

Name of the Student: _____

Max. Marks : 18 Marks

Time : 18 Minutes

Mark Schemes

Q1.

- (a) (i) Use of $P = VI$ with pair of valid coordinates from graph

C1

0.52 (W)

Allow 1sf if within 0.49 to 0.52

A1
2

- (ii) Correct general shape

M1

Linear rise between 0.0 – 0.5 V and falls to zero at 0.71 V

A1
2

- (iii) Use of $\text{efficiency} = \frac{\text{useful power out}}{\text{total power in}}$

C1

Use of $I = \frac{P}{A}$

C1

Their (i) / 67.5 (m²)

(7.7 × 10⁻³ if correct)

A1
3

- (b) (i) 0.7 J of work done (by cell) per 1 C of charge (when moved round circuit)
OR
(Terminal) pd across (solar) cell with no load / current is 0.7 V
Not "per unit charge"

B1
1

- (ii) 20 cells in series (to produce 14 V)

Series arrangement has internal resistance of 15.6Ω

Cells in parallel (needed to reduce total internal resistance of array)

80 cells / 4 parallel sets of 20 cells in series

- (c) The marking scheme for this question includes an overall assessment for the quality of written communication (QWC). There are no discrete marks for the assessment of QWC but the candidate's QWC in this answer will be one of the criteria used to assign a level and award the marks for this question.

Descriptor □ an answer will be expected to meet most of the criteria in the level descriptor.

Level 3 – good

- claims supported by an appropriate range of evidence;
- good use of information or ideas about physics, going beyond those given in the question;
- argument is well structured with minimal repetition or irrelevant points;
- accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling.

Level 2 – modest

- claims partly supported by evidence;
- good use of information or ideas about physics given in the question but limited beyond this;
- the argument shows some attempt at structure;
- the ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling.

Level 1 – limited

- valid points but not clearly linked to an argument structure;
- limited use of information about physics;
- unstructured;
- errors in spelling, punctuation and grammar or lack of fluency.

Level 0

- incorrect, inappropriate or no response.

Some points:

Use on communication satellite:

Continuous supply of energy from Sun

No need for fuel (for power purposes)

Large area of solar cells not needed (but possible)

Low mass

Can be unfolded (after launch)

No environmental hazard

Reliable/no moving parts

Continuous operation:

Arrays need to track sun (to maximise absorption)

Shielding required as can be damaged by meteors or cosmic rays

*Need storage system (rechargeable batteries / capacitors) for back up
(if in shadow)*

Limit use of energy-intensive operations

Use on space probe:

Light intensity / energy too low at large distance

Intensity falls as inverse-square

Area of array would be too large

Solar cells will have degenerated too much over this time

B6
6

[18]