

# Week 10 Quiz

Thursday, December 3, 2020 1:07 PM

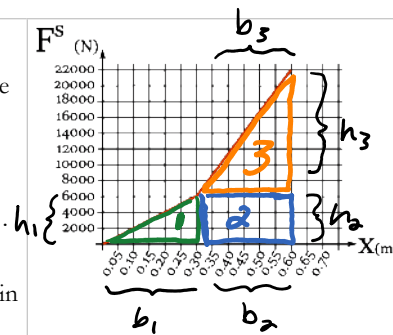
The news of Benny's successful weather probe launch last week travelled fast. Benny is now regarded as one of the world's most prestigious atmospheric researchers. Penn State University contacted Benny to design a new spring apparatus to launch a 0.50 kg weather probe. Benny came up with a design and plotted its spring force vs distance as shown in the graph below.

(a) What is the magnitude of work required to compress this spring apparatus from 0 to 0.60 meters?

(b) After the spring is compressed, the weather probe is placed on top of the spring. The weather probe is then launched vertically upwards by the spring. What is the sign of the work from the spring on the weather probe as the spring uncompresses? Explain your reasoning in words, phrases, diagrams, etc...

(c) After leaving the spring apparatus, while the probe is flying upwards, what is the sign of the work currently being done by gravity on the probe? Explain your reasoning in words, phrases, diagrams, etc...

(d) After the probe reaches its maximum height, it begins to fall back downwards. What is the sign of work currently being done by gravity on the probe as it is moving downwards. Explain your reasoning in words, phrases, diagrams, etc..



(a)  $Work = \vec{F} \cdot \Delta \vec{r} = \text{Area under } F(x) \text{ curve.}$

$A_1 + A_2 + A_3 = \frac{1}{2} b_1 h_1 + b_2 h_2 + \frac{1}{2} b_3 h_3 = 5100 \text{ J}$

(b)  $\vec{F}_{sp} \uparrow, \Delta \vec{r} \uparrow, w/ w = \vec{F} \cdot \Delta \vec{r} = F_{sp} \parallel \text{ to } \Delta \vec{r}, \text{ work is positive}$   
 ...also  $W = \Delta K, w/ \Delta K (+), W \text{ must be}$

(c)  $\vec{F}^g \downarrow, \Delta \vec{r} \uparrow, w/ \dots \vec{F}^g \text{ anti-} \parallel \text{ to } \Delta \vec{r}, \text{ work is negative}$   
 ...also " " ,  $w/ \Delta K (-)$

(d)  $\vec{F}^g \downarrow, \Delta \vec{r} \downarrow, w/ \dots \vec{F}^g \parallel \text{ to } \Delta \vec{r}, \text{ work is positive}$   
 ...also " " ,  $w/ \Delta K (+)$

**Rubric**

<p>~~ part (a) ~~                  2 pts - work = area under f(x) curve                  1.5 pts - finding area                  0.5 pt - answer + units</p>	<p>~~ part (b) ~~                  1.5 pts - reasoning                  0.5 pts - answer</p>	<p>~~ part (c) ~~                  1.5 pts - reasoning                  0.5 pts - answer</p>	<p>~~ part (d) ~~                  1.5 pts - reasoning                  0.5 pts - answer</p>
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