**Performance Task**

9.3 Simple Machines 21.

Conservation of Energy and Energy Transfer; Cause and Effect; and S&EP, Planning and Carrying Out Investigations

Plan an investigation to measure the mechanical advantage of simple machines and compare to the *IMA* of the machine. Also measure the efficiency of each machine studied. Design an investigation to make these measurements for these simple machines: lever, inclined plane, wheel and axle and a pulley system. In addition to these machines, include a spring scale, a tape measure, and a weight with a loop on top that can be attached to the hook on the spring scale. A spring scale is shown in the image.

SPRING
SCALE

Grams	Newtons
0	0
100	01
200	02
300	03
400	04
500	05
600	06
700	07
800	08
900	09
1000	10
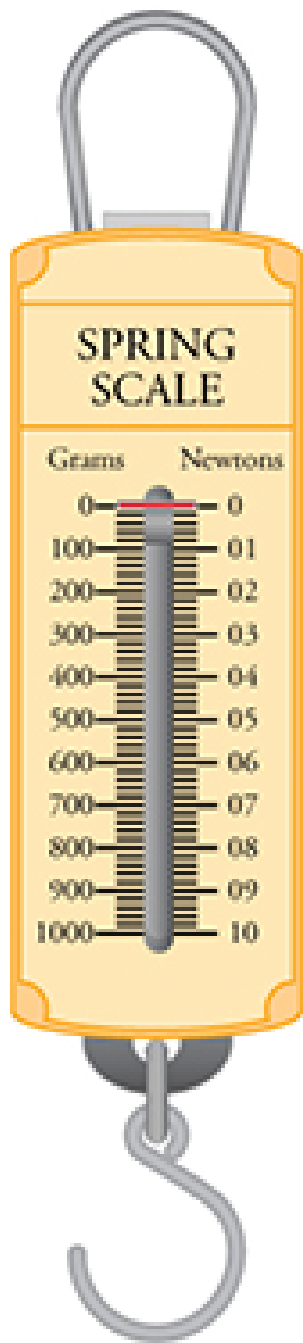
A spring scale measures weight, not mass.

LEVER: Beginning with the lever, explain how you would measure input force,

output force, effort arm, and resistance arm. Also explain how you would find the distance the load travels and the distance over which the effort force is applied. Explain how you would use this data to determine *IMA* and efficiency.

INCLINED PLANE: Make measurements to determine *IMA* and efficiency of an inclined plane. Explain how you would use the data to calculate these values. Which property do you already know? Note that there are no effort and resistance arm measurements, but there are height and length measurements.

WHEEL AND AXLE: Again, you will need two force measurements and four distance measurements. Explain how you would use these to calculate *IMA* and efficiency.

SCREW: You will need two force measurements, two distance traveled measurements, and two length measurements. You may describe a screw like the one shown in Figure 9.11 or you could use a screw and screw driver. (Measurements would be easier for the former). Explain how you would use these to calculate *IMA* and efficiency.

PULLEY SYSTEM: Explain how you would determine the *IMA* and efficiency of the four-pulley system shown in Figure 9.12. Why do you only need two distance measurements for this machine?

Design a table that compares the efficiency of the five simple machines. Make predictions as to the most and least efficient machines.