Physics 20 Problem Set 4

Harry Nelson

due Monday, October 25, by 5pm
to the Physics 20 Boxes in Broida Hall's Lobby

Course Announcments: Midterm on Oct. 27. Bring a bluebook and a calculator; 1 page of notes allowed.

Working problems is crucial to the understanding of physics. Expect to spend at least 12 hours a week outside of class studying and working problems. It is good to work with other students to understand how to solve problems, but **write up your solutions independently and originally; don't copy other work and use it as your own, from another student or off the web... that is, well, cheating, with potentially dramatic penalties.**

Please make your work neat, clear, and easy to follow. It is hard to grade sloppy work accurately. Generally, make a clear diagram, and label quantities. Derive symbolic answers, and then plug in numbers after a symbolic answer is available.

These problems pertain to the fourth week's three lectures, and the corresponding reading is pp. 52-75 of KK, and Chapter 5 of RHK4. The main topic is Newtons' laws.

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1. KK 2.2

2. KK 2.3

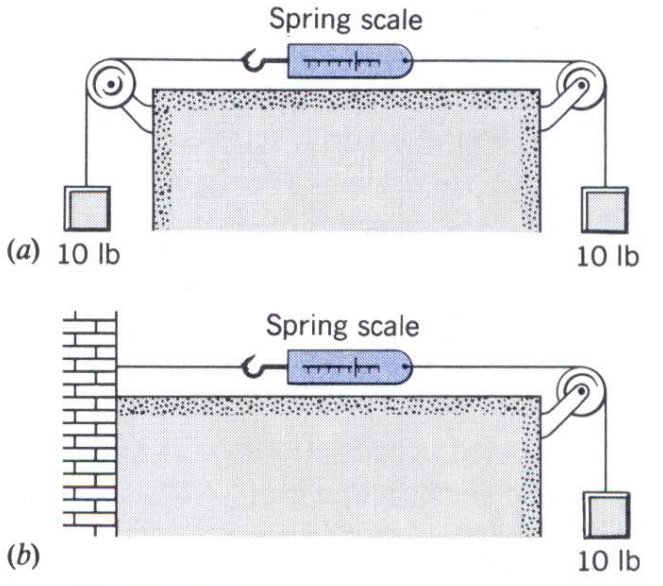

Figure 1: Problem 3.

3. (a) Two 10-lb weights are attached to a spring scale of negligible mass with cord of negligible mass as shown in Fig. 1(a). What is the reading of the scale (in pounds)?

(b) A single 10-lb weight is attached to the spring scale which itself is attached to a wall with cord of negligible mass, as shown in Fig. 1(b). What is now the reading of the scale? (RHK4 5.24)

Figure 2: Problem 4.

4. A chain consisting of five links, each with mass 100 g, is lifted vertically with a constant acceleration of 2.5 m/s^2, as shown in Fig 2. Find:
   (a) the forces acting between adjacent links,
   (b) the force F exerted on the top link by the agent lifting the chain, and
   (c) the *net* force on each link. (RHK4 5.58)

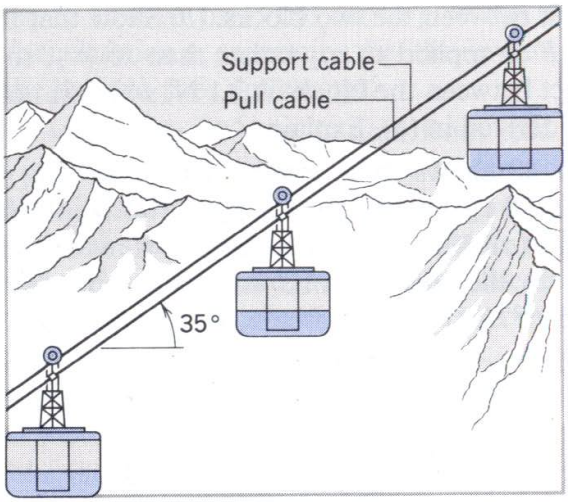

Figure 3: Problem 5.

5. Figure 3 shows a section of an alpine cable-car system. The maximum permitted mass of each car with occupants is 2800 kg. The cars, riding on a support cable, are pulled by a second cable attached to a connection at the top of each car. The force of the support cable on the wheel above each car is perpendicular to the direction of the support cable, and the forces applied by the pull cables are parallel to that direction. The angle $\theta = 35°$ as shown, and the cars accelerate up the incline at $a_\theta = 0.81\,\mathrm{m/s^2}$.
   (a) What is the difference in tension between adjacent sections of pull cable?
   (b) What is the magnitude of the force of the support cable on the wheel? (RHK4 5.66)
6. KK 2.16. Solve this for arbitrary incline angle θ, not just $\theta = 45°$.