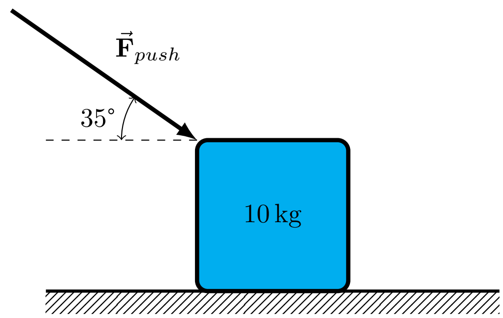
1 Objectives

Below are all the learning objectives summarized from the WebWorK or Video HW problems for Exam 2. These are in general what I will use to write the test problems. Clearly I can't include them all on a test, though some are simple enough that they could be merged into another problem.

- ☐ I can compute the gravitational force between two masses separated by some distance.
- ☐ I can use the electrostatic force to predict future motion in three dimensions.
- ☐ I can use conservation of momentum to approach problems in which external forces are negligible.
- ☐ I can use microscopic properties to make predictions about macroscopic behavior.
- ☐ I can use the Young's modulus of a material to predict the amount of deformation on object comprised of said material might experience from outside forces.
- ☐ I can utilize normal and frictional forces to analyze the motion of an object, and vice versa.
- ☐ I can use the analytic expression describing simple harmonic motion to make conclusions about the motion of an oscillating object.
- ☐ I can analyze static systems of forces to identify unknown forces or parameters in single mass systems.
- ☐ I can solve for one or more unknown values in a static, multi-mass configuration by utilizing free-body diagrams from several different system perspectives.
- ☐ I can relate pressure to force and compute one given the other.
- ☐ I can analyze multi-mass systems undergoing a change in momentum magnitude to determine unknown forces or values.
- ☐ I can utilize the buoyant force expression to relate pressure forces and displaces volumes of liquid or gas.
- ☐ I can break forces into parallel and perpendicular components to analyze motion.
- ☐ I can relate the required net force for circular motion to perpendicular forces in a problem.
- ☐ I can solve for unknown forces or parameters in problems in which an object is turning but no force points directly in the direction of $\frac{d\hat{\mathbf{p}}}{dt}$.

2 Extra Problems

1. A box is being pushed along the ground at a constant speed, as shown in the image below.



Which of the following are true?

A. $F_g > F_N$

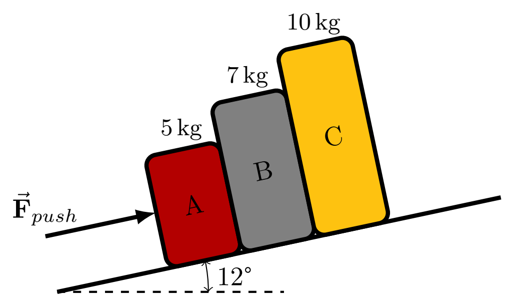
B. $F_{push} < F_{fric}$

C. $F_N > F_g$

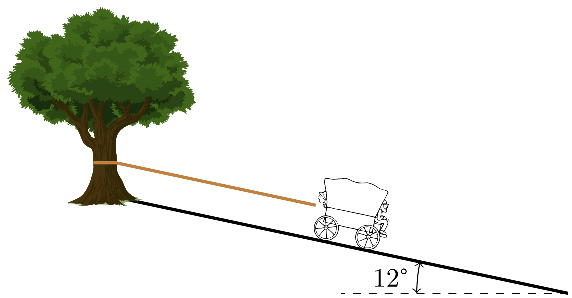
D. $F_{push} = F_N$

E. $F_N = F_g$

2. The blocks below are being pushed up the frictionless slope at a constant speed. What is the magnitude of the force of block A on block B?



3. Covered wagons on the Oregon Trail commonly used ropes around trees when descending steep slopes to limit their speed. If the wagon has a mass of 500 kg and wants to accelerate down the hill at only $2\,\mathrm{m/s^2}$, what must the tension in the rope be? You can assume that the wheels make things essentially frictionless.



4. The moon Io is observed to orbit Jupiter every 42 hours. If you know that Jupiter has a mass of 1.898×10^{27} kg and approximate the orbit as purely circular, how far is Io from the center of Jupiter?

3 Solutions

As before, I'm just including the final values here as a check. If you are struggling to replicate them, check with me and we can figure out where you are going wrong.

1. Only $F_N > F_g$
2. 34.6 N
3. 18.76 N
4. 4.185×10^5 km