PHYSICS DEPARTMENT

PHY 2005 Test 2 March 25, 2009

Name (print): _____ Signature: _____

On my honor, I have neither given nor received unauthorized aid on this examination.

YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.

(1) **Code your test number on your pink answer sheet (use 76–80 for the 5-digit number)**. Code your name on your answer sheet. Darken circles completely. Code your UF ID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) You will receive one point for each correct answer and zero points for an incorrect answer or no answer.
(4) Use a number 2 pencil on the answer sheet. Do not make any stray marks, or the answer sheet may not be read properly.
(5) "X" is never the correct answer.

Useful Equations:

$1\,\mathrm{N} = 1\,\mathrm{kg\,m/s^2}$	$1\,\mathrm{J} = 1\,\mathrm{N\,m} = 1\,\mathrm{kg\,m^2/s^2}$	$1\,\mathrm{W} = 1\ \mathrm{J/s}$
$1\,\mathrm{V} = 1\ \mathrm{J/C}$	$1\,\mathrm{F} = 1\,\mathrm{C/V}$	$1\,\mathrm{A} = 1\,\mathrm{C/s}$
$k = 1/4\pi\epsilon_0 = 9\times10^9\,\mathrm{N\,m^2/C^2}$	$\epsilon_0 = 9\times10^{-12}\,\mathrm{C^2/N\,m^2}$	$\mu_0 = 4\pi\times10^{-7}\,\mathrm{T\,m/A}$
$c = 3\times10^8\,\mathrm{m/s^2}$	$e = 1.6\times10^{-19}\,\mathrm{C}$	$\lambda f = c$
$\vec{F} = m\vec{a}$	$W = \vec{F}\cdot\vec{d}$	$\mathrm{K.E.} = \frac{1}{2}mv^2$
$F = \frac{kq_1q_2}{r^2}$	$\vec{F} = q\vec{E}$	$\mathrm{P.E.} = qV$
$V = iR$	$q = VC$	$\frac{dW}{dt} = P = iV = i^2R = V^2/R$
$C = \epsilon_0 A/d$	$C_{\mathrm{eff}} = C_1 + C_2 + C_3$	$\frac{1}{C_{\mathrm{eff}}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$
$R = \rho L/A$	$R_{\mathrm{eff}} = R_1 + R_2 + R_3$	$\frac{1}{R_{\mathrm{eff}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
$\mathrm{Intensity} = P/A$	$\lvert\vec{B}\rvert = \mu_0 ni$	$\lvert\vec{B}\rvert = \mu_0 i/2\pi r$
$\vec{F} = i\vec{\ell}\times\vec{B} = i\ell B\sin\theta$	$\vec{F} = q\vec{v}\times\vec{B} = qvB\sin\theta$	$m\frac{v^2}{r} = qvB$
$\phi_{\mathrm{B}} = B_\perp A$	$\mathcal{E}_{\mathrm{induced}} = -\frac{\Delta\phi_{\mathrm{B}}}{\Delta t}$	$\lvert\mathcal{E}\rvert = Bwv$ $\quad w$ stands for "width"
$\mathcal{E}_{\mathrm{S}} = \mathcal{E}_{\mathrm{P}}\frac{N_{\mathrm{S}}}{N_{\mathrm{P}}}$		for AC $\quad \mathcal{E}_{\mathrm{rms}} = \frac{1}{\sqrt{2}}\mathcal{E}_{\mathrm{max}}$

1. On your pink answer sheet, did you correctly bubble in your test number in rows 76–80, and also bubble in your name and your UF ID number (*not* your social security number!)? Also, did you print and sign your name at the top of your test, and will you hand in the "white sheets?" before leaving the room? This question counts, and the correct answer is "Yes", unless you erred in filling out the pink answer sheet.

   (1) Yes (2) X (3) X (4) X (5) X

2. Which of the following are the units for μ_0?

   (1) $\mathrm{T\,m\,s/C}$ (2) $\mathrm{T\,m/C\,s}$ (3) $\mathrm{A/T\,m}$ (4) $\mathrm{C/T\,m\,s}$ (5) $\mathrm{J\,T/m}$

3. Complete the following sentence:
In a demonstration I showed that the north poles of two magnets attract each other

(1) if one is much stronger than the other.
(2) never.
(3) if they are very close together.
(4) if the magnets are lined up parallel to each other.
(5) if they are very far from each other.

4. The apparatus near the front desk has two pendulums with a copper disk at the end. One disk has slits cut out of it, the other is solid. Each pendulum can be raised and then allowed to swing down toward the magnet below. Which of the following describes the the motion for each pendulum?

(1) The "solid" stops quickly the "slits" swings freely.
(2) The "slits" stops quickly the "solid" swings freely.
(3) Both disks swing freely.
(4) Both disks stop quickly.
(5) X

5. Which two of the following are correct ways to complete the sentence: If you look 90° away from the sun, the light from the sky is blue
(A) and polarized.
(B) and not polarized.
(C) because of water in the atmosphere.
(D) because of scattering of the shorter wavelengths of light.
(E) because of the Doppler effect.

(1) A and D (2) A and C (3) B and D (4) B and E (5) A and E

6. Which two of the following are correct ways to complete the sentence: If you look at the setting sun, the sunset is red
(A) and polarized.
(B) and not polarized.
(C) because of water in the atmosphere.
(D) because of scattering of the shorter wavelengths of light.
(E) because of the Doppler effect.

(1) B and D (2) A and C (3) A and D (4) B and E (5) A and E

7. The long straight wire in figure A carries a current i to the right that increases with time. What is the direction of the induced current in the circular wire loop, which lies in a plane parallel to the current in the wire?

(1) Clockwise.
(2) Counterclockwise.
(3) There is no induced current.
(4) It depends upon how rapidly the current changes.
(5) X

8. The current through a very long solenoid is increasing linearly as a function of time. The magnetic field *inside* the solenoid is

(1) parallel to the axis.
(2) in the form of circles centered on the axis of the solenoid.
(3) directed radially outward from the axis.
(4) zero.
(5) X

9. Figure B shows two long wires with current flowing in opposite directions. What is the direction of the force on the top wire?

   (1) Up on the paper. ↑
   (2) Down on the paper. ↓
   (3) To the right. →
   (4) Perpendicular, out of the paper. ⊙
   (5) To the left. ←

10. Figure C shows an object, which is a star, and two mirrors which are separated by a 90° angle. Which of the labeled points are at locations of images of the star?

    (1) d (2) b (3) c (4) a (5) e

11. Figure D shows an electron moving down in front of the north pole of a magnetic. What is the direction of the force on the electron?

    (1) Into the paper ⊗
    (2) Out of the paper ⊙
    (3) To the right →
    (4) To the left ←
    (5) There is no magnetic force on an electric charge.

12. Red light from a helium-neon laser has a wavelength $\lambda = 600\,\text{nm}$. Which is closest to the frequency of this light?

    (1) $5\times10^{14}\,\text{Hz}$ (2) $6\times10^{14}\,\text{Hz}$ (3) $12\times10^{14}\,\text{Hz}$ (4) $9\times10^{14}\,\text{Hz}$ (5) $18\times10^{14}\,\text{Hz}$

13. A laser has a power of $3\times10^{-3}\,\text{W}$, and the radius of the beam is $1\,\text{cm} = 10^{-2}\,\text{m}$. So that the area of the beam is $\pi r^2 = \pi\times10^{-4}\,\text{m}^2$ when the light leaves the end of the laser. Which is closest to the intensity of the laser light as it leaves the end of the laser?

    (1) $10\,\text{W}/\,\text{m}^2$ (2) $1\,\text{W}/\,\text{m}^2$ (3) $0.1\,\text{W}/\,\text{m}^2$ (4) $0.01\,\text{W}/\,\text{m}^2$ (5) $0.001\,\text{W}/\,\text{m}^2$

14. The laser in the previous problem is pointed at the moon. Which of the following is closest to the intensity of the laser beam when it reaches the moon, where the beam's radius has expanded to 50 m?

    (1) $4\times10^{-7}\,\text{W}/\,\text{m}^2$ (2) $10\,\text{W}/\,\text{m}^2$ (3) $4\times10^{-2}\,\text{W}/\,\text{m}^2$ (4) $0.001\,\text{W}/\,\text{m}^2$ (5) $4\times10^{-4}\,\text{W}/\,\text{m}^2$

15. A pinhole camera is used to take a picture of a 10 m tall tree, as shown in figure E. The camera is 20 m from the tree, and the distance from the pinhole to the film at the back of the camera is 10 cm. Which is closest to the height of the tree's image on the film?

    (1) 5 cm (2) 20 cm (3) 2 cm (4) 10 cm (5) 4 cm

16. During a class when I was out of town, your instructor dropped a very strong permanent magnet onto a thick copper plate which had been cooled with liquid nitrogen to 77K. The magnet then

    (1) bounced back up without touching the plate.
    (2) stopped and levitated above the copper plate.
    (3) fell on top of the copper plate as most other objects would.
    (4) slowed down and landed on the copper plate softly.
    (5) became a superconductor after it landed on the plate.

17. In the demonstration just described, the copper plate was cooled to a very low temperature because

(1) the resistance of copper is much smaller when it is very cold.
(2) it is just a cool thing to do.
(3) the copper plate turns magnetic below 100 K.
(4) the gravitational acceleration gets smaller at lower temperatures.
(5) X

18. Which of the following is not a primary color of *light*? Note: "X" is *not* the correct answer.

(1) yellow (2) red (3) blue (4) green (5) X

THE FOLLOWING QUESTIONS, NUMBERED IN THE ORDER OF THEIR APPEARANCE ON THE ABOVE LIST, HAVE BEEN FLAGGED AS CONTINUATION QUESTIONS: 14 17