PHYSICS 204 Final Exam

TIME: 2 h.

February 1, 2008

NAME & ID_____

Section _____

Grade

CIRCLE *ONE* ANSWER FOR EACH QUESTION (4 pts)

1. When water freezes, it expands about nine percent. What would be the pressure increase inside your automobile engine block if the water in there froze? (The bulk modulus of ice is 2.0×10^9 Pa, and 1 atm = 1.0×10^5 Pa.)

    a. 18 atm   b. 270 atm   c. 1 080 atm   d. 1 800 atm

    e. None of the above.

2. A Young's double-slit apparatus is set up. A screen is positioned 1.60 m from the double slits and the spacing between the two slits is 0.040 0 mm. The distance between alternating bright fringes is 1.42 cm. What is the light source wavelength? (1 nm = 10^{-9} m)

    a. 710 nm   b. 355 nm   c. 280 nm   d. 490nm

    e. None of the above

3. A silicon monoxide ($n = 1.45$) film of 100 nm thickness is used to coat a glass camera lens ($n = 1.56$). What wavelength of light in the visible region (390 to 710 nm) will be most efficiently transmitted by this system? (1 nm = 10^{-9} m)

    a. 580 nm   b. 492 nm   c. 624 nm   d. 400 nm

4. I place a 500-g ice cube (initially at 0°C) in a Styrofoam box with wall thickness 1.0 cm and total surface area 600 cm². If the air surrounding the box is at 20°C and after 4 hours the ice is completely melted, what is the conductivity of the Styrofoam material? ($L_f = 80$ cal/g)

a. 9.6×10^{-5} cal/s·cm·°C   b. 2.8×10^{-6} cal/s·cm·°C   c. 1.15×10^{-2} cal/s·cm·°C

d. 2.3×10^{-4} cal/s·cm·°C   e. None of the above

5. A spherical air bubble originating from a scuba diver at a depth of 18.0 m has a diameter of 1.0 cm. What will the bubble's diameter be when it reaches the surface? (Assume constant temperature.)

a. 0.7 cm   b. 1.0 cm   c. 1.4 cm   d. 1.7 cm

e. None of the above

6. A piece of aluminum has density 2.70 g/cm³ and mass 775 g. The aluminum is submerged in a container of oil of density 0.650 g/cm³. A spring balance is attached with string to the piece of aluminum. What reading will the balance register in grams (g) for the submerged metal?

a. 960 g   b. 775 g   c. 588 g   d. 190 g

e. None of the above

7. Light of wavelength 610 nm is incident on a slit of width 0.20 mm and a diffraction pattern is produced on a screen that is 1.5 m from the slit. What is the distance of the second dark fringe from the center of the bright fringe? (1 nm = 10^{-9} m)

a. 0.68 cm   b. 0.92 cm   c. 1.2 cm   d. 1.4 cm

e. None of the above

8. The lower A on a piano has a frequency of 27.5 Hz. If the tension in the 2.0-m-long string is 304 N and one-half wavelength occupies the string, what is the mass of the string?

a. 100 g   b. 25 g   c. 37 g   d. 50 g

e. None of the above

9. Audio system 1 produces a sound level of $\beta_1 = 90$ dB while system 2 produces a sound level of $\beta_2 = 93$ dB. The corresponding intensities (in W/m^2) are I_1 and I_2. The ratio I_2/I_1 is

a) 93/90   b) log (93/90)   c) 3   d) 1/3

e) none of the above, my answer is _____

10. A ray of light passes through three different media as shown. The speeds of light in these media obey the following inequality:

a) $v_3 > v_1 > v_2$ b) $v_1 > v_2 > v_3$ c) $v_2 > v_3 > v_1$

d) $v_3 > v_2 > v_1$ e) $v_1 > v_3 > v_2$ f) $v_2 > v_1 > v_3$

11. Two identical buckets are filled to the rim, with water, but one has a block of wood floating in the water. Which bucket, if either, is heavier?

(a) The one filled with water.   (b) The one with the wooden block

(c) Both have the same weight   (d) Cannot tell, more info is needed.

**12**. A ray of light is incident on the mid-point of a glass prism surface at an angle of 25.0°
with the normal. For the glass, $n = 1.55$, and the prism apex angle is 30.0°. What is
the angle of refraction as the ray enters the air on the far side of the prism?

a. 14.1°   b. 22.3°   c. 28.4°   d. 46.0°

e. None of the above

13.   A simple pendulum has a mass of 0.25 kg and a length of 1.0 m. It is displaced
through an angle of 30° and then released. After a time, the maximum angle of swing is
only 10°. How much energy has been lost to friction?

a. 0.29 J   b. 0.65 J   c. 0.80 J   d. 1.0 J

e. None of the above

14. What is the focal length of the lens shown below if $|R_2| = 10$ cm and $|R_1| = 5$ cm? (The
index of refraction of the lens is 1.50).
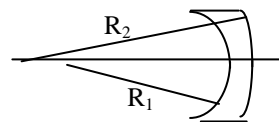
(a) 20 cm   (b) 6.67 cm   (c) –6.67 cm   (d) –20 cm

(e) none of the above my answer is:_____.

15.   A tuning fork is sounded above a resonating tube (one end closed), which
resonates at a length of 0.200 m and again at 0.600 m. What is the frequency of the
fork when the speed of sound is taken to be 340 m/s?

a. 567 Hz   b. 425 Hz   c. 1 700 Hz   d. 950 Hz

16. An object 2 cm high is placed 10 cm in front of a mirror. What type of mirror and
what radius of curvature is needed for an image that is upright and 4 cm tall?

a. Concave, $R = 20$ cm   b. Concave, $R = 40$ cm   c. Convex, $R = -10$ cm

d. Convex, $R = -20$ cm   e. None of the above

17.   A solid glass sphere with a radius of 5.00 cm and index of refraction of 1.52 has a small coin embedded 3.00 cm from the front surface of the sphere. For the viewer looking at the coin through the glass, at what distance from the front surface of the glass does the coin's image appear to be located?

a. 2.48 cm   b. 3.20 cm   c. 5.00 cm   d. 6.85 cm

e. None of the above

18. If a real object is placed in front of a diverging lens at a distance smaller than the focal distance, its image will be:

(a) Real, inverted and diminished.   (b) Real, inverted and enlarged.

(c) Virtual, erect and diminished.   (d) Virtual, erect and enlarged.

(e) None of the above.

19. Water (density $= 1 \times 10^3$ kg/m^3) flows at 10 m/s through a pipe with radius 0.030 m. The pipe goes up to the second floor of the building, 2.0 m higher, and the pressure remains unchanged. If $g = 10$m/s^2, what is the radius of the pipe on the second floor?

a. 0.046 m   b. 0.034 m   c. 0.015 m   d. 0.012 m

e. None of the above

20. Two convex thin lenses with focal lengths 10.0 cm and 20.0 cm are aligned on a common axis, running left to right, the 10-cm lens being on the left. A distance of 20.0 cm separates the lenses. An object is located at a distance of 15.0 cm to the left of the 10-cm lens. Where will the final image appear as measured from the 20-cm lens?

a. −13.3 cm   b. −6.67 cm   c. +6.67 cm   d. +13.3 cm

       (e) none of the above, my answer is:_____.

21. The image of a real object, placed between the center of curvature of a concave mirror and its focal point, is:

(a) Virtual, erect and magnified.   (b) Real, erect and diminished

(c) Virtual, inverted and magnified   (d) Real inverted and diminished.

(e) None of the above.

22.   A cylinder containing an ideal gas has a volume of 2.0 m^3 and a pressure of 1.0 × 10^5 Pa at a temperature of 300 K. The cylinder is placed against a metal block that is maintained at 900 K and the gas expands as the pressure remains constant until the temperature of the gas reaches 900 K. The change in internal energy of the gas is +6.0 × 10^5 J. How much heat did the gas absorb?

a. 0   b. 4.0 × 10^5 J   c. 6.0 × 10^5 J   d. 10 × 10^5 J

e. None of the above

23. A 3.00-g lead bullet is traveling at a speed of 240 m/s when it embeds in a wood post. If we assume that half of the resultant heat energy generated remains with the bullet, what is the increase in temperature of the embedded bullet? (specific heat of lead = 0.030 5 kcal/kg·°C, 1 kcal = 4 186 J)

a. 113°C   b. 137°C   c. 226°C   d. 259°C

e. None of the above

24. A train station bell gives off a fundamental tone of 500 Hz as the train approaches the station at a speed of 20 m/s. If the speed of sound in air is 335 m/s, what will be the apparent frequency of the bell to an observer riding the train?

a. 532 Hz   b. 530 Hz   c. 470 Hz   d. 472 Hz

25. The traces below show beats that occur when two different pairs of waves are added. Which of the following is true?
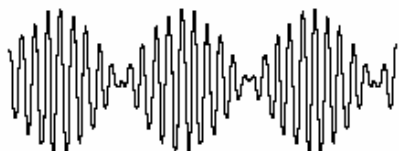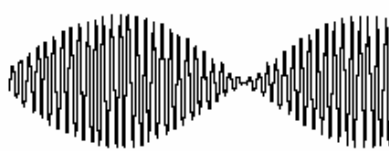
pair 1   pair 2

a. Pair 1 have the greatest difference in frequency and contains the wave with the highest frequency.

b. Pair 2 have the greatest difference in frequency and contains the wave with the highest frequency.

c. Pair 1 have the greatest difference in frequency but Pair 2 contains the wave with the highest frequency

d. Pair 2 have the greatest difference in frequency but Pair 1 contains the wave with the highest frequency.