Physics 20

Unit B: Forces and gravitation

Dynamics in society

Two stops from 12 m/s

- A 60 kg occupant slows by 12 m/s in 0.050 s during a rigid stop, which takes 14400 N.
- The same velocity change spread over 0.20 s in a crumple zone takes 3600 N.

Forces in daily life

- A seat belt or a crumple zone makes the slow down last longer, so the force stays smaller.
- Head Smashed In is a buffalo jump the community planned so the herd would supply meat and hides.
- Talk about seat belts with Newton’s first law: the passenger keeps moving until a force changes that velocity.

Key terms

injury prevention device

An injury prevention device lengthens the time of a velocity change so the force on a person stays smaller.

buffalo jump

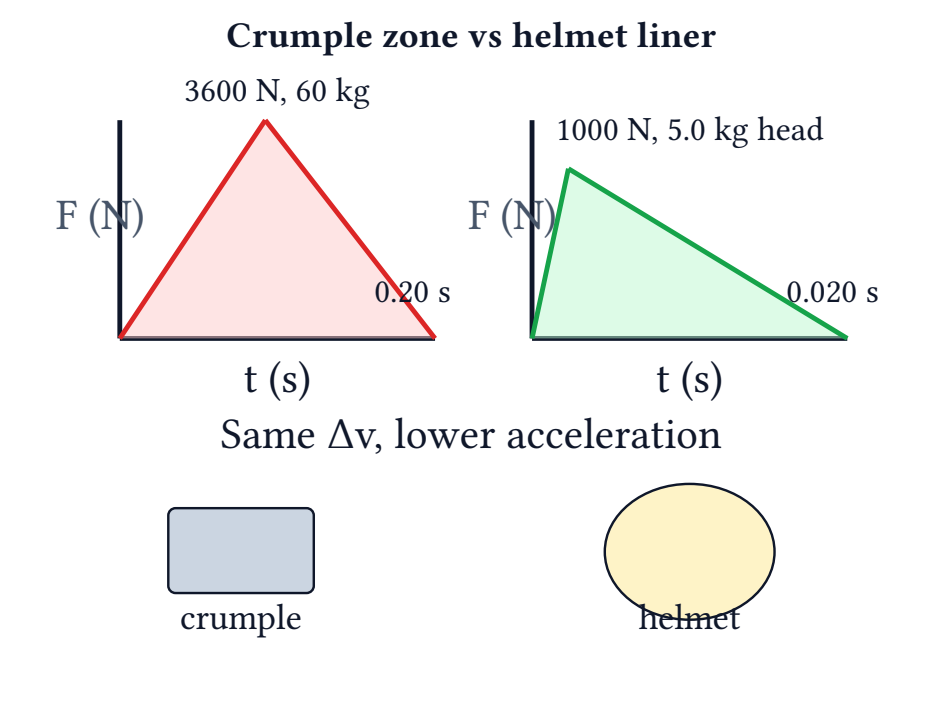
A buffalo jump is a coordinated cliff drive technology that supplied a community harvest of bison.

seat belt

A seat belt is a strap that exerts a force so a passenger's velocity changes with the vehicle.

Crumple metal and a crushing liner

- The crumple case uses 0.20 s and a 3600 N force on the 60 kg occupant.
- The helmet liner uses 0.020 s and a 1000 N force on the 5.0 kg head model.
- Both devices keep the velocity change and lower the acceleration.



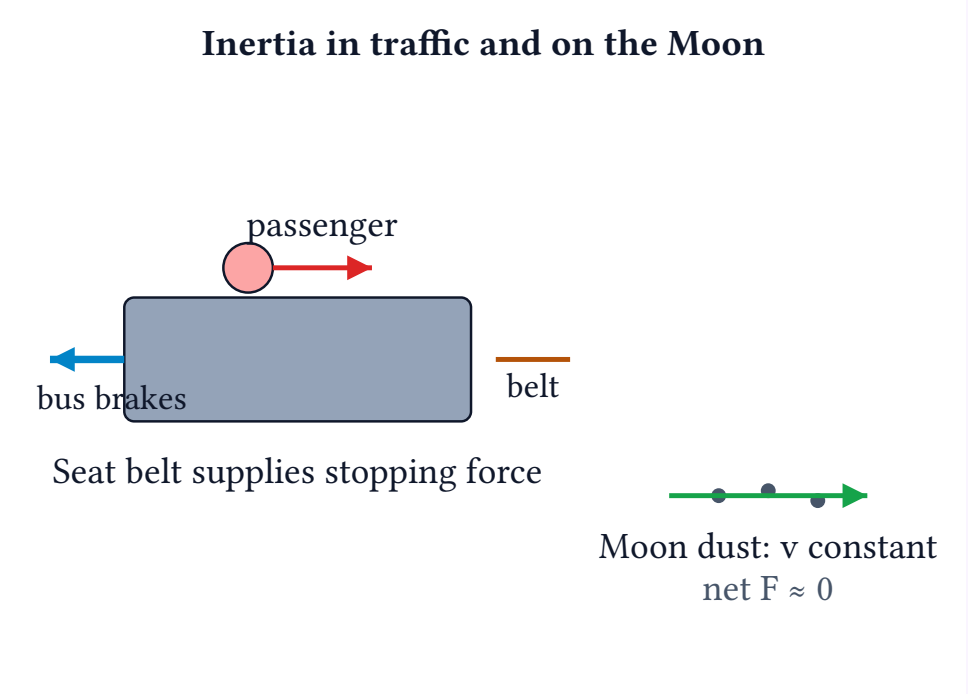
Head Smashed In as planned technology

- Niitsitapi runners and cairn lanes guided bison toward the cliff.
- A successful drive produced a community harvest of meat and hides.
- The drive depended on herd movement, cliff danger, and timing.



A braking bus and moon dust

- A passenger keeps the bus's earlier velocity until a force changes it.
- A seat belt or a tall padded seat back can supply that force.
- Lunar dust keeps a steady velocity after a kick because the net force is about zero.



One shared sentence about the bus

- Each person contributes one first law fact about the 15 m/s bus.
- The group writes a single sentence that includes a seat belt and a force.
- A second sentence says what the tall seat back does.

Forces in society

- A helmet stretch of 0.040 s changes a 4.0 m/s head velocity on a 5.0 kg model.
- Find the force and name the device.
- Add one sentence on the buffalo jump’s community harvest and one on a seat belt.

Image credits

Ken Thomas, Head-Smashed-In Buffalo Jump-27527-2, public domain