

EM Wave examples

Example 1

An EM wave is propagating in vacuum in the x direction. The wavelength is 50 m, and the electric field vibrates in the xy plane with an amplitude of 22.0 V/m.

- Calculate the frequency of the wave,
- Calculate the magnitude and direction of the B field when the E field is at its maximum pointing in the $-y$ direction.
- Write the equation for B as was done in the tutorial.

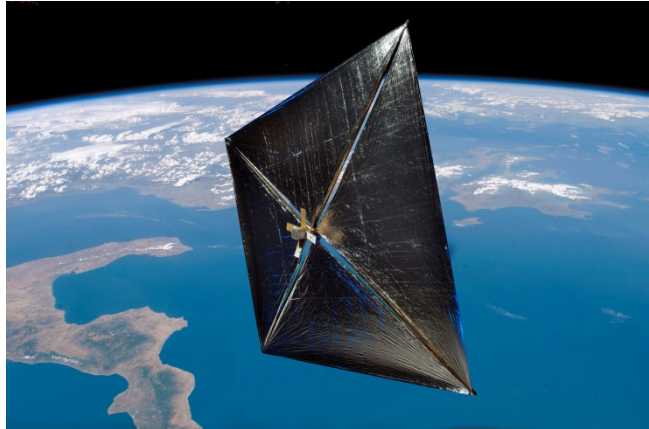
Example 2

- How much electromagnetic energy per cubic meter is contained in sunlight, if the intensity of sunlight at the Earth's surface under a clear sky is 1000 W/m^2 ?
- What should be the total area of solar panels if a solar installation were to produce 1.00 MW? Take 30 % as the efficiency of the solar panels.

Example 3

An AM radio station broadcasts isotropically (equally in all directions) with an average power of 4.00 kW. A dipole receiving antenna (as described in the tutorial) is at a location 4.00 kilometers from the transmitter. The length of the antenna is 65 cm. Compute the amplitude of the emf that is induced by this signal between the ends of the antenna.

Example 4



A possible means of space flight is to place a perfectly reflecting aluminized sheet into orbit around the Earth and then use the light from the Sun to push this "solar sail".

Suppose a sail of area $6.00 \times 10^5 \text{ m}^2$ and mass 6000 kg is placed into orbit facing the Sun.

- a) What force is exerted on the sail?
- b) What is the sail's acceleration?
- c) How long would it take the sail to reach the Moon $3.84 \times 10^8 \text{ m}$ away?

Ignore all gravitational effects. Assume that the acceleration calculated in part b) remains constant, and assume a solar intensity of 1340 W/m^2 .