Instructor(s): *A. Hebard/J. Klauder*

PHYSICS DEPARTMENT

PHY 2048 Exam 3 November 29, 2007

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 green answer sheet (use 76–80 for the 5-digit number)**. Code your name on your answer sheet. Darken circles completely. Code your UF ID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work on this exam to the right of the questions, and anywhere else on this exam that you like. At the end of the test, this exam printout is to be turned in. No credit will be given without both the answer sheet and printout, with the scratch work which most questions demand of anyone.
(4) You will receive one point for each correct answer and zero points for an incorrect answer or no answer.
(5) Use a number 2 pencil on the answer sheet. Do not make any stray marks, or the answer sheet may not be read properly.

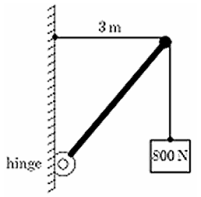
>>>>>>>>**BEFORE YOU FINISH** <<<<<<<<

Fold the exam so that your name is on top, include any figure sheet inside the printout. Hand in the answer sheet separately.

Possibly useful formulas:

$F_G = G\frac{M_1 M_2}{R^2}$	$\frac{F}{A} = E\frac{\Delta L}{L}$	$\omega = 2\pi f$	$f = \frac{1}{T}$	SHO:$\omega = \sqrt{\frac{k}{m}}$

1. A 5.0-m weightless strut, hinged to a wall, is used to support an 800-N block as shown. The horizontal (F_H) and vertical (F_Y) components of the force of the hinge on the strut are:

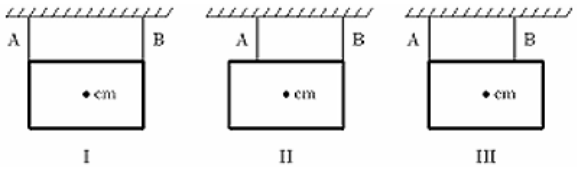


(1) $F_H = 600$N, $F_Y = 800$N (2) $F_H = 800$N, $F_Y = 800$N (3) $F_H = 800$N, $F_Y = 600$N (4) $F_H = 1200$N, $F_Y = 800$N (5) $F_H = 0$, $F_Y = 800$N

2. A uniform 240-g meter stick can be balanced by a 240-g weight placed at the 100-cm mark if the fulcrum is placed at the point marked:

(1) 75 cm (2) 60 cm (3) 50cm (4) 40 cm (5) 80 cm

3. A picture is to be hung from the ceiling by means of two wires. Order the following arrangements of the wires according to the tension force of wire B, from least to greatest.



(1) II, I, III (2) III, II, I (3) I and II tie, then III (4) I, II, III (5) all tie

4. A force of 5000N is applied outwardly to each end of a 5.0-m long rod with a radius of 34.0 mm and a Young's modulus of 125×10^8N/m^2. The elongation of the rod is:

(1) 0.55mm (2) 0.0040mm (3) 0.14mm (4) 0.0020mm (5) 1.42mm

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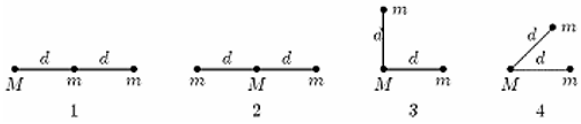
5. Three particles, two with mass m and one with mass M, might be arranged in any of the four configurations known below. Rank the configurations according to the magnitude of the gravitational force on M, least to greatest.



(1) 2, 1, 3, 4 (2) 1, 2, 3, 4 (3) 2, 1, 4, 3 (4) 2, 3, 4, 2 (5) 2, 3, 2, 4

6. Venus has a mass of about 0.0558 times the mass of Earth and a diameter of about 0.381 times the diameter of Earth. The acceleration of a body falling near the surface of Venus is about:

(1) 3.8 m/s^2 (2) 1.4 m/s^2 (3) 2.8 m/s^2 (4) 0.21m/s^2 (5) 25 m/s^2

7. An artificial satellite of Earth releases a bomb. Neglecting air resistance, the bomb will:

(1) never strike Earth
(2) strike Earth under the satellite at the instant of impact
(3) strike Earth ahead of the satellite at the instant of impact
(4) strike Earth behind the satellite at the instant of impact
(5) strike Earth under the satellite at the instant of release

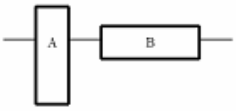
8. To measure the mass of a planet with the same radius as Earth, an astronaut drops an object from rest (relative to the planet) from an altitude of one radius above the surface. When the object hits its speed is 4 times what it would be if the same experiment were carried out for Earth. In units of Earth masses, the mass of the planet is:

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

9. 1 Pa is:

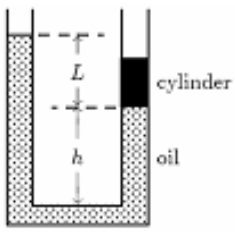
(1) 1 kg/(m·s^2) (2) 1m/N (3) 1 kg/(m·s) (4) 1N/m (5) 1N/(m·s)

10. Two identical blocks of ice float in water as shown. Then:



(1) the two blocks displace equal volumes of water since they have the same weight.
(2) block B displaces a greater volume of water since the pressure is less on its bottom.
(3) block A displaces a greater volume of water since the pressure acts on a smaller bottom area.
(4) block A displaces a greater volume of water since its submerged end is lower in the water.
(5) block B displaces a greater volume of water since its submerged end has a greater area.

11. 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

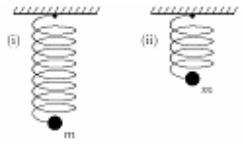
12. A U-tube has dissimilar arms, one having twice the diameter of the other. It contains an incompressible fluid and is fitted with a sliding piston in each arm, with each piston in contact with the fluid. When an applied force does work W in pushing the piston in the narrow arm down, the fluid does what amount of work on the piston in the wide arm.

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

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

(1) the displacement is maximum
(2) the displacement is zero
(3) the speed is maximum
(4) the force is zero
(5) the speed is between zero and its maximum

14. A simple harmonic oscillator consists of an particle of mass m and an ideal spring with spring constant k. The particle oscillates as shown in (i) with period T. If the spring is cut in half and used with the same particle, as shown in (ii), the period will be:



(1) $T/\sqrt{2}$ (2) $\sqrt{2}T$ (3) $2T$ (4) T (5) $T/2$

15. The displacement of an object oscillating on a spring is given by $x(t) = x_m \cos(\omega t + \phi)$. If the object is initially displaced in the negative x direction and given a negative initial velocity, then the phase constant ϕ is between:

(1) $\pi/2$ and π rad
(2) 0 and $\pi/2$ rad
(3) π and $3\pi/2$ rad
(4) $3\pi/2$ and 2π rad
(5) none of the above (ϕ is exactly 0, $\pi/2$, π, or $3\pi/2$ rad)

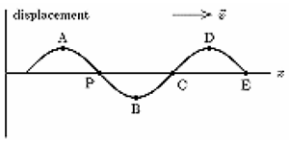
16. A block attached to a spring undergoes simple harmonic motion on a horizontal frictionless surface. Its total energy is 50.0 J. When the displacement is half the amplitude, the kinetic energy is:

(1) 37.5 J (2) 12.5 J (3) 25.0 J (4) zero (5) 50.0 J

17. A wave is described by $y(x,t) = 0.1\sin(3 - 10t)$, where x is in meters, y is in centimeters, and t is in seconds. The angular frequency is:

(1) 10 rad/s (2) 3.0π rad/s (3) 10π rad/s (4) 20π rad/s (5) 0.10 rad/s

18. A traveling sinusoidal wave is shown. At which point is the motion 180° out of phase with the motion at point P?



(1) C (2) A (3) B (4) D (5) E

19. 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 velocity v_o and displacement y_o. The phase constant ϕ is given by $\tan\phi =$:

(1) $\omega y_0/v_0$ (2) $v_0/(\omega y_0)$ (3) $\omega v_0/y_0$ (4) $y_0/(\omega v_0)$ (5) $\omega y_0 v_0$

20. A transverse traveling sinusoidal wave on a string has a frequency of 100Hz, a wavelength of 0.040m, and an amplitude of 2.0mm. The maximum acceleration in $\mathrm{m/s^2}$ of any point on the string is:

(1) 790 (2) 130 (3) 395 (4) 0 (5) 1600