(8.) What is the force of the mat on the vaulter?

(a.) 4 tons
(b.) 3 tons
(c.) 2 tons
(d.) 1 ton
(e.) 16 tons

$F_s \cdot x = \frac{1}{2} \Rightarrow F_s \frac{1}{T2}$

(9.) How much kinetic energy does the vaulter hit the pit with?

(a.) 43 ons
(b.) 2000J
(c.) 4000J
(d.) 1000J
(e.) 8000J

$\frac{1}{2}mv^2 : \frac{1}{2} : W_{grav}$ From 5m 4000 J
" 2.5 2000 J

(10.) If the wrong pit was used and the spring constant was ¼ its original value, how far would the original vaulter sink into the pit?

(a.) 0.3m
(b.) 0.15m
(c.) 0.6m
(d.) 0.2m
(e.) 1.2m

kx^2 same
$\uparrow$
$\frac{1}{4} \Rightarrow x : 2$

For the next 4 problems, consider a champion Canadian stair climber (60 kg) who trains for the world record by carrying two 10 kg beavers while climbing. Loaded with beaver, the climber can do the 1760 steps of the 342m high CNN tower in 8m 30s (510s). In doing so, she expends 274,000 J of energy at an optimum power of 540W. The following questions deal with her world record (WR) attempt, without beavers at the same power:

(11.) What energy does she expend in the WR?

(a.) 206,000J
(b.) 274,000J
(c.) 137,000J
(d.) 4000J
(e.) 2000J

$m : \frac{3}{4} \Rightarrow W_{grav} : \frac{3}{4}$

(12.) How would this compare to an 80kg man?

(a.) Same
(b.) 4/3
(c.) ¾
(d.) ½
(e.) 9/16

same mass as with beavers

(13.) What is the time of her WR climb?

(a.) Same
(b.) 255s
(c.) 383s
(d.) 1020s
(e.) 128s

$P_{same} = \frac{W}{\Delta t}$ ← $\frac{3}{4}$
$\Delta t \rightarrow \frac{3}{4}$ 510

(14.) How high could she climb in 8m 30s?

(a.) Same
(b.) 684m
(c.) 300m
(d.) 404m
(e.) 456m

$P_{same} = \frac{W}{\Delta t}$ ← $\frac{mgH}{3/4}$ ← 4/3
↑ same

$H = \frac{4}{3}$ 342

The next 4 problems refer to a 300 yd golf drive where the ball speed is 182 mph and the club head speed is 123 mph. The mass of the ball is .046kg and the mass of the club is .17kg.

(15.) Compare the momentum of the club before collision to the ball after.

(a.) Same
(b.) Club is greater
(c.) Ball is greater
(d.) Depends on swing speed

$MV > mv$ because club does not stop

(16.) Likewise for the kinetic energies.

(a.) Same
(b.) Club is greater
(c.) Ball is greater
(d.) Depends on swing speed

$\frac{\frac{1}{2}MV^2}{\frac{1}{2}mv^2} = \frac{.17}{.046}\left(\frac{123}{182}\right)^2 \sim 1.7$