

Physics 189 Lecture One

Jan 6, 2014

Dr. Jones¹

¹Department of Physics
Drexel University

January 6, 2014

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity

Symbols

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction

Symbols

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal

Symbols

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push

Symbols

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull

Symbols

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension

Symbols

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f
- F_N or N

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f
- F_N or N
- F

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f
- F_N or N
- F
- F

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f
- F_N or N
- F
- F
- T or F_s

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f
- F_N or N
- F
- F
- T or F_S
- F_S

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f
- F_N or N
- F
- F
- T or F_S
- F_S

Static Equilibrium

Forces

In Part I, we learned about various types of forces:

- Gravity
- Friction
- Normal
- Push
- Pull
- Tension
- Compression

Symbols

- g
- F_f
- F_N or N
- F
- F
- T or F_s
- F_s

All of these forces are alike but one, which is?

The two types of forces:

Contact forces

Forces that occur when one object is in direct physical contact with another object.

Field forces

Forces that do not require direct contact between two physical objects. “Action at a distance”.

Gravity is really...

$$F_g = \frac{Gm_1m_2}{R^2}$$

where G is a universal constant (where did it come from?) that is given as $G = 6.67 \times 10^{-11} \text{ N(m/kg)}^2$.

Gravity is really...

$$F_g = \frac{Gm_1m_2}{R^2}$$

where G is a universal constant (where did it come from?) that is given as $G = 6.67 \times 10^{-11} \text{ N(m/kg)}^2$.

See example of N-Body simulation using 24 million particles representing chunks of matter:

http://www.youtube.com/watch?v=o0_HBsuZUIk

What causes lightening?

- Was Physics completed by Newton?

What causes lightening?

- Was Physics completed by Newton?
- Physics was fully born with Newton, but could not explain many things.

What causes lightening?

- Was Physics completed by Newton?
- Physics was fully born with Newton, but could not explain many things.
- How did the Earth pull on the moon without contact?

What causes lightening?

- Was Physics completed by Newton?
- Physics was fully born with Newton, but could not explain many things.
- How did the Earth pull on the moon without contact?
- What was light?

What causes lightening?

- Was Physics completed by Newton?
- Physics was fully born with Newton, but could not explain many things.
- How did the Earth pull on the moon without contact?
- What was light?
- What was the origin and the end of the universe?

What causes lightening?

- Was Physics completed by Newton?
- Physics was fully born with Newton, but could not explain many things.
- How did the Earth pull on the moon without contact?
- What was light?
- What was the origin and the end of the universe?
- What was lightening?

What causes lightening?

- Was Physics completed by Newton?
- Physics was fully born with Newton, but could not explain many things.
- How did the Earth pull on the moon without contact?
- What was light?
- What was the origin and the end of the universe?
- What was lightening?
- What was the shock one feels from a carpet?

Benjamin Franklin and electric fire



Benjamin Franklin and electric fire

- Franklin proposed that “electric fire”, lightening, was the same sort of “electric fluid”, electricity, that could be found by, say, rubbing a piece of fur against a glass rod.

Benjamin Franklin and electric fire

- Franklin proposed that “electric fire”, lightning, was the same sort of “electric fluid”, electricity, that could be found by, say, rubbing a piece of fur against a glass rod.
- The kite experiment was first proposed by Franklin, but first successfully executed by a French scientist.

Benjamin Franklin and electric fire

- Franklin proposed that “electric fire”, lightning, was the same sort of “electric fluid”, electricity, that could be found by, say, rubbing a piece of fur against a glass rod.
- The kite experiment was first proposed by Franklin, but first successfully executed by a French scientist.
- Unfortunately, a number of scientist who didn't fully understand Franklin's proposal were executed when struck by lightning.

Benjamin Franklin and electric fire

- Franklin proposed that “electric fire”, lightning, was the same sort of “electric fluid”, electricity, that could be found by, say, rubbing a piece of fur against a glass rod.
- The kite experiment was first proposed by Franklin, but first successfully executed by a French scientist.
- Unfortunately, a number of scientist who didn't fully understand Franklin's proposal were executed when struck by lightning.
- Franklin was insulated—so it is claimed.

Benjamin Franklin and electric fire

- Franklin proposed that “electric fire”, lightning, was the same sort of “electric fluid”, electricity, that could be found by, say, rubbing a piece of fur against a glass rod.
- The kite experiment was first proposed by Franklin, but first successfully executed by a French scientist.
- Unfortunately, a number of scientist who didn't fully understand Franklin's proposal were executed when struck by lightning.
- Franklin was insulated—so it is claimed.
- One historian proposes that the kite proposal was a joke on the British Royal Society by Franklin that spun out of control. The Mythbusters, and some historians, believe it was a hoax.

Benjamin Franklin and electric fire

- Franklin proposed that “electric fire”, lightning, was the same sort of “electric fluid”, electricity, that could be found by, say, rubbing a piece of fur against a glass rod.
- The kite experiment was first proposed by Franklin, but first successfully executed by a French scientist.
- Unfortunately, a number of scientist who didn't fully understand Franklin's proposal were executed when struck by lightning.
- Franklin was insulated—so it is claimed.
- One historian proposes that the kite proposal was a joke on the British Royal Society by Franklin that spun out of control. The Mythbusters, and some historians, believe it was a hoax.
- <http://dsc.discovery.com/tv-shows/mythbusters/mythbusters-database/ben-franklin-electricity.htm>

Benjamin Franklin and electric fire

- Franklin proposed that “electric fire”, lightning, was the same sort of “electric fluid”, electricity, that could be found by, say, rubbing a piece of fur against a glass rod.
- The kite experiment was first proposed by Franklin, but first successfully executed by a French scientist.
- Unfortunately, a number of scientist who didn't fully understand Franklin's proposal were executed when struck by lightning.
- Franklin was insulated—so it is claimed.
- One historian proposes that the kite proposal was a joke on the British Royal Society by Franklin that spun out of control. The Mythbusters, and some historians, believe it was a hoax.
- <http://dsc.discovery.com/tv-shows/mythbusters/mythbusters-database/ben-franklin-electricity.htm>
- A number of 18th century amateur scientist are said to have been executed trying to replicated this experiment.

What we do know that Franklin did

- Advanced the science of electricity with numerous experiments

What we do know that Franklin did

- Advanced the science of electricity with numerous experiments
- Named the two type of charges positive and negative after realizing they were two sides of the same coin.

What we do know that Franklin did

- Advanced the science of electricity with numerous experiments
- Named the two type of charges positive and negative after realizing they were two sides of the same coin.
- First proposed the concept of the conservation of charge: charges can neither be destroyed nor created.

Coulomb's Law

Building upon Franklin's work, and the work of many other scientist, Coulomb proposed that the the forces exerted by charged objects on one another has almost the exact same form as the gravitational force:

$$F_e = k_e \frac{k_e q_1 q_2}{R^2}$$

where $k_e = 8.9876 \times 10^9 \text{ N(m/C)}^2$. Here, C is the SI unit for the quantity of charge.

Electric fluid?

Early scientist thought of electricity as a fluid like water. Millikan proved this to be false. Electric charge is “quantized”, that is, it comes in discrete quantities.

