

Name of the Student: _____

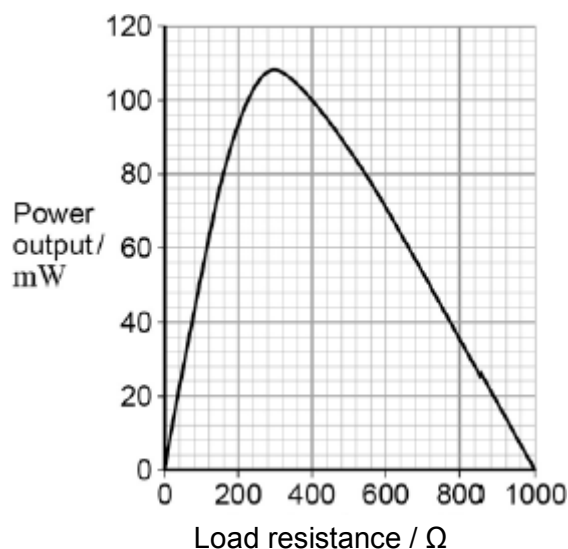
Max. Marks : 23 Marks

Time : 23 Minutes

Q1.

Figure 1 shows data for the variation of the power output of a photovoltaic cell with load resistance. The data were obtained by placing the cell in sunlight. The intensity of the energy from the Sun incident on the surface of the cell was constant.

Figure 1



- (a) The intensity of the Sun's radiation incident on the cell is 730 W m^{-2} . The active area of the cell has dimensions of $60 \text{ mm} \times 60 \text{ mm}$.

Calculate, at the peak power, the ratio $\frac{\text{electrical energy delivered by the cell}}{\text{energy arriving at the cell from the Sun}}$

- (b) The measurements of the data in **Figure 1** were carried out when the rays from the sun were incident at 90° to the surface of the panel. A householder wants to generate electrical energy using a number of solar panels to produce a particular power output.

Identify **two** pieces of information scientists could provide to inform the production of a suitable system.

(2)

(Total 5 marks)

Q2.

A student performs an experiment to find the acceleration due to gravity. The student measures the time t for a spherical object to fall freely through measured vertical distances s . The time is measured electronically. The results are shown in the table below.

s/m	t_1/s	t_2/s	t_3/s	mean time t_m/s	t_m^2/s^2
0.300	0.245	0.246	0.244	0.245	0.0600
0.400	0.285	0.286	0.286	0.286	0.0818
0.500	0.319	0.321	0.318	0.319	0.102
0.600	0.349	0.351	0.348	0.349	0.122
0.700	0.378	0.380	0.378	0.379	0.144
0.800	0.403	0.406	0.404		
0.900	0.428	0.428	0.430		

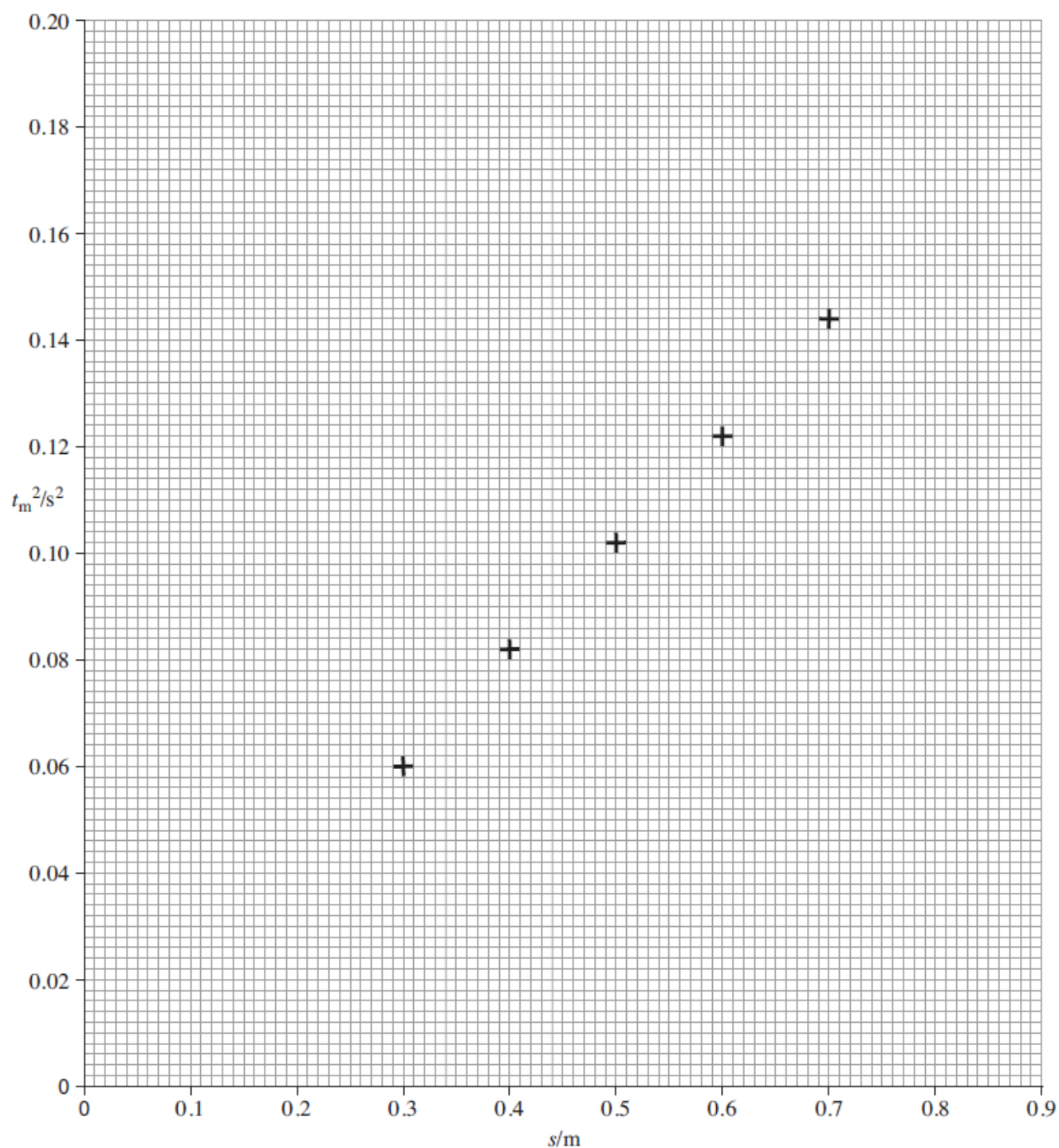
- (a) Complete the table by entering the missing values for t_m and t_m^2

(1)

- (b) Complete the graph below by plotting the remaining two points and draw a line of best fit.

(2)

- (c) Determine the gradient of the graph.



- (d) Theory suggests that the equation for the line is $t^2 = \frac{2s}{g}$ where g is the acceleration due to gravity.

Calculate a value for g using the above equation and the gradient of your graph above.

(1)

- (e) Calculate the percentage difference between your value for g and the accepted value of 9.81 m s^{-2} .

(1)

- (f) Calculate the uncertainty in the smallest value of t_m .

(1)

- (g) Calculate the value of g which would be given from the smallest value of t_m and the corresponding value of s .

(3)

- (h) The uncertainty in each value of s is $\pm 0.001 \text{ m}$.

Calculate the uncertainty in the value of g you calculated in part **(g)**.

You will need to use the uncertainty for t_m you calculated in part **(f)**.

- (i) A student wishes to investigate the effect of changing the mass of the spherical object on the acceleration of free fall.

Explain how you would modify the experiment seen at the start of this question.

(3)

(Total 18 marks)