Homework Discussion, Week 6

Physics 1302 Dr. Andersen

Chapter 23

15.) In this case, only the magnetic field strength is changing, so we can write Faraday's law as $\mathcal{E} = -NA\cos\theta(\Delta B/\Delta t)$. Because the field reverses itself over $\Delta t = 0.30\ s$, the change in magnetic field strength must be $\Delta B = 2(0.20\ T) = 0.40\ T$. (Alternatively, you can note that the angle between the field and the perpendicular to the field changes from $0°$ to $180°$, so that $\cos\theta$ changes from 1 to -1 over that time, with B held constant–the result is the same either way.) Plug everything into Faraday's law, and there you go.

16.) In this case, only the area of the loop is changing, so we can write Faraday's law as $\mathcal{E} = -NB\cos\theta(\Delta A/\Delta t)$. Given we know the perimeter (p) of the square and the circumference (c) of the circle are both 1.12 m, we can find the area the square from $(\frac{p}{4})^2$, and of the circle from $\pi(\frac{c}{2\pi})^2$, and thus get the change in area. Just plug that into Faraday's law.
Answer: $5.29 \times 10^{-4}\ V$.

30.) a) The induced emf in the loop will be the motional emf across the sliding bar, $\mathcal{E} = vBl$. The current in the loop will just be that given by Ohm's law or $\mathcal{E} = IR$, so that $IR = vBl$, or $v = IR/Bl$. b) No, the only difference would be that the direction of current flow would be reversed.
Answer: a) $4.6\ m/s$.

61.) Just use the ideal transformer equation.