



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

BIOLOGY

0610/43

Paper 4 Theory (Extended)

May/June 2017

MARK SCHEME

Maximum Mark: 80

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2017 series for most Cambridge IGCSE[®], Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

© IGCSE is a registered trademark.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **11** printed pages.

Mark schemes will use these abbreviations

- ; separates marking points
- / alternatives
- I ignore
- R reject
- A accept (for answers correctly cued by the question, or guidance for examiners)
- AW alternative wording (where responses vary more than usual)
- AVP any valid point
- **ecf** credit a correct statement / calculation that follows a previous wrong response
- **ora** or reverse argument
- () the word / phrase in brackets is not required, but sets the context
- underline actual word given must be used by candidate (grammatical variants excepted)
- max indicates the maximum number of marks that can be given

Question	Answer	Marks	Guidance
1(a)(i)	arrow / (s) from a vena cava through atria and into right ventricle ;	1	
1(a)(ii)	C , aorta ;	1	
1(b)(i)	ventricles relax ; increased volume of ventricles ; higher blood pressure in, the arteries / C , D and E / aorta and pulmonary artery (than in the ventricles) ; ora	1	
1(b)(ii)	stop back-flow (of blood) / ensure (blood) flows one way ;	1	! pressure changes
1(c)	1 (right) ventricle contracts ; 2 blood pressure increases (in heart) ; 3 higher blood pressure in ventricles than in arteries ; 4 semilunar valve / valve 1 , opens ; 5 blood flows into, D / E / pulmonary artery ; 6 semilunar valve closes (when blood in pulmonary artery) ; 7 D / E , is a pulmonary artery ; 8 valve 1 is a semilunar valve ;	4	sequence of events must be in the correct order
1(d)	1 septum ; <i>either</i> 2 separates oxygenated and deoxygenated blood ; <i>or</i> 3 to allow a double circulation ;	2	

Question	Answer	Marks	Guidance
2(a)	two cotyledons ; broad leaves ; leaves with branching veins ; petioles ; flower parts in multiples of four or five / flower parts not in threes ; pollen with three furrows or pores ; stem vascular bundles in a ring ; roots, develop from radicle ; AVP ;	1	A seed leaves A not adventitious e.g. secondary growth often present
2(b)(i)	a length of <u>DNA</u> ; that codes for a <u>protein</u> ;	2	
2(b)(ii)	different sequences of amino acids ; composed of different amino acids ; different shapes / folded differently / AW ;	2	
2(c)	<i>mRNA to max 1</i> 1 mRNA carries copy of, gene / DNA / base pair sequence ; 2 goes from nucleus to, ribosome / cytoplasm ; 3 determines the specific, order / sequence, of amino acids ; <i>ribosome to max 1</i> 4 site of, protein synthesis ; ('protein synthesis' is in question) 5 ribosome assembles amino acids into proteins ; 6 passes through the ribosome / reads mRNA ;	2	
2(d)(i)	1 temperature ; 2 surface area of substrate ; 3 concentration / volume / amount / number, of enzyme (solution) ; 4 concentration / volume / amount, of (named) substrate (solution) ; 5 type of enzyme ; 6 type of substrate ;	2	

Question	Answer	Marks	Guidance
2(d)(ii)	1 increases and decreases ; 2 peaks at / optimum, at pH 4.0 / 0.55 (au) ; 3 no activity beyond pH 6.5 ; 4 curve is symmetrical / AW ; 5 any data quote, e.g. activity is 0.55 (au) at pH 4.0 ;	3	A works best / AW I denatured
2(d)(iii)	1 pH 4 is the <u>optimum</u> (pH) ; 2 pH 7 enzyme is <u>denatured</u> ; 3 enzyme / protein / active site, has changed shape at pH 7; 4 shape of active site is complementary to substrate (4) / not (7) ; 5 <u>enzyme-substrate complexes</u> form (4) / not (7) ; 6 (most) effective collisions (between enzyme and substrate) (4) / none (7) ;	4	

Question	Answer	Marks	Guidance
3(a)	<i>description</i> 1 (stem) cells divide ; 2 by mitosis ; 3 to form, daughter / genetically identical, cells ; 4 nucleus buds off / AW ; 5 digested / broken down, mitochondria ; 6 only one of stem cells specialises / others continue to be stem cells ; <i>adaptations</i> 7 haemoglobin made prior to, mitochondria / nucleus removed / maturation ; 8 (loss of structures) gives space for, oxygen transport / haemoglobin ; 9 haemoglobin, transports / AW, oxygen ; 10 biconcave shape / described ; 11 large surface area (to volume ratio) ; 12 for diffusion of oxygen / gas(es) ; 13 AVP ;	6	MP1 I reproduce MP4 A no nucleus (in mature red blood cell) MP5 A no mitochondria (in mature red blood cell) MP7 must be in correct place in sequence of events MP8 A volume for space, I area MP12 I ref to gas exchange
3(b)	plasma ;	1	

Question	Answer	Marks	Guidance
3(c)	replacement / repair / wound healing ; cells die / are, rubbed off / exfoliated / AW ; growth ;	2	
3(d)(i)	iron / Fe / Fe ²⁺ / Fe ³⁺ ;	1	R ion unqualified A vitamin <u>B₁₂</u>
3(d)(ii)	tired / lethargic / 'no energy' / weakness / AW ; shortness of breath ; chest pain ; fast heartbeat ; frequent infections ; headache / dizziness / light-headedness ; cold, hands / feet ; inflammation / soreness, of tongue ; brittle nails ; unusual cravings for non-nutritive substances, such as ice, dirt or starch ; poor appetite ; tingling or crawling feeling in legs ;	2	A pale skin
3(e)	1 <u>mutation</u> ; 2 change in, base sequence / DNA ; 3 in gene / allele, for haemoglobin ; 4 inherit the <u>allele</u> (for sickle cell anaemia / mutated haemoglobin / Hb ^S) ; 5 having the recessive allele(s) / being, homozygous recessive / Hb ^S Hb ^S / heterozygous / Hb ^S Hb ^A ; 6 produce, abnormal / AW, haemoglobin ; 7 red blood cells have, sickle shape / described ; 8 AVP ;	4	I references to malaria MP4 A <u>allele</u> passed down from, a carrier / parent with sickle-cell anaemia

Question	Answer	Marks	Guidance
4(a)	birds / Aves ; <i>Any two features for max 1 ;</i> feathers beak / bill hard-shelled eggs scaly legs no teeth air sacs light-weight skeletons AVP	2	1 wings / four-chambered heart
4(b)	1 (isolated) group of individual animals / AW ; 2 of, one / the same, <u>species</u> ; 3 living in the same, habitat / ecosystem / environment / area / place / location ; 4 at the same time ;	3	
4(c)	1 killed by predators / not able to evade predators / new predators ; 2 not able to find food ; 3 more prone to disease / AW ; 4 poaching ; 5 ref to, low genetic variation ; 6 competition with new species ; 7 idea of no survival instinct /AW ; 8 AVP ; e.g. techniques not as advanced in 1980	2	MP 7 A captive animals unable to 'cope' in wild / too docile / ref to artificial selection / not integrated with wild population of parrots

Question	Answer	Marks	Guidance
4(d)	1 inbreeding / described ; 2 less / little, (genetic) variation ; 3 reduced number of alleles ; 4 increased risk of <u>genetic</u> disease ; 5 cannot reproduce / sterile ; 6 not enough animals to breed ; 7 less likely to, adapt / to evolve to / cope with, (named) change in environment ; 8 cost ; 9 AVP ;;	3	
4(e)	1 to prevent extinction (of many species) / maintain (bio)diversity ; 2 ref to preventing disruption of food, chains / web ; 3 provide, habitats (for shelter / breeding grounds / AW) for many species ; 4 and 5 ecosystems provide, 'service', for humans ; ; 6 idea of areas for, recreation / (eco)tourism / education ; 7 ethical reasons / aesthetic reasons / AW ;	3	MP 1 A saves many species MP 4 examples ref to flooding / natural disasters ref to nutrients cycle ref to maintenance of water cycle ref to greenhouse gas / carbon storage / carbon sink waste disposal provide, resources / food / fuel / drugs / raw materials / building materials provide genes (for selective breeding / genetic engineering)

Question	Answer	Marks	Guidance
5(a)(i)	72 (%) ;;	2	difference = $724 \text{ g m}^{-2} \text{ year}^{-1}$ = $724 / 1009 \cdot 100$
5(a)(ii)	1 (fertiliser provides) nutrients / salts / ions / minerals (required by plants) ; 2 (nitrogen / nitrate) needed for making, amino acids / proteins / RNA / DNA / AW ; 3 proteins are used in growth ; 4 (magnesium for) making chlorophyll ; 5 (chlorophyll for) photosynthesis ; 6 AVP ;	3	A original soil lacked minerals
5(a)(iii)	eutrophication ;	1	
5(b)	1 fertiliser decreases species diversity ; 2 at 21 weeks the difference is greater (than other weeks) ; 3 species diversity increases and decreases ; 4 peak at 6 weeks ; 5 week 24 with fertiliser not following the trend / AW ; 6 any data quote including data for both plots with units ;	3	I anomaly A increases
5(c)	1 some species compete much better than others / better at obtaining (named) resource(s) ; 2 competition for, light / water / nutrients / space / AW ; 3 some species grow faster ; 4 example of grassland, adoptions / fast growth ; 5 better at using ions released by fertiliser ; 6 more 'robust' / less successful at combating disease or pests ; 7 some cannot survive grazing by grassland herbivores / AW ; 8 ref to adaptations ;	2	MP 2 I competition for mates MP 4 examples: taller stems / larger leaves / longer roots

Question	Answers	Marks	Guidance
6(a)	(disease is caused by) a <u>pathogen</u> ; passes from one host to another ;	2	
6(b)	1 <u>electrical</u> signal ; 2 passes along / AW, a, nerve cell / neurone ; 3 in one direction ;	2	1 impulse
6(c)(i)	1 (vaccine contains) harmless / attenuated / dead / AW, form of, (named) pathogen / antigen ; 2 (antigens / vaccine) stimulate an <u>immune response</u> ; 3 ref to lymphocytes ; 4 lymphocytes / white blood cells, make antibodies ; 5 ref to specificity ; 6 production of memory cells ; 7 rapid, immune response / AW, if exposed to same, pathogen / antigen ; 8 gives long-term immunity ; 9 AVP ;	4	
6(c)(ii)	1 bacteria may still be present (in the population) ; 2 in carriers / in people who have no symptoms ; 3 infected people moving into the, country / area / AW ; 4 if few people are, immune / vaccinated, bacterium is more likely to be transmitted ; 5 idea of herd immunity ; 6 some people cannot respond to, antigens / vaccines ; 7 protects people who travel to other countries ; 8 booster vaccinations are sometimes required) / AW ;	2	MP5 A new people arriving in a country (who are not vaccinated) MP6 e.g. people with HIV / babies / elderly
6(d)(i)	1 antibodies are made of protein ; 2 proteins / antibodies, are digested / denatured, in the alimentary canal ; 3 direct route to site of infection ;	2	

Question	Answer	Marks	Guidance
6(d)(ii)	1 no (active) immune response ; 2 no memory cells ; 3 antibodies are broken down in the body ; 4 antibodies are not made by body's own lymphocytes ;	2	