KEY

# Physics 110 Final Exam

Answer the following questions by bubbling the scantron sheet. MAKE SURE YOU PUT YOUR NAME! You are allowed to use a calculator and up to four cheat sheets. Good luck.

The following set of 8 questions refers to the series of pole vault problems we did in class. To refresh your memory, recall that we found for an 80 kg vaulter who runs into the pit at 10 m/s: (1) a force of 360 lbs was required for the pole to stop the vaulter in 2m; (2) the vaulter reached a maximum height of 5 m; (3) the vaulter compressed the springs of the pit (spring constant $k$ = 78,400 N/m) roughly 0.3 m when landing, feeling a force of roughly 3 tons. (If you need it, $\sqrt{2} = 1.4$ and $\sqrt{3} = 1.7$)

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If the vaulter's mass is 40 kg and the pole stop and the pit are the same (i.e. the pole always stops the vaulter in 2m and the springs of the mat have the same spring constant), answer the following questions:

(1.) What is the force on the vaulter?
- (a.) 360lbs
- (b.) 180 lbs
- (c.) 720 lbs
- (d.) 90 lbs
- (e.) 80kg

$m: \frac{1}{2} \Rightarrow KE: \frac{1}{2} \Rightarrow$ all $W: \frac{1}{2}$

$W_{pole} = F_{pole} \cdot x \Rightarrow F_{pole}: \frac{1}{2}$ ($x$: same)

(2.) How high would the vaulter go?
- (a.) 5m
- (b.) 2.5m
- (c.) 1.3m
- (d.) 10m
- (e.) 20m

$W_{grav}: \frac{1}{2} = mgH \leftarrow$ same ($H: \frac{1}{2}$)

(3.) How far would the mat compress?
- (a.) 0.3m
- (b.) 0.15m
- (c.) 0.6m
- (d.) 0.2m
- (e.) 1.2m

$W_s = kx^2: \frac{1}{2}$ $x: \frac{1}{\sqrt{2}} \Rightarrow 0.7(0.3m)$

(4.) What is the force of the mat on the vaulter?
- (a.) 4 tons
- (b.) 3 tons
- (c.) 2 tons
- (d.) 1.5 tons
- (e.) 16 tons

$F_s \cdot x: \frac{1}{2}$ ($x: \frac{1}{\sqrt{2}}$, $F_s: \frac{1}{\sqrt{2}}$) $\quad 0.7 \times 3$ tons

For the next five problems, assume you observe an 80 kg vaulter clear a height of 2.5m:

(5.) What is the pole's force on the vaulter?
- (a.) 360lbs
- (b.) 180 lbs
- (c.) 720 lbs
- (d.) 90 lbs
- (e.) 80kg

$H: \frac{1}{2} \Rightarrow W_{grav}: \frac{1}{2} \Rightarrow KE: \frac{1}{2}$

$F_{pole} \cdot x = \frac{1}{2}$

(6.) How fast did the vaulter enter the pit?
- (a.) 5m/s
- (b.) 2.5m
- (c.) 7 m/s
- (d.) 1.3m/s
- (e.) 20m/s

$\frac{1}{2}mv^2: \frac{1}{2}$ $v: \frac{1}{\sqrt{2}}$ $\quad 0.7 \cdot 10 m/s$

(7.) How far would the mat compress?
- (a.) 0.3m
- (b.) 0.15m
- (c.) 0.6m
- (d.) 0.2m
- (e.) 1.2m

$F_s \cdot x: \frac{1}{2}$ $x: \frac{1}{\sqrt{2}}$ $\quad 0.7$ $0.3$

$kx^2$