Physics 131- Fundamentals of Physics for Biologists I

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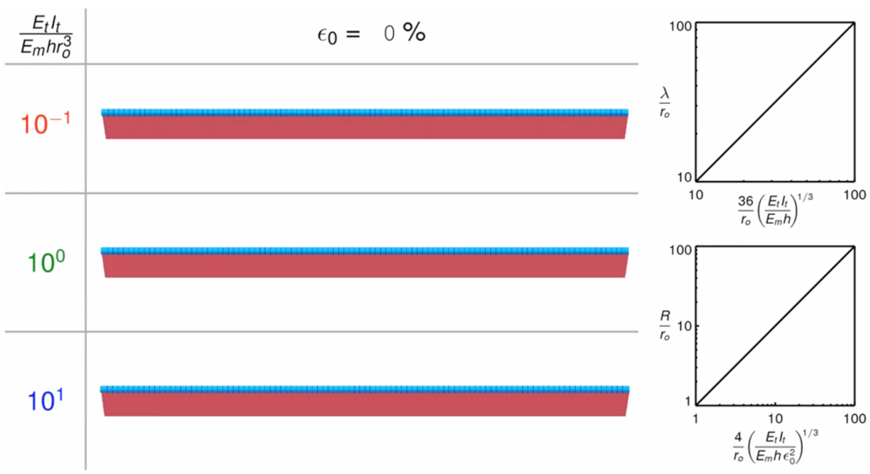
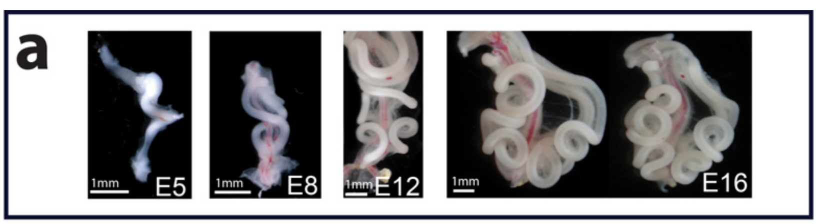
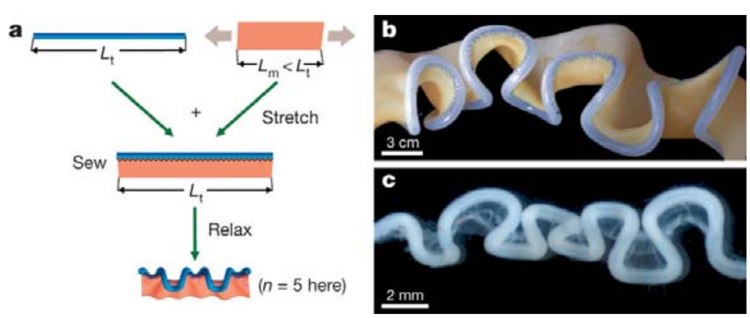


T Savin *et al. Nature* 476, 57-62 (2011) doi:10.1038/nature10277

The shape of the gut – can it be explained by simple physics?



Yes! A simple mechanical model with hose and stretched rubber sewn together captures the shape of the gut



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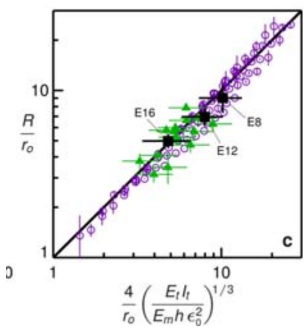
Model Prediction for radius of loops: $R \simeq 4(\frac{E_t I_t}{E_m h \varepsilon_0^2})^{1/3}$

How to show that the model works?

Log-log plots!



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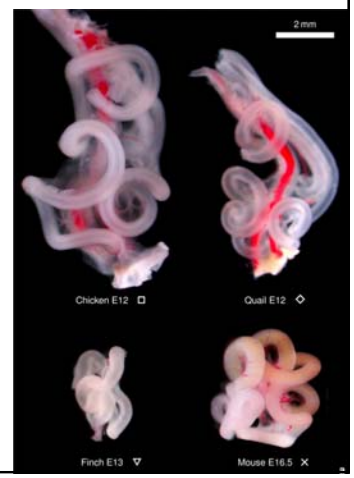

Outline

Quiz 9 Review

More on Potential Energy

Forces from PE

Moving to molecules

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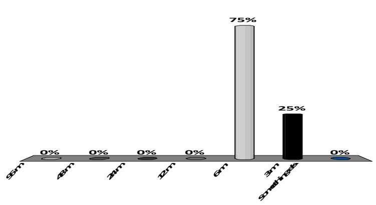
Quiz 9

Ave ~4

CORRECT	CD	A	A
main other	E	B	BD

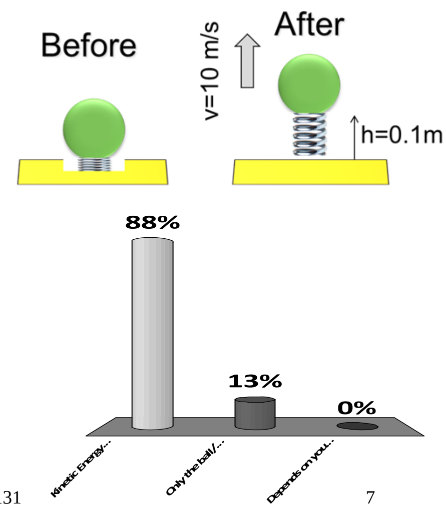
A spring-loaded toy dart gun is used to shoot a dart straight up in the air, and the dart reaches a maximum height of 24 m. The same dart is shot straight up a second time from the same gun, but this time the spring is compressed only half as far before firing. How far up does the dart go this time, neglecting friction and air resistance and assuming an ideal spring?

1. 96 m
2. 48 m
3. 24 m
4. 12 m
5. 6 m
6. 3 m
7. Something else



Comparing the before and after state, the spring pushes on both the ball and the earth giving them kinetic energy and momentum

1. Kinetic Energy change of ball/spring and earth is the same
2. Only the ball/spring changes Energy
3. Depends on your choice of system



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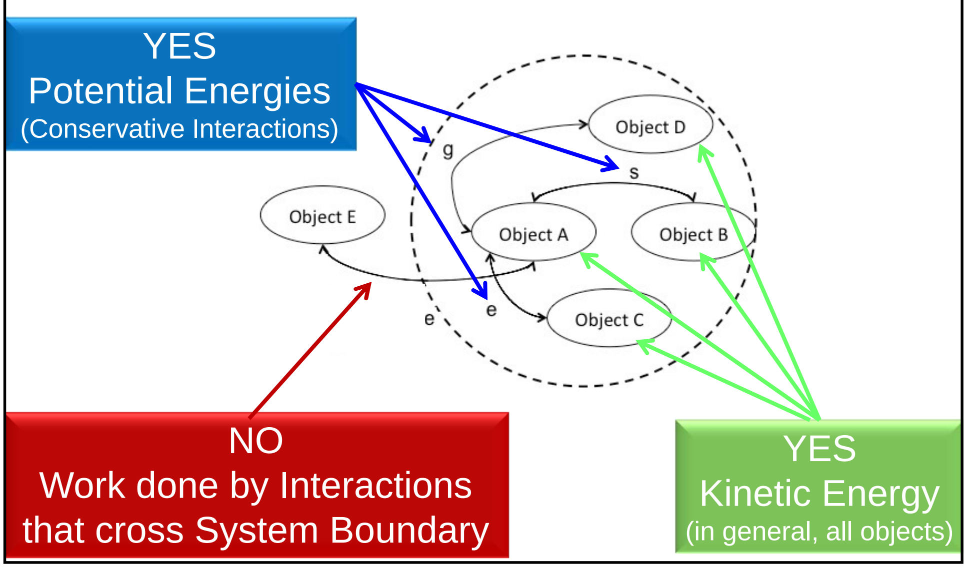
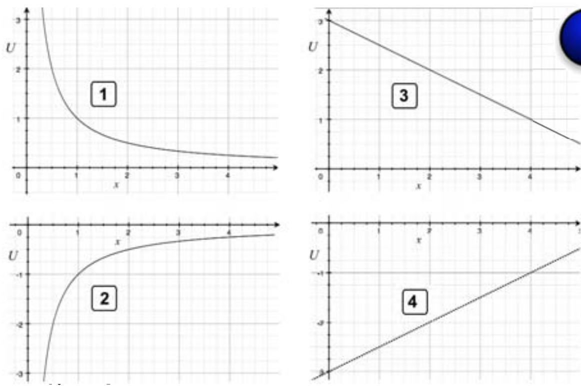
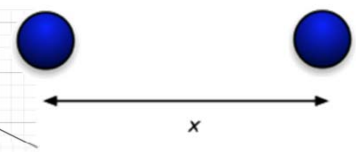
Which Energies add to Total Mechanical Energy?

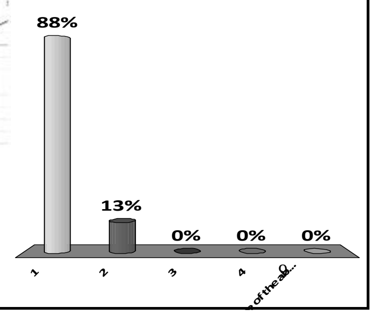


What does the electric potential energy between two identical charges look like?

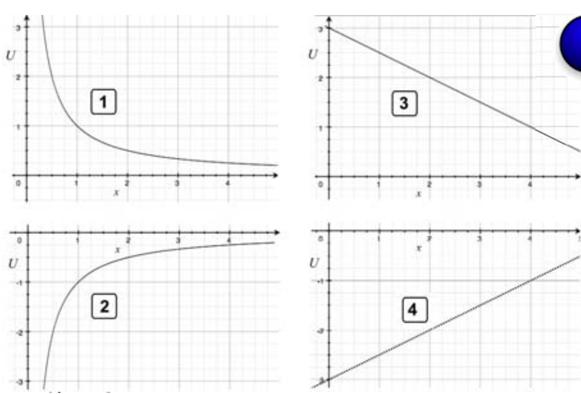


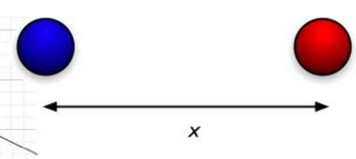


5. None of the above

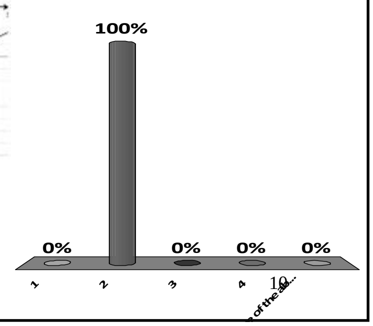


What does the electric potential energy between two opposite charges look like?

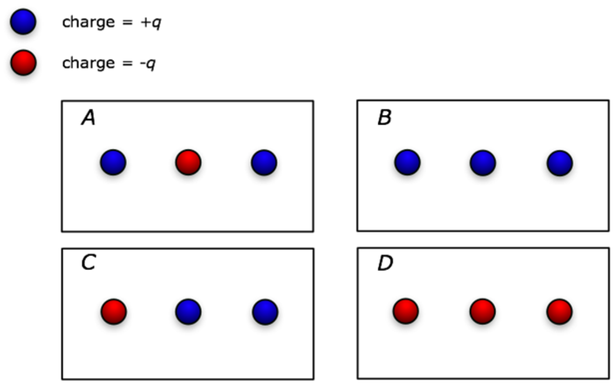




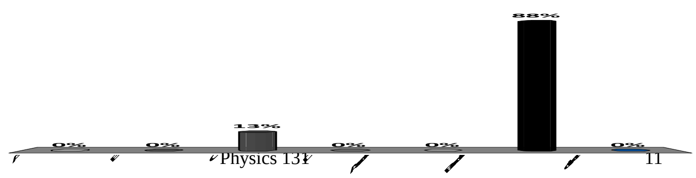
5. None of the above



Which group of charges has the largest potential energy



1. A
2. B
3. C
4. D
5. A and C
6. B and D
7. other



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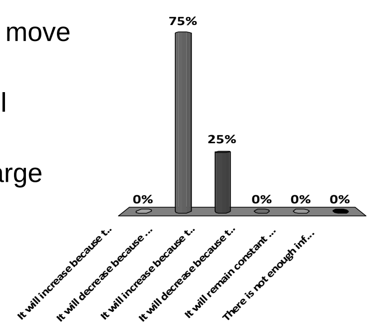
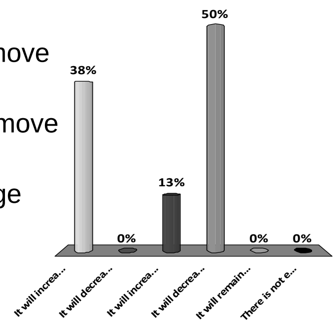
When a positive (test) charge is released from rest near a fixed positive (source) charge what happens to the electric potential energy of the interaction between the test charge and source.

1. It will increase because the test charge will move towards the source charge.
2. It will decrease because the test charge will move away from the source charge.
3. It will increase because the test charge will move away from the source charge.
4. It will decrease because the test charge will move towards the source charge.
5. It will remain constant because the test charge remains at rest.
6. There is not enough information to tell.



When a negative (test) charge is released from rest near a fixed positive (source) charge what happens to the electric potential energy of the interaction between the test charge and source?

1. It will increase because the test charge will move towards the source charge.
2. It will decrease because the test charge will move away from the source charge.
3. It will increase because the test charge will move away from the source charge.
4. It will decrease because the test charge will move towards the source charge.
5. It will remain constant because the test charge remains at rest.
6. There is not enough information to tell.



Foothold ideas: Forces from PE

- For conservative forces, PE can be defined by

$$\vec{F} \cdot \Delta\vec{r} = -\Delta U$$

- If you know *U*, the force can be gotten from it via

$$F_{\|}^{type} = -\frac{\Delta U_{type}}{\Delta r} = -\frac{dU_{type}}{dr}$$

- In more than 1D need to use the *gradient*

$$\vec{F}^{type} = -\vec{\nabla} U_{type}$$

- The force always points down the PE hill.