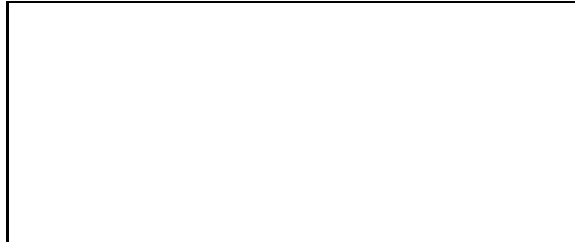


Physics 203– Final Exam
December 19, 2006
Prof. George Horton

Your name sticker
with exam code

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1. The exam will last from 4:00 to 7:00 p.m. Use a #2 pencil to make entries on the answer sheet. Enter the following id information now, before the exam starts.
2. In the section labelled **NAME** (Last, First, M.I.) enter your last name, then fill in the empty circle for a blank, then enter your first name, another blank, and finally your middle initial.
3. Under STUDENT # enter your 9-digit **RUID Number**..
4. Enter 203 under COURSE, and your section number under SEC.
5. Under **CODE** enter the exam code given above.
6. You may bring an 8 1/2" x 11" sheet of paper with notes of your choice and a standard hand calculator.
7. The exam consists of 30 multiple choice questions. For each multiple choice question mark only one answer on the answer sheet. There is no deduction of points for an incorrect answer, so even if you cannot work out the answer to a question, you should make an educated guess. Always select the best answer to each question.
8. Before starting the exam, make sure that your copy contains all 30 questions. Raise your hand if this is not the case, and a proctor will help you. Also raise your hand during the exam if you have a question.
9. Answers and results will be posted on the 203 website on 12/20/2006.
10. A proctor will check your name sticker and your student ID sometime during the exam. Please have them ready.
11. Please hand in only the cover sheet.
12. Cell phones are not permitted.
13. If you have questions about the Final Exam or the grading contact Rafael Greenblatt.

1. A mass of 4.10 kg is lifted vertically from rest a distance of 1.60 m by a constant upward, applied force of 52.7 N. Which answer correctly states the work done by the applied force and the work done by the force of gravity on the mass respectively?
 - a) 84.3 J , -64.3 J
 - b) 84.3 J , 64.3 J
 - c) 19.9 J , 64.3 J
 - d) 84.3 J , 19.9 J
 - e) -64.3 J , 19.9 J

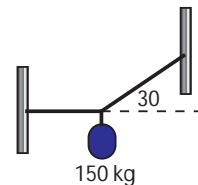
2. A person of mass m is released on a swing from an angle of 60° with the vertical. The maximum tension of 800 N is allowed in the supporting rope. What is the maximum value of m ? (Neglect friction and air resistance.)
 - a) 31 kg
 - b) 36 kg
 - c) 41 kg
 - d) 44 kg
 - e) 50 kg

3. A small hoop of radius r of mass m is released from rest at the top of a wedge of height $h = 20$ cm. Its speed when it reaches the bottom of the wedge is (Neglect air resistance).
 - a) can't answer without a value for θ .
 - b) 2.4 m/s
 - c) 1.4 m/s
 - d) 2 m/s
 - e) 1.7 m/s

4. A mass m is attached to a horizontal spring and released at the turning point $x=D$. What is its speed at $x=D/2$? Neglect friction, air resistance and assume the motion is along the x -axis. Assume $\omega = \sqrt{k/m}$.
 - a) $\omega D\sqrt{3}/2$
 - b) $\omega D/2$
 - c) ωD
 - d) $2\omega D$
 - e) $2\omega D/\sqrt{3}$

5. Consider a 20 kg object sliding up a surface inclined 20° from the horizontal. The coefficient of kinetic friction at the surface is 0.30. What is the magnitude of the object's acceleration as it slides UP this surface?
- a) 2.8 m/s^2
 - b) 4 m/s^2
 - c) 6.1 m/s^2
 - d) 12 m/s^2
 - e) none of these.
6. A race-car will make one lap around a circular track of radius R . When the car has traveled halfway around the track, what is the magnitude of the car's displacement from the starting point?
- a) $2R$
 - b) πR
 - c) zero
 - d) R
 - e) $2\pi R$
7. A shell is fired with a horizontal velocity in the positive x -direction from the top of an 80-m high cliff. The shell strikes the ground 1330 m from the base of the cliff. What is the speed of the shell as it hits the ground?
- a) 4.0 m/s
 - b) 82 m/s
 - c) 335 m/s
 - d) 9.8 m/s
 - e) 170 m/s
8. A system of two cables supports a 150-N ball as shown. What is the tension in the right-hand cable?

- a. 87 N
- b. 260 N
- c. 150 N
- d. 300 N
- e. 170 N



9. A person pulls a crate up a rough, inclined plane at constant speed. Which one of the following statements concerning this situation is false?
- The gravitational potential energy of the crate is increasing.
 - The net work done by all the forces acting on the crate is zero joules.
 - The work done on the crate by the normal force of the plane is zero joules.
 - The person does "positive" work in pulling the crate up the incline.
 - The work done on the object by the force of gravity is zero joules.
10. A 7.30-kg bowling ball strikes a 1.60-kg pin at rest head-on. Before the collision, the velocity of the ball is +6.00 m/s. After the collision, the velocity of the ball is +5.40 m/s. What is the velocity of the pin after the collision?
- +0.6 m/s
 - +1.2 m/s
 - +3.2 m/s
 - +5.4 m/s
 - +2.7 m/s
11. A wheel, originally rotating at 126 rad/s undergoes a constant angular deceleration of 5.00 rad/s^2 . What is its angular speed after it has turned through an angle of 628 radians?
- 15 rad/s
 - 98 rad/s
 - 150 rad/s
 - 19 rad/s
 - 121 rad/s
12. When a 0.20-kg block is suspended from a vertically hanging spring, it stretches the spring from its original length of 0.050 m to 0.060 m. The same block is attached to the same spring and placed on a horizontal, frictionless surface. The block is then pulled so that the spring stretches to a total length of 0.10 m. The block is released at time $t = 0 \text{ s}$ and undergoes simple harmonic motion. What is the frequency of the motion?
- 0.50 Hz
 - 5.0 Hz
 - 31 Hz
 - 1.00 Hz
 - 10.0 Hz

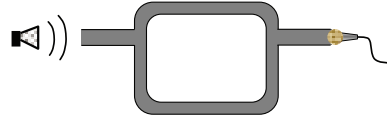
13. An incompressible fluid is flowing through a horizontal pipe with a constriction. The velocity of the fluid in the wide section of the pipe is 6.0 m/s and the velocity of the fluid in the narrow section of pipe is 8.0 m/s. The pressure of the fluid in the wide section is 2.50×10^5 Pa. What is the pressure in the narrow section of the pipe? (density of the fluid is 1000 kg/m^3)
- a) 1.83×10^5 Pa
 - b) 2.36×10^5 Pa
 - c) 2.68×10^5 Pa
 - d) 2.85×10^5 Pa
 - e) 2.98×10^5 Pa
14. Which statement is true concerning the buoyant force on an object submerged in a liquid?
- a) It depends only on the mass of the object
 - b) It depends only on the weight of the object
 - c) It is independent of the density of the liquid
 - d) It depends only on the weight of the liquid displaced
 - e) It will increase with depth if the liquid is incompressible
15. Pour 50 g of water at 60°C into a 200 g aluminum beaker whose temperature is 20°C . What is the final temperature of the water and beaker at equilibrium. ($C_w = 4186 \text{ J/kg} \cdot ^\circ\text{C}$, $C_{al} = 9 \times 10^2 \text{ J/kg} \cdot ^\circ\text{C}$)
- a) 48.7°C
 - b) 52.8°C
 - c) 31.4°C
 - d) 28.1°C
 - e) 41.5°C
16. Which of the following processes take place at constant pressure?
- a) adiabatic
 - b) isothermal
 - c) isobaric
 - d) reversible
 - e) irreversible

17. Jogging along the beach you do 4.3×10^5 J of work and give off 3.8×10^5 J of heat. What is the change in your internal energy?
- a) 8.1×10^5 J
 - b) -8.1×10^5 J
 - c) 0.5 J
 - d) -0.5 J
 - e) not enough information given
18. If the intensity of a source is doubled, the sound level changes by
- a) 6 dB
 - b) 3 dB
 - c) -3 dB
 - d) -6 dB
 - e) 9 dB
19. Sound at a distance r_2 is 6 dB less than that heard at a distance r_1 . What is the ratio r_2/r_1 ?
- a) 1/4
 - b) 4
 - c) 2
 - d) 1/2
 - e) 3
20. A harmonic on a string 1.3 m long has a frequency of 15.6 Hz. The next higher frequency is 23.4 Hz. Both ends of the string are fixed. What is the fundamental frequency?
- a) 7.8 Hz
 - b) 15.6 Hz
 - c) 23.4 Hz
 - d) 3.8 Hz
 - e) 9.3 Hz
21. A 10 kg ball has an apparent weight of 75 N when submerged in water. The buoyant force of the water on the ball is:
- a) 32 N
 - b) 30 N
 - c) 14 N
 - d) 23 N
 - e) 19 N

22. A copper plate has a length of 0.12 m and a width of 0.10 m at 25 °C. The plate is uniformly heated to 175 C. If the linear expansion coefficient for copper is $1.7 \times 10^{-5}/\text{C}^\circ$, what is the change in the area of the plate as a result of the increase in temperature?
- a) $2.6 \times 10^{-5} \text{ m}^2$
 - b) $3.2 \times 10^{-6} \text{ m}^2$
 - c) $7.8 \times 10^{-7} \text{ m}^2$
 - d) $6.1 \times 10^{-5} \text{ m}^2$
 - e) $4.9 \times 10^{-7} \text{ m}^2$
23. Neon gas at 20 °C is confined within a rigid vessel. The gas is then heated until its pressure is doubled. What is the final temperature of the gas?
- a) 10 °C
 - b) 40 °C
 - c) 586 °C
 - d) 20 °C
 - e) 313 °C
24. Complete the following statement: The absolute temperature of an ideal gas is directly proportional to
- a) the number of molecules in the sample.
 - b) the average momentum of a molecule of the gas .
 - c) the average kinetic energy of the gas molecules.
 - d) the amount of heat required to raise the temperature of the gas by 1 °C.
 - e) the relative increase in volume of the gas for a temperature increase of 1 °C.
25. A Carnot engine operates between hot and cold reservoirs with temperatures 527 °C and $-73.0 \text{ }^\circ\text{C}$, respectively. If the engine performs 1000.0 J of work per cycle, how much heat is extracted per cycle from the hot reservoir?
- a) 878 J
 - b) 1163 J
 - c) 2010 J
 - d) 1333 J
 - e) 1527 J

26. A speaker generates a continuous tone of 440 Hz. In the drawing, sound travels into a tube that splits into two segments, one longer than the other. The sound waves recombine before being detected by a microphone. The speed of sound in air is 339 m/s. What is the minimum difference in the lengths of the two paths for sound travel if the waves arrive in phase at the microphone?

- a. 0.10 m
- b. 0.77 m
- c. 1.54 m
- d. 0.39 m
- e. 1.11 m



27. Determine the shortest length of pipe, open at both ends, which will resonate at 256 Hz. The speed of sound is 343 m/s.

- a) 0.330 m
- b) 0.990 m
- c) 1.67 m
- d) 0.670 m
- e) 1.32 m

28. The body of a man whose weight is 690 N contains $5.2 \times 10^{-3} \text{ m}^3$ of blood. What is the blood as a percentage of the body weight? ($\rho_{\text{blood}} = 1060 \text{ kg/m}^3$)

- a) none of these
- b) 8.7%
- c) 3.9%
- d) 7.8%
- e) 4.8%

29. Which of the following is not associated with the properties of fluids?

- a) Bernoulli's Equation
- b) Archimedes' Principle
- c) Pascal's Principle
- d) The Law of Universal Gravitation
- e) none of these

30. The train engineer sounds a whistle approaching a tunnel in a cliff. the whistle has a frequency of 650 Hz. The speed of the train = 21.2 m/s. What is the frequency of the sound reflected by the cliff and heard by the engineer.
- a) 650 Hz
 - b) 693 Hz
 - c) 736 Hz
 - d) 611 Hz
 - e) none of these