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A2 Biology OCR

Unit F214: Communication, Homeostasis and Energy

Module 1.1 – 1.3 Communication, Nerves & Hormones

Answers

1. (a) 1 myelin / myelinated / lipid / fatty (sheath);
***DO NOT CREDIT** fatty acids*
- 2 (Schwann) cell, wrapped around / surrounds / AW, axon;
- 3 except at nodes of Ranvier / (sheath) not continuous / presence of gaps (in the sheath);
*must be in the context of structure rather than function
 (as many refer to it in context of saltatory conduction)*
- 2 max

- (b) (i) 1 (myelination produces) greater speeds;
***IGNORE** ref to axon diameter for this mp*
- 2 unmyelinated needs larger diameter to produce same speed;
- 3 comparative figs, **all** with units, to support either the general trend or the exception to the trend with the mollusc;
1 speed for myelinated (25 / 30 / 35, $m s^{-1}$) and 1 speed for unmyelinated (3 / 30, $m s^{-1}$) (allow m/s)
or
*calculated difference in speed between myelinated and unmyelinated (**with units unless** a multiple e.g. approx. $\times 12$)*
- 2 max

- (ii) 1 larger axon diameter produces greater speeds; **ora**
needs to be a general statement
- 2 comparative figs, **all** with units, to support;
*2 diameters & speeds (**both with units**) for myelinated*
or
*calculated difference in diameter for 2 stated speeds (**both with units unless** diameter is a multiple e.g. around $\times 1.4$ / around 140%)*

type of neurone	diameter (μm)	speed ($m s^{-1}$)	animal taxon
myelinated	4	25	mammal
myelinated	10	30	amphibian
myelinated	14	35	amphibian

- or**
*2 diameters & speeds (**both with units**) for unmyelinated*
or
*calculated difference in diameter for 2 stated speeds
 (**both with units unless** diameter is a multiple e.g. about $\times 10$)*

type of neurone	diameter (μm)	speed ($m s^{-1}$)	animal taxon
unmyelinated	15	3	mammal
unmyelinated	1 000	30	mollusc

2 max

- (c) (i) 1 increased kinetic energy / KE so,
- ions diffuse, across (axon) membrane / into neurone / into cell / between nodes / along neurone, more quickly
- or**
- faster movement of (neurotransmitter) vesicles / exocytosis (of neurotransmitter)
- or**
- neurotransmitter diffuses more quickly across, synapse / synaptic cleft
- or**
- neurotransmitter (ACh) broken down by enzyme (acetylcholinesterase) more quickly;

2 faster diffusion of ions leads to,

- faster depolarisation

or

- shorter duration of action potential

or

- shorter refractory period

or

- faster repolarisation;

description of ion movement must be correct (e.g. Na^+ in for depolarisation / Ca^{2+} into presynaptic knob)

1 max

(ii) **DO NOT CREDIT** general denaturation of proteins / enzymes

1 ion, channels / pumps, disrupted / denatured / no longer function;

2 fluidity of, membrane / phospholipid / bilayer, disrupted;
IGNORE leaky membrane unless qualified

3 (named) synaptic enzymes denatured;

1 max

[8]

2. (a) A axon terminal / synaptic knob / synaptic bulb;
 B cell body / centron; 2
- (b) *at X:*
 sodium channels open and sodium ions move into neurone;
 potential difference rises from -70mV to 30mV ;
- at Y:*
 potassium channels open and potassium ions move out of neurone;
 potential difference falls from 30mV to -76mV ;
- AVP;; e.g. ref. to voltage gated channels
 ref to movement by diffusion / passively
 ref to electrochemical gradient 4
- (c) *effect:*
 myelinated fibres conduct more quickly than unmyelinated / AW;
 ref. to one set of comparative figures from table;
- explanation - max 4*
 myelin sheath acts as (electrical) insulator;
 lack of sodium and potassium gates in myelinated region;
 depolarisation occurs at nodes of Ranvier only;
 (so) longer local circuits;
 (action potential) jumps from one node to another / saltatory conduction; 5
- [11]
3. thick axons transmit impulses quicker than thin ones / AW;
 myelinated fibres quicker than unmyelinated / AW;
 invertebrates have slower speed of impulse / ora;
 ref to one set of comparative figures from table;
- [2]
4. (i) A 3
 B 2
 C 1; 1
- (ii) A 1 (voltage gated) sodium channels open;
 2 sodium (ions) enter (axon);
 3 positive feedback/more sodium channels open;
 4 depolarisation/description of depolarisation;
 5 sodium channels close;
 6 ref to $+ 40 \text{ mV}$;

- B** 7 (voltage gated) potassium channels open;
8 potassium (ions) move out (of axon);
9 positive feedback/more potassium channels open;

only award marking points 3 or 9, not both

- 10 repolarisation/description of repolarisation;
11 beyond -65 mV/hyperpolarisation/AW;

- C** 12 Na/K pump (helps to), restore/maintain, resting potential;
13 membrane more permeable to potassium ions
(at resting potential);
14 (many) potassium channels open (at resting potential); max 5

[6]

- 5.** 1 sodium ions (inside axon), move/diffuse
2 towards, resting/negative region;
3 causes, depolarisation of this region/change of PD to reach threshold value;
4 (more) sodium channels open;
5 sodium (ions) move in;

marking points 3-5 only available if linked to sodium ions moving within axon

- 6 ref to local circuits;
7 one way transmission;
8 ref refractory period/region of axon behind AP recovering;
9 ref to insulating role of, myelin sheath/Schwann cells;
10 depolarisation cannot occur through myelin/
impermeable to (Na⁺ and K⁺) ions/ora;
11 ref to nodes of Ranvier;
12 longer local circuits;
13 saltatory conduction/AW;
14 AVP; e.g. fewer (Na⁺ and K⁺) ion channels in myelinated region/ora.
15 AVP; ref. to absolute and relative refractory period, ref. to actual
distance between nodes (1 – 3mm); max 7

QWC – legible text with accurate spelling, punctuation and grammar; 1

[8]

6. (a) transmit (information) between neurones ;
 ensure one way transmission of impulses ;
 integration of nerve pathways ; **A** allows, convergence / divergence /
 summation filter out low level stimuli ;
 prevent overstimulation and fatigue ;
 ref to inhibition ; 2 max
 AVP ; e.g. role in, learning / memory

- (b) vesicles move to presynaptic membrane ;
 vesicles fuse with presynaptic membrane ;
 exocytosis / AW ;
 neurotransmitter moves across synaptic cleft ;
 neurotransmitter binds to receptor on postsynaptic membrane ;
 recycling of neurotransmitter / channels for uptake of neurotransmitter ; 3
 max

- (c) **1** to allow repolarisation to occur ;
2 by unblocking (neurotransmitter) receptor ;
3 prevents sodium channels remaining open ;
4 so more neurotransmitter can bind ;
5 new action potential is generated ;
6 to allow movement to occur ;
7 recycling of neurotransmitter ;
8 AVP ;
- or*
- 1** permanently depolarised ;
2 receptors (permanently) blocked ;
3 sodium channels open ;
4 no more neurotransmitter can bind ;
5 no new action potential / action potentials continuously fired ;
6 continuous contraction / AW ;
7 no recycling of neurotransmitter ;
8 AVP ; 2 max

[7]

7. acetylcholine – neurotransmitter / AW ;
 acetylcholinesterase – breaks down ACh / enables repolarisation of post synaptic
 membrane ;

[2]

- 8. 1 ref to, medulla (oblongata) / cardiovascular centre (in brain) ;
- 2 sympathetic nervous system / accelerator nerve (to heart) ;
- 3 short preganglionic, neurone / fibre ;
- 4 (transmitter substance) noradrenaline ;
- 5 to sino atrial node (SAN) (in correct context) ;
- 6 heart rate increases ;
- 7 increased force of contraction ;
- 8 ref to adrenaline ;
- 9 parasympathetic nervous system / vagus nerve ;
- 10 (transmitter substance) acetylcholine ;
- 11 long preganglionic, neurone / fibre ;
- 12 heart rate decreases ;
- 13 AVP ; e.g. myogenic heart muscle / cardiac inhibitory centre

if answers to sympathetic and parasympathetic are interchanged mark to 4 max 7
 max

QWC – legible text with accurate spelling, punctuation and grammar ; 1

[8]

9.

	<i>excretion</i>	<i>secretion</i>
1 <i>one difference</i>	(metabolic) waste or toxin / harmful or substance is to be removed from body or does not use vesicles	useful product or used in cell communication (e.g. to target tissues) or released from glands (ducts or ductless) or uses vesicles or remain in body
2 <i>one example of a product</i>	urea / carbon dioxide / water / bile pigment / named example	hormone / enzyme / antibodies / mucus / bile salts / neurotransmitter / named example
3 <i>one similarity</i>	requires ATP or (involved in) homeostasis or (compounds) produced by cell(s) /	

	produced by metabolism / need to cross membrane / need to move through membrane / need to leave cell / (may be) transported in blood
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One mark per row.

CREDIT converse statements on either side or unmatched statements for each

1 IGNORE name or type of product without qualification
DO NOT CREDIT any ref to egestion in 'excretion'

2 IGNORE sweat / urine / bile / saliva / salt / (named) digestive juice

3 CREDIT method of leaving cell e.g. exocytosis
IGNORE going into cells (as some excretory products do)

[3]

- 10.** (i) **A** islet of Langerhans / α and β cells ;
B (branch of pancreatic) duct ; 2
- (ii) *endocrine* ductless gland ;
hormones / named hormone ; e.g. insulin / glucagon
into blood ;

exocrine enzymes / pancreatic juice / HCO_3^- ;
amylase / trypsin / chymotrypsin / lipase / carboxypeptidase ;
into duct ;

if answers are interchanged then mark to 2 max 4 max

[6]

- 11.** **1** detected by cells in pancreas ;
2 β cells of islets of Langerhans ;
3 insulin produced ;
4 secreted into, blood / circulation / HPV ;
5 cells / named example, take up more glucose ;
6 more glucose carriers in membrane ;
7 conversion to glycogen / glycogenesis ;
8 increased rate of glucose use in respiration ;
9 ref to negative feedback ;
10 glucose concentration kept below threshold value in glomerular filtrate ;
11 all reabsorbed in PCT ;
12 AVP ; inhibits glucagon secretion, suppresses gluconeogenesis 5 max

[5]

12. (i)

Max 1 if referring to insulin receptors

- 1 unable to produce (enough) insulin / do not secrete insulin / produces ineffective insulin;
DO NOT CREDIT excrete' as incorrect
- 2 insulin-producing cells / beta cells / islets of Langerhans, not functioning (correctly) / damaged / destroyed / attacked;
ALLOW lack of beta cells / ref to b cells
DO NOT CREDIT alpha cells / B cells (if lymphocytes implied)
- 3 by (body's own) immune system / by (body's own) antibodies / auto-immune disease;
CREDIT description
- 4 (idea of) family history / genetic / hereditary;
- 5 (condition can be) triggered by, virus / environmental factor;
e.g.
 - *shock*
 - *drugs side effect*
 - *(pancreatic) cancer*
 - *infection / disease*

2 max

(ii) **Mark the first 3 responses only**

- 1 increasing age / older / ageing / more prevalent over 40;
DO NOT CREDIT age without 'older' implication
- 2 (idea of) family history / genetic / hereditary;
- 3 (more common in) males;
- 4 (more common in)
some ethnic groups / African / Afro-Caribbean / Asian / Hispanic /
Oceanic;
- 5 obese / overweight / fat around abdomen;
CREDIT 'apple shaped'
- 6 high / frequent, intake of, sugar / highly processed food / high
GI food;
IGNORE 'poor diet' / 'bad diet' / 'unhealthy diet'
IGNORE fat / carbohydrate, in diet
- 7 lack of physical activity / sedentary lifestyle;
- 8 high blood pressure;
CREDIT history of, heart attack / stroke
- 9 excessive alcohol intake;
idea of too much is needed

3 max

[5]