Instructor(s): *Hirschfeld/Matcheva*

PHYSICS DEPARTMENT

PHY 2048 Exam 1 February 3, 2009

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.
(6) **Hand in the answer sheet separately.**

Where needed use $g = 9.80$ m/s^2

1. A uniform solid sphere has a radius of 21 cm and a mass of 1.9 kg. Its mass density is about:

   (1) 49 kg/m^3 (2) 2.0×10^{-6} kg/m^3 (3) 2.0×10^{-2} kg/m^3 (4) 1.4 kg/m^3 (5) 14 kg/m^3

2. A particle moves along the x axis from x_i to x_f . Of the following values of the initial and final coordinates, which results in a negative displacement?

   (1) $x_i = 8$ m, $x_f = 4$ m (2) $x_i = 4$ m, $x_f = 6$ m (3) $x_i = -4$ m, $x_f = 2$ m (4) $x_i = -4$ m, $x_f = -2$ m (5) $x_i = -4$ m, $x_f = 4$ m

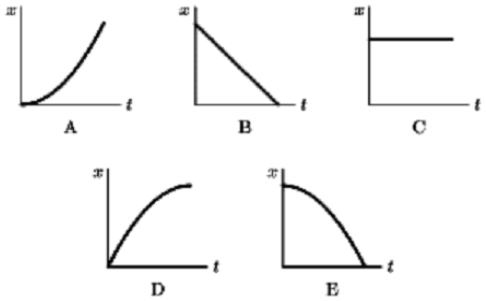
3. A car traveling at a constant speed starts at point A, goes 50 km in a straight line to point B, immediately turns around, and returns to point A (in a straight line). The time for this round trip is 2 hours. The magnitude of the average velocity of the car for this round trip is:

   (1) zero (2) 50 km/hr (3) 100 km/hr (4) 200 km/hr (5) 25 km/hr

4. A car travels 40 kilometers at a constant speed of 80 km/h and then travels 40 kilometers at a constant speed of 40 km/h. The average speed of the car for this 80-km trip is:

   (1) 53 km/h (2) 40 km/h (3) 45 km/h (4) 60 km/h (5) 80 km/h

5. Which of the following five graphs of position, x, versus time, t, represents the motion of an object moving with a constant nonzero speed?



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

6. Each of four particles move along the x-axis. Their coordinates (in meters) as functions of time (in seconds) are given by

   particle 1: $x(t) = 3.5 - 2.7t^3$
   particle 2: $x(t) = 3.5 + 2.7t^3$
   particle 3: $x(t) = 3.5/t$
   particle 4: $x(t) = 3.5 - 3.4t - 2.7t^3$

   Which of these particles have constant acceleration?

   (1) None of them (2) Only 3 and 4 (3) All four (4) Only 1 and 2 (5) Only 2 and 3

7. If θ is the angle between the two non-zero vectors $\vec{A}$ and $\vec{B}$, then which of the following angles θ results in $\vec{A} \cdot \vec{B} = |\vec{A} \times \vec{B}|$?

   (1) 315° (2) 135° (3) 225° (4) 0° (5) none

8. If $\vec{A} + \vec{B} = 2\vec{C}$, $\vec{A} - \vec{B} = -\vec{C}$, and $\vec{C} = 2\hat{i} - 2\hat{j}$, then what is the value of the dot product $\vec{A} \cdot \vec{B}$?

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

9. Starting at time $t = 0$, an object moves along a straight line. Its coordinate in meters is given by $x(t) = 75t - 1.0t^3$, where t is in seconds. What is the acceleration of the object when it momentarily stops (with $t > 0$)?

(1) -30 m/s^2 (2) 30 m/s^2 (3) -15 m/s^2 (4) 15 m/s^2 (5) zero

10. An object is released from rest at $t = 0$ near the surface of the Earth. How far does it fall during the second second of its fall (*i.e.*, from $t = 1$ s to $t = 2$ s)?

(1) 14.7 m (2) 9.8 m (3) 4.9 m (4) 19.6 m (5) 24.5 m

11. If $\vec{A} = 2.0\hat{i} + 3.0\hat{j} + 5.0\hat{k}$ and $\vec{B} = 2.0\hat{i} + 2.0\hat{j} - 2.0\hat{k}$, then the angle between the vector $\vec{A}$ and the vector $\vec{B}$ is:

(1) 90° (2) 180° (3) 45° (4) 0° (5) none of these answers

12. Two trains are headed toward each other on the same straight track. At $t = 0$ the two trains are 200 meters apart and both have a speed of 30 m/s. If one train is traveling at a constant speed and the speed of the other train is increasing at a rate of 10 m/s^2, when do the two trains collide?

(1) $t = 2.7$ s (2) $t = 3.3$ s (3) $t = 1.5$ s (4) $t = 6.6$ s (5) $t = 5.4$ s

13. One revolution per minute is about:

(1) 0.105 rad/s (2) 0.0524 rad/s (3) 0.95 rad/s (4) 1.57 rad/s (5) 6.28 rad/s

14. A boy whirls a 0.25-kg stone in a horizontal circle of radius 1.0 m and at height 2.0 m above level ground. The string breaks, and the stone flies off horizontally and strikes the ground after traveling a horizontal distance D. If the tension in the string was 9.8 N when it broke, what is the distance D?

(1) 4 m (2) 2 m (3) 16 m (4) 3 m (5) 9 m

15. A startled armadillo leaps upward at time $t = 0$, at time $t = 1$ s it is a height of 2 m above the ground. At what time does it reach its maximum height?

(1) 0.7 s (2) 1.2 s (3) 1.7 s (4) 1.5 s (5) 1.0 s

16. A constant horizontal force, $\vec{F}_a$, is applied to block A, which pushes against block B with a force $\vec{F}_1$ directed horizontally to the right as shown in Fig. 1. The same force, $\vec{F}_a$, is applied to block B; now block A pushes on block B with a force $\vec{F}_2$ directed horizontally to the left as shown in Fig. 2. If $|\vec{F}_1| = 1N$ and $|\vec{F}_2| = 2N$, and if the combined mass of the two blocks is 6 kg, and if there is no friction between the blocks and the surface, the acceleration of the blocks is:

Fig. 1

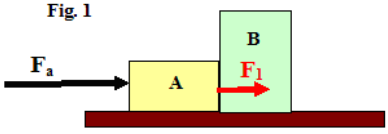
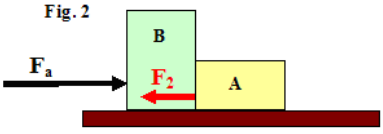
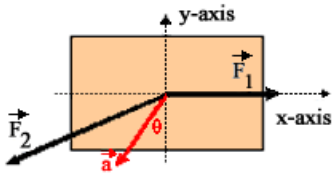


Fig. 2



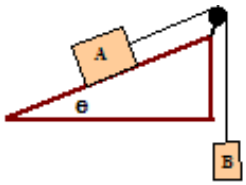
(1) 0.5 m/s^2 (2) 1.0 m/s^2 (3) 2.0 m/s^2 (4) 3.0 m/s^2 (5) 4.0 m/s^2

17. There are two forces on the 5.0 kg box in the overhead view of the figure. If $\vec{F}_1$ points in the positive x-direction and if $|\vec{F}_1| = 10N$, $|\vec{a}| = 12m/s^2$, and $\theta = 30°$, as shown in the figure, what is the magnitude of $\vec{F}_2$?



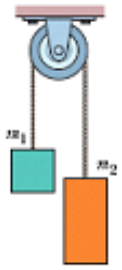
(1) 65.6 N (2) 40.0 N (3) 50.0 N (4) 13.1 N (5) 73.2 N

18. The mass of block A is $M_A = 15$ kg, and the mass of block B is $M_B = 10$ kg, and the angle θ is 30°, as shown in the figure. If block A is at rest, what is the minimum static coefficient such that it will remain at rest after it is released?



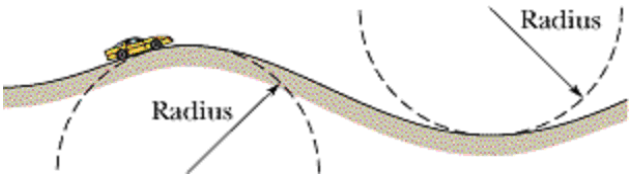
(1) 0.192 (2) 0.385 (3) 0.667 (4) 0.333 (5) 0.144

19. The figure shows two blocks with masses m_1 and m_2 connected by a cord (of negligible mass) that passes over a frictionless pulley (also of negligible mass). If when released from rest block 2 accelerates upward at $g/2$, what is the mass of block 1?



(1) $3m_2$ (2) $4m_2$ (3) $6m_2$ (4) $2m_2$ (5) $5m_2$

20. In the figure, a car is driven at speed v_1 over a circular hill and then into a circular valley with the same radius, but with speed v_2. At the top of the hill, the normal force on the driver from the car seat is zero and the driver's mass is M. If $v_2 = 2v_1$, what is the magnitude of the normal force on the driver from the seat when the car passes through the bottom of the valley?



(1) 5 Mg (2) 2 Mg (3) Mg (4) 0.5 Mg (5) zero