

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

PHY 2048

April 23, 2011

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

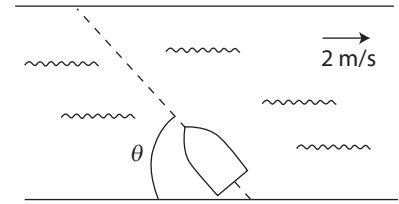
*On my honor, I have neither given nor received unauthorized aid on this examination.***YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.**

- (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 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 $g = 10 \text{ m/s}^2$ as the acceleration due to gravity.

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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 θ should he point the bow (front) of his boat?



- (1) 90°
 (2) 30°
 (3) 45°
 (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. The 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. 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. 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) π/ω (4) $1/2\omega$ (5) $\omega/2\pi$

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

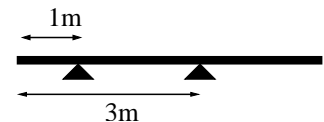
6. A rock, of density 1500 kg/m^3 and volume 0.1 m^3 is completely submerged in water. What is the magnitude of its initial acceleration in m/s^2 ?

- (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 with $-3V$. They collide and stick together. How much kinetic energy is "lost" in the collision?

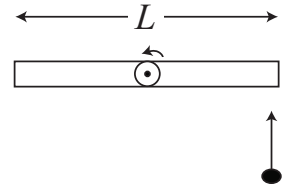
- (1) $4MV^2$ (2) 0 (3) $5MV^2$ (4) $2.5MV^2$ (5) $3MV^2$

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 N (4) 40 N (5) 26.66 N

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