# National University

## of Computer & Emerging Sciences

## Applied Physics (NS-1001)

## Fall 2023

## Assignment # 3

## Submission Deadline: 17th October, 2023

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**Dear students! You have to submit the soft copy (pdf form) of the assignment on Google Class Room. You'll have an assignment based quiz in week 9 in your respective classes according to your timetable on campus.**

**Q.1:** The gravitational force exerted on a baseball is 2.21 N down. A pitcher throws the ball horizontally with velocity 18.0 m/s by uniformly accelerating it along a straight horizontal line for a time interval of 170 ms. The ball starts from rest.

(a) Through what distance does it move before its release?

(b) What are the magnitude and direction of the force the pitcher exerts on the ball?

**Q.2:** A brick of mass M has been placed on a rubber cushion of mass m. Together they are sliding to the right at constant velocity on an ice-covered parking lot.

(a) Draw a free-body diagram of the brick and identify each force acting on it.

(b) Draw a free-body diagram of the cushion and identify each force acting on it.

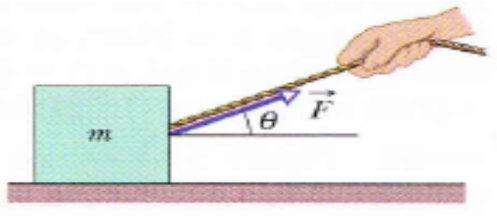
(c) Identify all of the action–reaction pairs of forces in the brick–cushion–planet system.

**Q.3:** In Fig. a block of mass 5.00 kg is pulled along a horizontal frictionless floor by a force of magnitude F = 12.0 N at an angle $\theta = 25.0^{o}$

(a) What is the magnitude of the block's acceleration?

(b) The force magnitude F is slowly increased. What is its value just before the block is lifted (completely) off the floor?

(c) What is the magnitude of the block's acceleration just before it is lifted (completely) off the floor?



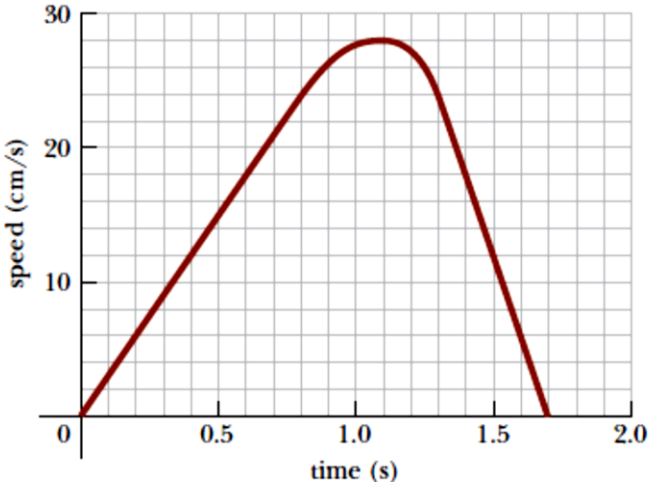

**Q.4:** A block slides down a frictionless plane having an inclination of θ =15.0°. The block starts from rest at the top, and the length of the incline is 2.00 m.

(a) Draw a free-body diagram of the block.

(b) Find the acceleration of the block and

(c) Its speed when it reaches the bottom of the inclined.

**Q.5:** Figure shows the speed of a person's body as he does a chin-up. Assume the motion is vertical and the mass of the person's body is 64.0 kg. Determine the force exerted by the chin-up bar on his body at (a) t = 0, (b) t = 0.5 s, (c) t =1.1 s, and (d) t = 1.6 s.

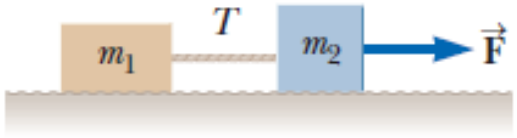



**Q.6:** To determine the coefficients of friction between rubber and various surfaces, a student uses a rubber eraser and an incline. In one experiment, the eraser begins to slip down the incline when the angle of inclination is 36.0° and then move down the incline with constant speed when the angle is reduced to 30.0°. From these data, determine the coefficients of static and kinetic friction for this experiment.

**Q.7:** Two blocks connected by a rope of negligible mass are being dragged by a horizontal force. Suppose $\vec{F}$ = 568.0 N, $m_1$ = 12.0 kg, $m_2$ = 18.0 kg, 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 (c) the tension T in the rope.



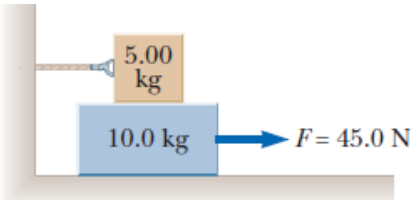

**Q.8:** A circular curve of highway is designed for traffic moving at 60 km/h. Assume the traffic consists of cars without negative lift.

(a) If the radius of the curve is 150 m, what is the correct angle of banking of the road? (b) If the curve were not banked, what would be the minimum coefficient of friction between tires and road that would keep traffic from skidding out of the turn when traveling at 60 km/h?

**Q.9:** A 5.00-kg block is placed on top of a 10.0-kg block. A horizontal force of 45.0 N is applied to the 10-kg block, and the 5.00-kg block is tied to the wall. The coefficient of kinetic friction between all moving surfaces is 0.200.

(a) Draw a free-body diagram for each block and identify the action–reaction forces between the blocks.

(b) Determine the tension in the string and the magnitude of the acceleration of the 10 kg block.




**Q.10:** *Why is the following situation impossible?* A book sits on an inclined plane on the surface of the Earth. The angle of the plane with the horizontal is 60.0°. The coefficient of kinetic friction between the book and the plane is 0.300. At time t = 0, the book is released from rest. The book then slides through a distance of 1.00 m, measured along the plane, in a time interval of 0.483 s.