Mark Scheme (Results)

March 2014

NQF BTEC Level 1/Level 2 Firsts in Applied Science

Unit 8: Scientific Skills (20474E)

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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.

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
1(a)	Light meter (1)	Accept: Phonetic spelling	List or multiple answers.	1
1(b)	Any **two** of the following kept the same: • Voltage/Power (1) • Source/light source (1) • Same cable type (1) • Diameter/thickness of cable (1) • Straightness/angle of cable (1) • Light from outside the experiment (1).	Cable Ignore: Light meter		2
1(c)	Any **one** of the following correctly <u>linked</u> descriptions: (Electrocution/electric) shock (1) from electricity/power (supply) (1) Or eye damage (1) from (bright) lights/(fibre optics) cable (1) Or	If not linked either 1 mark for a simple risk or 1 mark for the hazard. Accept: From loose/broken wires		2

	cuts (1) from (broken) fibre optic cable (1) Or burns (1) from the light source (1).			
				Total **5 marks**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
2	MP 1 -Change the length of fibre optic cable/ Use different length cables. (1) MP 2 - Take readings from light meter/ measure light. (1) MP 3 - Keep the fibre optic cable type the same/keep everything the same except the length(of the cable)/keep light (source) the same. (1) MP 4 - Will produce enough results to draw a conclusion. (1) MP 5 - Repeat readings. (1) MP 6 - (To give) reliability/ repeatability. (1)	Choose a range of lengths/gives a number of lengths. (1) Use different size/brand cables (1) Independent variable is length of cable (1) As an alternative to MP1 and MP 2 allow a correct hypothesis linking the length of the fibre optic cable with the light intensity (2) Keep diameter/ brand/voltage/ material the same. (1) Produce enough results to spot a trend/pattern/ be able to plot a graph (1) Gives some suggestion of doing a length/size more than once (1) To calculate an average/mean (1) To spot anomalies/outliers		6

		(1) Ignore: Lists of equipment as this is given in question 1 Fair test without this being qualified in some way.		
			Total	**6 marks**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3(a)(i)	B Measuring cylinder (1)			1
3(a)(ii)	Thermometer (1)	Temperature probe (1) Data logger (1) Accept phonetic spelling		1
3(b)	10 (2) **Or** $\frac{71-21}{5}$ (2) **Or** 71 – 21 (1) **Or** $\frac{51}{5}$ (1) **Or** $\frac{71}{5}$ (1)	If followed by any further incorrect working max 1 mark. 50 (1) 10.2 (1) 14.2 (1)		2

<table>
<tr><th>Question Number</th><th>Correct Answer</th><th>Acceptable Answers</th><th>Reject</th><th>Mark</th></tr>
<tr><td>3(c)</td><td>Axes (1)
Correct labels and units on axes (1)
Scaling (2)
Scale appropriate (1)

Correct numbers on both axes (1)
Plotting (2)
All 6 points plotted correctly (2)
4 or 5 points plotted correctly (1)

Line (1)
Straight line of best fit (1)</td><td>Accept reversal of axes
Accept y-axis that does not start at zero

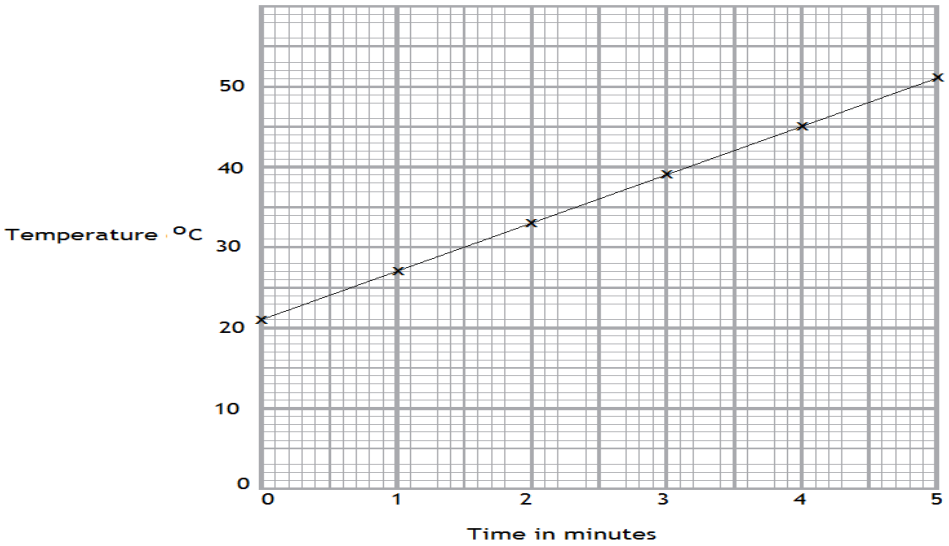
Covers more than half of the graph paper each way

Scale must be uniform

ECF on plotting points from scaling/numbering errors
However if the temperature values from the table are written on the Y axis evenly spaced then no plotting marks to be given
+/- a small square

Line of best fit must be a clear single line

Results that should be plotted for reference
<table><tr><td>Time in minutes</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Temperature (°C)</td><td>21</td><td>27</td><td>33</td><td>39</td><td>45</td><td>51</td></tr></table></td><td></td><td>6</td></tr>
<tr><td colspan="3"></td><td>Total</td><td>10 marks</td></tr>
</table>


Temperature °C
50
40
30
20
10
0
0
1
2
3
4
5
Time in minutes

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
3 (d)	MP1 (Although) there is a temperature change/rise for both fuels (1) Or the temperature of ethanol rises more quickly /every minute the ethanol releases more heat energy than methanol (1) MP2 (Ethanol) gives 10°C/higher rise in the water temperature (than methanol) (over 5 minutes) (1).	Must refer to temperature/heat/hotter/heat energy in the answer. Any suitable interpretation of the data e.g. after 1 minute ethanol is 2 degrees higher than methanol		2
		Total mark		**12**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4(ai)	The point at 0.4mm is circled (1)		points circled on the line of best fit	1
4(aii)	Any **two** of the following: MP1 - The thickness of the coating was not even/not correctly applied (1) MP 2 - The coating was wet (1) MP3 - The marble was pushed (1) MP4 - Inaccurate timing/speed (1) MP5 - Incorrect plotting on the graph/incorrect calculations (1) MP6 - Height of the ramp was changed/was steeper (1) MP7 - External environment was different – e.g. draught (1) MP8 - The starting point for the marble was changed (1) MP9 - The marble did not travel in a straight line (1) MP10 - They changed the marble (1)	Accept: Reference to a problem with the coating Inaccurate measuring Inaccurate recording of results Ramp was moved Ignore human error	Was not a fair test without qualification	2

4(b)(i)	(Speed) increases (1)			1

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
4(b)(ii)	6 (2) Or 0.6 x 10 (2) Or Distance = speed x time (1) Or 0.6 = $\frac{\text{distance}}{10}$ (1)	If followed by any further incorrect working max 1 mark.		2
			Total	**6 marks**

<table>
<tr><th>Question Number</th><th>Correct Answer</th><th>Acceptable Answers</th><th>Reject</th><th>Mark</th></tr>
<tr><td>5(a)</td><td>MP1:Column labelled concentration and Column labelled time (1)

MP2: Places the numbers in the correct column (1)

MP 3: Results placed in ascending/ descending order (1)

<table><tr><td>Concentration (M)</td><td>Time (s)</td></tr><tr><td>0.2
0.4
0.6
0.8
1.0</td><td>120
80
50
30
10</td></tr></table></td><td>Allow ECF from MP1 if student chooses own incorrect labels.

Results may be in order of concentration or time in either ascending or descending order.

Allow ECF from MP2 if placed in incorrect columns or placed together in one column</td><td></td><td>3</td></tr>
<tr><td>5 (b)</td><td><u>Any 2 linked pairs</u>

Calculate the mean for experiment 1 and 3 (for the results at 30 °C) (1)

(Because) the result for experiment 1 and 3 are similar/ fit in the pattern (1)

OR

Repeat/redo the experiment (at 30 °C) (1)

To get 3 similar results/ 3 results that fit the pattern/ concordant/same result (1)

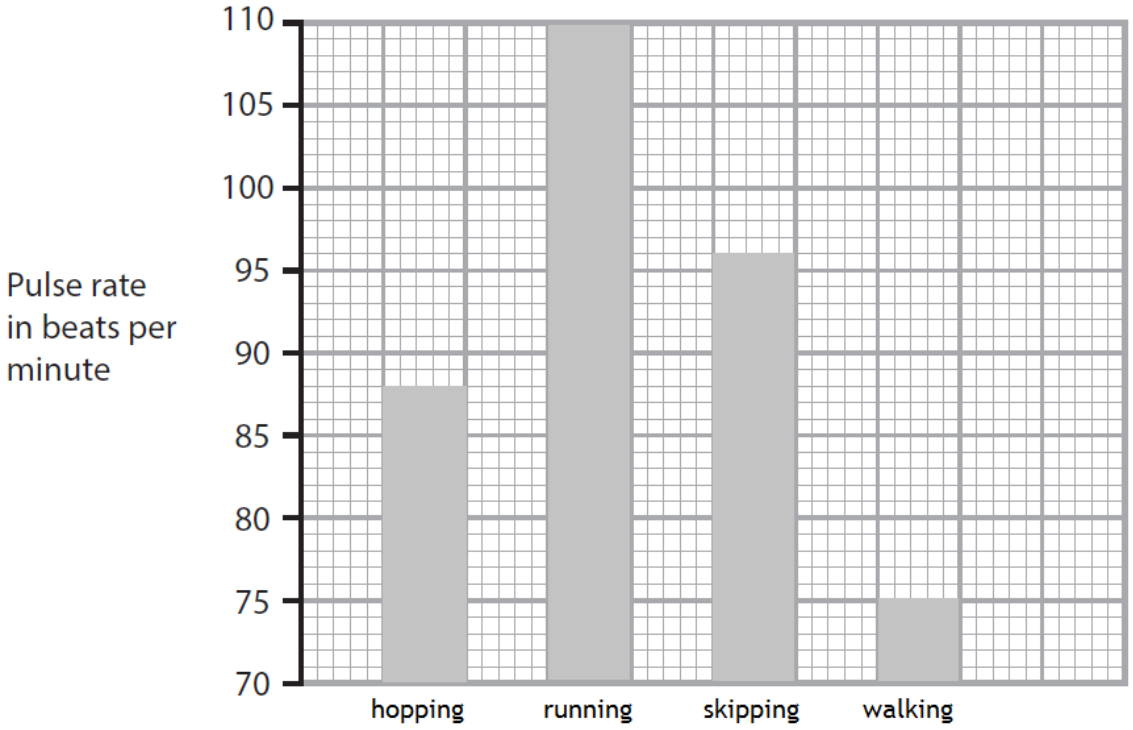
OR</td><td>Ignore experiment 2 when calculating mean (1)

(Otherwise) the mean would be too high (1)
The result from experiment 2 is much higher /different/does not fit the pattern (1)

To get enough results to calculate a mean</td><td></td><td>4</td></tr>
</table>

	Plot line of best fit for experiment 2 (1) To get expected result (1)			
			Total	**7 marks**

Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6(a)	(B) Measure the initial resting pulse rate (D) Rest between each exercise set			2
6 (b) (i)	(B) Running			1
6 (b) (ii)	Correct bar labels (1) All 4 bars correctly plotted (2) **OR** 2 or 3 bars correct (1) **Exercise for 2 minutes** / **Freya** Hopping 88 Running 110 Skipping 96 Walking 75	Plotted correctly plus or minus one small square Accept: vertical lines as bars. Ignore: no gaps between the bars,		3



Question Number	Correct Answer	Acceptable Answers	Reject	Mark
6 (b) (iii)	Any **two** of the following: MP1 - Freya's results were recorded incorrectly (1) MP2 - Freya calculated her pulse rate incorrectly (1) MP3 - Freya didn't exercise with as much intensity owtte (1) MP4 - Her resting pulse rate is lower (1).	Freya didn't time the two minutes correctly (1). Everyone else injured /lazier/tires more easily/heavier (1) e.g. Freya is fitter than everyone (1).		2

Question Number	Indicative content
7	**Analysis** • There is a positive correlation • The increase in pulse rate is not linear/non-uniform • The starting pulse rates were not the same/so not a fair comparison • Freya's pulse rate was always lower (than Jane and Saul/the others) **ORA** • The initial increase in pulse rate/pulse rate in the first few minutes increased the most • The increase in pulse rate was less for the higher number of minutes/after 4 minutes • The pulse rate/heart goes up • The pulse rate does not increase as much near the end of the experiment/time **Conclusion** • As the time spent walking increases the pulse rate increases • Walking has the same effect on all of the people/Freya, Saul and Jane • Freya is fitter than the others/Jane is less fit than the others • Freya is lazier than the others as her heart rate does not increase as much **Support of Hypothesis** • The hypothesis is imprecise/ vague • Although the heart rate will be affected/ go up • The hypothesis does not say how/in what way the heart is affected • The evidence does show that everyone's pulse rate increased/it affects the heart by making it beat faster • There is insufficient evidence to know/show how the heart is affected • Accept examples of how the heart rate may be affected e.g. stronger, healthier

Level	Mark	Descriptor
	0	No rewardable material
Pass	1-2	A few key points identified, **or** one point described in some detail. The answer is likely to be in the form of a list. Points made will be superficial/generic and not applied/ directly linked to the situation in question. E.g. Freya is fitter than Saul and Jane because her pulse rate is always lower than theirs.
Merit	3-4	Some points described, **or** a few key points explained. The answer is unbalanced. Most points made will be relevant to the situation in question, but the link will not always be clear. There is a conclusion. Maybe some inaccurate science. Eg The hypothesis is vague because they have not said how the heart is affected. The heart rate increases with exercise as the numbers are increasing on the graph for all three although Freya's is always lower.
Distinction	5-6	A detailed description and explanation of evidence. The majority of points made will be relevant and there will be some clear link to the situation in question. It will be clear how the evidence does or does not support the hypothesis. E.g. The hypothesis says that the heart rate is affected. This is right but it is vague. The pulse rate increases when the people exercised. The graph shows a positive correlation. Jane's pulse was always higher than the other two so she was not as fit.

Total for the paper	**50**

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