



ADVANCED
General Certificate of Education

Biology

Assessment Unit A2 1

assessing

Physiology, Coordination and Control,
and Ecosystems

[ABY11]

Assessment

**MARK
SCHEME**

General Marking Instructions

The main purpose of the mark scheme is to ensure that each question is marked accurately, consistently and fairly.

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which students may produce. In the event of unanticipated answers, teachers and lecturers are expected to use their professional judgement to assess the validity of answers.

Mark Scheme Notation

The use of a solidus (/) denotes alternative answers which can be awarded within the same question (or marking point in a question worth more than one mark).

The use of a semi-colon (;) denotes separate marking points. These are particularly relevant when separating the different marking points in a question worth more than one mark.

Part of an answer within brackets indicates that this part is not essential to gain credit – the bracketed section is usually to set context or for the purpose of completeness.

Some answers are shown as 'Any **two** from' (or any number between two and six). This means that any two (or other specified number) answers from the bullet-pointed list can be credited in this question or question part.

Some answers have 'Other appropriate response' (OAR) as an alternative answer which may be credited. OAR is most likely to appear in an answer where there are a wide range of possible answers worthy of credit and it is unlikely that the mark scheme contains all the possible answers.

Marking Calculations

Full marks are normally awarded for the correct answer – irrespective of whether working out has been shown (even when asked to show working out.) The principle of 'error carried forward' (ECF) usually applies in that if a student makes a mistake in the first part of a three-mark, three-stage calculation then the final two marks can be awarded if the second and third stage processes are carried out correctly. The same principle applies to a mistake at any stage in a calculation.

Essays

The mark scheme includes indicative points for essays. Each indicative point is numbered to aid marking. Following the indicative points in the mark scheme, a table is included which shows how many marks should be awarded for an answer that is credited with having a particular number of indicative points.

Additional Guidance

The Additional Guidance column in the mark scheme provides extra information to aid the marking process. This column includes clarification concerning some marking points: this may include naming key words which may be required in an answer or may provide a range of alternative answers which would be considered creditworthy under OAR, or examples of the ECF principle. It may also include examples of answers which would not be considered creditworthy.

Question	Answer			Additional Guidance	Mark
1 (a)	Blood group	Antigens on red blood cells	Antibodies in plasma	For antibody column allow b and a (for A and B blood groups respectively).	
	A	A	anti-b	For O row allow 'both' in antibody column. To gain a mark (for a row) both answers must be correct in that row.	
	B	B	anti-a;		
	AB	A and B	none/ neither;		
	O	neither	anti-a and anti-b;		
(b)	The recipient (group A) has anti-b antibodies in the blood and the donor (group B) carries the B antigen on their red cells; this will result in the formation of antibody-antigen complexes/ agglutination;			Marking point (MP) 1 – not just blood types are not compatible or implied – need description of both donor antigen and recipient antibody.	[3]

2 (a) (i)	A – myosin; B – actin;	Both terms correct but wrong way round = 1.	[2]
(ii)	A-band; (both) actin and myosin bands present (in this section);	(MP1) credit dark band but not just band where myosin and actin overlaps.	[2]
(b)	3 mm = 3 000 000 nm; $3\,000\,000 \div 170\,000 = 17.6$ nm;	If mistake in conversion (MP1), allow MP2 if process correct. 17.6 without working = 2 marks.	[2]
(c) (i)	Any four from: <ul style="list-style-type: none"> calcium ions released (following nervous stimulation) myosin head binds to the actin binding site the head rotates/changes angle; and pulls actin (filament) over myosin (filament) ATP hydrolysis allows myosin head release (and return to original position) 	Bullet point (bp1) – allow calcium ions spread over muscle. (bp2) allow myosin heads attach to the actin. (bp4) credit ATP enables myosin head to detach.	[4]
(ii)	Distance remains unchanged;		[1] [11]

3 (a)	Tears – lysozyme hydrolyses bacteria/ microbes; Mucus – traps pathogens;	(MP1) allow breaks down or other description of hydrolysis. For mucus allow traps/sticks to microbes/bacteria/viruses.	[2]
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Question	Answer	Additional Guidance	Mark
(b) (i)	Any three from: <ul style="list-style-type: none"> after 1840 the death rate on Ward B decreased dramatically (by up to 5.7%) (while rates on Ward A continued to rise) nurses on Ward B were less likely to come into contact with infectious disease because they did not work on other wards/have contact with other patients carrying pathogens doctors worked on other wards/ so were in contact with infectious disease nurses were less likely to transmit infectious disease to patients (or converse). 	(bp1) needs to be significant/large/ dramatic decrease, not just a decrease. (bp2) need both restricted movement of nurses and effect of this on coming into contact with pathogens. (bp4) allow less likely to spread infections or patients less likely to catch infections.	[3]
(ii)	9.3;		[1]
(iii)	There was a significant drop in deaths in Ward A after 1847 (11.3% to 2.0%); in Ward B there was little difference in the death rates;	(MP1) needs to be significant/ large/dramatic decrease, not just a decrease.	[2]
(iv)	Any two from: <ul style="list-style-type: none"> better knowledge of immunity better (new) drugs/better identification/treatment of infections isolation of patients sterilisation of equipment appropriate use of PPE some infectious diseases eradicated 	(bp1) refers to better understanding of human immune system. (bp2) includes medical advances such as vaccinations for (once) common infectious diseases – allow antibiotics for drugs. (bp5) allow PPE by description.	[2] [10]

4 (a) (i)	Destructive sampling/kills organisms if dry mass used;		[1]
(ii)	Phytoplankton have a high reproductive rate/high turnover rate/ standing crop (qualified)/population boom of zooplankton; this represents a very high productivity/causing a (temporary) crash in phytoplankton number;	(MP1) allow standing crop by description – phytoplankton biomass must have been high previously to support zooplankton population growth. First alternative in MP2 linked to first three alternatives in MP1. Second alternative in MP2 linked to final alternative in MP1	[2]
(iii)	Any two from: <ul style="list-style-type: none"> photosynthetic reaction inefficient misses the chloroplast incorrect wavelength 	Allow one of reflected from/absorbed by cuticle/cell wall/surface (of phytoplankton) or used in evaporating water (on their surface) but not 'used in respiration' as an additional bullet point.	[2]

Question	Answer	Additional Guidance	Mark
(b) (i)	$0.7 \times X = 1.21 \times 10^9$; $X = 1.21 \times 10^9 / 0.7 = 1.73 \times 10^9$; remaining seabirds $1.73 \times 10^9 - 1.21 \times 10^9 = 5.19 \times 10^8$ birds;	Credit $1.21 \times 10^9 = 70\%$ or $7/10$ of X as alternative first step. $(1.21 \times 10^9 / 7) \times 3 =$ remaining population (as second step). Allow 5.2×10^8 .	[3]
(ii)	Any two from: <ul style="list-style-type: none"> human disturbances to the environment getting tangled up in fishing gear declining food supply due to overfishing declining food supply due to fish migration (as a consequence of warming seas due to global warming) species cannot reproduce fast enough hunted by introduced species 	(bp1) includes habitat destruction (by e.g. coastal erosion leading to loss of nesting sites/pollution, e.g. oil, plastic).	[2] [10]

5 (a)	P_{730}/P_{fr}		[1]
(b) (i)	Flowers when the dark period is shorter than the critical period/light period exceeds critical value; dark period must be less than 12 hrs/ light period must be longer than 12 hrs;	Not just 'flowers in 13–14 hours light but not if 12 hours light'.	[2]
(ii)	During the light period P_{660} is (rapidly) converted to P_{730} ; in the dark there is a slow reconversion of P_{730} to P_{660} ; since it is the level of P_{730} that determines the flowering response it is the reconversion (dark) period which is important;	MPs likely to be distributed throughout response and not necessarily in order given here. (MP3) allow a short-night is necessary to prevent the P_{730} reconverting to below the critical level for flowering/if the night is too long not enough P_{730} will remain.	[3]
(iii)	The most cost-effective method requires short intervals of white/red light; interrupting the dark period; this requires less energy/electricity than extending the light period;	Credit 'short flash of light during night' as MP1 and MP2 (explanation of effect is not required).	[3]
(c) (i)	A log scale is used to show data that has a very large range;	Allow anything that implies a large range such as deals with numbers over several orders of magnitude.	[1]

Question	Answer	Additional Guidance	Mark
(ii)	<p>Any two from each section:</p> <p>Roots:</p> <ul style="list-style-type: none"> at very low auxin concentrations (10^{-6} to 10^{-3}) root growth is stimulated between 10^{-4} and 10^{-3} root growth is stimulated less above 10^{-3} auxin concentration growth inhibited/above critical auxin concentrations cell elongation is inhibited <p>Stems:</p> <ul style="list-style-type: none"> at very low auxin concentrations there is little or no stem stimulation maximum stem stimulation is with an auxin concentration of around 10^1 at concentrations above 10^1 stimulation of stem growth decreases rapidly and is ultimately inhibited/above auxin concentrations providing stimulation cell elongation is inhibited in the stem 	<p>(bp1) allow as an alternative, maximum root stimulation/growth at 10^{-4} auxin concentration.</p> <p>(bp2) credit idea that reduced stimulation/growth as concentration increases from 10^{-4} to (approx.) 10^{-3}.</p> <p>(bp1) credit there is no stem elongation/growth/auxin has no effect (on stems) with concentrations less than 10^{-3}.</p> <p>(bp2) credit maximum stimulation/growth in concentrations between 10^0 – 10^2.</p> <p>(bp3) must include both reduced stimulation (above optimum concentrations) and inhibition (above 10^3).</p>	[4]
(d)	<p>Cytokinin; promotes cell division; or gibberellin; promotes elongation of internodes;</p>		[2] [16]

6 (a) (i)	Primary (succession);		[1]
(ii)	Low water availability;	Can be implied (e.g. sand drains easily or high winds cause increased transpiration or salt water draws moisture from roots or similar).	[1]
(iii)	(Climax community) is the stable end stage of succession; which is in equilibrium with the environment;	(MP1) credit final stage in a succession.	[2]
(iv)	Species found in newer dunes are grasses/flowering plants/mosses/ in older regions larger shrubs and trees are found; biomass increases;	(MP1) credit plants in early stages of succession include mosses/grasses/flowering plants or by example, e.g. marram grass and later stages include shrubs/trees or by example, e.g. bracken/gorse.	[2]

Question	Answer	Additional Guidance	Mark
(v)	Soils are more developed;	Allow any reference to soil development, e.g. more humus/deeper soils.	[1]
(b) (i)	Carbon and nitrogen increase with time; nitrogen is always (much) lower than carbon/carbon increases (much) more than nitrogen; photosynthesis/feeding and decomposition (of dead organisms) adds carbon; nitrogen-fixation/decomposition/ammonification increase soil nitrogen levels;	(MP3) need reference to build-up of carbon in organism (photosynthesis/feeding) and subsequent release (decomposition).	[4]
(ii)	Taken up as nitrate; by active transport; combines with carbohydrate to form amino acids;		[3] [14]

7 (a)	(MPs 1 and 2) Any two from: <ul style="list-style-type: none"> mice are mammals/similar physiology to humans expect a similar (immune) response/progress of disease similar small/(relatively) easy to care for/breed rapidly/produce large numbers of offspring (for analysis) (MP3) mice may not have a similar/same immune response/may be important differences in how humans and mice respond to a disease;		[3]
(b)	Quaternary;		[1]
(c) (i)	Absence of the B-chain prevents the entry of the toxin to the cell; A-chain cannot bind with GABA;	(MP1) credit unable to enter neurone/cell.	[2]
(ii)	H ⁺ break bonds; ionic;	They break/disrupt ionic bonds = 2.	[2]
(d)	GABA not released (into synapse)/cannot bind to receptors on the post-synaptic membrane; so influx of negative ions/hyperpolarisation/IPSP is prevented; neurones therefore generate EPSPs; a high frequency of action potentials (results in sustained muscle contraction/spasm);	Allow inhibitory effect of GABA prevented/reduced as an alternative to any of MP1/2/3. (MP3) allow myofibril membrane remains depolarised. (MP4) allow calcium ions continue to be released (from sarcoplasmic reticulum).	[4]

Question	Answer	Additional Guidance	Mark
(e)	Individual vaccinated; active immune response is initiated/ by description/memory cells produced; booster dose given to maintain memory cell population;	If answer based on catching the disease MP1 not available. (MP3) credit vaccine contains antigens/harmless form of pathogen/ description of secondary immune response (i.e. memory cells allow antibodies to be produced rapidly when pathogen encountered).	[3] [15]
		Section A	[82]

Question	Answer	Additional Guidance	Mark																						
8 (a)	<p>Indicative content</p> <ol style="list-style-type: none">1. ultrafiltration is filtration under pressure2. occurs at the glomerulus3. increased filtration pressure due to afferent/efferent capillary narrowing4. short distance from heart5. coiling of glomerulus6. capillaries surrounded by basement membrane/effective filter7. capillary pores and podocytes (of Bowman's capsule) aid filtration8. selective reabsorption occurs at the PCT by facilitated diffusion and active transport9. cuboidal epithelial cells have microvilli to increase surface area available/basal invaginations increase surface area for transport to blood capillaries10. carrier/transport proteins are located here11. many mitochondria provide ATP for active transport12. molecules useful to the body are reabsorbed13. these include glucose, amino acids, small proteins and mineral ions (at least two named)14. urea also returns to the body by diffusion <table><tr><th>Indicative points</th><th>Marks</th></tr><tr><td>11+</td><td>9</td></tr><tr><td>10</td><td>8</td></tr><tr><td>9</td><td>7</td></tr><tr><td>8</td><td>6</td></tr><tr><td>7</td><td>5</td></tr><tr><td>6</td><td>4</td></tr><tr><td>5</td><td>3</td></tr><tr><td>4</td><td>2</td></tr><tr><td>1–3</td><td>1</td></tr><tr><td>0</td><td>0</td></tr></table>	Indicative points	Marks	11+	9	10	8	9	7	8	6	7	5	6	4	5	3	4	2	1–3	1	0	0	<p>(bp3) need idea that efferent capillary is narrower than the afferent or implied.</p> <p>(bp4) idea that this facilitates the high pressure.</p> <p>(bp6) credit basement membrane as the effective filter.</p> <p>(bp7) need both pores and podocytes.</p> <p>(bp8) selective is implied by reference to facilitated diffusion and active transport.</p> <p>(bp9) key points are cells lining the PCT lumen have increased surface area due to microvilli/basal invaginations.</p> <p>(bp11) need reference to many/large number of mitochondria and ATP production/providing energy for active transport.</p> <p>(bps 12 and 13) Glucose and amino acids but not urea are selectively reabsorbed.</p>	
Indicative points	Marks																								
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[9]

Question	Answer	Additional Guidance	Mark																						
(b)	<p>Indicative content</p> <ol style="list-style-type: none">the loop of Henlé acts as a counter-current multiplierthe descending limb is permeable to water (and ions)the ascending limb is impermeable to waterit actively pumps out sodium and chloride ionsinto the interstitial fluidproducing a solution with a negative solute/water potentialthis enables osmotic extraction of water from the descending limband also concentrates the ions in the descending limbthis enables a hypertonic urine to be producedhomeostasis is the balance of a constant internal environment and this includes osmoregulationfinal osmoregulatory balance is achieved by the osmoreceptors within the hypothalamus detecting blood water/solute potentialincreasing the release of ADH from the pituitary glandso increasing the permeability of the cells lining the (DCT and) collecting ductsand increasing the reabsorption of water from the urinary filtrate <table><tr><th>Indicative points</th><th>Marks</th></tr><tr><td>11+</td><td>9</td></tr><tr><td>10</td><td>8</td></tr><tr><td>9</td><td>7</td></tr><tr><td>8</td><td>6</td></tr><tr><td>7</td><td>5</td></tr><tr><td>6</td><td>4</td></tr><tr><td>5</td><td>3</td></tr><tr><td>4</td><td>2</td></tr><tr><td>1-3</td><td>1</td></tr><tr><td>0</td><td>0</td></tr></table>	Indicative points	Marks	11+	9	10	8	9	7	8	6	7	5	6	4	5	3	4	2	1-3	1	0	0	<p>(bp5) allow (kidney) tissue/ surrounding cells/blood vessels/vasa recta.</p> <p>(bp6) allow increasing osmotic gradient between (fluid/tissue) outside nephron and filtrate.</p> <p>(bp8) can be in context of water leaving descending limb (thus increasing concentration) or by ions entering.</p> <p>(bp11) key points are osmoreceptors in hypothalamus and blood water/ solute potential (but not blood concentration).</p> <p>(bps 12 – 14) can be in context of decreased ADH release and reduced reabsorption from collecting ducts if blood solute/water potential increases.</p>	
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		Section B	[18]																						
		Total marks	[100]																						