Instructor(s): *Saab/Sabin*

PHYSICS DEPARTMENT

PHY 2048 Exam 3 December 6, 2010

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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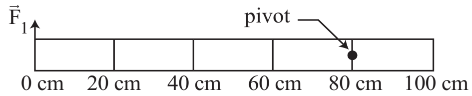
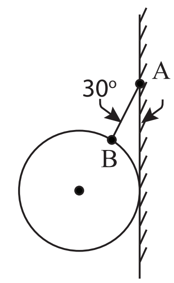
1. A meter stick on a horizontal frictionless table top is pivoted at the 80-cm mark. Two forces are applied to the stick, both of them horizontal (*i.e.,* in the plane of the table), and perpendicular to the stick. One force, $\vec{F}_1$, acts on the end of the stick at 0 cm as shown. A second force $\vec{F}_2$ (not shown) is applied perpendicularly at the 100-cm end of the stick. If the stick does not move, the force exerted by the pivot on the stick:



(1) must be directed opposite to $\vec{F}_1$ and have magnitude $|\vec{F}_2| + |\vec{F}_1|$
(2) must be in the same direction as $\vec{F}_1$ and have magnitude $|\vec{F}_2| - |\vec{F}_1|$
(3) must be directed opposite to $\vec{F}_1$ and have magnitude $|\vec{F}_2| - |\vec{F}_1|$
(4) must be in the same direction as $\vec{F}_1$ and have magnitude $|\vec{F}_2| + |\vec{F}_1|$
(5) must be zero

2. The ball shown, of weight 150 N, is suspended on a string AB and rests against a frictionless vertical wall. The string makes an angle of 30° with the wall. The ball presses against the wall with a force of:



(1) 87 N
(2) 30 N
(3) 75 N
(4) 150 N
(5) 173 N

3. A cube with 2.0-cm sides is made of material with a bulk modulus of $4.7 \times 10^5 \mathrm{N/m^2}$. When it is subjected to a uniform pressure of 2.0×10^5Pa, the length in cm of each of its edges is:

(1) 1.66 (2) 0.85 (3) 1.15 (4) 2.0 (5) none of these

4. Mars has about 1/10 the mass of Earth and about 1/2 the diameter of Earth. The acceleration (in $\mathrm{m/s^2}$) of a body falling near the surface of Mars is about:

(1) 4.0 (2) 9.8 (3) 2.0 (4) 4.9 (5) none of these

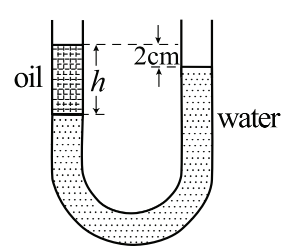
5. A spherical shell has inner radius R_1, outer radius R_2, and mass M, distributed uniformly throughout the shell. The magnitude of the gravitational force exerted on the shell by a point mass m a distance d from the center, outside the inner radius and inside the outer radius, is:

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

6. To measure moderately low pressures, oil with a density of 8.5×10^2 kg/m^3 is used in place of mercury in a barometer. A pressure change of 1.0 Pa produces a change in the height of the oil column of about:

(1) 1.2×10^{-4}m (2) 1.2×10^{-2}m (3) 1.2×10^{-3}m (4) 1.2×10^{-5}m (5) 1.2×10^{-6}m

7. The density of oil is 0.8 g/cm^3. The height h of the column of oil shown is:



(1) 10 cm
(2) 2 cm
(3) 4.6 cm
(4) 8 cm
(5) 11.8 cm

8. A bucket resting on the floor of an elevator contains an incompressible fluid of density ρ. When the elevator has an upward acceleration of magnitude a, the pressure difference between two points in a fluid separated by a vertical distance Δh, is given by:

(1) $\rho(g+a)\Delta h$ (2) $\rho a\Delta h$ (3) $\rho g\Delta h$ (4) $\rho(g-a)\Delta h$ (5) $\rho ga\Delta h$

9. A small steel ball floats in a half-full container of mercury. When water is added:

(1) the ball will rise slightly.
(2) the ball will float on the water.
(3) the mercury will float on the water.
(4) the ball will sink to the bottom of the container.
(5) the ball will lower slightly more into the mercury.

10. A weight suspended from an ideal spring oscillates up and down. If the amplitude of the oscillation is doubled, the period will:

(1) remain the same. (2) increase by a factor of $\sqrt{2}$. (3) double. (4) halve. (5) decrease by a factor of $\sqrt{2}$.

11. A particle moves in simple harmonic motion according to $x = 2\cos(50t)$, where x is in meters and t is in seconds. Its maximum velocity in m/s is:

(1) 100 (2) $100\sin(50t)$ (3) $100\cos(50t)$ (4) 200 (5) none of these

12. The period of a simple pendulum is 1 s on Earth. When brought to a planet where g is one-tenth that on Earth, its period becomes:

(1) $\sqrt{10}$ s (2) 1 s (3) $1/\sqrt{10}$ s (4) 1/10 s (5) 10 s

13. The rotational inertia of a uniform thin rod about its end is $ML^2/3$, where M is the mass and L is the length. Such a rod is hung vertically from one end and set into small amplitude oscillation. If $L = 1.0$ m and $M = 200$ g, this rod will have the same period as a simple pendulum of length:

(1) 67 cm (2) 33 cm (3) 50 cm (4) 100 cm (5) 150 cm

14. Sinusoidal water waves are generated in a large ripple tank. The waves travel at 20 cm/s and their adjacent crests are 5.0 cm apart. The time required for each new whole cycle to be generated is:

(1) 0.25 s (2) 100 s (3) 4.0 s (4) 2.0 s (5) 0.5 s

15. Sinusoidal waves travel on five identical strings. Four of the strings have the same tension, but the fifth has a different tension. Use the mathematical forms of the waves, given below, to identify the string with the different tension. In the expressions x and y are in centimeters and t is in seconds.

(1) $y(x,t) = (2\text{cm})\sin(4x - 10t)$
(2) $y(x,t) = (2\text{cm})\sin(2x - 4t)$
(3) $y(x,t) = (2\text{cm})\sin(6x - 12t)$
(4) $y(x,t) = (2\text{cm})\sin(8x - 16t)$
(5) $y(x,t) = (2\text{cm})\sin(10x - 20t)$

16. Two sinusoidal waves have the same angular frequency, the same amplitude y_m, and travel in the same direction in the same medium. If they differ in phase by 50°, the amplitude of the resultant wave is given by:

(1) $2y_m \cos 25°$ (2) $y_m \cos 50°$ (3) $2y_m \cos 50°$ (4) $y_m \cos 25°$ (5) $2y_m \cos 100°$

17. Two traveling waves:

$$y_1 = A \sin[k(x - vt)]$$

and

$$y_2 = A \sin[k(x + vt)]$$

are superposed on the same string. The distance between the adjacent nodes of the resulting standing wave is:

(1) π/k (2) vt/π (3) $vt/2\pi$ (4) $\pi/2k$ (5) $2\pi/k$

18. A 2 meter long uniform pole of mass 1 kg is hung horizonally by two vertical wires, one on each end. A 2 kg mass is hung from a position 0.5 m from the left end. What is the tension on the left wire?

(1) 20 N (2) 15 N (3) 10 N (4) 30 N (5) 5 N

19. A satellite, "A" is in orbit a distance R above the surface of a planet of radius R. A second, identical satellite, "B" is at a distance of $2R$ above the surface. What is the ratio of the forces, due to the planet, on the satellites (F_A/F_B)?

(1) 2.25 (2) 4 (3) 2 (4) 0.44 (5) 1

20. Three masses of equal mass m are at the points of an equilateral triangle of length L. The gravitational force on one of the masses is given by XGm^2/L^2. What is X?

(1) $\sqrt{3}$ (2) 2 (3) $\sqrt{3}/2$ (4) 0 (5) 1