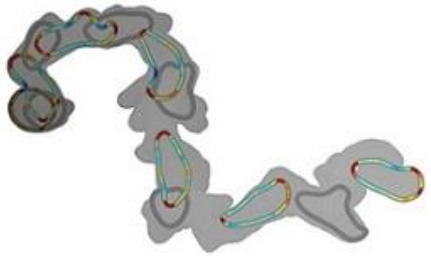
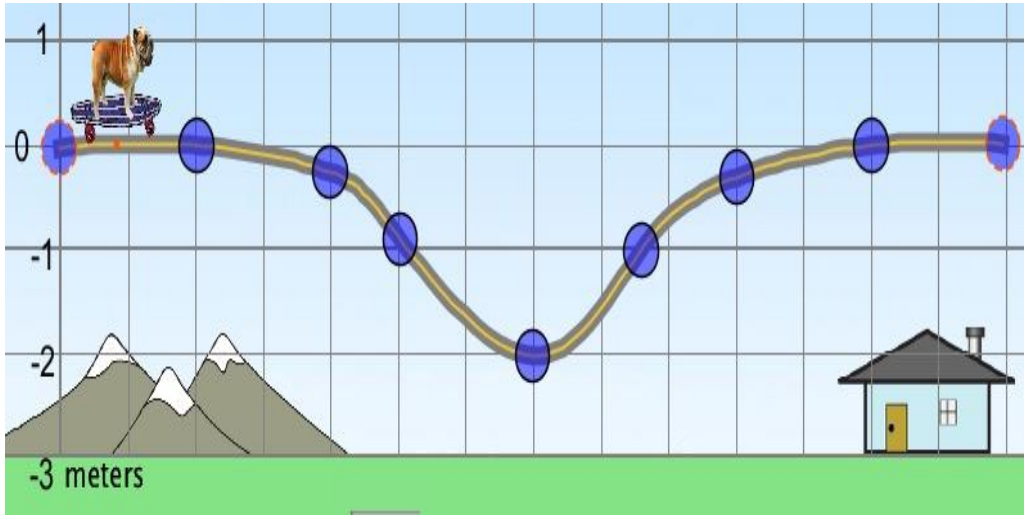
Physics 131- Fundamentals of Physics for Biologists I

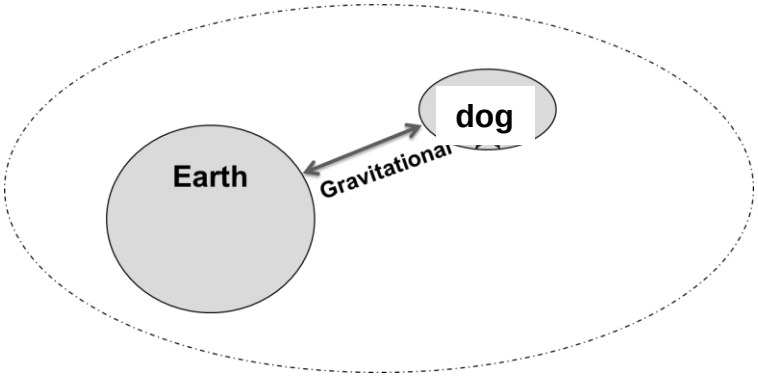


Forces from Potential Energy

Binding Energy

Conservation of Total Mechanical Energy





Forces from Potential Energy (PE)

- For conservative forces, PE can be defined by

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

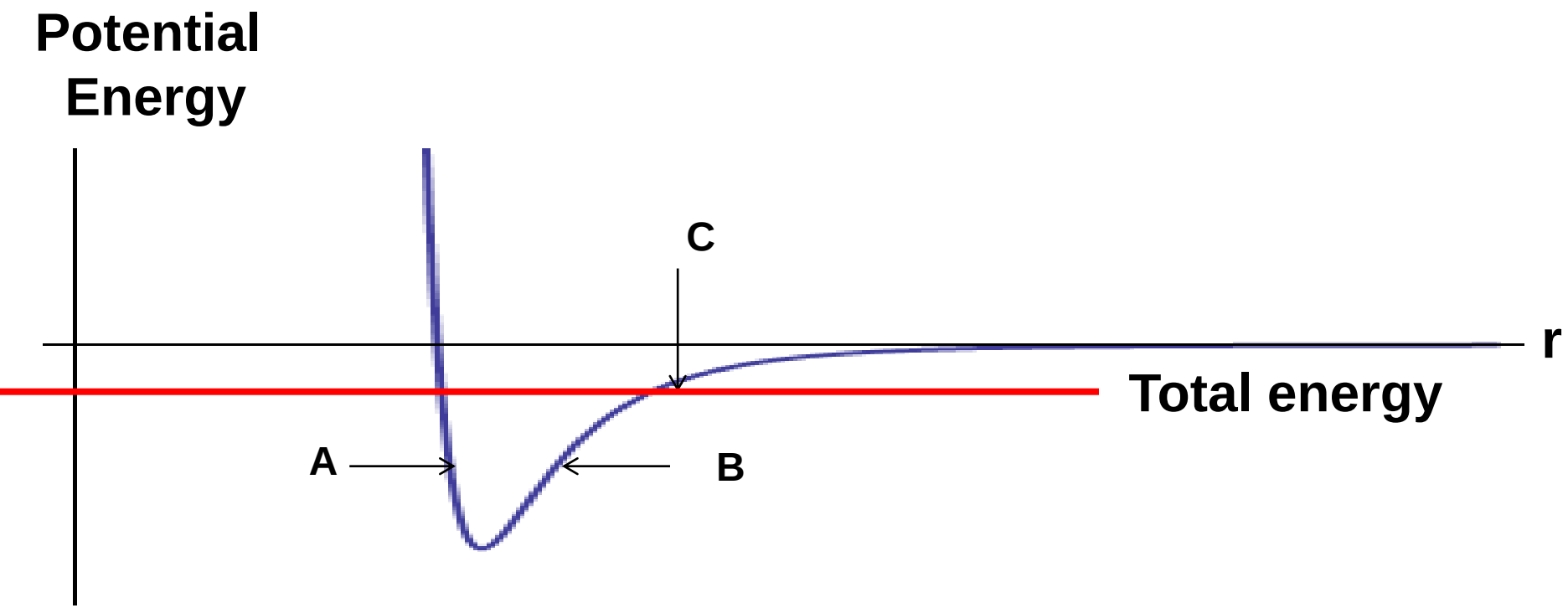
- If you know *U*, the force can be gotten from it via

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

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

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

- The force always points <u>down</u> the PE hill.

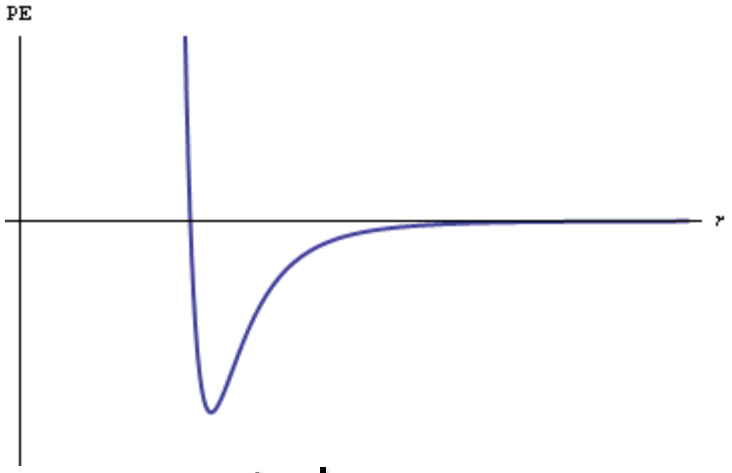


What is the **velocity** and **force** at point A,B,C
Consider both magnitude and direction!

Draw the vectors on the whiteboard

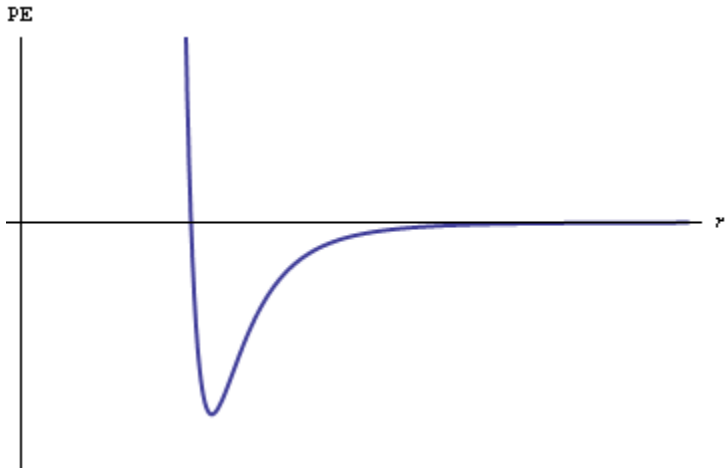
Whiteboard, TA & LA

You know that two atoms that are far apart are barely interacting. How is this represented visually in the PE diagram?



1. The potential energy approaches zero as r gets large.
2. **The PE curve is close to horizontal as r gets large.**
3. The PE curve is close to vertical as r gets small.
4. The potential energy has a minimum.
5. More than one of these
6. The PE diagram doesn't demonstrate this information
7. None of these

These two atoms can exist in a stable bound state. How is this represented visually in the PE diagram?



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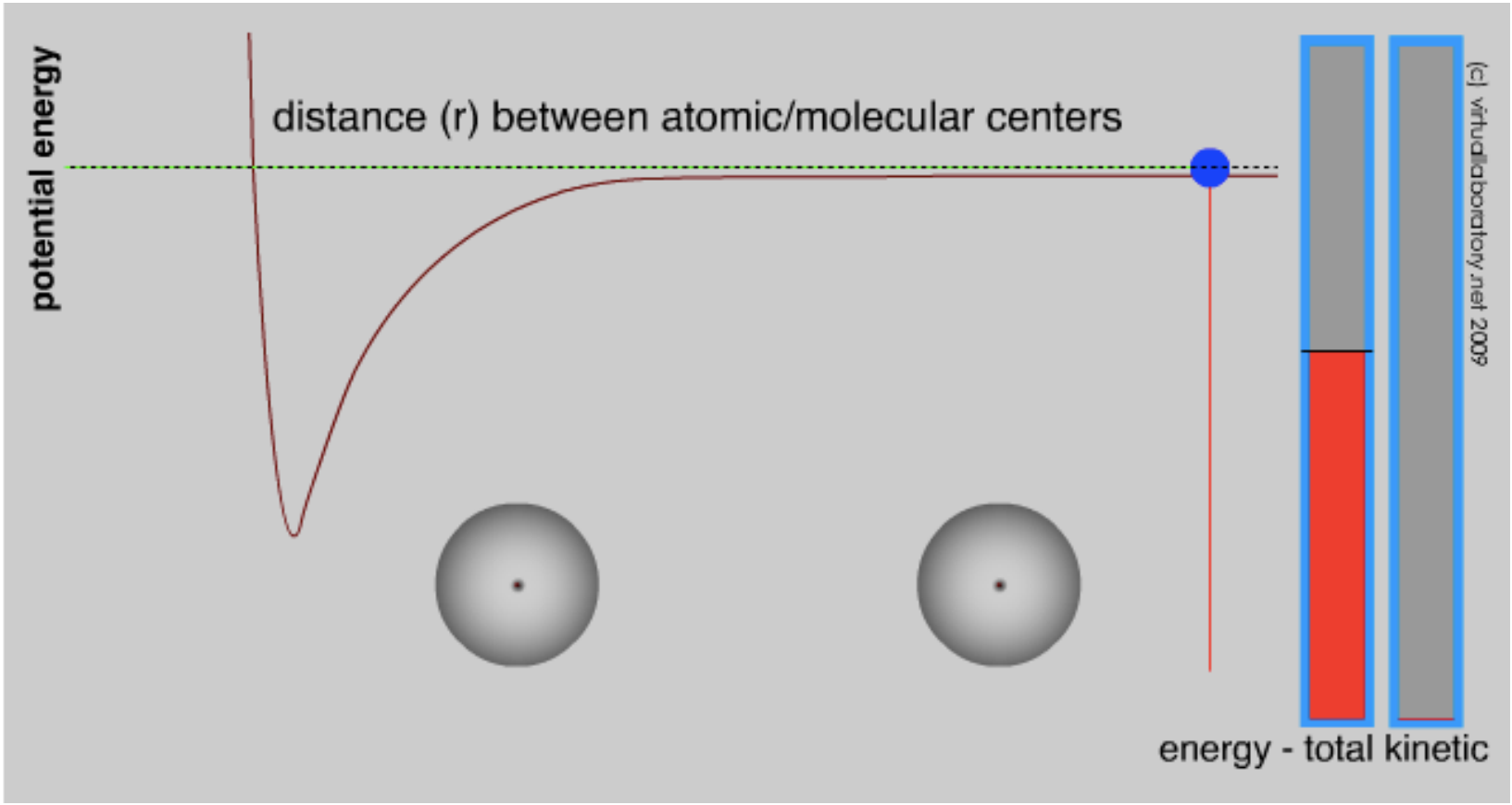
Molecular forces



http://besocratic.colorado.edu/CLUE-Chemistry/activities/LondonDispersionForce/1.2-interactions-0.html

Energies between charge clusters

- Atoms and molecules are made up of charges.
- The potential energy between two charges is

$$U_{12}^{elec} = \frac{k_C Q_1 Q_2}{r_{12}}$$

No vectors!

- The potential energy between many charges is

$$U_{12\ldots N}^{elec} = \sum_{i<j=1}^{N} \frac{k_C Q_i Q_j}{r_{ij}}$$

Just add up all pairs!