CENGAGE | WEBASSIGN

yathartha.regmi@ttu.edu
(Sign out)

← PHYS 2401, section 201, Summer 2 2022

Chapter 34 (Homework)

INSTRUCTOR
Keith West
Texas Tech University

Current Score

QUESTION	1	2	3	4	5	6	7
POINTS	–/3	–/1	–/1	–/11	–/6	–/1	–/2

TOTAL SCORE

–/25	0.0%

Due Date

THU, AUG 4, 2022
11:59 PM CDT

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Assignment Submission & Scoring

Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

Assignment Scoring

Your last submission is used for your score.

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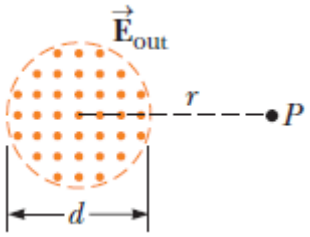
1. **[–/3 Points]** DETAILS **SERPSE10 33.1.OP.001.**

MY NOTES | ASK YOUR TEACHER | PRACTICE ANOTHER

An electric field is restricted to a circular area of diameter d = 10.4 cm as shown in the figure.



At the instant shown, the field direction is out of the page, its magnitude is 300 V/m, and its magnitude is increasing at a rate of 19.6 V/(m · s).

(a) What is the direction of the magnetic field at the point P, r = 15.6 cm from the center of the circle?

- ○ upwards
- ○ downwards

(b) What is the magnitude of the magnetic field (in T) at the point P, r = 15.6 cm from the center of the circle?

[ ] T

(c) **What If?** As before, at the moment shown in the figure, the electric field within the circle has a magnitude of 300 V/m and is increasing at a rate of 19.6 V/(m · s). In addition, suppose that the radius of the circular area of the electric field increases at a rate of 1.00 cm/s. What would the magnitude of the magnetic field be at point P at this moment (in T)?

[ ] T

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2. [–/1 Points] DETAILS SERPSE10 33.2.P.003.MI.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

A proton moves through a region containing a uniform electric field given by $\vec{\mathbf{E}}$ = 40.0 $\hat{\mathbf{j}}$ V/m and a uniform magnetic field $\vec{\mathbf{B}}$ = (0.200 $\hat{\mathbf{i}}$ + 0.300 $\hat{\mathbf{j}}$ + 0.400 $\hat{\mathbf{k}}$) T. Determine the acceleration of the proton when it has a velocity $\vec{\mathbf{v}}$ = 190 $\hat{\mathbf{i}}$ m/s.

$\vec{\mathbf{a}}$ =

m/s^2

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3. [–/1 Points] DETAILS SERPSE10 33.3.OP.005.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

The wavelength of light emitted by a krypton laser is λ = 568.2 nm. What is the frequency of these light waves (in Hz)?

Hz

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4. [–/11 Points] DETAILS SERPSE10 33.3.P.010.

MY NOTES ASK YOUR TEACHER

Perform the following steps to verify by substitution that equations C and D are solutions to Equations A and B, respectively.

$\frac{\partial^2 E}{\partial x^2} = \varepsilon_0 \mu_0 \frac{\partial^2 E}{\partial t^2}$	$E = E_{max} \cos(kx - \omega t)$
Equation A	Equation C
$\frac{\partial^2 B}{\partial x^2} = \varepsilon_0 \mu_0 \frac{\partial^2 B}{\partial t^2}$	$B = B_{max} \cos(kx - \omega t)$
Equation B	Equation D

(a) Calculate the first partial derivatives listed below. (Use the following as necessary: k, ω, x, t, and either E_{max} or B_{max}.)

$\frac{\partial E}{\partial x} =$

$\frac{\partial B}{\partial x} =$

$\frac{\partial E}{\partial t} =$

$\frac{\partial B}{\partial t} =$

(b) Calculate the second partial derivatives listed below. (Use the following as necessary: k, ω, x, t, and either E_{max} or B_{max}.)

$\frac{\partial^2 E}{\partial x^2} =$

$\frac{\partial^2 B}{\partial x^2} =$

$\frac{\partial^2 E}{\partial t^2} =$

$\frac{\partial^2 B}{\partial t^2} =$

(c) Given $k^2 / \omega^2 = (1 / f \lambda)^2$, calculate the ratios of the second partial derivatives below. (Use the following as necessary: c.)

=

$$\frac{\frac{\partial^2 E}{\partial x^2}}{\frac{\partial^2 E}{\partial t^2}} =$$

$$\frac{\frac{\partial^2 B}{\partial x^2}}{\frac{\partial^2 B}{\partial t^2}}$$

(d) Express $\varepsilon_0 \mu_0$. (Use the following as necessary: c.)

$\varepsilon_0 \mu_0 =$

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5. [–/6 Points] DETAILS SERPSE10 33.4.OP.009.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

An electromagnetic wave is traveling in a vacuum. At a particular instant for this wave, $\vec{\mathbf{E}} = [(90.0)\hat{\mathbf{i}} + (36.0)\hat{\mathbf{j}} + (-72.0)\hat{\mathbf{k}}]$ N/C, and $\vec{\mathbf{B}} = [(0.400)\hat{\mathbf{i}} + (0.160)\hat{\mathbf{j}} + (0.580)\hat{\mathbf{k}}]$ μT.

(a) Calculate the following quantities. (Give your answers, in μT · N/C, to at least three decimal places.)

E_xB_x = ____ μT · N/C

E_yB_y ____ μT · N/C

E_zB_z ____ μT · N/C

$E_xB_x + E_yB_y + E_zB_z$ ____ μT · N/C

Are the two fields mutually perpendicular? How do you know?

- ○ No, because their dot product *is equal to* zero.
- ○ No, because their dot product *is not equal to* zero.
- ○ Yes, because their dot product *is not equal to* zero.
- ○ Yes, because their dot product *is equal to* zero.

(b) Determine the component representation of the Poynting vector (in W/m^2) for these fields.

$\vec{\mathbf{S}}$ =

W/m^2

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6. [–/1 Points] DETAILS SERPSE10 33.5.P.021.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

A 24.3-mW laser beam of diameter 2.02 mm is reflected at normal incidence by a perfectly reflecting mirror. Calculate the radiation pressure on the mirror.

[ ] N/m^2

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7. [–/2 Points] DETAILS SERPSE10 33.7.OP.021.

MY NOTES ASK YOUR TEACHER PRACTICE ANOTHER

Electromagnetic waves are traveling in the vacuum of space. Calculate the wavelengths of these electromagnetic waves with the following frequencies. (Enter the first wavelength in pm and the second wavelength in cm.)

(a) 4.00×10^{19} Hz

[ ] pm

(a) 6.50×10^{9} Hz

[ ] cm

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