PHYSICS DEPARTMENT

PHY 2048 Final Exam April 28, 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.
(7) Use $g = 10$ m/s^2.

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1. A ball is in free fall. Its acceleration is:

(1) downward during both ascent and descent.
(2) downward during ascent and upward during descent.
(3) upward during ascent and downward during descent.
(4) upward during both ascent and descent.
(5) downward at all times except at the very top, when it is zero.

ANSWER #1 IS CORRECT FOR ALL QUESTIONS

2. A vector in the xy plane has a magnitude of 25 and an x component of 12. The angle it makes with the positive x axis is:

(1) 61° (2) 26° (3) 29° (4) 64° (5) 241°

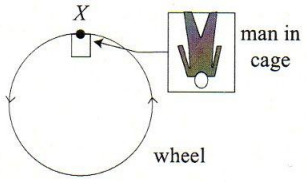
3. An object is shot from the back of a truck moving at 30 mph on a straight horizontal road. The launcher is aimed upward, perpendicular to the bed of the truck. If there is no air friction, the object falls:

(1) on the truck.
(2) in front of the truck.
(3) behind the truck.
(4) depends on the initial speed of the object.
(5) depends on the value of g.

4. A heavy steel ball B is suspended by a cord from a block of wood W. The entire system is dropped through the air. Neglecting air resistance, then tension in the cord is:

(1) zero.
(2) the difference in the masses of B and W.
(3) the difference in the weights of B and W.
(4) the weight of B.
(5) none of these

5. A giant wheel, having a diameter of 40 m, is fitted with a cage and platform on which a man of mass m stands. The wheel is rotated in a vertical plane at such a speed that the force exerted by the man on the platform is equal to his weight when the cage is at X, as shown. The net force on the man at point X is:



(1) $2mg$, down (2) zero (3) mg, down (4) mg, up (5) $2mg$, up

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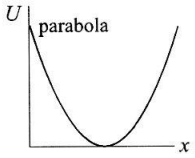
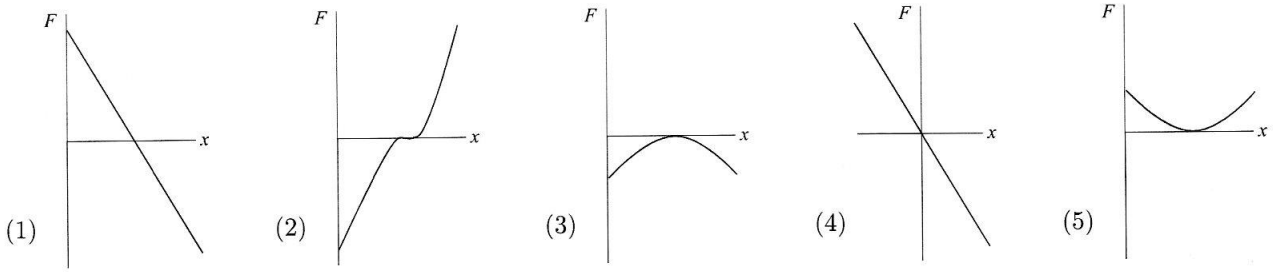
6. A pariticle moving along the x axis is acted upon by a single force $F = F_0 e^{-kx}$, where F_0 and k are constants. The paritcle is released from rest at $x = 0$. It will attain a maximum kinetic energy at $x =$ infinity of:

(1) F_0/k (2) F_0/e^k (3) kF_0 (4) $1/2(kF_0)^2$ (5) ke^kF_0

7. The first graph shows the potential energy $U(x)$ for a particle moving along the x axis. Which of the following five graphs correctly gives the force F exerted on the particle?

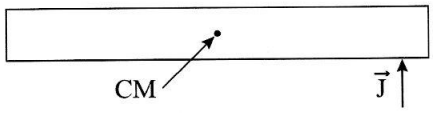




8. A 0.20-kg rubber ball is dropped from the window of a building. It strikes the sidewalk below at 30 m/s and rebounds at 20 m/s. The magnitude of the change in momentum of the ball as a result of the collision with the sidewalk is (in kg·m/s):

(1) 10 (2) 6.0 (3) 4.0 (4) 2.0 (5) 1.0

9. A uniform narrow bar, resting on ice, is given a transverse horizontal impulse $\vec{J}$ at one end as shown. The center of mass of the bar CM will then:



(1) move in a straight line.
(2) remain at rest.
(3) move in a circle.
(4) move in a parabola.
(5) move along some other curve.

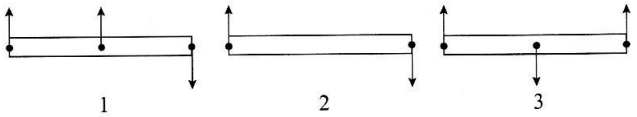
10. Two wheels are identical but wheel B is spinning with twice the angular velocity of wheel A. The ratio of the radial acceleration of a point on the rim of B to the radial acceleration of a point on the rim of A is:

(1) 4 (2) 1 (3) 2 (4) 1/2 (5) 1/4

11. A playground merry-go-round has a radius of 3.0 m and a rotational inertia of 600 kg·m^2. When the merry-go-round is at rest, a 20-kg child runs at 5.0 m/s along a line tangent to the rim and jumps on. The angular velocity of the merry-go-round/child system is then (in rad/s):

(1) 0.38 (2) 0.45 (3) 0.71 (4) 0.56 (5) 1.2

12. Three identical uniform rods are each acted on by two or more forces, all perpendicular to the rods. Which of the rods could be in static equilibrium if the magnitudes of the forces were suitably adjusted (but not made zero)?

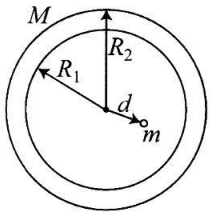


(1) only 3 (2) only 1 (3) only 2 (4) only 1 and 2 (5) all three

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

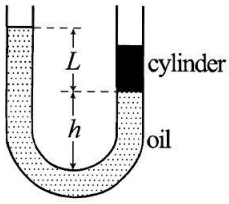
(1) 16 N (2) 100 N (3) 8 N (4) 32 N (5) 4 N

14. A spherical shell has inner radius R_1, outer radius R_2, and mass M, distributed uniformly throughout the shell. The magnitude of the gravitational force exerted on the shell by a point mass m a distance d from the center, inside the inner radius, is:



(1) 0 (2) GMm/R^2 (3) GMm/d^2 (4) $GMm/(R_2^2 - d^2)$ (5) $GMm/(R_1 - d)^2$

15. The diagram shows a U-tube with cross-sectional area A and partially filled with oil of density ρ. A solid cylinder, which fits the tube tightly but can slide without friction, is placed in the right arm. The system is in equilibrium. The weight of the cylinder is:



(1) $AL\rho g$ (2) $L^3\rho g$ (3) $A\rho(L+h)g$ (4) $A\rho(L-h)g$ (5) none of these

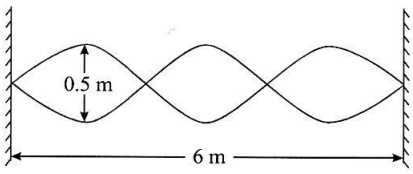
16. In simple harmonic motion, the magnitude of the acceleration is greatest when the:

(1) displacement is maximum. (2) displacement is zero. (3) velocity is maximum. (4) force is zero. (5) none of these

17. A block attached to a string undergoes simple harmonic motion on a horizontal frictionless surface. Its total energy is 50 J. When the displacement is half the amplitude, the kinetic energy is:

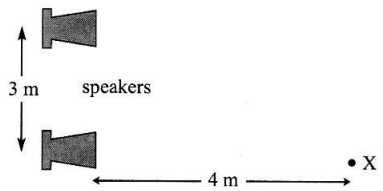
(1) 37.5 J (2) zero (3) 12.5 J (4) 25 J (5) 50 J

18. A standing wave pattern is established in a string as shown. The wavelength of one of the component traveling waves is:



(1) 4 m (2) 0.25 m (3) 0.5 m (4) 1 m (5) 2 m

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 she hears will be most intense if the wavelength is:



(1) 5 m (2) 6 m (3) 4 m (4) 3 m (5) 2 m

20. A source emits sound with a frequency of 1000 Hz. It is moving at 20 m/s toward a reflecting wall. If the speed of sound is 340 m/s, an observer at rest directly behind the source hears a beat frequency of:

(1) 118 Hz (2) 11 Hz (3) 86 Hz (4) 97 Hz (5) 183 Hz