



---

**BIOLOGY**

**0610/42**

Paper 4 Theory (Extended)

**October/November 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 International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2017 series for most Cambridge IGCSE<sup>®</sup>, Cambridge International A and AS Level 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 or reverse argument
- ora
- ( ) 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)	carbon dioxide / CO <sub>2</sub> / water / H <sub>2</sub> O (vapour) ; (respiring / all) cells / tissues / mitochondria / named tissue(s) / named organ(s) ;	2	R alveoli / lungs
1(a)(ii)	urea ;  toxic / poisonous / harmful / waste / AW ;	2	A ammonia / ammonium / creatin(ine) / uric acid / urine
1(b)(i)	glomerulus ;	1	A ball / knot / AW, of capillaries A Bowman's capsule / basement membrane
1(b)(ii)	red (blood) cells / erythrocytes ; phagocytes ; lymphocytes ; named plasma proteins ; ;  platelets ;	2	e.g. albumen / fibrinogen / insulin / glucagon / thrombin / antibodies / clotting factors
1(c)(i)	microvilli – E ; nucleus – A ; mitochondrion – C ;	3	
1(c)(ii)	stores / contains, chromosomes / genes / alleles / genetic information / DNA ; controls the (activity / reactions of the) cell ; controls how cells, develop / divide / reproduce / grow ; <i>idea that it stores instructions for, making proteins / protein synthesis / making RNA ;</i> AVP ;	1	I 'controls movement of cell'  I giving instructions unqualified A 'codes for protein' e.g. making ribosome(s)
1(c)(iii)	small intestine / duodenum / ileum ;	1	A villi / jejunum / tongue / liver / egg cell / white blood cells / ear / nose

Question	Answer	Marks	Guidance
1(c)(iv)	<p>(microvilli give a) large surface area ; for diffusion / described as movement down a concentration gradient ;</p> <p>lots of, mitochondria / <b>C</b> ; <b>C</b> / mitochondria, are the site of (aerobic) respiration ; <b>C</b> / mitochondria, provide energy / make ATP ; energy / ATP, is needed for active transport ; (active transport needed for) movement against concentration gradient ;</p> <p>ref to carrier proteins (in cell membrane) ; AVP ;</p>	<b>4</b>	<p>mp2 is linked to mp1</p> <p><b>R</b> 'produces energy'</p> <p>e.g. substances pass to blood to maintain concentration gradient</p>

Question	Answer	Marks	Guidance
2(a)	prevents contamination / transmission, of (named) pathogen / toxin ;  prevents, infection / spreading of disease / illness ; <b>ora</b>	<b>2</b>	
2(b)	1 low (concentration) of lactic acid in blood at, rest / the start / before ; 2 lactic acid (concentration) increases, steeply / quickly / AW, during exercise ; 3 reaches a peak / increases and decreases ; 4 decreases steeply, then gradually after exercise ; 5 any use of figures ;  <i>explanation</i> 6 oxygen, demand increases / does not reach muscles fast enough / AW ; 7 <u>anaerobic respiration</u> ; 8 provides / releases, energy ;  9 anaerobic respiration produces lactic acid ; 10 lactic acid diffuses from muscles into the blood ; 11 lactic acid is, broken down / respired / oxidised / converted to glucose / AW ; 12 in the liver ; 13 ref. to <u>oxygen debt</u> ;	<b>6</b>	e.g. peak at $13.2 \text{ mmol dm}^{-3}$ at 15 minutes $\pm 0.2 \text{ mmol}$  <b>A</b> produces ATP <b>R</b> produce / makes, energy'
2(c)(i)	<b>P</b> $12 \text{ (km h}^{-1}\text{)}$ <b>and Q</b> $10 \text{ (km h}^{-1}\text{)}$ ;	<b>1</b>	<i>One mark only both must be right</i>
2(c)(ii)	<i>idea that</i> trained athlete / <b>P</b> , has a higher level of (aerobic) fitness (than <b>Q</b> ) ;  difference in, gender / age / height / mass / lung capacity / lung mass / stroke volume / muscle type ; AVP ;	<b>1</b>	<b>A P</b> , is fitter than <b>Q</b> / has trained more than <b>Q</b>  e.g. ref to genetics but not different genes

Question	Answer	Marks	Guidance
2(c)(iii)	<ol style="list-style-type: none"> <li>1 increase in demand for energy ;</li> <li>2 increase in (aerobic) respiration ;</li> <li>3 increase in demand for oxygen ;</li> <li>4 increase in carbon dioxide (concentration) ;</li> <li>5 decrease in pH / increase in acid, in the blood ;</li> <li>6 detected by the, brain / chemoreceptors ;</li> <li>7 (brain stimulates) an increase in breathing rate / faster breathing ;</li> <li>8 (brain stimulates) an increase in depth of breathing / AW ;</li> <li>9 ref to negative feedback in correct context ;</li> </ol>	<b>4</b>	<p><b>A</b> 'needs' more energy</p> <p>e.g. rate of breathing remains high until carbon dioxide concentration returns to, normal / set point</p>

Question	Answer	Marks	Guidance
3(a)	<ol style="list-style-type: none"> <li>1 (immediate / steep) increase in numbers / no lag phase ;</li> <li>2 exponential / log, phase ;</li> <li>3 decelerating phase / described as increase slowing down ;</li> <li>4 stationary phase / plateau / levels off / remains constant ;</li> <li>5 levels, at 1.6 to 1.65 million / from between 1850 and 1875 ;</li> </ol>	<b>3</b>	

Question	Answer	Marks	Guidance
3(b)	<p><i>population increases</i></p> <ol style="list-style-type: none"> <li>1 more births than deaths ;</li> <li>2 more sheep are imported ;</li> <li>3 more food needed for increasing human population ;</li> <li>4 <i>idea that</i> more sheep needed for, export / economy of Tasmania ;</li> </ol> <p><i>population remains constant</i></p> <ol style="list-style-type: none"> <li>5 <i>idea that</i> population reaches, carrying capacity / described ;</li> <li>6 number of births = number of deaths / culling for meat / AW ;</li> <li>7 any ref to <u>limiting factor(s)</u> in correct context in either increase or plateau ;</li> <li>8 any example of a limiting factor ; resources food supply water supply space / area of land for grazing / AW disease predators competitors</li> </ol>	<b>3</b>	<p>e.g. maximum that the land can support</p> <p>I drought / floods / any other natural disaster</p>
3(c)	<ol style="list-style-type: none"> <li>1 <i>idea that</i> farmer, chooses / selects (animals that are best adapted to conditions) ;</li> <li>2 appropriate named feature(s) ;</li> <li>3 selected animals bred together / (cross) breed them ;</li> <li>4 select the offspring that show the features required ;</li> <li>5 repeat, the selection and breeding / the process ;</li> <li>6 <i>idea that</i> imports (male) sheep with desired features to mate with flock ;</li> <li>7 uses artificial insemination ;</li> </ol>	<b>4</b>	
3(d)	<p>providing for the needs of (the increasing) humans (population) ;</p> <p>without harm to the (natural) environment / ecosystem(s) / habitat / biodiversity ;</p>	<b>2</b>	<p><b>A</b> examples of development, e.g. roads / houses / cities / urbanisation / AW</p>

Question	Answer	Marks	Guidance												
4(a)	<p>little / less / AW / no, variation / (genetic) diversity ;  ref to becoming homozygous ;  less chance of, surviving / adapting / evolving, to, changing conditions / new environments / (new) disease ;  risk of <u>extinction</u> ;  increase chance of genetic disease ;</p> <p>adapted variety spreads / AW ;  only one plant needed / no mate required ; <b>R</b> if 'asexual reproduction' is given  greater chance of pollination / ensures pollination occurs ;  <i>idea that</i> reproduction / fertilisation, successful if no other plants (of same species)  nearby ;  less wastage of pollen ;  not dependent on (named) agent of pollination ;</p> <p>AVP ; no hybrid vigour / smaller gene pool</p>	4	<p><b>A</b> fewer <u>alleles</u> <b>I</b> ref to gene(s)  <b>R</b> cloning / uniform(ity)</p> <p><b>A</b> increased risk of abnormalities  /genetic 'weakness' / AW</p> <p><b>A</b> gametes <b>I</b> no wastage</p>												
4(b)(i)	<table border="1" data-bbox="412 740 1337 1177"> <thead> <tr> <th data-bbox="412 740 770 786">term</th> <th data-bbox="770 740 1337 786">example in <i>P. sativum</i></th> </tr> </thead> <tbody> <tr> <td data-bbox="412 786 770 866">dominant trait</td> <td data-bbox="770 786 1337 866">purple flowers</td> </tr> <tr> <td data-bbox="412 866 770 946">recessive allele</td> <td data-bbox="770 866 1337 946"><b>b</b> ;</td> </tr> <tr> <td data-bbox="412 946 770 1026">phenotype</td> <td data-bbox="770 946 1337 1026">(flower) colour / purple (flowers) / white (flowers) ;</td> </tr> <tr> <td data-bbox="412 1026 770 1106">homozygous genotype</td> <td data-bbox="770 1026 1337 1106"><b>BB</b> and / or <b>bb</b> ;</td> </tr> <tr> <td data-bbox="412 1106 770 1177">heterozygous genotype</td> <td data-bbox="770 1106 1337 1177"><b>Bb</b> ;</td> </tr> </tbody> </table>	term	example in <i>P. sativum</i>	dominant trait	purple flowers	recessive allele	<b>b</b> ;	phenotype	(flower) colour / purple (flowers) / white (flowers) ;	homozygous genotype	<b>BB</b> and / or <b>bb</b> ;	heterozygous genotype	<b>Bb</b> ;	4	
term	example in <i>P. sativum</i>														
dominant trait	purple flowers														
recessive allele	<b>b</b> ;														
phenotype	(flower) colour / purple (flowers) / white (flowers) ;														
homozygous genotype	<b>BB</b> and / or <b>bb</b> ;														
heterozygous genotype	<b>Bb</b> ;														



Question	Answer	Marks	Guidance
4(b)(ii)	<p><i>parental phenotype</i>      purple flowers x white flowers    purple flowers x white flowers</p> <p><i>parental genotype</i>                      Bb      x      bb                                      BB      x      bb ;</p> <p><i>genotypes of gametes</i>      B      b      +      b      (b)      B      B      +      b      (b)      ;</p> <p><i>offspring genotypes</i>                      Bb                      bb                                      Bb                      (Bb);</p> <p><i>offspring phenotypes</i>                      purple flowers, white flowers ;                                      purple flowers ;</p>	5	
4(c)(i)	<p><i>test cross 1</i></p> <p><b>GG x GG / GG x Gg    A GG on its own    R GG x gg ;</b></p> <p><i>test cross 2</i></p> <p><b>Gg x Gg ;</b></p>	2	<b>A Gg on its own</b>
4(c)(ii)	<p>white plants are, homozygous recessive / <b>gg</b> ; (white plants / no chlorophyll) cannot, photosynthesise / produce own food ; (therefore white plants) do not grow into mature plants / do not produce flowers / die before reproducing / AW ;</p>	2	I cannot survive unqualified

Question	Answer	Marks	Guidance
5(a)	<i>Helicobacter</i> ;	1	
5(b)	circular DNA / chromosome ; plasmid(s) ; cell membrane ; cell wall (not made of cellulose) ; cytoplasm ; capsule ; (small) ribosomes ; flagella ; AVP ;	2	A naked, DNA / chromosome  I cilia e.g. pili
5(c)(i)	antibiotic(s) ;	1	
5(c)(ii)	(stomach / hydrochloric / gastric) acid / HCl / mucus ;	1	
5(d)	<i>active immunity</i> 1 exposure to <u>antigen</u> ; <b>ora</b> 2 after, infection by pathogen / vaccination ; 3 immune response occurs / antibodies produced ;  <i>passive immunity</i> 4 <u>antibodies</u> acquired from another individual ; 5 e.g. by breast milk / injection of antibodies ; 6 active is, permanent / long-term (immunity) ; <b>ora</b> 7 ref to memory cells, in active / not in passive ; 8 response is slow on first exposure in active ; <b>ora</b>	4	

Question	Answer	Marks	Guidance																		
6(a)	<table border="1" data-bbox="439 244 1310 711"> <thead> <tr> <th data-bbox="439 244 685 320">blood vessel</th> <th data-bbox="685 244 1066 320">name of blood vessel</th> <th data-bbox="1066 244 1310 320">oxygenated / deoxygenated</th> </tr> </thead> <tbody> <tr> <td data-bbox="439 320 685 399"><b>A</b></td> <td data-bbox="685 320 1066 399">hepatic portal vein</td> <td data-bbox="1066 320 1310 399">deoxygenated ;</td> </tr> <tr> <td data-bbox="439 399 685 477"><b>B</b></td> <td data-bbox="685 399 1066 477">(inferior) vena cava</td> <td data-bbox="1066 399 1310 477">deoxygenated ;</td> </tr> <tr> <td data-bbox="439 477 685 555"><b>C</b></td> <td data-bbox="685 477 1066 555">pulmonary vein</td> <td data-bbox="1066 477 1310 555">oxygenated ;</td> </tr> <tr> <td data-bbox="439 555 685 633"><b>D</b></td> <td data-bbox="685 555 1066 633">aorta</td> <td data-bbox="1066 555 1310 633">oxygenated ;</td> </tr> <tr> <td data-bbox="439 633 685 711"><b>E</b></td> <td data-bbox="685 633 1066 711">femoral artery</td> <td data-bbox="1066 633 1310 711">oxygenated ;</td> </tr> </tbody> </table>	blood vessel	name of blood vessel	oxygenated / deoxygenated	<b>A</b>	hepatic portal vein	deoxygenated ;	<b>B</b>	(inferior) vena cava	deoxygenated ;	<b>C</b>	pulmonary vein	oxygenated ;	<b>D</b>	aorta	oxygenated ;	<b>E</b>	femoral artery	oxygenated ;	4	
blood vessel	name of blood vessel	oxygenated / deoxygenated																			
<b>A</b>	hepatic portal vein	deoxygenated ;																			
<b>B</b>	(inferior) vena cava	deoxygenated ;																			
<b>C</b>	pulmonary vein	oxygenated ;																			
<b>D</b>	aorta	oxygenated ;																			
<b>E</b>	femoral artery	oxygenated ;																			
6(b)(i)	chemical / substance, made by a gland ; travels in the blood (plasma) ; alters the activity of one or more specific target organs ;	2	I proteins R enzymes  A alters activity of / affects, target organ(s) A controls																		
6(b)(ii)	1 controls blood, glucose / sugar, concentration / level ; 2 increased, uptake / respiration, of glucose ; 3 (stimulates cells to) convert glucose to <u>glycogen</u> ; 4 <i>idea that</i> target organs are, muscle / liver ; 5 (so) decreases blood glucose concentration ; 6 ref to, negative feedback / homeostasis ;	3																			
6(c)	1 shunt vessels, constrict / close / AW ; 2 less blood flow through shunt vessels ; 3 arterioles, widen / dilate / relax ; 4 <u>vasodilation</u> (in context of arteries and arterioles) ;  5 more blood flow (through capillaries) near the surface of the skin / AW ; 6 (more) heat loss from blood (by radiation) ;	3	R if in context of capillaries / veins A 'blood vessels'																		