Regents Physics

Newton's 3rd Law

APlusPhysics

Objectives

- Explain the meaning of Newton's 3rd Law of Motion
- Recognize and identify force pairs
- Utilize Newton's 3rd Law to solve dynamics problems.

Newton's 3rd Law of Motion

All forces come in pairs. If Object 1 exerts a force on Object 2, then Object 2 must exert a force back on Object 1 which is equal in magnitude and opposite in direction

$$F_{1on2} = -F_{2on1}$$

also known as "Law of action and reaction"

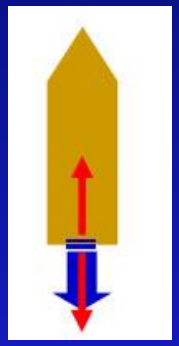
Examples

- How does a cat run forward?
- If you want to swim forward, which way do you push the water?
- How do you jump in the air?

Action-Reaction Pairs

- Girl kicking soccer ball

- Rocket ship in space



The rocket propels hot expanding gas particles.
So the gas particles in turn push the rocket forward.

- Gravity on you

Sample Problem 1

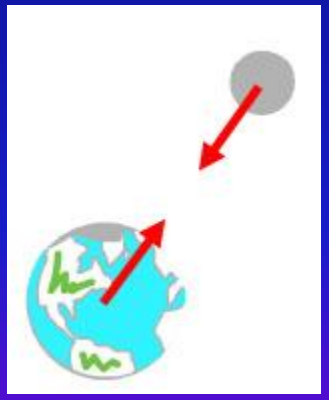
Earth's mass is approximately 81 times the mass of the Moon. If Earth exerts a gravitational force of magnitude F on the moon, the magnitude of the gravitational force of the Moon on Earth is

(1) F

(2) $F/81$

(3) $9F$

(4) $81F$



Sample Problem 2

A 400-newton girl standing on a dock exerts a force of 100 newtons on a 10,000-newton sailboat as she pushes it away from the dock. How much force does the sailboat exert on the girl?

Sample Problem 3

A carpenter hits a nail with a hammer.

Compared to the magnitude of the force the hammer exerts on the nail, the magnitude of the force the nail exerts on the hammer during contact is

(1) Less

(2) Greater

(3) The same