edexcel

Mark Scheme (Results)

Summer 2016

Pearson Edexcel International Advanced Level in Biology (WBI06) Practical Biology and Investigative Skills

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2016
Publications Code 46644_MS*

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.

Question Number	Answer	Additional Guidance	Mark
1(a)	1. Incubation of eggs at a range of temperatures between 20°**C** & 40°**C** ; 2. (incubation of eggs) {for two months / until they hatch / eq} ; 3. and 4. two other control variables identified ;; • control of source of eggs • control of substrate / covering eggs / arrangement of eggs • control of oxygen / humidity 5. {counting / observing} gender of offspring ; 6. repeat (at each temperature) to calculate a mean ;	1. **ACCEPT** five stated temperatures with some between 20°**C** & 40°**C** **ALLOW** additional temperatures of either above 40°C or below 20°C **IGNORE** same species – species is specified in the question **ACCEPT** e.g. {mass / age} of female, age of egg / eggs from same batch / from same {female / population / geographical area / eq} **ACCEPT** with the same {depth / mass / pH / type} of soil **ACCEPT** repeat for reliability / reproducibility	**(5)**

Question Number	Answer	Additional Guidance	Mark
1(b)	Any one from: 1. idea of genetic variation ; 2. difficulty of keeping temperature constant ; 3. variation in temperature or age of eggs when collected ; 4. errors in identifying sex of offspring ; 5. not all eggs {hatch / are viable} / offspring die / eq ;	 ACCEPT mutation / different alleles ACCEPT gender may already be determined	**(1)**

Question Number	Answer	Additional Guidance	Mark
1(c)	Any **two** from: 1. idea of incubation in suitable conditions ; 2. idea of leaving some eggs in each nest from which eggs are collected ; 3. idea of providing food to lizards ; 4. idea of handling {eggs / lizards / eq} carefully ; 5. lizards should be {returned to wild / only released when they are old enough to survive / placed in a zoo / eq} ;	 **ACCEPT** {temperature / pH of soil} / natural conditions	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(d)(i)	Two from **Advantages:** 1. idea of more females to { lay eggs / produce offspring} ; 2. idea that one male can **fertilise** many eggs ; 3. idea of less competition between males ; Two from **Disadvantages:** 4. possibility of too few males (to mate with all females) ; 5. idea that weaker males may be able to mate ; 6. idea of insufficient nesting sites ; 7. idea of reduced genetic variation ;	MAX 2 marks for advantages MAX 2 marks for disadvantages	**(4)**

Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	1. idea that enzymes are involved ; 2. more collisions / more enzyme-substrate complexes formed ; 3. idea of increase in the rate of reactions ;	**ACCEPT** increase of named relevant reaction or process e.g. respiration, DNA replication, protein synthesis, metabolism, growth	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(a)	1. there is no **significant difference** ; 2. between the **sugar content** of modern and traditional apples ;	**ACCEPT** alternative descriptions e.g. old and new apples **IGNORE** 'sweetness'	**(2)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>2(b)</td><td>1. table with minimum headings of { apple / apple type / apple variety}, sugar content including units and mean ;

2. all raw data for modern apples and traditional apples are grouped together in the table ;

3. correctly calculated means given to 1dp ;</td><td>1. NOT if units repeated in any data cells
ACCEPT g / grams
Suitable examples:
<table>
<tr><th>Apple</th><th colspan="3">Sugar content in 100g / g</th><th>Mean (/ g)</th></tr>
<tr><td>Modern / new</td><td>15.7
13.5
12.7</td><td>14.8
13.2
12.3</td><td>14.6
12.6
11.9</td><td>13.5</td></tr>
<tr><td>Traditional / old</td><td>13.3
12.9
12.4</td><td>13.2
12.1
12.2</td><td>12.6
11.4
11.7</td><td>12.4</td></tr>
</table>
<table>
<tr><th>Apple</th><th colspan="4">Sugar content / g</th></tr>
<tr><th>Variety</th><th>Trial 1</th><th>Trial 2</th><th>Trial 3</th><th>Mean</th></tr>
<tr><td>Gala</td><td>15.7</td><td>14.8</td><td>14.6</td><td rowspan="3">13.5</td></tr>
<tr><td>Braeburn</td><td>13.5</td><td>13.2</td><td>12.6</td></tr>
<tr><td>Cox</td><td>12.7</td><td>12.3</td><td>11.9</td></tr>
<tr><td>Lord L</td><td>13.3</td><td>13.2</td><td>12.6</td><td rowspan="3">12.4</td></tr>
<tr><td>Pearmain</td><td>12.9</td><td>12.1</td><td>11.4</td></tr>
<tr><td>Egremont</td><td>12.4</td><td>12.2</td><td>11.7</td></tr>
</table>
<table>
<tr><th colspan="2">Apple</th><th colspan="4">Sugar content / g</th></tr>
<tr><th>Group</th><th>Variety</th><th>Trial 1</th><th>Trial 2</th><th>Trial 3</th><th>Mean</th></tr>
<tr><td>Modern</td><td>Gala</td><td>15.7</td><td>14.8</td><td>14.6</td><td rowspan="3">13.5</td></tr>
<tr><td>Modern</td><td>Braeburn</td><td>13.5</td><td>13.2</td><td>12.6</td></tr>
<tr><td>Modern</td><td>Cox</td><td>12.7</td><td>12.3</td><td>11.9</td></tr>
<tr><td>Traditional</td><td>Lord L</td><td>13.3</td><td>13.2</td><td>12.6</td><td rowspan="3">12.4</td></tr>
<tr><td>Traditional</td><td>Pearmain</td><td>12.9</td><td>12.1</td><td>11.4</td></tr>
<tr><td>Traditional</td><td>Egremont</td><td>12.4</td><td>12.2</td><td>11.7</td></tr>
</table></td><td>(3)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
2(c)	A axes with suitable linear scales, suitable labels and units ; P means for { modern and traditional apples / all apple varieties} plotted accurately as **bar chart** ; B range bar included for each ;	e.g. minimum labels: mean sugar / g, apple, modern, traditional A. **ACCEPT** key P. **ALLOW** ECF from means in 2(b) + / - half a square B. Modern = 15.7-11.9, Trad = 13.3-11.4 ALLOW standard deviation modern 1.3 traditional 0.7	**(3)**

Question Number	Answer	Additional Guidance	Mark
2(d)	1. modern apples have a higher sugar content ; 2. 2.120 identified (as critical value at p=0.05) ; 3. {2.196 / calculated value} is greater than the critical value ; 4. the null hypothesis can be rejected ; 5. there is a **significant** difference between the sugar content of modern and traditional apples ;	NB: Allow ecf for MP3, 4 and 5 if another value selected from the table 1**. ACCEPT** converse 3. 2.196 is greater than 2.120 = Mps 2 & 3 4. **ACCEPT** null hypothesis is not accepted 5. sugar content of modern apples is significantly higher = mps 1 & 5	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(e)	1. idea that a small {number of apples / sample size} was tested ; 2. only 3 traditional and 3 modern varieties were tested ; 3. {range / error / sd} bars overlap ; 4. named factor that has not been taken into consideration during apple **growing** ; 5. named factor that has not been taken into consideration **post-harvest** ;	2. accept idea that sample is not representative 4. eg. insolation, water supply, farming practices, 'temperature at which apples were grown' 5. eg. ripeness, storage time, age of apples, refrigeration, damage during transport IGNORE ref to traditional apples sourced directly from the farm unqualified	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(a)	**Safety:** 1. risk of {injury / damage to muscle / damage to ligaments / joints} ; 2. risk of infection from mouthpieces ; 3. exposure to soda lime ; **Ethical:** 4. idea that participants give consent or are {volunteers / informed about any potential risks of yoga} ; 5. participants with health issues should not take part ;	**ACCEPT** any two points from the 5 MPs **ACCEPT** disinfect mouthpiece (to avoid infection) **ACCEPT** idea of {breathing impurities from low grade oxygen / use of medical grade oxygen} e.g. heart disease, asthma, breathing issues	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. practise proposed method to see if it will work / eq ; 2. idea of length of yoga {class / session} **Or** type of yoga exercises ; 3. idea of standardising participants ; 4. idea of determining timescale for measurable effect (on VC) ;	3. e.g. age of participants, gender of participants, health, previous experience of yoga, VC training, usual training regime, height, body mass, BMI	**(3)**

Question Number	Answer	Additional Guidance	Mark
3(c)	1. clear statement of independent variable as number of yoga classes attended per week / eq ; 2. suitable number of values for IV – at least 5 per unit time ; 3. idea of a group not doing yoga ; 4. clear statement of dependent variable as VC ; 5. credit one detail of how a value for VC will be measured ; 6. idea of needing to measure initial VC for each participant ; 7. and 8. identification of **three** variables that should be controlled ;; 9. idea of repeat measurements for each person ; 10. multiple people for each value of the IV ;	2. e.g. 1, 2, 3, 4 and 5 classes per week 3. 0, 1, 2, 3 and 4 classes per week gets MP2 and 3 5. e.g. calibrate spirometer difference between peak and trough for a deep breath on a spirometer or datalogger trace, moving air to the graduated region of a breath bag and reading off volume, displacement of water 7. & 8. e.g. age, gender, BMI, state of health, smoking, athletic discipline, recovery time, posture during VC measurement For MP7 and MP8 together: **two** variables gains **1** mark, **three** variables gains **2** marks	**(8)** **+ 2 SPG** **(see below)**

Level	Mark	Descriptor
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.
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 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.

Question Number	Answer	Additional Guidance	Mark
3(d)	1. table with headings and units including measurements of VC ; 2. columns for initial and final VC **Or** change in VC calculated, e.g. final - initial ; 3. means indicated from repeat data ; 4. {line / scatter} graph selected with frequency of yoga on x-axis and (change in) VC on y-axis ; 5. use of an appropriate named test e.g. Spearman's rank, Pearson's for a {relationship / correlation} ;	**ACCEPT** MPs 2, 3 and 4 from table 1. table must have space for raw data. 4. Units not required **ACCEPT** bar chart if simple with / without yoga data collected 5. **ACCEPT** t-test or Mann-Whitney **only for with / without yoga**	**(4)**

Question Number	Answer	Additional Guidance	Mark
3(e)	1. difficult to control all variables affecting VC / eq ; 2. named example of relevant variable relating to participants that would be very difficult to control ; 3. idea that participants will differ in their effort ; 4. idea that there may be a 'ceiling' on an individual's VC, even with training (which may already have been reached) ; 5. idea that accurate measurement of VC is reliant on the subject exhaling fully (which may not be the case) ; 6. idea that the {results / participants} may not be representative (of an individual / the population) ;	2. Accept E.g. genetic variability, previous history of yoga, additional activities outside of yoga sessions, diet	**(3)**

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL