**PHYSICS 1**

**MIDTERM EXAMINATION**

**60 mins**

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All paper documents are allowed. Laptops and communication devices is not allowed

1. A frictionless plane is 10.0 m long and inclined at 35.0o. A sled starts at the bottom with an initial speed of 5.00 m/s up the incline. When the sled reaches the point at which it momentarily stops, a second sled is released from the top of the incline with an initial speed vi. Both sled reach the bottom of the incline at the same moment.

a. Determine the distance that the first sled traveled up the incline.

b. Determine the initial speed of the second sled.

2. A ball on the end of a string is whirled around in a horizontal circle of radius 0.300m. The plane of the circle is 1.20m above the ground. The string breaks and the ball lands 2.00m (horizontally) away from the point on the ground directly beneath the ball’s location when the string breaks. Find the radial acceleration of the ball during its circular motion.

3. Two blocks connected by a rope of negligible mass being dragged by a horizontal force. Suppose F=68.0N, m1=12kg, m2=18.0kg, and the coefficient of kinetic friction between each block and the surface is 0.100.

a. Draw a free-body diagram for each block.

b. Determine the acceleration of the system and the tension T in the rope.

4. A 0.400-kg object is swung in a vertical circular path on a string 0.500m long. If the angular is 4.00m/s at the top of the circle, what is the tension in the string there?

SOLUTION

1. First, consider the free-body diagram given at the right of either sled on the frictionless slope of inclination θ = 35.0o. The acceleration of the sled will be directed down the incline (chosen as the +x direction) and has the magnitude of

a. If the first sled start up the incline with speed vOx=-5.00m/s at the bottom, the distance it travels up the incline before stopping is

b. After stopping momentarily (vOx=0), the time for the first sled to go 2.22m back down the incline is given by as

In this same time, the second sled (with vOx=+vi and ax=g sin θ) must travel the full length of the incline (Δx=10.0m). The required initial speed is given by as

2. The time of fall can be found using

The horizontal velocity can be found using

The radial acceleration can be found using

3. For the entire system: N = (m1 + m2)g = 30g =294N

The total friction force is: (0.100)(294) = 29.4N

The net force on the system is (68 - 29.4) = 38.6N

The acceleration of the system is 38.6/(12.0 + 18.0) = 1.29 m/s2

T – Fk1 = ma = (12.0)(1.29) = 15.44N

T = 15.44 + µmg = 15.44 + 11.76 = 27.2N

4. At the top of the vertical circle,