12 In recent years, astronomers have discovered sources of fast radio bursts (FRBs) in other galaxies. Studies suggest that these sources may be a type of standard candle.

(a) State what is meant by a standard candle.

(1)

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(b) An FRB source emits intense bursts of radio waves, each burst lasting for a fraction of a second. The closest FRB source is in a massive spiral galaxy 4.60×10^{24} m from the Earth.

A detector of area 1.00×10^{-4} m^2 on the surface of the Earth received bursts of radio waves. In one burst, 9.40×10^{-23} J of energy was received in a time of 1.15 ms.

(i) Show that the luminosity of the source is about 2×10^{35} W.

(4)

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(ii) When FRB sources were first discovered, some observers suggested that the bursts might be alien communications.

Suggest why this is unlikely.

luminosity of the Sun = 3.8×10^{26} W

(2)

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(Total for Question 12 = 7 marks)