Quiz 20-21 **Name:** GRACE JOHNSTON **Score:** 20 / 20

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As always, *show all your work* and *circle your final answer*. All numeric values are good to 3 significant figures.

$$F = qvB\sin\theta, \quad F = I\ell B\sin\theta, \quad \mathcal{E} = B\ell v, \quad \Phi = BA\cos\phi, \quad \mathcal{E} = -N\frac{\Delta\Phi}{\Delta t}, \quad \mathcal{E} = NAB\omega\sin\omega t$$

$$\frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p}, \quad V_{RMS} = \frac{V_{max}}{\sqrt{2}}, \quad f_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi\sqrt{LC}}, \quad V=IR, \quad P=IV$$

1. [3 pts.] A bar magnet with the 'N' pole pointing down and the 'S' pole pointing up is dropped through a loop of conducting wire. As the magnet is moving downward, towards the loop, in what direction does the magnet feel a force produced by the loop?

A. Up; opposing the motion of the magnet.	**B.** Down; the same direction as the motion of the magnet.	**C.** Left; perpendicular to the motion of the magnet.	**D.** Right; perpendicular to the motion of the magnet.	**E.** None of these.

2. [3 pts.] As shown at right, two coils of wire are side-by-side, and in the same plane as your piece of paper. In coil #1, the current is very quickly turned on. Which of the following occurs?

#1 (I just turned on, counterclockwise) #2 (I=?) induced to oppose Δflux

A. A clockwise current is induced in coil #2	**B.** A counter-clockwise current is induced in coil #2	**C.** The magnetic field in coil #2 changes, but no current is produced	**D.** The magnetic field in coil #2 does *not* change, and no current is produced	**E.** 42

3. [3 pts.] You know that a transformer is a device that is intended to be used with alternating current. But, you decide to supply a direct (constant) current to the primary coil. As a result, which of the following is most likely to happen?

A. The primary coil eventually gets hot.	**B.** The secondary coil eventually gets hot.	**C.** Both A and B occur.	**D.** Neither A nor B occur.	**E.** 42

4. [3 pts.] What is the resonant frequency of an AC circuit that has a resistor (R = 1000 Ohms), a capacitor (C = 5.00×10^{-6} F), and an inductor (L=4.00×10^{-2} H) in series with one another?

$$f = \frac{1}{2\pi}\frac{1}{\sqrt{LC}} = \frac{1}{2\pi}\frac{1}{\sqrt{(4\times10^{-2}\,H)(5\times10^{-6}\,F)}} = 356\ Hz \quad (\text{or } 2240\ \tfrac{rad}{s})$$

5. [6 pts.] Suppose a single coil of wire lies in the plane of the page and originally has an area of 0.250 m^2. There is a uniform magnetic field of 3.00 T pointing directly out of the page. What is the average magnitude of the induced voltage in the wire if it turns 90.0° (perpendicular to the plane of the page) in 0.100s?

$$\mathcal{E} = \frac{-N\Delta\Phi}{\Delta t} = \frac{-1\Delta(BA)}{\Delta t} = \frac{-(3.00\ T)(.250\ m^2 - 0\ m^2)}{.100\ s}$$

$$= 7.50\ V$$

6 [2 pts] How would your answer above change if the wire were wrapped with the same dimensions, but with 10 loops of the wire?

It would be 10 times as large: 75.0V