EZY SCIENCE

# Science in the News Question Feedback and Guidance

## NOVEMBER EDITION

This document provides the mark schemes and additional written feedback to support each question in November's edition of the Science in the News. The answers aim to support students develop exam technique and provide additional tips on how to succeed in these styles of questions in an exam.

| Using Liquid Air to Store Energy – Question Mark Scheme | | | | |
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| | **Answers** | **Extra Guidance** | **Mark** | **Skills Addressed** |
| **Q1** | Any **two** from:<br>• Wind speed varies widely /between 3 m/s and 15 m/s **and so** the electricity supply will vary widely<br>• Wind speed may be low(er) when demand is high(er) **and so** electricity supply may not match demand<br>• There is no clear pattern in the wind speeds **and so** the electricity supply cannot be predicted | Both parts of each answer must be seen for the mark to be scored.<br>Accept alternative wording and reverse arguments:<br>• Wind speed is not constant / wind speed is variable<br>• Wind speed may be higher when electricity is not needed<br>• Wind speed cannot be predicted / we can't tell when the wind speed will be higher or lower or enough<br>Ignore references to possible breakdown of equipment or the idea of wind farms being a long distance from where the electricity is needed. | **2** | **WS 3.5, 3.6**<br>**MS 2c** |
| **TOTAL = 2 marks** | | | | |
| **Q2** | 16 – 20 (hours) | Any answer in this range acceptable. | **1** | **WS 3.2** |
| **TOTAL = 2 marks** | | | | |
| **Q3** | Calculation involving dividing Highview storage by battery storage per kilogram | This mark can be scored by writing a word equation, a symbol equation or an equation with ***any*** numbers in it if what is being calculated is clear e.g.<br>• Number of batteries = (Highview storage)/(battery storage)<br>• N= 50/6<br>• N = 50,000,000/6,000 | **1** | **WS 4.4, 4.5**<br>**MS 1c, 3d** |
| | Values of storage are consistent | The energy storage for the Highview plant and one battery must be expressed in the same units.<br>e.g.<br>• 6 kWh and 50,000 kWh<br>• 0.06 MWh and 50 MWh<br>• 6,000 Wh and 50,000,000 Wh<br><br>NOTE: units do not need to be seen and should be ignored if they are incorrect – the important point is the numbers should correspond correctly.<br><br>N = 50,000/6, N = 50/0.06 or N = 50,000,000/6,000 scores two marks | **1** | |

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| | 8,333(.333…) | Accept answer correctly rounded to three or two significant figures (8,330, 8,300) **OR** 8,334<br><br>Correct answer on its own scores all three marks | **1** | |
| **TOTAL = 3 marks** | | | | |
| **Q4** | **Storage:**<br>electrical energy (→ kinetic energy (in pump)) → gpe (in water) | To score these marks only the starting and end energies for each stage (electrical energy and gpe) are needed.<br>Ignore intermediate forms of energy UNLESS they are incorrect. | **1** | **WS4.1** |
| | **Release:**<br>gpe (in water) (→ kinetic energy (in water and turbine)) → electrical energy | For example, if thermal and sound energy are correctly identified as forms of waste energy, that is fine; however, any mentions of chemical energy or elastic potential energy mean that the relevant mark is not awarded.<br>These can be described in words. E.g. '(Extra) electrical energy is converted to gpe in water, which is then converted to electrical energy (when required)' scores two marks. | **1** | |
| **TOTAL = 2 marks** | | | | |
| **Q5** | Any three from:<br>• LAS takes up less space than batteries or PSS – 700 $m^3$ air compressed into 1 $m^3$ liquid air, whereas batteries and PSS take up a lot of space<br>• Technology for LAS is already well developed whereas batteries are still being developed<br>• Raw materials required for LAS are plentiful and cheap (air is taken from the atmosphere and is free) whereas batteries require finite and expensive materials / use materials that have to be mined / use materials that damage the environment when extracted OR a PSS requires the building of a large infrastructure / might damage the environment when built<br>• A LAS plant lasts for 20 years whereas batteries must be replaced regularly | For each mark a valid comparison must be made.<br><br>Ignore descriptions of disadvantages such as LAS being less efficient or a PSS possibly lasting longer than a LAS plant. | **3** | **WS1.3,1.4** |
| **TOTAL = 3 marks** | | | | |

**Additional Question Feedback and Guidance**:

**Question 1**: This question requires an explanation – the consequences of particular features of the graph need to be described; simply describing the features of the graph will not score any marks in this situation. Here 'reliability' means the ability to provide electricity when it is needed, and this must be clear from the answers.

**Question 2**: This question allows a range of answers because the horizontal scale on the graph is a little awkward (1.25 small squares to represent 1 year) and a method does not need to be seen. However, any answer outside the range automatically scores zero and it is worth taking some time adding up the times for which the production line is above the demand line.

**Question 3**: There are two aspects to this question – the application of simple arithmetic and the use of decimal prefixes – you must make sure that you understand the prefixes listed in the specification (tera (T), giga (G), mega (M), kilo (k), centi (c), milli (m), micro (μ) and nano (n)) and how to convert between them – probably the simplest way is to convert to the basic unit – in this case converting kWh and MWh to Wh.

Although three marks can be scored here for simply writing the correct answer after putting the numbers correctly into a calculator this is strongly discouraged – it is always worth writing out a method so that if a simple error is made when writing the answer most of the marks can still be scored.

**Question 4**: There is always a temptation in questions like this simply to list as many facts as can be recalled and most of the time this might work as points that do not address the question will probably just be ignored. However, it is quite easy to shoot yourself in the foot and write something that contradicts the correct answer. In this question descriptions of the intermediate energy types will be ignored as long as they are correct – for example, if thermal energy and sound energy are mentioned it must be made clear that these are forms of wasted energy, and if inappropriate forms of energy, such as elastic potential energy or chemical energy in this case, are included this may well result in marks being lost.

**Question 5**: It is not enough here simply to list the positive aspects of the liquified air system (LAS) – each aspect must be compared with a corresponding feature of the battery or PSS systems.

| Invention of the Plastic Bag – Question Mark Scheme | | | | |
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| | **Answers** | **Extra Guidance** | **Mark** | **Skills Addressed** |
| **Q1** | **Level 1:** One valid simple comparison made regarding the bottom three rows of the table and one valid qualitative comparison regarding the first four rows of the table. | Bottom three rows:<br>Paper bags will have less impact in landfill than plastic bags; **if plastic bags are used many times,** they have less impact on pollution than paper bags; if both types of bag are recycled the impacts on pollution will be the same; paper bags use a renewable raw material<br>Top four rows:<br>• Fuel used to transport paper bags greater (because of greater mass)<br>• Much more energy used in the production of paper bags<br>• Greater amounts of greenhouse gases emitted in production of paper bags<br>• Greater volumes of water consumed in production of paper bags | **1-2** | **WS 3.3, 3.5, 3.6**<br>**MS 1c** |
| | **Level 2:** Two valid simple comparisons made regarding bottom three rows of the table and one quantitative comparison per bag regarding the first four rows of the table. | Top four rows:<br>• The mass of 1 paper bag is nearly ten times (50/6 = 8.3) greater than 1 plastic bag and so would cost more to transport;<br>• The energy used in the production of one paper bag is more than twice (1.7/0.7 = 2.4) the energy used for one plastic bag;<br>• The mass of greenhouse gases emitted when producing one paper bag is twice as much as for a polythene bag;<br>• The fresh water consumed in the production of one paper bag is nearly twenty times (4,000/220 = 18.18) greater than for one plastic bag.<br>References to 1,000 bags is acceptable. | **3-4** | |

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| | **Level 3:** A detailed comparison made involving more than one of the bottom three rows of the table and two valid detailed quantitative comparisons made regarding the first four rows of the table. | Bottom three rows:<br>• Although plastic bags are not biodegradable recycling can reduce their impact;<br>• Although both types of bag are recyclable plastic bags can be used for a much longer time;<br>• Although plastic bags are not biodegradable, they can be used for a much longer time<br>Top four rows:<br>The fact that for every plastic bag used by Grace five paper bags are used by John clearly understood:<br>• The mass of paper bags used by John is more than 40 times (5 x 50/6 = 41.5) greater than the plastic bags used by Grace and so would cost more to transport;<br>• The energy used in the production of the paper bags used by John is more than twelve times (5 x 1.7/0.7 = 12.1) the energy used for the plastic bags used by Grace;<br>• The mass of greenhouse gases emitted when producing the paper bags by John is ten times (5 x 80/40 = 10) as much as for a polythene bags used by Grace<br>• The fresh water consumed in the production of the paper bags used by John is nearly 100 times (5 x 4,000/220 = 90.9) greater than for the plastic bags used by Grace | **5-6** | |
| **TOTAL = 6 marks** | | | | |
| **Q2** | Answer in terms of one bag or 1,000 bags:<br>Grace is correct:<br>One paper bag has a mass about 10 times the mass of one plastic bag **and** so more fuel is burned (which produces $CO_2$) | The point that Grace is correct must be made. | **1** | **WS 1.3, 1.4** |
| | **OR**<br>Answer in terms of the relative numbers of bags used by John and Grace:<br>Grace is correct: | | **2** | |

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| | The five paper bags used by John for each plastic bag used by Grace have a mass about 40 times greater **and** so much more fuel is burned (which produces $CO_2$) | | | |
| **TOTAL = 2 marks** | | | | |

**Additional Question Feedback and Guidance**:

**Question 1**: In order to score the higher marks in questions like this value needs to be added to the data provided in the question. Simply using the given data to illustrate a point can score some marks, as in Level 1 for this question, but usually to score the higher marks requires a calculation of a ratio or percentage change.

**Question 2**: This question also requires value to be added to data given in the question. It also requires you to come to a clear conclusion about whether or not Grace is correct.

| **Effectiveness of the Flu Jab – Question Mark Scheme** | | | | |
|---|---|---|---|---|
| | **Answers** | **Extra Guidance** | **Mark** | **Skills Addressed** |
| **Q1** | Identification of most successful and least successful years | 2010-11 (57) and 2004-5 (10) | **1** | **WS 3.2**<br>**MS 2c** |
| | (57 – 10 =) 47 (%) | Correct answer on its own scores two marks.<br>One mark can be scored for an incorrect answer if the relevant years are correctly identified but the graph is then misread)<br>For example, '55% in year 2010-11 – 10% in year 2004-5 = 45% would score one mark. | **1** | **WS 3.3**<br>**MS 1c** |
| **TOTAL = 2 marks** | | | | |
| **Q2** | Effectiveness in 2017-2018 = 35% | | **1** | **WS3.2**<br>**MS 2c** |
| | (35/100 x 294,000 =) 102,900 | Accept 103,000<br>Correct answer on its own scores 2 marks | **1** | **WS 3.3**<br>**MS 1c** |
| **TOTAL = 2 marks** | | | | |

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| Q3 | 7,200,000 patients vaccinated | | 1 | WS 3.2<br>MS 2c |
| | (35/100 x 7,200,000 =) 2,520,000 | Accept 2,500,000<br>Correct answer on its own scores 2 marks | 1 | WS 3.3<br>MS 1c |
| TOTAL = 2 marks | | | | |
| Q4 | The susceptibility to the flu virus depends on several factors. | Ignore specific and definite statements such as 'old people are less healthy'<br>Ignore 'obvious' answers that simply repeat the question such as 'flu is unpredictable' | 1 | WS 3.5 |
| | Examples of possible factors – any **two** from:<br>• Different groups/individuals may come into contact with different numbers of people<br>• Different groups/individuals might have different issues with their immune systems<br>• Flu infections might depend on weather<br>• Different strains of flu might emerge unexpectedly<br>• Not all people report their illness. | | 2 | |
| TOTAL = 3 marks | | | | |

**Additional Question Feedback and Guidance**:

**Question 1:** This is a simple subtraction and can be carried out directly from the graph. However, this question is worth more than one mark and so if you simply write the answer and make a simple slip, then all the marks are lost, whereas, if the working out is shown, then some marks can be scored.

**Question 2:** This question can also be answered directly on the calculator, but once again a simple slip might lead to all the marks being lost if the working out is not shown.

**Question 3:** This question can also be answered directly on the calculator, but once again a simple slip might lead to all the marks being lost if the working out is not shown.

**Question 4:** The command word in this question is 'suggest'. This involves using your biology knowledge and every-day 'common sense'. The important point is that your suggestion addresses the question being asked.