

PHYSICS 1A

Quiz #4B

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Closed book and notes; only these sheets, Scantron, pen/pencil and calculator may be used. This is exam version B. Mark your Scantron Test Form "B" and code your UCSD ID# under ID Number. Write your Name and ID number on the second sheet of this Quiz. Answer Questions 1-6 on the Scantron; answer Problem 7 in the space provided. Organize your work if you want to be considered for partial credit. GOOD LUCK!

Useful Formulae:

$$F_{grav} = mg$$

$$f_s \leq \mu_s N \quad f_k = \mu_k N$$

$$\langle \vec{v} \rangle = \frac{\Delta \vec{x}}{\Delta t} \quad \vec{v} = \frac{d\vec{x}}{dt}$$

$$\langle \vec{a} \rangle = \frac{\Delta \vec{v}}{\Delta t} \quad \vec{a} = \frac{d\vec{v}}{dt} = \frac{d^2 \vec{s}}{dt^2}$$

$$\begin{aligned} x &= x_0 + v_{0x} \cdot t + \frac{1}{2} a_x \cdot t^2 & y &= y_0 + v_{0y} \cdot t + \frac{1}{2} a_y \cdot t^2 \\ v_x &= v_{0x} + a_x t & v_y &= v_{0y} + a_y t \end{aligned}$$

$$g = -9.80 m s^{-2}$$

$$W = \int F_{\parallel} ds$$

$$PE_{grav} = mgh \quad KE = \frac{1}{2}mv^2$$

$$\vec{p} = m\vec{v} \quad net \vec{F} = m\vec{a} = \frac{d\vec{p}}{dt} \quad \Delta \vec{p} = \langle \vec{F} \rangle \cdot \Delta t$$

$$F_{centrip} = \frac{mv^2}{r} \quad a_{centrip} = \frac{v^2}{r}$$

$$\text{Quadratic :} \quad ax^2 + bx + c = 0 \quad \rightarrow \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

1. You are a passenger in a car and not wearing your seat belt. Without increasing or decreasing its speed, the car makes a sharp left turn, and you find yourself colliding with the right-hand door. Which is the correct analysis of the situation?
 - a) Starting at the time of collision, the door exerts a leftward force on you.
 - b) Before and after the collision, there is a rightward force pushing you into the door.
 - c) both of the above
 - d) neither of the above
6. A pebble with mass m falls vertically into a moving railway car with $M \gg m$. The horizontal momentum of the pebble plus railway car after the pebble falls into the car will be
 - a) slightly less than before it fell.
 - b) the same.
 - c) slightly more than before it fell.
2. Two bullets of equal mass, fired at equal velocity, strike stationary identical blocks of wood ($m_{block} \gg m_{bullet}$). Bullet A embeds itself in Block A, while Bullet B is rubber and bounces off of Block B. Which of the following is most correct immediately after the interaction?
 - a) $v_{BlockB} \approx 2v_{BlockA}$.
 - b) $v_{BlockA} \approx v_{BlockB}$.
 - c) $v_{BlockA} \approx 2v_{BlockB}$.
 - d) $v_{BlockA} \gg v_{BlockB}$.
 - e) $v_{BlockB} \gg v_{BlockA}$.
3. You swing a water-filled bucket with mass M in a vertical circle with just exactly the right velocity so that the water does not fall out. When the bucket is right at the top of the circle (radius = R):
 - a) $v = (gR)^2$
 - b) $v = MgR$
 - c) $v = \sqrt{gR}$
 - d) $v = \sqrt{2gR}$
 - e) $v = \sqrt{MgR}$
4. A fastball, pitched with $v = 50m/s$, is hit by the batter so that it leaves with the same speed, but in the opposite direction. The ball, $m = 0.2kg$, is in contact with the bat, $M = 1kg$, for 1 ms. What is the average force on the bat?
 - a) 1000N
 - b) 5000N
 - c) 10,000N
 - d) 20,000N
 - e) 50,000N
5. In a new Olympic event, ice skaters race by firing 100g bullets backward from a rifle, propelling themselves forward by recoil. If bullets are fired with velocity $v = 1 km/s$, how many shots will it take for a 100kg contestant to reach 10 m/s?
 - a) 1
 - b) 10
 - c) 30
 - d) 100
 - e) 300

Name_____

ID # A_____

7) A car with mass 1000 kg rounds a bend with radius of curvature, $R = 50m$ with a speed of 15 m/s . What is the minimum coefficient of static friction between the road & tires for the car to round the curve without slipping.

 $\mu_s =$ _____