

Exam 1011

**Physics 1710
Fall 2003
Examination 1**

Name: _____

SS#: _____

Professor/Section: Krokhin/3
(circle one) Holland/4
Weathers/5

DIRECTIONS for Bubble Sheet

Bubble in your name (last, first, MI),
SS# (A through I of identification number)
Course section # (L of special codes),
Exam # (MNOP of special codes)

This test consists of 8 multiple-choice questions and 4 problems. To receive credit for the 4 problems, you must show all of your work on the pages provided. Don't hand in any extra sheets or other paper. We strongly recommend that you also show your work for the multiple choice questions.

We suggest that you use the following procedure to solve the problems:

- 1. Read each problem carefully and make sure you know what is being asked before starting the problem.**
- 2. Draw a figure for the problem.**
- 3. List the parameters given.**
- 4. Write down the equations to be used.**
- 5. Solve for the answer algebraically.**
- 6. Substitute numbers into your final equation and circle your answer.**
- 7. Mark your scantron for the multiple choice questions.**

WORK THE EASY PROBLEMS FIRST!!!

1. The proton can be modeled as a sphere with a radius of 1.2×10^{-15} m. Given that the mass of the proton is 1.67×10^{-27} kg, what is the proton's average density in g/cm^3 ?
 - a. 2.3×10^{17}
 - b. 9.2×10^1
 - c. 2.3×10^{14}
 - d. 9.2×10^{-1}
 - e. 1.2×10^{17}

2. An object is thrown vertically upward with an initial velocity $\mathbf{v}_0 = v_0 \mathbf{j}$. At the highest point in the object's trajectory,
 - a. its velocity and acceleration are both zero.
 - b. its velocity is zero, and its acceleration is nonzero and directed downward.
 - c. its velocity and acceleration are both nonzero.
 - d. its velocity is zero, and its acceleration is nonzero and directed upward.
 - e. its acceleration is zero, and its velocity is nonzero and directed downward.

3. Given that vector $\mathbf{A} = 2.0 \mathbf{i} + 4.0 \mathbf{j} - 7.0 \mathbf{k}$ and vector $\mathbf{B} = 5.0 \mathbf{i} - 3.0 \mathbf{j} + 1.0 \mathbf{k}$, what is the angle between \mathbf{A} and \mathbf{B} ?
 - a. 90°
 - b. 54°
 - c. 94°
 - d. 101°
 - e. 136°

4. A motorboat is crossing a river. From the perspective of the boat's driver, the boat is pointed straight north and is moving at 15.0 m/s with respect to the water. The river's current carries the water to the east at 11.0 m/s. What is the speed of the boat with respect to an observer standing on the bank?
 - a. 18.6 m/s
 - b. 5.10 m/s
 - c. 26.0 m/s
 - d. 15.0 m/s
 - e. 4.0 m/s

5. An astronaut in a centrifuge is being whirled around in a horizontal circle of radius 5.0 m at constant speed. If the astronaut experiences a centripetal acceleration of $3.0g$ (i.e., 3 times the size of the acceleration in free-fall near Earth's surface), how fast is she moving?
- 5.4 m/s
 - 3.9 m/s
 - 7.0 m/s
 - 15.0 m/s
 - 12.1 m/s
6. In which case below is the motion described by Newton's first law?
- a ball moving in a horizontal circle at constant speed
 - a car slowing down as it approaches a stop light
 - a skydiver falling at constant speed
 - a projectile fired vertically at the instant it reaches the highest point in its motion
 - a child sliding down an icy (frictionless) slope
7. Two boys are trying to break a rope. Each boy can exert a force F on the rope when he pulls on it as hard as possible. They try three different experiments: 1) They each take an end of the rope and pull in opposite directions. 2) They fasten one end of the rope to a wall, and one boy pulls on the free end. 3) They fasten one end of the rope to a wall, and both boys pull on the free end together. Rank these experiments in order of how likely they are to succeed at breaking the rope, with the most likely first.
- 1 and 3 equally likely, then 2
 - 3, 1, 2
 - 3, then 1 and 2 equally likely
 - 1, 3, 2
 - 1, 2, 3
8. A chair of mass m sitting on a rough horizontal surface requires a force F applied in a horizontal direction to cause it to slide at constant speed. If a person of mass M sits in the chair, what horizontal force F' is now required to slide the person and chair at constant speed?
- $F' = (M + m)g$
 - $F' = Mg$
 - $F' = (M/m)F$
 - $F' = [1 + (M/m)]F$
 - None of the above

9. A car traveling along a horizontal road with an initial speed of 35.0 m/s starts to decelerate at a constant rate of $a = -2.50 \text{ m/s}^2$. How far does the car travel from the point where it started to decelerate to the point where it comes to rest?

10. Consider three vectors: $\mathbf{A} = 4.0 \mathbf{i} - 9.0 \mathbf{j} + 6.0 \mathbf{k}$; $\mathbf{B} = -1.0 \mathbf{i} + 2.0 \mathbf{j}$; and \mathbf{C} , which lies in the x - y plane, has a magnitude of $r = 6.0$, and makes an angle of $\theta = 60^\circ$ to the $+x$ axis, measured in the direction of the $+y$ axis (i.e., with plane-polar coordinates (r, θ)). Evaluate the magnitude of the quantity $\mathbf{A} + (\mathbf{B} \times \mathbf{C})$.

- 11.** A ball is shot from the ground into the air. At a height of 9.1 m, its velocity is observed to be $\mathbf{v} = 7.6 \mathbf{i} + 6.1 \mathbf{j}$ in meters per second (\mathbf{i} horizontal, \mathbf{j} upward). (a) To what maximum height above the ground does the ball rise? (b) What total horizontal distance does the ball travel by the time it returns to the ground?

12. In the figure below, two blocks are connected over a pulley. The mass of block A is 10.0 kg and the coefficient of kinetic friction between A and the incline is 0.200 . Angle θ of the incline is 30° . Block A slides down the incline at constant speed. What is the mass of block B ?

