77777

Instructor(s): Matcheva/Sabin

## PHYSICS DEPARTMENT

PHY 2048	Final Exam	April 23, 2011
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.

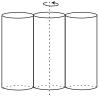
- (1) Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number). Code your name on your answer sheet. DARKEN CIRCLES COMPLETELY. Code your UFID number on your answer sheet.
- (2) Print your name on this sheet and sign it also.
- (3) Do all scratch work anywhere 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 <u>blue</u> or <u>black</u> 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.

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1.	A boy wishes to row from one bank of the river to the other in the shortest possible time. He can row at 4 m/s in still water and the river is flowing at 2 m/s. At what angle $\theta$ should he point the bow (front) of his boat?  (1) 90° (2) 30° (3) 45°				θ ~~~~	2 m/s			
	(4) 60° (5) 63°			_					
2.	Two objects X and Y are held at rest on a horizontal frictionless surface. A spring is compressed between X and Y. Th mass of X is twice the mass of Y. After the objects are released, the ratio of the kinetic energy of X to that of Y is:								
	(1) 1/2	(2) 1/4	(3) 2	(4) 1	(5) 4				
3.	3. If a particle moves such that $x = 2t^2 - 8$ , and $y = 3t + 2$ , what is the speed of the particle when $t = 1$ ?								
	(1) 5	(2) 10	$(3) \sqrt{41}$	$(4) \sqrt{61}$	(5) 2				
4.	4. A Simple Harmonic Oscillator has a displacement of $x = x_m \cos(\omega t)$ . The phase constant $\phi = 0$ . At what time t is the magnitude of the velocity the greatest?								
	(1) $\pi/2\omega$	(2) $1/\omega$	(3) $\pi/\omega$	(4) $1/2\omega$	(5) $\omega/2\pi$				
5.	5. A Simple Harmonic Oscillator has a displacement of $x = 3\cos(2t)$ . What is the maximum acceleration?								
	(1) 12	(2) 6	(3) 3	(4) 9	(5) 18				
6.	A rock, of density 1500 acceleration in $m/s^2$ ?	$0\mathrm{kg}/\mathrm{m}^3$ and volume $0$	$1\mathrm{m}^3$ is completely sub	nerged in water. V	What is the magnitud	e of its initial			
	(1) 3.33	(2) 5	(3) 33.3	(4) 12.5	$(5) \ 0.33$				
7.	Two carts, each of mass $M$ , travel towards each other on a frictionless air track, one with velocity $V$ , and the other wir $-3V$ . They collide and stick together. How much kinetic energy is "lost" in the collision?								
	$(1) \ 4MV^2$	(2) 0	$(3) \ 5MV^2$	(4) $2.5MV^2$	(5) $3MV^2$				
8.	A 5 meter long plank has a mass of 4 kg. It is supported by 2 supports, the first at 1 meter from the end, and the second at 3 meters from that same end. How much upward force is supplied by the second support?								
	(1) 30 N	(2) 20 N	$(3)\ 10\mathrm{N}$	$(4) 40 \mathrm{N}$	$(5) 26.66 \mathrm{N}$				

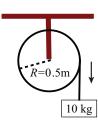
9. An object comprises 3 identical solid cylinders of mass m and radius r glued along their edges side-by-side (see diagram). Remembering that the rotational inertia of a cylinder about its axis of symmetry is  $0.5mr^2$ , find the rotational inertia of the three cylinders about the center line of the middle one.



- $(1) 9.5mr^2$
- (2)  $1.5mr^2$  (3)  $5.5mr^2$
- $(4) \ 3.0mr^2$
- $(5) 6.0mr^2$
- 10. A 2 kg mass hangs from the end of a 1 meter long string which is fixed at its other end. The mass is displaced so that the string is at 53° to the vertical and released (remember  $\sin(53^\circ) = \cos(37^\circ) = 0.8$ ). Find the magnitude of the total acceleration of the mass when the string is at 37° to the vertical.
  - $(1) 7.2 \text{ m/s}^2$
- $(2) 10.0 \text{ m/s}^2$
- $(3) 2.0 \text{ m/s}^2$
- $(4) 6.0 \text{ m/s}^2$   $(5) 4.5 \text{ m/s}^2$

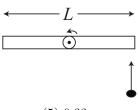
- 11. Find the tension in the string in the previous question, when it is vertical.
  - (1) 36 N
- (2) 20 N
- (3) 4 N
- (4) 180 N
- (5) 16 N
- 12. A child's catapault fires a ball with a set speed v. If it is fired horizontally and directly aimed at a target 10 meters away and at the same height above the ground, because of gravity the ball lands 5 meters below the target. How high above the target should it be aimed?
  - (1) 10 m
- (2) 5 m
- (3) 7 m
- (4) 8 m
- (5) 3 m
- 13. A child's slide is flat, 5 meters long, and sloped down so that the top is 3 meters higher than the bottom. A child slides down, starting from rest, and has v = 6 m/s at the bottom. Find the coefficient of kinetic friction,  $\mu_k$ .
  - (1) 0.3
- (2) 0.4
- (3) 0.2
- (4) 0.1
- $(5)\ 0.5$
- 14. A binary planet system comprises two identical planets of mass M and radius R with their centers a distance 10R apart. The minimum energy that the engines of a spacecraft need to supply to get a rocket of mass m from the surface of one planet to the surface of the other is of the form XGMm/R. What is X (choose closest)?
  - $(1)\ 0.7$
- (2) 0.9
- (3) 1.0
- (4) 0.5
- (5) 0.1
- 15. A police siren gives out sound of 500 Hz. When the police car is coming directly towards you (you are stationary), you hear a sound of 600 Hz. How fast is the police car traveling? Take the speed of sound as 300 m/s.
  - (1) 50 m/s
- (2) 30 m/s
- (3) 60 m/s
- (4) 20 m/s
- (5) 40 m/s

16. A mass of 10 kg is hung from a string which is wrapped (with no slippage) around a frictionless pulley of  $I = 5 \text{ kg m}^2$  and radius 0.5 m. What is the magnitude of the acceleration of the mass in m/s<sup>2</sup>?



- (1) 3.33
- $(2)\ 10.0$
- (3) 5.0
- (4) 2.5
- (5) 6.6

17. A stationary stick of length L and mass M is pivoted around its center like a propeller. A lump of mud also of mass M is thrown at the stick, near its end, with velocity v in a direction perpendicular to it as shown. The mud sticks and the stick+mud moves. What is the speed of the mud immediately after the collision? The rotational inertia for a stick rotated around its center as shown is  $I = \frac{1}{12}ML^2$ .



 $(1) \ 0.75v$ 

 $(2) \ 0.5v$ 

(3) v

 $(4) \ 0.25v$ 

 $(5) \ 0.33v$ 

18. A sound wave is travelling at 300 m/s in the x direction. At one instant, an air molecule at x = 2.0 m is at its maximum positive displacement of 5.0 nm. Another air molecule at x = 2.1 m is not displaced at all. All molecules between x = 2.0 m and x = 2.1 meters are at positive displacements. What is the frequency of the wave?

(1) 750 Hz

(2) 375 Hz

(3) 187 Hz

 $(4)\ 1500\ Hz$ 

 $(5)\ 3000\ Hz$ 

19. An isotropically radiating point source of sound has a power output of 100 W. What is the sound intensity at a point 2 meters away (in  $W/m^2$ )?

(1) 2

(2) 25

 $(3)\ 3$ 

(4) 12.5

 $(5)\ 50$ 

20. What is the x-coordinate of the center of mass of an object consisting of the following point masses; M at (0,0), 2M at (10,0), 3M at (10,10) and 4M at (20,0)?

(1) 13

(2) 14

 $(3)\ 15$ 

 $(4)\ 10$ 

(5) 12

THE FOLLOWING QUESTIONS, NUMBERED IN THE ORDER OF THEIR APPEARANCE ON THE ABOVE LIST, HAVE BEEN FLAGGED AS CONTINUATION QUESTIONS: 11