

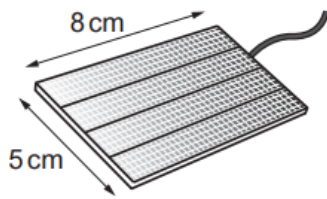
**GCSE Physics B (Twenty First Century Science)**  
**J259/03** Depth in physics (Higher Tier)

**Question Set 22**

- 1 Jane investigates the maximum power provided by two types of solar cell, as shown in **Fig. 9.1**.

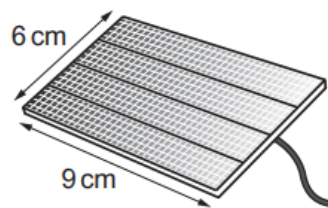
The solar cells are **not** the same size.

**Cell X**



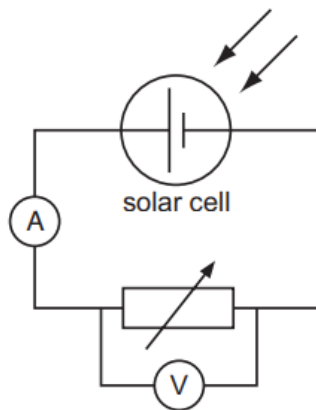
not to scale

**Cell Y**



**Fig. 9.1**

Jane uses the circuit shown in **Fig. 9.2** to measure the power provided by each cell. She carefully controls the intensity of light falling on each solar cell so that it does not change.



**Fig. 9.2**

- (a) Describe how to use the circuit in **Fig. 9.2** to measure the maximum power provided by each cell.

Include details of any calculations that must be completed.

- (b) The table shows the results of Jane's experiment.

| Cell | Maximum power (W) |
|------|-------------------|
| X    | 25                |
| Y    | 32                |

[3]

**Ben**

Cell **X** is the most effective because it has the greatest maximum power.



**Jane**

It is not a fair comparison because the cells **X** and **Y** are not the same size.



Compare the effectiveness of solar cells **X** and **Y**, taking into account their surface area.

[3]

- (c) Suggest **two** factors, other than maximum power, that could affect someone's decision to use solar cells to generate electricity for their home.

[2]

**Total Marks for Question Set 22: 8**

## Mark scheme

The breakdown of Assessment Objectives for GCSE (9-1) Physics B:

|              | <b>Assessment Objective</b>   |
|--------------|---|
| <b>AO1</b>   | <b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>  |
| AO1.1        | Demonstrate knowledge and understanding of scientific ideas.  |
| AO1.2        | Demonstrate knowledge and understanding of scientific techniques and procedures.  |
| <b>AO2</b>   | <b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>                                       |
| AO2.1        | Apply knowledge and understanding of scientific ideas.  |
| AO2.2        | Apply knowledge and understanding of scientific enquiry, techniques and procedures.   |
| <b>AO3</b>   | <b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b> |
| <b>AO3.1</b> | Analyse information and ideas to interpret and evaluate.  |
| AO3.1a       | Analyse information and ideas to interpret.   |
| AO3.1b       | Analyse information and ideas to evaluate.  |
| <b>AO3.2</b> | Analyse information and ideas to make judgements and draw conclusions.  |
| AO3.2a       | Analyse information and ideas to make judgements.   |
| AO3.2b       | Analyse information and ideas to draw conclusions.  |
| <b>AO3.3</b> | Analyse information and ideas to develop and improve experimental procedures.   |
| AO3.3a       | Analyse information and ideas to develop experimental procedures.   |
| AO3.3b       | Analyse information and ideas to improve experimental procedures.   |

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

| <b>Annotation</b>   | <b>Meaning</b>  |
|---------------------|---|
| /                   | alternative and acceptable answers for the same marking point |
| ✓                   | Separates marking points                                      |
| <b>DO NOT ALLOW</b> | Answers which are not worthy of credit                        |
| <b>IGNORE</b>       | Statements which are irrelevant                               |
| <b>ALLOW</b>        | Answers that can be accepted                                  |
| ( )                 | Words which are not essential to gain credit                  |
| —                   | Underlined words must be present in answer to score a mark    |
| <b>ECF</b>          | Error carried forward   |
| <b>AW</b>           | Alternative wording   |
| <b>ORA</b>          | Or reverse argument   |

| Question |     | Answer  | Marks | AO element         | Guidance  |
|----------|-----|---|-------|--------------------|---|
| 1        | (a) | <p>change resistance of variable resistor ✓</p> <p>record current and voltage readings (from ammeter and voltmeter) ✓</p> <p>power = potential difference × current ✓</p>   | 3     | 3.3a × 2           | <p><b>ALLOW</b> take the readings from the ammeter and the voltmeter</p> <p><b>IGNORE</b> multiply the readings from the meters to get the power</p>                |
|          | (b) | <p><math>5 \times 8 = 40</math> <b>OR</b> <math>6 \times 9 = 54</math> ✓</p> <p><math>25/40 = 0.625</math> <b>AND</b> <math>32/54 = 0.593</math> ✓</p> <p><b>OR</b></p> <p><math>40/25 = 1.6</math> <b>AND</b> <math>54/32 = 1.6875</math> ✓</p> <p><b>OR</b></p> <p>Y is 1.35 times bigger than X <b>AND</b> Y is 1.28 times more power than X ✓</p> <p>Conclusion: Cell X is more effective (because it provides more power per unit area <b>or</b> less area is needed per watt) ✓</p> | 3     | 1.2<br>2.2<br>3.2a | <p>Check space next to Fig. 9.1</p> <p><b>ALLOW</b> 0.592 or 0.59</p> <p><b>Dependent mark</b>, only award this mark if the conclusion is based on calculations</p> |
|          | (c) | <p><b>Any two from:</b><br/>(installation/maintenance) cost / savings / pay-back time ✓</p> <p>low pollution / no CO<sub>2</sub> / renewable / eco-friendly / sustainable / environmental impact ✓</p> <p>(take up large) amount of space / size / surface area / appearance ✓</p> <p>availability of light ✓</p>   | 2     | 1.1 × 2            | <b>IGNORE</b> efficiency  |

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