Physics 20

Unit B: Forces and gravitation

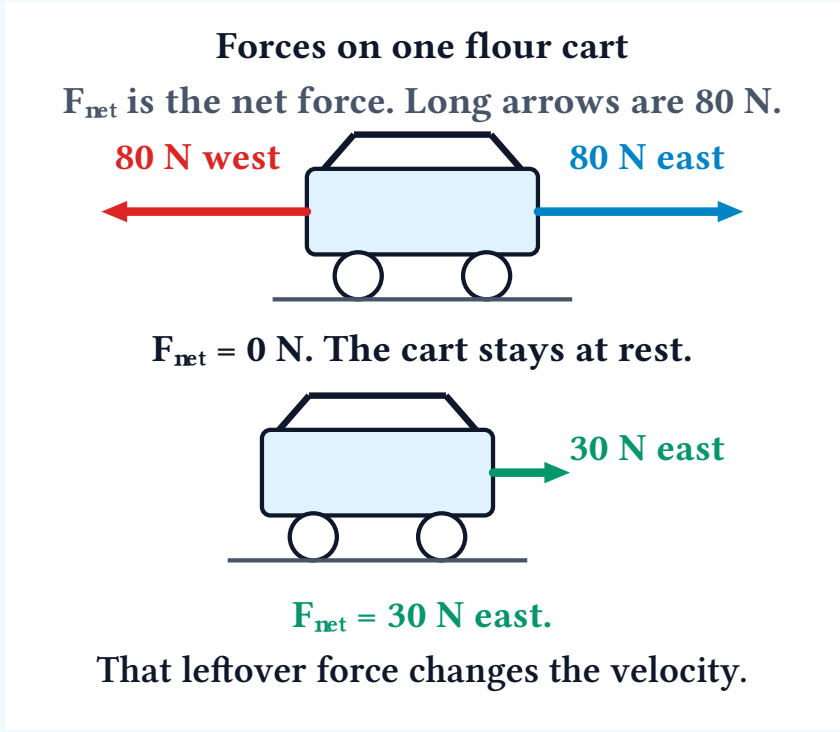
Net force and Newton's first law

A flour cart in an Airdrie aisle

- Two workers push a flour cart with 80 N east and 80 N west, and the cart stays at rest.
- A third push of 30 N east leaves a resultant of 30 N east, and the cart’s velocity starts to change.

Net force and inertia

- Net force, written F_{net}, is the vector sum of every force on one object.
- A net force with magnitude above zero changes velocity.
- When the forces on one object add to zero, the object stays at rest or keeps a steady velocity. That tendency is inertia.



Key terms

net force

Net force is the vector sum of every force on an object, with magnitude and direction. (F_{net})

inertia

Inertia is the tendency of an object to keep its current state of rest or uniform motion.

Newton's first law

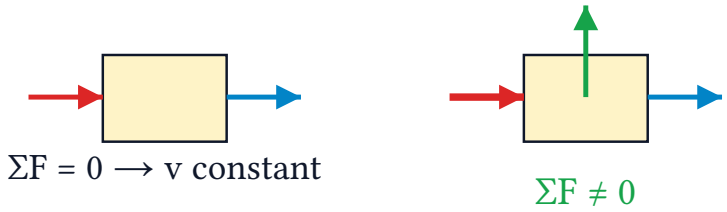
Newton's first law says an object stays at rest or in uniform motion when the net force is zero.

balanced forces

Balanced forces are forces on one object that sum to a zero resultant.

A resultant above zero changes velocity

- Add forces on one object by direction before you predict the motion.
- A net force with magnitude above zero changes the velocity.
- Equal opposing forces on the same object leave a zero resultant.



Add forces by direction on one object

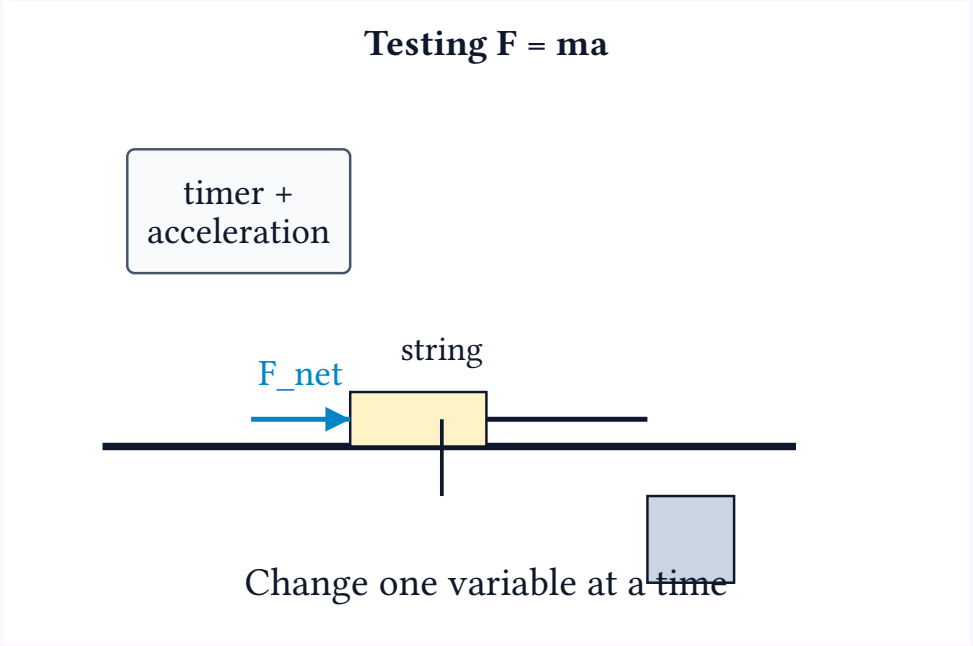
Resultant changes velocity when |ΣF| > 0

Three ropes on a crate skid

- A 6.0 kg skid has ropes of 25 N east, 10 N west, and 9.0 N east.
- The resultant is 24 N east, so the velocity changes toward the east.
- Balanced forces would require that vector sum to be 0 N.

Testing the second law

- The investigation question asks how acceleration, mass, and force are related.
- Change one manipulated variable at a time and record acceleration with a timer.
- Clear the track, catch the cart, and wear eye protection on every run.



A hallway bin with two pushes

- A hallway bin receives 48 N north and 48 N south.
- Decide whether the forces are balanced and what the velocity does.
- Then replace the south push with 33 N south and describe the new resultant.

Rest and a shove

- A curling stone slides east at a steady 2.0 m/s while the forces on it add to 0 N.
- State the law and the role of inertia for that glide.
- A later 4.0 N south force becomes the only remaining force. Describe the velocity.