

# Chapter 33 End-of-Chapter Problems

Halliday & Resnick, 10th Edition

Donald Aingworth IV

Hit me where it Matters

# 1 Problem 1

A certain helium-neon laser emits red light in a narrow band of wavelengths centered at 632.8 nm and with a “wavelength width” (such as on the scale of Fig. 33-1) of 0.0100 nm. What is the corresponding “frequency width” for the emission?

## 1.1 Solution

Use the traditional formula for the wavelength. Here, the speed of the wave is the speed of light. We can treat this like an error and raw value issue.

$$v = \lambda f \rightarrow f = \frac{c}{\lambda} \quad (1)$$

$$\frac{\delta f}{f} = \frac{\delta \lambda}{\lambda} \quad (2)$$

$$\delta f = f * \frac{\delta \lambda}{\lambda} = c * \frac{\delta \lambda}{\lambda^2} \quad (3)$$

$$= 2.998 \times 10^8 \text{ m/s} * \frac{0.0100 \text{ nm}}{(632.8 \text{ nm})^2} \quad (4)$$

$$= \boxed{7.49 \text{ GHz}} \quad (5)$$

## 2 Problem 5

What inductance must be connected to a 17 pF capacitor in an oscillator capable of generating 550 nm (i.e., visible) electromagnetic waves? Comment on your answer.

### 2.1 Solution

### 3 Problem 7

What is the intensity of a traveling plane electromagnetic wave if  $B_m$  is  $1.0 \times 10^{-4} \text{ T}$ ?

#### 3.1 Solution

## 4 Problem 9

Some neodymium-glass lasers can provide 100 TW of power in 1.0 ns pulses at a wavelength of 0.26  $\mu\text{m}$ . How much energy is contained in a single pulse?

### 4.1 Solution

## 5 Problem 11

A plane electromagnetic wave traveling in the positive direction of an x axis in vacuum has components  $E_x = E_y = 0$  and  $E_z$  has the below value.

$$E_z = (2.0 \text{ V/m}) \cos [(\pi \times 10^{15} \text{ s}^{-1})(t - x/c)] \quad (6)$$

(a) What is the amplitude of the magnetic field component? (b) Parallel to which axis does the magnetic field oscillate? (c) When the electric field component is in the positive direction of the z axis at a certain point P, what is the direction of the magnetic field component there?

### 5.1 Solution

## 6 Problem 13

### 6.1 Solution

## 7 Problem 19

### 7.1 Solution



## 8 Problem 21

### 8.1 Solution

## 9 Problem 29

### 9.1 Solution

## 10 Problem 33

### 10.1 Solution

## 11 Problem 37

### 11.1 Solution

## 12 Problem 41

### 12.1 Solution

## 13 Problem 43

### 13.1 Solution

## 14 Problem 45

### 14.1 Solution

## 15 Problem 49

### 15.1 Solution



## 16 Problem 51

### 16.1 Solution

## 17 Problem 55

### 17.1 Solution

## 18 Problem 59

### 18.1 Solution

## 19 Problem 65

### 19.1 Solution

## 20 Problem 69

### 20.1 Solution

## 21 Problem 71

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## 22 Problem 75

### 22.1 Solution

## **23 Problem 83**

### **23.1 Solution**



## 24 Problem 87

### 24.1 Solution

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