

Instructor(s): *Matcheva/Sabin*PHYSICS DEPARTMENT
Final Exam

December 8, 2012

Name (print, last first): _____ Signature: _____

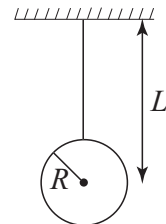
*On my honor, I have neither given nor received unauthorized aid on this examination.***YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.**

- (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.

Take $g = 9.8 \text{ m/s}^2$ as the acceleration due to gravity.

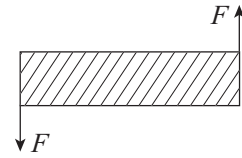
Take $g = 9.8 \text{ m/s}^2$ as the acceleration due to gravity.

1. A stone is thrown outward from the top of a 59.4-m high cliff with an upward velocity component of 19.5 m/s. How many seconds will the stone be in the air before hitting the bottom of the cliff?
- (1) 6 (2) 5 (3) 4 (4) 7 (5) 8
2. A 5-kg concrete block is lowered with a downward acceleration of 2.8 m/s^2 by means of a rope. The force of the block on the rope is:
- (1) 35 N, down (2) 63 N, up (3) 63 N, down (4) 35 N, up (5) 49 N, up
3. An object moves in a circle. If the mass is tripled, the speed halved, and the radius unchanged, then the centripetal force must change by a factor of:
- (1) $3/4$ (2) $3/2$ (3) $9/4$ (4) 6 (5) 12
4. A 1.5-kg crate falls from a height of 2.0 m above a spring scale before it drops onto the spring scale which has a spring constant of $1.5 \times 10^5 \text{ N/m}$. At its greatest compression, the reading on the scale is:
- (1) $3.0 \times 10^3 \text{ N}$ (2) $2.1 \times 10^3 \text{ N}$ (3) $1.5 \times 10^3 \text{ N}$ (4) 30N (5) 15N
5. Given a potential energy function $U(x)$, the corresponding force \vec{F} is in the positive x direction if:
- (1) U is a decreasing function of x .
 (2) U is positive.
 (3) U is negative.
 (4) U is an increasing function of x .
 (5) It is impossible to obtain the direction of \vec{F} from U .
6. Bullets from two revolvers are fired with the same velocity. The bullet from gun #1 is twice as heavy as the bullet from gun #2. Gun #1 weighs three times as much as gun #2. The ratio of the momentum imparted to gun #1 to that imparted to gun #2 is:
- (1) 2:1 (2) 2:3 (3) 3:2 (4) 3:1 (5) 6:1
7. A sphere of radius R and mass M has a rotational inertia about a diameter that is given by $\frac{5}{2}MR^2$. A string of length L is attached to the surface and used to suspend the sphere from the ceiling. Its rotational inertia about the point of attachment at the ceiling is:

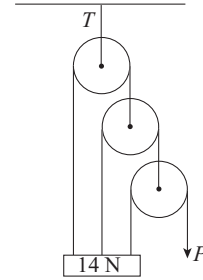


- (1) $M \left(\frac{5}{2}R^2 + L^2 \right)$ (2) $\frac{5}{2}M(R + L)^2$ (3) $\frac{5}{2}MR^2$ (4) $\frac{5}{2}M(L - R)^2$ (5) $M \left(L - \frac{5}{2}R \right)^2$

8. A rod rests on frictionless ice. Forces that are equal in magnitude and opposite in direction are simultaneously applied to its ends as shown. The quantity that is zero is the:



- (1) total linear momentum (2) angular momentum (3) angular acceleration (4) kinetic energy (5) rotational inertia
9. The pull P is just sufficient to keep the 14-N block and the weightless pulleys in equilibrium as shown. The tension T in the upper cable is:



- (1) 16 N
 (2) 14 N
 (3) 28 N
 (4) 9.33 N
 (5) 18.7 N

10. A particle might be placed:
- inside a uniform spherical shell of mass M , but not at the center.
 - inside a uniform spherical shell of mass M , at the center.
 - outside a uniform spherical shell of mass M , a distance r from the center.
 - outside a uniform solid sphere of mass M , a distance $2r$ from the center.
- Rank these situations according to the magnitude of the gravitational force on the particle, least to greatest.

- (1) A and B tie, then D, then C
 (2) All tie
 (3) A, B, C, D
 (4) A and B tie, then C and D tie
 (5) A and B tie, then C, then D

11. The mass of a hypothetical planet is $1/100$ that of Earth and its radius is $1/4$ that of Earth. If a person weighs 100 N on Earth, what would he weigh on this planet?

- (1) 16 N (2) 100 N (3) 8 N (4) 32 N (5) 4 N

12. An object is dropped from an altitude of one Earth radius above Earth's surface. If M is the mass of Earth and R is its radius, the speed of the object just before it hits Earth is given by:

- (1) $\sqrt{GM/R}$ (2) $\sqrt{GM/2R}$ (3) $\sqrt{2GM/R}$ (4) $\sqrt{GM/R^2}$ (5) $\sqrt{GM/2R^2}$

13. A certain object floats in three different fluids with different densities:

A. $0.9\rho_0$

B. ρ_0

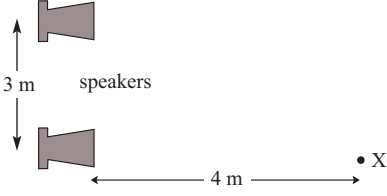
C. $1.1\rho_0$

Rank these fluids according to the magnitude of the buoyant force they exert on the object, least to greatest.

- (1) All are the same (2) A, B, C (3) C, B, A (4) B, C, A (5) C, A, B

14. A large water tank, open at the top, has a small hole in the bottom. When the water level is 30 m above the bottom of the tank, the speed of the water leaking from the hole:

- (1) is 24 m/s.
 (2) is 2.5 m/s.
 (3) is 44 m/s.
 (4) cannot be calculated unless the area of the hole is given.
 (5) cannot be calculated unless the areas of the hole and tank are given.

15. A 0.25-kg block oscillates on the end of the spring with a spring constant of 200 N/m. If the system has an energy of 6.0 J, then the amplitude of the oscillation is:
- (1) 0.24 m (2) 0.06 m (3) 0.17 m (4) 4.9 m (5) 6.9 m
16. A simple pendulum has length L and period T . As it passes through its equilibrium position, the string is suddenly clamped at its midpoint. The period then becomes:
- (1) none of these (2) $2T$ (3) T (4) $T/2$ (5) $T/4$
17. The displacement of a string carrying a traveling sinusoidal wave is given by $y(x, t) = y_m \sin(kx - \omega t - \phi)$. At time $t = 0$, the point at $x = 0$ has a velocity of 0 and positive displacement. The phase constant ϕ is:
- (1) 270° (2) 45° (3) 90° (4) 135° (5) 180°
18. When a 100-Hz oscillator is used to generate a sinusoidal wave on a certain string, the wavelength is 10 cm. When the tension in the string is doubled, the generator produces a wave with a frequency and wavelength of:
- (1) 100 Hz and 14 cm (2) 200 Hz and 20 cm (3) 141 Hz and 10 cm (4) 100 Hz and 20 cm (5) 50 Hz and 14 cm
19. Two small identical speakers are connected (in phase) to the same source. The speakers are 3 m apart and at ear level. An observer stands at X, 4 m in front of one speaker, as shown. The sound he hears will be least intense if the wavelength is:
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- (1) 2 m (2) 5 m (3) 4 m (4) 3 m (5) 1 m
20. A source emits sound with a frequency of 1000 Hz. Both it and an observer are moving toward each other, each with a speed of 100 m/s. If the speed of sound is 340 m/s, the observer hears sound with a frequency of:
- (1) 1830 Hz (2) 294 Hz (3) 545 Hz (4) 1000 Hz (5) 3400 Hz