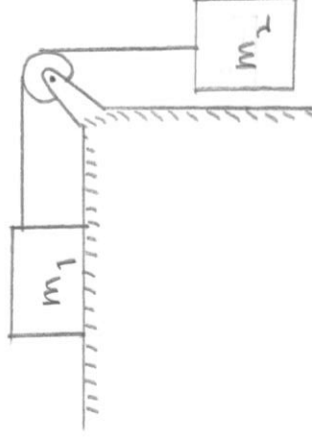


FYSP101 PHYSICS I

EXAMINATION April 3, 2009

Use: $g = 9.8 \text{ m/s}$

1. The blocks $m_1 = 2.0 \text{ kg}$ and $m_2 = 4.0 \text{ kg}$ shown in the figure are attached to each other by a flexible cord that does not stretch and has negligible mass. The pulley has negligible mass, rotates without friction and the cord does not slip on it. Determine the acceleration of the blocks and the tension of the cord, given that the kinetic friction between the block m_1 and the horizontal surface is



- (a) $\mu_k = 0$, (b) $\mu_k = 0.4$.
2. Two identical automobiles enter a curve side-by-side, one travelling on the inside lane, the other on the outside. The curve is an arc of circle, and it is unbanked. Each automobile travels through the curve at the maximum speed tolerated without skidding.

- (a) Which automobile has the higher speed?
- (b) Which automobile emerges from the curve first?

Prove your answer!

3. A horse pulls a barge (cargo boat) in a channel using a horizontal rope attached to the horse and the barge. The taut rope forms an angle 35° relative to the moving horse. If the horse moves with a speed of 5.0 km/h and the tension of the rope is 400 N what is the power, in units of hp, generated by the pulling horse? ($1 \text{ hp} = 0.746 \text{ kW}$)
4. An automobile of mass 1500 kg and a truck of 3500 kg collide at an intersection. Just before the collision the automobile was traveling north at 80 km/h and the truck was traveling east at 50 km/h . After the collision both vehicles remain joined together.
 - (a) What is the velocity (magnitude and direction) of the vehicles immediately after the collision?
 - (b) How much kinetic energy is lost during the collision? Regard the automobile and the truck as a system of two particles.
5. A rocket launched vertically upwards from the Earth's surface reaches the speed 300 m/s at an altitude of 1000 m and then explodes into three pieces of equal mass. After the explosion one of the pieces continues vertically upwards at speed 450 m/s and another one towards the east at speed 240 m/s .
 - (a) Find the speed and direction of the third piece after the explosion.
 - (b) Determine the location of the center of mass of the three pieces 3.0 s after the explosion.