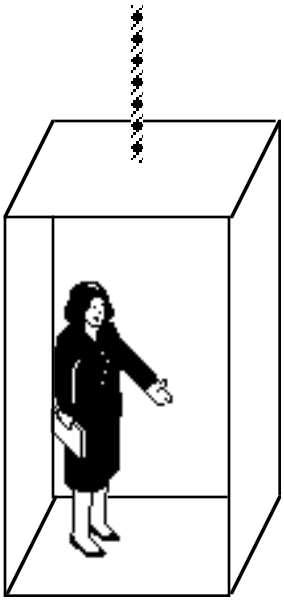
UNIT V: OPTIONAL WHITEBOARD SET



For questions 1-5 consider the 50 kg woman shown at right. Sketch the force diagram, motion map, including acceleration, and a graph for the woman appropriate to each situation. Find the value of each force acting on the woman. This elevator moves only in the vertical dimension with the kinematic quantities indicated for each problem. Upward is positive. Assume the elevator remains at rest once it comes to a stop.

1. The elevator moves with a constant velocity of +2 m/s.

2. The elevator moves with a constant velocity of -3 m/s.

3. The elevator moves downward with a velocity of -4 m/s and has an acceleration of +1 m/s^2.

4. The elevator moves upward with a velocity of +3 m/s and has an acceleration of +1 m/s^2.

5. The elevator moves downward with a velocity of -4 m/s and has an acceleration of -2 m/s^2.

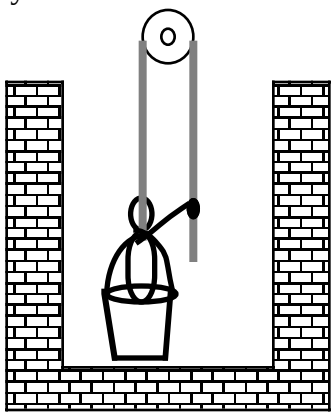
6. A helicopter holding a 90. kg box suspended from a rope 5.0 m long accelerates upward at a rate of 2.1 m/s^2. Air resistance is negligible.

   a. Draw and label a force diagram for the box.

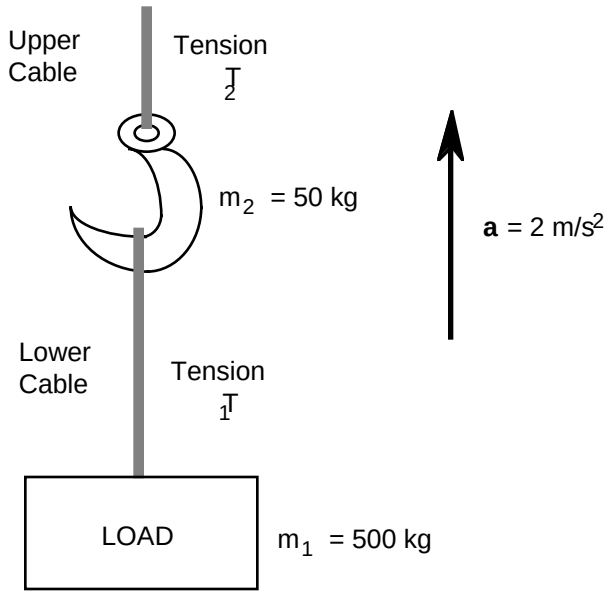
   b. Determine the tension in the rope.

   c. At the moment that the upward velocity of the helicopter is 12 m/s, the rope is cut. The helicopter from then on accelerates upward at 2.5 m/s^2. Determine the distance between the helicopter and the package 3.0 seconds after the rope is cut.

7. Having fallen down a well, a boy finds himself with the water bucket tied to a rope which goes over a pulley at the top. Fortunately the other end of the rope has fallen down to the bottom of the well, too. So, he decides to get into the bucket and start pulling on the other end of the rope in order to get himself out. His mass is 32 kg and the bucket has a mass of 3.0 kg. How much force will the boy have to exert on the rope in order to pull himself up with a relatively constant velocity?

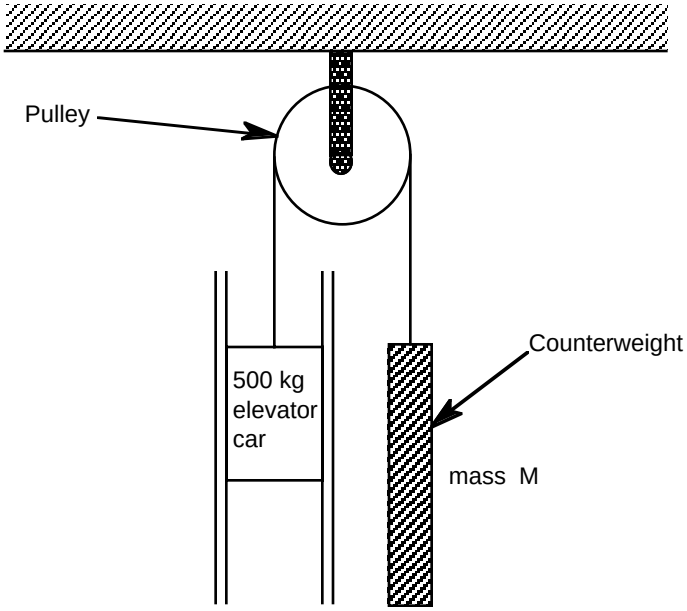


8. A crane is used to hoist a load of mass $m_1 = 500$ kg. The load is suspended by a cable from a hook of mass $m_2 = 50$ kg, as shown above. The load is lifted upward at a constant acceleration of 2 m/s^2.



a. Draw a force diagram for the hook, and label each force clearly, identifying the agent exerting it.
b. Determine the tension T_1 in the lower cable and the tension T_2 in the upper cable.

9.



An elevator is rising at a speed of 5.00 m/s. It comes to a halt in 4.0 s. The guide rails on the side of the elevator each exert a 110 N frictional force on the elevator. The pulley has negligible friction and mass for the purposes of this analysis.

a. Find the tension in the cable during the slowing of the elevator.
b. Find the mass M that the counterweight must have in order for the elevator to stop as stated above.