

don't really know a lot about it. You have to keep it after you take it. After you are done with it, you are responsible for returning its parts to where they originally came from in the most sustainable way. Anybody who wants it has to ensure me that you can comply with these conditions.”

c) INVITE students to ask questions about the contents

Sample questions and responses:

*something to eat? (shake your head, enlarge your eyes, incredulously respond “Definitely not”)

*does it have a use for me? (yes, you could use it every day, it will save you time)

*is it harmful? (Yes, I have heard it can be but only when you want to get rid of it. I don't really know – ie you lack scientific information)

*what is it made of? (oh a bunch of things were written on the label but they were all really big words that you didn't really understand or recognize...)

*where do the parts of it go when I am done with them? (Well, you would have to break it up into its parts and then I guess you would have to figure that out...I don't really know WHAT it is made of so I don't really know where you will have to put its parts when you are done...)

d) After you (or the students) feel that the point has been made that we really should know more about what we buy, SHOW the contents of the box.

e) Expected response will be that polyester is not harmful. Explore their knowledge of how what it is made of (the TAKE part – what do we need to take from the earth to make this product), how polyester and plastic are made (ie the MAKE part – what do we do to make this product), and what how it's parts get returned to where they originally came from (the WASTE part- what happens to this product when we deem it no longer usable – ie when it is considered “waste”). What eventually does it break down to?

2. **Slide 13 & 14 DISCUSS** “What do our collective responses show about the way we think (and do not think) about what we consume (ie our mental models)?

Sample answers: we buy things without ever knowing what is in them, where they came from, how they were made (and we trust that it is all safe). Sometimes we hear that something is not safe/good for us but we might not really know the details. Invite students to tell of where they have heard/experienced other examples of this. Discuss that “fear” can also be a marketing strategy.

TYPE ANSWERS DIRECTLY ON THE SLIDE FOR LATER REFERENCE

4. DISCUSS how the answers for the mystery box would have been different for the fabric sample that is 100% natural (example: 100% cotton shirt) emphasizing the TAKE – MAKE – WASTE ideas

Sample answers:

TAKE – sun, soil, water, proper growing conditions to grow a cotton plant

MAKE – cotton worms –that's it – then we might spin it or dye it

WASTE - biodegradable

Emphasize that we have “blends” of fabrics to keep the physical properties that we desire from both fabric types (example: cotton wrinkles easily but polyester doesn't)

6. Distribute STUDENT HANDOUTS: Rubber/Plastics & Fibers

Discuss how rubbers and plastics are made, showing samples of rubbers and plastics

OR by using the magazine Petroleum: The Source of So Much

Assign as in-class/homework/groupwork as you wish

PROJECT LINK → these handouts help students with the TAKE & MAKE reports of the project

7. Slides 15 & 16 are a summary of the content in the 2 handouts organized so that the human mental model is contrasted to the natural mental model. This provides the foundation of comparing the mental models and so some time can be spent on the display boards at this time.

Extension Learning Activities

DISCUSS (or have students write about) mental models:

- a) Why are products with a direct natural origin “a raw material” a “natural resource” (ie often has direct living connections) are simpler to take, make and deal with as waste?
- b) Does the fact that we do not “know” what we consume disturb us? Why/why not?
- c) Is the underlying “mental model” that we CAN be disconnected from natural systems and just let “science” take care of all of the MAKE processes? Is the general public involved in knowing the origins of what they consume?

Natural and Synthetic Organic Compounds

There are four main types of fibers, classified in relation to their origin. They are animal fibers, plant fibers, mineral fibers, and synthesized fibers.

Animal Fibers

- Animal fibers are created from materials taken from animals
- The two major sources of animal fibers are silk and wool
- All animal fibers are proteins
- Examples include silk and wool
- Most animal fibers are used to make fabric

Plant Fibers

- Plant fibers are created from materials taken from plants
- The most important plant fibers are cotton and flax
- These plant fibers are mainly composed of cellulose
- Mercerization is a process that improves the qualities of cotton
- Examples include cotton, flax, hemp and jute
- Usually used to make fabrics and other simple things like string, as well as pulp fiber, which in turn, is made into paper

Mineral Fibers

- Mineral fibers are taken from the earth. For example, asbestos is taken from volcanic formations
- Examples include fiberglass (which is used with plastic, which reinforces it, thus allowing it to be used to make boat hulls, pipes, and furniture) asbestos (which was used as insulation and fire-proofing, until it was discovered to cause cancer)
- The small metal wires used in window screens are made from a mineral fiber
- Glass

Synthetic Fibers

- Synthetic fibers are produced by chemical treatments on certain raw materials, such as woodchips, cotton linters, coal, and petroleum byproducts
- Often, synthetic fibers are made to create cheaper, or improved (having more of the desired qualities) versions of natural fibers, such as rayon, which is synthetic silk. Other times, synthetic fibers are made with their own unique properties, such as nylon.
- Some examples are acetate, acrilan, dynel, and nylon

<p>Acetate</p> <ul style="list-style-type: none"> -Acetate has cellulose for its base -It has an odour similar to vinegar -Acids decompose acetate -It can be dissolved in acetone -Overhead sheets are made from acetate -Acetate does not rot, does not deteriorate from salt or mould, and dries rapidly 	<p>Dynel</p> <ul style="list-style-type: none"> -Dynel is a copolymer -It burns on contact with an open flame, and does not melt or drip -The monomers that dynel consists of are acrylonitrile and vinyl chloride -It begins to shrink and stiffen at 101.6°C
<p>Acrilan</p> <ul style="list-style-type: none"> -Good resistance to acids, bases and bleaches -Organic solvents and sunlight do not affect it -Does not melt, but burns -Blends well with other fibers -Washes and dries easily and resists wrinkling 	<p>Nylon</p> <ul style="list-style-type: none"> -Made up of coal-tar and oil products -There is no flame when burning, but there is melting and dripping -Nylon is used in seatbelts, rope and pantyhose, and many other fabrics and materials that need to be strong

Rubbers and Plastics

Natural Rubbers

- Natural rubber comes from tropical plants and trees
- Charles Goodyear discovered a process of adding sulfur to the rubber, to improve its usefulness, and restore its elasticity. This process is known as vulcanization
- In the plants and trees which rubber is made from there is a watery suspension called latex
- This latex is removed by means similar to that of maple syrup
- Natural Rubber is a hydrocarbon polymer. The monomer is isoprene (C₅H₈)
- When sulfur is added, it connects the polymer chains together, making even longer chains

Synthetic Rubbers

- Synthetic rubbers have been made from a number of polymers resembling natural rubber and their properties
- In synthetic rubber, the monomers are butadiene, isoprene and chloroprene
- These monomers are all elastic and some can be vulcanized, Just as natural rubber can, and some have rubber-like properties better than those of natural rubber
- As of present there is no good way to dispose of rubber, so a serious waste problem is occurring

What are Plastics?

- Plastics are polymers
- Plastics are products that appear to be solid in the finished state, but were liquids when they were being shaped
- As well as the polymer substance, plastics contain materials such as filler to improve the strength and flexibility of the plastic

Formation of Plastics

- Most plastics are formed into fibers (such as nylon), or films and foams (such as urethanes, which are used as cushions and insulation)

Examples of Plastics

- There are many different plastics because each plastic is made up of different polymers
- Thermal plastics soften when heated and harden when cooled. Some examples are nylon, rayon, plexiglass, and sarans
- Thermosetting plastics become permanently hard when heated to a particular temperature. Examples are the plastics used in shoe soles, phonograph records, and polyester

Questions

1. Name two fibers produced by animals, and two by plants.
 2. a) Name 3 artificial fabrics. Why have synthetic fibers replaced the natural fibers in recent years?
b) Why do temperature ranges in washing machines and on irons vary for different synthetic fibers?
 3. a) When natural rubber is vulcanized, what element is added?
b) How does this affect the polymers in the rubber?
 4. a) Why has the need for rubber increased so much in the last fifty years?
b) Why does this result in environmental problems?
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