

Physics 131- Fundamentals of Physics for Biologists I



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Outline

- Quiz 5
- Momentum
- Emergent Phenomena
- Random Motion

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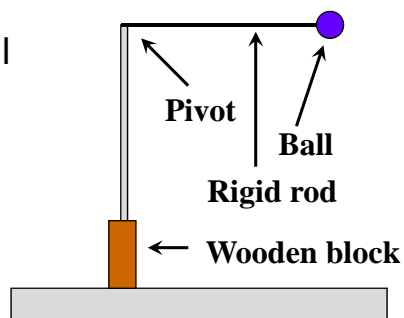
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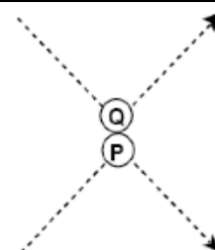
Which ball is more likely knock the block over?



1. A bouncy superball
2. A non-bouncy clay ball of equal mass
3. Both
4. Neither

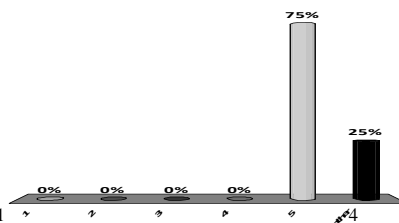


The diagram at the right depicts the path of two colliding steel balls rolling on a table. Which set of arrows best represents the direction of the change in momentum of each ball?




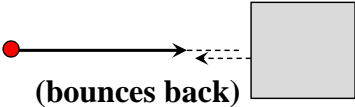
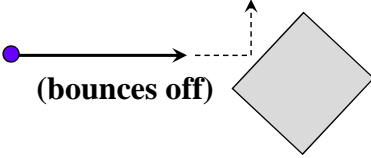
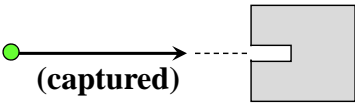
- (1) (2) (3) (4) (5)
1. 1
 2. 2
 3. 3
 4. 4
 5. 5
 6. other

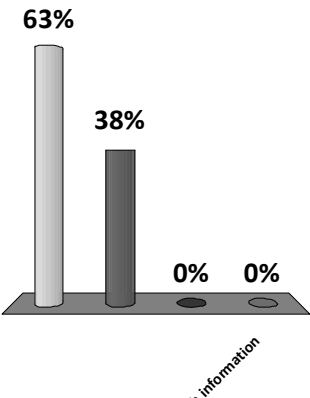
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A ball on a table sliding and hitting a block.
Which ball exerts the most force on the block?



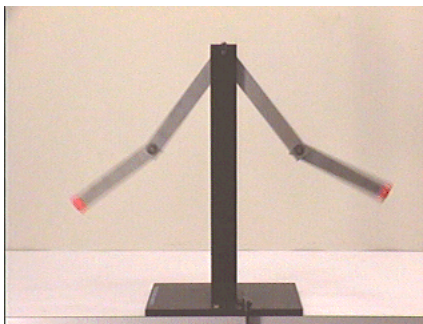
1.  (bounces back)
2.  (bounces off)
3.  (captured)
4. Not enough information



| Option | Percentage |
|---------------------------|------------|
| 1. (bounces back) | 63% |
| 2. (bounces off) | 38% |
| 3. (captured) | 0% |
| 4. Not enough information | 0% |

- How well can we predict motion when the system gets more complicated?

Example: Double pendulum

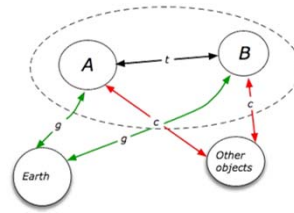


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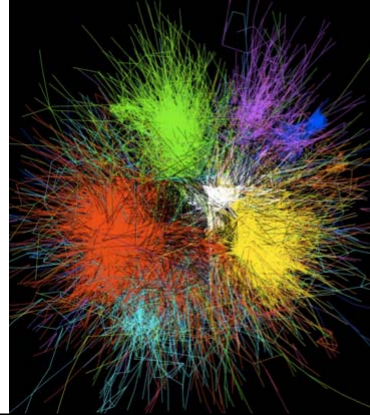
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- So far we have studied about 1-5 objects.



- to study cells, fluids, etc
 - LOTS of objects
 - MANY interactions



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Chaos

- Its impossible to predict motion very accurately if interactions and objects become more complex

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Models should be as simple as possible but not simpler

The question: Can the properties of a system can be explained in terms of the properties of its component parts (so, biology can be explained by chemistry, chemistry by physics)?

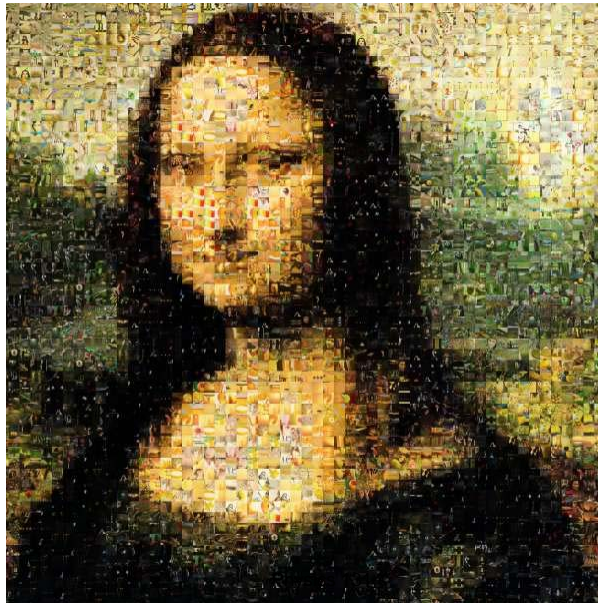
Emergence –means that some phenomena are undetectable when looked at “in the small”. They emerge only when looking at the system as a whole rather than its parts.

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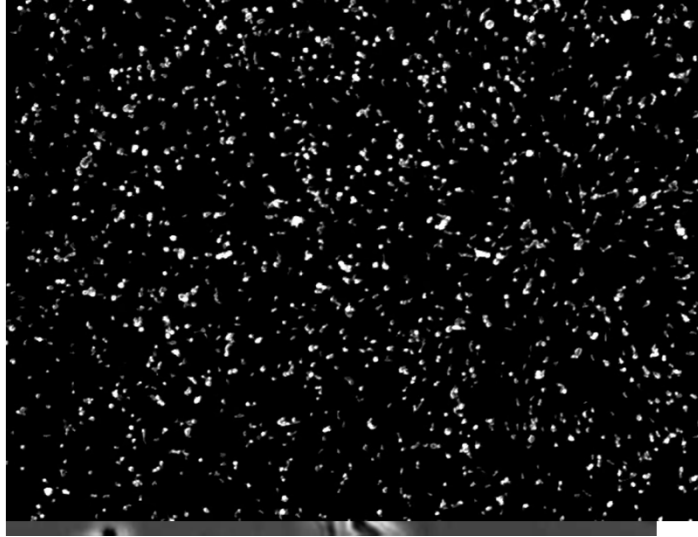
Example of emergence



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Biological Example of Emergence



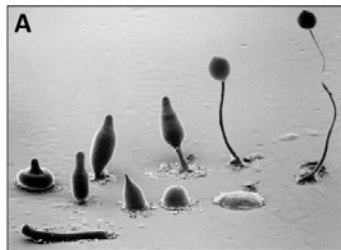
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Biological Example of Emergence

Spores



Brain



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