Virtual Learning

Physics

Normal Force and Tension

April 16, 2020

Physics

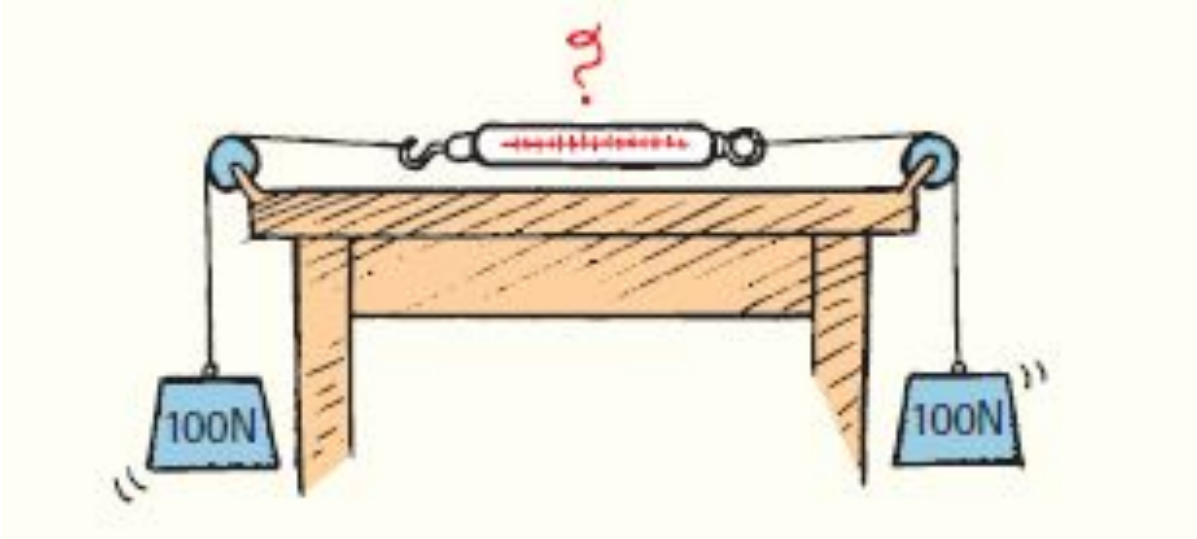
Normal Force and Tension: April 16, 2020

Objective/Learning Target:

Students will explore Normal Forces, Tensions and solve problems utilizing vectors.

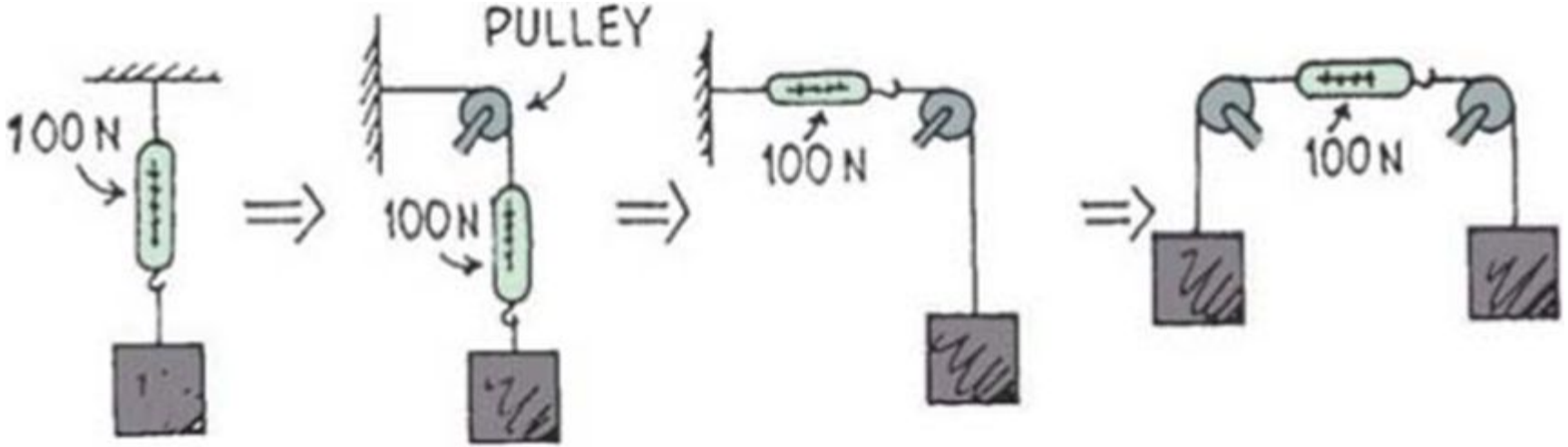
Quick Review #1

Two 100-N weights are attached to a spring scale as shown. Does the scale read 0, 100 N, or 200 N, or does it give some other reading?



Quick Review #1 Answer

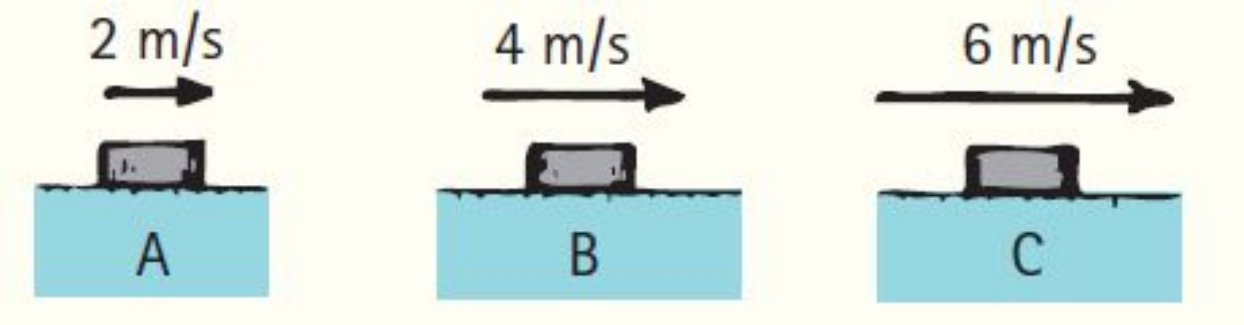
The scale would read 100 N. Follow through the series of diagrams below to see how. Remember Newton's 3rd Law!!



Quick Review #2

Three identical pucks, A, B, and C, are sliding across ice at the given speeds. The forces of air and ice friction are negligible.

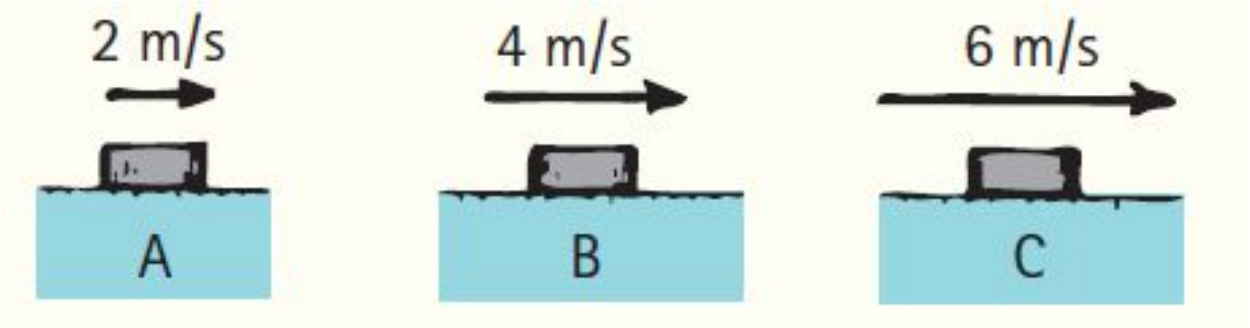
a. Rank the pucks by the force needed to keep them moving, from greatest to least.
b. Rank the pucks by the force needed to stop them in the same time interval, from greatest to least.



Quick Review #2 Answer

a. Newton's First Law- an object in motion stays in motion and with no friction working against them, then no force is needed to keep them moving, so A=B=C

b. Newton's 2nd Law says that F =ma. With all the masses being equal the force required to stop will depend directly on the accelerations. Since they are stopping in the same amount of time, the greater the initial velocity the greater the deceleration needs to be. So ranking from the greatest force needed to stop to least we get: C,B,A.



Normal Force and Tension

Link:Normal Force and Tension

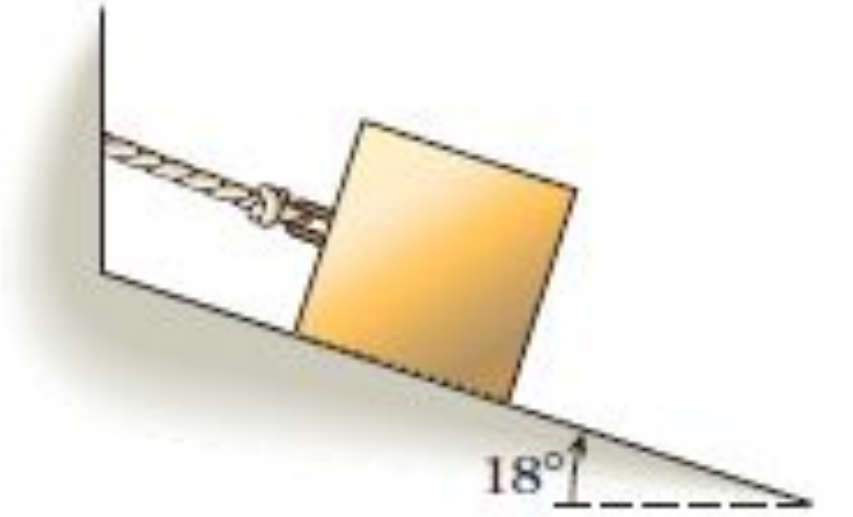
Directions:

- Read through Normal Force and Tension
- Work through any examples on a separate piece of paper before you scroll down to the solution.
- On a separate piece of paper complete the practice problems on the following slides.
- Check your answers.
- For additional practice check out the conceptual questions and the problems and exercises in the table of contents for the online text linked above.

Practice Problem #1

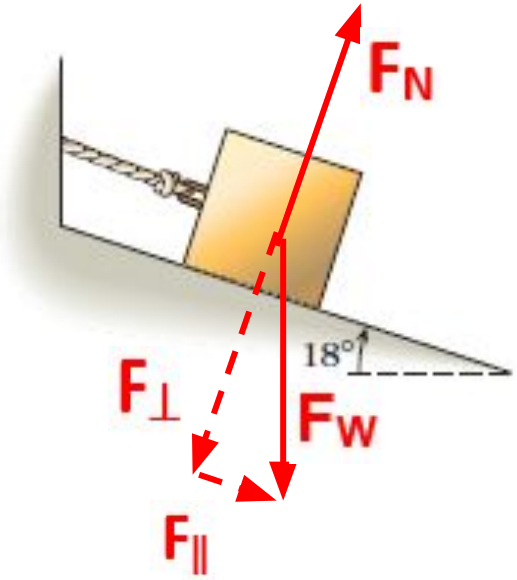
The block below weighs 98 N.

a. What is the magnitude of Normal force exerted by the ramp on the block?



b. If the slope is frictionless, find the force exerted by the rope.

Practice # 1 Answer



a. By definition $F_N = F_\perp$, So… $F_N = \cos\theta(F_W)$

$= \cos 18°(98N)$

$= 93\ N$

b. The tension in the rope is equal to the $F_\parallel$,

So… Tension$= \sin\theta(F_W)$

$= \sin 18°(98N)$

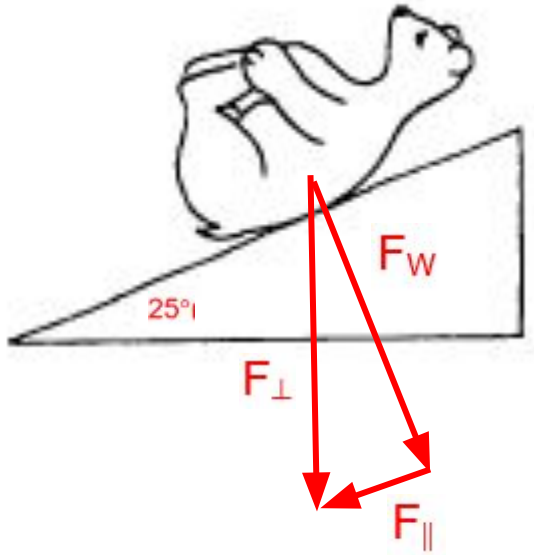
$= 30\ N$

Practice Problem #3

At the zoo, a 900.-kg polar bear slides down a frictionless wet slide inclined at an angle of 25.0° to the horizontal. What is the acceleration of the bear?

Practice Problem #3 Answer

In this problem the force that accelerates the bear down the slide is the component of his weight that is parallel to the slide.



The bear's weight = m(g)

= 900kg (9.8m/s^2)

= 8,820 N

So… $F_\parallel = \sin\theta(F_W)$

$= \sin 25°(8{,}820\text{N})$

= 3730 N

Now using Newton's 2nd Law

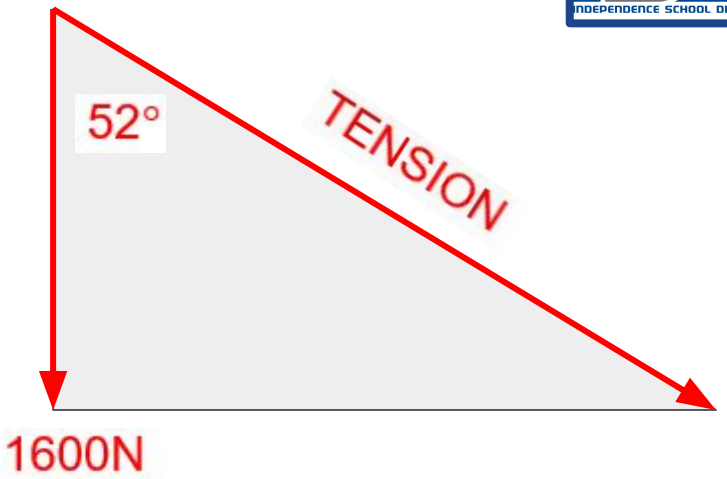
$$a = \frac{F}{m} = \frac{3730\text{N}}{900\text{kg}} = 4.14\ \text{m/s}^2$$

Practice Problem #3

Tarzan must swing Jane from their treehouse home to a neighboring tree as they venture out for the day's activities. If Tarzan has a weight of 980 Newtons and Jane a weight of 620 Newtons, calculate the tension in the vine just as they start their swing. The vine initially makes an angle of 52.0° with the vertical.

Practice Problem #3 Answer

To support Tarzan and Jane the vine must have an upward force component equal to their combined weight.



$$\text{Tension} = \frac{(F_W \text{ of both Tarzan and Jane})}{\text{Cos}\theta}$$

$$= \frac{1600\text{N}}{\text{Cos } 52°}$$

$$= 2599 \text{ N}$$

Additional Practice

For additional practice check out the conceptual questions and the problems and exercises in the table of contents from the online text linked above.