



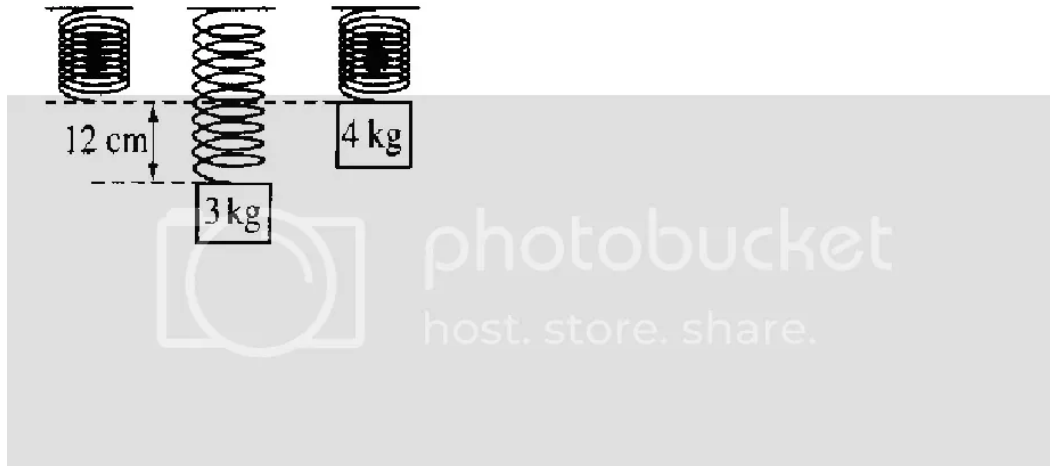
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### Question: 38. A block of mass 3.0 kg is hung from a spring,causing it to s...

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38. A block of mass 3.0 kg is hung from a spring,causing it to stretch 12 cm at equilibrium, as shown above. The 3.0 kg block is then replaced by a 4.0 kg block,and the new block is released from the position shown above, at which the spring is unstretched. How far will the 4.0 kg block fall before its direction is reversed?

- a. 9cm    b. 18cm    c. 24cm    d. 32cm    e. 48 cm

### Best Answer



GoldenMonkey answered this  
14,110 answers

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This is a tricky problem. Take it one step at a time.

First, the 3kg block allows you to find the spring constant,  $k$ . This is because the block is at equilibrium so you can write an expression for the forces being balanced:

$$kx = mg \quad \text{or} \quad k = mg/x = 3 * 9.8 / 0.12 = 245 \text{ N/m}$$

Now you can check out the info for the 4kg mass. The 4kg mass falls and you are asked to figure out how far it falls before its direction is reversed. At its lowest point it does stop momentarily, but be careful: it is NOT in equilibrium! Instead, we use conservation of energy!

The block drops a distance " $x$ ", and the spring is stretched the same distance  $x$ . When the block drops it loses potential energy of  $m g x$  and the spring stores PE of  $(1/2) k x^2$

These are equal, since energy is conserved, so:  $mgx = (1/2) kx^2$

$$\text{Or: } x = 2 m g / k = 2 * 4 * 9.8 / 245 = 0.32 \text{ meters or } 32 \text{ cm}$$

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### More Answers



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$F = ma$  assumes a constant force .... but the spring force is varying with  $x$ , so Newton's Law analysis is quite tricky and needs calculus.

In situations when ' $x$ ' is constant, perhaps equilibrium, you can use Newton 2 to get certain information. One example is a spring hanging from a support with a mass attached. When it stops moving the forces balance:  $F = kx = mg$

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ChemGenius answered this  
63 answers

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"Now you can check out the info for the 4kg mass. The 4kg mass falls and you are asked to figure out how far it falls before its direction is reversed. At its lowest point it does stop momentarily, but be careful: it is NOT in equilibrium! Instead, we use conservation of energy!"

I still have a question though. So, because the question doesn't ask for the "x" of the spring in equilibrium and instead asks for the "x" of when the block will reverse its direction.. you use the conservation of energy instead of:  $F=ma$ ? Do you only use  $F=ma$  when the springs are at equilibrium? I understand that there are still forces (spring force) on the block when it reaches the lowest point. That means  $F$  doesn't equal zero right? Therefore you cannot use  $F=ma$ ? Am I understanding this correctly? Thanks.=]

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Q: A block of mass 30 kg is hung from a spring, causing it to stretch 12 cm at equilibrium, as shown above. The 3.0 kg block is then replaced by a 40 kg block, and the new block is released from the position shown above, at which the spring is unstretched. How far will the 4.0 kg block fall before its direction is reversed? 9 cm 18 cm 24 cm 32 cm 48 cm

A: [See answer](#)

Q: 21. A block of mass 3.0 kg is hung from a spring, causing it to stretch 12 cm at equilibrium, as shown above. The 3.0 kg block is then replaced by a 4.0 kg block, and the new block is released from the position shown above, at which the spring is unstretched. How far will the 4.0 kg block fall before its direction is reversed?

A: [See answer](#) 100% (13 ratings)

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Q: 3. A block on a level surface is attached to one end of a spring, as shown in the figure above. The other end of the spring is attached to a wall. There is friction between the block and the surface. A person displaces the block from its equilibrium position and releases it. Which of the following shows the mechanical energy  $E$  as a function of time  $t$  for the system that includes...

A: [See answer](#) 100% (6 ratings)

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