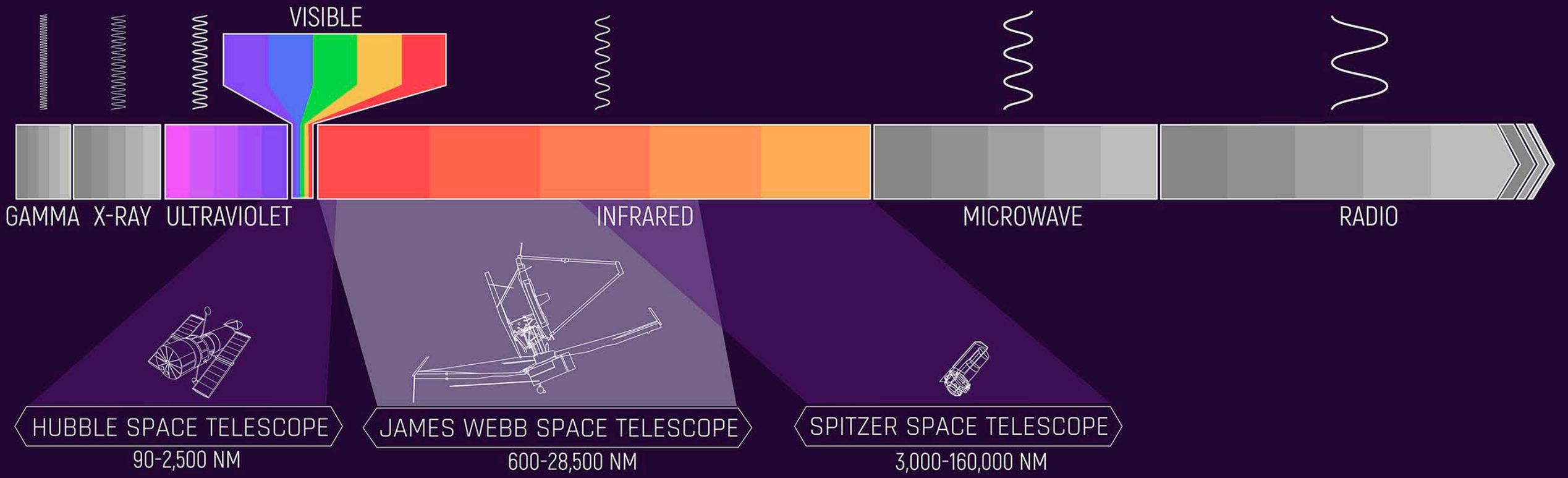
Exercise

What is the maximum strength of the B -field in an electromagnetic wave that has a maximum E-field strength of 1000 V/m ?

Exercise

An electromagnetic wave propagates in the negative y direction. The electric field at a point in space is momentarily oriented in the positive x direction. In which direction is the magnetic field at that point momentarily oriented? (a) the negative x direction (b) the positive y direction (c) the positive z direction (d) the negative z direction.

Electromagnetic Spectrum



https://webbtelescope.org/contents/media/images/4188-Image

Exercise

In many kitchens, a microwave oven is used to cook food. The frequency of the microwaves is on the order of 10^{10} Hz. Are the wavelengths of these microwaves on the order of

(A) kilometers

(B) meters

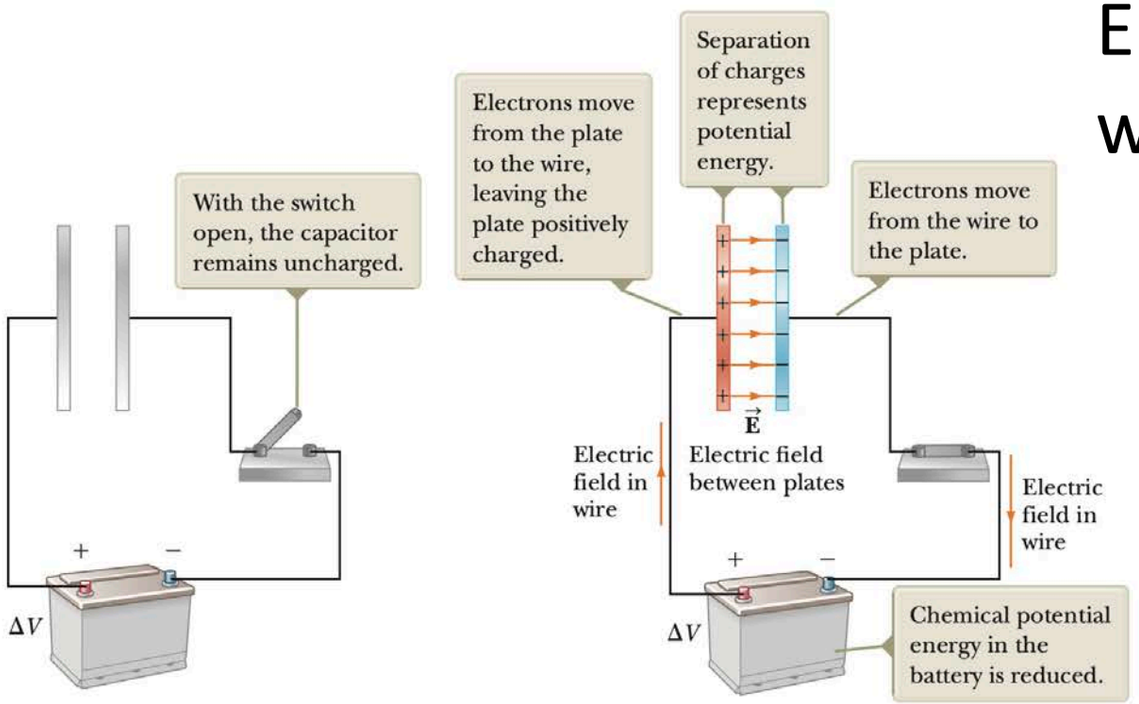
(C) centimeters

(D) micrometers

Exercise

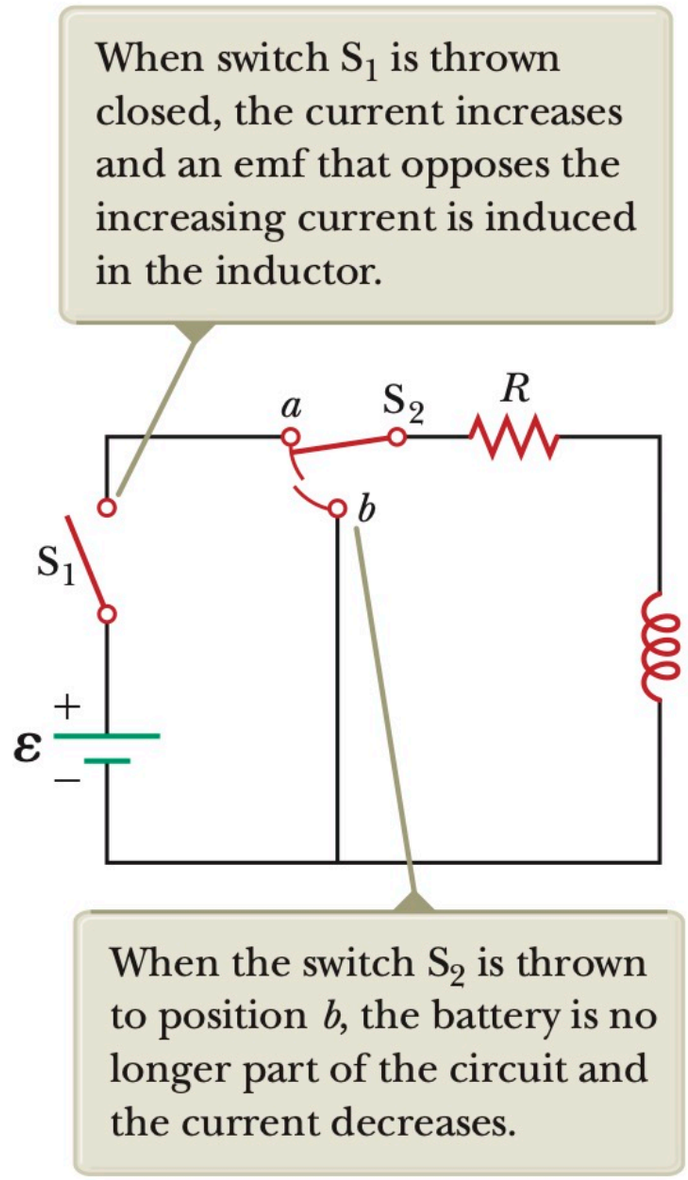
The eye is most sensitive to light having a wavelength of 5.5×10^{-7} m, which is in the green-yellow region of the electromagnetic spectrum. What is the frequency of this light?

Energy carried by electromagnetic waves



Energy per unit volume associated with an electric field:

Energy per unit volume associated with an magnetic field:



Energy carried by electromagnetic waves

Example

In SI units, an electromagnetic wave has an electric field described by

$$\vec{E} = \hat{k}1000\sin(20y + \omega t)$$

- What is the angular frequency ω?
- What is the frequency f?
- What is the direction of $\vec{E}$?
- What is $\vec{B}$?
- What is the average energy density and average intensity?

Example

Assuming the antenna of a 10.0 kW radio station radiates spherical electromagnetic waves, compute the maximum value of the magnetic field 5.00 km from the antenna.