Mark Scheme (Pre-standardisation)

June 2017

Pearson BTEC Level 3 – Applied Science

Unit 7: Contemporary Issues in Science
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Unit 7: Contemporary Issues in Science - Sample marking grid

General Marking Guidance

- All learners must receive the same treatment. Examiners must mark the first learner in exactly the same way as they mark the last.
- Marking grids should be applied positively. Learners must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the marking grid not according to their perception of where the grade boundaries may lie.
- All marks on the marking grid should be used appropriately.
- All the marks on the marking grid are designed to be awarded. Examiners should always award full marks if deserved. Examiners should also be prepared to award zero marks if the learner's response is not rewardable according to the marking grid.
- Where judgment is required, a marking grid will provide the principles by which marks will be awarded.
- When examiners are in doubt regarding the application of the marking grid to a learner's response, a senior examiner should be consulted.

Specific Marking guidance

The marking grids have been designed to assess learner work holistically.

Rows within the grids identify the assessment focus/outcome being targeted. When using a marking grid, the 'best fit' approach should be used.

- Examiners should first make a holistic judgement on which band most closely matches the learner response and place it within that band. Learners will be placed in the band that best describes their answer.
- The mark awarded within the band will be decided based on the quality of the answer in response to the assessment focus/outcome and will be modified according to how securely all bullet points are displayed at that band.
- Marks will be awarded towards the top or bottom of that band depending on how they have evidenced each of the descriptor bullet points.
Question 1: Discuss the implications of the scientific issue identified in the articles (12 marks)

Possible indicative content for Question 1:

Other valid points that they make due to own research/knowledge should also be credited.

Learners may cover a number of examples from the list below but would not be expected to cover all to get full marks:

Issues:

- climate control
- global warming
- climate deal
- Britain not yet launched carbon capture
- CC is still in infancy
- manufacturing or power industry as problems
- local regeneration

Ethical implications:

- used by high emitting countries/puts low emitting countries at risk
- First world/Third world argument
- risk to ecosystems
- political decision

Social implications:

- jobs in areas where fossil fuels brought in jobs
• variety of jobs created
• increased prosperity
• decreased air pollution
• revival of communities

**Economic implications:**

• profit for Britain
• carbon penalties
• storage is valuable
• extend life of north sea fields
• committing to fossil fuels/lack of commitment to renewable energy
• need to borrow money to start carbon capture
• cost of starting carbon capture
• cost of power
• cost of transport
• not meeting targets
• viable alternatives e.g. wind/solar

**Environmental implications:**

• lowers carbon emissions
• keeps use of fossil fuels going
• committing to fossil fuels/lack of commitment to renewable energy
• decreased air pollution
• deals with carbon dioxide produced in factories
• can cause seismic activity
• lowers global temperature
• effects on weather
• untested technology/risks
Question 2: Identify the different organisations/individuals mentioned in the articles and suggest how they may have an influence on the scientific issue (6 marks)

<table>
<thead>
<tr>
<th>Assessment focus</th>
<th>Band 0</th>
<th>Band 1</th>
<th>Band 2</th>
<th>Band 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding the influence of different organisations/individuals</td>
<td>Level of response not worthy of credit</td>
<td>Demonstrates adequate knowledge and understanding of how key organisations/individuals can influence the scientific issue by identifying different types of organisations/individuals. A basic explanation of how the organisation/individual may have an influence is given but with general statements made and limited linkages to the articles.</td>
<td>Demonstrates good knowledge and understanding of how key organisations/individuals can influence the scientific issue by identifying different types of organisations/individuals (including any references/acknowledgments in footnotes) from all three articles. An explanation of how these organisations/individuals may influence the issue is given which is occasionally supported through linkage and application to the articles.</td>
<td>Demonstrates comprehensive knowledge and understanding of how key organisations/individuals can influence the scientific issue by identifying and selecting different types of organisations/individuals (including any references/acknowledgments in footnotes) from all three articles. An explanation of how these organisations/individuals may influence the issue is given which is supported throughout with linkage and application to the articles.</td>
</tr>
</tbody>
</table>

Indicative content

Learners may cover a number of examples from the list below but would not be expected to cover all to get full marks:

**Influence**
Level of influence
Audience influenced

**Organisations and type of influence**
- Universities: research/development/education
- Government/treasury: research/funding/politics/regulations
- Shell: research/development/production/lobbying
- UK Oil and Gas Authority: research/funding/education
- Commons Select Committee on Energy and Climate Change: research/funding/politics/
- Foreign governments: Paris accord/politics/lobbying/funding/regulations
- UK's Carbon Capture and Storage Association: research/funding/development/education
- Friends of the Earth: lobbying/funding/education
- Greenpeace: lobbying/funding/education
- Britain's official Committee on Climate Change: policy expert/Britain's official Committee on Climate Change
- the International Energy Agency: research/funding/development/education
- the Intergovernmental Panel on Climate Change: research/funding/development/education
- EU’s Zero Emissions Panel: research/ funding/ development/ education
- Green Alliance: research/ funding/ lobbying/ education
- Global CCS Institute: research/ funding/ development/ education
- RWE (energy provider) research/ funding/ development
- Energy and Climate Intelligence Unit research/ funding/ development/ education
- Sask Power research/ funding/ development
- UK’s Department of Business: research/ funding/ development
- Press: education, lobbying, opinion

**Question 3:** Discuss whether article 3 has made valid judgements. (12 marks)

<table>
<thead>
<tr>
<th>Assessment focus</th>
<th>Band 0</th>
<th>Band 1</th>
<th>Band 2</th>
<th>Band 3</th>
<th>Band 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpretation, analysis and evaluation of scientific information</td>
<td>Level of response not worthy of credit</td>
<td>Vague statements about the validity of article 3 are made with limited attempt to consider:</td>
<td>The validity of article 3 is discussed which is partially supported by a consideration of:</td>
<td>The validity of article 3 is discussed which is mostly supported by a consideration of:</td>
<td>The validity of article 3 is discussed and is consistently supported throughout the consideration of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- how the article has interpreted and analysed the scientific information to support the conclusions/ judgments being made</td>
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<tr>
<td></td>
<td></td>
<td>- the validity and reliability of data</td>
<td>- the validity and reliability of data</td>
<td>- the validity and reliability of data</td>
<td>- the validity and reliability of data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- references to other sources of information</td>
<td>- references to other sources of information</td>
<td>- references to other sources of information</td>
<td>- references to other sources of information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The discussion will be unstructured and limited to basic points made.</td>
<td>The discussion shows some structure and coherence.</td>
<td>The discussion shows a structure which is mostly clear, coherent and logical.</td>
<td>The discussion shows a well-developed structure which is clear, coherent and logical.</td>
</tr>
</tbody>
</table>

**Indicative content.**

Learners should consider how the article has analysed the scientific information to support the conclusions/judgements being made; the validity and reliability of data; references to other sources of information.
Learners may cover a number of examples from the list below but would not be expected to cover all to get full marks:

**Conclusions**

- CCS can reduce carbon dioxide levels
- reducing levels in atmosphere, land management and bio energy with CCS is easy
- energy consumption can be lowered
- recyclability of CCS can be achieved
- research is needed into carbon storage and use
- research is needed into geological storage
- research will allow for development of the innovative chemistry to convert CO2 into synthetic fuels and chemicals.

**Validity and reliability:**

- range of sources
- sources in agreement
- more advantages than disadvantages- is it balanced
- three authors still publishing/ stand scrutiny
- data used
- original data
- opinions backed with data and references
- some bias but both arguments given

**References:**

- referenced throughout
- professional bodies
- some references very old e.g. Bottoms 1930
- nothing past 2014
- all references from same journal
- sometimes quoting their own research
- may be more current research that disagrees
**Question 4:** Suggest potential areas for further development and/or research of the scientific issue, from the three articles (5 marks)

**Indicative content for question 4**

<table>
<thead>
<tr>
<th>Assessment focus</th>
<th>Band 0</th>
<th>Band 1</th>
<th>Band 2 (2-3)</th>
<th>Band 3 (4-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interprets, analyses and evaluates articles to identify potential areas for further development and/or research</td>
<td>Level of response not worthy of credit</td>
<td>Areas for further development and/or research of the scientific issue are identified but these are usually vague descriptions with limited analysis/evaluation of the articles to support the statements being made.</td>
<td>A description for further areas of development and/or research of the scientific issue is given. Provides occasional evidence from the analysis/evaluation of the articles and attempts to synthesise and integrate relevant knowledge.</td>
<td>A description for further areas of development and/or research of the scientific issue is given. Consistently provides evidence from the analysis/evaluation of the articles and demonstrates throughout the skills of synthesising and integrating relevant knowledge.</td>
</tr>
</tbody>
</table>

Learners may cover a number of examples from the list below but would not be expected to cover all to get full marks:

**Further development:**
- parasitic energy consumption should be lowered
- develop alternatives for geological storage such as carbon mineralization
- development of the innovative chemistry to convert CO2 into synthetic fuels and chemicals.
- development of technologies for monitoring, verification, and assessment (MVA) to ensure that the CO2 remains trapped underground
- CO2 conversion pathways
- use of existing pipelines
- value/use of carbon dioxide

**Further research:**
- research in carbon storage and utilisation
- determine the correct composition of carbonate minerals to be included in the concrete matrix to reduce issues related to mechanical strength of the materials
- how to upgrade carbon dioxide to a fuel
- CO2 conversion pathways
- increasing the efficiency of the absorption process on coal fired power plants
- lowering costs
- carbon dioxide leakage
- risks and impacts of CCS
- less production of carbon dioxide compared to increased removal of carbon dioxide
Question 5: You are a junior researcher working for the government’s Department of Energy and Climate Change (DECC). Research the feasibility of developing the national carbon capture programme and write a report for a DECC committee on this issue. (15 marks)

<table>
<thead>
<tr>
<th>Assessment focus</th>
<th>Band 0</th>
<th>Band 1</th>
<th>Band 2</th>
<th>Band 3</th>
<th>Band 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthesises content ideas and demonstrates an understanding of scientific reporting and its relationship with reporting medium and target audience</td>
<td>Level of response not worthy of credit</td>
<td>Identifies some of the main points and evidence from the three articles with limited attempt to summarise these.</td>
<td>Summarises the main points and evidence including any supporting and conflicting statements from the three articles.</td>
<td>Summarises and attempts to synthesise the main points and evidence including any supporting and conflicting statements from the three articles.</td>
<td>Summarises and synthesises the main points and evidence including any supporting and conflicting statements consistently from the three articles.</td>
</tr>
<tr>
<td></td>
<td>Shows little awareness of audience or purpose.</td>
<td></td>
<td>Shows an awareness of audience and purpose.</td>
<td></td>
<td>Consistently selects and organises material for particular effect, with effective use of tone, style and scientific terminology.</td>
</tr>
<tr>
<td></td>
<td>The article will be unstructured and limited to basic points made.</td>
<td></td>
<td>The article shows some structure and coherence.</td>
<td></td>
<td>The article shows a well-developed structure which is clear, coherent and logical.</td>
</tr>
</tbody>
</table>

Indicative content for question 5
Learners may cover a number of examples from the list below but would not be expected to cover all to get full marks:

**Tone and style shows awareness of audience:**
- varied audience
- not all scientists
- professionals
- scientific terms- explained terms

**Main Points**

**Feasible:**
- lower carbon dioxide
- infrastructure available
- providing jobs and regeneration
- increased prosperity
- increase profit
- reduce carbon footprint
reduce greenhouse effect
reduce global warming
Britain meeting carbon dioxide target
removal of carbon dioxide from manufacturing

Not Feasible:

environmental issues e.g. seismic activity
no impact on carbon footprint
no impact on greenhouse effect
no impact on global warming
diversion of funding from renewable energy sources to CCS
increasing use of fossil fuels
cost of CCS
technology in infancy/more research needed/more development needed
risks

Conclusion

carbon capture is feasible/not feasible
use of supporting/conflicting statements from the three articles