12.2

+ 28.2

3. Attach the weight hanger to the lower pulley assembly. The weight hanger and any slotted weights placed upon it will be regarded as the useful load F_{out}. Attach the weight pan to the free end of the string. The weight of the weight pan plus that of weights placed in it will constitute F_{in}.

4. Move the weight pan downward through some convenient (e.g. 100 cm or 60 cm) distance S_{in}. Measure the resulting distance S_{out} through which the hanger rises. Calculate the IMA by equation (5). Compare this value to the alternate value indicated and find the percent difference. Copy these results to the appropriate blanks on the data sheet.

S_{in} = 100 cm S_{out} = 16.5 cm

$$IMA = \frac{S_{in}}{S_{out}} = \frac{100}{16.5} = 6.06$$

Also: IMA = number of strings supporting the lower pulley = 6

$$\%\ Dif = \left|\frac{IMA_1 - IMA_2}{IMA_1 + IMA_2}\right| \times 200 = \left|\frac{6.06 - 6}{6.06 + 6}\right| \times 200 = \frac{0.66}{12.06} = 1.1\ \%$$

5. With no additional weights on the weight hanger, add weights to the pan until a condition is reached, whereby the pan descends with a constant velocity after the string is given a slight downward tug. You may have to repeat this observation several times with a very slow speed to see if the velocity is really constant. (If the pan accelerates downward with no weights added, add a small slotted weight to the weight hanger). Record the values of F_{in} and F_{out} below and on the first line of the data table. Remember that F_{in} is the sum of the weights in the weight pan plus the weight of the pan that you measured in step 1. F_{out} is the sum of the weights on the hanger plus 50 gwt for the hanger.

F_{in} = 28.2 gwt F_{out} = 50 gwt

6. Calculate the input work W_{in} and the output work W_{out} using equations (2a) and (2b). Show the substitutions below and copy these values to the first line of the data table.

$W_{in} = F_{in} \times S_{in}$ = (Substitute) = 2780 gwt·cm

$W_{out} = F_{out} \times S_{out}$ = = 825 gwt·cm

7. Calculate the actual mechanical advantage using equation (4). Copy your result to the first line of the data table.

$$AMA = \frac{F_{out}}{F_{in}} = \frac{50}{28.2} = 1.77$$

(Substitute above)

8. Calculate the efficiency using equation (1b). Copy your result to the first line of the data table.

$$\text{Percent Efficiency} = \frac{W_{out}}{W_{in}} \times 100 = \frac{825}{2820} = 29.3\ \%$$

(Substitute above)

9. Repeat steps 5 through 8 three additional times for various amounts of weight added to the weight hanger up to 1000 gwt. Copy your results to the