Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Acceptable Answer	Additional Guidance	Mark
1(a)	An explanation that makes reference to the following: • so no other (potentially pathogenic) species of microorganism will be cultured (1) • no microorganisms could be present that would compete with the selected bacterium (1)		(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	An explanation that makes reference to the following: • to prevent anaerobic conditions (1) • which tend to encourage the growth of pathogenic bacteria (1)	Allow converse	(2)

Question Number	Answer	Additional Guidance	Mark
1(c)	An answer that makes reference to the following: Either • discourages pathogenic bacteria from growing (1) • as 40 °C near human body temperature (1) Or • bacteria less likely to die (due to the heat) (1) • bacterial enzymes less likely to denature (1)		(2)

Question Number	Answer	Additional Guidance	Mark
1(d)(i)	An explanation that makes reference to the following: • extract contains cinnamaladehyde which diffused { out of the disc / into the agar } (1) • killed the bacteria around it / stopped them from reproducing (1)		(2)

Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	An explanation that makes reference to the following: • area of clear zone calculated for each extract (1) • area for clear zone found to be the same for both (1)		(2)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	An explanation that makes reference to the following: • temperature would affect the rate of growth (1) • this would invalidate the results (1)		**(2)**

Question Number	Acceptable Answers	Additional Guidance	Mark
2(a)(ii)	An explanation that makes reference to two of the following: • greater genetic variety (1) • to avoid anomalous results (1) • supply sufficient for {collection of valid data / allow sufficient repeats } (1)	Allow reduced risk of fatal genetic disorder	**(2)**

Question Number	Acceptable Answers	Additional Guidance	Mark
2(a)(iii)	An answer that makes reference to the following: • (generally) increased CO_2 concentration is reducing the growth of lobster larvae (1) • increased it at day 14 (1) • greatest reduction at 28 days (1)	Allow before 28 days there may not be a significant effect	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(b)	An explanation that makes reference to the following: • CO_2 is a greenhouse gas (1) • {solar / short wavelength} radiation reaches the Earth's surface (1) • greenhouse gases reduce the amount of {longer wavelength radiation / heat / infra-red} radiated from the Earth's surface leaving the atmosphere (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(c)	An answer that makes reference to four of the following: • a suitable range of different temperatures stated (1) • state how temperature of seawater is controlled (1) • record the number of eggs that hatch in a set timeframe at each temperature (1) • calculation to work out rate (1) • control of a named relevant variable (1)	Do not allow anything above 40^oC e.g. use a thermostatically-controlled water bath for each e.g. salinity of seawater, pH	**(4)**

(Total for Question 2 = 13 marks)

Question Number	Acceptable Answer	Additional guidance	Mark
3(a)(i)	An explanation that makes reference to the following: • stated volume of DCPIP (1) • addition of fruit drink to DCPIP until no further decolourising of DCPIP (1) • record the volume of fruit drink required to bring about colour change (1) • therefore concentration of vitamin C can be determined by comparing values to those obtained from vitamin C solutions of known concentration (1)	Allow reference to addition of DCPIP to known volume of fruit drink Allow use of colorimeter Allow reference to standardised tests or calibration curve	**(4)**

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	• difference calculated / actual value found (1) • correct answer (1)	<u>Example of calculation:</u> (119.77 x 1.67) = 200.0159 = 200.016 / 200	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)(iii)	An explanation that makes reference to three of the following: • several measurements for each fruit drink (1) • statistical test carried out (1) • calculated value compared to the critical value (1) • at the {5% significance level / p=0.05} (1)	e.g. student t-test	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)	A description that makes reference to the following: • an increased (specific) immune response (1) • greater antibody production (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(i)	An explanation that makes reference to the following: • four times faster as the temperature difference is 20^{o}C (1) • As Q_{10} of 2 means the ripening process doubles every 10^{o}C increase in temperature (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(ii)	• the length of time the banana has been in the incubator would have no effect on the rate of ripening		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)	An answer that makes reference to five of the following: • bananas of the same { age / mass } of banana (1) • same { volume / concentration } of hydrogen peroxide (1) • reaction conducted at range of suitable temperatures (1) • method for measuring volume of oxygen evolved (1) • set period of time stated (1) • initial rate of reaction calculated (from graphs) (1)		**(5)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)(i)	• location (of gene) on a chromosome		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)(ii)	An answer that makes reference to the following: • greater mean genetic diversity in East Thailand (1) • the range of data shows there is overlap in the number of different alleles per gene locus (1) • lowest (mean number of different alleles) for East Thailand is 1.30 and highest for South Thailand is 1.32 (1) • unlikely to be a significant difference between the two regions (1)		**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(i)	An answer that makes reference to the following: • homozygous for allele 1 (1) • only allele 1 is present /100% of the alleles are allele 1 (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(ii)	• correct proportion of heterozygotes (2pq) (1) • correct number of heterozygotes (1)	<u>Example of calculation:</u> 2 x (0.980 x 0.02) or 0.0392 = 0.0392 0.0392 x 50 = 1.96 = 2	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(iii)	An answer that makes reference to three of the following: • allele 3 is result of a mutation (1) • (allele 3) confers a selective advantage (1) • population Z isolated from other populations (1) • it is rare therefore it will not always be present in all populations (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(a)	A drawing that includes three of the following: • at least three curved cisternae (1) • sizes decreasing from largest to smallest in sequence (1) • { cisterna / flattened membrane sac } correctly labelled (1) • { forming / convex / immature } or { mature / concave side } correctly labelled (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)	An explanation that makes reference to the following: • lysosomes are membrane-bound (organelles) • only organisms of the Eukaryota have cells containing membrane-bound organelles (1)		**(2)**

Question Number	Indicative content
6(c)	Answers will be credited according to candidates' deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Candidates are expected to offer a range of appropriate examples of processes to support comments on the importance of exocytosis. • acrosome reaction necessary for success for fertilisation • cortical reaction necessary to prevent polyspermy • release of neurotransmiter at synapse to transmit nerve impulses • bulk transport e.g. secretion of { hormones / enzymes } • release of 'fragments' of pathogen following phagocytosis • placing antigen onto cell surface of an APC • release of antibodies

Level	Mark	Descriptor
	0	No rewardable material
1	1-3	Limited scientific judgement made with a focus on mainly just one process, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.
2	4-6	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each process identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.
3	7-9	A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.

Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)	An explanation that makes reference to the following: • methyl groups added or removed to DNA (1) • changes copied when cells divide (1) • changes passed on in gametes (1)		(3)

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)	An explanation that makes reference to the following: • genome includes all the (coding and non-coding) DNA (1) • that makes up the genetic code for a species or organism (1)		(2)

Question Number	Acceptable Answer	Additional Guidance	Mark
7(c)	An explanation that makes reference to the following: • natural selection in response to selection pressures (1) • most successful survive to reproduce (1) • passing on their advantageous alleles to the next generation (1) • allele frequency change over many generations (1)	Do not allow reference to gene	(4)

Question Number	Acceptable Answers	Additional Guidance	Mark
7(d)	A explanation that makes reference to the following: • handling of rats in first 3 weeks by humans results in more { grooming / licking } by the mothers (1) • which reduced production of stress hormones in those rats when they became adult (1) • making them calmer when exposed to stress compared to their litter mates that were not handled (1)	Allow arched-back nursing	(3)

Question Number	Acceptable Answers	Additional Guidance	Mark
7(e)	A description that makes reference to the following: • mRNA carries the code from the nucleus to the ribosome (1) • mRNA contains the sequence of bases that is translated at the ribosome (1) • complementary base pairing between mRNA and tRNA (1) • tRNA carries a specific amino acid (to the ribosome) (1)		(4)

Question Number	Acceptable Answers	Additional Guidance	Mark
7(f)	An explantion that makes reference to four of the following: • methyl groups removed (1) • DNA uncoils from the histone (spool) (1) • DNA double helix untwists at appropriate gene (1) • transcription factor can then bind to the promotor region (1) • transcription initiation complex formed / RNA polymerase binds (to promoter region) (1)		**(4)**

Question Number	Acceptable Answers	Additional Guidance	Mark
7(g)	• correct calculation of G + C and A + T (1) • correct calculation of number of A (1) • correct percentage calculated (1)	<u>Example of calculation:</u> G + C = 16 and A + T = 52 = 26 adenine A = 26 ÷ 68 = 38.2359 = 38.24	**(3)**

Question Number	Acceptable Answers	Additional Guidance	Mark
7(h)	• below the hypothalamus (1)		**(1)**

Question Number	Acceptable Answers	Additional Guidance	Mark
7(i)	An answer that makes reference to the following: • young male mice exposed to stress by being placed with aggressive mice (1) • sperm from these males used for IVF (1) • offspring produced did not demonstrate the same behaviour as the male parent (1)		(3)

Question Number	Acceptable Answers	Additional Guidance	Mark
7(j)	An explantion that makes reference to the following: • two groups of patients suffering { depression / anxiety / post-traumatic stress disorder } (1) • one group given the epigenetic medication and the other { placebo / psychiatric drug } (1) • neither patient nor the person conducting the trial know which treatment is being administered (1) • epigenetic medication considered effective if there is a significant improvement in symptoms compared to { placebo / current medication } (1)		(4)