PHYSICS DEPARTMENT

PHY 2005 Final Exam April 30, 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.

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 statements is either *false* or did *not* happen during class?
   (A) The lecturer put liquid nitrogen in his mouth.
   (B) The red light at sunset is not polarized.
   (C) The lecturer slowly lowered a pointed conducting rod up close to the charged up Van de Graaff generator, and there was no spark.
   (D) The north poles of two different magnets might attract each other.
   (E) The copper disk with slits cut through it, swung freely between the poles of a very strong magnet.

   (1) None (2) A (3) B and A (4) C and A (5) D and E

3. For a demonstration, I had two "bars" (I also called them "tuning forks") that are sitting on the front table. First I hit them individually, and the tone and the loudness of the sound was about the same for each. Then, when I hit them simultaneously the sound

   (1) changed from louder to softer to louder to softer ...
   (2) was twice as loud as the sound of one.
   (3) was four times as loud as the sound of one.
   (4) was half as loud as the sound of one.
   (5) died away very quickly.

4. In a demonstration, I poured liquid nitrogen into the "funnel" held just above a big magnet by the front lab table. After a while a "liquid" condensed on the funnel and collected below being held in place by the very strong field of the magnet. What was the liquid?

   (1) Oxygen (2) Nitrogen (3) Water (4) Carbon dioxide (5) Hydrogen

5. Figure G shows a converging lens, the focal points and an object shown as an arrow. There are a number of images. Which of the other arrows is closest to the location of one of the images. ?

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

6. A diverging lens has a focal length of $-12\,\text{cm}$. An object of height $h_o = 4\,\text{cm}$ is placed $4\,\text{cm}$ from the lens. Which is closest to the *size* of the image?

   (1) $3\,\text{cm}$ (2) $4\,\text{cm}$ (3) $1\,\text{cm}$ (4) $2\,\text{cm}$ (5) $0\,\text{cm}$

7. With the same lens and object, the image is

   (1) virtual and right-side up
   (2) real and right-side up
   (3) real and upside down
   (4) virtual and upside down
   (5) There is no image

8. Light traveling through three transparent materials follows the path shown in Figure A. Note the total internal reflection on the bottom surface. Which of the following is the order of indices of refraction?

   (1) $\mu_3 < \mu_1 < \mu_2$ (2) $\mu_2 < \mu_1 < \mu_3$ (3) $\mu_1 < \mu_2 < \mu_3$ (4) $\mu_1 < \mu_3 < \mu_2$ (5) $\mu_2 < \mu_3 < \mu_1$

9. Figure B shows the path of light going from a vacuum into a piece of glass. The lengths of the sides of two convenient triangles are also given. Which is closest to the index of refraction of the glass?

   (1) 1.3 (2) 1.2 (3) 1.8 (4) 1.5 (5) 1.67

10. Light from a laser is diffracted through two narrow slits in a piece of paper. The slits are $2\times10^{-4}\,\text{m}$ apart. An interference pattern appears on a screen $20\,\text{m}$ away, and a bright spot appears $4\,\text{cm}$ away from the central maximum (the brightest of the bright spots). What is the wavelength of the light from the laser?

    (1) $400\,\text{nm}$ (2) $600\,\text{nm}$ (3) $800\,\text{nm}$ (4) $200\,\text{nm}$ (5) $1000\,\text{nm}$

11. If the distance between the slits in the previous problem were changed to $4\times10^{-4}$, then which would be closest to the new distance between the central maximum and the next bright spot?

    (1) $2\,\text{cm}$ (2) $4\,\text{cm}$ (3) $6\,\text{cm}$ (4) $8\,\text{cm}$ (5) $10\,\text{cm}$

12. Light with a frequency of $9\times10^{14}\,\text{Hz}$ is traveling through water where the index of refraction is approximately $\mu = 1.33 \approx 4/3$. Which is closest to the wavelength of the light as measured in the water?

    (1) $250\,\text{nm}$ (2) $400\,\text{nm}$ (3) $100\,\text{nm}$ (4) $700\,\text{nm}$ (5) $900\,\text{nm}$

13. A simple slide projector can be made with a bright light to shine on a photographic slide and a converging lens. The brightly lit slide is the object. If the focal length of the lens is $4\,\text{cm}$, then which is closest to the distance from the slide to the lens in order to create a focused image on a screen $50\,\text{m}$ away from the lens?

    (1) $4\,\text{cm}$ (2) $6\,\text{cm}$ (3) $3\,\text{cm}$ (4) $5\,\text{cm}$ (5) $8\,\text{cm}$

14. The diameter of the sun is $1.5\times10^6$ km. The distance to the sun is $1.5\times10^8$ km. Which object could you hold at arms length (1 m) to just barely block out the sun?

(1) Aspirin dia $\approx$ 1 cm
(2) Nickel dia $\approx$ 2 cm
(3) Quarter dia $\approx$ 3 cm
(4) Silver dollar dia $\approx$ 4 cm
(5) Not enough information.

15. Figure C shows an object, which is a star, and two mirrors which are separated by a 60° angle. Which of the labeled points is nearest the location of one of the images of the star?

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

16. Figure F shows an electron moving up in front of the south pole of a magnetic. What is the direction of the force on the electron?

(1) Into the paper $\otimes$
(2) Out of the paper $\odot$
(3) To the right $\rightarrow$
(4) To the left $\leftarrow$
(5) There is no magnetic force on an electric charge.

17. You have three charged objects, A, B and C. You notice that A attracts B and that B repels C. Which of the choices for the sign of the charges of A, B and C could explain this behavior?

(1) + − − (2) + + − (3) − − + (4) − + − (5) + + +

18. Figure H shows a cutaway view of a long solenoid with a steady current flowing around it. The $\otimes$ shows where the current goes into the paper, and a $\odot$ shows where the current comes out of the paper. At which of the marked locations in the figure could you place a small compass, and have the points of the compass match the marked N and S?

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

19. If you are lucky enough to see a double rainbow, the outer rainbow

(1) has the colors reversed.
(2) has a light beam being reflected three times inside a rain drop.
(3) actually never occurs.
(4) is higher than the rain clouds.
(5) has two pots of gold at each end.

20. Figure D shows two capacitors in parallel, with $C_1 = 1\,\mathrm{F}$ and $C_2 = 2\,\mathrm{F}$. The battery has an $\mathcal{E}$mf of 12 V. Initially the switch is open, and the capacitors are not charged. After the switch is closed how much total charge flows through the battery?

(1) 8 C (2) 4 C (3) 6 C (4) 12 C (5) 9 C

21. With the same situation in Figure D, after the switch is closed, what is the potential difference (i.e.voltage) across $C_2$?

(1) 4 V (2) 6 V (3) 8 V (4) 12 V (5) 9 V

22. Figure E shows two resistors in parallel, with $R_1 = 1\Omega$, and $R_2 = 2\Omega$. The battery has an $\mathcal{E}$mf of 12 V. How much current flows through $R_1$?

(1) 12 A (2) 4 A (3) 6 A (4) 8 A (5) 9 A

23. With the same situation in Figure E, How much current flows through $R_2$?

(1) 6 A (2) 4 A (3) 12 A (4) 8 A (5) 9 A

24. Two charges are separated by a distance $r = 5$ m. The magnitude of the force between these two charges is $F = 4$ N. Then the charges are moved until the magnitude of $F$ is 100 N. Now, how far apart are the charges?

(1) 1 m (2) 0.2 m (3) 1.25 m (4) 0.25 m (5) 0.5 m

25. An AC power supply provides a maximum $\mathcal{E}$mf of 10 V and is hooked up in series with a $2\Omega$ resistor. Which is closest to the average power loss in the resistor?

(1) 25 W (2) 12.5 W (3) 50 W (4) 10 W (5) 5 W

THE FOLLOWING QUESTIONS, NUMBERED IN THE ORDER OF THEIR APPEARANCE ON THE ABOVE LIST, HAVE BEEN FLAGGED AS CONTINUATION QUESTIONS: 7 11 21 23