IMPORTANT TERMS:

- **Action force**
- **Interaction**
- **Newton's third law**
- **Reaction force**

EQUATIONS:

$$a = \frac{F}{m}$$

$$F = ma$$

UNIT I: MECHANICS
Chapter 7: Newton's Third Law (Action and Reaction)

I. Forces and Interactions (7.1)

A. Force is part of a _____ action– an **interaction**

1. Acts between one thing and another

2. Each exert a _____ on the other object

B. Always a _____ of forces– led Newton to his third law (law of _____and _____)

II. Newton's Third Law (7.2)

A. Third law states:

Whenever one object exerts a _____on a second object, the second object exerts an _____ and _____ force on the first object

1. One force called _____ **force** and the other is called the _____ **force**

a. It doesn't matter which we call action or reaction force

b. They are "partners" in single interaction

c. Neither force exist without the other

d. They are _____ in strength and _____ **in direction**

("To every action there is always an equal opposing reaction")

B. Without the action force there cannot be reaction force

1. Thus **no** resulting _____

2. Forces include **contact** and **long-range forces**

III. Identifying Action and Reaction (7.3)

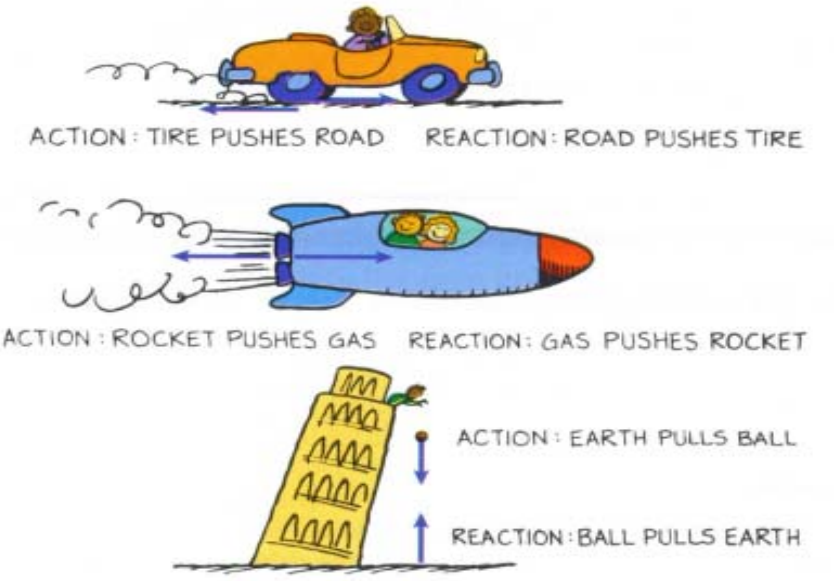
A. Identifying action and reaction pair

1. Can be difficult to identify sometimes

a. Start by identifying the _____
(e.g. Object A interacts with object B)

1). Action: Object A-

2). Reaction: Object B-



IV. Action and Reaction on Different Masses (7.4)

A. Interaction between falling boulder and the Earth

1. Forces are **equal in** _____ **and**

opposite in _____

a. Boulder falls to Earth

b. Earth falls to boulder

2. **Forces** between Earth and boulder are _____,

but _____ **not**

a. **Newton's second** law states that
_____ is not only

proportional to _____, but

also **inversely proportional to** _____.

b. Earth's **large** mass– infinitesimally **small**
_____

B. Cannon example

1. Interaction between cannon and cannon ball is exactly equal in magnitude and opposite in direction

2. Must consider **Newton's Second law**

a. Cannonball

b. Cannon

V. Defining Systems (7.5)

A. If action and reaction forces **are** _____ **to a system**, they_____ each other and produce **no** _____**of the system**

B. Action and reaction forces **do not cancel** each other when **either is** _____ **to the system** being considered.

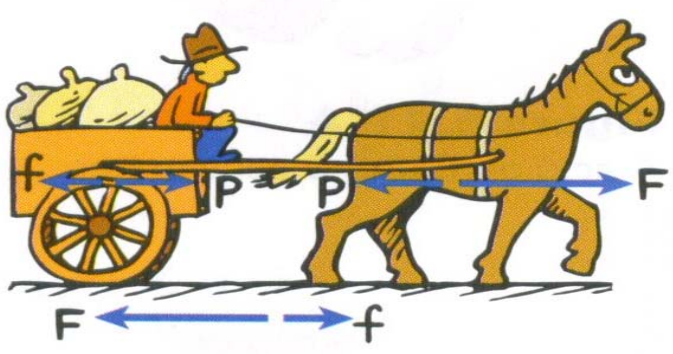
VI. The Horse-Cart Problem (7.6)

A. Can look at from three points of view

1. Cart system (net force exerted on cart divided by mass of cart = acceleration

2. Horse system (horse moves forward by interaction with the ground– horse pushes backwards on the ground and the ground pushes forward on the horse

3. Horse-cart system (when consider only internal forces , forces that act and react within the system, they cancel. There must be interaction with ground to produce acceleration)



B. Stalled car example– you cannot move car forward by sitting in car and pushing on the dashboard. Must interact with the ground-make ground push car.

VII. Action Equals Reaction (7.7)– for every interaction between things, there is always a pair of oppositely directed forces that are equal in strength.