Intensity of Radiation - Questions by Topic

Q1.

The orbits of planets around the Sun are elliptical.

The intensity of radiation received at the top of the Earth's atmosphere is monitored during one orbit of the Earth around the Sun.

The following data is recorded:

maximum intensity of radiation = 1.41 kWm^{-2}
minimum intensity of radiation = 1.32 kWm^{-2}

(a) Calculate the minimum distance between the Earth and the Sun.

power of the Sun = 3.83×10^{26}W

(3)

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Minimum distance = ...

(b) As Mars orbits the Sun, the intensity of radiation received at the top of its atmosphere

varies from 491 W m^{-2} to 711 W m^{-2}.

Explain two differences between the orbits of Mars and Earth that can be deduced from this data.

(3)

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(Total for question = 6 marks)

Q2.

Solar panels are devices that use sunlight as a source of energy to generate electricity.
A solar panel has a surface area of 1.54 m^2. The intensity of radiation incident on the Earth's surface is 1050 W m^{-2}. The manufacturer states that the maximum output power of the solar panel is 250 W.

Which of the following could be used to calculate the maximum efficiency of the solar panel?

☐ **A** $\frac{250 \times 1.54}{1050}$

☐ **B** $\frac{1050}{250 \times 1.54}$

☐ **C** $\frac{1050 \times 1.54}{250}$

☐ **D** $\frac{250}{1050 \times 1.54}$

(Total for question = 1 mark)

Q3.

Solar panels generate electricity when sunlight is incident on the surface of the panel.

(a) The total generation of electricity worldwide in the year 2014 was approximately 23 800 TWh (1 TWh = 3.6 × 10^{15} J).

Some scientists claim that if the Sahara Desert were covered with solar panels, sufficient electricity could be generated to supply the whole world.

(i) Calculate the maximum energy received by the solar panels in one hour.

maximum intensity of solar radiation at the Earth's surface = 1100 Wm^{-2} area of Sahara Desert = 9.2 × 10^{12} m^2

(2)

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Maximum energy received in one hour = ...

(ii) Determine whether covering the Sahara Desert with solar panels would be able to generate enough electricity for the whole world.

(2)

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(b) Sand storms are common in the Sahara Desert.

Explain why sand storms reduce the power generated by the solar panels.

(2)

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(Total for question = 6 marks)