

A black hole with a glowing accretion disk against a starry background. The black hole is a dark, circular void in the center, surrounded by a swirling, multi-colored ring of gas and dust. The colors range from dark purple and blue to bright yellow and white. The background is a dense field of stars of various colors, including white, yellow, and red, set against a dark, almost black space.

# Microenergy and Machines

By: Alex C., Jackie W., Colin W.

# Micro-Scale Energy

A Newton's cradle with five black spheres hanging from thin wires against a dark gray background. The spheres are arranged in a horizontal line, with the rightmost sphere slightly higher than the others.

- Two main categories of micro-scale energy
  - Potential Energy
  - Kinetic Energy
- Sub Energies - Fall under KE or PE
  - Chemical
  - Electrical
  - Nuclear
  - Thermal
- Mass Energy

# Mass Energy Pt. 1

- Mass of the object  $\neq$  the amount of matter in the object.
- Instead, the mass of the object is calculated by:
  - $M_{\text{object}} = M_{\text{parts}} + M_{\text{extra}}$ 
    - Where  $M_{\text{extra}} = (KE + PE + E_{\text{thermal}}) / c^2$
    - $c$  is the speed of light.

# Mass Energy Pt.2

- From that, we can see that mass depends on these two factors:
  - How are the parts of the object arranged within the bigger object.
    - Difference in potential energy.
  - How are the parts moving within the bigger object.
    - Difference in kinetic energy. (Heat created by friction, which is the difference in thermal energy).

# Mass Energy Pt.3

- As a review, I will bring up the fact that:
  - All atoms have less mass than than the combined masses of the protons, neutrons, and electrons that make them up.
  - HOW?
  - Because Potential Energy can be negative.
  - HOW?
  - Good question.

# Mass Energy Pt.4

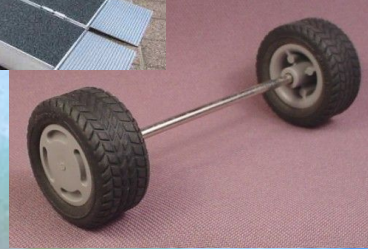
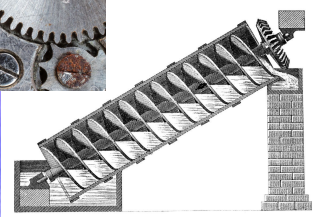
- Let us say that a proton and an electron are infinitely far away from each other, which means we have infinite amount of potential energy (even though there is no infinite energy).
- Set this amount to the reference number 0, so now we have 0 potential energy.
- Now we push both the proton and the electron toward each other, potential energy decreases from 0.
- We have **NEGATIVE** potential energy!!



**MASS IS ENERGY!**

# The Middle Class

- Simple machines
  - Only use directly applied force
  - Accomplish tasks in a single motion



- $Work_{in} = Work_{out}$ 
  - $\int F dx$  (Integral of a force vs. distance graph)
  - FORCE & distance = force & DISTANCE



# The Middle Class

- Mechanical Advantage ( $F_{\text{out}} / F_{\text{in}}$ )
  - Lever:  $MA_{\text{lever}} = \text{length}_{\text{in}} / \text{length}_{\text{out}}$
  - Ramp:  $MA_{\text{ramp}} = \text{length} / \text{height}$
  - Pulley:  $MA_{\text{pulley}} = \# \text{ of pulley blocks}$
- Efficiency ( $W_{\text{out}} / W_{\text{in}}$ )
  - $W_{\text{in}} = W_{\text{out}} \rightarrow \text{Efficiency} = 100\%$
  - In a perfect world... YES
  - In our world... NO

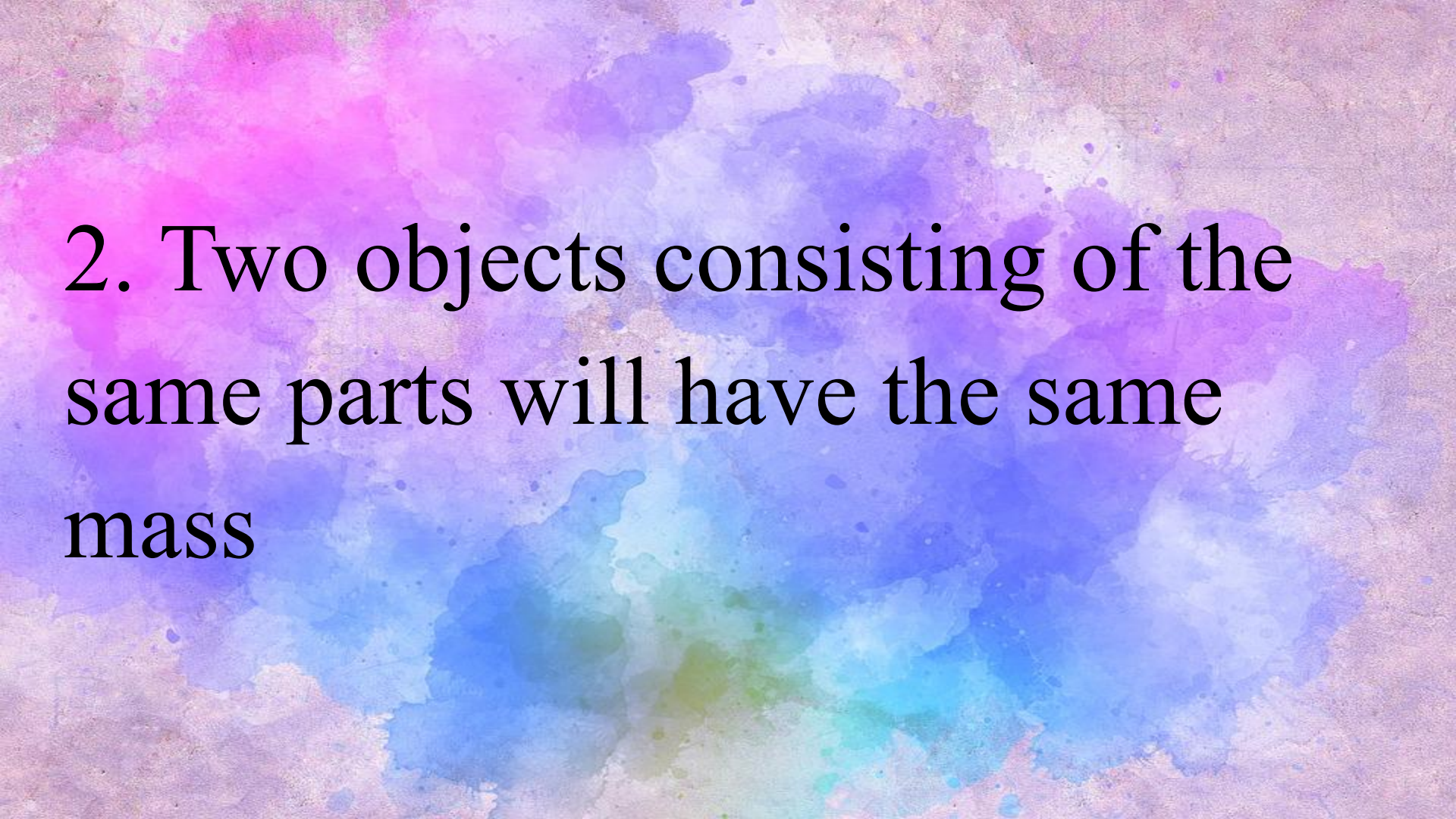
The background is a watercolor-style wash of colors, primarily purple, blue, and green, with some pink and white tones. The colors are blended and have a soft, painterly texture. The text is centered over this background.

# Common Misconceptions

By Nadia C., Maya U., Alex M.



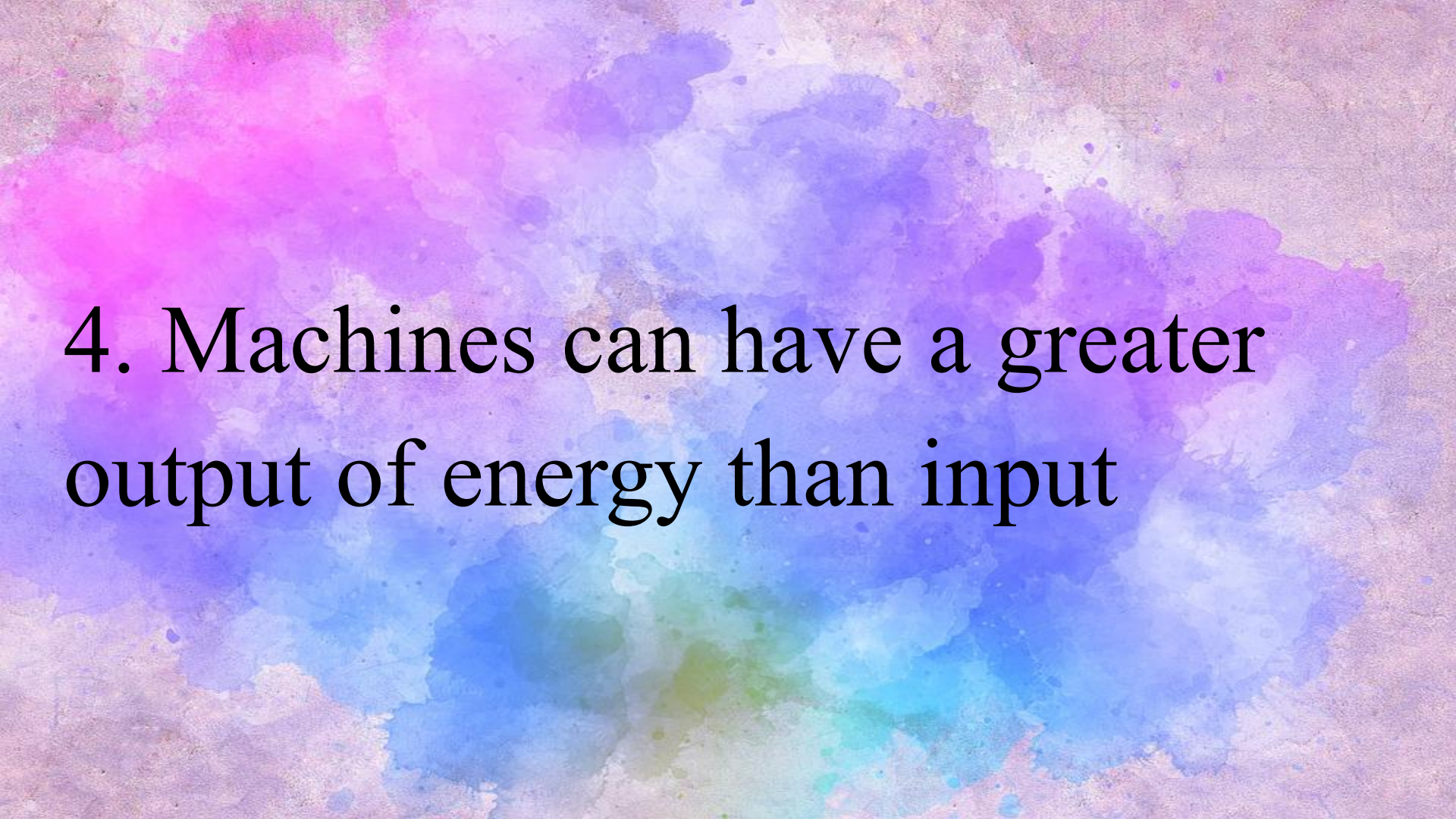
1. Mass can be converted into  
energy

A watercolor-style background with soft, blended colors. The top left features shades of pink and purple, transitioning into a large, central area of light blue and lavender. Below this, there are patches of teal and green, all set against a light, textured background that resembles aged paper or canvas.


2. Two objects consisting of the same parts will have the same mass



3. Potential energy can only be positive

A watercolor-style background with soft, blended colors. The top left features shades of pink and purple, transitioning into deep blues and purples in the center. The bottom portion shows lighter blues and hints of green. The overall texture is soft and painterly.

4. Machines can have a greater  
output of energy than input



5. If a force is exerted on an object it must do work



6. Kinetic energy solely depends  
on speed



# Kahoot!

<https://create.kahoot.it/share/micro-scale-energy-and-machines/b230ea58-2ac1-4edd-ab26-07ef0010471f>