

February 20, Week 6

Today: Chapter 4, Newton's Laws

Exam #1 is in mailboxes

Homework Assignment #5 - Due March 1.

Mastering Physics: 10 problems from chapters 4 and 5.

Written Questions: 5.74

Jonathan not here Thursday.

Review

First Law - The Law of Inertia

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$$w = Mg$$

Second Law Examples

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An object already in motion will not move in the direction of the net force. It will **accelerate** in the direction of the net force.

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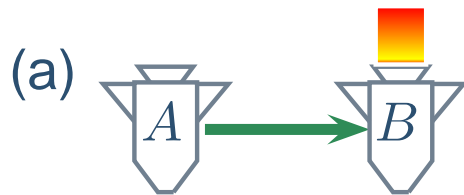
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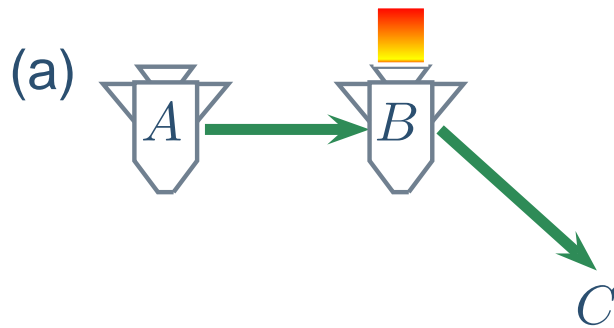
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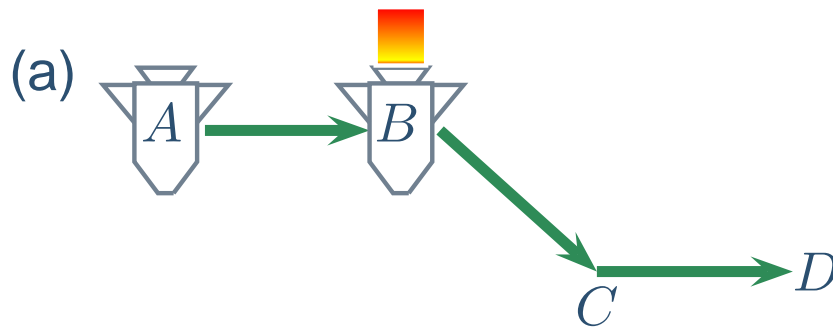
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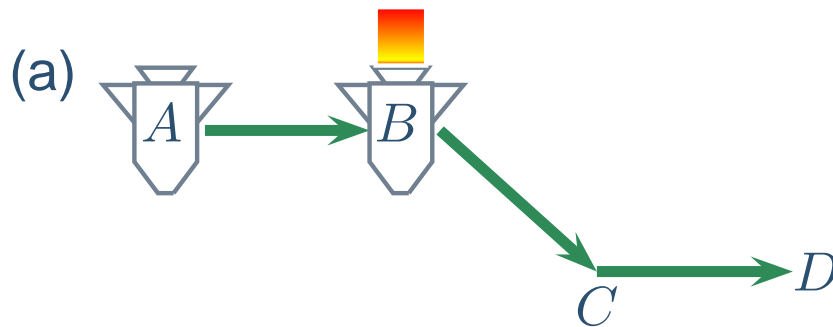
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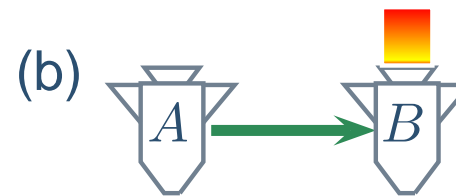
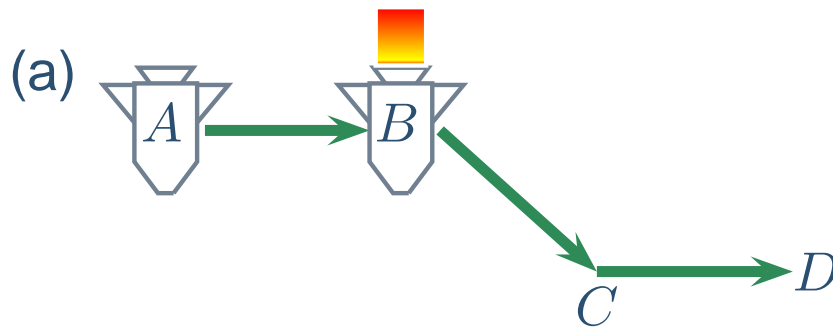
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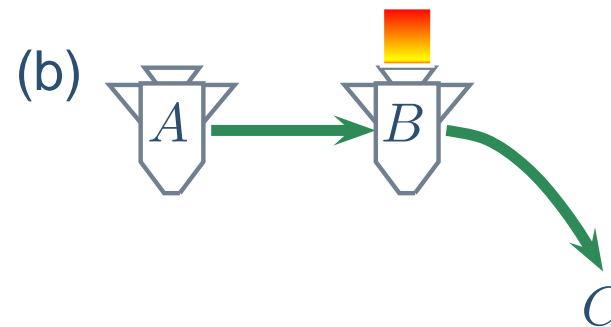
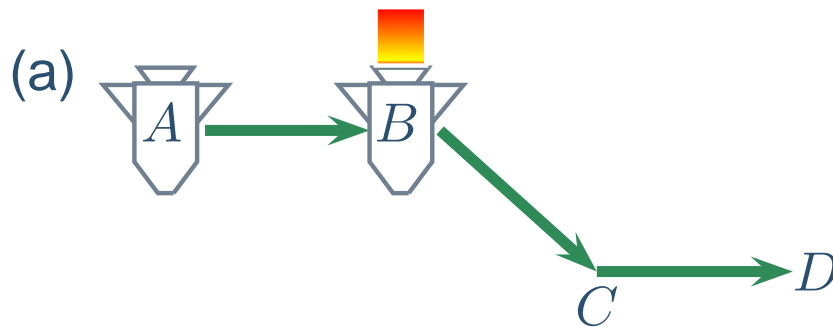
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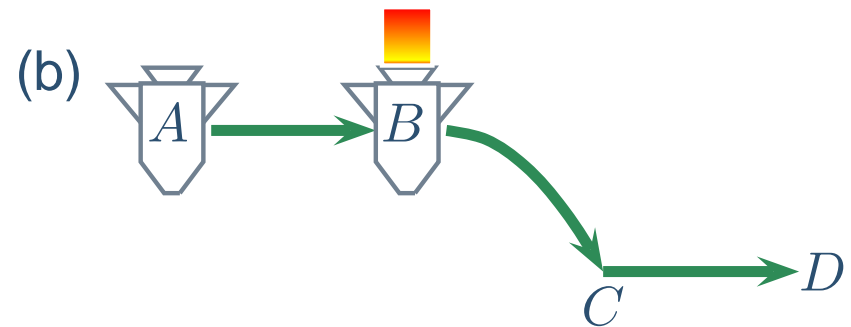
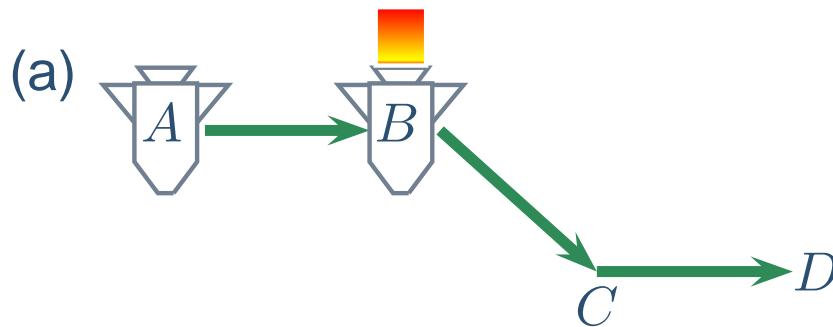
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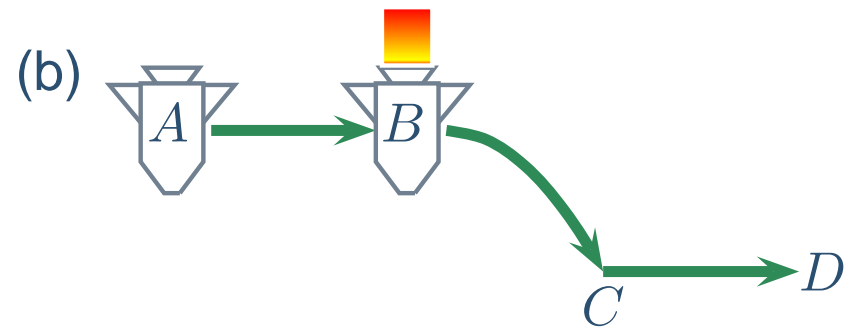
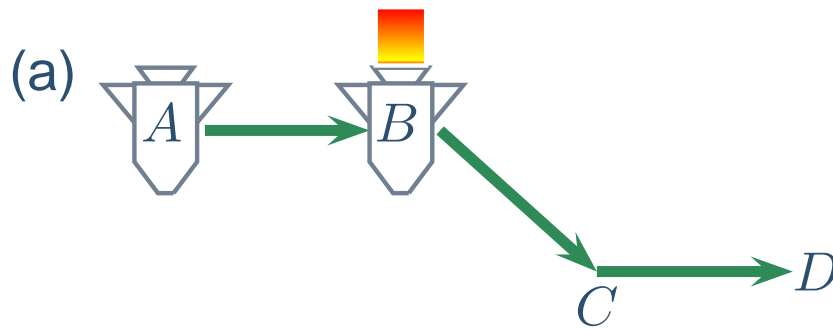
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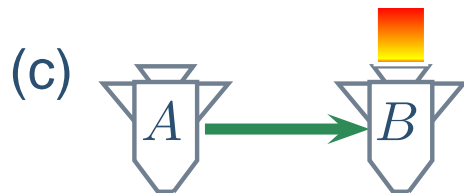
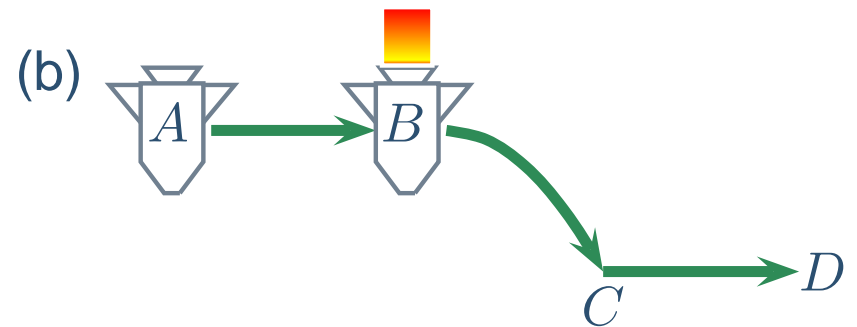
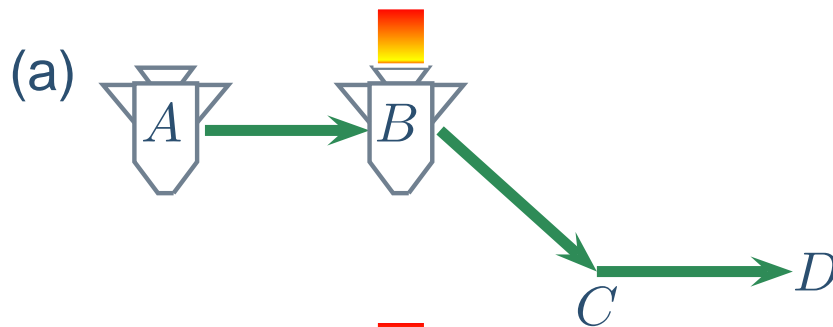
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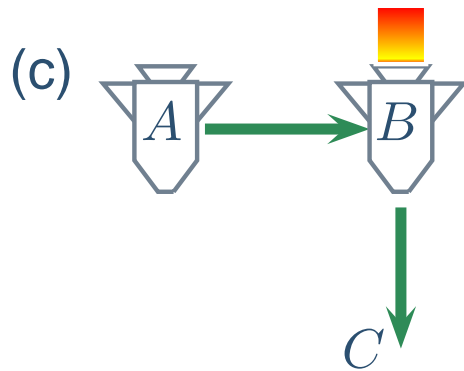
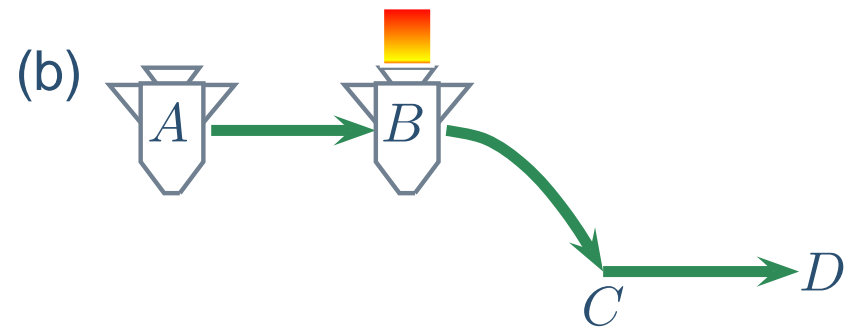
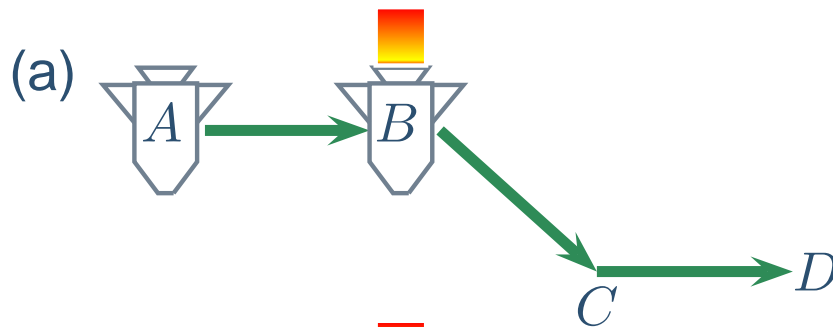
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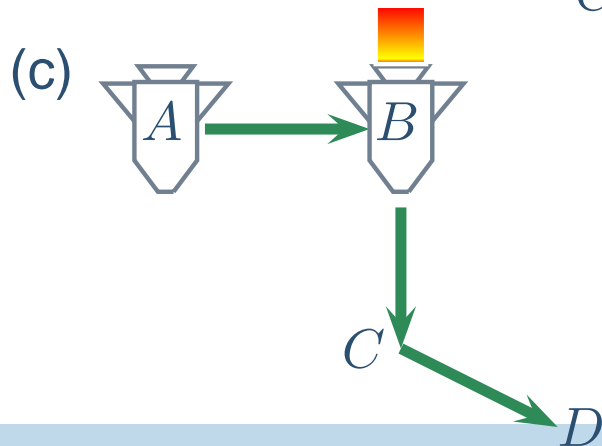
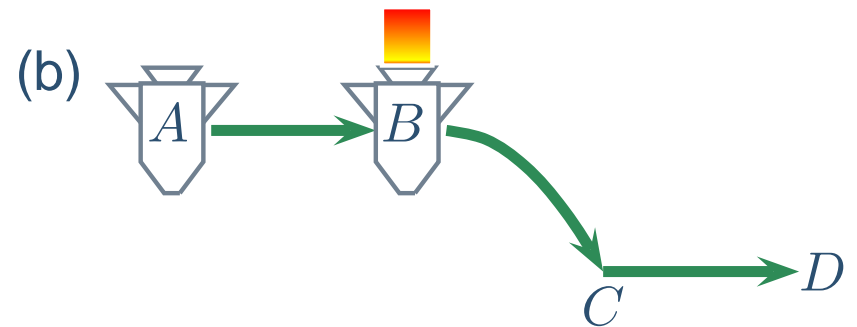
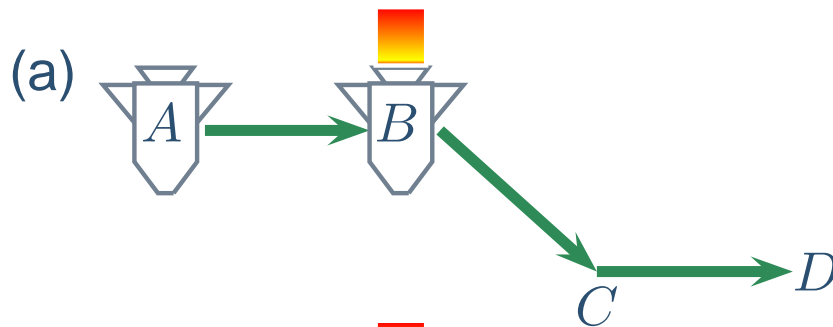
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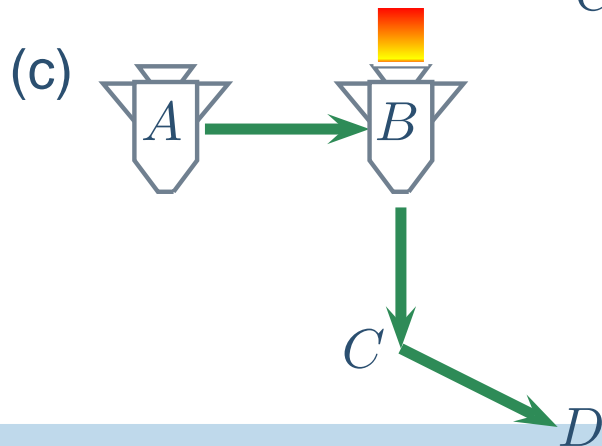
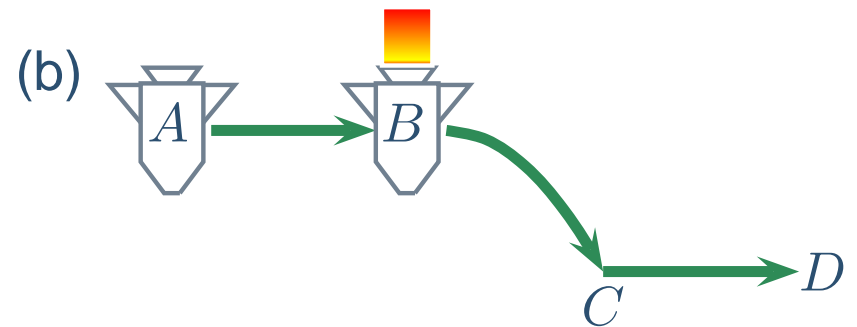
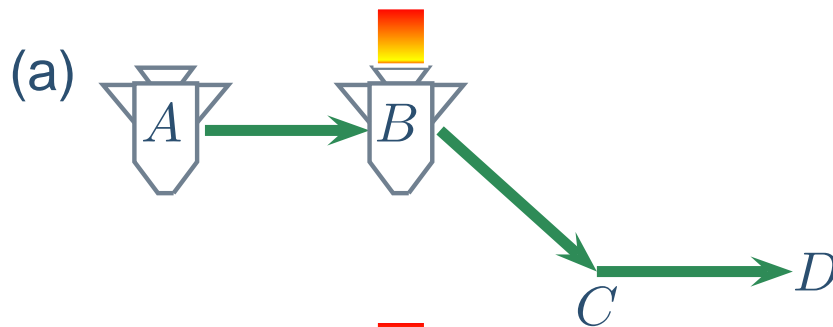
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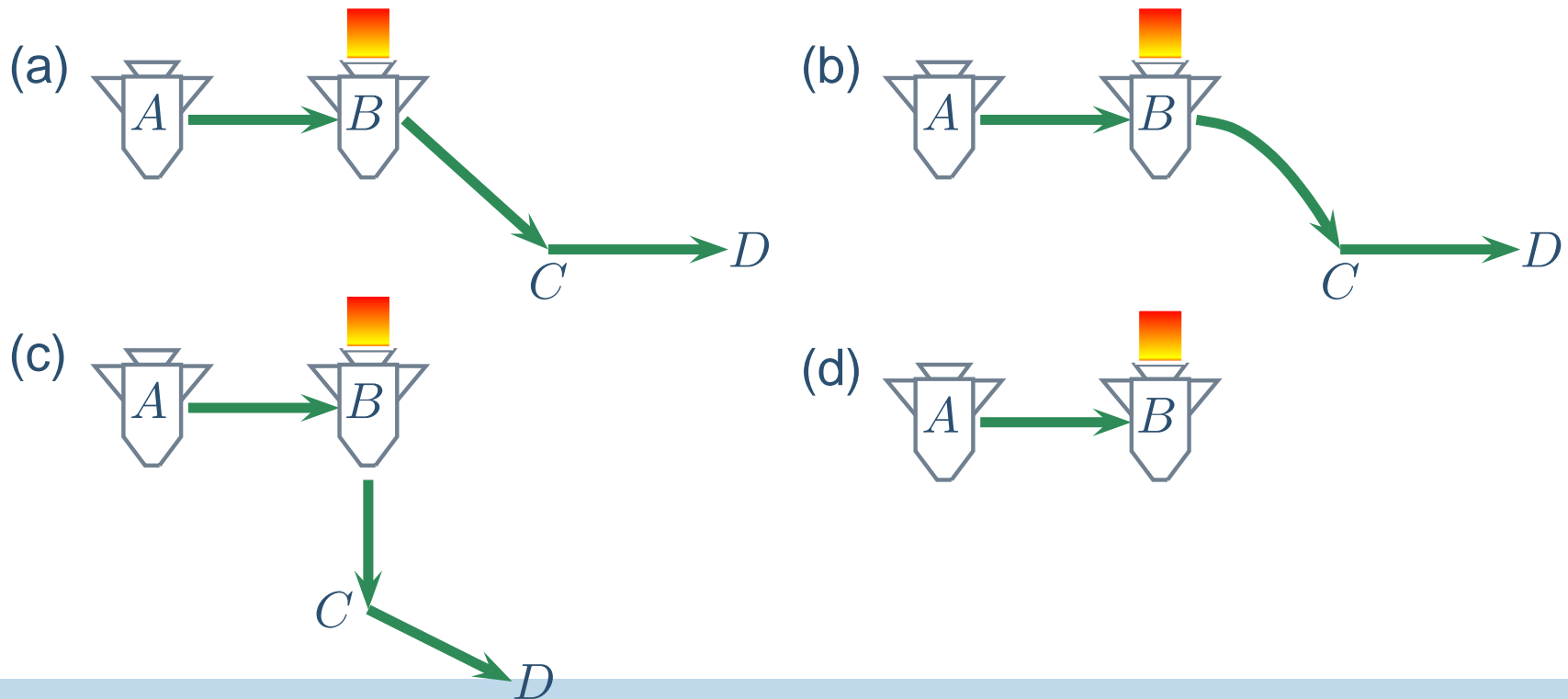
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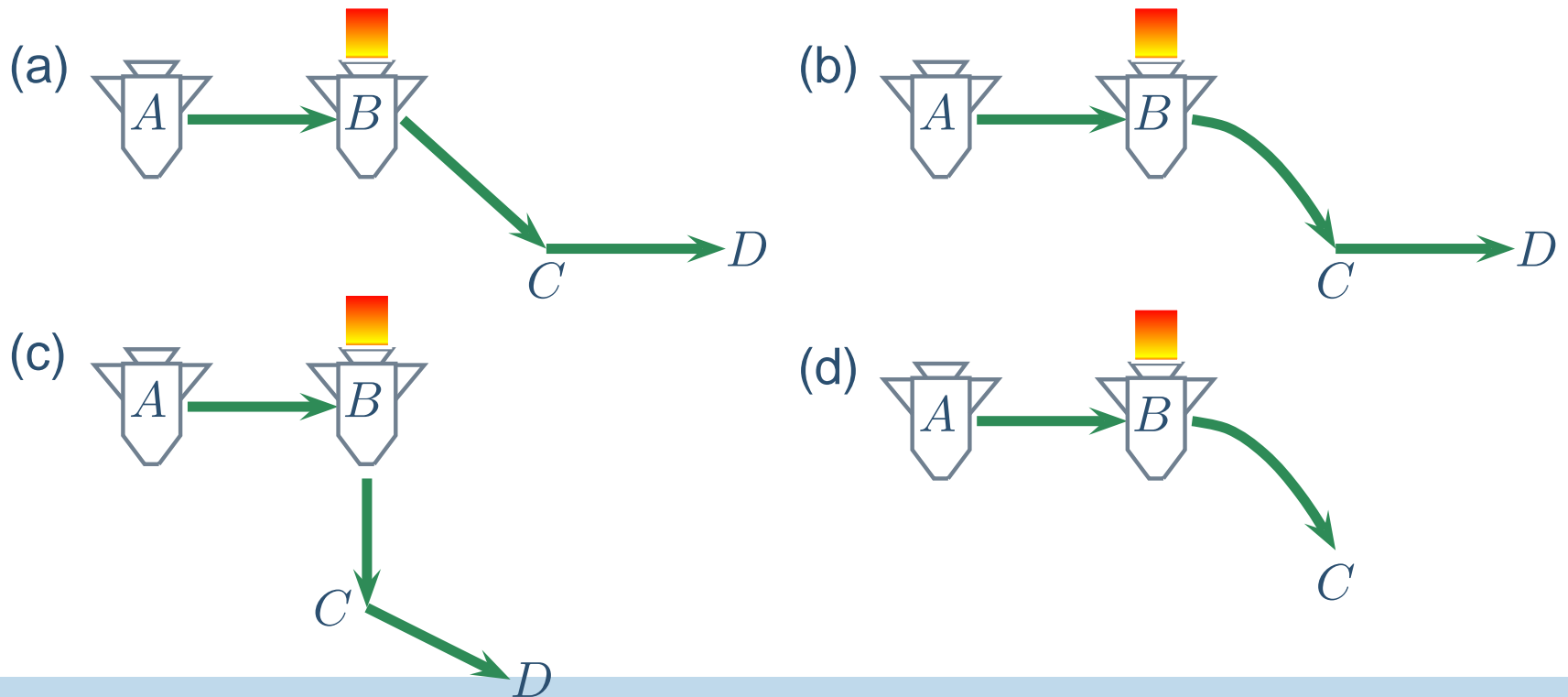
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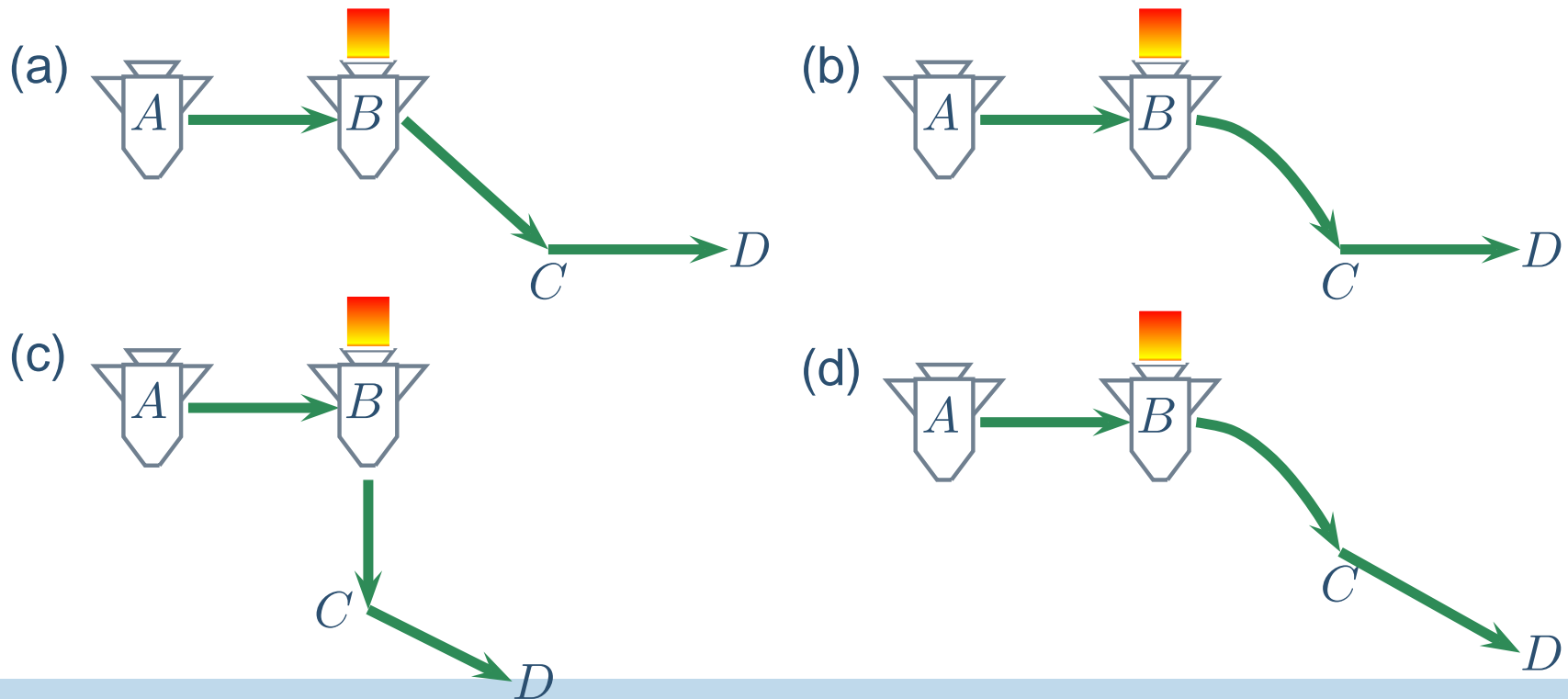
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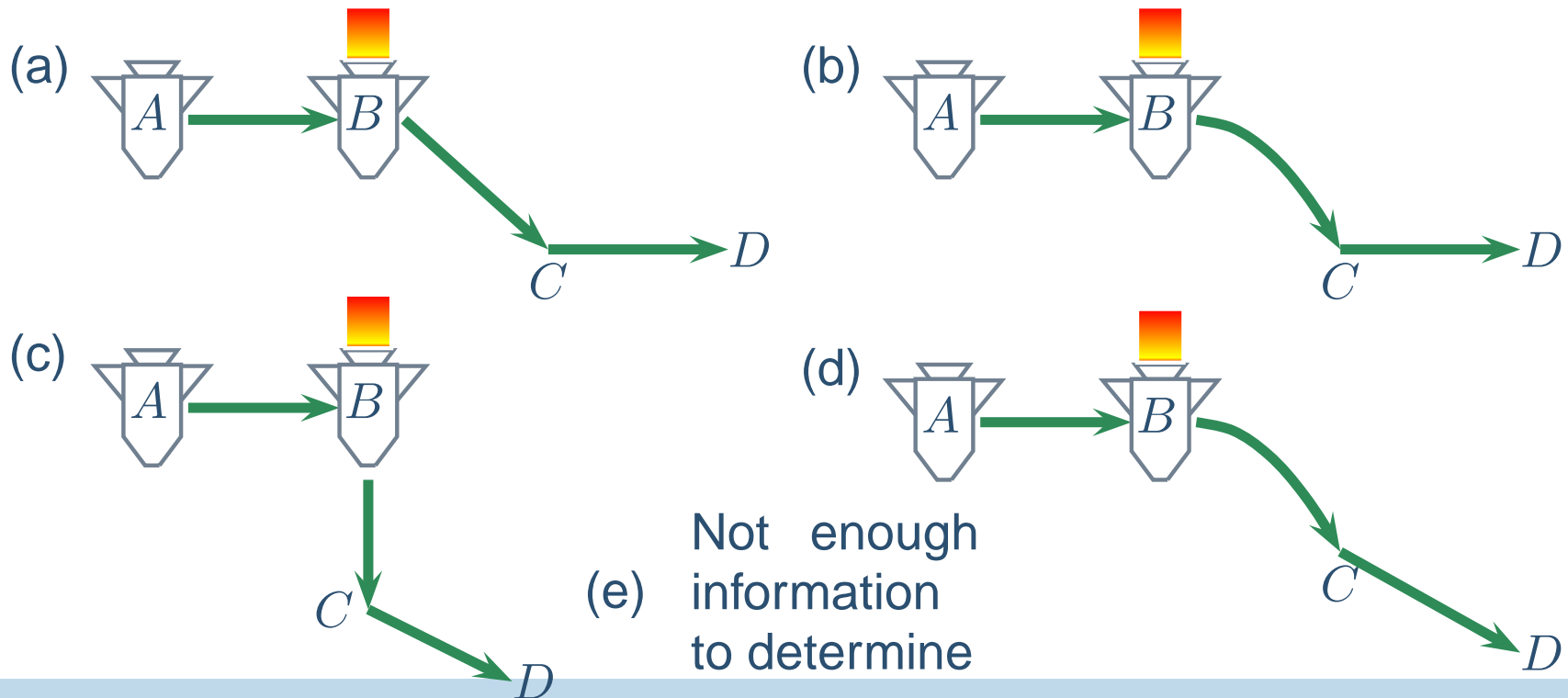
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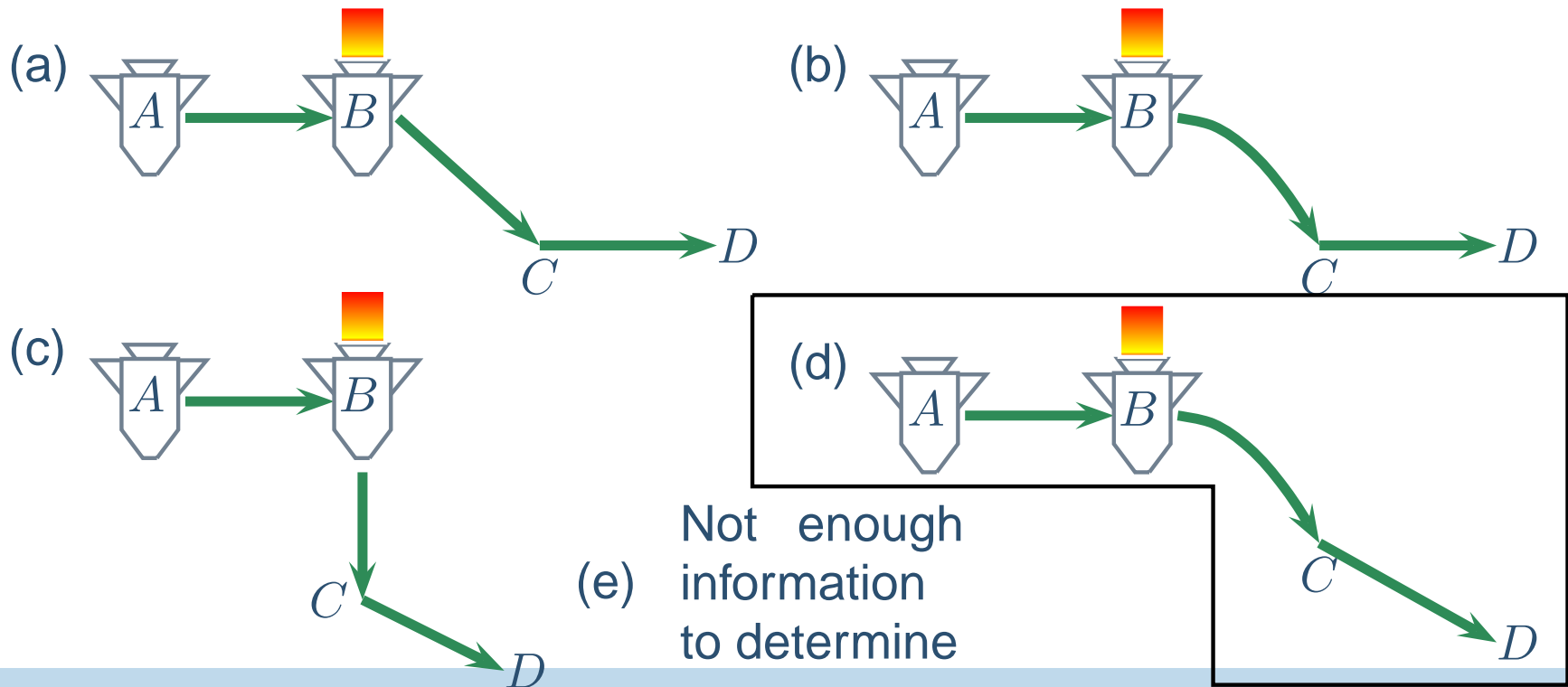
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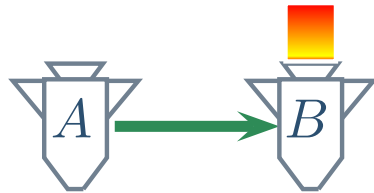
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From A to B rocket goes on straight line since no force \Rightarrow uniform motion

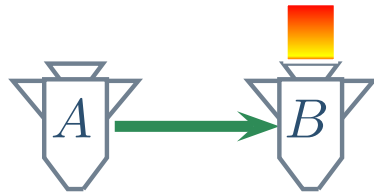


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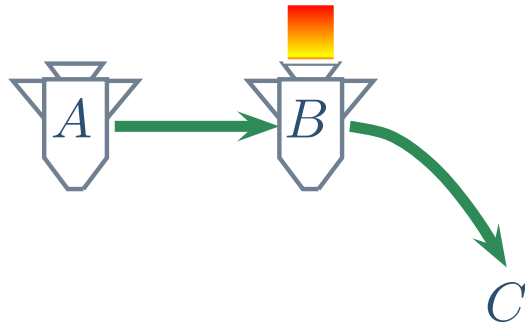
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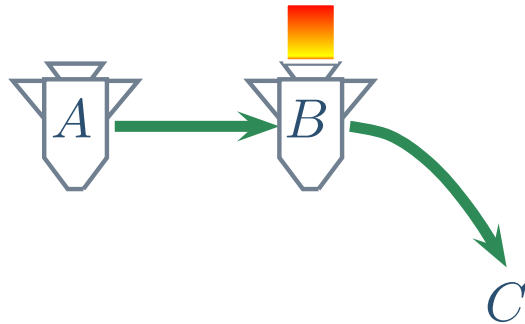
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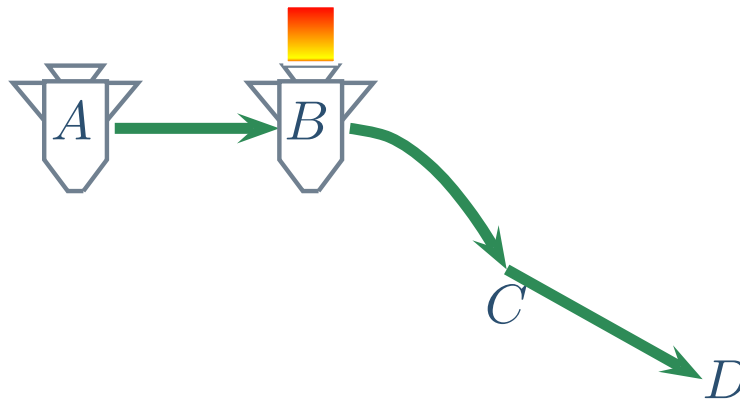


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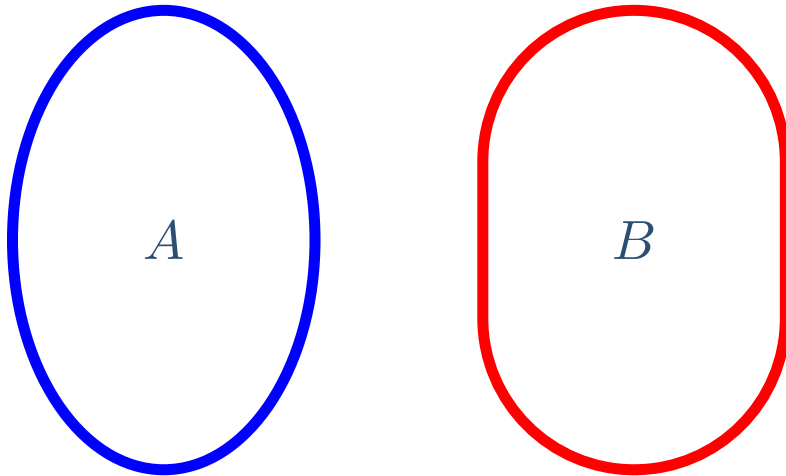
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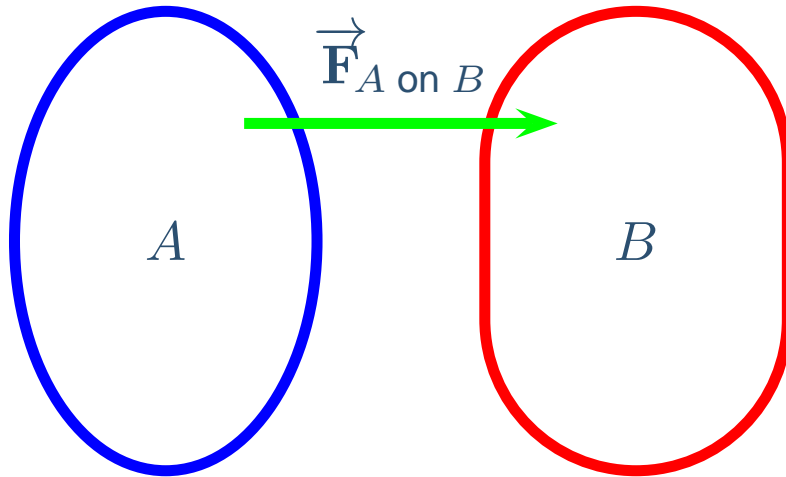
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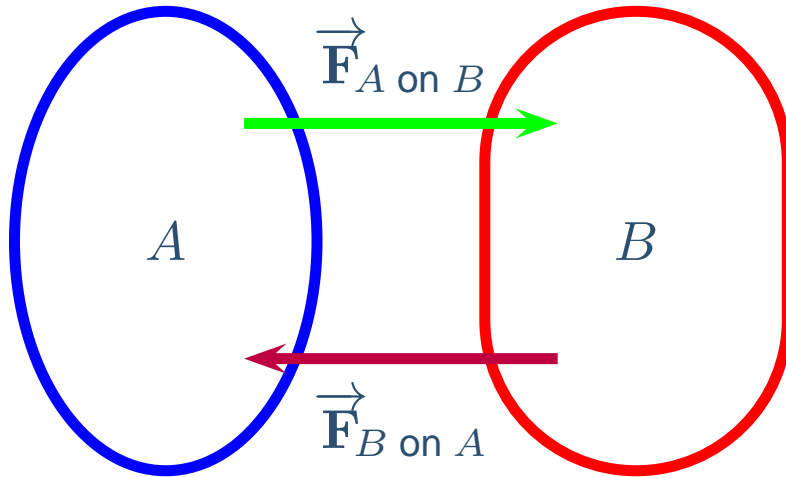
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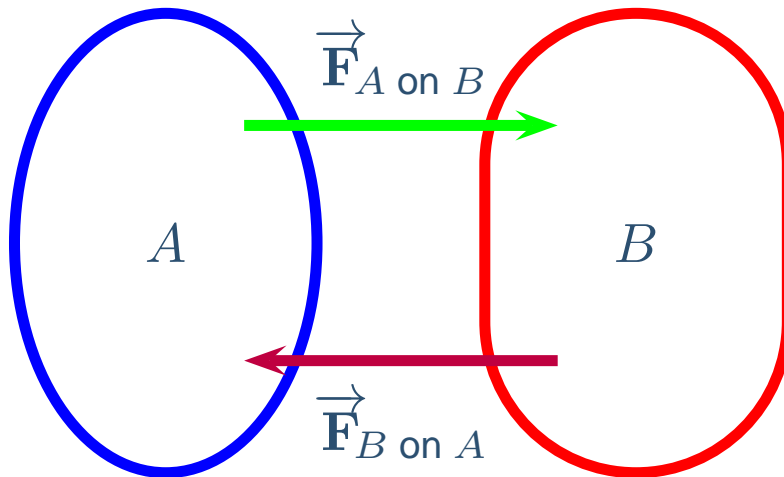


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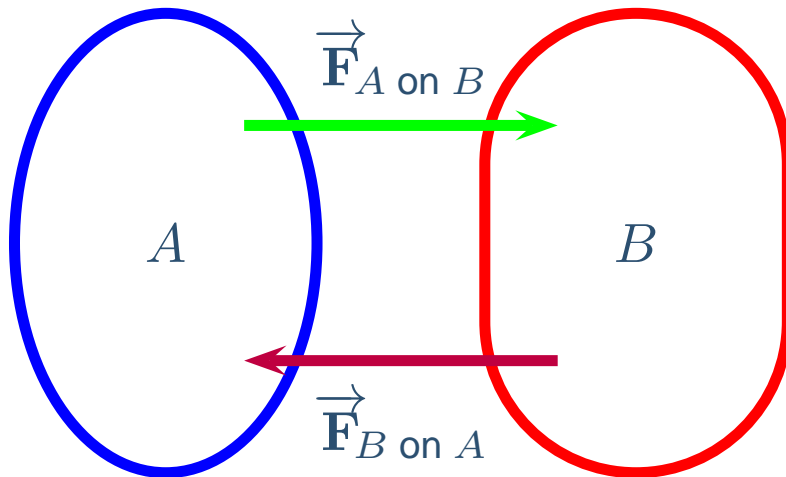
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Action and Reaction are applied to different objects!

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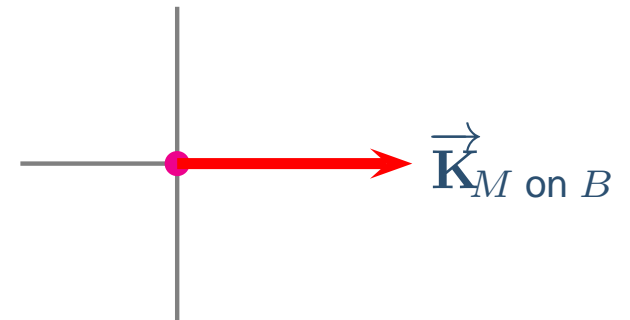
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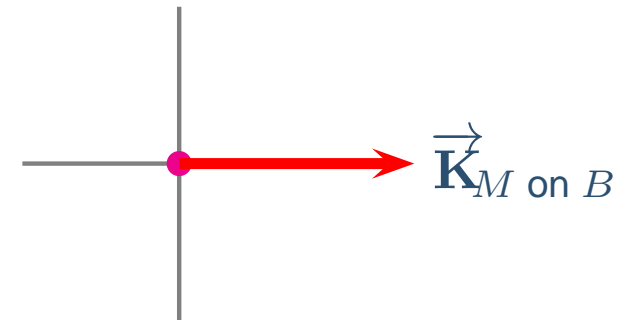


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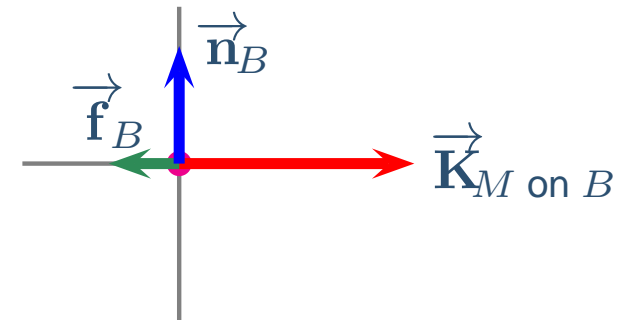


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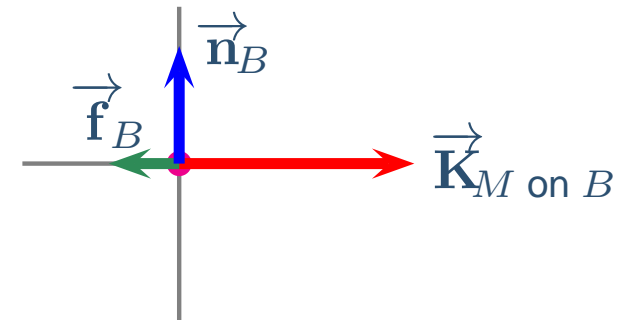
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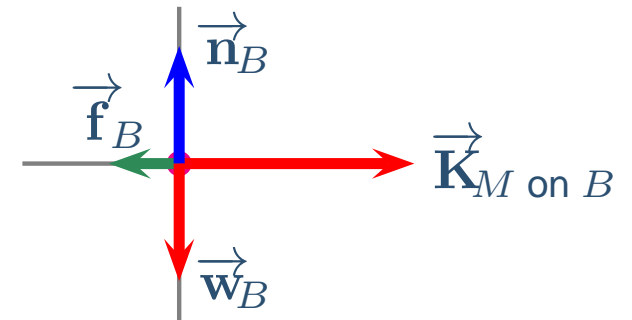
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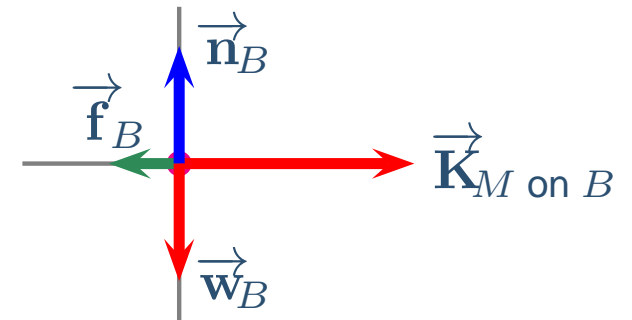
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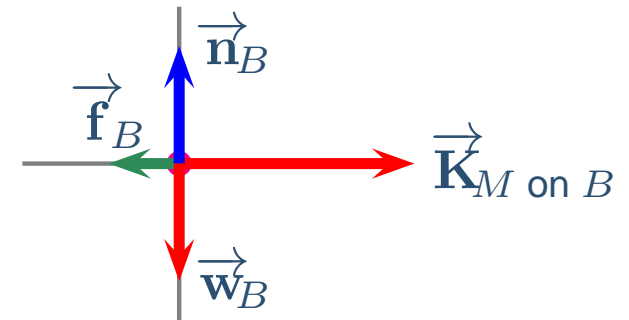
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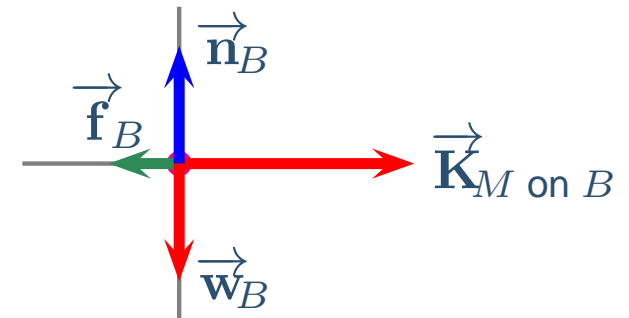
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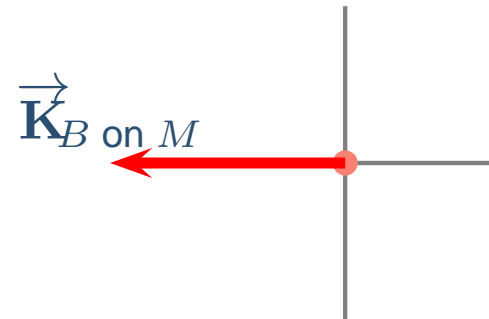
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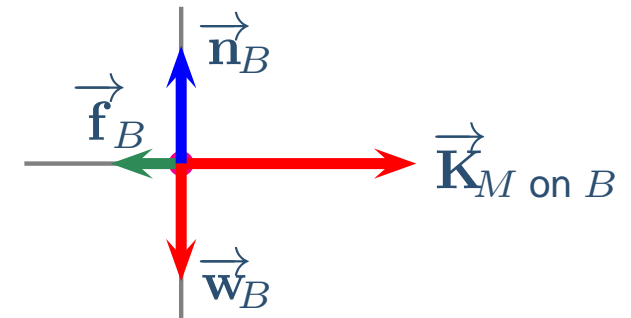
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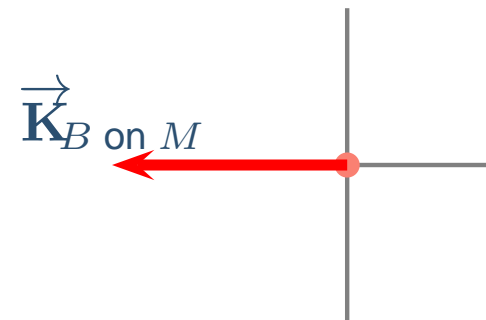
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Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M



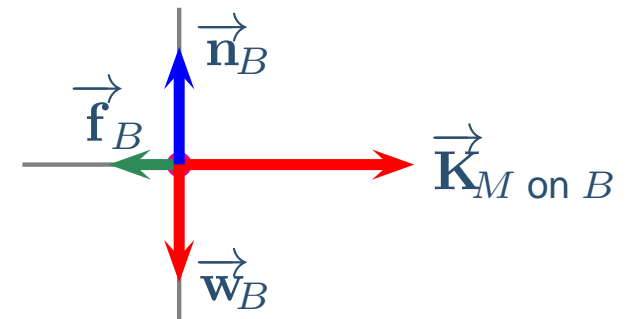
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

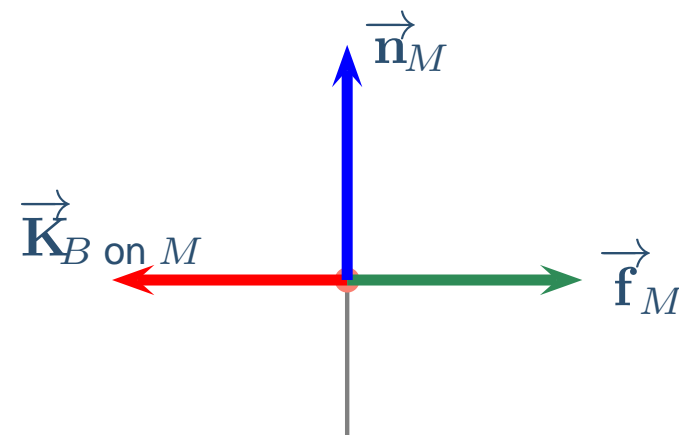
Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

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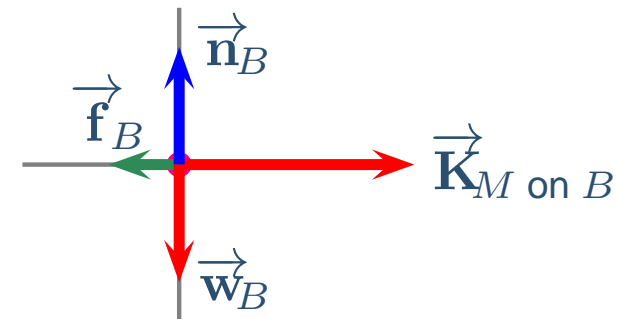
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

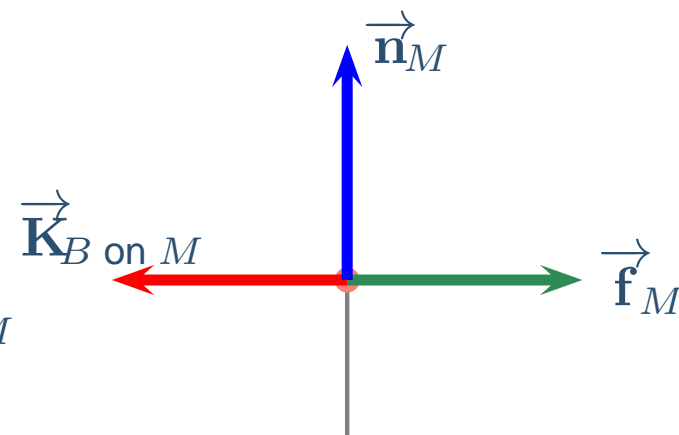
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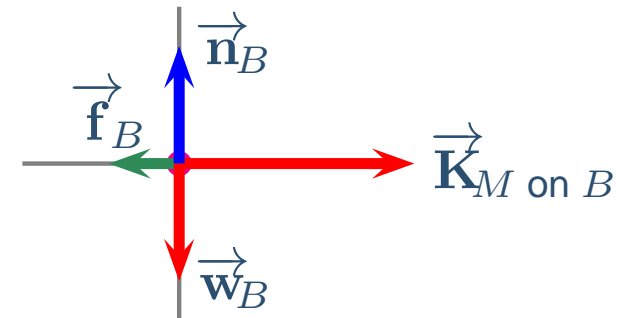
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

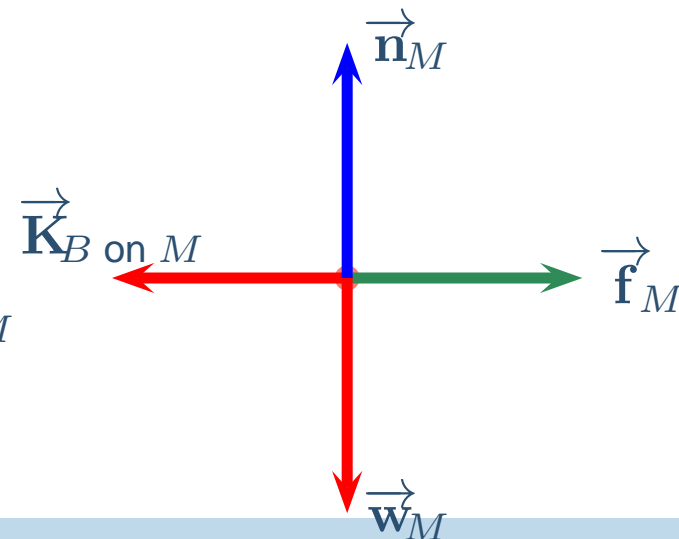
Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M

Long-Range Force on Messi: Weight \vec{w}_M



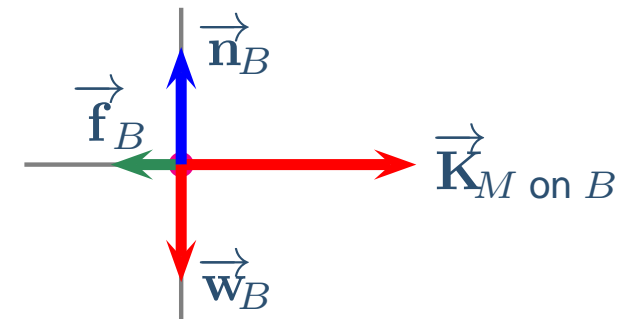
Third Law Followup



Forces on Ball from Messi: Kick $\vec{K}_{M \text{ on } B}$

Forces on Ball from ground: Normal \vec{n}_B , static friction \vec{f}_B

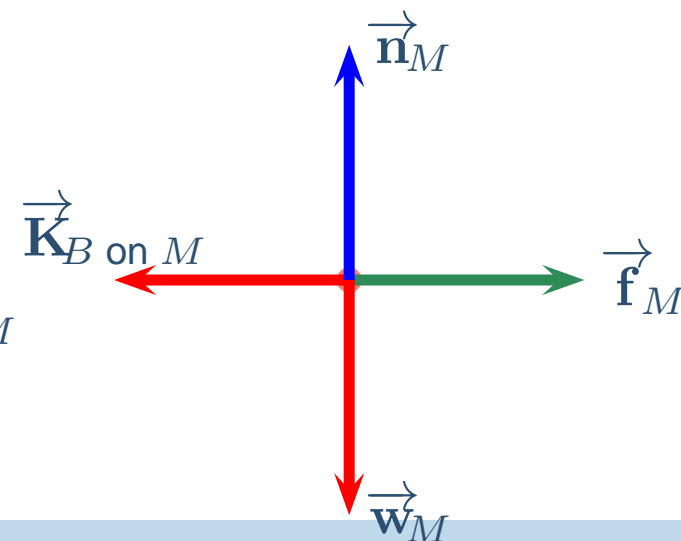
Long-Range Force on Ball: Weight \vec{w}_B



Forces on Messi from Ball: Kick $\vec{K}_{B \text{ on } M}$

Forces on Messi from ground: Normal \vec{n}_M , static friction \vec{f}_M

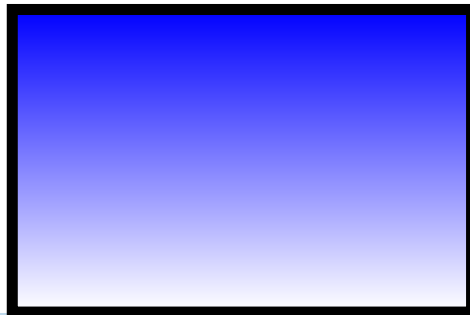
Long-Range Force on Messi: Weight \vec{w}_M



End Result: Ball moves, Messi does not

Third Law Exercise

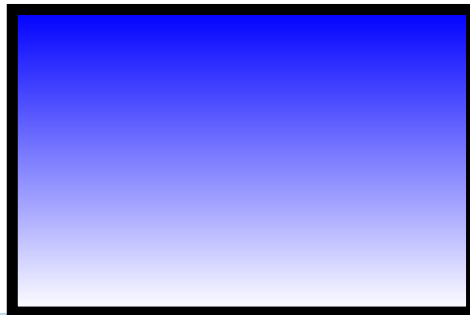
A 200- N crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:



Third Law Exercise

A $200\text{-}N$ crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:

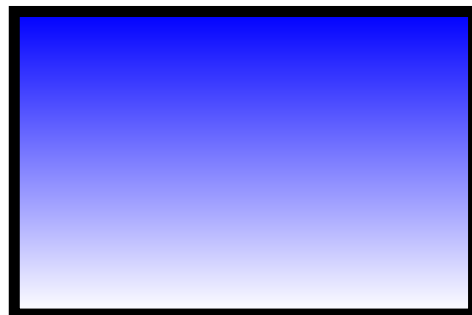
- (a) The $200\text{ }N$ upwards normal force on the crate



Third Law Exercise

A $200\text{-}N$ crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:

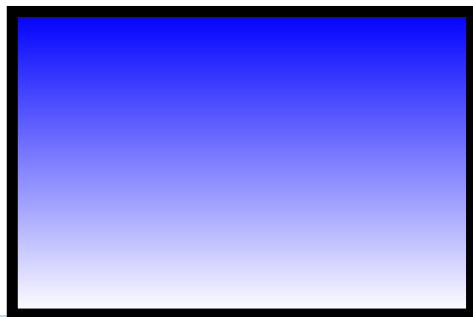
- (a) The $200\text{ }N$ upwards normal force on the crate
- (b) The $200\text{ }N$ downwards force on the crate



Third Law Exercise

A $200\text{-}N$ crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:

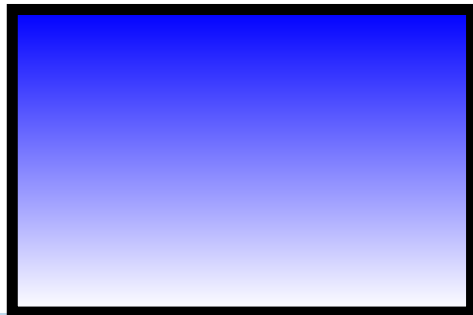
- (a) The $200\text{ }N$ upwards normal force on the crate
- (b) The $200\text{ }N$ downwards force on the crate
- (c) The $200\text{ }N$ downwards force on the earth



Third Law Exercise

A $200\text{-}N$ crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:

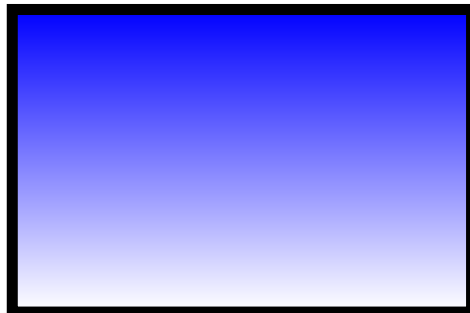
- (a) The $200\text{ }N$ upwards normal force on the crate
- (b) The $200\text{ }N$ downwards force on the crate
- (c) The $200\text{ }N$ downwards force on the earth
- (d) The $200\text{ }N$ upwards force on the earth



Third Law Exercise

A $200\text{-}N$ crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:

- (a) The $200\text{ }N$ upwards normal force on the crate
- (b) The $200\text{ }N$ downwards force on the crate
- (c) The $200\text{ }N$ downwards force on the earth
- (d) The $200\text{ }N$ upwards force on the earth
- (e) Intentionally left blank

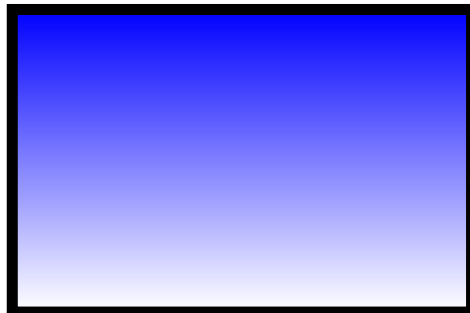


Third Law Exercise

A 200- N crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:

- (a) The 200 N upwards normal force on the crate
- (b) The 200 N downwards force on the crate
- (c) The 200 N downwards force on the earth
- (d) The 200 N upwards force on the earth
- (e) Intentionally left blank

Weight = \vec{w} = $\vec{F}_{E \text{ on } B}$ =
downwards force that earth
exerts on box



Third Law Exercise

A 200- N crate is placed on a horizontal surface. The reaction to the force of gravity on the crate is:

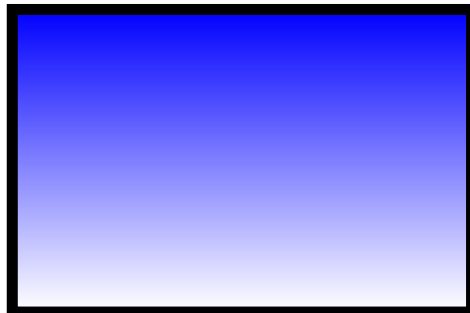
(a) The 200 N upwards normal force on the crate

(b) The 200 N downwards force on the crate

(c) The 200 N downwards force on the earth

(d) The 200 N upwards force on the earth

(e) Intentionally left blank



Weight = $\vec{w} = \vec{F}_{E \text{ on } B}$ = downwards force that earth exerts on box

Reaction = $\vec{F}_{B \text{ on } E}$ upwards force that box exerts on earth