**Chapter 34. Electromagnetic Waves**

St. ID: , Name:

1. A 0.200-A current is charging a capacitor that has circular plates 10.0 cm in radius. If the plate separation is 4.00 mm, (a) what is the time rate of increase of electric field between the plates? (b) What is the magnetic field between the plates 5.00 cm from the center?

Ans: (a) 7.19×1011 V/m‧s (b) 2.00×107 T

For the capacitor,

 

 (a) 

 (b) : 

 

1. A proton moves through a region containing a uniform electric field given by $\rightharpoonaccent{E}=50.0\hat{j}$ V/m and a uniform magnetic field $\rightharpoonaccent{B}=0.200\hat{i}+0.300\hat{j}+0.400\hat{k}$ T. Determine the acceleration of the proton when it has a velocity $\rightharpoonaccent{v}=200\hat{i}$ m/s.

Ans: $-2.87×10^{9}\hat{j}+5.75×10^{9}\hat{k}$ m/s2

The net force on the proton is the Lorentz force, as described by

 

 Taking the cross product of 

 

Then, 

1. The distance to the North Star, Polaris, is approximately 6.44 × 1018 m. (a) If Polaris were to burn out today, how many years from now would we see it disappear? (b) What time interval is required for sunlight to reach the Earth? (c) What time interval is required for a microwave signal to travel from the Earth to the Moon and back?

Ans: (a) 681 years (b) 8.32 min (c) 2.56 s

(a) Since the light from this star travels at 3.00 × 108 m/s, the last bit of light will hit the Earth in



 (b) From Table C.4 (in Appendix C of the textbook), the average Earth-Sun distance is *d* = 1.496 × 1011 m, giving the transit time as

 

 (c) Also from Table C.4, the average Earth-Moon distance is
*d* = 3.84 × 108 m, giving the time for the round trip as

 

1. Verify by substitution that the following equations are solutions to Equations 33.19 and 33.20, respectively:

 $E=E\_{max}cos\left(kx-wt\right)$

$$B=B\_{max}cos(kx-wt)$$

Ans:



 

 We must show: 

 That is, 

 But this is true, because 

 The proof for the wave of the magnetic field follows precisely the same steps.