F214 Communication, Homeostasis & Energy

Question			Expected Answers					Marks	Additional Guidance
1	(a)				*excretion*	*secretion*			**One mark per row.**
			1	*one difference*	(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	;		**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	*one example of a product*	urea / carbon dioxide / water / bile *pigment* / named example	hormone / enzyme / antibodies / mucus / bile *salts* / neurotransmitter / named example	;		2 **IGNORE** sweat / urine / bile / saliva / salt / (named) digestive juice

Question	Expected Answers			Marks	Additional Guidance
	3	*one similarity*	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 ;	3	**3** **CREDIT** method of leaving cell e.g. exocytosis **IGNORE** going into cells (as some excretory products do)

Question			Expected Answers		Marks	Additional Guidance
1	(b)				S & C	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **CREDIT one statement and a suitable explanation related to that (first) given statement** (e.g. S3 + E3 but not S4 + E1) **DO NOT AWARD 2 marks for 2 statements or 2 explanations**
			S1	glucose is not the only substrate / there are other substrates **;**		**1** 'fats can (also) be respired' = E1 'fats can be respired as well as glucose' = S1 + E1
			E1	named alternative substrate **;**		
				or		
			S2	ATP is produced / energy is released **;**		**S2** **DO NOT CREDIT energy** produced / made / created
			E2	(by) substrate level / oxidative, phosphorylation **;**		
				or		
			S3	ATP / energy, required **;**		
			E3	(for) phosphorylation / glycolysis **;**		
				or		
			S4	is not a single step reaction / other steps involved / other products / other intermediates **;**		**4** Krebs cycle / ETC **,** happens = E4 'other stages such as link reaction are involved' = S4 +
			E4	named stage(s) / named intermediate compound(s) **;**		**E4** E4 e.g. pyruvate / acetyl CoA / acetate **IGNORE** NAD(H) / FAD(H) / ATP
				or		
			S5	enzymes are involved **;**		
			E5	dehydrogenation / decarboxylation / oxidative phosphorylation / named (respiratory) enzyme **;**		
				or		
			S6	coenzymes / NAD, involved **;**		**S6** **DO NOT CREDIT** NADP
			E6	oxidative phosphorylation / link reaction / Krebs cycle / glycolysis **;**		
				or		
			S7	glucose does not, combine / react **,** (directly) with oxygen **;**		
			E7	(oxygen) used in oxidative phosphorylation / is final electron acceptor / is final hydrogen acceptor **;**	**2**	

Question			Expected Answers		Marks	Additional Guidance
1	(c)	(i)				**Max 1 if referring to insulin receptors**
			1	unable to produce (enough) insulin / do not secrete insulin / produces ineffective insulin **;**		**1** **DO NOT CREDIT** 'excrete' as incorrect
			2	insulin-producing cells / beta cells / islets of Langerhans, not functioning (correctly) / damaged / destroyed / attacked **;**		**2** **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 **;**		**3** **CREDIT** description
			4	(idea of) family history / genetic / hereditary **;**		
			5	(condition can be) triggered by **,** virus / environmental factor **;**		**5** e.g. • shock • drugs side effect • (pancreatic) cancer • infection / disease
					2 max	
1	(c)	(ii)				**Mark the first 3 responses only**
			1	increasing age / older / ageing / more prevalent over 40 **;**		**1** **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 **;**		**5** **CREDIT** 'apple shaped'
			6	high / frequent, intake of **,** sugar / highly processed food / high GI food **;**		**6** **IGNORE** **'**poor diet' / 'bad diet' / 'unhealthy diet' **IGNORE** fat / carbohydrate **,** in diet
			7	lack of physical activity / sedentary lifestyle **;**		
			8	high blood pressure **;**		**8** **CREDIT** history of **,** heart attack / stroke
			9	excessive alcohol intake **;**		**9** idea of *too much* is needed
					3 max	
				Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	glycolysis / glycolytic pathway ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **CREDIT** phonetic spelling but must have 'glycol...'
2	(a)	(ii)	cytoplasm ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **CREDIT** cytosol **DO NOT CREDIT** cytoplasm, in / of, mitochondrion
2	(a)	(iii)	**D** ATP ; **E** NAD ; **F** pyruvate ;	3	**Mark the first answer for each letter.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 mark** **E** **ALLOW** oxidised NAD **DO NOT CREDIT** NADP / reduced NAD **F** **ACCEPT** pyruvic acid

Question			Expected Answers		Marks	Additional Guidance	
2	(b)						**Award marks from labelled / annotated diagrams – but ensure that mp 2 only awarded if H clearly shown to be accepted by pyruvate**
			1	(pyruvate / **F**) converted to lactate **;**		**1**	**ACCEPT** lactic acid **DO NOT CREDIT** if pyruvate → ethanol in the animal is indicated/implied **DO NOT CREDIT** wrong reaction type (e.g. oxidation)
			2	**F** / pyruvate **,** accepts hydrogen (atoms) **;**		**2**	**ACCEPT** pyruvic acid **DO NOT CREDIT** hydrogen **ions** (unless also e^-) / molecules
			3	hydrogen from **, reduced** NAD / **reduced E ;**		**3**	**ACCEPT** NADH / $NADH_2$ / NADH + H^+
			4	(catalysed by) <u>lactate</u> dehydrogenase **;**		**4**	for pyruvate → lactate **ACCEPT** LDH
			5	no, oxygen / O_2 **,** to act as (final), hydrogen / electron, acceptor **;**			
			6	(so) link reaction / Krebs cycle / ETC, cannot take place **;**		**6**	Needs a clear statement of **not** taking place **CREDIT** no , electron transport chain / electron carrier chain / chemiosmosis / oxidative phosphorylation
			7	NAD / **E**, regenerated / recycled / able to be re-used **;**		**7**	**IGNORE** reduced NAD **,** oxidised / reoxidised (as this does not give the idea of reusing it)
			8	allows glycolysis to continue / pyruvate continues to be made **;**		**8**	Needs a clear statement
			9	limited / small amount of / some, ATP can be produced **;**		**9**	**CREDIT** 1 ATP (per pyruvate) / 2 ATP (rather than 28-38 per glucose) / only substrate level phosphorylation
					5 max		**IGNORE** 'enough ATP for ...'

Question			Expected Answers		Marks	Additional Guidance
2	(c)			*physical (probably from diagrams)*	S & C	
			1	large nostrils (open) to take in air ;		1 **ACCEPT** oxygen
			2	(when submerged) nostrils close / nose closes , to , keep air in / stop air from escaping ;		2 **ACCEPT** oxygen **IGNORE** ref to keeping water out
			3	lungs / airways , have high (vital) capacity ;		3 **ACCEPT** deep / barrel / large , chest **IGNORE** big lungs **CREDIT** large lung volume / takes in large volume of oxygen / larger numbers of alveoli / larger (exchange) surface area / increased number of capillaries
				links to respiration		
			4	*idea that* seal , has low(er) metabolic rate / has low(er) respiratory rate / has low(er) energy requirements / uses (relatively) little ATP ;		4 e.g. • (streamlined, less resistance so) uses less energy • (insulated so retain heat so) uses less energy • (buoyant so) less energy required • (small flippers so less surface area of extremity so loses less heat so) uses less energy
			5	able to respire anaerobically for a long time / more glycolysis ;		5 'anaerobic' needs time ref
			6	large supplies of NAD (to accept H) ;		
			7	(this) prevents , build-up of lactate / lowering of pH ;		7 **ACCEPT** lactic acid
			8	*idea that* (seal) tolerates lactate / removes lactate quickly ;		8 **ACCEPT** lactic acid
			9	*idea that* (seal) tolerates high CO_2 concentration ;		
			10	*idea that* (seal) tolerates low pH / has **more** pH buffers ;		
				synoptic / inference		
			11	*idea that* blood diverted from certain regions / certain regions have reduced metabolic activity ;		11 **DO NOT CREDIT** zero respiration rate
			12	*idea that* has plenty of , haemoglobin / red blood cells / myoglobin (as oxygen source) ;		
			13	*idea that* haemoglobin has a higher affinity for oxygen / dissociates less readily / dissociation curve shifted to **left** ;	3 max	
				Total	13	

Question			Expected Answers		Marks	Additional Guidance
3	(a)		1 2 3	myelin / myelinated / lipid / fatty (sheath) ; (Schwann) cell, wrapped around / surrounds / AW, axon ; except at nodes of Ranvier / (sheath) not continuous / presence of gaps (in the sheath) ;	2 max	1 **DO NOT CREDIT** fatty acids 3 must be in the context of structure rather than function (as many refer to it in context of saltatory conduction)
3	(b)	(i)	1 2 3	(myelination produces) greater speeds ; unmyelinated needs larger diameter to produce same speed ; comparative figs, **all** with units, to support either the general trend or the exception to the trend with the mollusc ;	2 max	1 **IGNORE** ref to axon diameter for this mp 3 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. x12)
3	(b)	(ii)	1 2	larger axon diameter produces greater speeds ; **ora** comparative figs, **all** with units, to support ;	2 max	1 needs to be a general statement 2 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 x 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 x10)

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

Question				Expected Answers	Marks	Additional Guidance
3	(c)	(i)	1	increased <u>kinetic energy</u> / <u>KE</u> so, • ions <u>diffuse</u>, 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 **;**	**S & C** **1 max**	description of ion movement must be correct (e.g. Na^+ in for depolarisation / Ca^{2+} into presynaptic knob)
			2	faster <u>diffusion</u> of ions leads to, • faster depolarisation ***or*** • shorter duration of action potential ***or*** • shorter refractory period ***or*** • faster repolarisation **;**		
3	(c)	(ii)	1	ion, channels / pumps, disrupted / denatured / no longer function **;**	**1 max**	**DO NOT CREDIT** general denaturation of proteins / enzymes
			2	fluidity of, membrane / phospholipid / bilayer, disrupted **;**		**IGNORE** leaky membrane unless qualified
			3	(named) synaptic enzymes denatured **;**		

Question			Expected Answers		Marks	Additional Guidance
3	(d)					**IGNORE** ref to influx of Na^+ and events when action potential arrives at the synaptic knob – start when the Ca^{2+} channels open
			1	calcium **channel**s open **;**		
			2	Ca^{2+} / Ca^{++} / calcium ions **,** enter / diffuse into,		**2** **DO NOT CREDIT** 'calcium' alone **DO NOT CREDIT** Ca^+ **DO NOT CREDIT** **'**enter membrane' – must cross it
			3	acetylcholine / ACh / **neurotransmitter**, in **vesicle**(s) **;**		
			4	(synaptic) vesicles move towards **presynaptic** membrane **;**		**4** **CREDIT pre-synaptic**
			5	vesicles fuse with membrane **;**		**5** **DO NOT CREDIT** attach / bind / join
			6	release acetylcholine, by **exocytosis ,** into synaptic **cleft ;**		'vesicles move and fuse with presynaptic membrane' = mps 4 & 5
					3 max	'vesicles move and fuse with membrane' = mp 5 only
			QWC – technical terms used appropriately and spelt correctly **;**		**1**	Use of **three** terms from: **channel**(s), **vesicle**(s), **neurotransmitter**, **presynaptic / pre-synaptic**, **exocytosis**, **cleft**,
				Total	**12**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	ultrafiltration ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** This term required but **ACCEPT** phonetic spelling
4	(a)	(ii)	17.9 ; ;	2	**Correct answer = 2 marks** If answer incorrect, not rounded or incorrectly rounded then allow 1 mark for working 125 ÷ 700 **or** an unrounded answer e.g. 17.857412
4	(b)	(i)	(cuboidal) epithelium / epithelial ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** 'epithelium **cells'** / 'ciliated epithelium' / 'squamous epithelium' / endothelium **ALLOW** columnar epithelium
4	(b)	(ii)	microvilli / microvillus ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** 'brush border' **DO NOT CREDIT** cilia

Question			Expected Answers		Marks	Additional Guidance
4	(b)	(iii)	***This is a QWC question***			
			1	selective **<u>re</u>absorption ;**	**S & C**	
			2	of glucose <u>and</u> amino acids **;**		**2** **DO NOT CREDIT** if glucose & amino acids **& proteins**
			3	**co-transport** / ***facilitated*** **diffusion** / uptake described **;**		**3** **ACCEPT** direct uptake , of glucose / amino acids, by active transport
			4	water follows by **osmosis** so concentration of, ions / nitrogenous waste / urea / remaining substances **,** increases **;**		
			5	AVP **;**		**5** e.g. • microvilli provide large surface area for uptake • many mitochondria provide energy for uptake • many brush border enzymes (ATPase) for active uptake • active secretion of nitrogenous waste into lumen
					3 max	
			QWC - technical terms used appropriately and spelt correctly **;**		**1**	Use of **three** terms from: **reabsorption** (or derived term), **co-transport** (or derived term), **facilitated diffusion**, **osmosis**

Question			Expected Answers	Marks	Additional Guidance
4	(c)	(i)	**L** artery / shunt / vein (at arterial end of shunt) **AND** **M** vein **;**	1	**IGNORE** names of artery / vein (e.g. renal) **DO NOT CREDIT** aorta and vena cava
4	(c)	(ii)	so that clots don't form, while in the (dialysis) machine / during dialysis **;**	1	**ALLOW** congeal instead of clot **IGNORE** prevents clotting in the body **IGNORE** clumping
4	(c)	(iii)	*idea of* allowing blood to clot normally after treatment **;**	1	**CREDIT** preventing low blood pressure (as low viscosity)
4	(c)	(iv)	(simple) <u>diffusion</u> **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **IGNORE** dialysis **DO NOT CREDIT** facilitated diffusion
4	(c)	(v)	*idea that* it, maintains diffusion gradient / maintains concentration gradient / maximises diffusion gradient / maximises concentration gradient / allows maximum removal of waste / allows maximum rate of diffusion / AW **;**	1	**IGNORE** unqualified ref to countercurrent e.g. • solutions in contact over greater distance • provides maximum contact for exchange • allows exchange over longer distance **IGNORE** ref to surface area
			Total	14	

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	control ;	1	**CREDIT** a description e.g. • comparison • to compare results with • to show that (wavelengths of) light is producing the effect • to show the result produced without light • create baseline • create set point • validity **IGNORE** 'fair test' **DO NOT CREDIT** 'control variable' / 'controlled variable'

Question				Expected Answers	Marks	Additional Guidance
5	(a)	(ii)				**Read as paragraph. Mark the first 2 responses only.** **DO NOT CREDIT** ref to **time** / same **number** of leaf discs / **same plant** (as these given in the question) **IGNORE** 'fair test' without further explanation
			1	discs, the same size / cut with same cutter, ***so*** same surface area **;**		**1** **ALLOW** for same amount of pigment / chloroplast
			2	discs taken from same part of the leaf / leaves used from the same part of the plant ***so*** same amount of **,** pigment / chloroplast **;**		
			3	tubes same distance from light source ***so*** light intensity is the same **;**		
			4	light bulb the same (wattage) each time ***so*** light intensity is the same **;**		
			5	same thickness of filter ***so*** light intensity is the same **;**		
			6	carry out in darkened room / only 1 light source in room / completely cover tube with filter, ***so*** only light of desired wavelength enters **;**		
			7	CO_2 in excess / AW, ***so*** CO_2 not limiting / enough CO_2 for photosynthesis / enough CO_2 for Calvin cycle / enough CO_2 for light independent stage **;**		
			8	same **,** <u>volume</u> / <u>concentration</u> / batch, of indicator ***so*** that colour changes are comparable **;**		
			9	heat, sink / shield, between light source and tube ***to*** reduce temperature changes **;**		
			10	carry out at, same / constant, temperature ***as*** temperature affects enzyme, activity / structure **;**		**10** Enzyme ref must be qualified
			11	carry out **,** repeats / replicates, ***to***, calculate <u>mean</u> / identify anomalies **;**		**11** **IGNORE** ref to improving reliability **IGNORE** how anomalies dealt with **DO NOT CREDIT** preventing anomalies
			12	AVP (to include precaution and explanation) **; ;**	**2 max**	**12** **CREDIT** any reasonable precaution with a suitable explanation (even if explanation already given) e.g. • rinse test tubes with distilled water ***so*** starting pH is the same

Question			Expected Answers		Marks	Additional Guidance
5	(a)	(iii)	chlorophyll a **;**		1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ALLOW** chlorophyll A / chlorophyll α **IGNORE** p680 / p700 / PSI / PSII **DO NOT CREDIT** chlorophyll a and b **DO NOT CREDIT** chlorophyll alone
5	(a)	(iv)	**1**	chlorophyll / pigments / leaf, reflect / does not absorb / absorbs little, green light / light of this wavelength **;**	3 max	**1** Needs to refer to green rather than other colours
			2	(green light) cannot be used in photosynthesis / no photosynthesis / little photosynthesis / no light dependent reaction (or described) / little light dependent reaction (or described) correct ref to action spectrum in green region **;**		**2** Needs to refer to green rather than other colours
			3	little / no, photolysis / splitting of water **;**		**3** **CREDIT** (some) photolysis with accessory pigments
			4	little / no, CO_2 **,** taken up / fixed (in light independent reaction) **;**		
			5	some CO_2 produced during respiration **;**		
			6	(slight) increase in CO_2, increases acidity / decreases pH **;**		**6** **CREDIT** increase in H^+ decreasing pH for accessory pigments
			7	AVP **;**		**7** e.g. • accessory pigments absorb (some) green light

Question			Expected Answers		Marks	Additional Guidance	
5	(b)				S & C		**Question is asking for an <u>increased</u> rate of photosynthesis and maximum production** **IGNORE LIGHT**
			1	photosynthesis / named stage, is controlled by / needs / involves / uses **,** (named photosynthetic) enzymes **;**		**1**	Needs to be a clear generalised statement – cannot be implied from a description of the effects **IGNORE** 'enzymes are affected by temperature'
			2	temperature can be, increased by heater / reduced by ventilation (or fan) maintained by air conditioning (or other method) **;**		**2**	Needs to indicate ***how*** factor is controlled
			3	increase CO_2 concentration (in environment) by burning, fuel / gas / paraffin **;**		**3**	Needs to indicate ***how*** factor is controlled **CREDIT** increase in CO_2 by other reasonable methods
			4	*idea that* increased / more / high<u>er</u>, CO_2 (conc), so CO_2 no longer a limiting factor / increases CO_2 fixation / (or described) increases Calvin cycle (or described) **;**		**4**	**ALLOW** ref to maximum rate for increase in rate
			5	*idea that* easier to control, water supply / irrigation (to prevent wilting) / humidity / minerals / fertiliser **;**		**5**	Look for the idea that factors can be more easily regulated in the greenhouse rather than outside **CREDIT** use of hydroponics
			6	*idea that* easier to control use of, pesticides / pest control / biological control **;**		**6**	Look for the idea that factors can be more easily regulated in the greenhouse rather than outside
			7	AVP **;**		**7**	e.g. • gas / paraffin , heater supplies heat **and** CO_2 • prevents described damage of plants by, wind chill / frost / wind / hail / etc • description / effect, of photorespiration
					4 max		
				Total	**11**		