

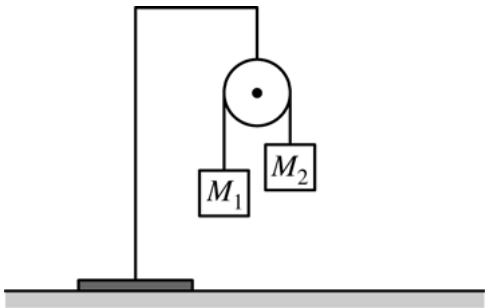
PHYSICS C: MECHANICS

SECTION II

Time—45 minutes

3 Questions

Directions: Answer all three questions. The suggested time is about 15 minutes for answering each of the questions, which are worth 15 points each. The parts within a question may not have equal weight. Show all your work in this booklet in the spaces provided after each part.

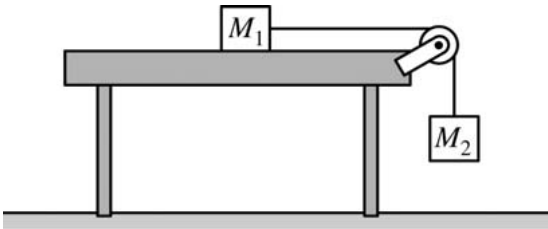


1. An Atwood's machine consists of two blocks connected by a light string that passes over a frictionless pulley of negligible mass, as shown in the figure above. The masses of the two blocks, M_1 and M_2 , can be varied. M_2 is always greater than M_1 .
- (b) Using the forces in your diagrams above, write an equation applying Newton's second law to each block and use these two equations to derive the magnitude of the acceleration of the blocks and show that it is given by the equation: $a = \frac{(M_2 - M_1)}{(M_1 + M_2)}g$

The magnitude of the acceleration a was measured for different values of M_1 and M_2 , and the data are shown below.

M_1 (kg)	1.0	2.0	5.0	6.0	10.0
M_2 (kg)	2.0	3.0	12.0	8.0	14.0
a (m/s ²)	3.02	1.82	4.21	1.15	1.71

- (c) Indicate below which quantities should be graphed to yield a straight line whose slope could be used to calculate a numerical value for the acceleration due to gravity g .
- Vertical axis: _____
- Horizontal axis: _____
- Use the remaining rows in the table above, as needed, to record any quantities that you indicated that are not given.
- (e) Using your straight line, determine an experimental value for g .



- The experiment is now repeated with a modification. The Atwood's machine is now set up so that the block of mass M_1 is on a smooth, horizontal table and the block of mass M_2 is hanging over the side of the table, as shown in the figure above.
- (f) For the same values of M_1 and M_2 , is the magnitude of the tension in the string when the blocks are moving higher, lower, or equal to the magnitude of the tension in the string when the blocks are moving in the first experiment?
- ____ Higher ____ Lower ____ Equal to
- Justify your answer.
- (g) The value determined for the acceleration due to gravity g is lower than in the first experiment. Give one physical factor that could account for this lower value and explain how this factor affected the experiment.