# Homework: Ch. 24

1. As a parallel-plate capacitor with circular plates 20.0 cm in diameter is being charged, the current density of the displacement current in the region between the plates is uniform and has a magnitude of 20.0 A/m^2.
   a. Calculate the magnitude B of the magnetic field at a distance r= 50.0 mm from the axis of symmetry of this region.
   b. Calculate $\Delta E/\Delta t$ in this region.

2. A 0.50 T magnetic field is applied to a paramagnetic gas whose atoms have an intrinsic magnetic dipole moment of 1.0×10^{-23} J/T. At what temperature will the mean kinetic energy of translation of the atoms equal the energy required to reverse such a dipole end for end in this magnetic field?

3. Assume the average value of the vertical component of Earth's magnetic field is 43 μT (downward) for all of Arizona, which has an area of 2.95×10^5 km^2. What then is the magnitude of the net magnetic flux through the rest of Earth's surface (the entire surface excluding Arizona)?

4. A silver wire has resistivity $\rho = 1.62 \times 10^{-8}$ $\Omega \cdot$ m and a cross-sectional area of 5.00 mm^2. The current in the wire is uniform and changing at the rate of 2000 A/s when the current is 100 A. What is the magnitude of the (uniform) electric field in the wire when the current in the wire is 100 A?

5. In the figure below three snapshots of the electric field and the magnetic field of different electromagnetic waves. In each snapshot, what is the direction of the wave's travel?
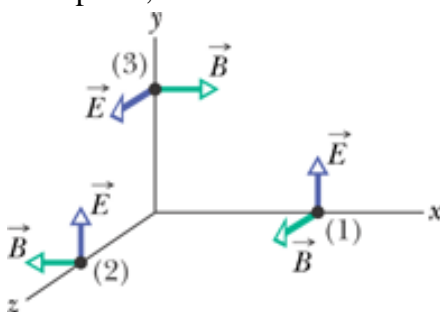
6. A uniform beam of light completely illuminates a card that is perpendicular to the beam and that has area $A = 4.00 \times 10^{-4}$ m^2. The light intensity is 7.0×10^{-15} W/m^2. What is the radiation pressure and radiation force on the card if it is totally reflecting (it reflects all of the light) back along the incident path?

7. A searchlight (the type that was once used to search for incoming enemy aircraft at night) emits a beam of light at a power Pr = 24 kW. What is the force on the searchlight housing due to the light emission? Assume that the area of the housing is 2.50×10^{-2} m^2.

8. What is the magnitude of the electric field component and the magnitude of the Poynting vector of a traveling plan electromagnetic wave if $B_m = 1.0 \times 10^{-4}$ T?

9. The average intensity of the solar radiation that strikes normally on a surface just outside Earth's atmosphere is 1.4 kW/m^2. (a) What radiation pressure p_r is exerted on this surface, assuming complete absorption? (b) For comparison, find the ratio of p_r to Earth's sea-level atmospheric pressure, which is 1.0×10^5 Pa.

10. In a plane radio wave the maximum value of the electric field component is 5.00 V/m. Calculate the maximum value of the magnetic field component and the wave intensity.

11. Sunlight just outside the Earth's atmosphere has an intensity of 1.40 kW/m^2. Calculate E_m and B_m for sunlight there, assuming it to be a plane wave.