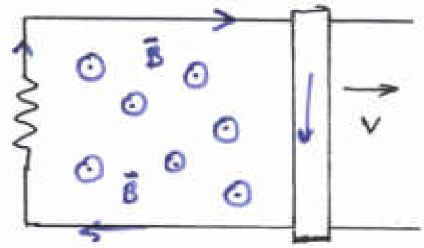
Name______________________________

Phys 122 — Section 4

Quiz #4

1. Shown here is a ciruit in which there is an induced emf because its area is changing (and hence the magnetic flux is changing.) The uniform magnetic field points out of the page, and the bar is moving to the right.

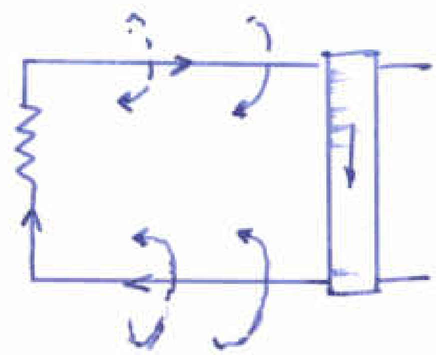


a) On the drawing, indicate the direction of the induced current in the circuit

b) Carefully explain why you made your choice in part (a).

As the bar moves to the right the flux (B·A) thru the circuit is out of the page and increasing. To counteract this change a current is set up so as to give a flux into the page.

By the RHR-2, this will come about if the current goes as shown, since this gives a magnetic field inside the circuit pointing into the page.



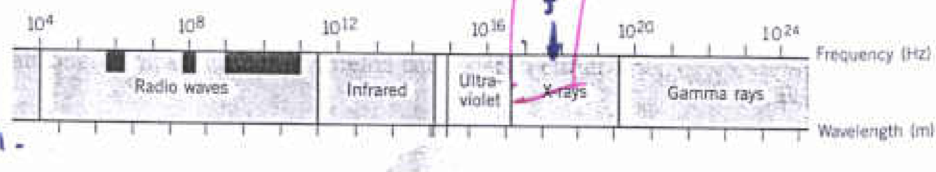
2. a) The wavelength of certain type of electromagnetic radiation is 2.11×10^{-10} m. Find the frequency of this radiation.

$\lambda = 2.11 \times 10^{-10}\,m$

Use: $\lambda f = c$ Then $f = \frac{c}{\lambda} = \frac{(2.998 \times 10^{8}\, m/s)}{(2.11 \times 10^{-10}\, m)} = \boxed{1.42 \times 10^{18}\, Hz}$

b) Using this figure (taken from the book), what is the type of radiation given in part (a)?

Locate f from (a) on chart:

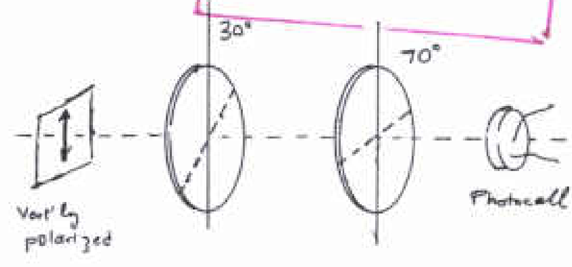


This is the $\boxed{\text{X-ray}}$ region.

c) How far does light travel in one hour (3600 s)? (Express the answer in meters.)

$$d = vt = ct = (2.998 \times 10^8 \tfrac{m}{s})(3600\,s) = \boxed{1.079 \times 10^{12}\ m}$$

3. A beam of light polarized in the vertical direction and having intensity $300\,\frac{\mathrm{W}}{m^2}$ passes through two polarizers. The first one has its axis tilted at 30° from the vertical and the second has its axis tilted at 70° from the vertical.



What is the intensity of the light transmitted by both polarizers?

After the light passes thru the first polarizer, it is pol'd at 30° from the vertical and its intensity is

$$(300\,\tfrac{W}{m^2})(\cos^2 30°) = 225\,\tfrac{W}{m^2}$$

After the light passes thru the second polarizer it is pol'd at 70° from the vertical (40° different from the former direction) so its intensity is now

$$(225\,\tfrac{W}{m^2})(\cos^2 40°) = \boxed{132\,\tfrac{W}{m^2}}$$

You must show all your work!

$$\epsilon_0 = 8.895 \times 10^{-12}\,\frac{\mathrm{C}^2}{\mathrm{N \cdot m^2}} \qquad \mu_0 = 4\pi \times 10^{-7}\,\frac{\mathrm{T \cdot m}}{\mathrm{A}} \qquad c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = 2.998 \times 10^8\,\frac{\mathrm{m}}{\mathrm{s}}$$

Polarity of an induced emf is such that the induced current produces an induced magnetic field that opposes the change in flux causing the emf.

$$V = IR \qquad P = IV \qquad N_2\Phi_2 = MI_1 \qquad N\Phi = LI \qquad \text{Energy} = \tfrac{1}{2}LI^2$$

RHR–2: Point thumb in direction of current, fingers "wrap" in direction of **B** field.

$$\lambda f = c \qquad \overline{u} = \epsilon_0 E_{\mathrm{rms}}^2 = \frac{1}{\mu_0}B_{\mathrm{rms}}^2 \qquad \overline{S} = c\epsilon_0 E_{\mathrm{rms}}^2 = \frac{c}{\mu_0}B_{\mathrm{rms}}^2 \qquad \overline{S} = \overline{S}_0 \cos^2\theta$$

Some EM units: Coulomb, Volt, Farad, Ampere, Ohm, Tesla, Weber, Henry