1. [1pt]
This is a tough one! \( M_1 \) and \( M_2 \) are two masses connected as shown. The pulley is light and frictionless. Find the mass \( M_1 \), given that \( M_2 \) (5.50kg) accelerates downwards at \( 2.95\text{m/s}^2 \), that the angle \( \theta \) is \( 25.0^\circ \), and that \( \mu_k \) is 0.280.

\[ \text{Answer:} \ 

![Diagram](image)

2. [1pt]
A steel ball of mass 1.27 kg is attached to a thin (massless) cable and whirled around in a circle in a vertical plane. The circle has a radius of 1.40 m. When it is at the bottom of the circle, the ball has a speed of 11.7m/s. Calculate the magnitude of the tension in the cable when the mass is at the bottom of the circle.

\[ \text{Answer:} \ 

A block of mass \( M \) slides down a plane at an angle of 37 degrees to the horizontal. The coefficient of kinetic friction = 0.20. The horizontal lines in the picture represent magnitude of forces, in units of the force of gravity on the block. The arrows show directions for forces. DATA: \( \sin(37^\circ)=0.60 \)
\[ \cos(37^\circ) = 0.80, \tan(37^\circ) = 0.75. \]

3. [1pt]
Enter the two-letter combination for the Normal force on the block. [The two-letters for the force of gravity on the block are FJ. Enter F first, (magnitude) and J second, (direction).]

**Answer:**

Submit All Answers

4. [1pt]
Enter the 2-letter combination for the frictional force on the block.

**Answer:**

Submit All Answers

5. [1pt]
Enter two 2-letter combinations, for the component of the force of gravity on the block (1) along the incline and (2) perpendicular to the incline. Format the answer with no spaces and a comma. Example: BE,SN

**Answer:**

Submit All Answers

6. [1pt]
Enter the 2-letter combination for the total force on the block.
7. [1pt]
An engineer must design a curved exit ramp for a highway in such a way that a car, exiting at the posted speed limit of 11.18 m/s (25 mi/hr), does not depend on friction to round the curve without skidding. The radius of the curve is 198.0 m. At what angle with respect to the horizontal must the curve be banked? Use "deg" for units.

Answer: 

8. [1pt]
A block with mass m = 19.2 kg slides down an inclined plane of slope angle 35.3° with a constant velocity. It is then projected up the same plane with an initial speed 4.65 m/s. While the mass is heading up the incline, what is the magnitude of its acceleration?

Answer: 

9. [1pt]
A mass M is initially at rest on a horizontal surface, μ_s=0.30 and μ_k=0.20. A horizontal string then pulls M with a tension T. Forces below are magnitudes. (Give ALL correct answers, i.e., B, CD, ADF,...)

A) N equals Mg
B) M will accelerate if T exceed μ_s N
C) M will accelerate if T exceeds μ_k N
D) If M does not accelerate, then T less than or equal μ_s N
E) T equals μ_s N if M remains at rest
F) The NET force on M (if M does not move) is T

Answer: 

10. [1pt]
The Wall of Death in an amusement park is comprised of a vertical cylinder that can spin around the vertical axis. Riders stand against the wall of the spinning cylinder and the floor falls away leaving the riders held up by friction. The radius of the cylinder is 4.3 m and the coefficient of static friction between the rider and the wall is 0.30. Find the tangential velocity of the spinning wall necessary so that the riders do not slip down the wall.
11. [1pt]
In the figure to the right, M2 has more mass than M1 and M1 has more mass than M3. The questions refer to the magnitudes of tensions and weights. There is friction between the horizontal plane and M2 (\mu_k \neq 0). M2 is observed to travel at a constant speed. Assume that the pulleys are frictionless and have negligible mass. Select the appropriate symbol for each statement: T (True), F (False), G (Greater than), L (Less than), or E (Equal to). (If the first two are 'greater than,' and the last four 'less than,' then enter GGLLLL).

A) M1 accelerates downwards.
B) T2 is ... T1.
C) M3 g is ... T4.
D) T2 is ... T3.
E) T1 is ... M1 g.
F) The magnitude of the net force on M2 is T2 - T3.

Answer: 

12. [1pt]
Two vectors are given by \( a = 2 \hat{i} - 10 \hat{j} \) and \( b = -10 \hat{i} + 20 \hat{j} \). Find \( a \cdot b \).

Answer: 

13. [1pt]
Referring to the previous problem, what is the angle between \( a \) and \( b \)? Enter units of degrees as "deg".