

Question 1

Question	Marking Guidance	Mark	Comments
01.1	1. Laboratory-raised female (guppies) might not react/behave/choose in the same way (as wild guppies); 2. (Transparent) barrier might not allow for normal (courtship) behaviour/interaction; 3. Do not know if (guppies) have been used in previous experiments; 4. 10 minutes might not be long enough for females to make a (final) choice OR Not enough time for females to make a (final) choice;	3 max	Ignore answers relating to sample size 1. Accept laboratory-raised female (guppies) might not be representative of wild females 2. Accept choice might involve chemical/mechanical signals/interaction 2. Accept colour might not be the only thing females are attracted to 4. Accept descriptions of a choice eg 'show attraction'
01.2	1. (Females with large brains) will mate with males bright in colour; 2. Their (male) offspring would be (more likely to be) bright in colour; 3. (Bright in colour male) offspring could attract larger brained females; 4. The population/offspring could (evolve to) have larger brains; 5. The population/offspring are better at identifying/avoiding predators;	3 max	Accept answers that include references to alleles 4. and 5. Ignore answers relating to females only
01.3	1. Not geographically isolated; 2. (Leading to) reproductive isolation OR Gene pools kept separate; 3. Changes in allele <u>frequencies</u> ; 4. Cannot breed/mate to produce fertile offspring;	3 max	1. Accept are in the same area 2. Accept large brained females will only mate with males bright in colour <u>and</u> small brained females will only mate with males dull in colour 3. Reject gene frequencies 4. Reject inbreeding

Question 2

Question	Marking Guidance	Mark	Comments
03.1	1. Mutation in the viral DNA/RNA/genome/genetic material; 2. Altered (tertiary structure of the) viral attachment protein; 3. Allows it/attachment protein/virus to bind (to receptors of other species);	2 max	1. Accept named examples mutations 2. Accept 'antigen' for 'attachment protein' 2. Accept causes antigenic variability 3. Accept descriptions of binding eg is complementary
03.2	For one mark, accept any two of the following: • The polymerase chain reaction • Genetic/DNA fingerprinting • (Gel) electrophoresis • DNA/genome sequencing;	1	Accept PCR for polymerase chain reaction Accept autoradiography Accept DNA hybridisation Accept compare DNA/base sequence for 'DNA sequencing' Ignore compare mRNA base sequence Ignore compare amino acid sequence Ignore DNA probes
03.3	1. (The scientists) could identify proteins (that derive from the genetic code) OR (The scientists) could identify the proteome; 2. (They) could (then) identify potential antigens (to use in the vaccine);	2	2. Reject if answer suggests vaccine contains antibodies

03.4	1. B cell (antibody) binds to (viral) specific/complementary receptor/antigen; 2. B cell clones OR B cell divides by <u>mitosis</u>; 3. <u>Plasma cells</u> release/produce (monoclonal) <u>antibodies</u> (against the virus); 4. (B/plasma cells produce/develop) memory cells;	3 max	1. Accept <u>B cell</u> forms antigen-antibody complex 2. Accept B cell undergoes clonal selection/expansion
------	--	-------	--

Question 3

Question	Marking Guidance	Mark	Comments
03.1	1. To break down links between cells/cell walls OR To separate cells/cell walls OR To break down/hydrolyse cellulose/cell wall; 2. Allowing the stain to pass/diffuse into the cells OR Allowing the cells to be (more easily) squashed; 3. To stop mitosis;	2 max (2 x AO2)	1. Ignore references to any bonds 3. Accept to stop cell division/cell cycle

Question	Marking Guidance	Mark	Comments
03.2	1. To create a single/thin layer of cells OR To spread out cells; 2. So that light could pass through;	2 (2 x AO3)	

Question	Marking Guidance	Mark	Comments
03.3	1. Anaphase; 2. Chromatids moved/pulled to opposite poles/ends;	2 (1 x AO1, 1 x AO2)	1. Reject 'Anaphase I (of meiosis)' 2. Accept 'chromosomes' for 'chromatids' 2. Reject homologous chromosomes for chromatids

Question	Marking Guidance	Mark	Comments
03.4	0.1 / 0.13 / 0.128;	1 (AO2)	Accept any correct rounding of 0.128205128205128 Reject answers expressed as a percentage

Question	Marking Guidance	Mark	Comments
----------	------------------	------	----------

03.5	1. (Garlic roots) are a different age OR (Garlic) grown in different conditions; 2. (Root tips) from different (garlic) plants/bulbs/species; 3. Single field of view is not representative of a root tip OR (Other) students may have looked at more fields of view OR (Other) students may have calculated a mean; 4. (Different fields of view are from) different parts of the root tip; 5. Cells/roots undergo mitosis/cell division at different times/rates;	2 max (2 x AO3)	1. Accept suitable descriptions of conditions, eg in different temperatures 3. Accept 'samples' for 'fields of view' 4. Reject different sized fields of view 4. Reject different number of cells (per field of view)
------	---	--------------------	---

Question 4

Question	Marking Guidance	Mark	Comments
01.1	1. Answer of 12/13 = 2 marks ;; 2. $0.36(48)/0.365/0.37 = 1 \text{ mark}$ OR $36(.48)/36.5/37\% = 1 \text{ mark}$ OR $q^2 = 0.06/0.059/0.0588 = 1 \text{ mark}$ OR or $q = 0.2/0.24/0.243 = 1 \text{ mark}$;	2	For 1 mark accept $q^2 = 6\%/5.9\%/5.88\%$

Question	Marking Guidance	Mark	Comments
01.2	0.71	1	

Question	Marking Guidance	Mark	Comments
01.3	Second box ticked/answer key: B: The mutation that caused black fur happened in a common ancestor of <i>S. carolinensis</i> and other closely related species.	1	

Question	Marking Guidance	Mark	Comments
01.4	1. $2.55\% = 2 \text{ marks}$;; 2. $2.61\% = 1 \text{ mark}$ (question misread ie $8/306 \times 100$) OR Evidence of dividing by 314 or 942 = 1 mark OR Answers not given to three significant figures = 1 mark ;	2	

Question	Marking Guidance	Mark	Comments
01.5	1. Mutation/lack of glutamic acid leads to (permanent) activation of the receptor/protein; 2. (Because) the receptor/protein does not require the binding/leaving of α MSH (to become activated); 3. ASIP (might) not (be) able to bind to the receptor/protein; 4. (Only) the dark <u>pigment</u> is produced	3 max	2. Answer must convey the idea that binding/leaving is not required

Question 5

Question	Marking Guidance	Mark	Comments
03.1	Two suitable examples;; Examples 1. amino acid/protein/ polypeptide/peptide; 2. nucleic acid/nucleotide/base; 3. DNA; 4. RNA; 5. ATP/ADP; 6. NAD/NADP (reduced or not); 7. Cyclic AMP/cAMP; 8. Chlorophyll;	2 max	List rule applies Reject for either point nitrates/nitrites/ammonia/ammonium/urea 4. Accept pre-mRNA/mRNA/rRNA/tRNA
03.2	Correct answer in the range 90 to 133.2 scores 2 marks;; 1 mark for answers where yield calculated correctly for 1970 OR 2005; (1970 in range) 170.8 to 176.4 OR (2005 in range) 266.4 to 304.0;	2	Accept positive or negative values
03.3	1. Using more but getting less response over time; 2. The graph shows correlation but doesn't prove changes in yield due to fertiliser/but there could be other factors; 3. Becomes less cost effective with time;	2 max	Idea of over time is important 1. accept fertiliser becomes less effective over time 1. Accept use of figures from graph 1. Accept the idea of less grain/crop over time 2. Ignore whether correlation is positive or negative

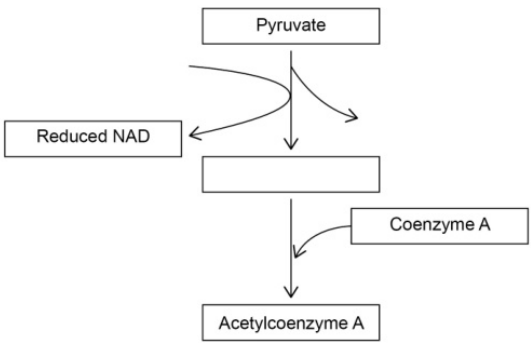
Question 6

Question	Marking Guidance	Mark	Comments
02.1	Accept any two of the following for one mark: Concentration/mass of yeast Concentration/mass of glucose/sugar (solution/s) Concentration of oxygen (in solution) Volume of yeast Volume of glucose/sugar (solution/s) pH (of glucose/sugar solution/s) Species/type of yeast Size/diameter/volume of test tubes	1 (AO3)	Ignore number of yeast cells Ignore amount for volume or concentration

Question	Marking Guidance	Mark	Comments
02.2	Correct answer of 2.5×10^{-2} = 2 marks ;; 4.2×10^{-2} (scale read from the wrong direction) = 1 mark OR 2.5×10^{-3} (scale read as 3.7 mm not 3.7 cm) = 1 mark OR 2.4×10^{-2} (scale read as 36.5) = 1 mark OR Correct answer not in standard form and/or not to 2 significant figures, eg 0.0247/0.025/2.47 x 10^{-2} = 1 mark OR Answer in incorrect standard form eg 25×10^{-3} or 0.25×10^{-1} = 1 mark OR Evidence of $37 \div 1500$ or $37 \div (25 \times 60)$ = 1 mark	2 (2 x AO2)	

Question	Marking Guidance	Mark	Comments
02.3	1. Maltose is a disaccharide; 2. (Time to be) hydrolysed into glucose OR (Time to) break glycosidic bond(s);	2 (2 x AO2)	1. Accept maltose is made of two glucose/monosaccharides 2. Accept monosaccharides for glucose

Question	Marking Guidance	Mark	Comments
----------	------------------	------	----------

02.4	This method would be less accurate because 1. Colour/endpoint is subjective; The accuracy of this method could be improved by 2. (Have a) colour standard (of the yellow) as a reference for the end point; OR (Have a) colorimeter/absorbance/transmission reading (of the yellow) as a reference for the end point;	2 (2 x AO3)	1. Accept descriptions of the word 'subjective' 2. Accept use a colorimeter to time how long it takes to reach a certain value/absorbance/transmission 2. Ignore any references to coloured filters used in a colorimeter
Question	Marking Guidance	Mark	Comments
02.5	All 4 correct = 2 marks;; Any 2 or 3 correct = 1 mark 	2 (2 x AO1)	Accept pyruvic acid for pyruvate For reduced NAD accept NADH, NADH + H⁺ or NADH₂ For reduced NAD reject reduced NAD^P / NADPH / NADPH₂ / NADPH + H⁺ For acetylcoenzyme A accept acetyl co A

Question 7 Level of response marking guidance

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

21–25	Extended Abstract	Response shows holistic approach to the question with a fully integrated answer which makes clear links between several different topics and the theme of the question.
	Generalised beyond specific context	Biology is detailed and comprehensive A-level content, uses appropriate terminology, and is very well written and always clearly explained. No significant errors or irrelevant material. For top marks in the band, the answer shows evidence of reading beyond specification requirements.
16–20	Relational	Response links several topics to the main theme of the question, to form a series of interrelated points which are clearly explained.
	Integrated into a whole	Biology is fundamentally correct A-level content and contains some points which are detailed, though there may be some which are less well developed, with appropriate use of terminology. Perhaps one significant error and/or, one irrelevant topic which detracts from the overall quality of the answer.
	Multistructural	Response mostly deals with suitable topics but they are

11–15	Several aspects covered but they are unrelated	not interrelated and links are not made to the theme of the question. Biology is usually correct A-level content, though it lacks detail. It is usually clearly explained and generally uses appropriate terminology. Some significant errors and/or, more than one irrelevant topic.
6–10	Unistructural Only one or few aspects covered	Response predominantly deals with only one or two topics that relate to the question. Biology presented shows some superficial A-level content that may be poorly explained, lacking in detail, or show limited use of appropriate terminology. May contain a number of significant errors and/or, irrelevant topics.
1–5	Unfocused	Response only indirectly addresses the theme of the question and merely presents a series of biological facts which are usually descriptive in nature or poorly explained and at times may be factually incorrect. Content and terminology is generally below A-level. May contain a large number of errors and/or, irrelevant topics.
0		Nothing of relevance or no response.

Commentary on terms and statements in the levels mark scheme

The levels mark scheme for the essay contains a number of words and statements that are open to different interpretations. This commentary defines the meanings of these words and statements in the context of marking the essay. Many words and statements are used in the descriptions of more than one level of response. The definitions of these remain the same throughout.

Levels mark scheme word/statement	Definition
Holistic	Synoptic, drawing from different topics (usually sections of the specification)
A fully integrated answer which makes clear links between several different topics and the theme of the question.	All topics relate to the title and theme of the essay; for example, explaining the biological importance of a process. When considering, for example, the importance of a process, the explanation must be at A-level standard. 'Several' here is defined as at least four topic areas from the specification covered. This means some sentences, not just a word or two. It does not mean using many examples from one topic area.
Biology is detailed and comprehensive A-level content, uses appropriate terminology, and is very well written and always clearly explained.	Detailed and comprehensive A-level content is the specification content. Terminology is that used in the specification. Well written and clearly explained refers mainly to biological content and use of terminology. Prose, handwriting and spelling are secondary considerations. Phonetic spelling is accepted, unless examiners are instructed not to do so for particular words; for example, glucagon, glucose and glycogen.
No significant errors or irrelevant material.	A significant error is one which significantly detracts from the biological accuracy or correctness of a described example. This will usually involve more than one word. Irrelevant material is several lines (or more) that clearly fails to address the title, or the theme of

For top marks in the band, the answer shows evidence of reading beyond specification requirements.	the title. An example that is relevant to the title and is not required in the specification content. The example must be used at A-level standard.
Response mostly deals with suitable topics but they are not interrelated and links are not made to the theme of the question.	Not addressing the biological theme of the essay (eg importance) <u>at A-level standard</u> .

Question	Marking Guidance	Mark	
07.1	The importance of complementary shapes of molecules in organisms • 3.1.4.2 Many proteins are enzymes • 3.1.5.1 Structure of DNA and RNA • 3.1.5.2 DNA replication • 3.1.6 ATP • 3.2.2 All cells arise from other cells • 3.2.3 Transport across cell membranes • 3.2.4 Cell recognition and the immune system • 3.3.3 Digestion and absorption • 3.4.1 DNA, genes and chromosomes • 3.4.2 DNA and protein synthesis • 3.4.3 Genetic diversity can arise as a result of mutation or during meiosis • 3.5.1 Photosynthesis • 3.5.2 Respiration • 3.6.1.2 Receptors • 3.6.2.1 Nerve impulses • 3.6.2.2 Synaptic transmission • 3.6.3 Skeletal muscles are stimulated to contract by nerves and act as effectors • 3.6.4.2 Control of blood glucose concentration • 3.6.4.3 Control of blood water potential • 3.8.1 Alteration of the sequence of bases in DNA can alter the structure of proteins • 3.8.2.2 Regulation of transcription and translation • 3.8.2.3 Gene expression and cancer	[25 marks]	

In order to fully address the question and reach the highest mark bands students must also include at least four topics in their answer, to demonstrate a synoptic approach to the essay.

Students may be able to show the relevance of other topics from the specification.

Note; other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.

Question	Marking Guidance	Mark	
----------	------------------	------	--

07.2	The importance of ions in metabolic processes • 3.1.4.2 Many proteins are enzymes (H and denaturation) • 3.1.5.2 DNA replication • 3.1.6 ATP • 3.1.8 Inorganic ions • 3.2.3 Transport across cell membranes • 3.3.3 Digestion and absorption • 3.3.4.1 Mass transport in animals • 3.3.4.2 Mass transport in plants • 3.4.2 DNA and protein synthesis • 3.5.1 Photosynthesis • 3.5.2 Respiration • 3.5.4 Nutrient cycles • 3.6.1.1 Survival and response • 3.6.1.2 Receptors • 3.6.2.1 Nerve impulses • 3.6.2.2 Synaptic transmission • 3.6.3 Skeletal muscles are stimulated to contract by nerves and act as effectors • 3.6.4.3 Control of blood water potential • 3.8.4.3 Genetic fingerprinting	[25 marks]	
------	--	------------	--

In order to fully address the question and reach the highest mark bands students must also include at least four topics in their answer, to demonstrate a synoptic approach to the essay.

Students may be able to show the relevance of other topics from the specification.

Note, other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.