

1. (a) A radio telescope with a reflecting dish of diameter d receives signals from a radio source. Show that the power of the signal received by the telescope is proportional to d^2 .

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(2)

- (b) A radio telescope has a dish of radius 60 m and detects a signal of power 7.5×10^{-16} W from a radio source. If the distance of the source from the telescope is 2.5×10^{28} m, calculate the power of the source. Assume that the energy is radiated uniformly in all directions and that there is no absorption of energy.

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(3)

(Total 5 marks)

2. (a) The original dish design of the Lovell Radio Telescope at Jodrell Bank used a 50 mm open wire mesh. Estimate the minimum wavelength detectable using this design.

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(1)

- (b) Before completion, the mesh was replaced by a solid metal surface of diameter 76 m capable of detecting radio signals as small as 60 mm wavelength. Calculate the resolving power of the telescope when detecting radiation of this wavelength.

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(2)

- (c) The Jodrell Bank Observatory also has a 13 m diameter radio telescope. State **two** advantages the telescope described in part (b) has over this smaller telescope when detecting radio waves of the same wavelength. Support each answer with a calculation.

advantage 1:

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advantage 2:

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(4)
(Total 7 marks)

