

Instructor(s): *C. Parks*PHYSICS DEPARTMENT
EXAM 3

August 3, 2012

Name (print, last first): _____ 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 answer sheet (use lines 76–80 on the answer sheet for the 5-digit number).** Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY.** Code your UFID number on your answer sheet.
- (2) Print your name on this sheet and sign it also.
- (3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
- (4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink.** Do not make any stray marks or some answers may be counted as incorrect.
- (5) **The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.**
- (6) Hand in the answer sheet separately.

Given Information:

$$g = 9.80 \text{ m/s}^2 \quad 1 \text{ atmosphere} = 1.01 \times 10^5 \text{ Pa} \quad \text{speed of sound} = 340 \text{ m/s} \quad A = \pi r^2 \quad 1 \text{ m} = 100 \text{ cm}$$

1. A steel cable of diameter 2.4 cm supports a 250-kg mass. What is the fractional length increase of the cable compared to the length when there is no load if the Young's modulus for steel is 2.0×10^{11} Pa?
 - (1) 2.7×10^{-5}
 - (2) 6.8×10^{-5}
 - (3) 2.8×10^{-6}
 - (4) 6.9×10^{-7}
 - (5) None of these.
2. Determine the change in the volume of a 2.00-m³ block of granite when it's submerged about 3 km in the ocean, where the pressure on all its surfaces is about 300 times atmospheric pressure. The bulk modulus of granite is 50.0×10^9 Pa.
 - (1) $-1.2 \times 10^{-3} \text{ m}^3$
 - (2) $-1.2 \times 10^{-2} \text{ m}^3$
 - (3) $-1.2 \times 10^{-4} \text{ m}^3$
 - (4) $-1.2 \times 10^{-8} \text{ m}^3$
 - (5) None of these.
3. A 3-kg mass executes simple harmonic motion when attached to a spring. If the period of the motion is 0.3 s, what is the spring constant?
 - (1) 1300 N/m
 - (2) 1.2 N/m
 - (3) 33 N/m
 - (4) 56 N/m
 - (5) None of these.
4. A bob of mass m is suspended from a string of length L , forming a pendulum. The period of the pendulum is 3.6 s. If the pendulum bob is replaced with one of mass $m/2$ and the length of the pendulum is increased to $2L$, what is the period of one oscillation?
 - (1) 5.1 s
 - (2) 1.8 s
 - (3) 2.5 s
 - (4) 7.2 s
 - (5) None of these.
5. A 0.75-kg mass is oscillating on a spring with spring constant 30 N/m. When the mass' speed is 0.80 m/s, the spring is stretched 15 cm. What is the amplitude of the mass' oscillations? Assume that mechanical energy is conserved.
 - (1) 20 cm
 - (2) 30 cm
 - (3) 15 cm
 - (4) 28 cm
 - (5) None of these.
6. A mass' motion in time can be described by the equation $x = A \cos \omega t$ where $A = 0.50$ m. The period of the mass is 1.5 s. What is its velocity at 5 seconds?
 - (1) -1.8 m/s
 - (2) 0 m/s
 - (3) 2.1 m/s
 - (4) 8.8 m/s
 - (5) None of these.

7. Frustrated by his failure to capture Princess and overcome Peach's vegetable defense, Bowser roars in anger. A Koopa Troopa standing 3 m from Bowser is hit with a sound wave with intensity 10 W/m^2 . A second Koopa is standing 4 m from Bowser. What intensity does the second Koopa hear?



- (1) 5.6 W/m^2 (2) 18 W/m^2 (3) 10 W/m^2 (4) 5.0 W/m^2 (5) None of these.
8. A 100-gram wire has a 50 kg mass hanging from it. If the wire is 8 m long, how long does it take for a transverse wave to travel the length of the wire?
- (1) 0.040 s (2) 0.13 s (3) .024 s (4) 0.080 s (5) None of these.
9. In a transverse wave, the individual particles of the medium
- (1) move perpendicularly to the direction of the wave's travel
 (2) move parallel to the direction of the wave's travel
 (3) move in circles
 (4) move in ellipses
 (5) None of these.
10. What is the wavelength of a 440-Hz sound wave traveling through air?
- (1) None of these. (2) 1.3 m (3) 4.9 m (4) 0.12 m (5) 0.21 m
11. A 25-Hz wave with amplitude A is traveling in the $+x$ -direction at 50 m/s. What is the equation for the traveling wave?
- (1) $y = A \sin((157 \text{ rad/s})t - (3.14 \text{ rad/m})x)$
 (2) $y = A \sin((157 \text{ rad/s})t + (3.14 \text{ rad/m})x)$
 (3) $y = A \sin((25 \text{ rad/s})t - (2 \text{ rad/m})x)$
 (4) $y = A \sin((25 \text{ rad/s})t + (2 \text{ rad/m})x)$
 (5) None of these.
12. Two successive pulses are traveling down a rope as shown. The rope is attached to a wall forming a fixed point for the rope. The first pulse reflects back and interferes with the second pulse. What is the amplitude of the rope when the two pulses overlap? Assume the pulses have the same amplitude A .
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- A diagram showing a rope fixed to a vertical wall on the right. Two pulses are traveling to the right towards the wall. Each pulse is a single hump above the horizontal rope line. Arrows above each pulse indicate their direction of travel.

- (1) zero (2) $2A$ (3) $A/2$ (4) $\sqrt{2}A$ (5) None of these.

13. The distance between two nodes in a standing wave is 30 cm. If the frequency of the wave is 60 Hz what is the equation of the standing wave. The amplitude of the wave is $2A$.

- (1) $y = 2A \sin((377 \text{ rad/s})t \cos((10.5 \text{ rad/m})x)$
 (2) $y = 2A \sin((377 \text{ rad/s})t \cos((5.24 \text{ rad/m})x)$
 (3) $y = 2A \sin((60 \text{ rad/s})t \cos((0.30 \text{ rad/m})x)$
 (4) $y = 2A \sin((60 \text{ rad/s})t \cos((10.5 \text{ rad/m})x)$
 (5) None of these.

14. A wave can spread around an obstacle when the obstacle's wavelength is similar to the size of the obstacle. This is called
- (1) diffraction (2) reflection (3) refraction (4) interference (5) None of these.
15. A 160-gram rope 4 m long is fixed at both ends. The tension in the rope is 400 N. What is the frequency of the second harmonic wave in the rope?
- (1) 25 Hz (2) 50 Hz (3) 75 Hz (4) 43 Hz (5) None of these.
16. How much larger is the intensity of a 90 dB sound than the intensity of a 74 dB sound?
- (1) 40 times (2) 16 times (3) 8 times (4) 20 times (5) None of these.
17. The shortest pipes used in pipe organs are about 7.7 cm long. What is the fundamental frequency of a pipe this long that is open at both ends?
- (1) 2200 Hz (2) 4400 Hz (3) 1100 Hz (4) 3300 Hz (5) None of these.
18. The Bernoulli whistle we made in class (cut from a drinking straw) can be considered to a tube with one end open (and one end closed). At its full length, its fundamental frequency is f . If we cut the straw so that it is now $2/3$ as long as before, what is the new fundamental frequency?
- (1) $3f/2$ (2) $2f/3$ (3) $f/3$ (4) f (5) None of these.
19. Two identical tuning forks oscillate at 440 Hz. Dropping one of the tuning forks breaks a piece off the tip of the vibrating end. Now when the tuning forks sound, a beat frequency of 6 Hz is heard. What is the frequency of the damaged tuning fork? (Hint: The piece is broken from the vibrating end, reducing its mass. Will it vibrate faster or slower?)
- (1) 446 Hz (2) 434 Hz (3) 440 Hz (4) 220 Hz (5) None of these.
20. While driving down Museum Road, you see Mr. Parks crossing the road. Seeing your opportunity, you accelerate your car (1200 kg) from 9.0 m/s (about 20 miles/hour) to 15 m/s. Unfortunately, you do not see another car (mass of 1500 kg) pull out in front of you and they collide. Emergency vehicles come racing to the scene at 70 mph (31 m/s). From your volunteer work at Shand's, you know that the siren on the ambulance has a frequency of 1000 Hz. What frequency do you hear? You are at rest after the collision.
- (1) 1100 Hz (2) 920 Hz (3) 910 Hz (4) 1000 Hz (5) None of these.