# Module 05

# Newton's Third Law

## QUESTIONS

**Question 1 (LV1)**: On a frictionless horizontal surface, you push with force $\vec{F}$ on a book of mass $m$. Identify the forces acting on the book and the interactions with the agent responsible for the interaction, and explain how the forces acting on you and the book are related.

**Question 2 (LV2)**: A 50-kg skateboarder stands next to a wall on a frictionless skateboard and pushes the wall with a force of 40 N. Find the skateboarder's acceleration.

**Question 3 (LV3)**: A wooden board of mass $m_b = 2.0$ kg is being pulled by an ideal rope along a smooth and horizontal surface. The force of tension exerted by the rope on the board is horizontal and its magnitude is $F = 30$ N. On top of the board sits a plate of mass $m_p = 0.5$ kg that remains at rest with respect to the wooden board. Calculate the acceleration of the plate.

**Question 4 (LV4)**: A small, low mass pulley has a light string over it connected to two masses, $m_1 = 10$ kg and $m_2 = 20$ kg. If the system (see Fig. 1) is released from rest, what is the acceleration of the two masses.

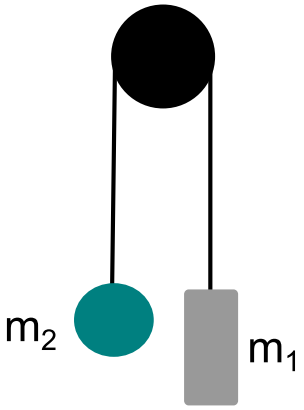


FIG. 1: Two masses on a pulley

## PROBLEMS

**Problem 1 (LV2)**: Two ice skaters push against each other with a constant force for half of a second. As they lose contact with each other, the speed of the skater on the left is 30% larger than the speed of the skater on the right. If the mass of the skater on the left is $m_l = 60.0$ kg find $m_r$, the mass of the skater on the right.

**Problem 2 (LV3)**: A 2-kg box is placed against the vertical front of a 20-kg cart as shown in Fig. 2. The coefficient of static friction between the block and the cart is 0.3. (a) Draw free body diagrams for the cart and the block. (b) What acceleration must the cart have so that the block does not fall?

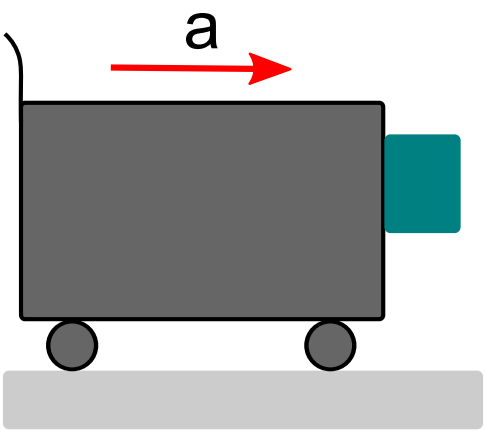


FIG. 2: Box attached to cart