

Announcements

- MCAT Physics session here in Olin 268 tonight, 7:00-8:00 pm
- Physics alumni panel Thursday, Feb. 26 at 7:00 pm in the Hildreth-Mirza Great Room



The poster features a central illustration of a white teapot with a red lid and two white teacups with saucers, all decorated with a red speckled pattern. The teapot is pouring red liquid into the cups. The illustration is set against a dark purple background with teal leaf-like shapes. A teal oval in the upper right contains the text 'TEA AND COOKIES SERVED' in orange. The event details are written in white and orange text.

TOYS & TEA

TEA AND COOKIES SERVED

THURSDAY
FEBRUARY 19TH
4:00 - 5:00 PM

LEARN ABOUT
MICROWAVE
PHYSICS

PHYSICS
STUDENT LOUNGE
OLIN 251A

COME AND CONDUCT EXPERIMENTS WITH YOUR
FAVORITE PHYSICS & ASTRONOMY FACULTY
ALL ARE WELCOME

Lecture 9 — Concept Test 1

A wave on a string is described by the equation

$$y(z, t) = 8 \cos(2z + 4t),$$

where distance is in meters and time is in seconds.

(a) What is the wavelength of this wave?

1. 8 m

3. 4 m

5. π m

2. 2 m

4. $\pi/4$ m

6. $\pi/2$ m

(b) What is the propagation direction of this wave?

1. $+x$

3. $+y$

5. $+z$

2. $-x$

4. $-y$

6. $-z$

Lecture 9 — Concept Test 2

Generate a traveling wave by oscillating the end of a slinky with a frequency of 2 Hz. The resulting wavelength is 60 cm. If we now increase the frequency to 4 Hz with the same slinky, what is the new wavelength for the wave?

1. 0
2. 15 cm
3. 30 cm
4. 60 cm
5. 120 cm
6. not enough information

Maxwell's Equations of Electricity and Magnetism

- ▶ Gauss's law for electricity: $\oint \vec{E} \cdot d\vec{A} = q_{\text{enc}}/\epsilon_0$
- ▶ Gauss's law for magnetism: $\oint \vec{B} \cdot d\vec{A} = 0$
- ▶ Faraday's law: $\oint \vec{E} \cdot d\vec{\ell} = -\frac{d\Phi_B}{dt}$
- ▶ Ampere-Maxwell law: $\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I_{\text{enc}} + \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$

Maxwell's Equations in Vacuum (no q or I)

- ▶ $\oint \vec{E} \cdot d\vec{A} = 0$
- ▶ $\oint \vec{B} \cdot d\vec{A} = 0$
- ▶ $\oint \vec{E} \cdot d\vec{\ell} = -\frac{d\Phi_B}{dt}$
- ▶ $\oint \vec{B} \cdot d\vec{\ell} = \mu_0 \epsilon_0 \frac{d\Phi_E}{dt}$

Lecture 9 — Concept Test 3

Suppose the electric field in an EM wave is described by the equation

$$\vec{E} = E_0 \cos(kz - \omega t) \hat{i}.$$

Which of the following could represent the magnetic field for this EM wave?

1. $\vec{B} = -\frac{E_0}{c} \cos(kz - \omega t) \hat{j}$

4. $\vec{B} = \frac{E_0}{c} \cos(kz - \omega t) \hat{i}$

2. $\vec{B} = \frac{E_0}{c} \cos(kz - \omega t) \hat{j}$

5. $\vec{B} = -\frac{E_0}{c} \cos(kz - \omega t) \hat{k}$

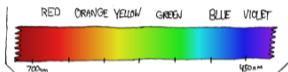
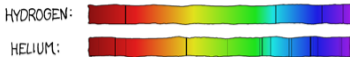
3. $\vec{B} = -\frac{E_0}{c} \cos(kz - \omega t) \hat{i}$

6. $\vec{B} = \frac{E_0}{c} \cos(kz - \omega t) \hat{k}$

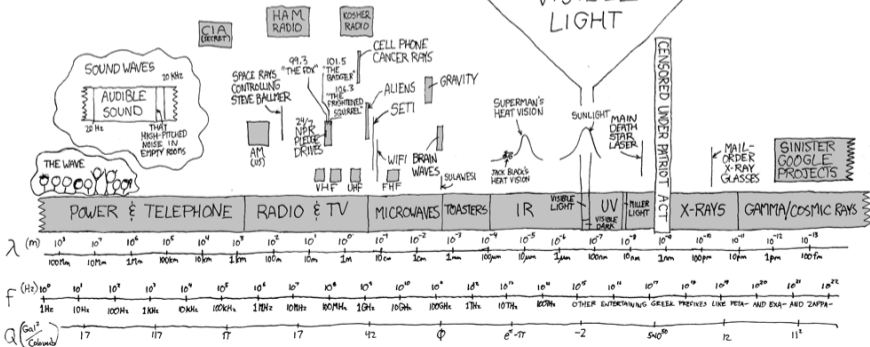
THE ELECTROMAGNETIC SPECTRUM

THESE WAVES TRAVEL THROUGH THE ELECTROMAGNETIC FIELD. THEY WERE FORMERLY CARRIED BY THE AETHER, WHICH WAS DECOMMISSIONED IN 1897 DUE TO BUDGET CUTS.

ABSORPTION SPECTRA:

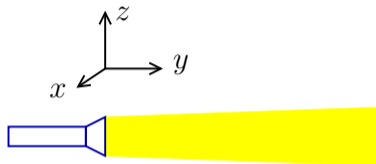


VISIBLE LIGHT



Lecture 9 — Concept Test 4

Consider a beam of light that is propagating along the y -axis and polarized along the z -axis. The light enters a diffuse vapor cloud.



(a) Along which axis do the electrons in the vapor cloud oscillate?

1. $\pm x$
2. $\pm y$
3. $\pm z$

(b) Along which axes can the re-radiated light propagate?

1. $\pm x$ and $\pm y$
2. $\pm x$ and $\pm z$
3. $\pm y$ and $\pm z$