**PHYSICS 1050 Final Examination**
University of Wyoming
3 May 2011

This test is open-note and open-book. Any reference material is permitted during the test. Calculators and computers are also permitted. However, no sharing of materials, collaboration, consultation, or communication with other people (other than the administrator) is allowed by any means, including but not limited to verbal, written, or electronic methods.

If you have a question about the test, please raise your hand. Please do not open this test booklet until everyone has received a booklet and the test administrator has indicated for you to begin.

**Physical Constants:**

Gravitational const: $G = 6.67 \times 10^{-11}\ \mathrm{Nm^2/kg^2}$
Earth surface gravity: $g = 9.8\ \mathrm{m/s^2} = 9.8\ \mathrm{N/kg}$
Boltzmann const: $k_B = 1.3807 \times 10^{-23}\ \mathrm{J/K}$
Coulomb const: $k = 8.992 \times 10^{9}\ \mathrm{Nm^2/C^2}$
Speed of light: $c = 2.9979 \times 10^{8}\ \mathrm{m/s}$
Planck const: $h = 6.626 \times 10^{-34}\ \mathrm{Js}$
Proton charge: $e = 1.6021 \times 10^{-19}\ \mathrm{C}$

**Formulas:**

Instantaneous velocity: $\vec{v} = \lim_{\Delta t \to 0} \Delta\vec{x}/\Delta t$
Instantaneous acceleration: $\vec{a} = \lim_{\Delta t \to 0} \Delta\vec{v}/\Delta t$
Dist in const accel: $\Delta\vec{x} = \vec{v}_0 \Delta t + \frac{1}{2}\vec{a}(\Delta t)^2$
Acceleration from net force $\vec{F}$: $\vec{a} = \vec{F}/m$
Momentum: $\vec{p} = m\vec{v}$
Work: $w = \vec{F} \cdot \Delta\vec{x} = \Delta E$
Simple machine: $\vec{F}_1 \cdot \Delta\vec{x}_1 = -\vec{F}_2 \cdot \Delta\vec{x}_2$
Kinetic energy: $KE = \frac{1}{2}mv^2$
Earth's surface gravity: $\vec{F} = m\vec{g}$
Gravitational PE: $PE = mgh$
Universal gravitation: $F = Gm_1m_2/d^2$
Torque: $\vec{\tau} = \vec{r} \times \vec{F}$
Angular momentum: $\vec{l} = \vec{r} \times \vec{p}$
Centripetal acceleration: $a = v^2/r$

Electrostatic force: $F = kq_1q_2/d^2$
Electric field: $F = qE$
Electric potential: $PE = q\varepsilon$
Voltage: $V = \Delta\varepsilon$
Ohm's law: $I = V/R$
Electric power: $P = VI$
Kirchoff's rules: $\Sigma V_{\mathrm{loop}} = 0$; $\Sigma I_{\mathrm{in}} = \Sigma I_{\mathrm{out}}$
Series resistance: $R = R_1 + R_2 + \ldots$
Parallel resistance: $R = \dfrac{1}{1/R_1 + 1/R_2 + \cdots}$
Electromagnetic (Lorenz) force: $\vec{F} = q\vec{v} \times \vec{B}$
Transformer: $V_1/V_2 = N_1/N_2$; $V_1I_1 = V_2I_2$
Electromagnetic wave energy: $E = hf$
Alpha decay: $Z_d = Z_p - 2$; $N_d = N_p - 2$; $A_d = A_p - 4$
Beta decay: $Z_d = Z_p + 1$; $N_d = N_p - 1$; $A_d = A_p$

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## Short Problems

1. (10 points) Identify whether each statement below about magnetism is true or false.

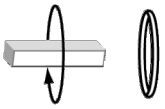
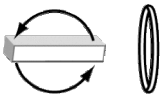
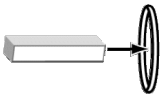
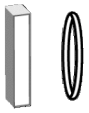
a. Field lines: (One is true, one is false.)
   T F Magnetic field lines run in continuous closed loops, with no beginning or end.
   T F Magnetic field lines begin at north poles and end at south poles.

b. Magnetic poles: (One is true, one is false.)
   T F Magnetic north and south poles can never be separated from each other.
   T F Some particles are magnetic north poles, and others are magnetic south poles.

c. Effect on charges: (One is true, one is false.)
   T F A magnetic field exerts a net force only on moving charged particles.
   T F A magnetic field exerts a net force on any electrically charged particle.

d. Positive and negative charges: (One is true, one is false.)
   T F A magnetic field has the same effect on positive and negative charges.
   T F A magnetic field has opposite effects on positive and negative charges.

2. (10 points) Each diagram below shows a bar magnet near a circle of conducting wire. For each situation, identify whether or not the magnet induces an electric current in the circle of wire.

| Induced current? | | Diagram | Description |
|---|---|---|---|
| Yes | No |  | a. The north pole of the magnet at the face of the circle, magnet rotating about the axis connecting its poles. |
| Yes | No |  | b. The north pole of the magnet at the face of the circle, magnet stationary. |
| Yes | No |  | c. The north pole of the magnet at the face of the circle, magnet rotating about an axis perpendicular to the line between its poles. |
| Yes | No |  | d. The north pole of the magnet at the face of the circle, magnet moving toward the circle. |
| Yes | No |  | e. The north-south axis of the magnet at the face of the circle, magnet stationary. |

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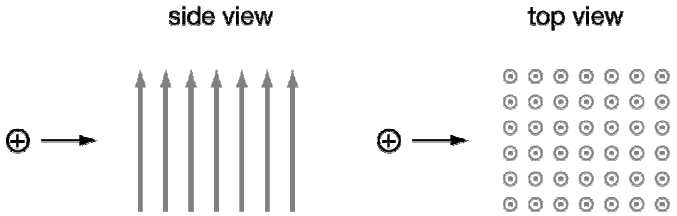
3. (10 points) A particular AC transformer has 5,000 windings in its primary circuit and 2,000 windings in its secondary circuit. Its primary circuit carries 50 A of current at a voltage of 110 V.

   a. What is the current in its secondary circuit? _____ A

   b. What is the voltage in its secondary circuit? _____ V

4. (10 points) A particle with a positive electric charge moves into a uniform electric field directed upward, as indicated by the thick gray lines. What does the particle do inside the field?




   a. It circles up, then down.

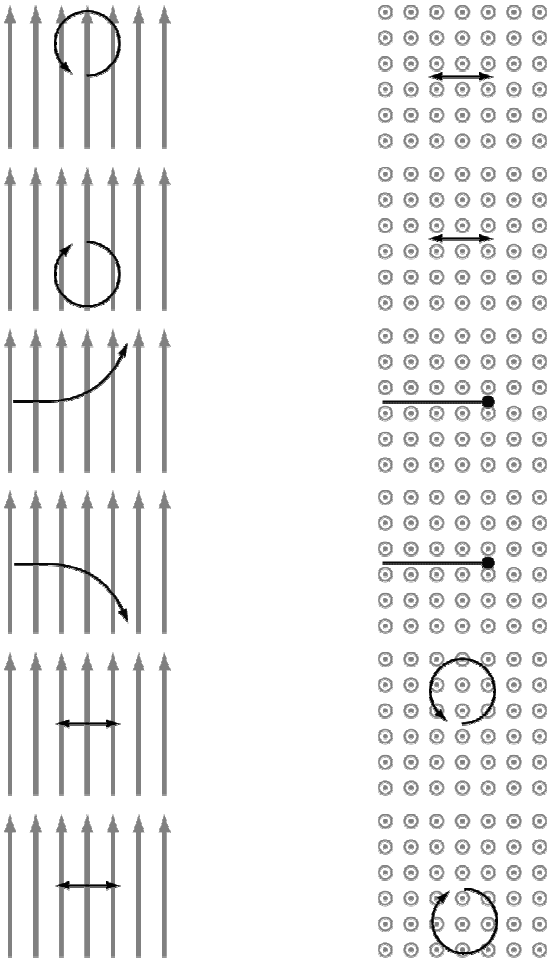
   b. It circles down, then up.

   c. It moves upward.

   d, It moves downward.

   e. It circles left, then right.

   f. It circles right, then left.



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5. (10 points) What is light composed of?

   a. Quarks.
   b. Moving electric charges.
   c. Moving magnetic particles.
   d. Electric and magnetic fields.
   e. Neutrinos.

6. (10 points) In an electromagnetic wave, what does a short wavelength mean?

   a. The wave has low energy.
   b. The wave has high energy.
   c. Energy is not related to wavelength of electromagnetic waves.

7. (10 points) Each statement below claims that a filter of a specific color absorbs red light. Identify whether each is true (T) or false (F).

   T F a. A red filter absorbs red light.
   T F b. A green filter absorbs red light.
   T F c. A blue filter absorbs red light.
   T F d. A cyan filter absorbs red light.
   T F e. A magenta filter absorbs red light.
   T F f. A yellow filter absorbs red light.

8. (10 points) What is the daughter nucleus produced when a radon-222 parent decays by alpha decay?

   _____

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9. (10 points) Nuclear power plants generate electricity using the energy released by controlled nuclear reactions. What specific type of nuclear reactions do they control?

   a. Alpha-decay.
   b. Beta-decay.
   c. Gamma-decay.
   d. Fusion.
   e. Fission.

10. (10 points) Fission products tend to have:

   a. stable nuclei.
   b. nuclei with not enough neutrons to be stable.
   c. nuclei with too many neutrons to be stable.
   d. nuclei that are too heavy to be stable.

## Free response questions

11. (10 points) The three "additive" primary colors are red, green, and blue. Why are there three of them and not more or fewer?

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12. (10 points) Faraday's law $V = \Delta\Phi/\Delta t$ equates the rate of change of $\Phi$, the magnetic flux through a circuit, to $V$, the voltage induced around the circuit. Use this information to determine the units of magnetic flux $\Phi$. Express them in terms of some or all of the fundamental units m, kg, s, and C.

## Extra Credit

13. (5 points) In class, I sang, "Any charge to cross those lines feels a right-handed force." What "lines" was I referring to?