OCR
Oxford Cambridge and RSA

GCE

Biology

Unit **F214:** Communication, Homeostasis & Energy

Advanced GCE

Mark Scheme for June 2014

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
BP	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Correct answer
	Incorrect response
BOD	Benefit of Doubt
NBOD	Not Benefit of Doubt
ECF	Error Carried Forward
GM	Given mark
	Underline (for ambiguous/contradictory wording)
^	Omission mark
I	Ignore
	Correct response (for a QWC question)
QWC+	QWC* mark awarded
V	Verbal Construction

Quality of Written Communication

Question			Answer	Mark	Guidance
1	(a)	(i)	chlorophyll **,** a / 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** **ACCEPT** chlorophyll 680 **and** chlorophyll 700 (**Note** that both are required for this option) **IGNORE** P680 / P700 **DO NOT CREDIT** chlorophyll α
1	(a)	(ii)	chlorophyll b / xanthophyll(s) / carotenoid(s) / (β / beta-) carotene **;**	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** karatine (as could be confused with keratin)
1	(a)	(iii)	able to **,** absorb / use **,** a range of / different / more / other **,** (light) wavelengths / λ **;**	1	e.g. absorb wavelength(s) not absorbed by primary pigment **IGNORE** frequency **IGNORE** absorb all wavelengths **IGNORE** ref to chlorophyll b **DO NOT CREDIT** ref to reflection where ***a*** pigment absorbs and reflects the ***same*** wavelength
1	(a)	(iv)	ATP **;**	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** O_2 / oxygen / red NADP / NADPH **DO NOT CREDIT** inaccurate name for ATP e.g. 'ATP (adenine triphosphate)' = 0 marks

Question			Answer	Mark	Guidance
1	(b)	(i)	rubisco / RuBP carboxylase / ribulose bisphosphate carboxylase ;	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** ribulose biphosphate carboxylase **IGNORE** oxygenase
1	(b)	(ii)	GP / glycerate(3-)phosphate ;	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** PGA / phosphoglyceric acid / phosphoglycerate **DO NOT CREDIT** PGAL / GALP / phosphoglyceraldehyde **DO NOT CREDIT** inaccurate name for GP e.g. 'GP (glycerol phosphate)' = 0 marks
1	(b)	(iii)	RuBP / ribulose bisphosphate ;	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** ribulose biphosphate
1	(b)	(iv)	starch / amylose / amylopectin **and** cellulose ;	1	**Mark the first two answers.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
			Total	**8**	

Question			Answer	Mark	Guidance
2	(a)	(i)	it converts energy (mechanical) into **,** another / different **,** form of energy (electrical) **;**	1	If type of energy is specified, it must be as indicated in the brackets **ACCEPT** 'converts one form of energy into another' **IGNORE** pressure
2	(a)	(ii)	*idea that deformation of membrane will allow more Na^+ through because* **1** (the increased pressure) causes sodium (ion) channels to open **;** **2** (temporary) gaps / holes / spaces **,** appear **,** between the <u>phospholipids</u> / in the <u>bilayer</u> **;**	1 max	**1** **CREDIT** Na^+ channels **DO NOT CREDIT** Na channels **DO NOT CREDIT** ref to voltage(-gated) channels **2** **IGNORE** weakened **DO NOT CREDIT** '*breaks* in the bilayer' **DO NOT CREDIT** 'pores' for 'gaps' **DO NOT CREDIT** idea of additional **,** channels / carriers **,** inserted
2	(a)	(iii)	if the **,** stimulus is not strong enough / threshold (value) is not reached / depolarisation (of membrane) is insufficient **,** then **,** it / an action potential **,** is not **,** generated / AW **;** **ora**	1	**ACCEPT** 'impulses' for 'action potentials' **DO NOT CREDIT** ref to 'strength' of an action potential **IGNORE** ref to numerical value for threshold potential **IGNORE** ref to 'it' or 'action potential' reaching threshold **DO NOT CREDIT** ref to action potentials of different sizes/values

Question			Answer	Mark	Guidance
2	(a)	(iv)	**1** *idea that* it is represented by the frequency of the action potentials ; **2** high , frequency / rate (of generation) , of action potentials shows , a strong / an intense , stimulus ; **ora**	2	**Note: max 1 if term 'frequent' or derived term NOT used in answer** **ACCEPT** 'impulses' for 'action potentials' **1** **CREDIT** represented by how , frequently / often, the action potentials are , transmitted / generated **2** **DO NOT CREDIT** ref to speed of , action potentials / impulses **Note:** e.g. 'a higher frequency of impulses represents a strong stimulus' **= 2 marks**
2	(b)		*action potentials not generated because* **1** sodium (ion) channels (remain) open / resting potential not re-established ; **2** *idea of* ions being in the wrong place for correct ion movement (across membrane) ;	1 max	**IGNORE** lack of (named) neurotransmitter as the Q refers to generation of the action potential in the receptor and not its onward transmission **1** **CREDIT** Na^+ channels **IGNORE** 'voltage-gated' **DO NOT CREDIT** Na channels

Question			Answer	Mark	Guidance
2	(c)			3 max	**ACCEPT** 'action potentials' for 'impulses' **IGNORE** 'messages' and 'signals' throughout
			1 allows **,** neurones to communicate / cell signalling **;**		**1** e.g. ● passes impulse on to next neurone ● passes neurotransmitter on to next neurone
			2 ensure transmission (between neurones) in one direction (only) **;**		**2** **Must be transmission *between* neurones** **IGNORE** description unless for clarification
			3 allows **,** convergence / impulses from more than one neurone to be passed to a single neurone **;**		**3** **IGNORE** 'summation' **ACCEPT** 'neurotranmsitter' instead of 'impulse'
			4 allows **,** divergence / impulses from a single neurone to be passed to more than one neurone **;**		**4** **ACCEPT** 'neurotranmsitter' instead of 'impulse'
			5 idea that filters (out) **,** 'background' / low level **,** stimuli **or** ensures that only stimulation that is strong enough will be passed on **;**		
			6 prevents fatigue / prevents over-stimulation **;**		
			7 allows many low level stimuli to be amplified **;**		**7** **IGNORE** 'summation'
			8 *idea that* presence of inhibitory and stimulatory synapses allows impulses to follow specific path **;**		
			9 permits **,** memory / learning / decision making **;**		
					Note: **'**impulses from more than one neurone can pass to a single neurone' = **2 marks** (mps 1 & 3) **Note:** **'**impulses from a single neurone can pass to many neurones' = **2 marks** (mps 1 & 4)
			Total	**9**	

Question			Answer	Mark	Guidance
3	(a)	(i)	diabetes (mellitus) ;	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** hyperglycaemia **IGNORE** Type 1 or Type 2 **DO NOT CREDIT** hypoglycaemia
3	(a)	(ii)	*idea that* time needed , to restore normal (blood) glucose concentration / for insulin to act (fully) ;	1	
3	(a)	(iii)	18.6 ; ;	2	**Correct answer = 2 marks**, even if no working shown. **If answer is incorrect**, then **ALLOW** 1 mark for seeing: 1.1 ÷ 5.9 **or** (7.0 – 5.9) ÷ 5.9 **or** 118.6 **or** 118.64 **If the answer is not correctly rounded to 1dp**, then **ALLOW** 1 mark for seeing a correct unrounded answer e.g. 18.64
3	(b)		**1** HbA1C / glycosylated Hb , contained within , red blood cell(s) / erythrocyte(s) ; **2** red blood cells / erythrocyte(s) , have limited life span / live for 8 to 12 weeks **or** red blood cells / erythrocyte(s) , break down after , 12 weeks / 3 months ; **3** HbA1C / glycosylated Hb , broken down , in liver / by hepatocytes / by Kupffer cells ;	2 max	**CREDIT** RBC / rbc for 'red blood cell' throughout **3** **IGNORE** ref to recycling

Question			Answer	Mark	Guidance
3	(c)		patient might have had a drink containing sugar ; AVP ;	1 max	**DO NOT CREDIT** ref to having eaten (as patient had confirmed that he had not eaten) **CREDIT** ref to a specific sugar-containing drink e.g. ● patient was nervous and secreted adrenaline ● other medication interferes with glucose levels ● patient's haemoglobin does not bind effectively with glucose (e.g. anaemia / sickle cell)
3	(d)	(i)	**1** if blood glucose falls , extremely / dangerously / too / very , low ; **2** if patient , cannot produce (enough) glucagon / produces little glucagon ; **3** *idea that* glucose source cannot be taken by mouth ;	1 max	**1** **CREDIT** hypoglycaemic / hypoglycaemia **IGNORE** 'below normal' alone **2** **CREDIT** ref to dysfunctional , α cells / glucagon receptors **3** **CREDIT** a suitable reason (e.g. fitting or in a coma)

Question			Answer	Mark	Guidance
3	(d)	(ii)	*when blood glucose concentration decreases* **1** (glucagon) released by the **, <u>alpha</u>** / <u>α</u> **,** cells in **,** **islet**s of Langerhans / **pancreas ;** **2** promotes / AW **,** conversion of **glycogen** to glucose / **glycogenolysis ,** in **,** liver / muscle / **effector ,** cells **;** **3** ref **gluconeogenesis** / described **;** **4** ref conversion of triglycerides to (free) fatty acids / lipolysis / increased use of fatty acids in respiration **;** **5** **negative feedback ,** reduces / inhibits **,** the secretion of glucagon **;** **6** glucagon **,** reduces / inhibits **,** insulin secretion **;**	4 max	**IGNORE** ref to insulin or events following an increase in blood glucose concentration **1** **DO NOT CREDIT** 'alpha cells are produced' **2** **Any description must** correspond correctly to term **DO NOT CREDIT** if glucagon *converts* glycogen directly **3** **Any description must** correspond correctly to term **IGNORE** imprecise ref to glucagon *doing the conversion* **4** **Any description must** correspond correctly to term **IGNORE** imprecise ref to glucagon *doing the conversion* **5** **DO NOT CREDIT** stopping glucagon secretion **6** **DO NOT CREDIT** stopping insulin secretion
			QWC – technical terms used appropriately and spelled correctly **;**	1	Use of **three** terms from: **alpha**, **islet**, **pancreas** , **glycogen**, **glycogenolysis**, **effector**, **gluconeogenesis**, **negative feedback** **Please insert a QWC symbol next to the pencil icon, followed by** **a tick (✓) if QWC has been awarded** **or a cross (×) if QWC has not been awarded** **You should use the green dot to identify the QWC terms that you are crediting.**
			Total	**13**	

Question			Answer	Mark	Guidance
4	(a)	(i)	acetylcholine **;**	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** other correct examples e.g. dopamine / noradrenaline / norepinephrine **ACCEPT** ACh
4	(a)	(ii)	***either*** post-synaptic membrane **;** (TRPA1) prevents attachment of (named) neurotransmitter to its receptor **;** ***or*** pre-synaptic membrane / (pre)synaptic knob / axon terminal / bouton / synaptic bulb **;** (TRPA1) prevents **,** release of (named) neurotransmitter / influx of calcium ions **;**	2	**Explanation must match correct location for 2 marks.** **If no location stated then explanation can be awarded independently for 1 mark.** **Incorrect location = 0 marks.** **IGNORE** 'interferes' (as in Q) **IGNORE** ref to dendrites / cell bodies /neurone(s) / synapse(s) **CREDIT** causes hyperpolarisation **DO NOT CREDIT** idea that TRPA1 is a free protein that will enter the ACh receptor and block it (rather like a competitive inhibitor occupying the active site of an enzyme) **ACCEPT** Ca^{2+}

Question			Answer	Mark	Guidance
4	(b)	(i)	**A** sinusoid **;** **B** (branch of) bile duct **;** **C** (branch of) hepatic portal <u>vein</u> **;** **D** (branch of) hepatic artery / arteriole **;** **E** (branch of) hepatic / central **,** <u>vein</u> **;**	5	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **B** **DO NOT CREDIT** canaliculus **C** **IGNORE** inter lobular **but** **DO NOT CREDIT** intra lobular **D** **IGNORE** inter lobular **but** **DO NOT CREDIT** intra lobular **E** **IGNORE** intra lobular **but** **DO NOT CREDIT** inter lobular
4	(b)	(ii)	**1** because there is not enough <u>glutathione</u> / <u>glutathione</u> has run out **;** **2** enzyme catalysing glutathione reaction is **,** working at V_{max} / inhibited / in short supply **;** **3** the NAPQI cannot **,** cross the cell (surface) membrane / leave the cell / leave (named) organelle **;**	1 max	**2** **DO NOT CREDIT** in context of P450 system **3** **IGNORE** ref to excretion
4	(b)	(iii)	hepatocytes **<u>and</u>** <u>mitosis</u> / <u>mitotic</u> (division) **;**	1	**CREDIT** (liver) stem cells / hepatic cells **IGNORE** liver cells unqualified **DO NOT CREDIT** Kupffer cells **ONLY CREDIT** correct spelling for mitosis / mitotic
			Total	**10**	

Question			Answer	Mark	Guidance
5	(a)	(i)	**1** (as the temperature increases) the respiration rate increases **;** **2** respiration rate doubles with a 10°C temperature increase **;** **3** **comparative** figures with **correct units** (units once for respiration and once for temperature) in the context of either mp **;**	2 max	**Only credit answers that refer to an increase in temperature – no ora** **1** **Clear statement required – cannot be inferred from figures quoted.** **ACCEPT** positive correlation between temperature and respiration rate **IGNORE** ref to directly proportional **2** **Clear statement required – cannot be inferred from figures quoted.** **CREDIT** $Q_{10} = 2$ **3** e.g. ● between 0 and 20°C the respiration goes from 17 to 69 mg CO_2 kg^{-1} h^{-1} ● between 5 and 10°C the rate changes by 13 mg CO_2 kg^{-1} h^{-1} e.g. ● between 0 and 10°C the rate goes from 17 to 34 mg CO_2 kg^{-1} h^{-1} ● between 10 and 20°C the respiration goes from 34 to 69 mg CO_2 kg^{-1} h^{-1} **Note:** 'between 0 and 20°C the respiration rate increased from 17 to 69 mg CO_2 kg^{-1} h^{-1}' = **2 marks** (mps 1 & 3) **But** 'at 0 °C the respiration is 17 mg CO_2 kg^{-1} h^{-1}' and at 20°C it is 69' = **1 mark** (mp 3)

0 °C	5 °C	10 °C	15 °C	20 °C
17	21	34	44	69

Question			Answer	Mark	Guidance
5	(a)	(ii)	**1** *best conditions are* low(er) temperatures because respiration rate low **;** **2** 0 °C / freezing **,** could be / is **,** best **;** **3** *idea that* 0 °C might be too low as (the food cells) might be damaged at 0 °C **;** **4** *idea that* for some (named) food(s) (storage) temperature doesn't seem to matter **;** **5** *idea that* data is incomplete for **,** potato / parsnip **,** so **,** only limited / no **,** conclusions can be made **;** **6** *idea that* if product needs to ripen during storage then a higher temperature (not above 20 °C) will be ideal **;**	2 max	**1** 5 °C or below **IGNORE** statements that simply describe a trend **3** **ACCEPT** ref to freezing instead of 0 °C **4** **NOT** asparagus, blackberry or cauliflower **6** **IGNORE** ref to ethene **Note:** '0 °C is best as the respiration rate is low' = **2 marks** (mps 1 & 2)
5	(a)	(iii)	**1** onion **;** **2** has low(est) respiration rate **;** **3** across all temperatures (in the investigation / up to 20 °C) **or** temperature has **,** the least / little **,** effect on respiration rate **;** **4** can be **,** stored / kept **,** at **,** higher temperatures / room temperature / at 20 °C **;**	3	**1** **DO NOT CREDIT** if an additional suggestion is made **3** **DO NOT CREDIT** 'temperature has **no** effect on respiration rate' **4** **CREDIT** *idea that* no need to store in fridge

Question			Answer	Mark	Guidance
5	(a)	(iv)	asparagus **and** has a high respiration rate across all temperatures / has the highest respiration rate (of the foods) **;**	1	**Both parts of the mark point required for the mark to be awarded** **DO NOT CREDIT** 'asparagus' without a supporting reason **ACCEPT** 'has a high respiration rate even at low temperature(s)'
5	(b)	(i)	**1** *idea that* parasites have little access to oxygen **;** **2** (inaccessible because) little oxygen dissolved in plasma / oxygen not very soluble (in plasma) **;** **3** (inaccessible because) *idea that* oxygen is **,** combined with haemoglobin / contained in red blood cells **;** 4 *idea that* haemoglobin has greater affinity for oxygen than parasite (pigment) **;**	2 max	**1** **DO NOT CREDIT 'no** oxygen accessible' clearly stated **DO NOT CREDIT** in the context of **,** the mammal respiring anaerobically / deoxygenated blood / temporary lack of oxygen **3** **ACCEPT** in context of saturation **Note:** 'because the oxygen is bound to haemoglobin, the parasite is unable to use it' = **2 marks** (mps 3 & 1)

Question			Answer	Mark	Guidance
5	(b)	(ii)	*in animals* **A1** **pyruvate** is **,** converted / reduced , to **,** **lactate** / lactic acid **;** **A2** can be reversed as no **,** atoms lost / other product formed **;** **A3** **lactate dehydrogenase** available to reverse the reaction **;** *in yeast* **Y1** pyruvate converted to **ethanol** (in 2 steps) **and** **carbon dioxide** / CO_2 **;** **Y2** cannot be reversed as **,** carbon dioxide is / atoms are **,** lost **;** **Y3** (de)**carboxylase** enzyme cannot reverse the reaction **;**	3 max	**Only award 3 content marks if A mark(s) plus Y mark(s) awarded** **A1** **Cannot be inferred** from awarding of **A2 or A3** **A2** e.g. pyruvate and lactate are both 3C compounds so reaction can be reversed **Y1** **CREDIT** pyruvate decarboxylated to ethanol **Y2** e.g. pyruvate is 3C and **,** ethanol / ethanal **,** is 2C so reaction cannot be reversed
			QWC – technical terms used appropriately and spelled correctly **;**	1	Use of **three** terms from: **pyruvate**, **lactate**, **lactate dehydrogenase** **carbon dioxide**, **ethanol** **(de)carboxylase / (de)carboxylation** (or derived term) **Please insert a QWC symbol next to the pencil icon, followed by** **a tick (✓) if QWC has been awarded** **or a cross (×) if QWC has not been awarded** **You should use the green dot to identify the QWC terms that you are crediting.**
			Total	**14**	

Question			Answer	Mark	Guidance
6	(a)	(i)	**Q ;**	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** named region as question requires candidates to identify the relevant regions from the diagram.
6	(a)	(ii)	**Q and J and K and L ;**	1	**All 4 letters required for the mark.** **If additional letters given, = 0 marks** **IGNORE** named region as question requires candidates to identify the relevant regions from the diagram.
6	(a)	(iii)	**J ;**	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** named region as question requires candidates to identify the relevant regions from the diagram.
6	(b)		**1** more (sodium and chloride) ions pumped **,** out of ascending limb / into medulla **;** **2** builds up greater water potential gradient **;** **3** allows **,** reabsorption / removal **,** of *more* water from **,** collecting duct / M **;**	2	**1** **CREDIT** active transport / AW **,** for 'pumped' **IGNORE** salts / diffusion **2** **ACCEPT** ***even more*** negative water potential in medulla (than other mammals)

Question			Answer	Mark	Guidance
6	(c)		anabolic steroids ;	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** androgenic steroids **IGNORE** named steroids as *type* of drug asked for
			Total	**6**	

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