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Mark Scheme (Results)

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Pearson Edexcel International Advanced Level in Biology (WBI06) Paper 01

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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.
A penalty for a QWC should only be applied once only. If a response has gained additional marking points to the maximum allowed, then a QWC should not be applied.

Question Number	Answer	Additional Guidance	Mark
1(a)	1. suitable range of temperatures suggested ;	1. at least 5 temperatures, evenly spaced, at least 5 degrees between each, at least 3 values below 50C	**(5)**
	2. use of appropriate method to maintain constant temperatures ;	2. e.g. water bath, incubator	
	3. use of appropriate material (to absorb CO_2) / eq ;	3. e.g. NaOH, KOH, soda lime. NOT limestone, lime water	
	4. description of how apparatus allowed to equilibrate before starting to record oxygen use / eq;		
	5. explanation of how uptake of oxygen can be measured ;	5. ACCEPT distance moved by liquid OR calculation of volume OR change in concentration measured with oxygen / CO_2 probe	
	6. idea of calculation of rate ;	6. ACCEPT {volume / distance} divided by time	
	7. description of suitable control ;	7. ACCEPT e.g. empty apparatus, glass beads, boiled seeds OR whole experiment done with compensating respirometer	

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	1. oxygen concentration / eq ; 2. {mass / number / source / genetic composition / age / eq} of seeds ; 3. humidity / moisture / eq ; 4. light exposure / wavelength / eq ; 5. air pressure / eq ; 6. pre-treatment of seeds ;	1. NOT carbon dioxide 2. ACCEPT species, type, variety 3. ACCEPT pH of water added 6. e.g. soaking time, freezing	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. appropriate control method described for named variable ; 2. description of likely effect on the dependent variable ;	1. ACCEPT any named variable other than temperature. Must be controlled not just monitored. 2. direction of effect should be mentioned (i.e. increase or decrease in rate of respiration)	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(c)	1. uptake of water ; 2. need to {synthesise / activate / eq} enzymes ; 3. named enzyme or class of enzyme ; 4. required to break down stored molecules / named stored molecule e.g. starch / lipids ; 5. to provide {glucose / fatty acids / glycerol / respiratory substrate / eq} ; 6. idea of no oxygen uptake in {glycolysis / Krebs cycle} / oxygen required only at end of ETC ;	3. e.g. amylase, lipase, protease, dehydrogenase	**(3)**

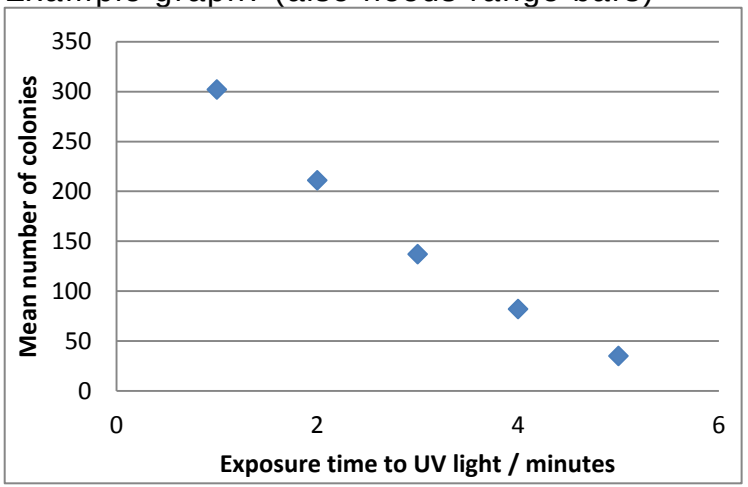
Question Number	Answer	Additional Guidance	Mark
2(a)	1. no significant correlation ; 2. between exposure to UV light and the number of bacterial colonies / eq ;	2. IGNORE 'survival of bacteria', 'effect' of UV light, 'colonies' alone	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)	1 mark for at least 3 correct means ; 2 marks for all five means correctly calculated ;	<table><tr><th>Mins</th><th>Mean</th></tr><tr><td>1</td><td>302</td></tr><tr><td>2</td><td>211</td></tr><tr><td>3</td><td>137</td></tr><tr><td>4</td><td>82</td></tr><tr><td>5</td><td>35</td></tr></table>	**(2)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>2 (c)</td><td>1. suitable table with appropriate headings ;

2. populated with raw data and calculated means ;</td><td>Example table:
<table><tr><td rowspan="2">Exposure to UV light / minutes</td><td colspan="4">Number of colonies*</td></tr><tr><td colspan="3">Raw data</td><td>Mean</td></tr><tr><td>1</td><td>282</td><td>302</td><td>322</td><td>302</td></tr><tr><td>2</td><td>187</td><td>215</td><td>231</td><td>211</td></tr><tr><td>3</td><td>108</td><td>129</td><td>174</td><td>137</td></tr><tr><td>4</td><td>70</td><td>82</td><td>94</td><td>82</td></tr><tr><td>5</td><td>21</td><td>37</td><td>47</td><td>35</td></tr></table>*NOT arbitrary units (au) for colonies

2. ACCEPT ECF for means</td><td>(2)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
2(d)	**A** axes: linear scales with suitable labels and units ; **P** line graph with points plotted accurately ; **B** range bars included ;	A. Labels as shown below. x and y axes must be the correct way round. P. Points +/- 1 mm or within 1 small square ACCEPT ECF from calculation of means IGNORE line of best fit / eq Example graph: (also needs range bars)  	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(e)	1. idea that (graph shows) increasing length of exposure to UV reduces the number of colonies ; 2. the (absolute) correlation value (0.99) is greater than the critical value (of 0.90) /eq ; 3. reject the null hypothesis ; 4. the (negative) **correlation** between the length of exposure to UV light and number of colonies is **significant** / eq ; 5. idea that range bars do not overlap ;	1. We are looking for a description of the general trend: the idea that more light = fewer colonies. This is different from mp4, which is the result of the statistical test. 4. Candidates do not have to explicitly state 'negative' correlation because this is given in the stem. 5. IGNORE references to low variability in data	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(f)	1. recognition that other factors may not have been taken into consideration / eq ; 2. specific factor named ; 3. single type of bacteria investigated / eq ; 4. a control with zero exposure time is not used / eq ; 5. trend may not continue at longer exposure times / eq ;	2. Factors should be directly relevant to the experiment. ACCEPT e.g. temperature, (UV) light intensity, {number / strain} of bacteria. IGNORE humidity, pH, oxygen. 3. NOT if mp2 awarded in context of different bacterial strains.	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(a)	1. suitable ethical argument ; 2. suitable safety point ;	1. ACCEPT there are no significant ethical issues, idea of no damage to habitat when collecting plant 2. e.g. enzymes or plant material may be irritants, hazards associated with collecting or preparing plant material such as use of spade or sharp knife, specific fieldwork hazards	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. idea of trialling method to see if it will work ; 2. determine suitable {extraction method / solvent} (for the inhibitor) / eq ; 3. determine suitable {source / concentration} of {starch / enzyme / amylase} ; 4. determine suitable conditions for the {enzyme / amylase} activity / eq ; 5. determine suitable method for detecting presence of starch ; 6. idea of determining {time needed for reaction to reach endpoint / appropriate frequency of readings} ;	2. ACCEPT test whether e.g. blending, chopping, grinding of plant are suitable 3. ACCEPT concentration of plant extract, NOT part of plant (this is the IV) 4. e.g. suitable pH, temperature 5. ACCEPT method for measuring glucose / reducing sugars 6. IGNORE timescale unqualified ACCEPT time to produce measurable glucose / reducing sugars	**(3)**

Question Number	Answer	Additional Guidance	Mark
3 (c)	1. clear statement of independent variable (different parts of plant / eq) ; 2. idea of obtaining tissue extract through homogenisation with solvent ; 3. appropriate experimental design involving starch + amylase + each tissue (extract) ; 4. idea of control involving starch + amylase and {no tissue / solvent alone / water / eq} ; 5. clear statement of dependent variable (e.g. amylase activity / eq) ; 6. clear description of method for detecting amylase activity ; 7. description of appropriate method to obtain rate of reaction ; 8. and 9. identification of two variables that could affect the result obtained ;; 10. and 11. description of how two variables can be controlled ;; 12. clear reference to need for repeats ;	2. ACCEPT blending/eq, water, buffer solution. NOT ethanol. 5. ACCEPT {rate / time} for starch digestion or glucose production or change in indicator. 6. e.g. Loss of starch: iodine, blue/black to yellow/brown OR clear areas in starch agar. Presence of glucose: Benedict's / Fehling's solution, red. 7. e.g. 1/time to reach endpoint OR determination of extent of reaction in a given time 8. - 11. IGNORE light, O_2, CO_2, humidity. Credit max. 1 plant variable (size, age, growing conditions, etc) and max. 1 solution variable (volume, concentration, etc of any solution).	**(8 + 2 SPG)**

SPG award up to 2 marks

level	Mark	Descriptor
Level 3	**2**	The account is well organised with no undue repetition and a correct sequence. There is good use of scientific vocabulary in the context of the investigation described. The account is written in continuous prose which is grammatically sound with no major spelling errors.
Level 2	**1**	There is some disorganisation in the account which is not always in the correct sequence. Some relevant scientific vocabulary is used. The account is not always in continuous prose and there are grammatical errors and some important spelling mistakes.
Level 1	**0**	The account is very disorganised and is very difficult to follow. Scientific vocabulary is very limited with many spelling and grammatical errors.

Question Number	Answer	Additional Guidance	Mark
3(d)	1. appropriate table for **raw** data with headings and units ; 2. means calculated from repeat data ; 3. bar graph with correctly labelled axes ; 4. application of a suitable named statistical test ;	1. Must include parts of plant (no units). DV recorded depends on candidate's method, but must have appropriate units. 2. Table must include at least 1 repeat for the award of mp2. Reference to calculation of mean may be in the text. 3. ACCEPT line graph with a line for each part of the plant. NOT separate graphs for each part. Units are not required on axis labels. 4. e.g t-test, Mann-Whitney, Wilcoxon	**(4)**

Question Number	Answer	Additional Guidance	Mark
3(e)	1. difficult to control all variables (affecting amylase activity) ; 2. specific point relating to difficulty of measuring the dependent variable; 3. idea of limitation linked to inhibitor extraction; 4. idea of {different / additional} inhibitors present in different parts of plant ; 5. idea that some parts of plant may contain {amylase / starch / glucose} ; 6. idea that plant(s) used may not be {representative / typical} (of pigeon pea plants in general) ;	1. ACCEPT named example of uncontrolled variable 2. e.g. difficulty in judging endpoint 3. e.g. incomplete extraction of inhibitor, extraction affects inhibitor activity 5. ACCEPT reducing sugars, enzymes that break down starch 6. ACCEPT diseased / genetic variation / growing conditions / age / eq	**(3)**

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