2)**

Question Number	Answer	Additional Guidance	Mark
(c)	1. the FGF-I gene is removed from (the DNA) of a human ; 2. gene/plasmid is cut using a restriction enzyme/endonuclease ; 3. gene and plasmid are joined using (DNA) ligase ; 4. plasmid with the FGF-1 gene is inserted into bacteria ; 5. credit additional information on method of inserting plasmid into the bacteria ;	**ALLOW** gene is synthesised based on known DNA sequence **ALLOW** other appropriate microorganisms e.g. yeast	**(4)**

2 – (WCH11/5(IAL)_Summer_2020_Q2) – *Transition Metals And Organic Nitrogen Chemistry*

Question Number	Answer	Additional Guidance	Mark
(a)(i)	**D retina** A is not correct. The lens focusses light on the retina at the back of the eye. B is not correct. The optic nerve transmits impulses from the retina to the brain. C is not correct. The pupil is an opening in the iris that allows light into the eye.		**(1)**

Question Number	Answer	Additional Guidance	Mark
(a)(ii)	**A membrane bound organelles in the outer segment** B is not correct. The membrane bound vesicles containing the photoreceptor is in the outer segment of the cell. C is not correct. The photoreceptor is located in membrane bound vesicles. D is not correct. The photoreceptor is located in membrane bound vesicles in the outer segment.		**(1)**

Question Number	Answer	Additional Guidance	Mark
(a)(iii)	**D rhodopsin** A is not correct. Auxin is a growth factor found in plant cells. B is not correct. Cytochrome is a pigment found in the electron transport chain C is not correct. Phytochromes are pigments found in plant cells.		**(1)**

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. the more intense the light flash the more (hyper)polarised the cell membrane becomes / the greater the intensity the more negative the membrane potential becomes ; 2. the more intense the flash the longer the cell remains (hyper)polarised / the greater the intensity the longer the membrane potential stay negative ; 3. there is a maximum (hyper)polarisation so (very) high light intensity has no further effect on the size of the membrane potential / the more intense the light the more rapidly the cells are hyperpolarised ;	**ALLOW** membrane potential decreased more	**(2)**

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. the greater the {hyperpolarisation/generator potential} the {less / no} {glutamate / neurotransmitter} is released (by the rod cell) ; 2. the greater the number of action potentials generated in the {bipolar cell / sensory neurone} ; 3. increased frequency of action potentials is interpreted as more intense light ; 4. (by) the visual cortex/occipital lobe ;	**ALLOW** optic nerve	**(3)**

3 – (WCH11/5(IAL)_Summer_2020_Q3) – *Transition Metals And Organic Nitrogen Chemistry*

Question Number	Answer	Additional Guidance	Mark
(a)(i)	**B homeostasis** A is not correct. Habituation is a learned response. C is not correct. Photoperiodism is a response that is controlled by a light cycle. D is not correct. Respiration is a metabolic process.		**(1)**

Question Number	Answer	Additional Guidance	Mark
(a)(ii)	**A Q** B is not correct. R is the cerebrum. C is not correct. S is the cerebellum D is not correct. T is the medulla oblongata		**(1)**

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. inverse relationship (between temperature and oxygen consumption) for temperatures up to {26 °C / 30°C} ; 2. no change in oxygen consumption for temperatures above {26 °C / 30° C} ; 3. credit a quantitative statement to support mark point 1 ;	e.g. calculation of the gradient of the line between 5 and 26 °C ;	**(2)**

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. as temperature decreases mouse {loses heat faster / needs to produce more heat} ; 2. (as part of homeostatic response) (aerobic) respiration/metabolism increases ; 3. to provide ATP for increased {muscle contractions / shivering} ; 4. respiration produces heat (to help maintain body temperature) ;	Converse for all mps NOT energy unqualified	**(3)**

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	1. a larger animal has a smaller surface area to volume ratio ; 2. the smaller the surface area to volume ratio the slower the rate of heat loss ; 3. idea that the graph will have a less steep gradient/ will level off at a lower oxygen consumption rate ;	**ALLOW** 'not as easily' **ALLOW** idea that less affected by change in (environmental) temperature / curve to the left of this data because lower metabolic rate	**(2)**