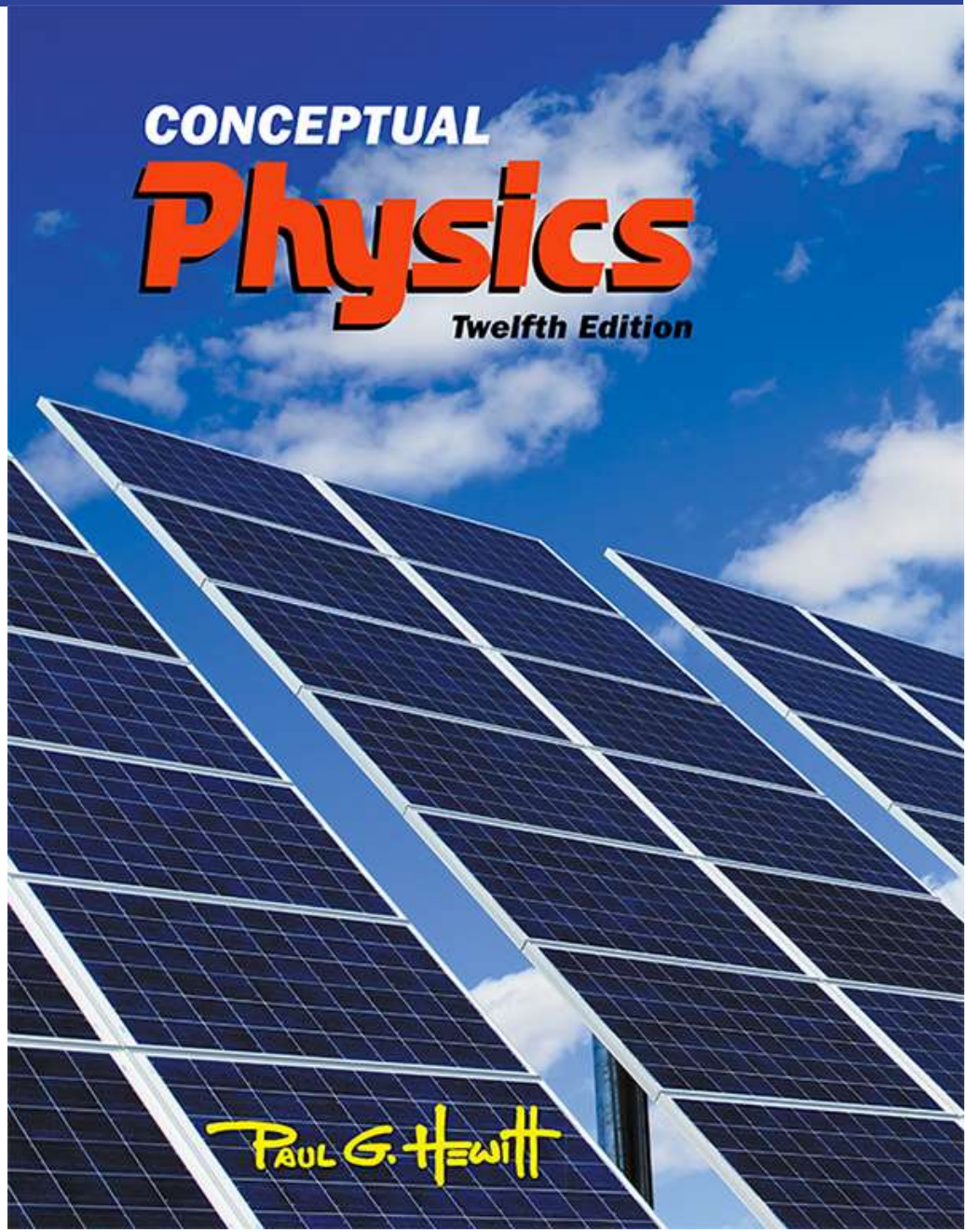
Lecture Outline



Chapter 7: Energy

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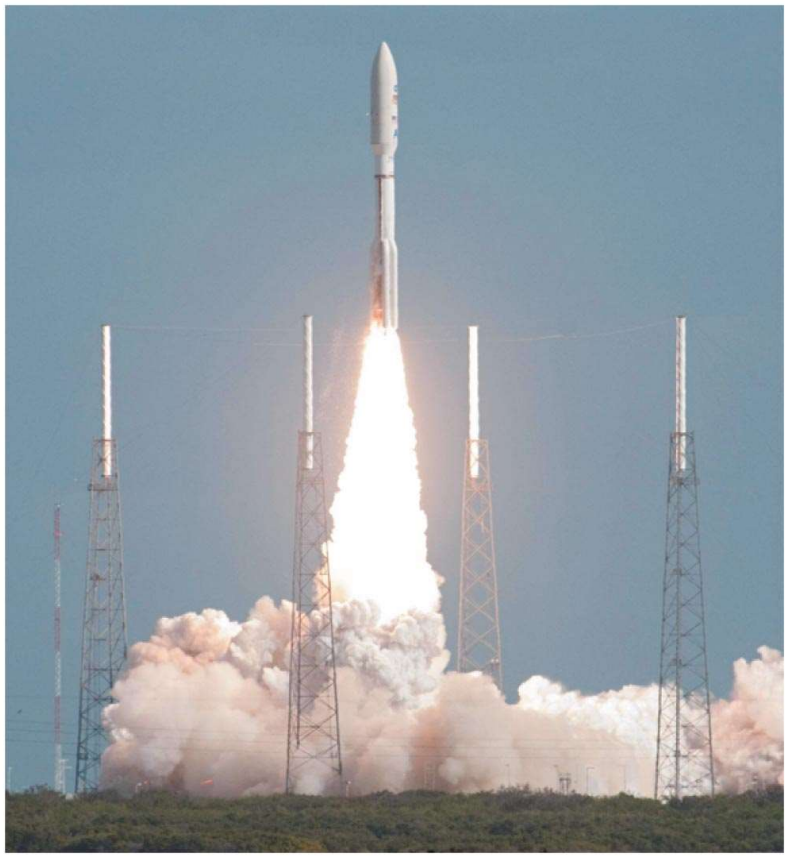
Power

- Power:
  - Measure of how fast work is done
  - In equation form:

$$Power = \frac{work\ done}{time\ interval}$$



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Power

- Example:
  - A worker uses more power running up the stairs than climbing the same stairs slowly.
  - Twice the power of an engine can do twice the work of one engine in the same amount of time, or twice the work of one engine in half the time or at a rate at which energy is changed from one *form* to another.

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Power

- Unit of power
  - joule per second, called the watt after James Watt, developer of the steam engine
    - 1 joule/second = 1 watt
    - 1 kilowatt = 1000 watts

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Mechanical Energy

- Mechanical energy is due to position or to motion, or both.
- There are two forms of mechanical energy:
  - Potential energy
  - Kinetic energy

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Potential Energy

- Stored energy held in readiness with a potential for doing work
- Example:
  - A stretched bow has stored energy that can do work on an arrow.
  - A stretched rubber band of a slingshot has stored energy and is capable of doing work.

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Potential Energy—Gravitational

- Potential energy due to elevated position
- Example:
  - water in an elevated reservoir
  - raised ram of a pile driver

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Potential Energy—Gravitational

- Equal to the work done (force required to move it upward x the vertical distance moved against gravity) in lifting it
- In equation form:
  - Potential energy

    = mass x acceleration due to gravity x height

    = *mgh*

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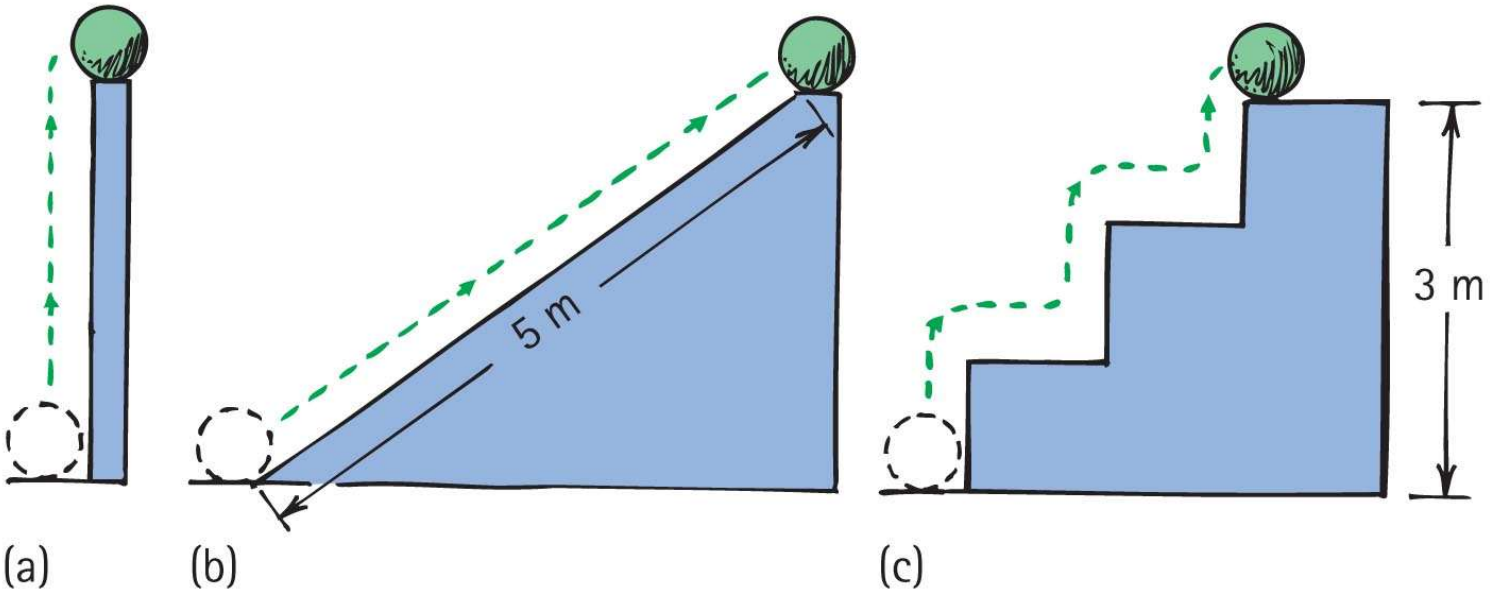
Potential Energy

- Example: Potential energy of 10-N ball is the same in all 3 cases because work done in elevating it is the same.



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Kinetic Energy

- Energy of motion
- Depends on the mass of the object and square of its speed
- Include the proportional constant 1/2 and kinetic energy = 1/2 x mass x speed x speed
- If object speed is doubled $\Rightarrow$ kinetic energy is quadrupled.

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Kinetic Energy

- Kinetic energy and work of a moving object
  - Equal to the work required to bring it from rest to that speed, or the work the object can do while being brought to rest
  - In equation form: net force x distance = kinetic energy, or $Fd = 1/2\ mv^2$

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