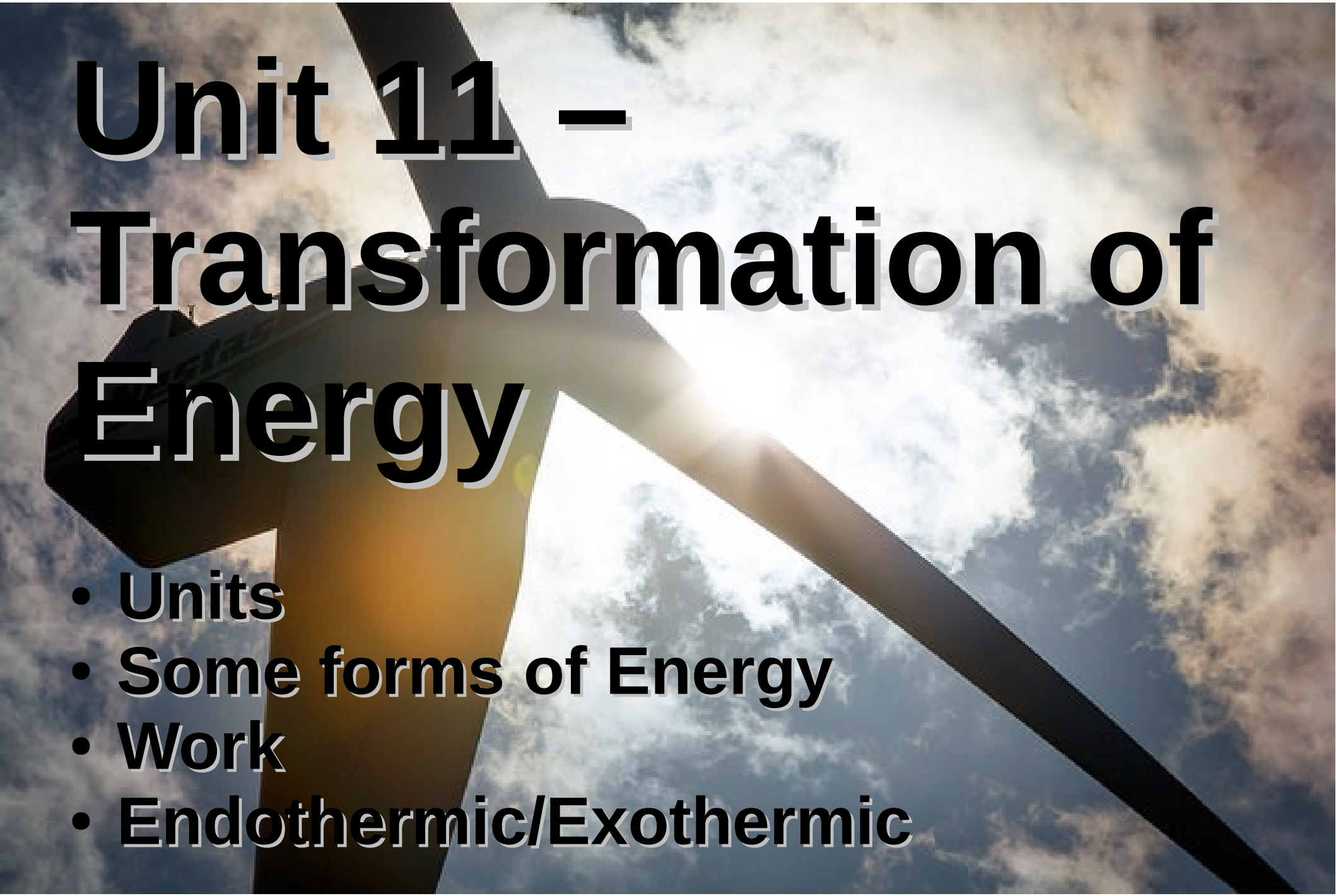


Unit 11 – Transformation of Energy

- Units
- Some forms of Energy
- Work
- Endothermic/Exothermic

Competencies

The student will be able to:

- define work and the relationship between work, force and displacement
- define the relationship between mass and weight
- define the relationship between work and energy
- define potential energy ($U = mgh$), kinetic energy ($K = \frac{1}{2} mv^2$) and to perform simple calculations.
- define Heat and the relationship between heat energy, specific heat capacity, mass and temperature variations and to perform simple calculations ($Q = mC\Delta T$).
- define Exothermic and Endothermic Reactions
- state the law of conservation of energy

Energy

What is energy? - “Bank analogy”

Units of Energy

SI-Unit: Joules [J]

Other Units: 1 kWh = 3.6 x 10^6 Joules

Hydro-Quebec

4.184 Joules [J] = 1 calorie [cal] (exact)

1 Calorie [Ca]) = 1 kilocalorie [kcal] = 1000 calories [cal]

Often given for food

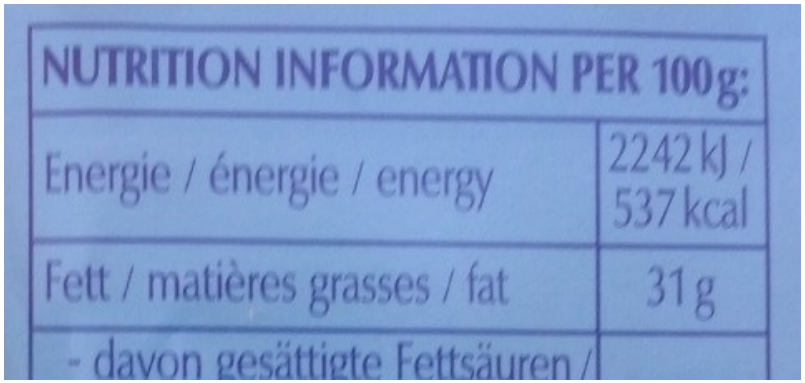


Image: Nutrition information on Swiss Chocolate
Stefan Bracher

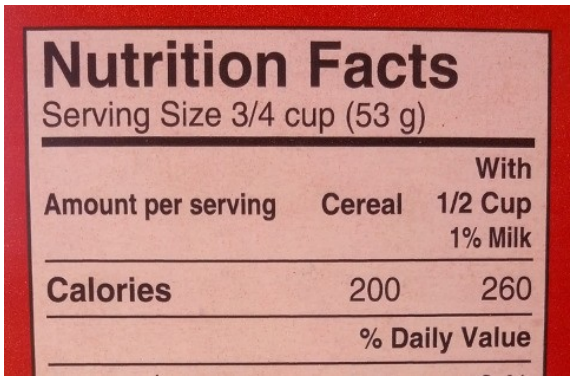


Image: Nutrition information on Cereals
Stefan Bracher

→ Calculate the energy (in Joules) of a Food item

Forms of Energy

Forms of Energy:

- Mechanic (Kinetic and Potential)
- Heat
- Chemical
- Electric
- Nuclear
- …

Kinetic Energy

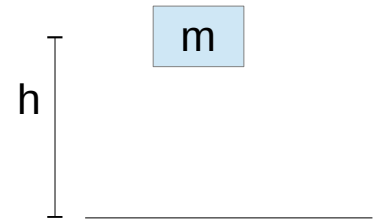
$$KE = \frac{1}{2} m v^2$$

m → v

Potential (gravitational) Energy

$$U = PE_g = m g h$$

g: gravitational constant [9.8 N/kg]
m: mass [kg]
mg: weight [N] → Competency!!!



Heat

$$Q = \Delta E_{th} = mc \Delta T$$

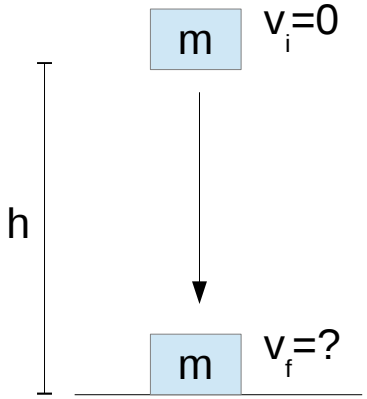
c: specific heat capacity

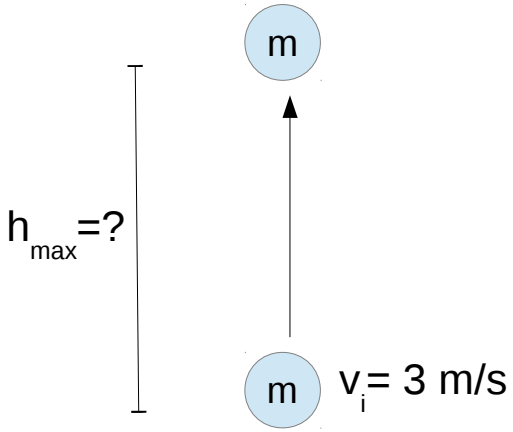
Image: **„Heat“ by Stefan Bracher**

→ Do Unit XI Problems 7-12, 3-5

Law of conservation of Energy

Law of conservation of Energy: Energy can not be created or destroyed. The total amount of energy is always constant, but it changes from one form to another.





m=5 kg, g=9.8 m/s^2

Law of conservation of Energy

Law of conservation of Energy: Energy can not be created or destroyed. The total amount of energy is always constant, but it changes from one form to another.

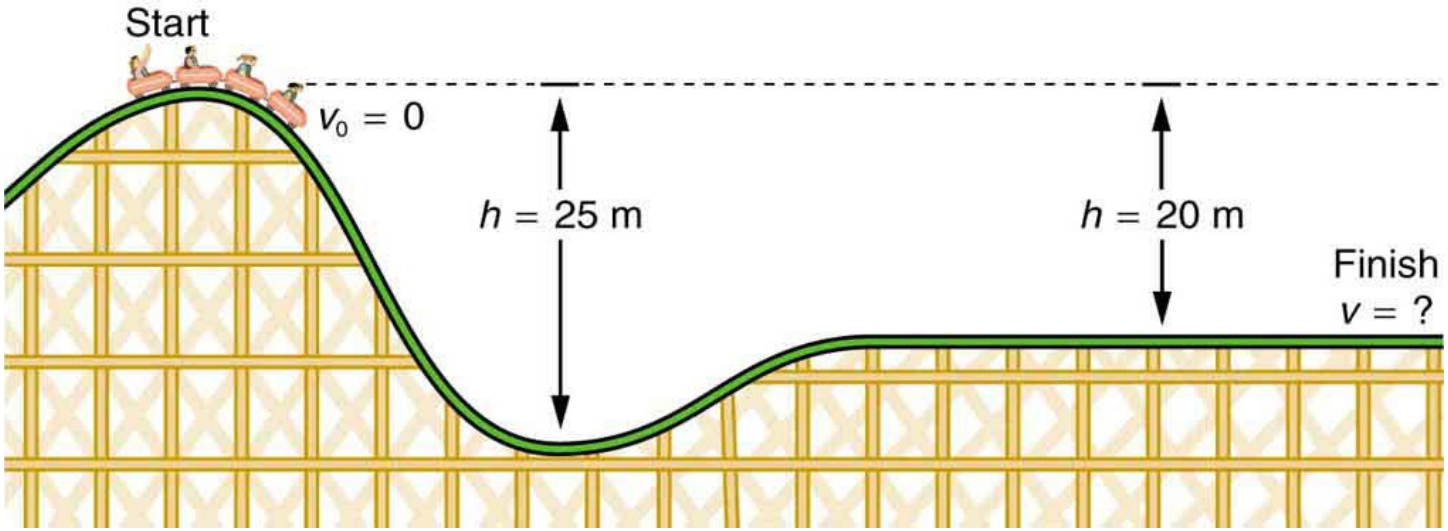


Image: **OpenStax, College Physics. OpenStax CNX. 25. Feb. 2016**
http://cnx.org/contents/Ax2o07UI@9.30:RTxYH8A6@7/Gravitational-Potential-Energy

→ Do Unit XI Problems 6, 1-2

Work

Exchange of Energies through Work

Work

The part of the force that is parallel to the displacement

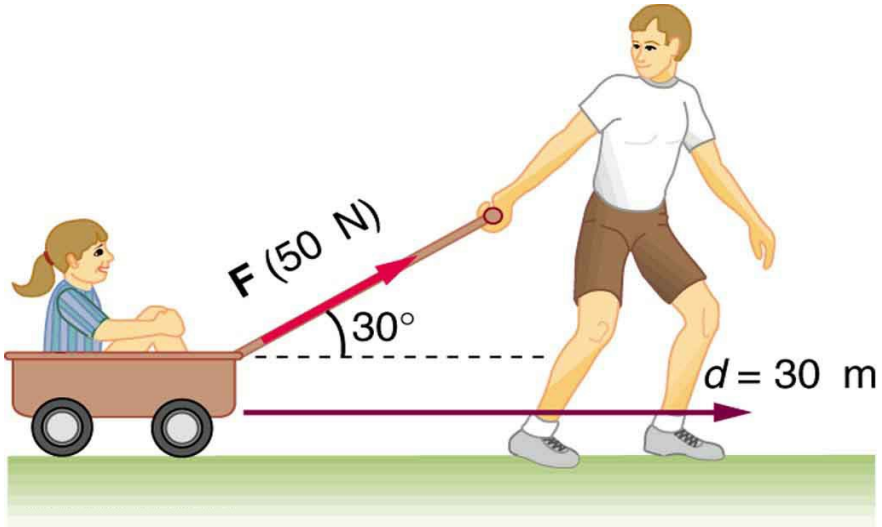
$$W = F_{II} \cdot d = F \cdot d \cdot \cos(\Theta)$$

SI-Units

Force:	Newtons [N]
Distance:	meters [m]
Work:	Joules [J]

$$E_f = E_i + W_{ext}$$

Examples:



Calculate the work done if you pull with 50 N :

- straight forward

- upward

- at an angle of 30° as shown

Work

Exchange of Energies through Work

Work

The part of the force that is parallel to the displacement

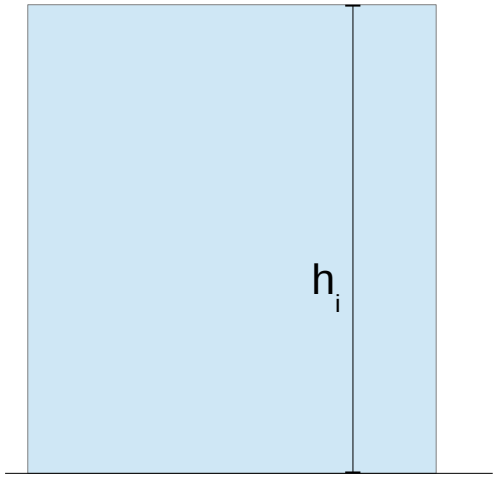
$$W = F_{II} \cdot d = F \cdot d \cdot \cos(\Theta)$$

SI-Units

Force:	Newtons [N]
Distance:	meters [m]
Work:	Joules [J]

$$E_f = E_i + W_{ext}$$

Examples:



How much work is needed to transport a 75 kg person to the top of a building of 10. m height?

How much chocolate would the person need to do so?

Exothermic and Endothermic Processes

Exothermic processes: - Release heat (Temperature goes up)
- Continue by themselves

Endothermic processes: - Absorb heat (Temperature goes down)
- Need a constant source of energy to continue

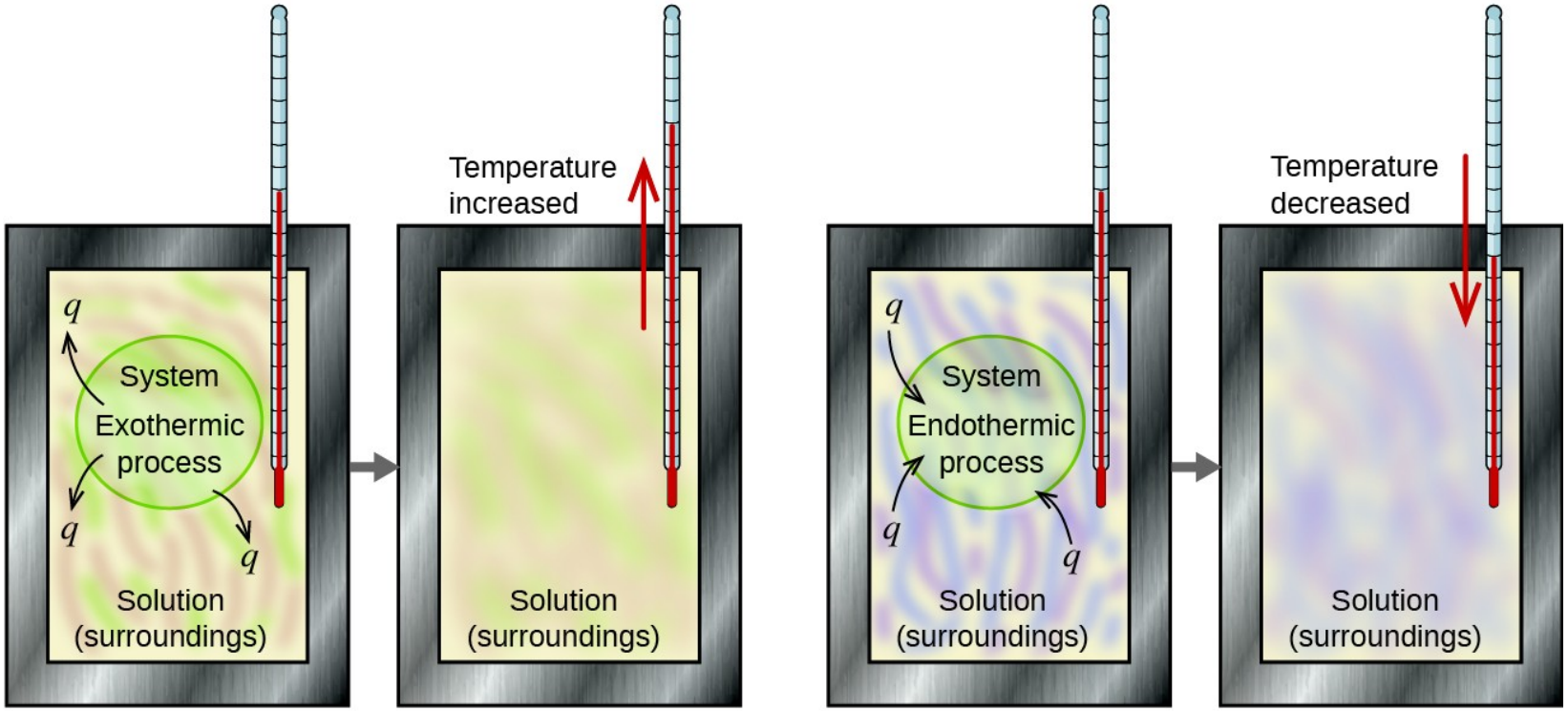


Image: **OpenStax, College Chemistry. OpenStax CNX. 13. Okt. 2015**
http://cnx.org/contents/85abf193-2bd2-4908-8563-90b8a7ac8df6@9.110:30/Calorimetry

→ Do Unit XI Problems 13-14

Additional Resources

- Work, Energy and Energy Ressources, OpenStax „College Physics“
http://cnx.org/contents/Ax2o07Ul@9.30:ZDtuSt4h@2/Introduction-to-Work-Energy-an

- Thermochemistry, OpenStax „College Chemistry“
http://cnx.org/contents/havxkyvS@9.280:YRqBrVc4@4/Introduction