**Period 8 Exercises**

**E.1** Carlos wants to raise a 4,000 lb car using a hydraulic lift. If he applies a 100 lb force over a distance of 8 ft, how much work does the hydraulic lift do on the car? (Assume no energy is wasted by the force of friction.)

a) 100 ft-lbs  
b) 500 ft-lbs  
c) 800 ft-lbs  
d) 4,000 ft-lbs  
e) 32,000 ft-lbs

\[ W = F \times D = 100 \text{ lb} \times 8 \text{ ft} = 800 \text{ ft-lbs} \]

**E.1 = c**
E.2 What is the efficiency of a hydraulic machine if 5 newtons of force are required to move the small piston in 3 cm and 10 newtons of force out move the large piston out 0.5 cm?

a) 3%
b) 8%
c) 33%
d) 83%
e) 300%

\[
\text{Eff} = \frac{\text{Work}_{\text{out}}}{\text{Work}_{\text{in}}} = \frac{F_{\text{out}} D_{\text{out}}}{F_{\text{in}} D_{\text{in}}} = \frac{10 \text{ N} \times 0.5 \text{ cm}}{5 \text{ N} \times 3 \text{ cm}} = \frac{5}{15} = \frac{1}{3}
\]

E.2 = c
E.3 A complex machine is composed of a block and tackle and a lever. The mechanical advantage of the block and tackle is 4, and the mechanical advantage of the lever is 5. What is the mechanical advantage of the machine?

\[ MA_{\text{complex}} = MA_{\text{block}} \times MA_{\text{lever}} = 4 \times 5 = 20 \]

a) 1  
b) 1.67  
c) 8  
d) 15  
e) 20

E.3 = e

E.4 In question E.3, if the efficiency of the lever is 60% and the efficiency of the block and tackle is 20%, what is the efficiency of the machine?

\[ \text{Eff}_{\text{complex}} = \text{Eff}_{\text{block}} \times \text{Eff}_{\text{lever}} = 0.20 \times 0.60 = 0.12 \]

a) 3%  
b) 12%  
c) 33%  
d) 40%  
e) 80%

E.4 = b
In his job as a bricklayer, Ian must move a load of bricks to the top of a building. There are two winches Ian can choose to use. The first winch requires 50 turns and the second winch requires 100 turns to pull up the load. Which of the following statements is TRUE if we assume that friction is very small?

a) Each of the winches will require the same force.

b) The first winch will require more energy than the second.

c) The first winch will require less energy than the second.

d) The first winch will require half as much force as the second.

e) The first winch will require twice as much force as the second.

The winch requiring 50 turns has one-half the distance in as the winch requiring 100 turns. Thus the 50 turn winch requires twice as much force in as the 100 turn winch.

E.5 = e
E.6 The mechanical advantage of a complex stapling machine is 10. The machine includes a lever with a mechanical advantage of 2.5. What is the mechanical advantage of the rest of the machine?

\[ MA_{\text{complex}} = MA_{\text{lever}} \times MA_{\text{rest}} \]

\[ MA_{\text{rest}} = \frac{MA_{\text{complex}}}{MA_{\text{lever}}} = \frac{10}{2.5} = 4 \]

a) 1  
b) 2.5  
c) 4  
d) 7.5  
e) 10

E.6 = c
E.7 Samantha's complex machine is made up of a hydraulic jack with an efficiency of 50%, a lever with an efficiency of 60%, and a block and tackle with an efficiency of 40%. What is the overall efficiency of her machine?

\[
MA_{\text{complex}} = 0.50 \times 0.60 \times 0.40 = 0.12
\]

a) 12%
b) 40%
c) 60%
d) 120%
e) 150%

E.7 = a
Solutions to Period 8 Exercises

E.1 = c
E.2 = c
E.3 = e
E.4 = b
E.5 = e
E.6 = c
E.7 = a