Seminar 2: Lectures 3-4

Print and answer all questions found below.
Please bring your completed worksheet to the Seminar Class.

Question 1

Suppose two children push horizontally, but in exactly opposite directions, on a third child in a wagon. The first child exerts a force of 75.0 N, the second a force of 90.0 N. Please take into account that friction is 12.0 N, and the mass of the third child plus wagon is 23.0 kg.

(a) What is the system of interest if the acceleration of the child in the wagon is to be calculated?
(b) Draw a free-body diagram, including all forces acting on the system.
(c) Calculate the acceleration.
(d) What would the acceleration be if friction were 15.0 N?

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

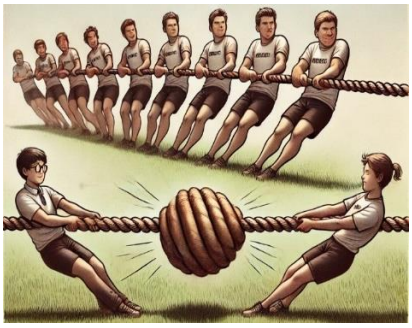
Seminar 2: Lectures 3-4

Question 2

Two teams of nine members each engage in a tug of war. Each of the first team's members has an average mass of 68 kg and exerts an average force of 1350 N horizontally. Each of the second team's members has an average mass of 73 kg and exerts an average force of 1365 N horizontally.

(a) What is magnitude of the acceleration of the two teams?

(b) What is the tension in the section of rope between the teams?



……

……

……

……

……

Question 3

A nurse pushes a cart by exerting a force on the handle at a downward angle 35.0º below the horizontal. The loaded cart has a mass of 28.0 kg, and the force of friction is 60.0 N.

(a) Draw a free-body diagram for the system of interest.

(b) What force must the nurse exert to move at a constant velocity?

……

……

……

……

……

……

……

Seminar 2: Lectures 3-4

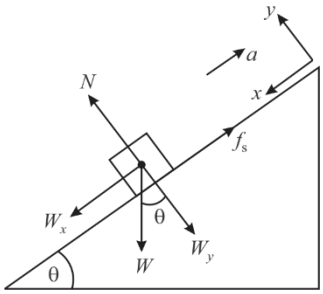
Question 4

Calculate the maximum acceleration of a car that is heading up a 4º slope under the following road conditions. Assume that only half the weight of the car is supported by the two drive wheels and that the coefficient of static friction is involved—that is, the tires are not allowed to slip during the acceleration (ignore rolling.)

(a) On dry concrete, ($\mu_s = 0.7$).

(b) On wet concrete, ($\mu_s = 0.4$).

(c) On ice, ($\mu_s = 0.1$).



.....

.....

.....

.....

.....

.....

Question 5

An electron leaves one end of a TV picture tube with zero initial speed and travels in a straight line to the accelerating grid, which is 1.80 cm away. It reaches the grid with a speed of $2.60 \times 10^6\ m/s$. If the accelerating force is constant, calculate:

(a) the acceleration of the electron,

(b) the time it takes the electron to reach the grid, and

(c) the net force that is accelerating the electron, in Newtons (you can ignore the gravitational force on the electron).

.....

.....

.....

.....

.....

.....

.....

.....

Seminar 2: Lectures 3-4

Question 6

You push your physics book 1.50 m along a horizontal tabletop with a horizontal push of 2.40 N while the opposing force of friction is 0.60 N. How much work does each of the following forces do on the book?

(a) your 2.40 N push,

(b) the friction force,

(c) the normal force from the table, and

(d) gravity?

(e) What is the net work done on the book?

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 7

A bullet is fired into a large stationary absorber and comes to rest. Temperature measurements of the absorber show that the bullet lost 1960 J of kinetic energy, and high-speed photos of the bullet show that it was moving at $400\ m/s$ as it struck the absorber. What is the mass of the bullet?

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Seminar 2: Lectures 3-4

Question 8

A roller coaster train of mass $3 \times 10^3\ kg$ travels at $8.34\ m/s$ as it enters a railway station. Once in the station, brakes are applied to the train to slow it down to $1.0\ m/s$ in $5.44\ m$.

(a) Calculate the braking force slowing the train?

(b) How much time did it take to slow the train down?

(c) What was the acceleration of the train in g's?

.....

.....

.....

.....

.....

.....

.....

.....

Extension Questions

Question 9

(a) What is the acceleration of two falling sky divers of combined mass 123 kg (including parachute), when the upward force of air resistance is equal to one-fourth of their weight?

(b) After popping open the parachute, the divers descend leisurely to the ground at constant speed. What now is the force of air resistance on the sky divers and their parachute?

.....

.....

.....

.....

.....

.....

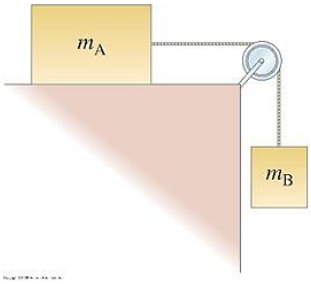
Seminar 2: Lectures 3-4

Question 10

(a) If m_A = 13.0 kg and m_B = 5.0 kg, are shown in the figure below, determine the acceleration of each block.

(b) If initially m_A is at rest 1.25 m from the edge of the table, how long does it take to reach the edge of the table if the system is allowed to move freely?

(c) If m_B = 1.0 kg, how large must m_A be if the acceleration of the system is to be kept at 0.01 g?



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

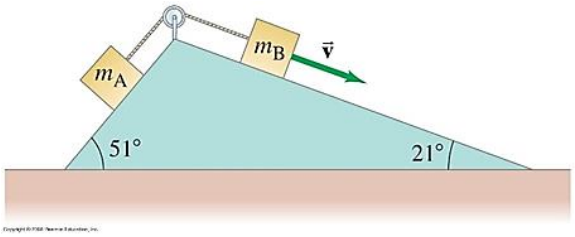
.....

\

Seminar 2: Lectures 3-4

Question 11

Two masses m_A = 2.0 kg and m_B = 5.0 kg are on inclines and are connected together by a string. The coefficient of kinetic friction (μ_k) between each mass and its incline, μ_k = 0.30. At a given moment, m_A moves up, and m_B moves down, determine their acceleration.



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....