Chapter 10 Geology: Processes, Hazards, and Soils

The Mount St. Helen’s Eruption
1. May 1980, volcano in the _______ range erupted, within 8 miles all obliterated; 19 miles all trees knocked down; 57 people died along with wild animals, crops and salmon hatcheries suffered losses
2. By 1990, various forms of life recolonized damaged area; showing that Earth is dynamic; geology-study of Earth

10-1 Geologic Processes:
-What is the Earth’s Structure
  a. Core (innermost layer- solid, liquid layers); Mantle (surrounds core) broken into asthenosphere and lithosphere
  b. Crust- consists of continental and oceanic crust

10-2 Internal and External Earth Processes
-What Geologic Processes Occur within the Earth’s Interior?
  a. Heat from the Earth’s interior rise through the mantle to create giant convection cells creating mantle plumes that drives plate tectonics

-What is Plate Tectonics?
  a. Tectonic plates (composed of crust and upper mantle- lithosphere) float on the mantle and move at the rate of your finger nail growth; PT became widely accepted in the 1970s due to ideas of ___________________ and sea-floor spreading
  b. Plate motion produces mountains, volcanoes, earthquakes and many of the natural resources we extract

-What Types of Boundaries Occur between the Earth’s Plates?
  a. Divergent plate boundary- plates move apart; convergent- plates collide (produce an ocean trench, volcanoes and strong earthquakes); transform faults- plate slide past each other (produce earthquakes)

-What Geologic processes occur on the Earth’s surface?
  a. External forces- erosion- natural weathering away of rocks and deposited somewhere else; weathering- can be mechanical (gravity, freezing/thawing) or chemical (oxidation)

10-3 Minerals, Rocks and Rock Cycle
-What are Minerals and Rocks?
  a. A mineral is an element or inorganic compound that occurs naturally and solid
  b. A rock- a combination of minerals that make up most of the crust

-What are the three major ways types of rock?
  a. Igneous rocks- formed from magma or lava (form bulk of the earth’s crust); sedimentary rocks-preexisting rocks that have weathered and eroded, deposited elsewhere and ‘glued’ together (cover majority of earth’s continents); metamorphic rocks- existing rocks exposed to high heat and pressure

-What is the rock cycle?
  a. Interaction of processes that change rocks from one type to another

10-4 Natural Hazards: Earthquakes and Volcanic Eruptions
-What are Earthquakes?
  a. Stress released in the Earth’s crust that produce an abrupt movement and vibrations; mainly caused by faulting; primary and secondary effects from earthquakes have cost $$$ and killed millions over the past 100 years

-Solutions: How can we reduce Earthquake Hazards?
  a. Locate active fault zones; make maps of high risk areas; establish building codes that regulate where and how buildings are built

-What are volcanoes?
  a. Magma reaches the surface and is ejected as large rocks, liquid lava, or gases; volcanic activity is concentrated near plate boundaries; though destructive, volcanoes are beneficial- new soil, land, beautiful scenery
How can we reduce volcano hazards?
   a. Better __________________; better prediction; effective evacuation plans;

10-5 Soil Resources: Formation and Types
-What major layers are found in mature soils?
   a. Soils are created by weathering of rocks and decaying organic matter
   b. Soil horizons- mature soils have over 3 layers
      1. ______________- surface litter layer; decomposed leaves, twigs, animal waste, etc.;
         normally black to dark brown
      2. A Horizon- topsoil layer; partially decomposed organic matter (humus); some inorganic
         minerals particles; most roots are concentrated in two upper layers; color of topsoil tells us
         what crops to grow (gray, yellow, red- low organic matter/ dark brown, black- organically
         rich)
      3. B Horizon- subsoil and C horizon (parent material) contain most of the soils’ inorganic
         matter, consist mainly of sand, silt, clay and gravel lying on top parent rock (bedrock)
      4. Soil components are dissolved and carried to lower layers in a process called leaching

-How do soils differ in texture, porosity and acidity?
   a. Clay- very fine particles, silt- fine particles, sand- medium sized particles, gravel (coarse particles);
      Soils with roughly equal mixtures of clay, silt, sand and gravel are called loams
   b. Soil porosity- measure of the volume of pores or spaces per volume of soil; permeability- average
      size of the spaces or pores determines rate at which water and air move through upper to lower soil
      layers
   c. _____________- best soils for growing, hold lots of water but not too lately; Sandy soils- easy to
      work but water flows through rapidly; Clay soil- more porous than sand and greater water holding
      capacity but lower permeability, upper layers usually too waterlogged for growing crops
   d. Acidity influenced by bedrock affects what type of plants can take nutrients

10-6 Soil Erosion and Degradation
-What causes soil erosion?
   a. Erosion is the movement of soil components from one place to another, the two main agents are
      flowing water and wind; soils vulnerable to erosion have been modified by farming, logging,
      construction, overgrazing, etc.
   b. Types of erosion:
      1. Sheet erosion- water peels off fairly uniform sheets or layers of soil
      2. _____________- fast flowing water makes small gullies
      3. Gully erosion- rivulets of fast-flowing water that cut channels and create large gullies usually
         occur on steep slopes
      4. Soils are classified as a renewable resource where natural processes regenerate it, in tropical and
         temperate areas takes 200-1000 years for 1 inch of new topsoil to be created

-How serious is global soil erosion?
   a. On 1/3 of world’s cropland, topsoil is eroding faster than it forms; one reason that soil erosion is not a
      high priority because it occurs so slowly
-How serious is soil erosion in the U.S.?
   a. According to U.S. Dept. of Agriculture, soil on cultivated land is eroding 16 times faster than it can
      form; costs the US $30 billion in 1997 not including ecological effects
-What is desertification, and how serious is this problem?
   a. Arid land fall to unproductive desert caused by drought and unsustainable human activities; in the past
      50 years an area the size of Brazil has become desertified worldwide; can be prevented by reducing
      overgrazing, deforestation, mining, etc.; plant trees and grasses
- The Dust Bowl
   a. 1930s much of the topsoil in the Midwest was lost due to poor cultivation and prolonged drought;
      caused dust clouds that choked wildlife along with most Midwesterners abandoning their farms; led to
1935 ________________ to promote more sustainable practice; threat of another Dust Bowl more likely due to climate change

-How do excess salts and water degrade soils?
  a. ~17% of world’s cropland that is irrigated produced 40% of all food; downside- most irrigated water leaves behind accumulation of salts (salinization) which stunts crop growth, lowers crop yields, etc.
  b. ________________ is major problem in Colorado Basin, California, China, India and Pakistan
  c. Waterlogging- farmers apply large amounts of water to leach salts into soil which raises water table too high

10-7 Solutions: Soil Conservation

-How can conservation tillage reduce soil erosion?
  a. Goal to reduce soil erosion and restore soil fertility; conventional tillage farming- farmers plow the land making it vulnerable to erosion; conservation-tillage farming- disturb the soil as little as possible by no till (plant machines inject seeds, fertilizers and herbicides) or minimum-tillage (only break up subsurface layer not topsoil layer)

Solutions: What Other Methods can reduce soil erosion?
  a. Terracing- reduces erosion on steep slopes, retains water at each level
  b. ________________ - used on gently sloped land, rows go across contours of land
  c. Strip cropping- planting alternating strips of row crop (corn) and another crop (grass) allows for trapping soil and water and restores soil fertility
  d. Alley cropping (agroforestry)- several crops are planted in alleys between trees and shrubs that can provide fuelwood
  e. Windbreaks (shelterbelts)- surrounding farms with trees reduces wind erosion, provides habitats for pollinators
  f. ________________ - restoring severely eroded land with fast growing shrubs, vines to stabilize soil
  g. Land classification- identify easily erodible land that should not be used for agriculture

- Slowing soil erosion in the U.S.
  a. 1985 Farm Act established a strategy for reducing soil erosion, by 2001 1/10th of US cropland were in Conservation Reserve Program (farmers who violate must payback all subsidies such as farmed, grazed or cut for hay)
  b. Has cut soil loss by 65%, made the US the first major food producing country to make soil conservation a national priority

-How can we maintain and restore soil fertility?
  a. Organic fertilizer-
    1. Animal manure- dung of livestock improves soil structure, adds nitrogen and stimulates beneficial bacteria/fungi; drawbacks- most manure not produced on farms, high costs of transporting, replacement of livestock with tractors=less manure
    2. Green manure- green vegetation plowed into the soil for next planting
    3. ________________- sweet-smelling, dark brown, humus-like material, microorganisms break down leaves, food wastes, paper and wood and make a rich natural fertilizer
    4. Spores of mushrooms, puffballs and truffles- rapidly growing mycorrhizae fungi attach to plant roots and help to take in moisture and nutrients, very cheap to apply

-Can inorganic fertilizers save the soil?
  a. Inorganic fertilizers are rich in nitrogen, phosphorous and potassium, easy to transport, store and apply
  b. Cons: do not add ________________ to soil, cannot hold as much water, lower oxygen content, only supply 2-3 of 20 nutrients plant need, require lots of energy to transport, produce and apply, release nitrous oxide a greenhouse gas; cause cultural eutrophication

Chapter 21 Solid and Hazardous Waste

There is no “away” Love Canal
a. Near Niagara Fall, NY OxyChem-sealed chemical waste were dumped into an old canal excavation; covered it in 1953 with clay/topsoil and sold it to local school board for $1 (warned school not to disturb wastes, toxic waste could leak, issued a disclaimer against legal liability)

b. By 1977, roads and homes were built nearby and chemical smells and burns were being reported, declared a Federal Disaster Area -- all homes were evacuated and purchased

c. By 1999, Oxychem has paid over $100 million in settlement costs; lessons -- there is no ‘away’, preventing pollution is cheaper and safer than cleaning it up

21-1 Wasting Resources
-What is solid waste, and how much is produced?
  a. US (4.6% of world population) produces 33% of world’s solid waste; __________ / American
  b. 1.5% considered Municipal Solid Waste -- what we throw out each week; 98.5% Mining and gas production, agriculture, sewage sludge and industrial activities -- all indirect forms of solid waste

-What does it mean to live in a high-waste society?
  a. Page 526 -- staggering statistics; fastest growing waste -- electronics many hazardous

-What is hazardous waste, how much is produced?
  a. Any waste that contains 39 toxic, carcinogenic, mutagenic or terratogenic compounds, catches fire easily, capable of corroding metal, does not include: radioactive waste, hazardous waste discarded by households and small businesses, mining, oil and gas drilling wastes, cement kiln dust,

-Mining and Smelting Waste in Montana
  a. Two of the largest toxic waste sites in Montana, 99.7% of site is waste rock after copper extracted in multiple 50 foot tall piles causing acidic and toxic metals to pollute waterways
  b. Wells 100’s of miles away unsafe to drink from; will cost >$1 billion to clean up

-A Black Day in Bhopal
  a. World’s worst industrial accident in India 1984, pesticide company exploded converting gas to ____________ killing at least 10,000 and permanently injured 60,000, cost $4.1 billion victim only received $600-3000; further lawsuits pending

-What is the threat from release of toxic chemicals from industrial plants because of accidents and terrorism?
  a. Since 9/11 attacks many industrial plants are seen as easy targets for terrorist; most plants are not as secure as nuclear power plants

21-2 Producing less waste and pollution
-What are our options?
  a. Waste mgmt. high waste approach -- waste production an unavoidable product of economic growth, bury or burn or ship to another state/country
  b. Waste and pollution prevention, a low waste approach -- recognizes there is no away; views waste as a resource that should be recycled, composted or reused; discourages waste production prevention could reduce solid and hazardous waste by 60-80%

-Solutions: how can we reduce waste and pollution?
  a. ____________ -- do you really need this item or just want it? Can I buy it second hand? Can I borrow or lease it?
  b. Redesign manufacturing process to use less material, energy, waste and pollution, use less packaging
  c. Develop products that are easy to repair, reuse and recycle, design products to last longer
  d. Tax on trash to reduce waste

21-3 Solutions: Cleaner production and selling services instead of things
-What is the ecoindustrial revolution, what are its benefits?
  a. Industrial ecology, manufacturing processes designed as a closed system of cyclical material flow mimicking biogeochemical cycles; many companies have adopted pollution prevention programs saving $$ (Xerox has saved $2 billion from 1992-02)

-We have been asking the wrong questions about wastes
  a. Where to put waste has been the wrong questions asking why we produce leads to pollution prevention instead of waste management; challenge industry to make less packaging, less chemicals
  b. Some have a vested interest in waste management; better decisions need to be made
- Doing more with less: Increasing Resource Productivity
  a. Design revolution- find substitutes, make products with less material, many paper documents can be accessed via internet, CD-ROM etc., ex: a skyscraper built today uses 35% less material than in 1960, also have reduced weight of cars, appliances and fuel efficiency by 25%
  b. We can still increase resource productivity by 75-90% according to the book “_____________
- What is service flow economy, and what are its advantages?
  a. A proposal of instead of buying products and goods outright, customers would ______________ services or goods; puts stewardship back on manufacturer to treat product as an asset that needs to last
  b. Already being done with photocopiers (Xerox), carpeting, warmth services in France, cooling services (Carrier), organic solvents (Dow)

21-4 Reuse
- What are the advantages of refillable containers?
  a. Reuse is a form of waste production such as lunch boxes, Tupperware, shopping bags, shipping pallets, power tools, e-paper and of course reusable water bottles
  b. Bad news: more throwaway tissues, paper towels less handkerchiefs, reusable cloth ones; more paper plates, cups, plastic utensils are being consumed than the past

-Ray Anderson
  a. CEO of Interface, makes carpet manufacturing tiles that is the first to be a totally sustainable green corporation; goals- zero waste, (lease carpets instead of sales, recycle all tiles) reduced energy use; 100% solar energy use;

21-5 Recycling
- What are two types of recycling?
  a. Primary- wastes are discarded and produced new products (newspaper into newspaper); reduces virgin resources and energy use
  b. Secondary- waste materials are converted into lower quality
  c. Best solution- buy products with the most ______________recycled materials
- What kind of grocery bags should we use?
  a. Paper or plastic? Neither!! both are environmentally wasteful; choose reusable bags
- Case study: Recycling municipal solid waste in the U.S.
  a. In 2000, 30% of US MSW was recycled or composted; 98% of steel in cars, 96% of car batteries, 50% of paper, 40% of yard waste; could recycle up to 60-80% of waste
- Is Centralized Recycling of Mixed Solid Waste the Answer?
  a. Materials-recovery facilities shred and separate mixed waste to recover raw materials, or to recycle, burn for electricity
  b. Drawbacks- expensive to build, operate and maintain, emit toxic air pollutants and toxic ash; owners have a vested interest to __________
- Is separating solid waste for recycling the answer?
  a. Some experts believe households and businesses should separate items; source separation produces little pollution, lower operating costs, provides more jobs per unit of material over MRFs, landfills and incinerators, educates people about recycling
- Cleaner Production: New Environmentalism for the 21st century
  a. Pollution mgmt. approach of environmentalism has failed, pollution prevention is best hope; damage to humans is abundantly documented
- Solutions: using composting to recycle biodegradable wastes
  a. Composting a way to produce plant nutrients that can be recycled into the soil; European countries compost at higher rates, must be able to control odors, exclude toxic material that can make compost unsuitable as fertilizer
- Does recycling make economic sense?
  a. Critics to recycling- does not make sense if it is not ________________, most places are not running out of landfill space, glass does not make much sense to recycle (plenty of sand worldwide)
b. Proponents- primary goal not to reduce use of landfills and incinerators but rather environmental benefits, recycling employs over 1 million people

-Why don’t we have more reuse and recycling?
  a. Failure to include harmful environmental/health costs of raw materials, more tax breaks/subsidies for resource extracting industries than for recycling, lack of steady markets for recycled materials
  b. Suggestions: increase pays-as-you-throw system, view landfills and incinerators as ______________, pass laws that require companies to take back and recycle appliances, motor vehicles, etc.

21-6 Case Studies: Recycling Aluminum, Wastepaper and Plastics

-Recycling, reuse and waste reduction in Germany
  a. Enacted the world’s toughest packaging law; 86% of all packaging is recycled, up from 12% in 1992; has inspired 28 other countries to enact similar take-back laws for packaging materials
-How is paper made, and how much is being recycled?
  a. Trees are stripped of bark then treated with caustic soda (sodium hydroxide) to turn wood into a soft mush or pulp of cellulose fibers, rinsed several times, bleached (using toxic chlorine), or pressed into a thin sheet and dried
  b. Easiest of materials to recycle, remove ink, glue, etc; reconvert to pulp and rinsed/bleached to make high grade paper (textbook paper is all recycled);
  c. 2000 US recycled 50% of wastepaper; recycling does not involve cutting new trees, saves energy, reduces air and water pollution, created 5x more jobs than harvesting trees
  d. Most recycled paper is made from preconsumer waste (scraps and cuttings recovered from printing plants), a marketing ploy, not really recycled material, most has only 10% postconsumer waste; govt. needs to require companies to use labels indicating postconsumer content and chlorine free bleach
-Is it feasible to recycle plastics?
  a. Plastics are various types of polymer molecules produced by oil and natural gas; very difficult to recycle because of many types of __________, oil prices are low
  b. Plastic benefits: durability, lightweight, unbreakable (compared to glass), some reusable
  c. Drawbacks: lot of hazardous waste in production, toxic cadmium and lead can leak out, take 200-400 years to break down

21-7 Detoxifying, Burning, Burying and Exporting Wastes

-How can use biological methods to detoxify hazardous waste?
  a. ________________- biological treatment of hazardous waste into harmless compounds (pesticides, diesel fuel, gasoline, PCBs, organic solvents); does not work for toxic metals and highly concentrated chemical wastes
  b. Phytoremediation- using natural or genetically engineered plants to filter and remove contaminants; plants such as poplar, sunflower, clover, mustard, and ferns
-How can we use chemical methods to detoxify hazardous waste?
  a. ________________-_ type of sugar, made from corn starch to remove toxic materials from contaminated groundwater; it can be injected and attracts pollutants
-Is detoxifying hazardous waste with a plasma torch the answer?
  a. Plasma arch torch- exposes wastes to 10,000 C or higher, converts materials to simple molecules and released as a gas or a molten glassy material, can be used at many site
  b. Drawbacks- releases CO2 and CO and toxic particulates, very $$
-Is burning solid and hazardous waste the answer?
  a. Mass burn incinerators- 170 in the US, combusts 16% of MSW; pros- less landfill space needed, less water pollution; cons- $$, air pollution, highly toxic ash, encourages waste production
-Is land disposal of solid waste the answer?
  a. 54% by weight of MSW in US sent to landfills; solid wastes are spread in thin layers, compacted and covered with clay or plastic foam; landfills are lined with plastic and an impermeable layer before being filled with garbage; the liner collects ________________ (contaminated rainwater) and sent to sewage treatment plant; older landfills are a serious problem with leaks into groundwater
- Is land disposal of hazardous waste the answer?
  a. Deep underground wells- pumped liquid hazardous waste below aquifers and isolated in impermeable layers of rock (wastes may leak into groundwater over time)
  b. Surface impoundments- placed in ponds, pits, lagoons, where water eventually evaporates most likely to pollute groundwater
  c. State of the art landfills- hazardous waste stored in drums and buried in carefully designed landfills
  d. Above ground storage facilities- two story building made of reinforced concrete, fans to create negative air pressure to prevent the release of toxic gases

- Is exporting hazardous waste the answer?
  a. Some haz. waste producers have been legally shipping waste to developing countries due to cheaper rates; in 1995 Basel Convention on Hazardous Waste- ban all hazardous waste exports from developed countries to developing countries

21-8 Case studies: Lead, Dioxins, and Chlorine

- What is the threat from lead?
  a. Lead is potent neurotoxin that harms the nervous system especially in children; ~15,000 treated for acute lead poisoning annually; causes blindness, paralysis, mental retardation;

- How can we reduce exposure to lead?
  a. Test all children, banned incineration of hazardous materials, phase out leaded ___________, remove lead pipes and paint

- What is the threat from mercury?
  a. Mercury is also a potent neurotoxin that affects brains and spinal cord, inhaled as a vapor or eating fish contaminated with ________________
  b. Originates in coal burning, waste incineration; most at risk- pregnant women, children less than 6 and people who consume a lot of fish

- Using landfill methane to heat a school?
  a. Pattonville High School (near St. Louis) became first school to use methane gas from nearby landfill as a source of heat due to ecology club; school built upgrade, has recouped investment and is now saving $$

- How can we reduce exposure to Mercury
  a. Emissions control- lower emissions of coal and incinerators, tax mercury emitted
  b. Prevention- remove mercury before it is burned, convert coal to liquid, shift to natural gas, ban use of mercury in thermometers and batteries, collect used fluorescent bulbs at recycling facilities, require labels on all products containing mercury

- What should we do about chlorine?
  a. We are dependent on chlorine- plastics, solvents; accumulate in ________________, persistent, harmful to human health
  b. Substitutes- soap and water, stream cleaning, citrus-based solvents, physical cleaning; find substitutes to make plastics instead of chlorine

- How dangerous are dioxins
  a. Dioxins are a family of more than 75 different chlorinated hydrocarbon compounds an unwanted by-product of industrial purposes
  b. Sources- Wood burning fireplaces, coal power plants, metal smelting, paper mills, sludge from mwtp’s
  c. Most dioxins are likely ________________, at risk- those who eat large amounts of fatty meats and dairy products

21-9 Hazardous Waste Regulation in the U.S.

- What is the Resource Conservation and Recovery Act?
  a. An act in 1976 and amended in 1984 requiring the EPA to identify hazardous waste and restrict firm with only permits to dispose of waste

- What is the Superfund Act?
  a. Through taxes on raw materials, provides a trust fund for identifying abandoned hazardous waste sites, cleaning the sites and identifying the responsible parties to pay for the cleanup (polluter-pays principle)
What are Brownfields?
   a. Abandoned industrial and commercial sites that are contaminated (junkyards, gas stations, older landfills); 450,000-600,000 sites in the U.S.; after cleanup many sites have become used by public

Using honeybees to detect toxic pollutants
   a. Honeybees can detect toxins as low as several ppm; are able to identify many pollutants; great

-How can the superfund law be improved?
   a. Polluters and insurance companies have fought the polluter-pays principle and make superfund public pays by denying responsibility, sue local govt. to make them responsible for cleanup, pose public relations campaign showing that toxic sites pose little threat
   b. Solutions- set up $8 billion fund to use rather than individual insurance companies; exempt individuals and small businesses; involve local govt., rank sites

21-10 Solutions: Achieving a Low-Waste Society
-What is the role of grassroots action? Bottom-up change
   a. Most toxic facilities (incinerators, landfills, etc.) are found in communities populated mostly by African Americans, Asian Americans, Latinos and poor whites-
   b. If local citizens adopt NIMBY (not in my backyard) then waste will have to go somewhere; better argument produce less hazardous waste NIABY (not in anyone’s backyard) or NOPE (not on planet Earth)

-What can be done at the international level?
   a. In 2000, 122 countries completed a global treaty to control 12 persistent (dirty dozen) include DDT, chlorine-containing persistent pesticides, PCBs, dioxins, and furans

-How can we make the transition to a low-waste society?
   a. Albert Einstein: “A clever person solves a problem, a wise person avoids it.”
   b. Everything is connected, there is no away, dilution is not always the solution, cheapest way to deal with pollution is to produce less
   c. ________________ products to educate consumers
Edible Landfill

Acquire these items:
- One 8-ounce cup (clear) - 5 Oreos
- Handful of raisins - 1 fruit rollup
- 2 graham crackers - 2 red licorice sticks
- 1 birthday candle - 1 serving of pudding
- 2 tablespoons of whipped cream - 1 plastic knife
- 1 plastic fork - 1 handful of chewable candies

While constructing your landfill pay attention to details. When you are finished, you are to diagram your edible landfill on a separate piece of paper and compare it to a real landfill in a second diagram.

1. Obtain one cup and five Oreos. The cup represents an excavated hole in the ground.
2. Carefully ‘unscrew’ two of the cookies, so that half has white cream and the other is bare. Crush the bare cookie into small pieces on a paper towel and place in the cup. The crushed cookies represent a layer of soil that is placed in the bottom of a real landfills.
3. Take the other cookie halves with white cream and break them up into two or three pieces. Place these pieces in the cup with the white cream facing up. This represents a layer of clay that is put on top of the soil.
4. Obtain the plastic knife and cut a fruit rollup to roughly fit the size of the top of the cup and slide into place on top of the cookies to represent a plastic liner. What do plastic liners prevent?
5. Next, crush your graham crackers, which represents your sand layer. What does this layer do in a landfill?
6. Place your raisins on top of the graham crackers, this layer represents a layer of pebbles.
7. Rip your licorice sticks in half and bite off both ends to represent leachate pipes. Stick the pipes into the pebble layer. What do these pipes do?
8. Sprinkle most of the candies on top of the raisin. These candies are your garbage.
9. Take your serving of pudding and place on top of the candies. Then add one your remaining candies on top of the landfill. The pudding represents seepage from rain running through the garbage. Why are more candies placed on top?
10. ‘Unscrew’ your remaining Oreos and repeat step #2. (You may eat the other cream-covered half 😊).
11. Use a layer of whipped cream to ‘cap’ the landfill, cover it up. What is the purpose of a cap?
12. Stick your candle into the landfill and light it. What does the candle and flame represent?
13. While diagramming your landfill using our various materials (BOTH FOOD ITEMS AD WHAT THEY REPRESENT), you may now eat your landfill!!!
Analyses
1. What is a landfill?

2. What is the composition of a landfill?

3. What is a bottom liner?

4. What is wrong with a clay liner?

5. What is wrong with a plastic liner?

6. What is wrong with a composite liner?

7. What is a leachate collection system?

8. What are some of the problems with leachate collection systems?

9. What is a cover?

10. What are the problems with covers?
Energy and Recycling

Introduction:

The Coors Brewing Company in Golden Colorado initiated an aluminum recycling program in 11 states. During the first 11 months they collected $4.97 \times 10^6$ pounds of cans. On an annual basis this works out to be about $5.5 \times 10^6$ pounds/year. If there are about 20 cans/lb, this works out to be about 110,000,000 cans. The average seller of cans to the brewery was a 16 year old boy driven by his parents. He lived more than 5 miles from the recycling center and the average amount sold to Coors was 53lb/seller. This program was hailed as a great success. Coors received a medal from the White House and everyone was extremely happy that 2750 tons of aluminum was recycled.

Lets look more closely at the situation. Aluminum is about 1/7 of 1% of urban and industrial waste. 16.3% of roadside litter was cans. Even if all the aluminum was collected it would comprise only about 0.5% of all litter. The project didn't reduce roadside litter to any extent.

Calculations: (Show all Math)

1- $53\text{lb/person/trip for } 5.5 \times 10^6 \text{ pounds of aluminum} = \text{_________trips}$

2- At an average of 10 miles, round trip, \text{_________total miles driven just to deliver the cans} (not counting any miles driven to gather them).

3- At an average of 15 miles/gal the total gasoline used is about \text{_________gal}

4- 2750 tons of aluminum is 1/20 of 1% of all aluminum used in the USA.

5- However, much energy is saved by recycling aluminum rather than mining and processing the most common aluminum ore, bauxite.

6- Virgin ore needs 134,770 BTU/lb of energy for processing into useful aluminum, whereas recycled material only needs about 5000BTU/lb. How much energy is saved by recycling 2750 tons of aluminum compared to processing virgin ore? Show your work.

7- Gasoline produces about 125,000BTU/gal. How many BTU's are needed to drive to deliver the cans? \text{______________}

8- How does this compare to the energy needed to process virgin ore to make aluminum? \text{____________________}

9- If you do the conversions, it would take about 1oz of gasoline/can to process the recycled aluminum. How many gallons (1gal = 132oz) of gasoline would be needed to process all the aluminum to be recycled? \text{_________gal}. How much energy is that equivalent to, in BTU's? \text{________BTU}

Compare the total energy needed to process recycled aluminum to the processing of virgin ore. \text{______________}

Questions:

1- Which method uses the most total energy?
2- Make a judgment as to the economy of recycling. Is it wasteful or is recycling good?

3- What about pollution caused by driving around to do the collecting and dropping off the cans? What about the wear and tear on the roads? Accidents?

4- Is it possible for well intentioned projects to do more harm than good? For example, to process virgin glass it takes 7800BTU/lb and to process recycled material it takes 7200 BTU/lb

5- Going to back to the plastic vs. paper argument go to: http://www.msnbc.msn.com/id/23358591/ and go to “Calculate Impact”

   1. If you were a 100% plastic bag user but eliminated use of them, how many bags would you ‘save’? __________ What if 50% of the U.S. did the same, how many less barrels of oils would need to be produced? __________________

   2. Now switch it to 100% paper bag user and you eliminate all paper bag use, how many bags would you ‘save’? _________ How many trees would be saved if 50% of the U.S. did the same? ___________

6- What are the advantages of recycling, or are there any? Is it worth the effort?
Name ___________________________

Field Trip: Landfill

1. What is the purpose of covering trash at the end of each day?

2. How is groundwater contamination prevented?

3. How is methane gas generated?

4. What is done with the methane gas that is collected?

5. How much garbage is received on average at this site every day?

6. How many people in local communities are served by this site?

7. What is the projected life of this landfill?

8. What are some alternative ways for them to manage their trash?

9. Itemized the solid waste you produced from your lunch. How could you reduce this?

10. What is the most surprising concept you have learned on today’s field trip?
1a) A percolation tube, having a radius of 3 cm, is filled with soil A. 50 mL of water is then poured steadily onto the surface of the soil. It takes 10 seconds from the start of pouring for the water to disappear below the surface of the soil. What is the percolation rate for soil A?

b) After soil A is fully saturated with water, a soil sample is removed from the percolation tube and weighed. This wet weight is 25.8 grams. After drying in an overnight, the soil sample is weighed again. The dry weight is 22.3 grams. What is the water holding capacity of the soil?

2) The percolation rate and the water holding capacity for soil B and C are found using similar methods. The following are the numbers:

<table>
<thead>
<tr>
<th>Soil</th>
<th>Percolation Rate</th>
<th>Water holding Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil B</td>
<td>4.3 mL/cm²/min.</td>
<td>35.5%</td>
</tr>
<tr>
<td>Soil C</td>
<td>7.5 mL/cm²/min.</td>
<td>23.3%</td>
</tr>
</tbody>
</table>

Considering the three soils, A, B, C which one contains predominately silt? Which one is predominately sand? Which one is predominately clay? Explain your answers.

3) A graduated cylinder is partially filled with a soil from the Hotchkiss area. Water is added and the cylinder is shaken so that the soil components are suspended in the water. The soil components are then allowed to settle into layers overnight. There is a 2.2 cm sand layer on the bottom, a middle 1.8 cm silt layer, and a 1.0 cm clay layer on top. What is the name of this soil using the Universal Soil Triangle?

4) Old flood plains (A flood plain is the flat area bordering a river or stream; an old flood plain has not had a flood in over ten years) commonly contain shallow pools or even small ponds. Using your knowledge of soils, explain this phenomenon.

5) Classified as loamy sand, the soil on top of Ice Cave Mountain contained very little clay. Explain why a soil lacking clay has low amounts of nutrients. Check chapter 10 if needed.

6) How does the soil type on top of Ice Cave Mountain help explain why fire is a typical disturbance in the Pine Plains ecosystem?
3.2 Investigation

Soil Surveys and You

Outcomes:
- Students will identify sources of information about local soil types.
- Students will identify soil types on a soil survey map.
- Students will locate information to determine whether a given soil type is suitable for a specific land use.

Background Information:
There are several thousand types of soil in the United States. Each soil type has unique physical and chemical properties. Soils only a few feet apart may have very different properties. These properties determine whether the soil is suitable for a specific land use.

How can we find out if the area we plan to use has soil that is suitable for the use we have planned? The Soil Conservation Service has surveyed and mapped the soil types on nearly 2 billion acres (0.8 billion hectares) of land. Surveying and mapping will continue until all areas in the United States are mapped. About 50 million acres (20 million hectares) are mapped each year. When a map has been published, it is available through the local Soil Conservation Service office.

The information contained in soil surveys can tell engineers, developers, builders, home buyers, and planning commissions:

- If the location of bedrock will increase the cost of excavation.
- If the soil can properly filter waste from a septic system.
- If special foundations are needed to prevent cracking.
- If erosion may damage a pipeline, road, or foundation.
- If the pipe is likely to be damaged by corrosion.
- If a site is a good source of sand or gravel.
- If flooding will be a hazard.

The soil scientists responsible for the surveys have walked many miles and dug many holes. In addition to the soil profile, they observed the slope of the land, the size of the streams, the type of rocks, the type of native plants, and the crops planted at each site. The soils were studied at the site and sometimes sent to the laboratory for further testing.

When the soil type was identified, it was given the name that had been assigned to other soils with similar profiles. This group of soils is called a series, and the series is usually named for a town or geographic feature where the soil was first seen.

The soil survey maps show the location of each type of soil in the area surveyed. On the map, the soils are identified by two letters of their name and a third letter that describes the slope. A capital letter is always used to refer to the slope. The absence of a letter indicates that the land is nearly level. Letters are used as follows:

- BeB = 0-8%
- BeC = 8-25%
- BeF = 25-70%
- MaB = 2-8%
- MaC = 8-15%
- LbB = 0-8%
- LbC = 8-25%
- OxB = 0-8%
- OxC = 8-25%
- WpB = 0-8%
- WpC = 8-25%
- WyA = 0-3%
- WyB = 3-8%
- WyC = 8-15%
- WyD = 15-25%
- WyE = 25-70%
In addition to the maps, the soil surveys also contain information on more than 25 different soil properties that may affect the proposed land use. Proper use of soil surveys can save thousands of dollars for homeowners and taxpayers by providing information about potential problems before construction begins.

Procedure:

The charts that follow have been adapted from a soil survey manual. They contain information about several different types of soil that are common to the area near the Delaware River in Monroe County, Pennsylvania.

The approximate locations of the soil types can be seen on the soil maps. Use the following charts and maps to answer the questions in the analysis section.

<table>
<thead>
<tr>
<th>Soil Symbol</th>
<th>USDA Texture Description</th>
<th>Depth in Inches</th>
<th>Rock Fragments (%)</th>
<th>&gt; 3 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be</td>
<td>Channery* silt loam</td>
<td>0-8</td>
<td>15-20</td>
<td></td>
</tr>
<tr>
<td>Benson-Rock</td>
<td>Shaly to very shaly silt loam</td>
<td>8-18</td>
<td>5-50</td>
<td></td>
</tr>
<tr>
<td>Outcrop****</td>
<td>Unweathered bedrock</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hy</td>
<td>Silt loam, loam, sandy loam, silty clay loam</td>
<td>8-41</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Holly</td>
<td>Gravelly loam, gr. silt loam, sandy loam</td>
<td>41-60</td>
<td>0-5</td>
<td></td>
</tr>
<tr>
<td>Lb</td>
<td>Extremely stony loam***</td>
<td>0-12</td>
<td>10-25</td>
<td></td>
</tr>
<tr>
<td>Lackawana</td>
<td>Ch. loam, ch. silt loam, ch. sandy loam</td>
<td>12-75</td>
<td>0-20</td>
<td></td>
</tr>
<tr>
<td>Ma</td>
<td>Ch. loam, ch. silt loam, gravelly** loam</td>
<td>9-24</td>
<td>5-10</td>
<td></td>
</tr>
<tr>
<td>Mardin</td>
<td>Gravelly loam, gr. silt loam, sand loam</td>
<td>24-99</td>
<td>10-25</td>
<td></td>
</tr>
<tr>
<td>Ms, Mp</td>
<td>Mucky peat</td>
<td>0-84</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>mucky peat</td>
<td>Silty clay loam, silt loam, ch. loam</td>
<td>84-99</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ox</td>
<td>Extremely stony loam</td>
<td>0-3</td>
<td>10-20</td>
<td></td>
</tr>
<tr>
<td>Oquaga part</td>
<td>Ch. loam, ch. silt loam, very ch. loam</td>
<td>3-26</td>
<td>10-25</td>
<td></td>
</tr>
<tr>
<td>Unweathered bedrock</td>
<td></td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Po, Pp</td>
<td>Silt loam</td>
<td>0-10</td>
<td>0-5</td>
<td></td>
</tr>
<tr>
<td>Pope</td>
<td>Silt loam, fine sandy loam, gravelly sandy loam</td>
<td>10-60</td>
<td>0-5</td>
<td></td>
</tr>
<tr>
<td>Wp</td>
<td>Extremely stony loam</td>
<td>0-10</td>
<td>10-25</td>
<td></td>
</tr>
<tr>
<td>Wellsboro</td>
<td>Gr. loam, ch. silt loam, loam</td>
<td>10-23</td>
<td>0-15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ch. loam, sandy loam, ch. loam</td>
<td>23-60</td>
<td>0-20</td>
<td></td>
</tr>
<tr>
<td>Wy</td>
<td>Gravelly sandy loam</td>
<td>0-8</td>
<td>0-15</td>
<td></td>
</tr>
<tr>
<td>Wyoming</td>
<td>Gr. sandy loam, very gr. sandy loam</td>
<td>8-26</td>
<td>0-25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Very gr. sandy loam, very gr. sand</td>
<td>26-60</td>
<td>5-30</td>
<td></td>
</tr>
</tbody>
</table>

*Channery—soil that is more than 15% (by volume) thin, flat fragments of sandstone, shale, slate, limestone, or schist. Fragments may be as much as 6 inches long. (Abbreviated as Ch.)

**Gravel—rounded or angular fragments of rock up to 3 inches in diameter. (Abbreviated as Gr.)

***Stones—rock fragments 10-24 inches in diameter.

****Rock outcrop—bedrock that is exposed or has no soil covering.
GLOSSARY:
The terms listed below are used in the tables that follow. Refer back to this section as needed.

**Slight limitation**—soil properties are generally favorable for specified use; limitations are minor and can be easily overcome.

**Moderate**—soil properties and site features are unfavorable for the specified use, limitations can be overcome or minimized by special planning and design.

**Severe**—one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required.

### Table 3.2-2 Limitations for Homesites

<table>
<thead>
<tr>
<th>Soil Symbol</th>
<th>Limitations for Building w/ Basement</th>
<th>Shrink-Swell Potential</th>
<th>Septic Tank Absorption Fields</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be</td>
<td>Severe: depth to bedrock</td>
<td></td>
<td>Severe: depth to bedrock</td>
</tr>
<tr>
<td>Benson-Rock Outcrop</td>
<td></td>
<td>large stones</td>
<td>large stones</td>
</tr>
<tr>
<td></td>
<td>(C,F) slope</td>
<td>low</td>
<td>(C,F) slope</td>
</tr>
<tr>
<td>Hy</td>
<td>Severe: floods</td>
<td></td>
<td>Severe: floods</td>
</tr>
<tr>
<td>Holly</td>
<td>wetness</td>
<td>low</td>
<td>wetness</td>
</tr>
<tr>
<td>Lb</td>
<td>Severe: large stones</td>
<td></td>
<td>Severe: percs slowly</td>
</tr>
<tr>
<td>Lackawana</td>
<td>(C) slope</td>
<td>low</td>
<td></td>
</tr>
<tr>
<td>Ma</td>
<td>Moderate: wetness</td>
<td></td>
<td>Severe: percs slowly</td>
</tr>
<tr>
<td>Mardin</td>
<td>(C) slope</td>
<td>low</td>
<td>wetness</td>
</tr>
<tr>
<td>Ms, Mp</td>
<td>mucky peat-shallow, deep</td>
<td>Severe: floods</td>
<td>Severe: floods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>high</td>
<td>excess humus</td>
</tr>
<tr>
<td>Ox</td>
<td>Severe: large stones</td>
<td></td>
<td>Severe: large stones</td>
</tr>
<tr>
<td>Oquaga part</td>
<td>depth to rock</td>
<td></td>
<td>depth to rock</td>
</tr>
<tr>
<td></td>
<td>(C) slope</td>
<td>low</td>
<td>(C) slope</td>
</tr>
<tr>
<td>Po, Pp</td>
<td>Severe: floods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pope</td>
<td>depth to rock</td>
<td>low</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(C) slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wp</td>
<td>Severe: wetness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wellsboro</td>
<td>large stones</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(C) slope</td>
<td>low</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slight: (A,B)</td>
<td></td>
<td>Slight: (A,B)</td>
</tr>
<tr>
<td></td>
<td>Moderate: (C) slope</td>
<td></td>
<td>Moderate: (C) slope</td>
</tr>
<tr>
<td>Wy</td>
<td>Severe: (D,E) slope</td>
<td>low</td>
<td>Severe: (D,E)</td>
</tr>
<tr>
<td>Wyoming</td>
<td></td>
<td></td>
<td>slope, percs rapidly</td>
</tr>
</tbody>
</table>
Table 3.2–3 Limitations for Land Use

<table>
<thead>
<tr>
<th>Soil Symbol</th>
<th>Farming</th>
<th>Pond or Reservoir Area</th>
<th>Camping</th>
<th>Wetland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be</td>
<td>Poor:</td>
<td>slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benson-Rock</td>
<td>large stones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcrop</td>
<td>rock outcrops</td>
<td>depth to rock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe:</td>
<td>large stones</td>
<td>(C,F) slope</td>
<td>Poor (B)</td>
<td></td>
</tr>
<tr>
<td>Hy</td>
<td>Poor:</td>
<td>Severe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holly</td>
<td>100°</td>
<td>seepage</td>
<td></td>
<td>Good</td>
</tr>
<tr>
<td>Lb</td>
<td>Poor:</td>
<td>slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lackawana</td>
<td>large stones</td>
<td>slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe:</td>
<td>large stones</td>
<td>Very Poor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ma</td>
<td>Poor:</td>
<td>Moderate:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mardin</td>
<td>85–90°</td>
<td>percs slowly wetness</td>
<td></td>
<td>Very Poor</td>
</tr>
<tr>
<td>Ms, Mp</td>
<td>Severe:</td>
<td>floods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mucky peat-shallow, deep</td>
<td>seepage</td>
<td>excess humus</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Severe:</td>
<td>slope</td>
<td>depth to rock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ox</td>
<td>Poor:</td>
<td>Severe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oquaga part</td>
<td>large stones</td>
<td>seepage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe:</td>
<td>large stones</td>
<td>Very Poor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Po, Pp</td>
<td>Poor:</td>
<td>Severe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pope</td>
<td>135°</td>
<td>seepage</td>
<td></td>
<td>Very Poor</td>
</tr>
<tr>
<td>Wp</td>
<td>Poor:</td>
<td>Severe:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wellsboro</td>
<td>large stones</td>
<td>slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe:</td>
<td>large stones</td>
<td>Very Poor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wy</td>
<td>Poor:</td>
<td>Moderate:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wyoming</td>
<td>75–90°</td>
<td>seepage</td>
<td></td>
<td>Very Poor</td>
</tr>
</tbody>
</table>

*yield of corn in bushels per acre
The maps above show some of the common soil types found in northeastern Pennsylvania. The maps are not to scale, and all soils are not shown. For a more complete map of these areas refer to the US Geological Survey Maps in the Soil Survey of Monroe County, Pennsylvania.
Review Questions:

1. What factors make a soil type suitable for a specific land use?

2. You were just informed that you inherited 5 acres (2 hectares) of land and a large amount of money. You have decided that you would like to build condominiums on the land. Where can you find information that would tell you if the soil is suitable for what you have planned?

3. What information can you find in the soil survey that will help you decide if you should go ahead with your plans?

4. Briefly describe how the soil surveys were made.

5. Some of the soil types have rather strange names such as Lackawana and Oquaga. Why did soil scientists use these names?

6. What do the letters which follow the soil sample (A, B, C, D, E, and F) tell you about the soil?

7. Why is it a good idea to refer to the soil survey before making detailed plans for a specific land site?

Data Analysis:

Indicate soil types by using the two letter symbols. If slope is a factor, include the letter that describes the slope.

Table 3.2-1

1. Identify the soil type that has bedrock less than 2 feet from the surface and often has rock exposed.
2. Which additional soil type has bedrock near the surface?
3. Which soil types are mostly peat?
4. Identify the soil types with topsoil that is silt loam with less than 10 percent rock fragments.
5. Identify two soil types in which stones would be likely to cause problems.
6. Which soil type might be called "gravel soil"?
7. Which soil types have the deepest soil?
8. Which of the following terms describes soils with the smallest rock fragments—channery, gravel, or stony soils?
Indicate soil types by using the two letter symbols. If slope is a factor, include the letter that describes the slope.

Table 3.2-2

1. Identify the soil types that would require blasting to excavate for a house with a basement.
2. Identify the soil types for which flooding would be a problem.
3. What percent (%) slope creates a moderate problem on Mardin soils?
4. What type of limitation is created when a slope is greater than 25%?
5. Which soil type is most favorable for a home with a basement?
6. Homes built on soil with a high shrink-swell potential can move several inches up and down as the soils expand and contract. This can result in cracked walls and foundations. Which soil type would require homes to be built with a specially designed foundations to prevent cracking?
7. Which soil type is most suitable for a septic tank absorption field?
8. Subsurface septic tank absorption fields require a minimum soil depth of 60 inches. Which soils are not suitable because of limited depth? (Also refer to Table 3.2-1.)
9. Elevated sand mounds are permitted only on slopes of less than 8%. Would a mound be suitable for soil type WpC?
10. For subsurface septic systems to be approved, the percolation rate must be between 6 and 90 minutes per inch. Which soil types may not have an approved percolation rate?

Table 3.2-3

1. Which soil has the greatest potential for growing corn?
2. If you want to buy land that is suitable for farming, but you do not want the land flooded during the growing season, what soil type would you look for? (For flooding information see “camping” column.)
3. In addition to flooding, what are two problems that make soil types unsuitable for farming?
4. What soil type is favorable for digging a pond?
5. A landowner insists on digging a pond on Oquaga soil. What will be the approximate depth of the pond? (See Table 3.2-1)
6. What are two other problems that make land unsuitable for a pond or at least increase the cost of digging a pond?
7. As a real estate salesperson, what type of soil would you look for if a customer wanted to buy land for a campground?

8. What soil types would you expect to find at a site that has good wetland habitat?

Indicate soil types by using the two letter symbols. If slope is a factor, include the letter that describes the slope.

Soil Survey Maps

1. Identify four soil types found along the Delaware River.

2. Which of these soil types are flat and easily flooded?

3. Where is soil type Hy found?

4. What is the most common soil type in the area near Shawnee-on-the-Delaware?

5. Assuming the island in the Delaware River is large enough, would it be suitable for farming?

6. If the island were for sale and money was not a problem, would you buy it to build a summer home? If not, explain why.

7. Locate the areas of deep mucky peat (Mp) in the Tannersville Cranberry Bog. What soil type surrounds this area?

8. What is the slope of the soil type along Cranberry Creek?

Would you expect the area along the creek to be wet?

9. If you wanted to build a ski slope, would you choose the site near Shawnee-on-the-Delaware or the site near Cranberry Creek?

What factors would be most important in making your decision?
APES Soil Texture Triangle Activity

Using the soil texture triangle, scientists have created classes which break the distribution of particle sizes (soil textures) into 12 categories: clay, sandy clay, silty clay, sandy clay loam, clay loam, silty clay loam, sand, loamy sand, sandy loam, loam, silt loam, silt.

The soil texture triangle is one of the tools that soil scientists use to visualize and understand the meaning of soil texture names. The textural triangle is a diagram which shows how each of these 12 textures is classified based on the percent of sand, silt, and clay in each. Note: these percentages are based on the USDA definition of sand and silt only.

Follow these steps to determine the textural class name of your soil sample:
1) Place a plastic sheet or tracing paper over Textural Triangle 3. Place the edge of a ruler at the point along the base of the triangle that represents the percent of sand in your sample. Position the ruler on the line that slants in the direction that the numbers are facing for percent sand.
2) Place the edge of a second ruler at the point along the right side of the triangle. Position the ruler on the line which slants in the direction that the numbers are facing for percent silt.
3) Place the point of a pencil or water soluble marker at the point where the two rulers meet. Place the top edge of one of the rulers on the mark, and hold the ruler parallel to the horizontal lines. The number on the left should be the percent of clay in the sample. Note that the sum of the percent of sand, silt, and clay should add up to 100.
4) The descriptive name of the soil sample (textural class) is written in the shaded area where the mark is located. If the mark should fall directly on a line between two descriptions, record both names.

For the example below, the textural class of the soil sample would be % Sand % Silt % Clay
USDA: 66.4 12.8 20.8 = ? (Sandy Clay Loam)

Soil Texture Practice Work Sheet

Use the following numbers to determine the soil texture name using the textural triangle. When a number is missing,

<table>
<thead>
<tr>
<th>% Sand</th>
<th>% Silt</th>
<th>% Clay</th>
<th>Texture Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>10</td>
<td>15</td>
<td>Sandy loam</td>
</tr>
<tr>
<td>10</td>
<td>83</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>52</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>35</td>
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The Garbage Game

Objectives
- Gain an increased awareness of what happens to items that are thrown in the trashcan
- Demonstrate an understanding of the need for recycling, reusing, composting and disposing of trash in landfills
- Differentiate between biodegradable and nonbiodegradable toxic and nontoxic household items
- Suggest methods for easing the nationwide landfill dilemma

Materials
- Plastic containers with slips of paper inside
- Plastic “landfill”

Part 1
1. Please cut out all of the garbage game trash slips carefully and place in the plastic container.
2. Pretend that the container you have received is a trashcan and the labeled slips of paper in it are actual items of trash. The object of the game is to keep as many items as possible out of the landfill by determining if you can recycle, reuse, or compost each item.
3. Remove the set of disposal alternative slips - “Recycle,” “Reuse,” “Landfill,” and “Compost.” Spread them out in a horizontal row on the table in front of you. Remove and set aside the set of category slips.
4. One by one, remove a trash item slip from the trashcan and decide, as a group, whether or not it should be recycled, reused or composted. Place the slip under the appropriate disposal alternative category. Be sure you can explain why you have placed it there.
5. If you cannot find an alternative for the item, place it under the landfill category. But remember, the purpose is to put as little garbage in the landfill as possible.
6. Once you are satisfied that you have kept as many items as possible out of the landfill, call Mr. W over to look at your work.

Part 2
1. Take out the paper-clipped set of category slips that you set aside in part 1. Remove the ‘biodegradable,’ and ‘nonbiodegradable’ slips. Place them on the table in front of you. Also take out the set of items you put in the landfill.
2. Look through the items that you put in the landfill and decide whether or not each is biodegradable. Place each slip under the appropriate category. When you are satisfied that you have categorized the items correctly, have Mr. W check your work.
3. Take the two remaining category slips ‘toxic’ and ‘nontoxic’ and place them in front of you on the table.
4. Look through the items you have just classified under ‘nonbiodegradable’ and decide if each is toxic or nontoxic. Place each slip under the appropriate category. When you are finished have Mr. W check your work.

Analysis
1. On a separate sheet of paper copy all of your categories.
2. There are many ways that students and their families can change their waste producing habits. List specific steps that you can take to increase awareness among friends and family members.
This is the dirtiest assignment of the year. Starting tomorrow morning, you will be given the task of collecting and holding on to the material you waste (i.e., trash) during the course of 24 hours. Your job is to carry this trash with you in any situation where you create waste! The goal of this project is to get a sense of how to better manage your consumption. This is a requirement, so don’t skip out on this! I will be checking throughout the day! Please collect the following “data” to support your effort.

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<thead>
<tr>
<th>Waste Event (i.e., meal, wash hands, etc.)</th>
<th>Date</th>
<th>Time</th>
<th># of “pieces” of waste</th>
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After 24 hours

Questions

1. What materials type(s) or category(ies) of municipal solid waste seem to outnumber the others?

2. If all the APES’ parents did this same assignment from question #1, do you think that the types of recorded/carried solid waste items would be significantly different? How would your parents compare? Discuss:

3. Did you alter your choice about foods eaten and items purchased during the day? If yes, please describe how your choices might have been modified or influenced. Was there a decision NOT to "have a little orange juice", just because it would mean "finishing off" the OJ and therefore the need to record the carton/bottle and possibly carry it around in your bag.

4. Discuss any aspects of this assignment that you found significant, meaningful, and/or worthwhile. Describe any experiences you may have had relating to this inventory/carrying of solid waste?

5. Would you change anything about this assignment? Describe.
Part 1: You will find Recycle City on the web by a) going to favorites and opening the “Welcome to Recycle City” bookmark or b) opening the following website: www.epa.gov/recyclecity/

1. Click on the “Go to Recycle City” icon.
   Take a few minutes to explore the city and read some of the information on solid waste disposal.

2. Gas stations are not just places to fill up the tank of your automobile. Find methods that Shaq at the Recycle City gas station uses to dispose of used CFCs, used antifreeze, old tires, and used motor oil.

3. How does Shaq know that his gasoline stored in underground storage tanks is contained and not contaminating the soil or water under the gas station? Do you think a similar system exists at Pool’s corner in Buckingham where the MTBE additive contaminated groundwater? Why or why not?

4. One of Shaq’s customers comes in for some gasoline. Shaq suggests the customer get a tune up for “the environment’s sake”. Is Shaq just trying to make some extra money or what environmental benefits can come from tuning up a car?

5. Some of Shaq’s customers own electric powered or hybrid cars. What are some of the pro’s and con’s of electric powered cars?
   Pro’s
   Con’s

At the Landfill:

6. Go to the Recycle City Landfill. What happens when residents and individuals dispose of hazardous wastes in their trash and that hazardous waste goes to a landfill?

7. What program did congress create to deal with landfills and other sites that contain hazardous wastes? What is this program called and what does it do?

8. a) How is the landfill designed to prevent substances from leaking out of the landfill?

   b) Draw and describe the various protective layers in the landfill.

   c) Landfills contain garbage and trash that would start to smell and attract rodents and bugs if left alone. What do landfill technicians do to prevent rats and insects from rummaging through the landfill each day? What do technicians do to prevent the trash from blowing out of the landfill on a windy day?

   d) What happens when a landfill is completely filled? How do landfill technicians treat the landfill to prevent substances from leaching out of the landfill?
9. Find Harlin Hazzard of the Recycle City Hazardous Waste Center. He wants to hire you as his assistant manager for $35/hour and one and a half hour lunch breaks. Before you can accept the position, you must name the four characteristics that make hazardous wastes hazardous.

10. Harlin may not look it, but he is pretty environmentally savvy. What are his (or the EPA’s) recommended ways to prevent pollution from hazardous waste?

11. Harlin decides to hire you and gives you four jobs on the first day:
   a) Determine the safest way to dispose of aerosol cans and pesticides
   b) Determine the best way to deal with motor oil, batteries and antifreeze
   c) Determine the best way to deal with oil-based paints, paint thinner, solvents and tar roofing
   d) Determine the best way to deal with a customer’s hazardous waste disposal

12. Go to Joe Yoshino’s Auto Wreckers. What does Joe do with the iron, steel and other metals from junk vehicles? What are some of the economic and environmental advantages of reusing metal instead of mining for raw metal?

13. What does Joe do with old car batteries? What would be the consequences if Joe just threw these old batteries into a sanitary landfill?

14. Some of the homes in Recycle City contain household wastes that are hazardous and should not be disposed of in the municipal weekly trash pick-up. Where would you dispose of these items in the Doylestown area? Find the closest location to dispose of 5 of the items that you use the most at home using the website www.Cleanup.org. Type in your home address zip code and write down five (or more) of the following items that you use regularly and the phone number or location of where these items can be disposed.

   - Old cell phones
   - Aerosol cans
   - Old/dead Christmas trees
   - #3, #4, #5, #6, or #7 plastics that are not recyclable in our local recycling
   - Old eyeglasses
   - Used plastic shopping/grocery bags
   - Packing peanuts
   - Old computers or old computer monitors
   - Old single use batteries or car batteries
   - Used Inkjet or toner cartridges
   - Old electronics such as broken stereos, radios, clocks, etc.
   - Milk and juice cartons (paper)
   - Old telephone books and cardboard