

PH 221 Week 4

Benjamin Bauml

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This material is borrowed/adapted from PH 201 Tutorial 4 for Fall 2020.

R4-1: Crate, Brick, Box, and Car FBDs

For the following exercises, draw the situation and identify and name all the forces acting on the object. Then, using the particle model, draw a free-body diagram for the object. Include the direction of the net force \vec{F}_{net} . Neglect air resistance.

- (a) A heavy crate is being lowered straight down at a constant speed by a steel cable.
- (b) A brick is falling from the roof a three-story building.
- (c) A girl is pushing a box across a rough horizontal floor at a steadily increasing speed.
- (d) You've slammed on your car brakes while going down a hill. The car is skidding to a stop.

R4-2: Free Fall from FBD

Using Newton's 2nd law, show that if air resistance is negligible the acceleration of a freely falling object equals the acceleration due to gravity. [Hint: see your free-body diagram from Activity 1(b).]

R4-3: Suitcase Pull

Using a handle at the end of a 15 kg suitcase, a boy is pulling it to the right across a rough horizontal floor with a force of 55 N at an angle of 25° above the horizontal. The force of kinetic friction between the suitcase and the floor is 75 N. Neglect air resistance and assume that the suitcase doesn't leave the floor.

- (a) Draw a sketch showing the suitcase and the boy.
- (b) Identify the forces acting on the suitcase. For each force state whether it is a contact force or a long-range force.
- (c) Draw a free-body diagram for the suitcase. Use the particle model.