



GCSE

Biology B

Unit **B732/02**: Modules B4, B5, B6 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2016

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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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B732/02

Mark Scheme

June 2016

Annotations used in scoris

Annotation	Meaning
	correct response
	incorrect response
BOD	benefit of the doubt
NBOD	benefit of the doubt not given
ECF	error carried forward
	information omitted
I	ignore
R	reject
CON	contradiction

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
allow	=	answers that can be accepted
not	=	answers which are not worthy of credit
reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant
()	=	words which are not essential to gain credit
<u> </u>	=	underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
ecf	=	error carried forward
AW	=	alternative wording
ora	=	or reverse argument

B732/02

Mark Scheme

June 2016

Question			Answer	Marks	Guidance
1	a	i	D (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
		ii	plasmolysed (1)	1	ignore flaccid allow phonetic spelling
	b		any two from: movement from (an area of) low concentration to (an area of) high concentration (1) using energy or respiration (1) using carrier (1)	2	allow moves from a lower concentration (into the root) (1) allow against or up a concentration gradient (1) ignore through or across a concentration gradient allow using ATP (1) ignore uses oxygen allow uses membrane proteins (1) ignore references to osmosis and diffusion
			Total	4	

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
2	a	<p>[Level 3] Explanation of why rate of photosynthesis is reduced AND Explanation of how and why transpiration is affected. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Description of reduced photosynthesis AND Description of effects on transpiration. OR Explanation of why rate of photosynthesis is reduced OR explanation of how and why transpiration is affected. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Description of reduced photosynthesis OR Description of effects on transpiration. OR attempts one explanation without stating if they are increased or decreased Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to A</p> <p>Indicative scientific points on explanations may include: Explanations of reduced photosynthesis</p> <ul style="list-style-type: none"> • photosynthesis reduced because of fewer collisions • photosynthesis reduced because reduced enzyme activity • photosynthesis reduced because high winds cause stomata to close so less carbon dioxide taken in <p>Explanation of effects on transpiration.</p> <ul style="list-style-type: none"> • transpiration increased because of increased diffusion (gradient) or increased evaporation • transpiration increased because of decreased humidity • transpiration may be reduced by low temperatures reducing evaporation or diffusion • transpiration decreased as dry soils means there is less water and the guard cells become flaccid <p>Indicative scientific points on descriptions may include: Description of reduced photosynthesis</p> <ul style="list-style-type: none"> • lower temperatures or high winds decrease the rate of photosynthesis • high winds close stomata <p>ignore effect of dry soil or sunlight on photosynthesis</p> <p>Description of effects on transpiration.</p> <ul style="list-style-type: none"> • high winds increase rate of transpiration • high winds cause stomata to close so less transpiration • dry soils may reduce transpiration • low temperatures can reduce transpiration <p>allow absolute ideas e.g. no photosynthesis when cold</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>

B732/02

Mark Scheme

June 2016

Question	Answer	Marks	Guidance
b	microbes / decomposers / saprophytes / bacteria (1) less respiration / reproduction or cannot respire / reproduce (1)	2	allow need oxygen to respire / reproduce (1) ignore decompose / rot ignore idea that oxygen or water are needed for decomposition
c	xylem (1) (transports) water / minerals (1) phloem (1) (transports) food / sugar (1)	4	Function mark is dependent on cell mark To gain full marks, functions must be clearly linked to correct cells e.g. 'xylem and phloem transport water and sugar' (2) e.g. xylem transports water phloem transports sugar and minerals (3) allow named mineral e.g. nitrate (1) not sugar / food / starch not phylum / phyllem allow named food substances e.g. glucose / sucrose / amino acids (1) not minerals or starch ignore water for phloem ignore nutrients for both ignore direction of movement

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
	d i	<p>any two from: idea that graph shows an increase in recent times (1)</p> <p>idea that there was a decrease until recently (1)</p> <p>idea that there have been great fluctuations (1)</p> <p>there have been wider rings at other times (in the past) / e.g. 3800 years ago (1)</p> <p>idea that results might not be representative of all trees (1)</p>	2	<p>ignore yes/no allow increases starting in any correct year (between 2000 years ago to present) allow trees are wider in present day (1) allow shows an overall increase (1)</p> <p>allow decreases (from 4000) to any correct year (between 2000 years ago to 500) (1)</p> <p>allow the pattern is random (1) allow it has gone up and down (1) BUT allow it has gone up and down but there is an increase in recent years (2)</p> <p>allow only shows bristlecone pine trees (1) allow only shows some bristlecone pine trees (1) allow only measured in California (1)</p> <p>ignore it is warmer in California</p>
	ii	<p>any two from: there is not enough evidence (to support theory) (1)</p> <p>other factors could have caused wider rings (1)</p> <p>only provides information about tree rings in one location (1)</p>	2	<p>ignore yes/no allow idea that correlation does not mean causation (1) ignore no evidence ignore not enough proof</p> <p>allow named factors such as rainfall or light (intensity) (1) ignore other things could have caused the wider rings</p> <p>ignore idea that graph supports global warming recently as rings are getting wider</p>
		Total	16	

B732/02

Mark Scheme

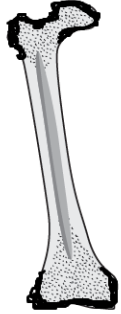
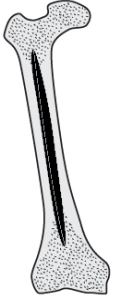
June 2016

Question		Answer	Marks	Guidance
3	a	idea that red seaweed uses or absorbs blue or green light (1) for photosynthesis (1) blue light reaches greater depths (1)	3	allow does not use red light / reflects red light (1) allow uses or absorbs all colours except red (1) allow uses or absorbs light from the other end of the spectrum to red (1) ignore other colours reach greater depths
	b	carbon / C hydrogen / H oxygen / O nitrogen / N	2	three or four correct (2) two correct (1) one or none correct (0) ignore H ₂ , O ₂ , N ₂
		Total	5	

B732/02

Mark Scheme

June 2016

Question			Answer	Marks	Guidance
4	a	i	acceptable region for cartilage label is shaded (1) 	1	allow line touching the outside of bone within the shaded area by eye or pointing at the shaded area allow lines that go in the bone but no more than approximately 2mm (by sight)
		ii	bone marrow labelled anywhere in the cavity (1) 	1	allow line touching the outside edge of the cavity by eye ignore lines that do not reach the edge of the cavity

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance	
	b	<p>ball and socket or hip joint move in more than one plane or direction (1)</p> <p>hinge or knee joint moves in one plane or direction (1)</p>	2	<p>allow for ball and socket or hip joint movement in three axes / rotation / in all or most directions / (all) around / 360°/ adduction and abduction and extension and flexion or flexes (1) ignore wide range of movement / flexible</p> <p>allow for hinge or knee joint movement in one axis / up and down / forwards and backwards / extension and flexion or flexes (1) ignore single dimension or limited movement</p> <p>allow one mark for identifying the differences but not naming the joints e.g. one joint moves in more than one direction while the other joint moves in one direction (1) but no marks if they link joints with incorrect range of movement</p> <p>ignore one joint moves in more directions than the other</p>	
	c	i	8 (kg) (1)	1	
		ii	<p>any two from: bones are weaker (1)</p> <p>because they are less dense or more porous (1)</p> <p>(might have) osteoporosis (1)</p>	2	<p>allow bones are brittle or fragile (1)</p> <p>allow idea of less calcium (1) allow less ossification (1) ignore references to phosphorus / phosphates ignore references to hormones</p>
Total				7	

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
5	a	<p>a by-pass operation <input checked="" type="checkbox"/></p> <p>a valve replacement <input type="checkbox"/></p> <p>inserting a pacemaker <input type="checkbox"/></p> <p>inserting a 'heart assist' device <input type="checkbox"/></p> <p style="text-align: right;">(1)</p>	1	more than one tick negates mark
	b	<p>[Level 3] describes the effect drugs have on dangerous blood clots AND describes the effect drugs have on dangerous bleeding AND Answer explains the effect of aspirin and warfarin Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] describes the effect drugs have on dangerous blood clots AND describes effect drugs have on dangerous bleeding OR Answer explains the effect of aspirin or warfarin Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] describes the effect drugs have on dangerous blood clots</p>	6	<p>This question is targeted at grades up to C.</p> <p>Indicative scientific points to explain the effect of the drugs may include:</p> <p>Wafarin</p> <ul style="list-style-type: none"> idea dangerous bleeding increases with warfarin because there is less fibrin to form clots idea dangerous blood clots reduces with warfarin because there is less fibrin to form clots <p>Aspirin</p> <ul style="list-style-type: none"> idea dangerous blood clots reduces with aspirin because platelets are unable to form clots idea dangerous bleeding increases with aspirin because platelets are unable to form clots <p>Indicative scientific points describing the effects of the drugs may include : blood clots</p> <ul style="list-style-type: none"> aspirin or warfarin or the drugs can reduce the risk of dangerous blood clots occurring less likely to have heart attack (as reduces risk of blood clots in coronary artery) the reduced risk of blood clots is greater than the

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance																															
		<p>OR describes the effect drugs have on dangerous bleeding Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>		<p>increased risk from bleeding</p> <p>dangerous bleeding</p> <ul style="list-style-type: none"> aspirin or warfarin or the drugs can increase the risk of dangerous bleeding using aspirin means less dangerous bleeding than using warfarin <p>Use the L1, L2, L3 annotations in Scoris. Do not use ticks.</p>																															
c	i	<table border="1"> <thead> <tr> <th colspan="2" rowspan="2"></th> <th colspan="4">Antibodies present</th> </tr> <tr> <th>anti-A</th> <th>anti-B</th> <th>anti-A and anti-B</th> <th>no anti-A no anti-B</th> </tr> </thead> <tbody> <tr> <th rowspan="4">Antigens present</th> <td>A</td> <td></td> <td></td> <td>(1)</td> <td></td> </tr> <tr> <td>B</td> <td></td> <td></td> <td>(1)</td> <td></td> </tr> <tr> <td>A and B</td> <td></td> <td></td> <td>(1)</td> <td></td> </tr> <tr> <td>no A no B</td> <td>(1)</td> <td>(1)</td> <td>(2)</td> <td>(1)</td> </tr> </tbody> </table>			Antibodies present				anti-A	anti-B	anti-A and anti-B	no anti-A no anti-B	Antigens present	A			(1)		B			(1)		A and B			(1)		no A no B	(1)	(1)	(2)	(1)	2	<p>Two marks if the tick is in the box indicated by (2) (shaded box)</p> <p>One mark if the tick is any box indicated by (1)</p> <p>more than one tick (0)</p>
		Antibodies present																																	
		anti-A	anti-B	anti-A and anti-B	no anti-A no anti-B																														
Antigens present	A			(1)																															
	B			(1)																															
	A and B			(1)																															
	no A no B	(1)	(1)	(2)	(1)																														
	ii	<p>agglutination would occur (1)</p> <p>antibodies or anti-A stick or join to the antigens (1)</p>	2	<p>allow clumping or coagulate(1) ignore clotting</p> <p>allow 'react' as alternative to 'stick to' ignore attack / fight ignore anti B antibodies</p>																															
		Total	11																																

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
6	a	(calculation for Sanchez) (-) 6.3 (%) (1) Sanchez is very dehydrated and will have muscle spasms / cramps (1)	2	second marking is dependent on the first allow: (-) 6.25 (%) / (-) 6 (%) (1) allow: ecf for symptoms if calculation incorrect e.g. calculate (-) 4.2 then say moderately dehydrated and his muscles work less efficiently (1) ignore choice of who wins
	b	i any two from: large surface area (1) villi (1) microvilli (1) rich or good blood supply / maintains a concentration gradient (1) idea of short diffusion pathway (1)	2	allow has many capillaries (1) ignore references to permeability / thin walls ignore very long
		ii any three from: Leroy drinks water and this dilutes his blood more than Sanchez's (1) (water level) detected by the hypothalamus (1) ADH released from the pituitary gland (1) less ADH released (1) decrease in permeability of nephron / kidney (1) less water reabsorbed (in kidney tubules) (1) produces urine that is more dilute (1)	3	allow reverse arguments for Sanches as long as it is clear allow Leroy's blood becomes more dilute (1) allow there is more water in Leroy's blood (1) allow no ADH released (1) ignore absorbed unqualified but allow less water absorbed back into the blood (1) ignore no water is reabsorbed
		Total	7	

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
7	a	50 (°C) and (pH) 5 (1)	1	allow any value for pH between 4.5 and 5
	b	(55 °C) uses less energy / cheaper as less heat needed (1) idea that if the pH is not exactly 5 it makes little difference at 55 (°C) but does make a difference at 60 (°C) (1)	2	ignore just 'cheaper' ignore just 'less heat' allow at 55 (°C) it works well at a range of pH but at 60 (°C) it only works at pH5 (1) allow at 60 (°C) it will denature if pH changes slightly (1) ignore just 'at 60 the enzyme will denature' ignore at pH 5 the activity is similar at 55 (°C) and 60 (°C)
	c	advantage of free enzymes: high(er) activity levels (1) advantage of immobilised enzymes: any one from: can reuse enzymes / recover enzymes (1) product not contaminated (with enzyme) (1) can use a continuous flow process (1)	2	must have an advantage of free enzymes and an advantage of immobilised enzymes for two marks allow immobilised enzyme has lower activity (1) allow free enzymes work quicker (1) allow idea of no expense needed to immobilise them (1) allow the idea that immobilised enzymes are more stable at different pH (1) but ignore immobilised enzymes are more stable at different temperatures

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
	d	less sugar needs to be added (1) so fewer calories / less fattening / can make low calorie food (1)	2	allow can use less fructose or glucose (1) ignore it is sweeter / tastes better allow used to make 'diet' foods (1) but ignore low fat foods / healthier foods ignore just 'cheaper' but allow idea that cost of converting sucrose is made up for by being able to use less in the final product (2) e.g. converting the sucrose is expensive but as less is needed the overall cost is cheaper (2)
		Total	7	

B732/02

Mark Scheme

June 2016

Question	Answer	Marks	Guidance
8	<p>[Level 3] Describes at least one similarity AND at least one difference AND provides an explanation for the difference. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Describes at least one similarity AND at least one difference OR provides an explanation for one difference. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Describes either one similarity OR one difference. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted at grades up to C Indicative scientific points for explanation may include: Explanation:</p> <ul style="list-style-type: none"> • only one peak in Arctic (A) because there are lower temperatures or lower light levels or lower mineral levels / ORA for North Atlantic (B) • peaks / more biomass at different times because temperatures or light levels or mineral levels are higher at different times of the years / ORA for North Atlantic (B) • biomass for phytoplankton / zooplankton (reach) higher levels in Arctic (A) because of longer day length during the summer / ORA for North Atlantic (B) <p>Indicative scientific points for descriptions may include: Similarities:</p> <ul style="list-style-type: none"> • both graphs are lowest in winter / ORA • peaks for phytoplankton are higher than peaks for zooplankton / ORA • peaks for phytoplankton are earlier than peaks for zooplankton / ORA • biomass for phytoplankton (reach) higher levels than zooplankton <p>Differences:</p> <ul style="list-style-type: none"> • plankton peaks once in the Arctic (A) and twice in the North Atlantic (B) • biomass for phytoplankton / zooplankton (reach) higher levels in Arctic (A) / ORA • peaks are at different times of the year • increases /decreases in biomass are at different times of the year or identify months when the peaks are different e.g. phytoplankton peak in June or July in Arctic (A) but in March for North Atlantic (B) <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
9	a	<p>advantages: any two from: has low carbon dioxide levels or is carbon neutral / does not contribute to global warming or the greenhouse effect (1)</p> <p>high energy content (1)</p> <p>it is renewable / is sustainable (1)</p> <p>disadvantage: needs time / energy / costly equipment to produce (1)</p>	3	<p>ignore references to methane ignore uses less carbon dioxide allow reverse argument for landfill gas or natural gas e.g. landfill has more carbon dioxide (1)</p> <p>allow has only 3% carbon dioxide (1) but ignore just 'has 3% carbon dioxide' ignore decreases global warming ignore cleaner / less pollution</p> <p>allow two advantages on one line e.g. less carbon dioxide and high energy (2)</p> <p>allow costly to produce (1)</p>
	b	<p>lack of oxygen (1)</p> <p>provides anaerobic conditions (for bacteria) (1)</p>	2	<p>ignore references to water and increased growth of microbes</p> <p>allow idea of anaerobic bacteria present (1)</p> <p>allow water displaces the gas (1)</p>
	c	<p>(above) 50 (°C) or higher temperature kills the bacteria / denatures enzymes (1)</p> <p>(below) 35 (°C) or lower temperature slow down growth / respiration / reproduction (1)</p>	2	<p>ignore references to heat expanding the gas ignore 'kills enzymes' or 'denature bacteria'</p> <p>allow enzymes have less (kinetic) energy so fewer collision (1)</p> <p>ignore just 'slows process' or 'less enzyme activity' unqualified</p>
	d	<p>(idea that no use as a fuel but) low percentages of methane or 10% methane is explosive (1)</p>	1	<p>ignore there is still a chance of explosions ignore references to pollution including global warming</p>
		Total	8	

B732/02

Mark Scheme

June 2016

Question			Answer	Marks	Guidance
10	a	i	restriction (enzyme) (1)	1	allow endonuclease (1) ignore restrictive / restricted ignore EcoR1 / BamH1 / protein / ribosomes
		ii	ligase (enzyme) (1)	1	not lipase
	b		idea that the two ends (of human and plasmid) have to be complementary (1) so the ends can join (1)	2	Assume they are referring to the enzymes being the same unless they state the enzymes are different allow if the enzymes are different the ends will not be complementary (1) ignore the two ends are the 'same' / matching pieces allow so the ends can stick together / the 'sticky ends' match up (1) allow ends ligate (1) allow if the ends are different they will not join (1) allow idea that if the ends are not complementary they will not join (2) allow idea of complementary base pairing used to join the ends e.g. the ends need to be joined by complementary base pairing (2) e.g. the 'sticky ends' fit together with the correct pairs GC and AT (2)
			Total	4	

B732/02

Mark Scheme

June 2016

Question			Answer	Marks	Guidance
11	a	i	<p>any two from:</p> <p>(yes, because) each survey was over a few years (1) each survey involved many birdwatchers (1)</p> <p>(no, because) idea that the two surveys just show a 'snapshot' / only cover 7 years / only two surveys / small sample size / no evidence about the years in between (1)</p> <p>ideas about difficulty in gathering data (1)</p> <p>don't know how extensive the surveys were (1)</p>	2	<p>ignore the yes and no</p> <p>allow have been seen in the same areas in both surveys / over last 20 years (1) allow survey involves two different time periods (1)</p> <p>allow not enough data (1)</p> <p>e.g. easy to miss birds or not easy to spot birds (1) e.g. could have counted the same birds more than once (1)</p> <p>allow don't know which parts of the country were surveyed (1)</p> <p>allow there is one breeding in Scotland or North that does not match trend (1)</p>

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
	ii	<p>any two from: (no because) there is no data about temperature (1)</p> <p>there are some parakeets in the north or Scotland (1)</p> <p>idea that the parakeets haven't had time to spread north (1)</p>	2	<p>allow there is no evidence to support the south is warmer (1)</p> <p>ignore found in the east or west</p> <p>allow additional marking point (they may prefer the south because of) other factors besides temperature or named factors e.g. food availability / lack of competition / lack of predators / other valid examples (1)</p> <p>ignore (yes) as they come from warmer countries</p>
b	i	2005 (1)	1	
	ii	idea of less variation in results of surveys / more surveys done (1)	1	<p>allow results gathered were all similar (1)</p> <p>allow dotted lines are closer together in some years(1)</p> <p>allow more birdwatchers record results (1)</p> <p>allow had more data / evidence (1)</p> <p>ignore more birds seen</p> <p>ignore less outliers</p>

B732/02

Mark Scheme

June 2016

Question		Answer	Marks	Guidance
	c i	<p>any two from: (yes because) two out of three groups of birds show a decrease in population or 57 species showed a decrease but 19 showed an increase (1)</p> <p>(no because) total bird population size has not changed (very much) (1)</p> <p>not all bird species are shown or 45 bird species are not shown (1)</p> <p>graph does not show which individual species have increased or decreased (1)</p>	2	<p>ignore yes or no</p> <p>allow the seabird population went up the other two went down or only the seabird population went up (1) allow only woodland and farmland decreased (1) allow only 57 species went down (1) allow only 19 species went up (1)</p>
	ii	<p>it is easier to compare data (1)</p> <p>BUT</p> <p>idea of it is easier to compare data when the actual numbers of birds in each group may be (very) different (2)</p>	2	<p>ignore simply 1970 is when they began keeping records ignore hard to count every bird</p>
		Total	10	

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