

Name: _____

Class: _____

ACTIVITY SHEET

4.5 Fusion power and the Sun's source of energy

Well before Einstein suggested the equivalence between energy and mass, the source of the Sun's energy posed a problem to science.

It was known that Earth's distance from the Sun was about 150 million km, and that the Sun's radiant intensity on the surface of Earth is about 1000 W m^{-2} .

- 1 Calculate the surface area of a sphere with a radius equal to the distance between Earth and the Sun in m^2 . (Use $A = 4\pi r^2$.)
- 2 Hence calculate the power being emitted by the Sun by multiplying your answer to Question 1 by the value of solar radiation intensity on Earth's surface.

- 3 A conventional fuel such as ethanol when combusted releases 29.7 MJ per kg of fuel burned. Calculate the mass of ethanol that would need to be combusted per second to release as much energy as the Sun produces in one second.
- 4 Now use the formula $E = mc^2$ where $c = 3.0 \times 10^8 \text{ m s}^{-1}$ to find the amount of mass being converted into energy in the Sun each second.
- 5 Which of your answers to Questions 3 and 4 requires the least amount of mass to be used as fuel? Does this give an indication as to the source of energy inside the Sun? Explain your answer.