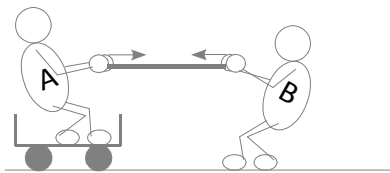


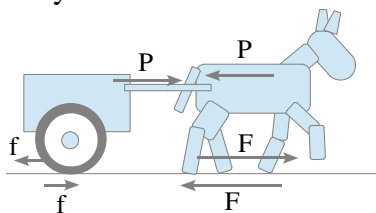
## Newton's Laws Questions

- Forces of 10N and 15N act on the same object in the same direction. Determine the net force.
- The speed of a ball increases as it rolls down a slope and decreases as it rolls up a slope. State what happens to it rolling along a flat frictionless surface.
- Newton's first law states that no force is required to keep an object in motion. State why you have to keep pedalling to keep your bike moving.
- If you are in a plane travelling at 600 km/h and a pillow falls from an overhead compartment:
  - Explain why the pillow doesn't go towards the back of the plane.
  - State the pillow's horizontal speed relative to the ground.
  - State the pillow's horizontal speed relative to you.
- The head of a hammer is loose and you wish to tighten it by bashing it down on a bench. Explain why holding the head end upwards and bashing the hammer downward will tighten it.
- Suppose a cart is being moved by a certain net force. If the net force is doubled, state how much the cart's acceleration changes by.
- Suppose a cart is being moved by a certain net force. If more is put in the cart, doubling its mass, state how much the acceleration changes by.
- The force of gravity is twice as great on a 2kg rock as on a 1kg rock. Explain why the 2kg rock does not fall with twice the acceleration.
- Calculate the acceleration of a 2000kg single-engine jet when the thrust of the engine is 500 N
- Calculate the acceleration of a  $3 \times 10^5$ kg four-engine jet if each engine has a thrust of  $3 \times 10^4$  N
- If the force of friction acting on a sliding crate is 100N:
  - State how much force must be applied to maintain a constant velocity.
  - State the net force acting on the crate.
  - Hence state the acceleration.
- Calculate the acceleration if you push with a 20N horizontal force on a 2kg block on a horizontal friction-free air table.
  - Calculate the acceleration if the friction force is 4N.
- If you push horizontally on your book with a force of 1N to make the book slide at a constant speed, state the force of friction on the book.
- Consider a hammer hitting a nail. Compare the force on the nail with the force on the hammer.
- When you swim, you push against the water (action). State the reaction force.
- When you jump, the Earth is pushed away from you. Explain why the Earth's movement is not noticed.
- 

- Draw any horizontal forces which are missing from the picture below.

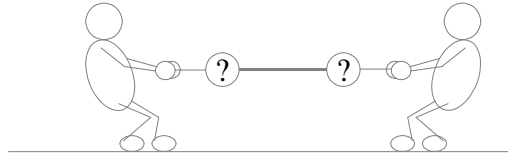


- State whether or not person A accelerates.
  - State whether or not person B accelerates.
- In the diagram below, consider only forces that are shown. Give your answers in terms of P, F and f.

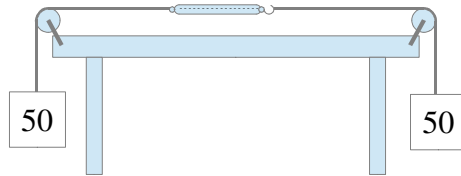


- State the forces exerted on the cart, and hence the net force on the cart.
- State the forces exerted on the robot horse, and hence the net force on the robot horse.
- State the forces exerted on the robot horse-cart system, and hence the net force on the system.
- To accelerate, the horse must push harder on the ground than it pulls on the cart. Explain why.

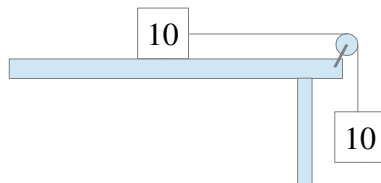
19. If you hit a wall with a force of 200N, state the force exerted on you.
20. Explain why you can't hit a feather in midair with a huge force.
21. Explain why a log floating in water moves backwards if you walk forwards on it.
22. Suppose you're weighing yourself next to a sink. If you push down on the sink, the scales read less, and if you pull up on the sink, the scales read more. Explain, using Newton's third law.
23. A bug splatters on a bus windshield. Compare the force the bug exerts with the force the bus exerts. Compare the acceleration of each.
24. The diagram below shows two people in a tug-of-war, where the question mark circles are measuring the force. State and explain whether it is possible for the two forces measured to be different.



25. A pair of 50N weights are attached to a spring scale as shown below. State whether the spring scale reads 0N, 50N or 100N.



26. State why physicists say mass is more fundamental than weight.
27. Calculate the *weight* of 2kg of pie.
28. Calculate the weight of a 2000kg elephant.
29. An apple weighs about 1N. Calculate its mass.
30. If somebody weighs 500 N on Earth, calculate how much the same person weighs on Jupiter, where the acceleration of gravity is  $26\text{ms}^{-2}$ .
31. A 10kg mass on a horizontal friction-free air track is accelerated by a string attached to another 10kg mass hanging vertically from a pulley as shown below. What is the force due to gravity on the hanging 10kg mass? What is the acceleration of the system of both masses?



32. Consider the two forces acting on a person standing on the ground; the downward pull of gravity and the upward push of the ground.
  - (a) Explain whether or not the forces are equal and opposite.
  - (b) Explain whether or not the forces are an action-reaction pair.
33. State the force of air resistance acting on a 100N bag of nails that falls at its terminal speed.
34. Calculate the horizontal force that must be applied to a 1kg puck to make it accelerate on a horizontal friction-free air table with the same acceleration it would have if it were dropped and fell freely.
35. A skydiver falls faster and faster through the air before reaching terminal speed.
  - (a) State and explain the effect of the increasing speed on the net force acting on the skydiver.
  - (b) State and explain the effect of the increasing speed on the acceleration of the skydiver.
  - (c) State and explain whether the skydiver fell more distance during the first, second or the third second of the fall.
  - (d) State and explain whether more speed was gained during the first second or the third second.