

TAP 217- 2: Free transport?

From here to there on nearly nothing

Reducing losses to a minimum is often an aim in transportation systems – sometimes critically so. Often the less the power available the more crucial this aim becomes. Going faster under human power is more about reducing losses than any other factor, for example. Here you look at one system where reducing losses is crucial.

You will need

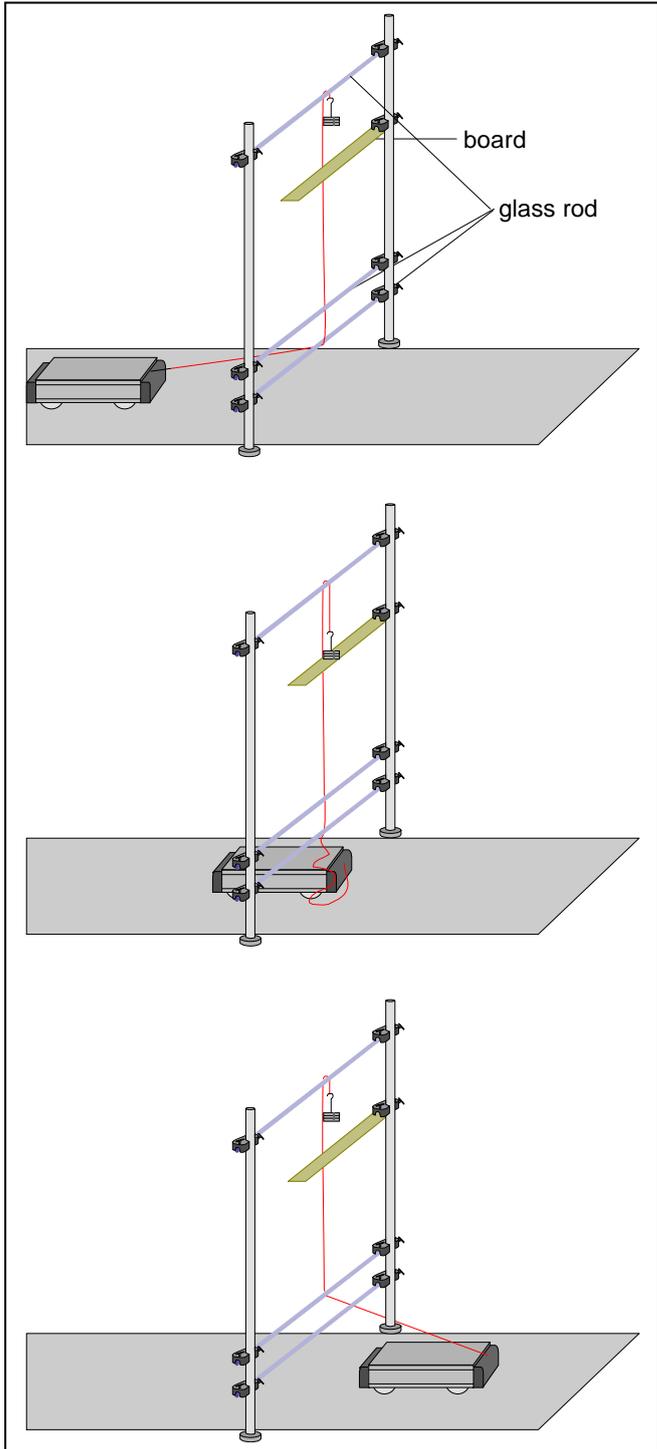
- ✓ dynamics trolley and runway or track
- ✓ two retort stands
- ✓ 3 smooth rods
- ✓ six bosses
- ✓ hanger masses, 10 g
- ✓ nylon monofilament
- ✓ a pendulum, supported on a retort stand clamped to the bench with a G-clamp
- ✓ a 6 inch nail held in a boss

Safety

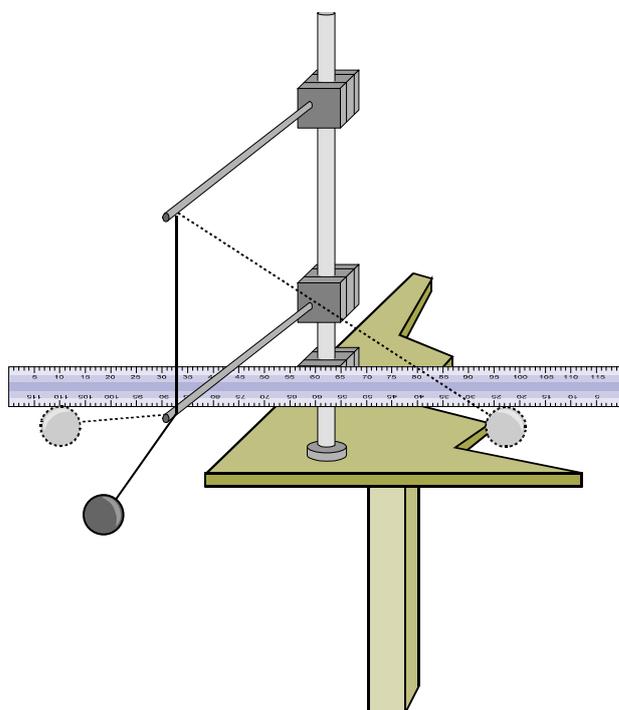
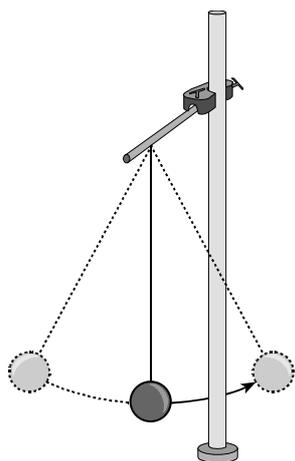
Large trolley runways are too heavy for one person to manipulate or carry. Ensure that two people share the load.

Planning and demonstrating energy transfers

When setting up the apparatus take care to reduce the frictional forces as much as possible. Carry out the sequence shown and devise a commentary to go with it. Add masses to the load. Repeat, notice the differences and script a new commentary. Now load the trolley. What difference does this make? Prepare another commentary to go with this.



Now reduce the friction, trying these two arrangements in succession.



(Remember to clamp the retort stand in the diagram above to the bench.)

Again both will need to give an explanation.

When you are ready show others what you have done and try out your commentaries.

Have you shown?

1. That the same energy turns up in gravitational potential energy and kinetic energy?
2. That transferring more potential energy results in more kinetic energy?
3. That reducing dissipative forces results in more and more energy ending up where you can measure it.

Practical advice

These experiments are not hard to set up, but do take care. A high-quality dynamics trolley is essential. The emphasis should be on the commentary: can the students (optimally two or three) handle the apparatus and use it to explain their understanding of energy transfers? The sequence moves steadily towards the less dissipative environment, extrapolation from here gives simple reason to believe in the conservation of energy.

Alternative approaches

Selected videotaped sequences could be substituted, but 'making nature behave' should be part of the students' experience at some stage.

Social and human context

The role of extrapolation and thought experiment in the foundations of dynamics has been, and is essential! Physics proceeds by making things very simple.

External references

This activity is taken from Advancing Physics Chapter 9, 300P