Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

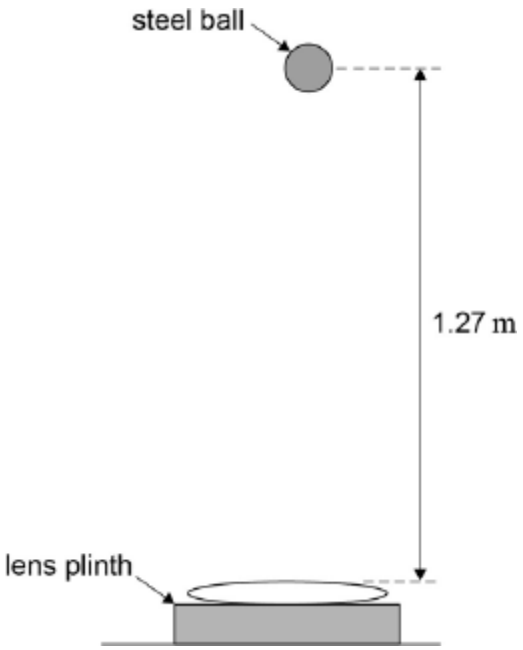
Spectacle lenses can be tested by dropping a small steel ball onto the lens, as shown in the figure below, and then checking the lens for damage.

A test requires the following specifications:

diameter of ball = 16 mm

mass of ball = 16 g

height of drop = 1.27 m



(a) Calculate the density of the steel used for the ball.

density = _____kg m^{-3}

(3)

(b) In a test the ball bounced back to a height of 0.85 m.

Calculate the speed of the ball just before impact.

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speed = _____ m s^{-1}

(2)

(c) Calculate the speed of the ball just after impact.

speed = m _____ m s^{-1}

(2)

(d) Calculate the change in momentum of the ball due to the impact.

momentum = m _____ kg m s^{-1}

(2)

(e) The time of contact was 40 ms. Calculate the average force of the ball on the lens during the impact.

average force = _____ N

(2)

(f) Explain, with reference to momentum, why the test should also specify the material of the plinth the lens sits on.

_____

_____

_____

_____

(2)

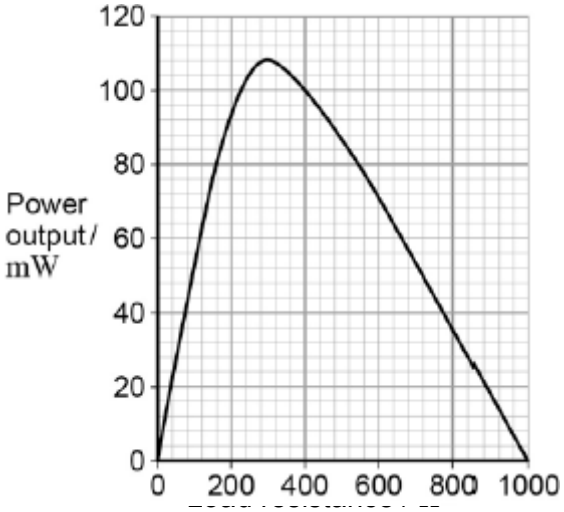
(Total 13 marks)

Q2.

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

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(a) Use data from **Figure 1** to calculate the current in the load at the peak power.

(3)

(b) 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 mm × 60 mm.

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

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(3)

(c) The average wavelength of the light incident on the cell is 500 nm. Estimate the number of photons incident on the active area of the cell every second.

(2)

(d) 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 10 marks)

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