PHYSICS 1A

Quiz #4A

H. E. Smith 21 May 2004

Closed book and notes; only these sheets, Scantron, pen/pencil and calculator may be used. This is exam version **A**. *Mark your Scantron Test Form* **"A"** *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:

$$F_{grav} = mg$$

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

$$< \vec{v} >= \frac{\Delta \vec{x}}{\Delta t} \qquad \vec{v} = \frac{d\vec{x}}{dt}$$

$$< \vec{a} >= \frac{\Delta \vec{v}}{\Delta t} \qquad \vec{a} = \frac{d\vec{v}}{dt} = \frac{d^2\vec{s}}{dt^2}$$

$$x = x_0 + v_{0x} \cdot t + \frac{1}{2} a_x \cdot t^2 \qquad y = y_0 + v_{0y} \cdot t + \frac{1}{2} a_y \cdot t^2$$

$$v_x = v_{0x} + a_x t \qquad v_y = v_{0y} + a_y t$$

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

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

$$PE_{grav} = mgh \qquad KE = \frac{1}{2} m v^2$$

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

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

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

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) Before and after the collision, there is a rightward force pushing you into the door.
b) Starting at the time of collision, the door exerts a leftward force on you.
c) both of the above
d) neither of the above

2. Two bullets of equal mass, fired at equal velocity, strike stationary identical blocks of wood ($m_{block} >> m_{bullet}$). 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) $v_{BlockA} \approx 2v_{BlockB}$.
b) $v_{BlockA} \approx v_{BlockB}$.
c) $v_{BlockB} \approx 2v_{BlockA}$.
d) $v_{BlockA} >> v_{BlockB}$.
e) $v_{BlockB} >> v_{BlockA}$.

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) $v = \sqrt{2gR}$
d) $v = \sqrt{gR}$
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

6. A pebble with mass m falls vertically into a moving railway car with $M >> m$. 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.

Name_____ ID # A_____

7) A car with mass 1000 kg rounds a bend with radius of curvature, $R = 50m$ with a speed of $20\,m/s$. What is the minimum coefficient of static friction between the road & tires for the car to round the curve without slipping.

$\mu_s =$ _____