

# Energy Transformation Notes

Energy – ability to cause change

EVERYTIME A CHANGE OCCURS ENERGY IS PRESENT

Law of Conservation of Energy – Energy can *NEVER* be created or destroyed, only transferred




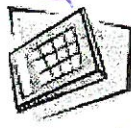













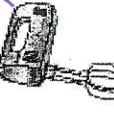






Examples:

- Solar calculator (light to electrical)
- Windmill (mechanical to electrical)
- Glow stick (chemical to light)
- Firecracker (chemical to sound and light)

Turbine – device used to change energy sources into useable electricity by rotating it

- Any time electricity needs to be used it requires the use of a turbine

# Energy Transformation Game

<b>Sun</b>  <i>nuclear → radiant</i>	<b>Windmill</b>  <i>E<sub>K</sub> → mech</i>	<b>Microwave</b>  <i>elec → radiant → mech → sound</i>	<b>Solar Calculator</b>  <i>radiant → elec</i>	<b>Crane</b>  <i>chem → mech</i>	<b>Satellite Dish</b>  <i>radiant → elec → sound</i>	<b>Siren</b>  <i>elec → sound</i>
<b>Tanning Bed</b>  <i>elec → radiant</i>	<b>Nuclear Power Plant</b>  <i>nuclear → HE → elec → mech</i>	<b>Hot-air Balloon</b>  <i>chem → HE → elec</i>	<b>Magnifying Glass</b>  <i>radiant → HE</i>	<b>Candle</b>  <i>chem → HE → light</i>	<b>Electric Guitar</b>  <i>elec → mech → sound</i>	<b>Firecracker</b>  <i>chem → HE → light → sound</i>
<b>Battery</b>  <i>chem → elec</i>	<b>Piano</b>  <i>mech → sound</i>	<b>Light Bulb</b>  <i>elec → light → HE</i>	<b>Mixer</b>  <i>elec → mech → sound</i>	<b>Iron</b>  <i>elec → HE</i>	<b>Lightstick</b>  <i>chem → light</i>	<b>Bicycle</b>  <i>chem → EK → mech</i>
<b>Television</b>  <i>elec → light → sound</i>	<b>Person Eating</b>  <i>mech → chem → mech</i>	<b>Plant</b>  <i>radiant → chem</i>				

Em = Electromagnetic  
T = Thermal

E = Electrical  
C = Chemical  
N = Nuclear

Mp = Mechanical (potential)  
Mk = Mechanical (kinetic)

# FORMS OF ENERGY

All forms of energy fall under two categories



## POTENTIAL

Potential energy is stored energy and the energy of position (gravitational)



### CHEMICAL ENERGY

Chemical energy is the energy stored in the bonds of atoms and molecules. Biomass, petroleum, natural gas, propane and coal are examples of stored chemical energy.

### NUCLEAR ENERGY

Nuclear energy is the energy stored in the nucleus of an atom. It is the energy that holds the nucleus together. The nucleus of a uranium atom is an example of nuclear energy.

### STORED MECHANICAL ENERGY

Stored mechanical energy is energy stored in objects by the application of a force. Compressed springs and stretched rubber bands are examples of stored mechanical energy.

### GRAVITATIONAL ENERGY

Gravitational energy is the energy of place or position. Water in a reservoir behind a hydropower dam is an example of gravitational potential energy. When the water is released to spin the turbines, it becomes kinetic energy.

## KINETIC

Kinetic energy is energy in motion. It is the motion of waves, electrons, atoms, molecules and substances



### RADIANT ENERGY

Radiant energy is electromagnetic energy that travels in transverse waves. Radiant energy includes visible light, x-rays, gamma rays and radio waves. Solar energy is an example of radiant energy.

### THERMAL ENERGY

Thermal energy (or heat) is the internal energy in substances; it is the vibration and movement of atoms and molecules within substances. Geothermal energy is an example of thermal energy.

### MOTION

The movement of objects or substances from one place to another is motion. Wind and hydropower are examples of motion.

### SOUND

Sound is the movement of energy through substances in longitudinal (compression/rarefaction) waves.

### ELECTRICAL ENERGY

Electrical energy is the movement of electrons. Lightning and electricity are examples of electrical energy.

### Energy Transformation Worksheet

Identify the different types of energy transformation in each of the pictures  
Record the answer to each question (10 points each) in your science notebook on page 12a (or right after your energy foldable notes)



1) **Windmill**  $E_k \rightarrow mech$   
Energy Transformation:

*turbine*  $E_k \rightarrow mech \rightarrow elec$   
*wind*



2) **Flashlight**  
Energy Transformation:

$chem \rightarrow elec \rightarrow light$



3) **Microwave**

Energy Transformation:

$elec \rightarrow radiant \rightarrow E_k \rightarrow HE$



4) **Firecracker**

Energy Transformation:

$chem \rightarrow HE \rightarrow sound$   
 $\hookrightarrow light$



5) **Bicycle**

Energy Transformation:

$chem \rightarrow E_k \rightarrow mech$



6) **Battery**

Energy Transformation:

$chem \rightarrow elec$

Give an example where the following energy changes would take place:

7) Electrical to Thermal

waffle maker

8) Chemical to Thermal

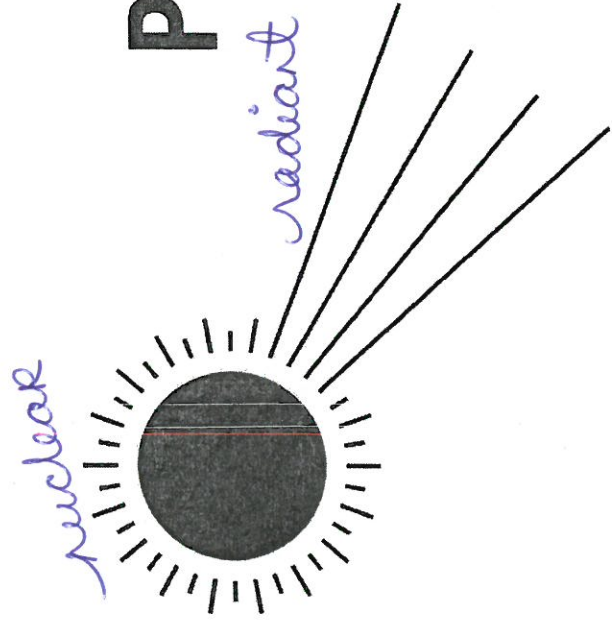
burning log

9) Electrical to Mechanical

fan

10) Radiant to Chemical

photosynthesis



# PHOTOSYNTHESIS



In the process of photosynthesis, plants convert radiant energy from the sun into chemical energy in the form of glucose, or sugar.

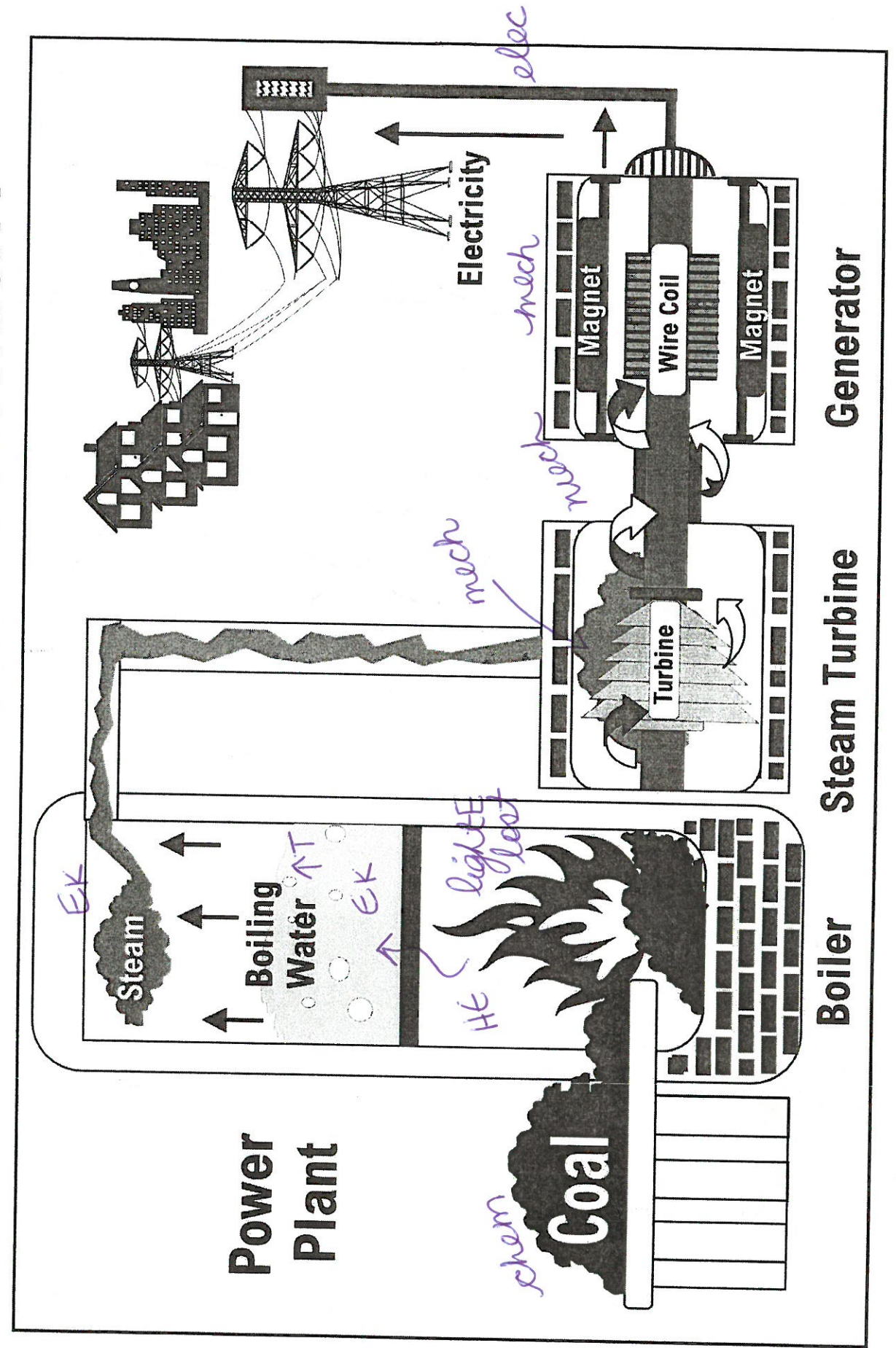
*photosynthesis*

*cellular respiration*



*"endothermic"*  
= energy on the reactant side

# BURNING COAL TO MAKE ELECTRICITY



**Support activities – Concept review**

**E&S5**

Concept review: energy transformations, forms of energy, natural energy sources, renewable and nonrenewable energy sources

# Energy

1. Complete the sentences, using the words in the box below. You will not need all the words.

- |          |                |             |                  |
|----------|----------------|-------------|------------------|
| • change | • movement     | • renewable | • transfer       |
| • forms  | • nonrenewable | • sources   | • transformation |

a) Energy is the ability to effect change. There are many natural sources of energy: solar energy, hydraulic energy, tidal energy, energy from waves and ocean currents, wind energy, biomass, fossil energy, geothermal energy and nuclear energy.

b) A renewable energy source is a source of energy that is regenerated naturally and in sufficient quantities compared to its rate of use. A

non-renewable energy source is a source of energy that is not regenerated naturally or that is not regenerated in sufficient quantities compared to its rate of use.

c) Energy transformation is the changing of energy from one form to another. Energy transfer is the movement of energy from one place to another.

d) Energy exists in many forms, including thermal energy, radiation energy, chemical energy and mechanical energy.

2. What form of energy fits each of the following descriptions?

a) energy derived from the speed of an object, its mass and its position in relation to objects around it

$E_k = \frac{1}{2}mv^2$

b) energy stored in molecular bonds

$E_p$  (chem potential E)

c) energy contained in and carried by an electromagnetic wave

electromagnetic (radiant)

d) energy derived from the random motion of all the particles in a substance

thermal E

( $E_k$ )

3. Match each of the following forms of energy with the correct description.

- |               |   |   |   |
|---------------|---|---|---|
| a) wind       | • | → | A. energy from moving water   |
| b) fossil     | • | → | B. energy stored in air masses and harnessed from the wind          |
| c) hydraulic  | • | → | C. energy from chemical elements such as uranium                    |
| d) solar      | • | → | D. energy from the transformation of plants into mineral substances |
| e) tidal      | • | → | E. energy from the tides  |
| f) geothermal | • | → | F. energy from the sun's rays                                       |
| g) nuclear    | • | → | G. energy from the Earth's internal heat                            |

4. Check the energy sources that are renewable.

- |                      |                                     |                     |                                     |
|----------------------|-------------------------------------|---------------------|-------------------------------------|
| a) geothermal energy | <input checked="" type="checkbox"/> | e) hydraulic energy | <input checked="" type="checkbox"/> |
| b) solar energy      | <input checked="" type="checkbox"/> | f) wind energy      | <input checked="" type="checkbox"/> |
| c) fossil energies   | <input type="checkbox"/>            | g) nuclear energy   | <input type="checkbox"/>            |
| d) tidal energy      | <input checked="" type="checkbox"/> |                     |                                     |

5. What form of energy is used in each of the following situations?

- |   |                  |
|---|------------------|
| a) A lamp lights up the room.                   | <u>radiant</u>   |
| b) An apple gives me energy.                    | <u>chem</u>      |
| c) The ball my brother threw broke the window.  | <u>Ek (mech)</u> |
| d) I use the microwave oven to warm up my soup. | <u>radiant</u>   |
| e) The sun melts the snow in the spring.        | <u>thermal</u>   |

6. For each of the following statements, write the form of energy that will result from the energy transformation described.

- |  |                |
|--|----------------|
| a) You turn on an electric radiator.         | <u>thermal</u> |
| b) Gas powers your car.                      | <u>mech</u>    |
| c) The nuclear power plant begins operation. | <u>elec</u>    |



Spheres: Biosphere = living things = B  
 Atmosphere = air = A  
 Lithosphere = earth = L  
 Hydrosphere = water = H  
 GHG = green house gas (CO<sub>2</sub> CH<sub>4</sub> H<sub>2</sub>O)

### Worksheet on different types of energy

Each type of energy has its advantages and disadvantages. Research each source and complete the table below.

NIMBY = not in my backyard

AR = acid rain

R/NR

Energy source	Source always available	Good points	Bad points	When/where is the source worth exploiting?	Sphere
Solar	No sun	low maintenance silent no GHG no AR free	during day need sun	only when certain places	A
Wind Nimby	No wind	no GHG no AR safe	need wind threat to animals	only where windy	A
Wave Nimby	No waves	no GHG no AR	hazardous for marine animals	near oceans	H
Biomass	garbage crops	cheap absorb CO <sub>2</sub> if grown	create CO <sub>2</sub> takes up space to grow	only if enough land to grow	B
Geothermal	More near volcanoes	no GHG no AR		volcanoes	L
Hydropower		no GHG cheap/free more reliable	people displacement kill animals H <sub>2</sub> O in water	river	H
Tides		no GHG predictable	close to land disruption	shores	H
Coal	FF running out	cheap	GHG! AR! SO <sub>2</sub> scenery NO <sub>x</sub>	transport deposits	L
Oil	FF running out	lots cheaper	GHG drilling transport	deposits	L
Natural gas	FF running out	less polluting than coal 70% L CO <sub>2</sub>	GHG \$	deposits	L
*NR Nuclear power		no GHG no AR only small amount needed	nuclear waste accidents		L

amt of U is finite in the Earth

\* debatable!

Renewable = an energy source / fuel type that regenerate + can replenish itself indefinitely ( & does not pollute)

