

PHYSICS 218, Spring 2003 FINAL EXAM RED TEST DATE

Fill in your name and I.D. number in both letters and filled circles in the area indicated on the scantron sheet. Use only a #2 pencil. Sign the scantron sheet where indicated. For section, use your lab number. Mark the correct answers on your copy of the test and fill in the answers in the circles on the scantron sheet. Hand in the scantron sheet and keep your test to check answers against the key to be posted outside. **BE SURE TO HAND IN YOUR SCANTRON SHEET IN THE CORRECT COLOR PILE.** Pick the answer closest to yours as some roundoff occurs. There are 20 questions, do them all. This is a one-hour exam.

1. A 60.0-kg skater begins a spin with an angular speed of 6.0 rad/s. By changing the position of her arms, the skater decreases her moment of inertia by 50%. What is the skater's final angular speed?
 - a. 3.0 rad/s
 - b. 4.5 rad/s
 - c. 9.0 rad/s
 - d. 12 rad/s
 - e. 18 rad/s

A projectile is fired from a gun and has initial vertical and horizontal components of velocity equal to 40 m/s and 30 m/s respectively.

2. Refer to the information above. What is the speed of the projectile when it is at the highest point in its trajectory?
 - a. zero
 - b. 20 m/s
 - c. 30 m/s
 - d. 40 m/s
 - e. 50 m/s

A 70 kg astronaut pushes to the left of a spacecraft with a force F in gravity-free space. The spacecraft has a total mass of 10,000 kg. During the push, the astronaut accelerates to the right with an acceleration of 0.36 m/s^2 .



3. Refer to the information above. Determine the magnitude of the acceleration of the spacecraft.
- 0.36 m/s^2
 - 51.4 m/s^2
 - $2.5 \beta 10^{-3} \text{ m/s}^2$
 - $7.0 \beta 10^{-3} \text{ m/s}^2$
 - 397 m/s^2
4. A roller coaster starts from rest at the top of a hill 18 m high. The car travels to the bottom of the hill and continues up the next hill which is 10 m high.

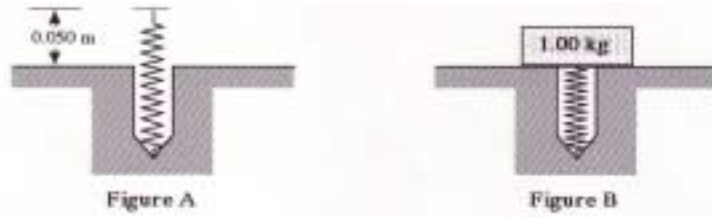


How fast is the car moving at the top of the 10.0 m hill if friction is ignored?

- 6.4 m/s
 - 8.1 m/s
 - 12.5 m/s
 - 15.3 m/s
 - 27.4 m/s
5. A rope of length L is clamped at both ends. Which one of the following is not a possible wavelength for standing waves on this rope?
- $L / 2$
 - $2L / 3$
 - L
 - $2L$
 - $4L$

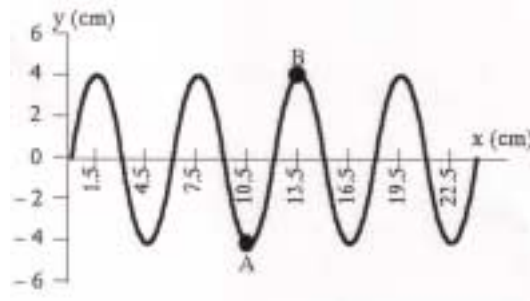
6. A certain string just breaks when it is under 400 N of tension. A boy uses this string to whirl a 10 kg stone in a horizontal circle of radius 10 m. The boy continuously increases the speed of the stone. At approximately what speed will the string break?
- 10 m/s
 - 20 m/s
 - 75 m/s
 - 100 m/s
 - 400 m/s
7. Which statement is true concerning an object executing simple harmonic motion?
- Its velocity is never zero.
 - Its acceleration is never zero.
 - Its velocity and acceleration are simultaneously zero.
 - Its velocity and is zero when its accelerations is a maximum.
 - Its maximum acceleration is equal to its maximum velocity.
8. The intensity of a spherical wave at a distance of 4.0 m from the source is 120 W/m^2 . What is the intensity at a point 9.0 m away from the source?
- 11 W / m^2
 - 24 W / m^2
 - 53 W / m^2
 - 80 W / m^2
 - 270 W / m^2
9. A cable stretches by an amount d when it supports a crate of mass M . The cable is replaced by another cable of the same material having the same length but twice the diameter. If the same crate is supported by the thicker cable, by how much will the cable stretch?
- d
 - $d / 2$
 - $d / 4$
 - $2d$
 - $4d$

A relaxed spring protrudes from an opening 0.050 meters as shown below in Figure A. A 1.00-kg mass is found to just force the spring completely into the opening as shown below in Figure B.



10. Refer to the information above. Determine the spring constant k .
- 20.0 N / m
 - 196 N / m
 - 392 N / m
 - 3920 N / m
 - 7840 N / m
11. A car moving at 35 m/s approaches a stationary whistle that emits a 220 Hz sound. The speed of sound is 343 m/s. What is the frequency of sound heard by the driver of the car?
- 198 Hz
 - 220 Hz
 - 242 Hz
 - 282 Hz
 - 340 Hz
12. When a force of 20 N is applied to a spring, it elongates 0.20 m. Determine the period of oscillation of a 4-kg mass suspended from the spring.
- 0.6 s
 - 1.3 s
 - 3.1 s
 - 4.1 s
 - 6.3 s

The figure below shows the displacement of a vibrating string versus position along the string. The periodic waves have a speed of 10 cm/s. A and B are two points along the string.



13. Refer to the information above. What is the amplitude of the wave?

- a. 2 cm
- b. 4 cm
- c. 8 cm
- d. 9 cm
- e. 16 cm

14. Refer to the information above. What is the wavelength of the wave?

- a. 3 cm
- b. 6 cm
- c. 9 cm
- d. 12 cm
- e. 15 cm

15. Refer to the information above. What is the frequency of the wave?

- a. 0.60 Hz
- b. 0.90 Hz
- c. 1.11 Hz
- d. 1.25 Hz
- e. 1.67 Hz

16. Refer to the information above. Approximately how long does it take the tennis ball to reach its maximum height?

- a. 0.50 s
- b. 2.04 s
- c. 4.08 s
- d. 6.08 s
- e. 9.80 s

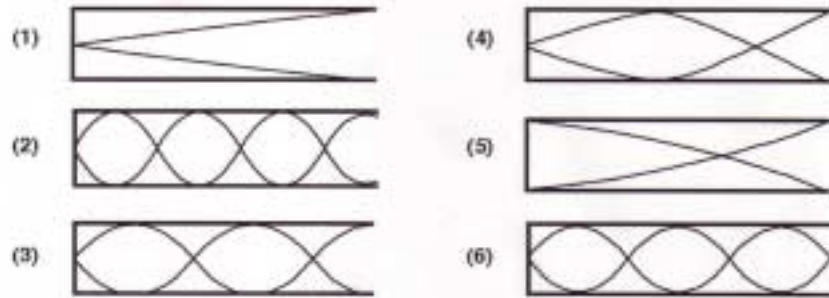
17. Two pulses of identical shape travel toward each other in opposite directions on a string as shown in the figure below.



What statement is true concerning this situation?

- a. The pulses will reflect from each other.
 - b. The pulses will diffract from each other.
 - c. The pulses will interfere to produce a standing wave.
 - d. The pulses will pass through each other and produce beats.
 - e. As the pulses pass through each other, they will interfere destructively.
18. A 0.050-kg lump of clay moving horizontally at 12 m/s strikes and sticks to a stationary 0.10-kg cart which can move on a frictionless air track. Determine the speed of the cart and clay after the collision.
- a. 2 m/s
 - b. 4 m/s
 - c. 6 m/s
 - d. 8 m/s
 - e. 12 m/s

The figures below show the standing waves of sound in six organ pipes of the same length. Each pipe has one end open and the other end closed. **Note:** some of the figures show situations that are not possible.



19. Refer to the information above. Which figures do not illustrate possible resonant situations?

- a. 1 and 4
- b. 2 and 3
- c. 4 and 5
- d. 5 and 6
- e. 4, 5 and 6

20. Refer to the information above. Which pipe emits sound with the highest frequency?

- a. 1
- b. 2
- c. 3
- d. 4
- e. 6

Answer Key

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1. D

2. C

3. C

4. C

5. E

6. B

7. D

8. B

9. C

10. B

11. C

12. B

13. B

14. B

15. E

16. B

17. E

18. B

19. D

20. B