Topics 4-5 Study Guide

I. Things to memorize. The first question on the test will be a blank space where you will be asked to reproduce the following information from memory.

A. Newton's Laws of Motion

• A body at rest remains at rest or, if in motion, remains in motion at constant velocity unless acted on by a net external force.

• The acceleration of a system is directly proportional to and in the same direction as the net external force acting on the system and is inversely proportion to its mass ($\Sigma\vec{F} = m\vec{a}$).

• Whenever one body exerts a force on a second body, the first body experiences a force that is equal in magnitude and opposite in direction to the force that it exerts.

B. Units:

The SI unit of force is the Newton (N) which is equivalent to a $kg \cdot m/s^2$.

C. Rules for Common Forces:

• Gravity. Magnitude: Mg. Direction: straight down.

• Normal Force. Magnitude: problem dependent. Direction: perpendicular to the surface.

• Static Friction. Magnitude: $f_s \leq \mu_s N$. Direction: parallel to the surface, resists motion.

• Kinetic Friction. Magnitude: $f_k = \mu_k N$. Direction: parallel to the surface, resists motion.

• Tension. Magnitude: problem dependent. Direction: parallel to the rope.

• Spring Force. $\vec{F} = -k\vec{x}$.

II. Proofs. Show that the acceleration of a block sliding down a ramp inclined at angle θ is given by $g\sin\theta - \mu_k g\cos\theta$. Do this by first drawing a precise free-body diagram with all forces and components clearly shown and labeled.

III. Problem solving. There will be 1 or 2 questions directly from the HW and 1 or 2 original questions.