

Question	Marking Guidelines	Mark	Comments						
1(a)(i)	Phosphate and ribose;	1	Accept in either order. Both correct for one mark. For phosphate accept PO <sub>4</sub> / Pi / (P) but not P. Do not accept phosphorus. Ignore references to pentose / sugar.						
1(a)(ii)	TAGGCA;	1							
1(b)(i)	Does not contain hydrogen bonds/base pairs /contains codons / does not contain anticodon / straight/not folded / no amino acid binding site/longer;	1	Assume that "it" refers to mRNA Do not accept double stranded.						
1(b)(ii)	(pre-mRNA) contains introns / mRNA contains only exons;	1	Assume that "it" refers to pre-mRNA Accept non-coding as equivalent to intron.						
1(c)(i)	<table border="1" data-bbox="376 1062 848 1267"> <thead> <tr> <th data-bbox="383 1066 719 1129">Part of chromosome</th> <th data-bbox="723 1066 842 1129">U</th> </tr> </thead> <tbody> <tr> <td data-bbox="383 1133 719 1197">Middle</td> <td data-bbox="723 1133 842 1197">18</td> </tr> <tr> <td data-bbox="383 1200 719 1264">End</td> <td data-bbox="723 1200 842 1264">21</td> </tr> </tbody> </table>	Part of chromosome	U	Middle	18	End	21	1	One mark for both figures correct
Part of chromosome	U								
Middle	18								
End	21								

1(c)(ii)	<ol style="list-style-type: none"><li>1. Different genes;</li><li>2. Have different (base) sequences / combinations of (bases);</li><li>3. (Pre-mRNA) transcribed from different DNA/codes for different proteins;</li></ol>	2 max	<p>Note this question is not about the position of bases on genes.</p> <ol style="list-style-type: none"><li>1. Telomere on end is equivalent</li></ol>
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Question	Marking Guidelines	Mark	Comments
2(a)	Organisms/individuals of one species in a habitat / same place;	1	Accept 'same gene pool' as 'species'
2(b)	Any two factors for one mark e.g. Improved medical care, improved nutrition, more food, improved sanitation, less disease, improved living conditions, improved economy, war ends;	1	Accept two related factors e.g. vaccination and better health care
2(c)	Correct answer in range of 269-291 (%);; One mark for incorrect answer but shows change of 6.2 ( $\times 1000$ ) / 6.3 ( $\times 1000$ ) / 6.4 ( $\times 1000$ );	2	
2(d)	1. Increase in (average) life expectancy;  2. Low death rate / decrease in death rate / few(er) deaths / more survivors / fewer babies/infants die / more old(er) people;	2	Allow <b>one maximum mark</b> if candidate provides correct answer using 2007 curve  2. Allow any description which suggests more survivors or fewer deaths

Question	Marking Guidelines	Mark	Comments
3(a)	<ol style="list-style-type: none"> <li>1. Large number of eggs/offspring/flies (therefore) improves reliability / can use statistical tests/ are representative / large <u>sample</u> (size) / reduces <u>sampling</u> error;</li> <li>2. Small size / (breed) in small flasks / simple nutrient medium (therefore) reduces costs/easily kept/stored;</li> <li>3. Size / markings / phenotypes (therefore) males/females easy to identify;</li> <li>4. Short generation time / 7-14 days / develop quickly / reproduce quickly (therefore) results obtained quickly / saves times / many generations;</li> </ol>	2 max	<p>Each mark point requires a feature linked in mark scheme (by therefore) to an explanation</p> <ol style="list-style-type: none"> <li>1. Do not accept a large number of eggs produces a large number of flies unless the term <u>sample</u> is used</li> <li>1. Ignore references to accuracy or precision</li> <li>2. Accept small size so can be kept in small flasks</li> <li>3. Answers must relate to size, markings or use the term phenotype</li> </ol>
3(b)(i)	<ol style="list-style-type: none"> <li>1. <math>X^R X^R</math> and <math>X^r Y</math>;</li> <li>2. <math>X^R</math> and <math>X^R</math> plus <math>X^r</math> and <math>Y</math>;</li> <li>3. <math>X^R X^r</math> and <math>X^R Y</math>;</li> </ol> <p><b>OR</b></p> <ol style="list-style-type: none"> <li>1. <math>X^R X^r</math> and <math>X^r Y</math>;</li> <li>2. <math>X^R</math> and <math>X^r</math> plus <math>X^r</math> and <math>Y</math>;</li> <li>3. <math>X^R X^r</math> and <math>X^R Y</math>;</li> </ol>	3	<p>All marking points are completely independent. Allow crosses from the following parents for a possible three marks:</p> <p><math>X^R X^R</math> and <math>X^r</math>-  <math>X^R X^R</math> and <math>X^r Y</math>;  <math>RR</math> and <math>rY</math> / <math>rY^-</math>  <math>RR</math> and <math>r</math>- or <math>RR</math> and <math>r</math></p> <p><b>OR</b></p> <p><math>X^R X^r</math> and <math>X^r</math>-  <math>X^R X^r</math> and <math>X^r Y</math>;  <math>Rr</math> and <math>rY</math> / <math>rY^-</math>  <math>Rr</math> and <math>r</math>- or <math>Rr</math> and <math>r</math></p> <p>Accept different symbols e.g. <math>W</math> and <math>w</math></p> <ol style="list-style-type: none"> <li>2. Accept gametes in a punnet square</li> </ol>
3(b)(ii)	Fertilisation is random / fusion of gametes is random / small/not large population/sample / selection advantage/disadvantage / lethal alleles;	1	<p>Mutation = neutral</p> <p>Random mating = neutral</p> <p>Accept fertilisation/fusion of gametes is due to chance</p>

<p>3(c)</p>	<ol style="list-style-type: none"> <li>1. Males have one <u>allele</u>;</li> <li>2. Females need two recessive alleles / must be homozygous recessive / could have dominant and recessive alleles / could be heterozygous/carriers;</li> </ol>	<p>2</p>	<p>Answers should be in context of alleles rather than chromosomes</p>
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Question	Marking Guidelines	Mark	Comments
4(a)	<ol style="list-style-type: none"> <li>1. Decrease in (percentage cover) of bare ground/water linked to more plants/species / increase in plant coverage;</li> <li>2. Change in diversity / number of plant/species/named (species) as abiotic conditions altered / due to <u>competition</u> / more soil / less hostile;</li> <li>3. Increase in depth of soil as plants die / humus formed;</li> </ol>	3	<p>Allow <b>one maximum mark</b> for answers which describe all three changes <b>without</b> a suitable explanation for any change</p> <ol style="list-style-type: none"> <li>1. Must be idea of more/increase not just change in species/plants</li> <li>2. Accept pioneer species replaced due to competition</li> <li>2. Accept description of change in species</li> <li>2. Accept 'more suitable' = less hostile</li> </ol>
4(b)	<ol style="list-style-type: none"> <li>1. Greater variety of food / more food <u>sources</u>;</li> <li>2. More/variety of habitats/niches;</li> </ol>	2	<ol style="list-style-type: none"> <li>1. 'More food' = neutral</li> <li>2. Ignore 'more homes' or reference to 'shelters'</li> </ol>
4(c)(i)	<ol style="list-style-type: none"> <li>1. Marking is not removed / marking does not affect survival/predation;</li> <li>2. Limited/no immigration/emigration;</li> <li>3. Sufficient time for (marked) individuals to mix (within the population);</li> <li>4. No/little births/deaths/breeding;</li> <li>5. Sampling method is the same;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>2. Accept 'migration' and descriptions of immigration/emigration</li> <li>2. and 4. Increase/decrease in population is not sufficient – there must be a reason</li> <li>3. Accept – 'For mixing to occur between samples'</li> <li>5. Ignore 'random sampling'</li> </ol>
4(c)(ii)	<p>Correct answer of ...34 = 2 marks;;                      Incorrect answer but shows correct formula in words or numbers                      e.g. <math>17 \times 20 \div 10</math>;</p>	2	<ol style="list-style-type: none"> <li>1. Allow <b>one mark</b> for an answer of 51 as candidate has misinterpreted the second sample as being = 30</li> <li>2. Reject correct formula multiplied by 100</li> </ol>

Question 5 & 6: N/A

Question	Marking Guidelines	Mark	Comments
7(a)	<ol style="list-style-type: none"> <li>Provides a standard/benchmark;</li> <li>Can compare (different pesticides/chemicals);</li> <li>Does not kill all the tadpoles/organisms/population;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>Accept 'kills 50% of tadpoles'</li> </ol>
7(b)	<ol style="list-style-type: none"> <li>Only carried out on one species of toad/African toad / not carried out on USA toads/tadpoles/species;</li> <li>Only tested for 1-4 days/short term / not 16 days/long term;</li> <li>Did not look at effect of predator/predation;</li> <li>Used various pesticides / may not have used malathion;</li> </ol>	3 max	<ol style="list-style-type: none"> <li>Accept not carried out on all species of toad</li> <li>Accept carried out on different species</li> <li>Do not accept one type of toad</li> <li>Do not accept biotic factor on its own, there must be a reference to the predator</li> <li>Accept 'did not use malathion'</li> </ol>
7(c)(i)	<ol style="list-style-type: none"> <li>(See) effect of pesticide/malathion;</li> <li>Without predator/newts/stress / to compare/see effect with predator/newts/stress present (in experiment <b>2</b>);</li> </ol>	2	
7(c)(ii)	<ol style="list-style-type: none"> <li>Tadpoles not killed/eaten;</li> <li>Newts are seen/detected;</li> </ol>	2	
7(d)	<ol style="list-style-type: none"> <li>Large surface area to volume ratio;</li> <li>Rapid/more diffusion / shorter diffusion pathway;</li> <li>Longer time exposure to pesticide / adults/toads live in and out of water / tadpoles remain/stay in water;</li> </ol>	2 max	



7(e)	<ol style="list-style-type: none"> <li>1. Link between using less (pesticide) and cost/less effect on environment/organisms;</li> <li>2. Pesticide/malathion diluted (in water);</li> <li>3. Concentrated due to evaporation;</li> <li>4. Concentrated in food chains/webs/tadpoles/habitat;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>1. Accept answers which link concentration (of pesticide) to being 'cost effective'</li>   <li>4. Accept (pesticide) 'builds up' in the environment / bioaccumulation / biomagnification</li> </ol>
7(f)	<ol style="list-style-type: none"> <li>1. Can see effect of other biotic factors / effect on other organisms;</li> <li>2. Can see effect of abiotic factors / named abiotic factor;</li> </ol>	2	

Question	Marking Guidelines	Mark	Comments
8(a)	<ol style="list-style-type: none"> <li>1. <u>Chlorophyll</u> absorbs light <u>energy</u>;</li> <li>2. Excites electrons / electrons removed (from chlorophyll);</li> <li>3. Electrons move along carriers/electron transport chain releasing <u>energy</u>;</li> <li>4. <u>Energy</u> used to join ADP and Pi to form ATP;</li> <li>5. <u>Photolysis</u> of water produces protons, electrons and oxygen;</li> <li>6. NADP reduced by electrons / electrons and protons / hydrogen;</li> </ol>	5 max	<ol style="list-style-type: none"> <li>1. Accept light <u>energy</u> 'hits' <u>chlorophyll</u></li> <li>1. Accept photon for light <u>energy</u></li> <li>2. Accept higher energy level as 'excites'</li> <li>3. Accept movement of H<sup>+</sup>/protons across membrane releases energy</li> <li>3. and 4. Negate 'produces energy' for either mark but not for both</li> <li>4. Accept energy used for phosphorylation of ADP to ATP</li> <li>4. Do not accept P as Pi</li> <li>6. Accept NADP to NADPH (or equivalent) by addition of electrons/hydrogen</li> <li>6. Do not accept NADP reduced by protons on their own</li> </ol>
8(b)	<ol style="list-style-type: none"> <li>1. Some light is reflected / not of appropriate wavelength;</li> <li>2. Some light misses leaves/ photosynthetic tissue/chloroplasts/chlorophyll;</li> <li>3. Heat loss;</li> <li>4. (Energy loss via) respiration;</li> <li>5. Loss via faeces/undigested food/part of organism not eaten;</li> <li>6. Excretion/named excretory product;</li> </ol>	5 max	<ol style="list-style-type: none"> <li>1. Light not absorbed is not enough on its own</li> <li>3. Accept (energy used to) maintain body temperature but do not accept to keep warm or warm blooded</li> <li>4. Do not accept 'energy used in respiration'</li> </ol>

<p>8(c)</p>	<ol style="list-style-type: none"> <li>1. Variation/variety;</li> <li>2. Mutation;</li> <li>3. Some plants have <u>allele</u> to survive/grow/live in high concentration of copper/polluted soils;</li> <li>4. (Differential) reproductive success / adapted organisms reproduce;</li> <li>5. Increase in frequency of <u>allele</u>;</li> <li>6. No interbreeding (with other populations) / separate gene pool / gene pool differs (from other populations);</li> </ol>	<p>5 max</p>	<ol style="list-style-type: none"> <li>2. Do not accept answers which suggest the mutation is caused by copper</li> <li>3. Reference to immunity disqualifies this mark</li> <li>3. Do not disqualify mark for references to allele providing resistance to copper</li> <li>6. Accept reproductive isolation</li> </ol>
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Question	Marking Guidelines	Mark	Comments
9(a)(i)	1. Has the restriction site (cut by <i>Kpn1</i> ); 2. Once; 3. 1000bp from <i>Kpn1</i> on site of plasmid / $\frac{1}{3}$ way along;	2	2. Must be explicit. Has a restriction site is point 1 only.
9(a)(ii)	(Most of) plasmid and rest of unknown DNA / rest of recombinant plasmid / rest of plasmid but not 1000 bp part;	1	Looking for idea rather than precise wording
9(b)	2;	1	
9(c)(i)	Give one mark for answer confined to smaller fragments move further/faster; Give two marks for comparing with distance/speed moved by fragments of known size/markers / DNA ladder;;	2	
9(c)(ii)	1. Large pieces of DNA present; 2. Add up to more than total length of original DNA / plasmid plus inserted DNA; 3. Because this would add undigested to total (original) length;	2	

Question	Marking Guidelines	Mark	Comments
10(a)	<ol style="list-style-type: none"> <li>1. Bind to DNA/gene;</li> <li>2. At specific region/base sequence/promoter sequence;</li> <li>3. Stimulate transcription / prevents transcription / turn on gene / turn off gene;</li> </ol>	2 max	<ol style="list-style-type: none"> <li>1. Generally attaching to DNA</li> <li>2. At specific place</li> <li>3. Accept description of transcription. Do not accept protein synthesis</li> </ol>
10(b)(i)	Has complementary base sequence;	1	
10(b)(ii)	<ol style="list-style-type: none"> <li>1. No longer able to make specific protein / cannot make whole protein / mRNA cannot be translated;</li> <li>2. Because mRNA has been cut into pieces;</li> </ol>	2	<ol style="list-style-type: none"> <li>1. Reference to transcribes negates this point.</li> <li>2. Do not accept mRNA destroyed / do not accept gene not expressed. Reference to target gene broken down negates this point.</li> </ol>
10(b)(iii)	<ol style="list-style-type: none"> <li>1. Some diseases are genetic / caused by mutations;</li> <li>2. siRNA will stop product of this gene / the protein being produced / stops translation;</li> </ol>	2	

Question	Marking Guidelines	Mark	Comments
11(a)	1. Hydrolysis breaks proteins / hydrolyses proteins / produces amino acids (from proteins); 2. Protein synthesis involves condensation; 3. Hydrolysis of polysaccharides/lipids linked to energy source (for synthesising proteins);	2 max	Do not award any credit if hydrolysis and condensation confused.  3. Accept hydrolysis of other molecules if related to protein synthesis
11(b)	Amino acids (from calliphorin) can be joined in different sequences/rearranged;	1	
11(c)	1. Fall, rise and fall; 2. Rise after 40 and fall after 80;	2	Ignore concentration values
11(d)(i)	Fall / increase then fall ; Lysosomes associated with tissue breakdown;	2	
11(d)(ii)	1. Tissues/cells are being broken down; 2. RNA is digested/hydrolysed/broken down; 3. By enzymes from lysosomes; 4. New proteins not made / no new RNA made;	2 max	
11(e)	1. (RNA) associated with making protein; 2. New / adult tissues are forming;	2	

11(f)	<ol style="list-style-type: none"><li>1. In the first 6 days no/little oxygen supplied / with breakdown of tracheae, no/little oxygen supplied;</li><li>2. (Without tracheae) respire anaerobically;</li><li>3. Anaerobic respiration involves reactions catalysed by enzyme <b>B</b> / conversion of pyruvate to lactate/involves lactate production;</li><li>4. Enzyme <b>A</b>/Krebs cycle is part of aerobic respiration;</li></ol>	4	Or, with emphasis on aerobic respiration: <ol style="list-style-type: none"><li>1. Tracheae supply oxygen / after 6 days oxygen supplied;</li><li>2. (With tracheae) tissues can respire aerobically;</li></ol>
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**Additional notes on marking Question 12**

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay are those corresponding to the appropriate descriptors. Candidates may gain credit for any information providing that it is biologically accurate, relevant and of a depth in keeping with an A-level course of study. Material used in the essay does not have to be taken from the specification, although it is likely that it will be. In fact, extra credit is given for those who show evidence of a greater breadth of study.

These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally come from each of the areas specified if maximum credit is to be awarded. Where the content is drawn from two areas, two marks should be awarded and where it is taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.



**Essay A Using DNA in science and technology**

Section

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**DNA and classification**

- 2.2 Structure of DNA
  - 2.3 Differences in DNA lead to genetic diversity
  - 2.9 Comparison of DNA base sequences  
DNA hybridisation
- 

**Genetic engineering and making useful substances**

- 1.3 Plasmids
  - 5.8 The use of recombinant DNA to produce transformed organisms that benefit humans
- 

**Other uses of DNA**

- 2.5 Cell cycle and treatment of cancer
  - 5.8 Gene therapy;  
Medical diagnosis and the treatment of human disease;  
The use of DNA probes to screen patients for clinically important genes;
-

**Essay B**     **A cycle is a biological pathway or process in which the end product of one cycle becomes the starting point for the next. Write an essay about cycles in biology.**

Section

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**Ecological cycles**

- 4.6     Nutrient cycles  
          Carbon cycle  
          Nitrogen cycle
- 

**Biochemical cycles**

- 1.2     Enzyme action  
 4.2     Synthesis of ATP from ADP  
 4.3     Light-independent reaction  
 4.4     The Krebs cycle
- 

**Physiological and genetic cycles**

- 1.4     The mechanism of breathing  
 1.5     The cardiac cycle  
 2.5     The cell cycle  
 5.3     Muscle contraction  
 5.5     Oestrous cycle
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