

# Part 7 The Environment

Name: \_\_\_\_\_

## Part 7 Lesson 1

<p>We talk about consuming, or using up material resources, but actually we _____consume any matter. We only_____some of the earth's resources for a while, taking them from the earth, carrying them to another part of the globe, processing them, using them, and then discarding, reusing, or recycling them.</p>	<p>In the process of using matter we may change it to another _____, but in every case we neither create nor destroy any measurable amount of matter. This results from the _____ _____ In any physical or chemical change, matter is neither created nor destroyed but merely changed from one form to another.</p>	<p>When you throw away something, remember there is _____. Everything we think we have thrown away is still here with us in one form or another.</p>
<p>How does this affect environmental science? Although we can certainly make the environment cleaner, the law of conservation of matter says we will_____ be faced with pollution of some sort. This means that we must _____one form of pollution for another.</p>	<p>This _____ involves making controversial scientific, political, economic, and ethical _____ about what is a dangerous pollution level, and to what degree a pollutant must be _____. and what amount of money we are willing to pay to reduce the amount of a pollutant to a harmless level.</p>	<p>The "_____" society found in most industrial countries is based on using more and more of the earth's _____ and _____ resources at a faster and faster rate. The earth receives a _____ flow of energy from the sun, but for all practical purposes _____ matter enters or leaves the earth.</p>

### First Law of Thermodynamics

This is the law of the conservation of \_\_\_\_\_. It states that energy can neither be \_\_\_\_\_, nor can it be \_\_\_\_\_. This means that the total amount of energy in the universe always remains conserved, or constant. However, energy can be changed from one \_\_\_\_\_ to \_\_\_\_\_. The definition of energy is the ability to do W \_\_\_\_\_. Thus, with energy, biochemical reactions, the processes of life, can proceed.

Please describe how The Second Law of Thermodynamics and the idea of TINSTAAFL "No free Lunch" are connected to the cheap plastic toy below. It was made in Taiwan.

\_\_\_\_\_

\_\_\_\_\_

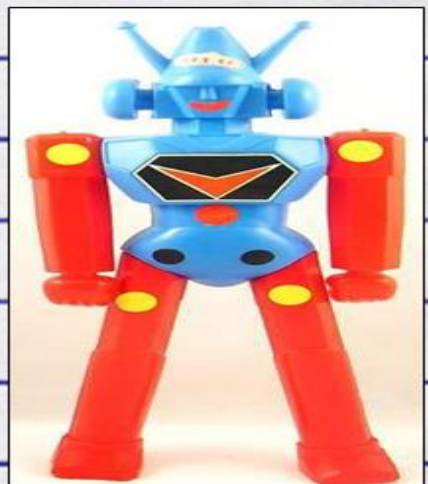
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\_\_\_\_\_

\_\_\_\_\_



Even with such a technological advance, the second energy law tells us that as we use more and more energy to transform matter into products and then recycle these products, the disorder in the environment will increase. Thus the second energy law tells us that the more we try to order, or "conquer" the earth, the greater the disorder we put into the environment.

We will always attempt to order the environment to some extent for our benefit, but the second energy law helps us understand that we should do so with ecological wisdom, care, and restraint.

What does this mean?

What does this mean?



Cradle



Grave

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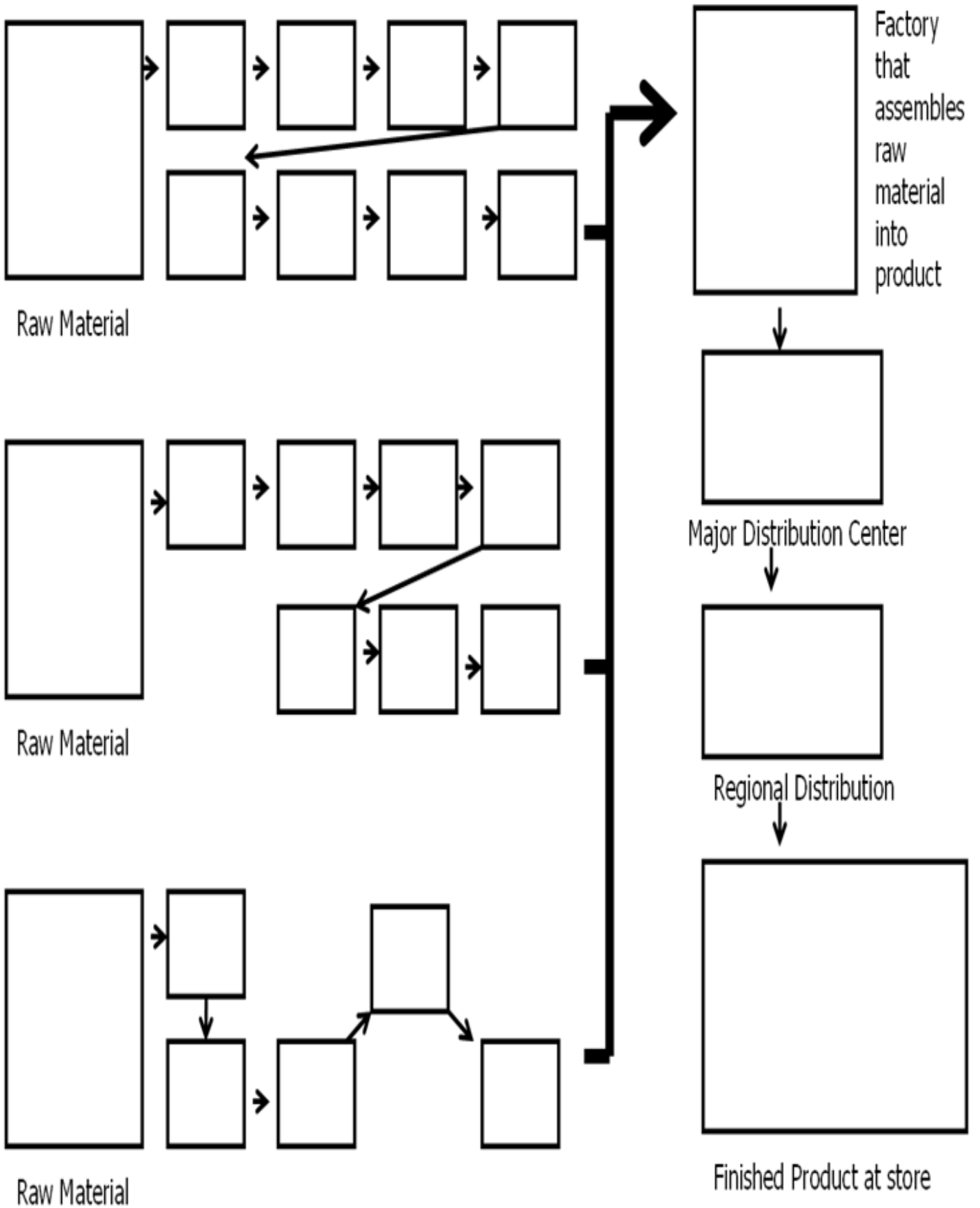
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Part 7 Lesson 2 Energy Flow

Examining energy flow

- Please find one thing on your person and draw it in your science journal.
- What is it made of?
- Where was it made?
- Where was it purchased?



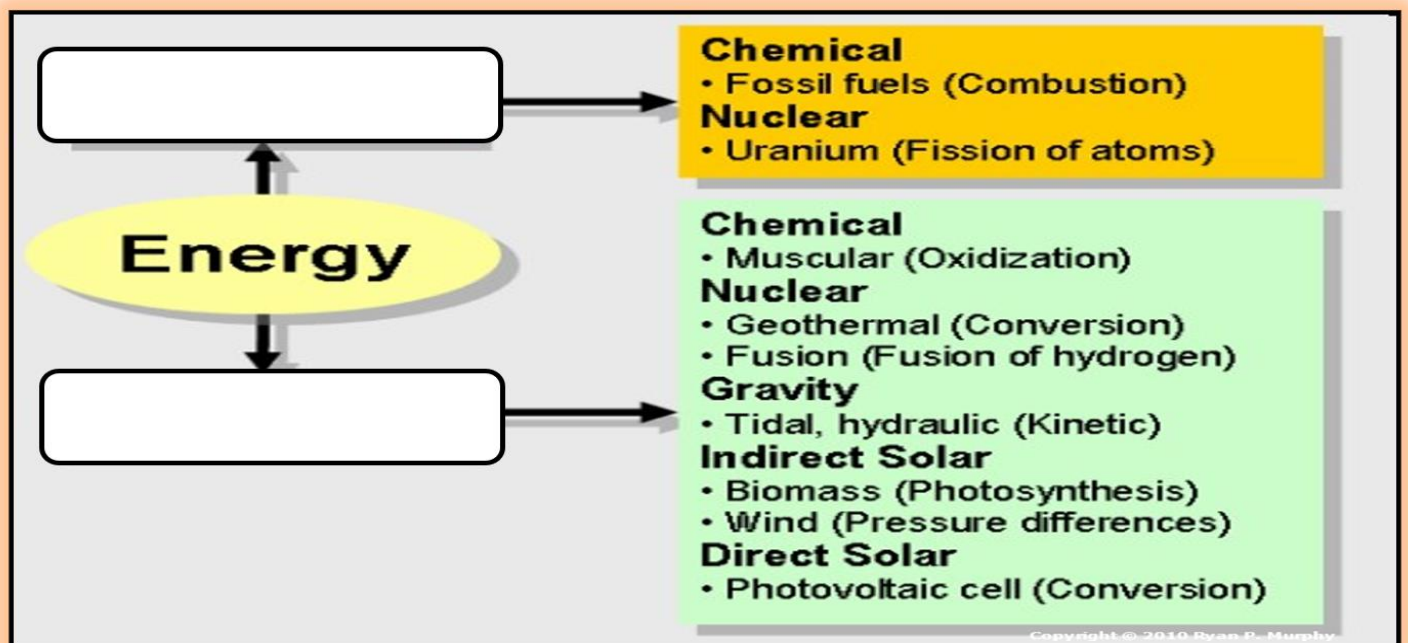
Questions to answer for energy flow brainstorm.

- How many resources go into making your stuff?
- Does this change anything? Will you still throw away a pencil without really using it?

### Part 7 Lesson 3 Materials Economy

Environmental science: The study of interactions among \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ components of the environment.

Environmental studies is the study of \_\_\_\_\_ interactions with their environment.



Match the term to the big concepts in environmental studies as covered in the slideshow.

A	B	C	D	E	F
Energy Conversions Underlie all ecological processes	Envs. problems have cultural and social context	The earth itself is one interconnected system	Science is a process	Human survival depends on developing sustainable systems	Humans alter Natural Systems

- 1 \_\_\_\_\_
  - Humans have an impact on the environment.
  - Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
- 2 \_\_\_\_\_
  - Natural systems change over time and space.
  - Biogeochemical systems vary in ability to recover from disturbances.
- 3 \_\_\_\_\_
  - Energy cannot be created; it must come from somewhere.
  - As energy flows through systems, at each step more of it becomes unusable.
- 4 \_\_\_\_\_
  - Science is a method of learning more about the world.
  - Science constantly changes the way we understand the world.
- 5 \_\_\_\_\_
  - A suitable combination of conservation and development is required.
  - Management of common resources is essential.
- 6 \_\_\_\_\_
  - Understanding the role of cultural, social and economic factors is vital to the development of solutions.

Name two types of human activities that can lead to pollution.

# The Love Canal Tragedy EPA Journal 1979

Quite simply, Love Canal is one of the most appalling environmental tragedies in American history.

But that's not the most disturbing fact.

What is worse is that it cannot be regarded as an isolated event. It could happen again--anywhere in this country--unless we move expeditiously to prevent it. It is a cruel irony that Love Canal was originally meant to be a dream community. That vision belonged to the man for whom the three-block tract of land on the eastern edge of Niagara Falls, New York, was named--William T. Love. Love felt that by digging a short canal between the upper and lower Niagara Rivers, power could be generated cheaply to fuel the industry and homes of his would-be model city.

But despite considerable backing, Love's project was unable to endure the one-two punch of fluctuations in the economy and Nikola Tesla's discovery of how to economically transmit electricity over great distances by means of an alternating current.

By 1910, the dream was shattered. All that was left to commemorate Love's hope was a partial ditch where construction of the canal had begun. In the 1920s the seeds of a genuine nightmare were planted. The canal was turned into a municipal and industrial chemical dumpsite. Landfills can of course be an environmentally acceptable method of hazardous waste disposal, assuming they are properly sited, managed, and regulated. Love Canal will always remain a perfect historical example of how not to run such an operation.

In 1953, the Hooker Chemical Company, then the owners and operators of the property, covered the canal with earth and sold it to the city for one dollar. It was a bad buy. In the late '50s, about 100 homes and a school were built at the site. Perhaps it wasn't William T. Love's model city, but it was a solid, working-class community. For a while.

On the first day of August, 1978, the lead paragraph of a front-page story in the New York Times read: NIAGARA FALLS, N.Y.--Twenty five years after the Hooker Chemical Company stopped using the Love Canal here as an industrial dump, 82 different compounds, 11 of them suspected carcinogens, have been percolating upward through the soil, their drum containers rotting and leaching their contents into the backyards and basements of 100 homes and a public school built on the banks of the canal.

In an article prepared for the February, 1978 *EPA Journal*, I wrote, regarding chemical dumpsites in general, that "even though some of these landfills have been closed down, they may stand like ticking time bombs." Just months later, Love Canal exploded.

The explosion was triggered by a record amount of rainfall. Shortly thereafter, the leaching began. I visited the canal area at that time. Corroding waste-disposal drums could be seen breaking up through the grounds of backyards. Trees and gardens were turning black and

dying. One entire swimming pool had been popped up from its foundation, afloat now on a small sea of chemicals. Puddles of noxious substances were pointed out to me by the residents. Some of these puddles were in their yards, some were in their basements, others yet were on the school grounds. Everywhere the air had a faint, choking smell. Children returned from play with burns on their hands and faces. And then there were the birth defects. The New York State Health Department is continuing an investigation into a disturbingly high rate of miscarriages, along with five birth-defect cases detected thus far in the area.

I recall talking with the father of one of the children with birth defects. "I heard someone from the press saying that there were *only* five cases of birth defects here," he told me. "When you go back to your people at EPA, please don't use the phrase '*only* five cases.' People must realize that this is a tiny community. Five birth defect cases here is terrifying." A large percentage of people in Love Canal are also being closely observed because of detected high white-blood-cell counts, a possible precursor of leukemia. When the citizens of Love Canal were finally evacuated from their homes and their neighborhood, pregnant women and infants were deliberately among the first to be taken out.

"We knew they put chemicals into the canal and filled it over," said one woman, a long-time resident of the Canal area., "but we had no idea the chemicals would invade our homes. We're worried sick about the grandchildren and their children."

Two of this woman's four grandchildren have birth defects. The children were born and raised in the Love Canal community. A granddaughter was born deaf with a cleft palate, an extra row of teeth, and slight retardation. A grandson was born with an eye defect.

Of the chemicals which comprise the brew seeping through the ground and into homes at Love Canal, one of the most prevalent is benzene -- a known human carcinogen, and one detected in high concentrations. But the residents characterize things more simply. "I've got this slop everywhere," said another man who lives at Love Canal. His daughter also suffers from a congenital defect.

On August 7, New York Governor Hugh Carey announced to the residents of the Canal that the State Government would purchase the homes affected by chemicals. By the month's end, 98 families had already been evacuated. Another 46 had found temporary housing. Soon after, all families would be gone from the most contaminated areas -- a total of 221 families have moved or agreed to be moved.

State figures show more than 200 purchase offers for homes have been made, totaling nearly \$7 million. A plan is being set in motion now to implement technical procedures designed to meet the seemingly impossible job of detoxifying the Canal area. The plan calls for a trench system to drain chemicals from the Canal. It is a difficult procedure, and we are keeping our fingers crossed that it will yield some degree of success.

I have been pleased with the high degree of cooperation in this case among local, State, and Federal governments, and with the swiftness by which the Congress and the President have acted to make funds available. But this is not really where the story ends.

We suspect that there are hundreds of such chemical dumpsites across this Nation. Unlike Love Canal, few are situated so close to human settlements. But without a doubt, many of these old dumpsites are time bombs with burning fuses -- their contents slowly leaching out. And the next victim could be a water supply, or a sensitive wetland near you.

Questions: Please answer 3 of the 8 questions in your journal.

- 1) Summarize the Love Canal Tragedy in four sentences.
- 2) Would you move to Love Canal if given the chance back in the 1950's? Keep in mind that it looks like a great place to live.
- 3) Whose fault was this tragedy?
- 4) What health effects were caused by the pollutants buried under Love Canal?
- 5) What was done for the people who lived above Love Canal, and what is being done in the area now?
- 6) Why was buying the land above Love Canal a bad buy for only one dollar?
- 7) React to the fact that an elementary school was built right on top of chemical waste.
- 8) You are in charge of bringing justice to this mess. What would you do?

Question # \_\_\_\_\_



Question # \_\_\_\_\_





Question #3 \_\_\_\_\_

Please describe some of the downside to valuable minerals. Columbite-tantalite (aka...coltan), or cobalt, and diamonds.



## Part 7 Lesson 5

### Candy Activity

- Questions...
  - How many candies did you get, Why?
  - Why is this exercise the basis of many serious environmental problems?
  - Why is it called the *Tragedy of the Commons*?
  - Were you a taker, or a giver?

Resource Allocation: The process of \_\_\_\_\_ resources in a way that ensures sustainability.

Is Greed Good?

**IS** **GREED**  
ENOUGH IS NEVER ENOUGH **Good?**

Which house took holiday cheer too far? \_\_\_\_\_

Electricity Vampires: These are the electronics and adapters that consume \_\_\_\_\_ when they are not being used. How many vamps do you have in your house?

\_\_\_\_\_

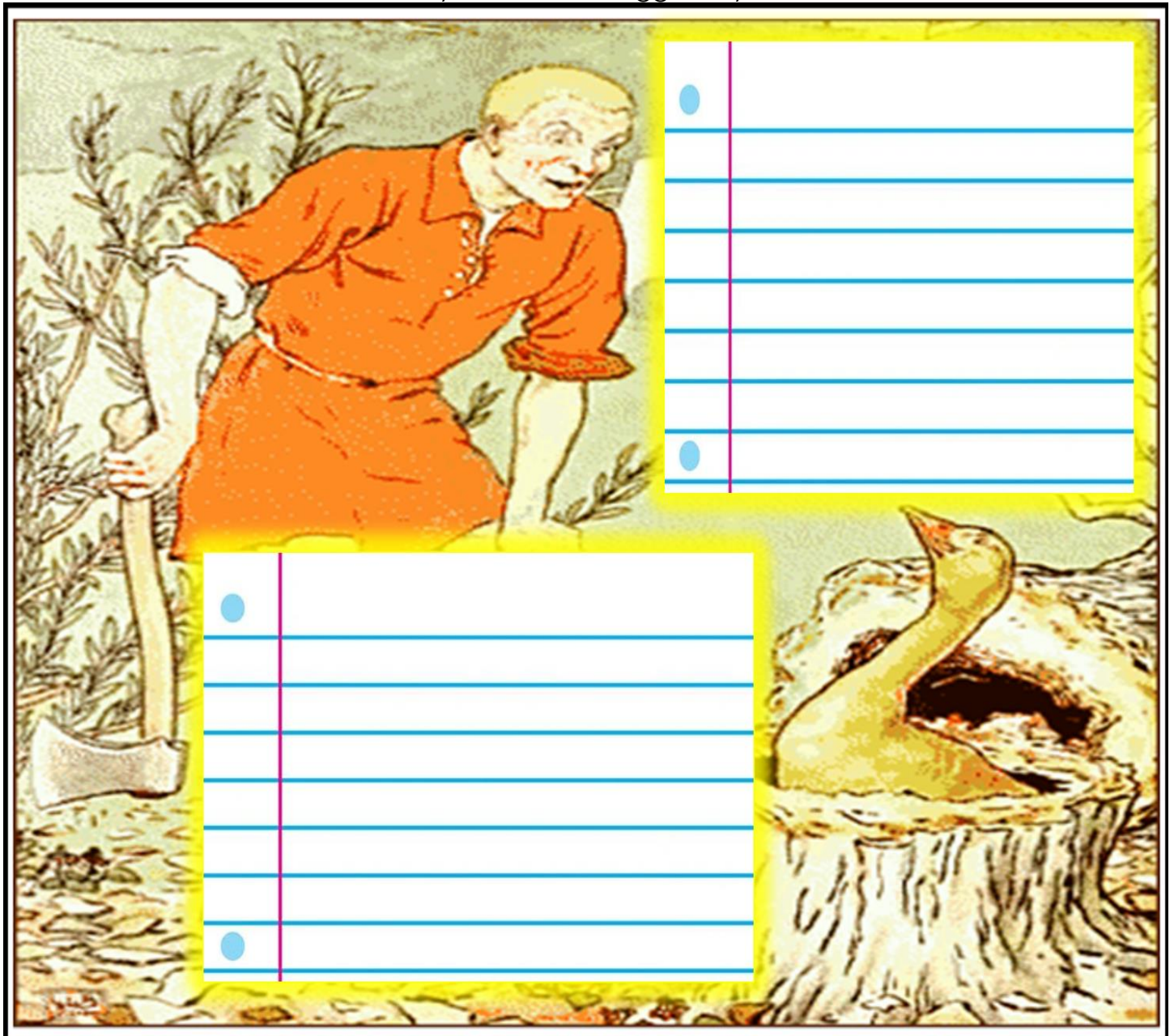
Activity! Calculating your carbon footprint.

- How many Earth's would the world need if everyone on the planet lived like you? How Many: \_\_\_\_\_

- <http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/>

Ecocentrism: Believing the \_\_\_\_\_, rather than any individual organism, is the source and support of all life.

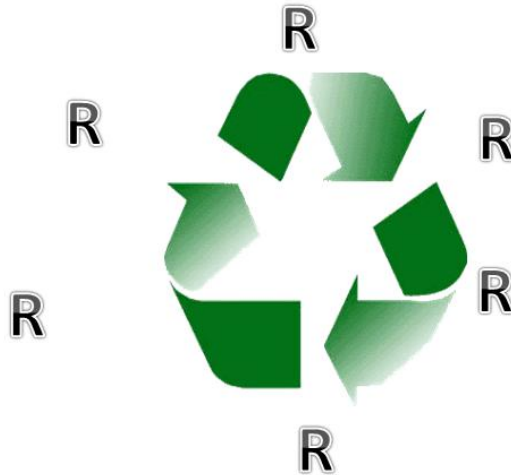
How is the earth the Goose that Lays the Golden Egg? Why shouldn't we eat her?





Part 7 Lesson 6 The R's

What are the 4 R's, Why do we recycle last? Try to imagine the 4<sup>th</sup> "R", and describe this somewhere below.



Frugality: Wise use of \_\_\_\_\_.  
Getting the maximum amount for your dollar.

Strategies of frugality: Reduce \_\_\_\_\_, curb expensive habits, be happy with \_\_\_\_\_, don't be materialistic.

How can your things become a thief of time? Explain below.

A large rectangular area with horizontal lines for writing. On the right side, there is a small illustration of a burglar in a black suit and mask, carrying a large sack over his shoulder and holding a flashlight.

## Part 7 Lesson 7 Human Population Growth

What is the current population of humans on planet Earth? \_\_\_\_\_

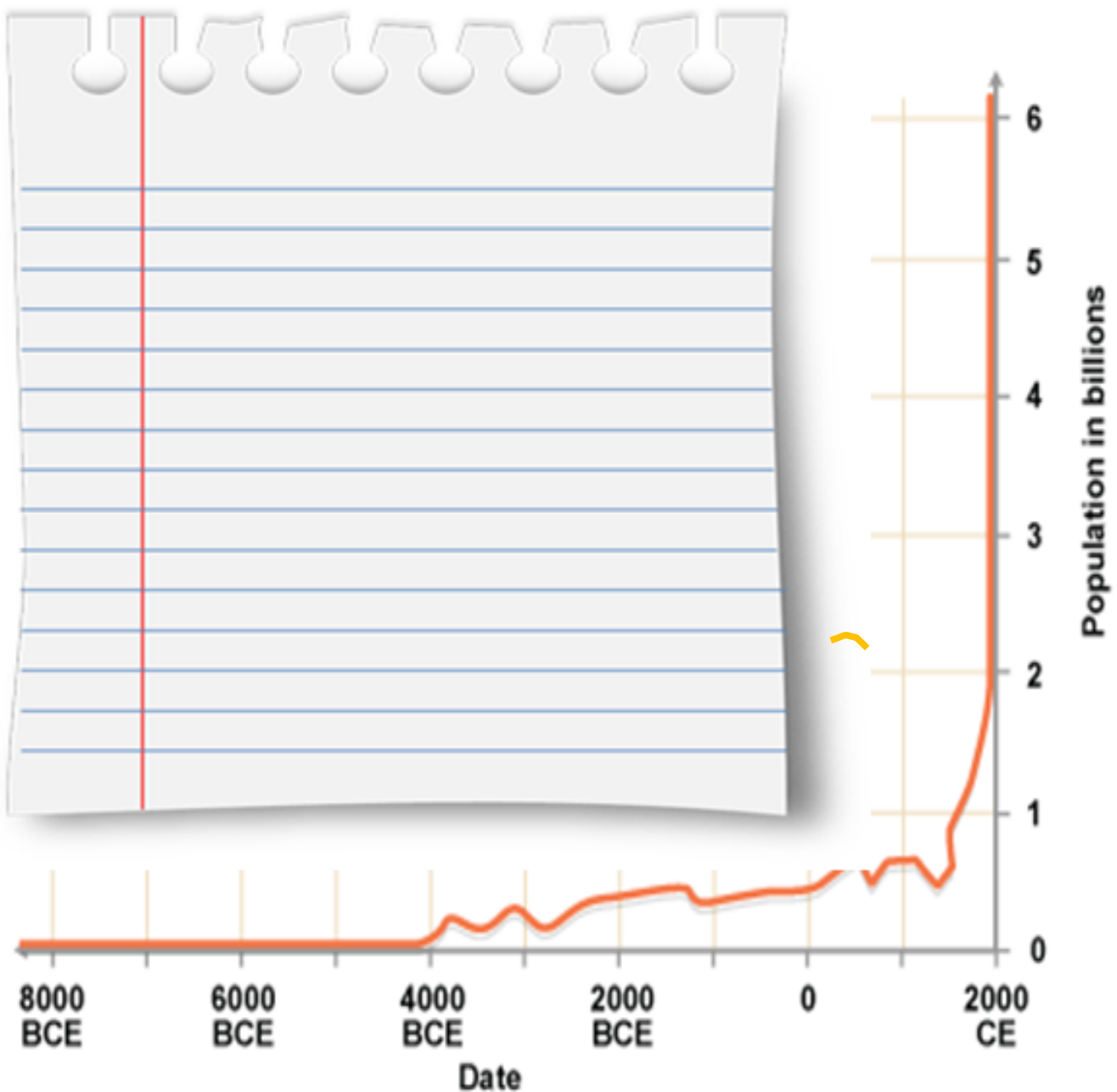
– <https://www.worldometers.info/world-population/>

Anthropogenesis: Humans shaping their \_\_\_\_\_.

Carrying Capacity: The amount of \_\_\_\_\_ that an area of land will yield.  
Therefore, the number of \_\_\_\_\_ that an area of land will support.

Fossil fuels are borrowed \_\_\_\_\_: The energy rich organic matter from millions of years ago.

What is so concerning about this graph about human population growth.



Ecological Niche: The place or function of a given organism within its \_\_\_\_\_. "Job"

Fundamental Niche: The theoretical role, place, or function that a species has within its ecosystem.

- This is what an organism wants but rarely gets.

Realized Niche: The way of life that an organism is reduced to live in due to limiting factors.

- Not the best situation but it works.

Limiting Factors: A factor that causes a population to \_\_\_\_\_ in size.



What are some density dependent, and independent limiting factors?

Density Dependent Factors (Other living things)	Density Independent Factors (Non-living / Abiotic)

Circle the limiting factors from the list below that were described in class?

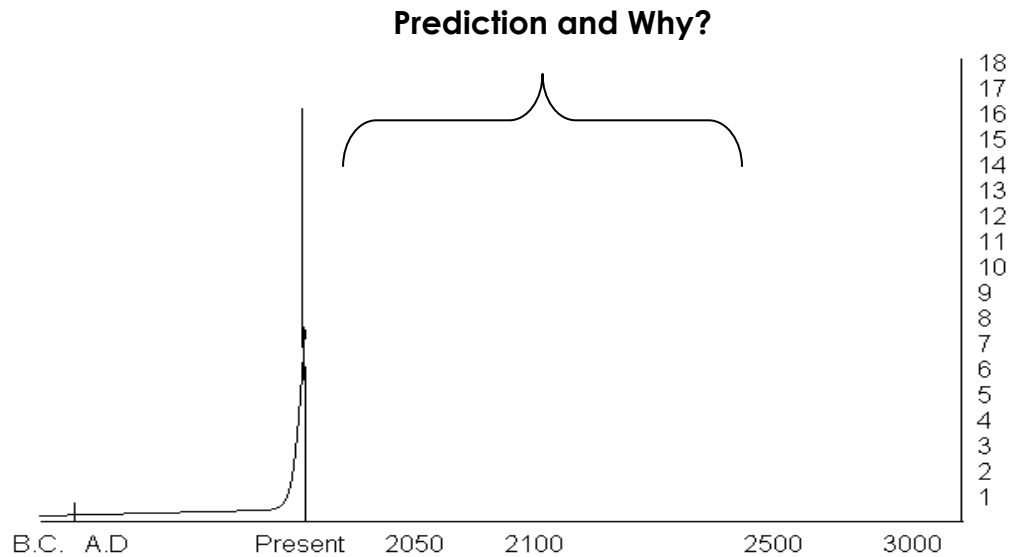
Mushrooms, Competition, Rainbows, Tacos, Space, Water, Sell by dates, scabs, Sunlight, Diseases, Holidays, Wipes, Hunting, Rechargeable Batteries, Dictionaries, Predators, Whistles, Energy Drinks, Magic Markers, Parasites, Almonds, Cans, Folds, Twix

Which box is showing a density dependent limiting factor, and which is showing a density independent limiting factors? **Explain**

<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<div data-bbox="155 1535 768 1633" style="border: 1px solid black; border-radius: 15px; width: 377px; height: 47px; margin-bottom: 10px;"></div> 	<div data-bbox="881 1535 1494 1633" style="border: 1px solid black; border-radius: 15px; width: 377px; height: 47px; margin-bottom: 10px;"></div> 



Please reflect on the graph from the previous page. Please make sure you define carrying capacity in your response. Also **make a prediction** by adding to the graph below.



### Conclusions to Human Population Growth

- Carrying capacity was artificially increased by the introduction of agriculture beginning roughly 10,000 years ago.
- Population increase was accelerated after 10,000 years ago, but not at modern levels.
- Massively accelerated population growth is a modern phenomenon.
- Human population growth is not a biological imperative, but is culturally determined.



**Part 7 Lesson 8 Sustainable Design**

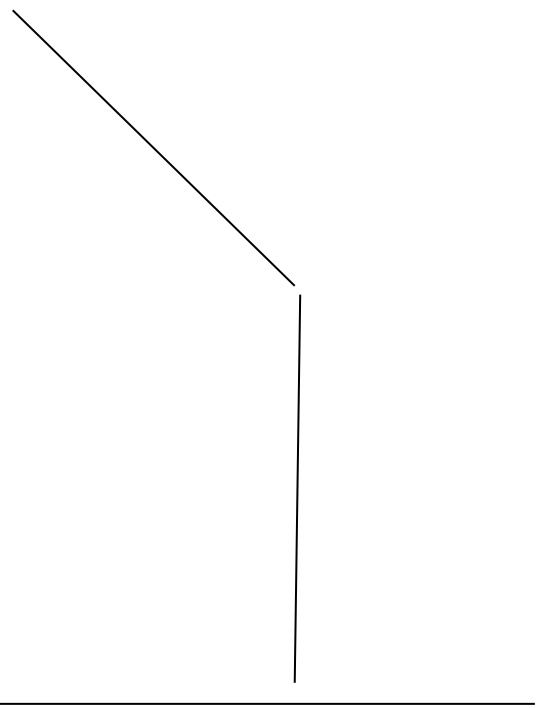
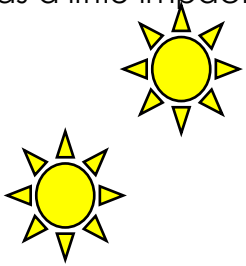
Human Footprint: A \_\_\_\_\_ of human demand on the earth's ecosystems.

Megalopolis: A \_\_\_\_\_ urban complex usually involving several major cities and towns.

Record the following with lines. (four lines and a slash =5)

Green Space	Housing	Industry	Shopping/Parking
Landfill	Mining	Golf Course	Cemetery
Oil	Other _____	Other _____	Other _____

Please decorate a house below with some features that make it sustainable and one that has a little impact on the environment as possible.



\_\_\_\_\_

Biomimicry – A design discipline that studies \_\_\_\_\_ best ideas and then imitates them.

## Sustainable Architecture Project

In the following project, you are required to research and then design an environmentally sustainable house. You are then required to present the design in front of an architectural forum of designers. You are required to design solo. During this project, you need to incorporate as many sustainable practices as possible using the boxes below. Please check off the box after you design it. You are being graded based on your use of research, design, neatness, artistic merit, time commitment, presentation and behavior. You can create your home using Google Sketch-Up 3D or traditional drafting using paper and rulers.

Solar 4 required	Water – Requires 2	Energy Requires 2	Environment 3 required
Smaller Home* Solar Passive Design* ●Solar Photovoltaic Cells ●Solar Hot water heater ●Solar Cooker ●Greenhouse ●Other	Recycled water system* ● Rainwater catching system ● Green Roof ● Aquaculture ● Horticulture ●Low flush or compost toilet	●Wind turbine* ●Solar Cells (repeat) ●Geothermal ●Earthen Home ●Bio-diesel ●Small hydropower dam ●Tankless hotwater ●Efficient insulation ●Improved air sealing	●Must produce food* ●Rooftop garden* ●Aquaculture / horticulture with waste water (repeat) ●Greenhouse for heat + food production ●Green space around home ●Porous materials around home ●Local building materials (adobe if south, stone, wood) ●Recycled or low impact materials ●Energy efficient appliances

### Other Requirements

- Text that describes each chosen above.
- Really strong projects have more than minimum requirements.
- Stronger paragraph with specifics such as the type of heating system, specific appliances, savings, food production, green space.
- Please do your best to be artistic and neat with the program.
- Stay on task, use the packets at least twice.

# Wealth and efficiency

Can't build a new home from scratch? Don't despair: there are plenty of ways to make your existing house green, says **Sian Griffiths**. And, although payback times are long, government grants will cover part of the costs

## Wind turbine

Installed on the roof or, for bigger turbines, on a mast in the garden. Great on windy coastlines or mountains, but not in towns or cities. May need planning permission.  
**Cost?** Depends on size: from £2,000 up to £20,000 for a system that covers a household's entire electricity demand.  
**Payback time?** Eight years or more.

## Solar photovoltaic electricity

Solar panels generate electricity as the sun's rays hit a silicon layer.  
**Cost?** Varies with size: perhaps £10,000 for a household system. If you generate surplus electricity, you can sell it back to the grid.  
**Payback time?** More than 20 years.

## Solar water-heaters

Collects warmth from the sun, heating water, which is then pumped through a coil in the hot-water tank. Best on south-facing roofs. It requires a hot-water storage tank and, in the UK, there is only enough sun to let you switch off the boiler six months a year.  
**Cost?** Typically £2,000 to £4,000.  
**Payback time?** More than 20 years at current gas prices.



## Better central heating controls

Inefficient controls mean many households waste energy. Look at intelligent alternatives such as the Dataterm, a combined thermostat and central heating programmer.  
**Cost?** About £500 for a completely new installation.  
**Payback time?** About seven years.

## Condensing boiler

Up to 30% more efficient than traditional boilers at converting fuel into heat.  
**Cost?** About £1,500.  
**Payback time?** Eight to 10 years.

## Insulating your loft

Increase it to a thickness of 25cm. The greenest insulating material is sheep's wool, but you can buy standard material from DIY stores. Foam backed with aluminium foil is the high-tech option.  
**Cost?** A few hundred pounds.  
**Payback time?** Two or three years.

## Insulating your door

Consider replacing a wood and glass door with a thick plastic one made to look like wood.  
**Cost?** £250 to £500.  
**Payback time?** More than 10 years.

All figures from How to Live a Low-carbon Life (Earthscan) by Chris Goodall

## Insulating walls

Cavity-wall insulation is a cheap and reliable way of keeping more heat indoors. It won't work in older houses: consider cladding the outside with insulating material and rendering over it.  
**Cost?** About £500.  
**Payback time?** Two or three years for detached houses.

## Ground-source heat pump

Extracts warmth from the soil for underfloor heating. Makes more financial sense if your house is not on a gas main: it runs on electricity, which is about four times as expensive as gas per kilowatt hour. You need a big garden.  
**Cost?** £6,000 to £12,000 for installation.  
**Payback time?** Probably more than 15 years.

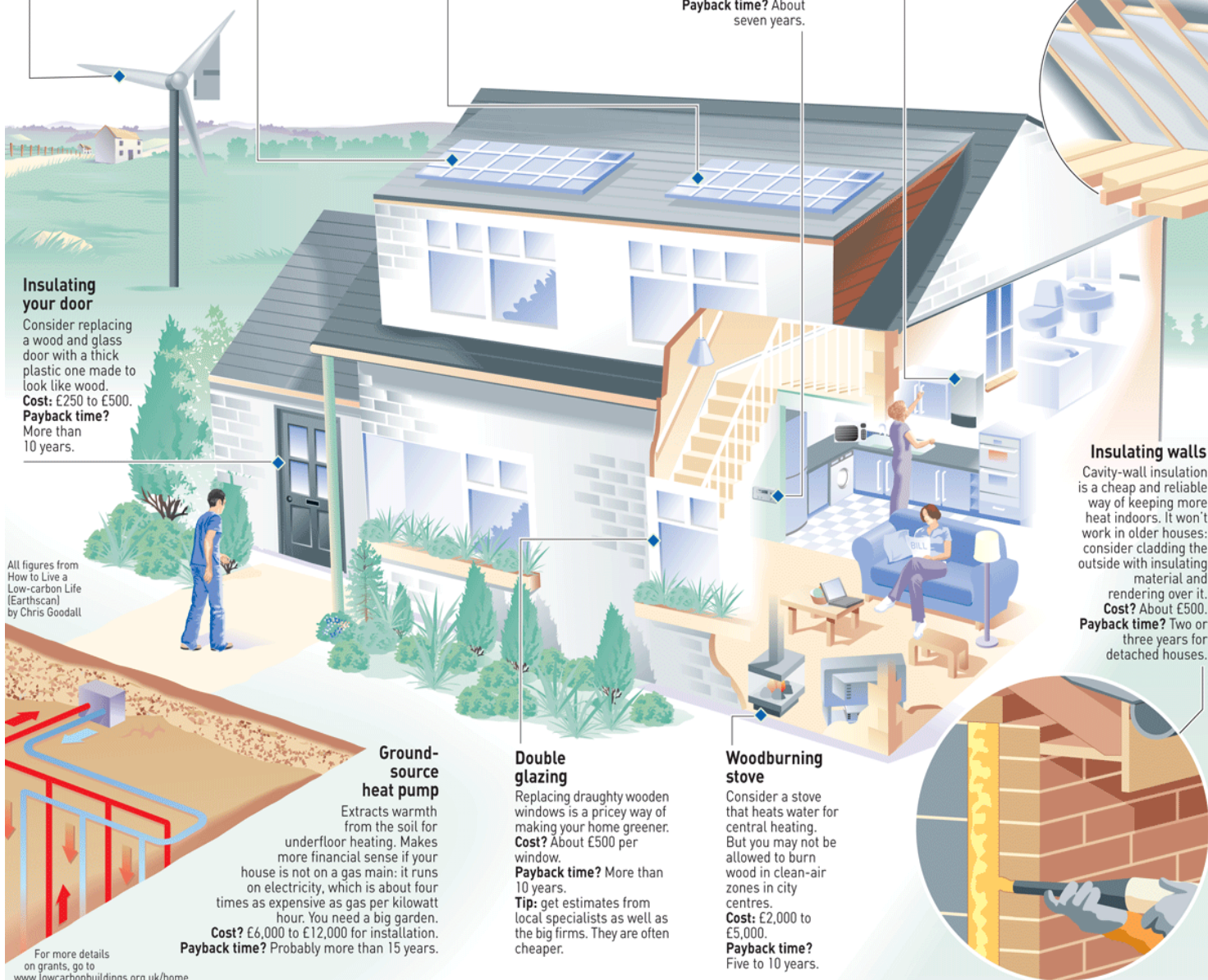
## Double glazing

Replacing draughty wooden windows is a pricey way of making your home greener.  
**Cost?** About £500 per window.  
**Payback time?** More than 10 years.  
**Tip:** get estimates from local specialists as well as the big firms. They are often cheaper.

## Woodburning stove

Consider a stove that heats water for central heating. But you may not be allowed to burn wood in clean-air zones in city centres.  
**Cost:** £2,000 to £5,000.  
**Payback time?** Five to 10 years.

For more details on grants, go to [www.lowcarbonbuildings.org.uk/home](http://www.lowcarbonbuildings.org.uk/home)



## Part 7 Lesson 9 Renewable Energy

Energy conversions underlie all ecological processes.

- Energy cannot be created; it must come from somewhere.
- As energy flows through systems, at each step more of it becomes unusable.

Record some types of renewable energy below.

Renewable energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale, including carbon neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat.



# Renewable Energy





Please respond to the movie the 11<sup>th</sup> hour.



Is it really the eleventh hour?  
What problems did they highlight?  
What solutions did they offer?  
What do you think is the future of our civilization?  
How will everyone's lifestyle need to change to avoid...?

**Across**

3. The global \_\_\_\_\_ population has grown from 1 billion in 1800 to 7.9 billion in 2020.
4. \_\_\_\_\_ design is the approach to creating products and services that have considered the environmental, social, and economic impacts from the initial phase through to the end of life.
5. \_\_\_\_\_ energy comes from sources that will run out or will not be replenished for thousands or even millions of years. Most sources of this energy are fossil fuels
10. Environmental studies is the study of \_\_\_\_\_ interactions with their environment.
11. The law of conservation of \_\_\_\_\_: In any physical or chemical change, matter is neither created nor destroyed but merely changed from one form to another.
13. Wise use of resources. Getting the maximum amount for your dollar.
16. Environmental science: The study of interactions among physical, chemical, and \_\_\_\_\_ components of the environment.
17. The \_\_\_\_\_ itself is one interconnected system. Natural systems change over time and space. Biogeochemical systems vary in ability to recover from disturbances.
18. Carrying \_\_\_\_\_: The amount of food that an area of land will yield. Therefore, the number of people that an area of land will support.
19. The first of the "R's" Our stuff becomes harmful waste.
22. \_\_\_\_\_ Allocation: The process of assigning resources in a way that ensures sustainability.
24. Believing the ecosphere, rather than any individual organism, is the source and support of all life.
25. The second of the "R's" So we can reduce. To use again

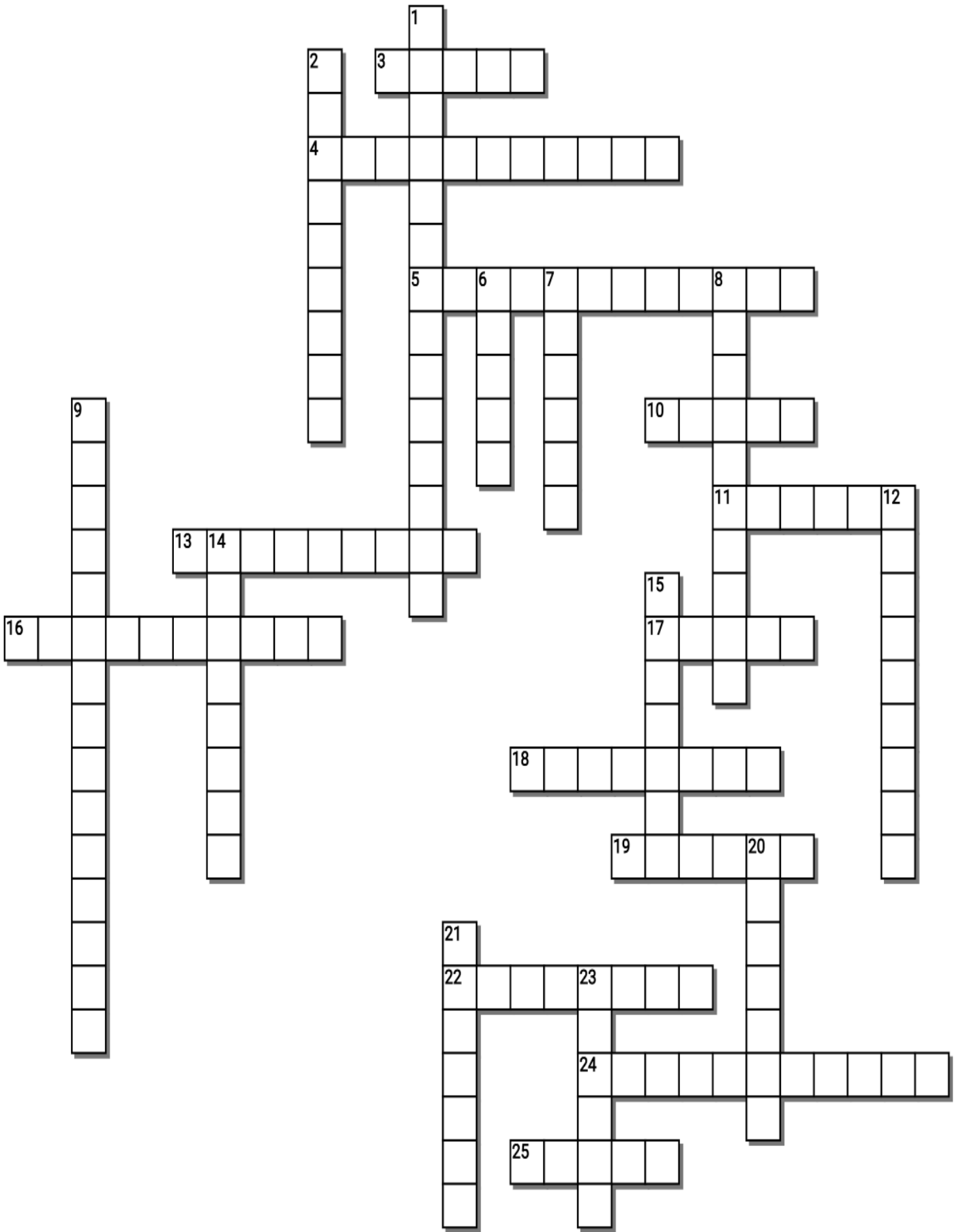
**Down**

1. Meeting the needs of the present without compromising the ability of future generations to meet their own needs.
2. Matter cannot be created or \_\_\_\_\_
6. Ecological \_\_\_\_\_: The place or function of a given organism within its ecosystem.
7. E\_\_\_\_\_ conversions underlie all ecological processes.
8. A design discipline that studies nature's best ideas and then imitates them.
9. Humans shaping their environment.
12. \_\_\_\_\_ energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale.
14. Rethink and Re\_\_\_\_\_ Everything with the "R's" in mind
15. Last of the "R's" It often requires energy
20. The Tragedy of the \_\_\_\_\_, by Garrett Hardin (1968)
21. Science is a... Science is a method of learning more about the world. Science constantly changes the way we understand the world.
23. Energy goes from useful to less \_\_\_\_\_

-----Teacher can remove this word bank to make the crossword more challenging-----

**Possible Answers**

CAPACITY, ANTHROPOGENESIS, BIOMIMICRY, COMMONS, DESTROYED, EARTH, ECOCENTRISM, ENERGY, FRUGALITY, HUMAN, MATTER, NICHE, NON-RENEWABLE, PROCESS, RECYCLE, REDUCE, REINVENT, RENEWABLE, RESOURCE, REUSE, SUSTAINABILITY, SUSTAINABLE, BIOLOGICAL, HUMAN, USEFUL





# Part 7 Environment

1-20 = 5 pts **Part 7 Lesson 11**  
 \*20-\*25 \* = Bonus + 1 pt,  
 (Secretly write owl in correct space +1 pt)  
 Final Question = 5 pt wager

Name: \_\_\_\_\_  
 Due: Today

Score \_\_\_\_ / 100

ENVIRONMENTAL THOUGHT	LIVING ON EARTH	OUR FUTURE	THINKING GREEN	NATIONAL PARKS Bonus round 1pt each
1)	6)	11)	16)	*21)
2)	7)	12)	17)	*22)
3)	8)	13)	18)	*23)
4)	9)	14)	19)	*24)
5)	10)	15)	20)	*25)

Final Question Wager \_\_\_\_/5 Answer: \_\_\_\_\_

# Part 7 The Environment

Name: \_\_\_\_\_

## Part 7 Lesson 1

<p>We talk about consuming, or using up material resources, but actually we <b>don't</b> consume any matter. We only <b>borrow</b> some of the earth's resources for a while, taking them from the earth, carrying them to another part of the globe, processing them, using them, and then discarding, reusing, or recycling them.</p>	<p>In the process of using matter we may change it to another <b>form</b>, but in every case we neither create nor destroy any measurable amount of matter. This results from the <b>law of conservation of matter</b>: In any physical or chemical change, matter is neither created nor destroyed but merely changed from one form to another.</p>	<p>When you throw away something, remember there is no <b>"away."</b> Everything we think we have thrown away is still here with us in one form or another.</p>
<p>How does this affect environmental science? Although we can certainly make the environment cleaner, the law of conservation of matter says we will <b>always be</b> faced with pollution of some sort. This means that we must <b>trade-off</b> one form of pollution for another.</p>	<p>This <b>trade-off</b> involves making controversial scientific, political, economic, and ethical <b>judgments</b> about what is a dangerous pollution level, and to what degree a pollutant must be <b>controlled</b>, and what amount of money we are willing to pay to reduce the amount of a pollutant to a harmless level.</p>	<p>The <b>"throwaway"</b> society found in most industrial countries is based on using more and more of the earth's <b>matter</b> and <b>energy</b> resources at a faster and faster rate. The earth receives a <b>constant</b> flow of energy from the sun, but for all practical purposes <b>little</b> matter enters or leaves the earth.</p>

### First Law of Thermodynamics

This is the law of the conservation of **matter**. It states that energy can neither be **created**, nor can it be **destroyed**. This means that the total amount of energy in the universe **always** remains conserved, or constant. However, energy can be changed from one **form** to **another**. There are several different forms of energy, such as **chemical, mechanical, thermal, radiant, and nuclear**. The definition of energy is the ability to do **WORK**. Thus, with energy, biochemical reactions, the processes of life, can proceed.

Please describe how The Second Law of Thermodynamics and the idea of TINSTAAFL "No free Lunch" are connected to the cheap plastic toy below. It was made in Taiwan.

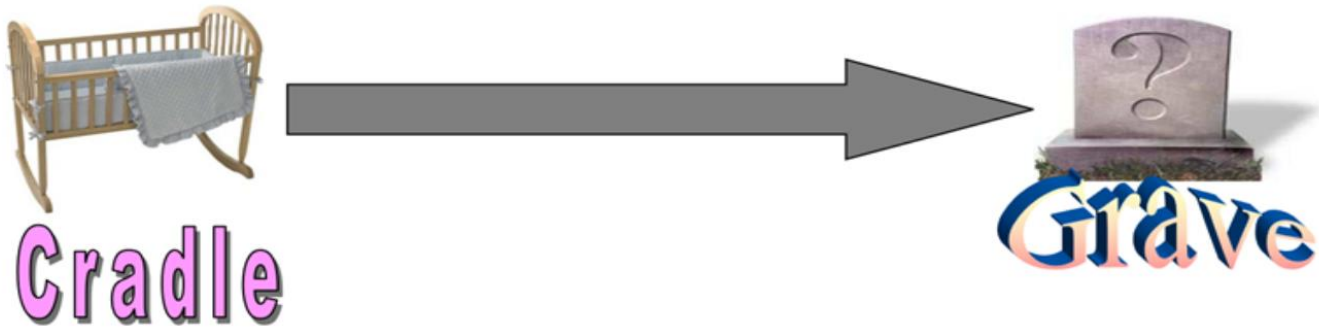
Even this toy was given to you for free, the energy to make it came from somewhere. Nothing is free, that is, there's no such things a free lunch. Energy was put into gathering the raw materials, heating it, molding it, assembling it, storing it, packaging it, and transporting it. All along the way valuable energy was lost to the environment, and likely many forms of pollution created. Hopefully, it won't just end up in the landfill.



Even with such a technological advance, the second energy law tells us that as we use more and more energy to transform matter into products and then recycle these products, the disorder in the environment will increase. Thus the second energy law tells us that the more we try to order, or "conquer" the earth, the greater the disorder we put into the environment.

We will always attempt to order the environment to some extent for our benefit, but the second energy law helps us understand that we should do so with ecological wisdom, care, and restraint.

What does this mean?



**Cradle to Grave, or Lifecycle Assessment (LCA), is a methodology used to evaluate natural effects linked to all the phases in the life of the product from obtaining of raw materials, processing of these materials, manufacturing, dissemination, usage, maintenance, and repair, and selling or reusing. Our materials economy unfortunately is filled with many "things" that get used for an extremely brief amount of time and then up being tossed "grave" into a landfill.**

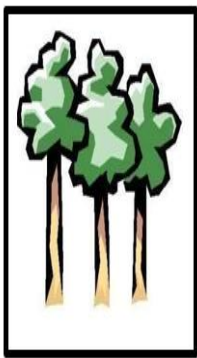
#### Part 7 Lesson 2 Energy Flow

Examining energy flow

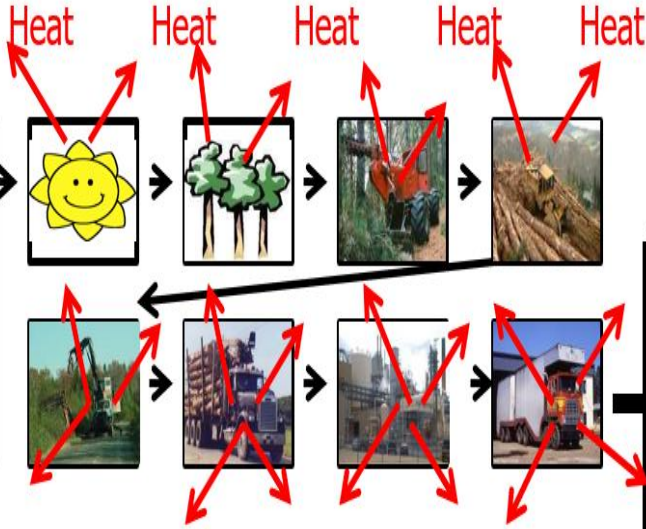
- Please find one thing on your person and draw it in your science journal.
- What is it made of?
- Where was it made?
- Where was it purchased?



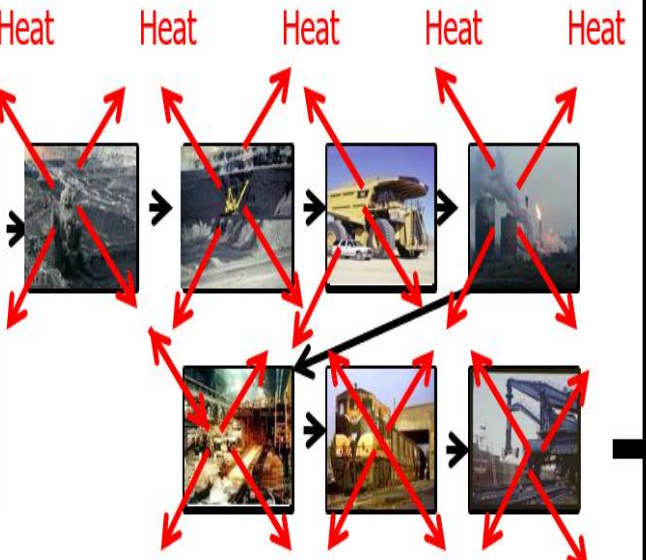
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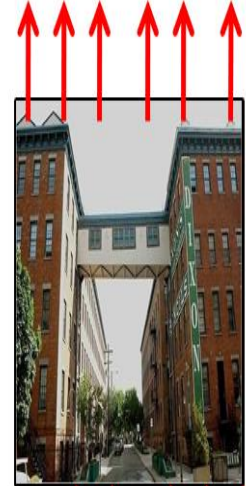
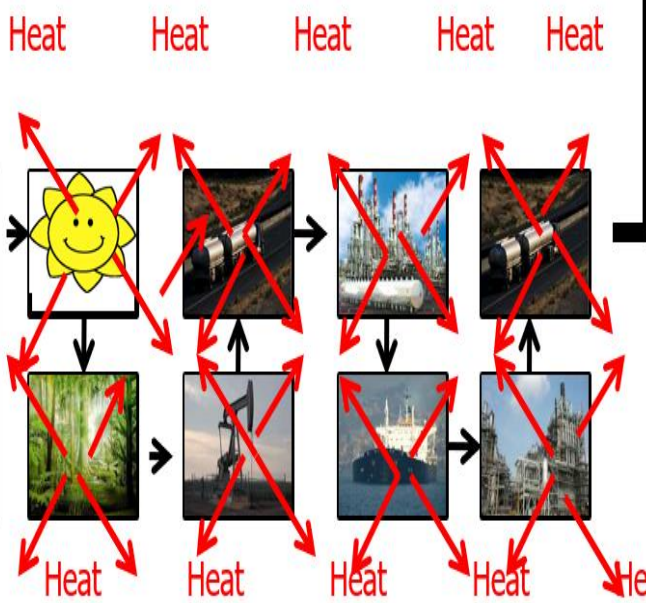
Raw Material



Raw Material



Raw Material



Factory that assembles raw material into product



Major Distribution Center



Regional Distribution



Finished Product at store



Questions to answer for energy flow brainstorm.

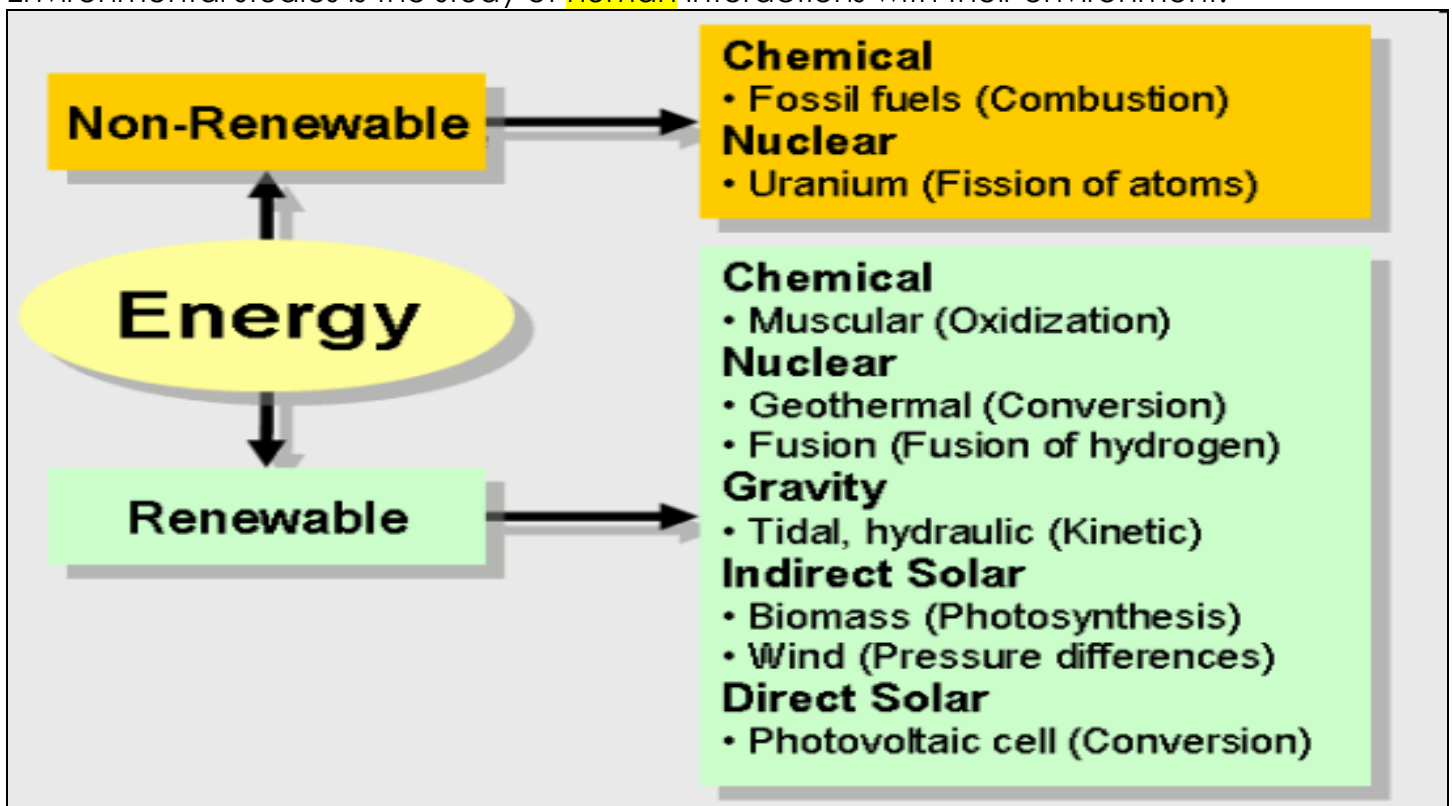
- How many resources go into making your stuff?
- Does this change anything? Will you still throw away a pencil without really using it?

An enormous amount of resources went to making my item. All along the way energy was used to excavate, transport, and alter my items form so it could become a product. Because my product came from overseas, even more energy in the form of transportation was used. All along this chain energy and some forms of pollution were created.

### Part 7 Lesson 3 Materials Economy

Environmental science: The study of interactions among **physical, chemical,** and **biological** components of the environment.

Environmental studies is the study of **human** interactions with their environment.





Match the term to the big concepts in environmental studies as covered in the slideshow.

A	B	C	D	E	F
Energy Conversions Underlie all ecological processes	Envs. problems have cultural and social context	The earth itself is one interconnected system	Science is a process	Human survival depends on developing sustainable systems	Humans alter Natural Systems

•1 **F Humans Alter Natural Systems**

- Humans have an impact on the environment.
- Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.

•2 **C The earth is an interconnected system**

- Natural systems change over time and space.
- Biogeochemical systems vary in ability to recover from disturbances.

•3 **A Energy Conversions underlie all eco - processes**

- Energy cannot be created; it must come from somewhere.
- As energy flows through systems, at each step more of it becomes unusable.

•4 **D Science is a Process**

- Science is a method of learning more about the world.
- Science constantly changes the way we understand the world.

•5 **E Human survival depends on dev. sustainability**

- A suitable combination of conservation and development is required.
- Management of common resources is essential.

•6 **B Envs problems has cultural and social context**

- Understanding the role of cultural, social and economic factors is vital to the development of solutions.

Name two types of human activities that can lead to pollution.

**Coal produces more pollution than any other energy source. While coal produces just 44% of U.S. electricity, it accounts for 80% of power plant carbon emissions. Burning coal leads to soot, smog, acid rain, global warming, and carbon emissions.**

Deforestation is the loss of trees and other vegetation can cause climate change, desertification, soil erosion, fewer crops, flooding, increased greenhouse gases in the atmosphere, and a host of problems for indigenous people.

# The Love Canal Tragedy EPA Journal 1979

Quite simply, Love Canal is one of the most appalling environmental tragedies in American history.

But that's not the most disturbing fact.

What is worse is that it cannot be regarded as an isolated event. It could happen again--anywhere in this country--unless we move expeditiously to prevent it. It is a cruel irony that Love Canal was originally meant to be a dream community. That vision belonged to the man for whom the three-block tract of land on the eastern edge of Niagara Falls, New York, was named--William T. Love. Love felt that by digging a short canal between the upper and lower Niagara Rivers, power could be generated cheaply to fuel the industry and homes of his would-be model city.

But despite considerable backing, Love's project was unable to endure the one-two punch of fluctuations in the economy and Nikola Tesla's discovery of how to economically transmit electricity over great distances by means of an alternating current.

By 1910, the dream was shattered. All that was left to commemorate Love's hope was a partial ditch where construction of the canal had begun. In the 1920s the seeds of a genuine nightmare were planted. The canal was turned into a municipal and industrial chemical dumpsite. Landfills can of course be an environmentally acceptable method of hazardous waste disposal, assuming they are properly sited, managed, and regulated. Love Canal will always remain a perfect historical example of how not to run such an operation.

In 1953, the Hooker Chemical Company, then the owners and operators of the property, covered the canal with earth and sold it to the city for one dollar. It was a bad buy. In the late '50s, about 100 homes and a school were built at the site. Perhaps it wasn't William T. Love's model city, but it was a solid, working-class community. For a while.

On the first day of August, 1978, the lead paragraph of a front-page story in the New York Times read: NIAGARA FALLS, N.Y.--Twenty five years after the Hooker Chemical Company stopped using the Love Canal here as an industrial dump, 82 different compounds, 11 of them suspected carcinogens, have been percolating upward through the soil, their drum containers rotting and leaching their contents into the backyards and basements of 100 homes and a public school built on the banks of the canal.

In an article prepared for the February, 1978 *EPA Journal*, I wrote, regarding chemical dumpsites in general, that "even though some of these landfills have been closed down, they may stand like ticking time bombs." Just months later, Love Canal exploded.

The explosion was triggered by a record amount of rainfall. Shortly thereafter, the leaching began. I visited the canal area at that time. Corroding waste-disposal drums could be seen breaking up through the grounds of backyards. Trees and gardens were turning black and dying. One entire swimming pool had been popped up from its foundation, afloat now on a small sea of chemicals. Puddles of noxious substances were pointed out to me by the

residents. Some of these puddles were in their yards, some were in their basements, others yet were on the school grounds. Everywhere the air had a faint, choking smell. Children returned from play with burns on their hands and faces. And then there were the birth defects. The New York State Health Department is continuing an investigation into a disturbingly high rate of miscarriages, along with five birth-defect cases detected thus far in the area.

I recall talking with the father of one of the children with birth defects. "I heard someone from the press saying that there were *only* five cases of birth defects here," he told me. "When you go back to your people at EPA, please don't use the phrase '*only* five cases.' People must realize that this is a tiny community. Five birth defect cases here is terrifying." A large percentage of people in Love Canal are also being closely observed because of detected high white-blood-cell counts, a possible precursor of leukemia. When the citizens of Love Canal were finally evacuated from their homes and their neighborhood, pregnant women and infants were deliberately among the first to be taken out.

"We knew they put chemicals into the canal and filled it over," said one woman, a long-time resident of the Canal area., "but we had no idea the chemicals would invade our homes. We're worried sick about the grandchildren and their children."

Two of this woman's four grandchildren have birth defects. The children were born and raised in the Love Canal community. A granddaughter was born deaf with a cleft palate, an extra row of teeth, and slight retardation. A grandson was born with an eye defect.

Of the chemicals which comprise the brew seeping through the ground and into homes at Love Canal, one of the most prevalent is benzene -- a known human carcinogen, and one detected in high concentrations. But the residents characterize things more simply. "I've got this slop everywhere," said another man who lives at Love Canal. His daughter also suffers from a congenital defect.

On August 7, New York Governor Hugh Carey announced to the residents of the Canal that the State Government would purchase the homes affected by chemicals. By the month's end, 98 families had already been evacuated. Another 46 had found temporary housing. Soon after, all families would be gone from the most contaminated areas -- a total of 221 families have moved or agreed to be moved.

State figures show more than 200 purchase offers for homes have been made, totaling nearly \$7 million. A plan is being set in motion now to implement technical procedures designed to meet the seemingly impossible job of detoxifying the Canal area. The plan calls for a trench system to drain chemicals from the Canal. It is a difficult procedure, and we are keeping our fingers crossed that it will yield some degree of success.

I have been pleased with the high degree of cooperation in this case among local, State, and Federal governments, and with the swiftness by which the Congress and the President have acted to make funds available. But this is not really where the story ends.

We suspect that there are hundreds of such chemical dumpsites across this Nation. Unlike Love Canal, few are situated so close to human settlements. But without a doubt, many of



these old dumpsites are time bombs with burning fuses -- their contents slowly leaching out. And the next victim could be a water supply, or a sensitive wetland near you.

Questions: Please answer 3 of the 8 questions in your journal.

- 9) Summarize the Love Canal Tragedy in four sentences.
- 10) Would you move to Love Canal if given the chance back in the 1950's? Keep in mind that it looks like a great place to live.
- 11) Whose fault was this tragedy?
- 12) What health effects were caused by the pollutants buried under Love Canal?
- 13) What was done for the people who lived above Love Canal, and what is being done in the area now?
- 14) Why was buying the land above Love Canal a bad buy for only one dollar?
- 15) React to the fact that an elementary school was built right on top of chemical waste.
- 16) You are in charge of bringing justice to this mess. What would you do?
- 17) Where is all this fighting occurring? What are they fighting over?

Answer – This article is written about a county in East Africa called Somalia. This country has been suffering from a drought and people are fighting over control of a well.

**18) What happened at the well near Rabadore?**

Answer- Warlords took control of a well and 250 people have died fighting over water.

**19) How many people are being affected by the drought in Somalia? What is happening to them?**

Answer -11 million people have been affected by the drought in Somalia. They are thirsty and the lack of water has made it difficult to grow food.

**20) Does Somalia have a government that can help? Explain?**

Answer – Somalia doesn't have an effective central government. There's lots of fighting and violence.

**21) What is a warlord? Are they good or bad? What do they do?**

Answer – A warlord is a person who controls people or resources with violence. They can tax people and kill them. They are bad for the Somalia people.

**22) Describe one person from the article. What is their life like?**

Answer- Fatuma Ali Mahmood, a 35 year old woman whose husband was killed looking for water. She has 9 children. Isha Aden Hussein, 38 is another woman whose husband was killed. She has 10 children and lives in a tent of trash bags and prays for a day when the rains come.

**23) How would your life be different if we didn't have any water or food?**

Answers will vary but everyone's life would be different in a negative way.

Please describe some of the downside to valuable minerals. Columbite-tantalite (aka...coltan), or cobalt, and diamonds.



Coltan is used primarily for the production of tantalum capacitors, used in many electronic devices. Coltan is important in the production of mobile phones; tantalum capacitors are used in almost every kind of electronic device.

The indiscriminate exploitation of coltan is dramatically affecting environmental biodiversity and disrupting ecosystems around mining sites. According to data available on the Global Forest Watch platform managed by the World Resources Institute, the DRC has lost 8.6% of its tree cover since 2000.



Child miners face harassment, abuse and ill health mining Coltan. Occupational hazards include daily exposure to Radon, a radioactive substance associated with coltan, which has been linked to lung cancer.





## Candy Activity

- Questions...
  - How many candies did you get, Why?
  - Why is this exercise the basis of many serious environmental problems?
  - Why is it called the *Tragedy of the Commons*?
  - Were you a taker, or a giver?

This was total crap. I didn't even get a single candy. Emmi and Steve were so greedy and just dove in front of everyone and got everything. I was a giver I guess.



The commons were overused and destroyed. The teacher should have been the allocator of resources.



Resource Allocation: The process of **assigning** resources in a way that ensures sustainability.

Is Greed Good?

**Is** **GREED** **Good?**  
ENOUGH IS NEVER ENOUGH

We're all taught to not be greedy when little, but later in life the messages about wealth and status in society paints a different picture. Humans are changing the environment in an unsustainable way, and in the process, we're accumulating vast amounts of materials that likely are not necessary, and at the expense of the earth's life sustaining systems.

Which house took holiday cheer too far? **I think anything past #2, but those better only be on from 5-8 pm**

Electricity Vampires: These are the electronics and adapters that consume electricity when they are not being used. How many vamps do you have in your house? Answers will vary

Activity! Calculating your carbon footprint.

- How many Earth's would the world need if everyone on the planet lived like you? How Many: Answers will vary but likely 3-6 earths

- <http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/>

Ecocentrism: Believing the earth, rather than any individual organism, is the source and support of all life.

How is the earth the Goose that Lays the Golden Egg? Why shouldn't we eat her?



### Part 7 Lesson 6 The R's

What are the 4 R's, Why do we recycle last? Try to imagine the 4<sup>th</sup> "R", and describe this somewhere below.

Do this last,  
not first





Frugality: Wise use of **resources**.

Getting the maximum amount for your dollar.

Strategies of frugality: Reduce **waste**, curb expensive habits, be happy with **less**, don't be materialistic.

How can your things become a thief of time? Explain below.

Materialism can be defined as the importance and centrality of possessions in providing happiness. Focusing on purchasing materials for the pursuit of happiness will likely backfire. Finding the things that really make you happy, creating friendships, and focusing on your personal growth can all be achieved with few material items. Society often makes us feel that success comes through owning things, when that cycle may just steal our time and happiness.



### Part 7 Lesson 7 Human Population Growth

What is the current population of humans on planet Earth? **8 Billion +likely around November 2022**

– <https://www.worldometers.info/world-population/>

Anthropogenesis: Humans shaping their **environment**.

Carrying Capacity: The amount of **food** that an area of land will yield.

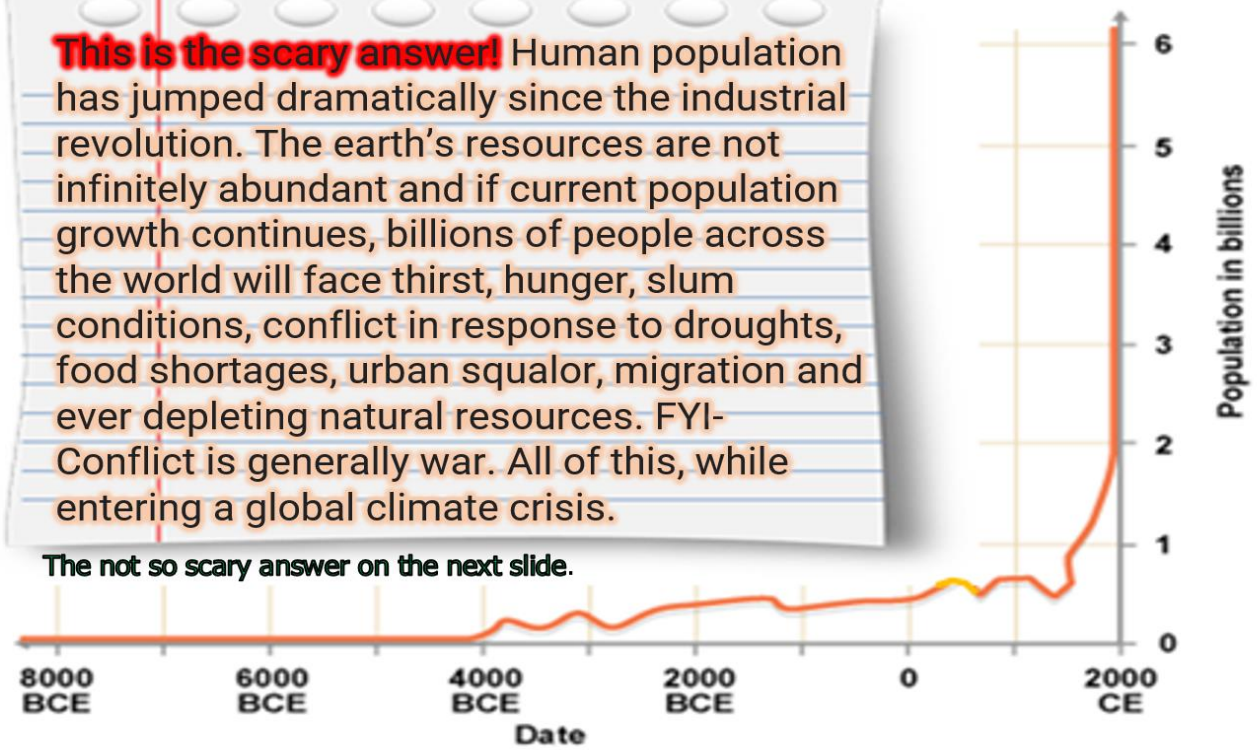
Therefore, the number of **organisms** that an area of land will support.

Fossil fuels are borrowed **Light**: The energy rich organic matter from millions of years ago.

What's so concerning about this graph about human population growth.

**This is the scary answer!** Human population has jumped dramatically since the industrial revolution. The earth's resources are not infinitely abundant and if current population growth continues, billions of people across the world will face thirst, hunger, slum conditions, conflict in response to droughts, food shortages, urban squalor, migration and ever depleting natural resources. FYI- Conflict is generally war. All of this, while entering a global climate crisis.

The not so scary answer on the next slide.



Ecological Niche: The place or function of a given organism within its environment. "Job"

Fundamental Niche: The theoretical role, place, or function that a species has within its ecosystem.

- This is what an organism wants but rarely gets.

Realized Niche: The way of life that an organism is reduced to live in due to limiting factors.

- Not the best situation but it works.

Limiting Factors: A factor that causes a population to decrease in size.

Circle the limiting factors from the list below that were described in class?

- Mushrooms, Competition, Rainbows, Tacos, Space, Water, Sell by dates, Corn Starch, Sunlight, Diseases, Holidays, Wipes, Hunting, Rechargeable Batteries, Dictionaries, Predators, Whistles, Energy Drinks, Magic Markers, Parasites, Almonds, Cans, Folds

From the circled list above, which are density dependent and which are density independent?

Density Dependent	Density Independent
Competition, space, diseases, predators, parasites	Sunlight, water, temperature, oxygen

Which box is showing a density dependent limiting factor, and which is showing a density independent limiting factor? **Explain**

Predators are density dependent limiting factors because predation increases prey death rate—which impacts how small or large the population of prey is.

Sunlight is a density independent limiting factor. No matter how large or small a population is, the sun will affect both, and the size of a population does not affect the sun's survival at all.

Density dependent limiting factor



Density independent limiting factor



Are we a "R" Species, or are we a "K" species? What does this have to do with human population growth and our environment?

We are a "K" species. We are slow-reproducing animals who are strong competitors in crowded niches and invest lots of energy in our offspring. When looking at human population growth and our environment, this is a problem because our growth is more like an "R" species. We are **off balance**, and exponential growth doesn't end well in "R" selected species.

R Species	K Species
Organism is very small size	Large Organism
Energy to make a new organism is low	Energy to make a new organism is high
Many babies made at once	Low number of babies made at a time
Early maturity	Long time for maturity
Short Life	Long Life
Each individual reproduces once and then dies	Individuals can reproduce many times throughout life



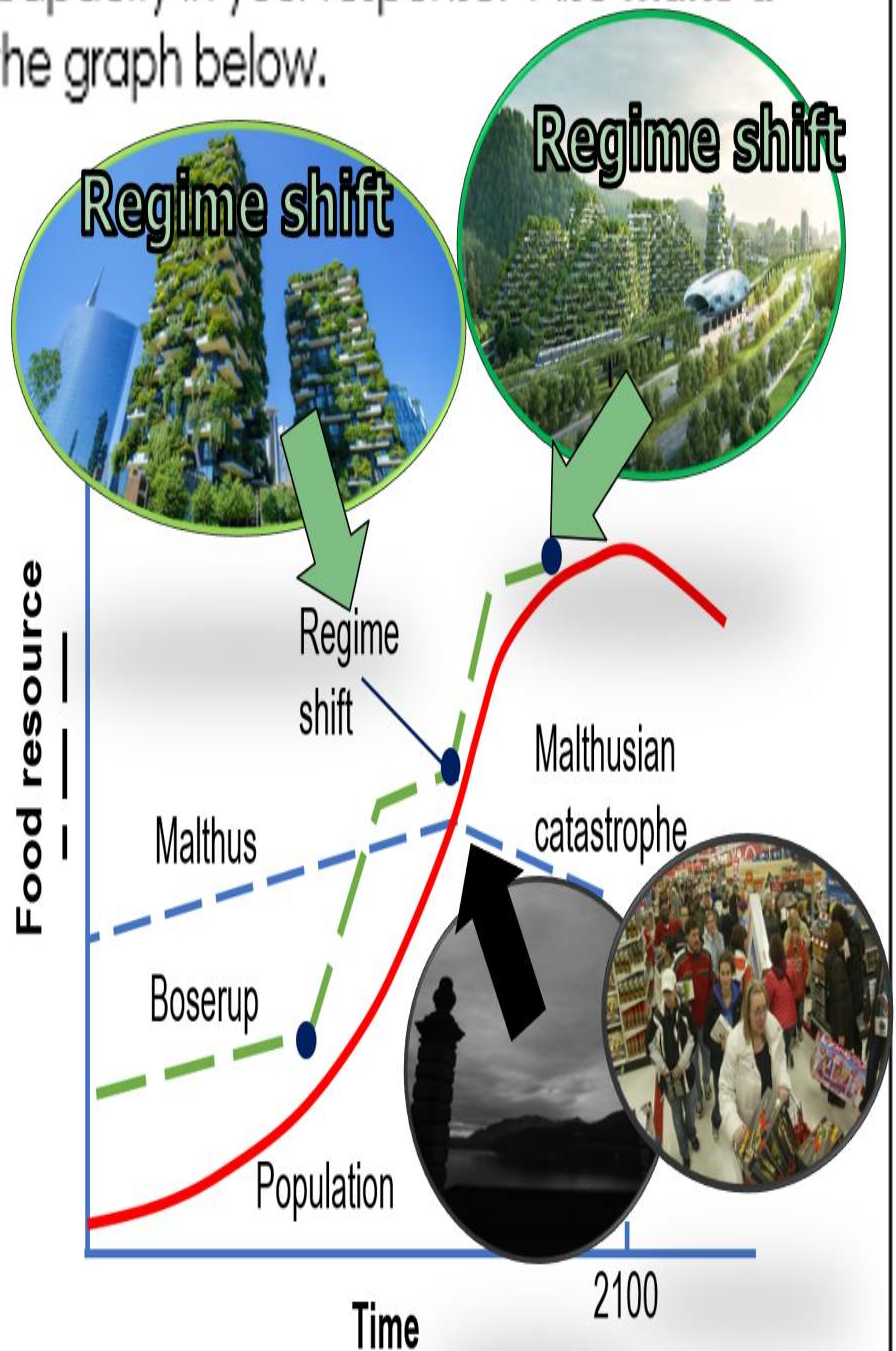
Please reflect on the graph from the previous page. Please make sure you define carrying capacity in your response. Also **make a prediction** by adding to the graph below.

### Malthus Approach to Biological Population and Carrying Capacity

- A biological population (including humans) increases until carrying capacity is exceeded, resulting in starvation and death of maybe billions.

### Boserups Approach to Human Populations and Carrying Capacity:

- Human population will increase only if carrying capacity is increased; human population growth is culturally determined.





- Carrying capacity was artificially increased by the introduction of agriculture beginning roughly 10,000 years ago.
- Population increase was accelerated after 10,000 years ago, but not at modern levels.
- Massively accelerated population growth is a modern phenomenon.
- Human population growth is not a biological imperative, but is culturally determined.

**Part 7 Lesson 8 Sustainable Design**

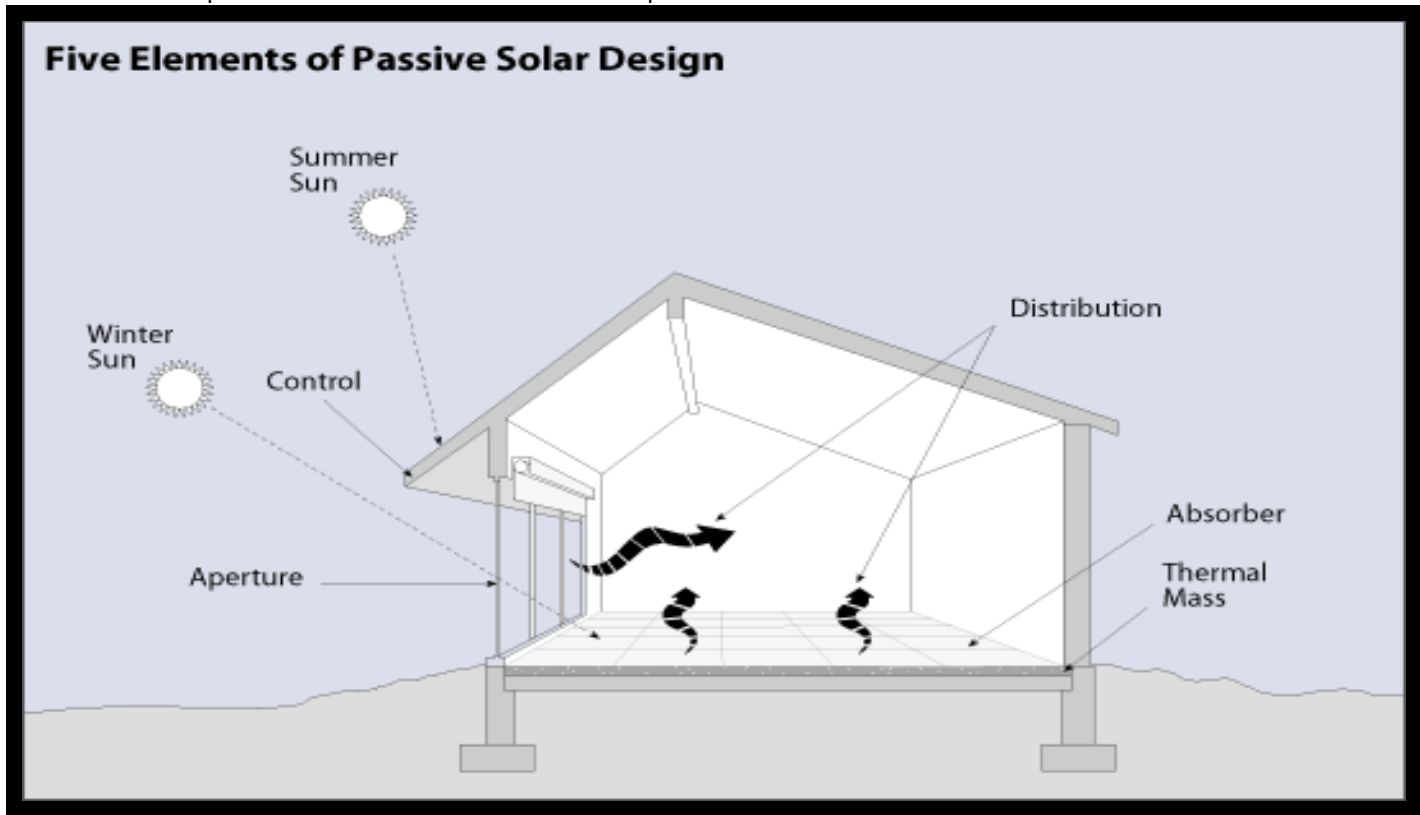
Human Footprint: A **measure** of human demand on the earth's ecosystems.

Megalopolis: A **massive** urban complex usually involving several major cities and towns.

Record the following with lines. (four lines and a slash =5)

Green Space Answers will vary, scrolling slowly using google earth,	Housing usually along the eastern seaboard. It gets interesting as you get to NYC and then south.	Industry	Shopping/Parking
Landfill	Mining	Golf Course	Cemetery
Oil	Other _____	Other _____	Other _____

Please decorate a house below with some features that make it sustainable and one that has a little impact on the environment as possible.



Biomimicry – A design discipline that studies **natures** best ideas and then imitates them.

## Sustainable Architecture Project

In the following project, you are required to research and then design an environmentally sustainable house. You are then required to present the design in front of an architectural forum of designers. You are required to design solo. During this project, you need to incorporate as many sustainable practices as possible using the boxes below. Please check off the box after you design it. You are being graded based on your use of research, design, neatness, artistic merit, time commitment, presentation and behavior. You can create your home using Google Sketch-Up 3D or traditional drafting using paper and rulers.

Solar 4 required	Water – Requires 2	Energy Requires 2	Environment 3 required
Smaller Home* Solar Passive Design* ●Solar Photovoltaic Cells ●Solar Hot water heater ●Solar Cooker ●Greenhouse ●Other	Recycled water system* ● Rainwater catching system ● Green Roof ● Aquaculture ● Horticulture ●Low flush or compost toilet	●Wind turbine* ●Solar Cells (repeat) ●Geothermal ●Earthen Home ●Bio-diesel ●Small hydropower dam ●Tankless hotwater ●Efficient insulation ●Improved air sealing	●Must produce food* ●Rooftop garden* ●Aquaculture / horticulture with waste water (repeat) ●Greenhouse for heat + food production ●Green space around home ●Porous materials around home ●Local building materials (adobe if south, stone, wood) ●Recycled or low impact materials ●Energy efficient appliances

### Other Requirements

- Text that describes each chosen above.
- Really strong projects have more than minimum requirements.
- Stronger paragraph with specifics such as the type of heating system, specific appliances, savings, food production, green space.
- Please do your best to be artistic and neat with the program.
- Stay on task, use the packets at least twice.

# Wealth and efficiency

Can't build a new home from scratch? Don't despair: there are plenty of ways to make your existing house green, says **Sian Griffiths**. And, although payback times are long, government grants will cover part of the costs

## Wind turbine

Installed on the roof or, for bigger turbines, on a mast in the garden. Great on windy coastlines or mountains, but not in towns or cities. May need planning permission. **Cost?** Depends on size: from £2,000 up to £20,000 for a system that covers a household's entire electricity demand. **Payback time?** Eight years or more.

## Solar photovoltaic electricity

Solar panels generate electricity as the sun's rays hit a silicon layer. **Cost?** Varies with size: perhaps £10,000 for a household system. If you generate surplus electricity, you can sell it back to the grid. **Payback time?** More than 20 years.

## Solar water-heaters

Collects warmth from the sun, heating water, which is then pumped through a coil in the hot-water tank. Best on south-facing roofs. It requires a hot-water storage tank and, in the UK, there is only enough sun to let you switch off the boiler six months a year. **Cost?** Typically £2,000 to £4,000. **Payback time?** More than 20 years at current gas prices.



## Better central heating controls

Inefficient controls mean many households waste energy. Look at intelligent alternatives such as the Dataterm, a combined thermostat and central heating programmer. **Cost?** About £500 for a completely new installation. **Payback time?** About seven years.

## Condensing boiler

Up to 30% more efficient than traditional boilers at converting fuel into heat. **Cost?** About £1,500. **Payback time?** Eight to 10 years.

## Insulating your loft

Increase it to a thickness of 25cm. The greenest insulating material is sheep's wool, but you can buy standard material from DIY stores. Foam backed with aluminium foil is the high-tech option. **Cost?** A few hundred pounds. **Payback time?** Two or three years.

## Insulating your door

Consider replacing a wood and glass door with a thick plastic one made to look like wood. **Cost?** £250 to £500. **Payback time?** More than 10 years.

All figures from How to Live a Low-carbon Life (Earthscan) by Chris Goodall

## Ground-source heat pump

Extracts warmth from the soil for underfloor heating. Makes more financial sense if your house is not on a gas main: it runs on electricity, which is about four times as expensive as gas per kilowatt hour. You need a big garden. **Cost?** £6,000 to £12,000 for installation. **Payback time?** Probably more than 15 years.

## Double glazing

Replacing draughty wooden windows is a pricey way of making your home greener. **Cost?** About £500 per window. **Payback time?** More than 10 years. **Tip:** get estimates from local specialists as well as the big firms. They are often cheaper.

## Woodburning stove

Consider a stove that heats water for central heating. But you may not be allowed to burn wood in clean-air zones in city centres. **Cost:** £2,000 to £5,000. **Payback time?** Five to 10 years.

## Insulating walls

Cavity-wall insulation is a cheap and reliable way of keeping more heat indoors. It won't work in older houses: consider cladding the outside with insulating material and rendering over it. **Cost?** About £500. **Payback time?** Two or three years for detached houses.

For more details on grants, go to [www.lowcarbonbuildings.org.uk/home](http://www.lowcarbonbuildings.org.uk/home)



## Part 7 Lesson 9 Renewable Energy

Energy conversions underlie all ecological processes.

- Energy cannot be created; it must come from somewhere.
- As energy flows through systems, at each step more of it becomes unusable.

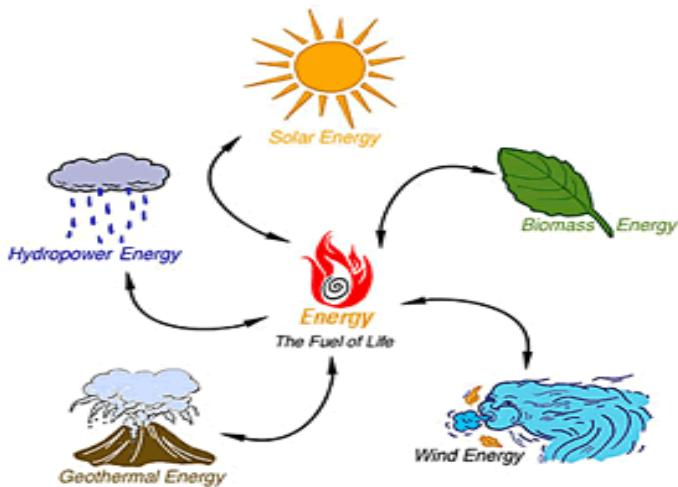
Renewable energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale, including carbon neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat.

# Renewable Energy

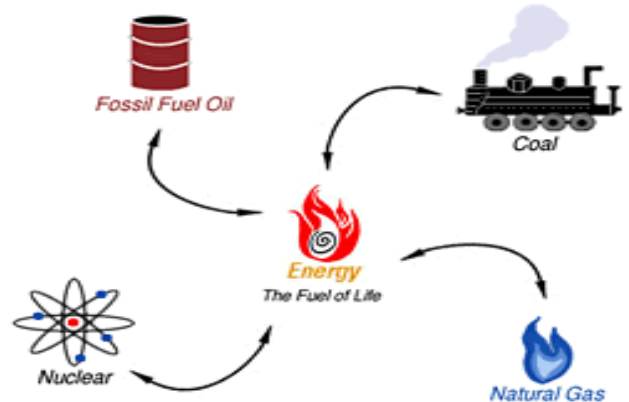
- Renewable energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale.
  - Including carbon neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat.
- Forms of renewable energy
  - Hydropower
  - Vortex, dam less hydro,
  - Ocean Thermal
  - Wave Energy
  - Tidal
  - Wind
  - Solar Chimney
  - Solar Thermal
  - Solar Photovoltaic
- Liquid Biofuels.
  - Vegetable oils
  - Ethanol
  - Biobutanol
  - Sweet Sorghum (food and fuel)
- Solid Biofuels.
  - Wood
  - Manure
  - Crop waste
  - Biogasification

Which is renewable energy? And which is nonrenewable energy?

## Renewable Energy



## Non-Renewable Energy



# What can you do?

Make environmental choices. Remember, you vote everyday. when you pay for things, when you put your money down, you're saying I approve of this product and its materials economy.

Get involved in change, it's one of the fastest growing movements. You'll likely meet some great people on your journey, while creating a better future. This issue is about awareness. Most people are unaware of the damages happening to our environment.

Find out what's important in your life, get outside, enjoy earth and its life sustaining systems.

Don't be gloomy, what an amazing opportunity to reinvent everything. We're going to need human ingenuity.



**Across**

3. The global \_\_\_\_\_ population has grown from 1 billion in 1800 to 7.9 billion in 2020.
4. \_\_\_\_\_ design is the approach to creating products and services that have considered the environmental, social, and economic impacts from the initial phase through to the end of life.
5. \_\_\_\_\_ energy comes from sources that will run out or will not be replenished for thousands or even millions of years. Most sources of this energy are fossil fuels
10. Environmental studies is the study of \_\_\_\_\_ interactions with their environment.
11. The law of conservation of \_\_\_\_\_: In any physical or chemical change, matter is neither created nor destroyed but merely changed from one form to another.
13. Wise use of resources. Getting the maximum amount for your dollar.
16. Environmental science: The study of interactions among physical, chemical, and \_\_\_\_\_ components of the environment.
17. The \_\_\_\_\_ itself is one interconnected system. Natural systems change over time and space. Biogeochemical systems vary in ability to recover from disturbances.
18. Carrying \_\_\_\_\_: The amount of food that an area of land will yield. Therefore, the number of people that an area of land will support.
19. The first of the "R's" Our stuff becomes harmful waste.
22. \_\_\_\_\_ Allocation: The process of assigning resources in a way that ensures sustainability.
24. Believing the ecosphere, rather than any individual organism, is the source and support of all life.
25. The second of the "R's" So we can reduce. To use again

**Down**

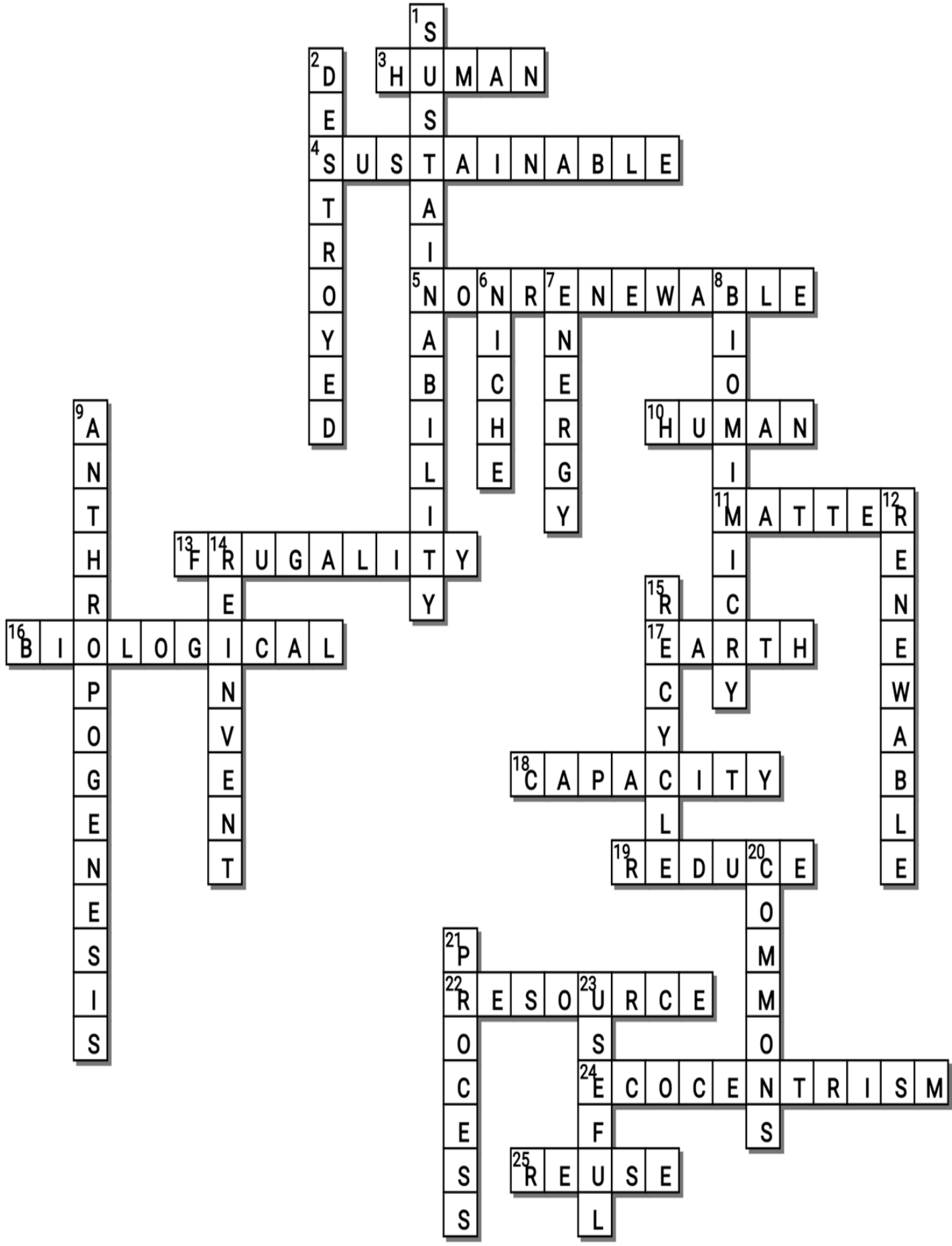
1. Meeting the needs of the present without compromising the ability of future generations to meet their own needs.
2. Matter cannot be created or \_\_\_\_\_
6. Ecological \_\_\_\_\_: The place or function of a given organism within its ecosystem.
7. E\_\_\_\_\_ conversions underlie all ecological processes.
8. A design discipline that studies nature's best ideas and then imitates them.
9. Humans shaping their environment.
12. \_\_\_\_\_ energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale.
14. Rethink and Re\_\_\_\_\_ Everything with the "R's" in mind
15. Last of the "R's" It often requires energy
20. The Tragedy of the \_\_\_\_\_, by Garrett Hardin (1968)
21. Science is a... Science is a method of learning more about the world. Science constantly changes the way we understand the world.
23. Energy goes from useful to less \_\_\_\_\_

-----Teacher can remove this word bank to make the crossword more challenging-----

**Possible Answers**

CAPACITY, ANTHROPOGENESIS, BIOMIMICRY, COMMONS, DESTROYED, EARTH, ECOCENTRISM, ENERGY, FRUGALITY, HUMAN, MATTER, NICHE, NON-RENEWABLE, PROCESS, RECYCLE, REDUCE, REINVENT, RENEWABLE, RESOURCE, REUSE, SUSTAINABILITY, SUSTAINABLE, BIOLOGICAL, HUMAN, USEFUL





# Part 7 Environment

1-20 = 5 pts **Part 7 Lesson 11**

\*20-\*25 \* = Bonus + 1 pt,

(Secretly write owl in correct space +1 pt)

Final Question = 5 pt wager

Name: \_\_\_\_\_

Due: Today

Score \_\_\_\_ / 100

ENVIRONMENTAL THOUGHT	LIVING ON EARTH	OUR FUTURE	THINKING GREEN	NATIONAL PARKS Bonus round 1pt each
1) <b>Resource Allocation</b>	6) <b>Frugality</b>	11) <b>Letter C</b>	16) <b>Megalopolis</b>	*21) <b>Arches National Park</b>
2) <b>Tragedy of the Commons</b>	7) <b>Sustainability</b>	12) <b>Letter C</b>	17) <b>Solar Passive</b>	*22) <b>Yellowstone National Park</b>
3) <b>Ecocentric</b>	8) <b>Human Population Growth</b>	13) <b>Fossil Fuels</b>	18) <b>Biomimicry</b>	*23) <b>Yosemite National Park</b>
4) <b>Kingdom Fungi</b>	9) <b>Approaching 8 Billion 8/10/2022</b>	14) <b>Carrying Capacity</b>	19) <b>Renewable Energy</b>	*24) <b>Everglades National Park</b>
5) <b>Reduce Ruse Reinvent Rethink Recover the Resource Recycle Last</b>	10) <b>Letter C</b>	15) <b>Letter C</b>	20) <b>Biofuels</b>	*25) <b>Denali National Park</b>

Final Question Wager \_\_\_\_/5 Answer: Hydropower.

**Damless Hydropower. Ocean thermal energy conversion. Wave Energy. Tidal Energy. Wind. Solar Chimney. Solar Thermal. Liquid Biofuels. Solid Biofuels.**

