

Classical Physics 171.105  
First Midterm Exam, October 16, 2001

You may use one 8.5x11" sheet of notes and a calculator. All four problems will be weighted equally. Explain your reasoning.

1. A 77 kg man is parachuting and experiencing a downward acceleration of  $2.5\text{m/s}^2$  shortly after opening the parachute. The mass of the parachute is 5.2kg.
  - a) What is the downward force exerted by the person on the parachute?
  - b) What is the upward force exerted on the parachute by the air?
2. A bicyclist travels around a circular track of radius  $r=25\text{m}$  at a constant speed of  $v=9.2\text{m/s}$ . The combined mass of the bicycle and rider is  $m=87\text{kg}$ . Calculate the components of the force exerted by the road on the bicycle and the angle of the total force relative to the vertical.
3. A rocket is fired at an angle  $\theta$  from the horizontal with speed  $v$ . Ignore air resistance in answering the following questions.
  - a) What is the maximum height it will reach and what is the horizontal distance from the launch site at this moment in time? (Do not just quote formula without explanation.)
  - b) At the maximum height the rocket splits instantly into two parts. One part, the capsule, has a mass  $m$  that is three times smaller than that of the other part, the booster. After separation, the velocity of the booster is zero relative to the ground. What is the velocity of the capsule?
4. Block B in the figure below has a mass  $m_B$ . The coefficient of static friction between block B and the table is  $\mu_s$ . The line connected to B is horizontal. What is the maximum mass  $m_A$  of block A for which B will remain at rest?

