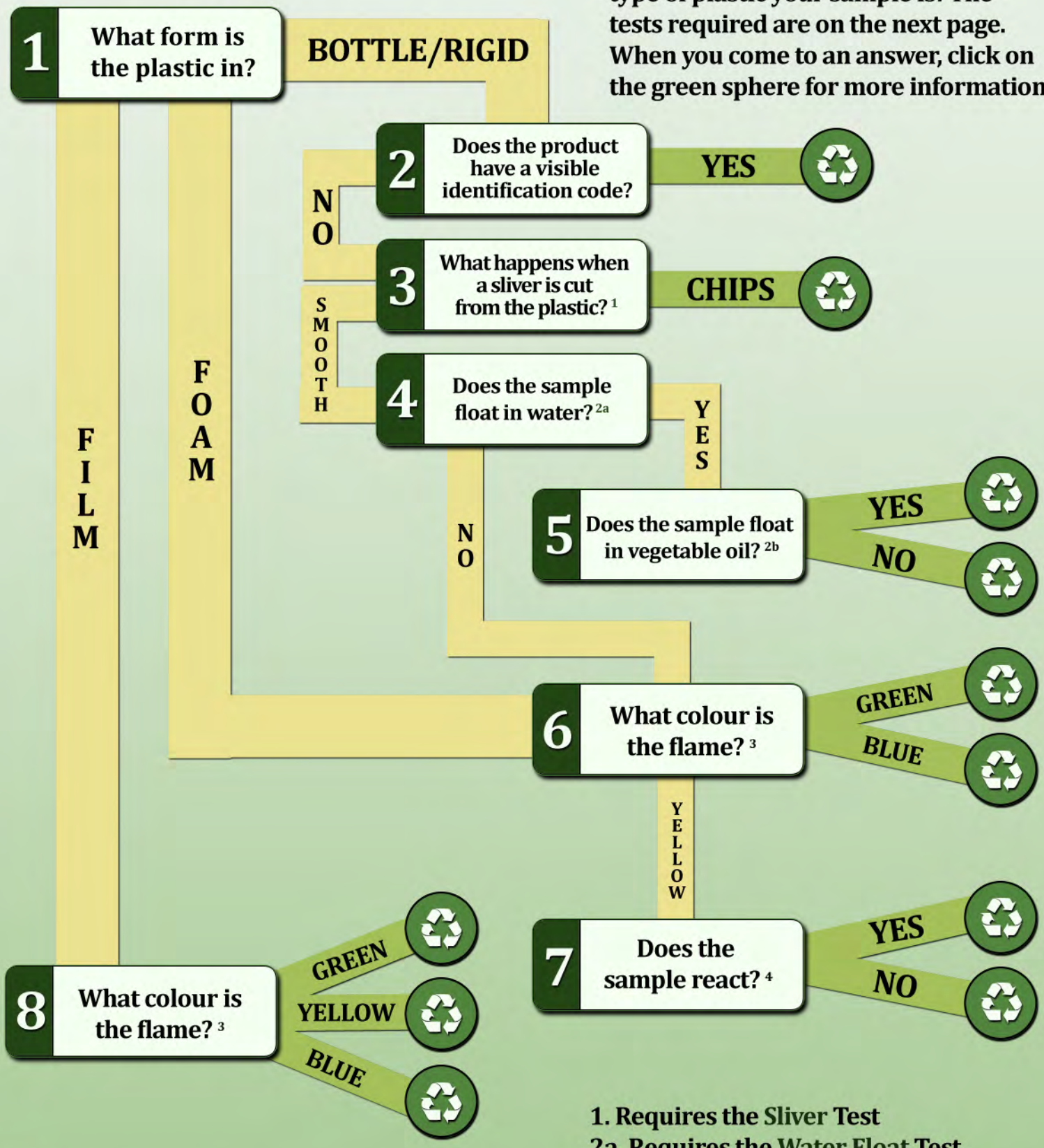
Polymer Identification

Follow the steps to figure out what type of plastic your sample is! The tests required are on the next page. When you come to an answer, click on the green sphere for more information!



1. Requires the Sliver Test
2a. Requires the Water Float Test
2b. Requires the Vegetable Oil Float Test
3. Requires the Copper Wire Flame Test
4. Requires the Acetone Test

STOP

DISCLAIMER: The Bluewater Recycling Association in no way suggests you use this guide as a blueprint for which plastics to recycle. Please approach this as a fun and unique way of learning about plastics.

Polymer Identification

The following tests are required to successfully determine and identify certain polymers. Read each of the instructions carefully and enjoy! Once the tests have been successfully conducted, return back to the flow chart on the previous page and continue on your search for identification!

Materials Required

* Plastic Samples
* Small Bowl
* Water
*Washing up Liquid
* Vegetable Oil
* Copper Wire
* Pliers
* Lighter/matches
* Candle
* Acetone

Safety Precautions

The copper wire will get hot when heated in a flame. One end of the wire should held with tongs or pliers to avoid burns.

When undertaking the copper wire test DO NOT INHALE THE FUMES, these can be highly toxic. Work in a well ventilated area. It is advisable to wear protective goggles when undertaking this test.

Acetone is flammable and the vapours are considered toxic. Keep the top on the bottle when you're not using it and work in a well ventilated area. Avoid flames.

Sliver Test

Cut a small sliver from the sample:

If powdery chips are formed the material is likely to be a thermoset

If a smooth sliver results the material is likely to be a thermoplastic

Thermosets tend not to be recycled, as they cannot be remelted.

Float Tests

Fill a small bowl with water, adding a little washing-up liquid (if the washing-up liquid is not added, surface tension will prevent the sample from behaving as it should). Place the sample in the bowl, gently pushing it down. Release it and wait a couple of minutes to see whether it floats or sinks.

Repeat this process with Mazola corn oil. A specific brand has been suggested here is that not all corn and vegetable oils have the necessary density and the test may therefore not work using other brands.

Flame Test

This test should be used on the samples that sank in the water and can also be used to identify plastic films and foams. You will need a piece of copper wire about 5cm in length. Hold one end of the wire with a pair of tongs or pliers, so you are not touching the wire directly while it is heated.

Set out a candle on a clear work surface and light it. With the plastic sample to hand, place the free end of the wire into the flame until it is hot and the flame no longer has a green colour.

Remove the wire from the flame and touch the hot wire to the plastic sample. A small amount of the plastic should melt onto the wire. If the wire sticks to the plastic use a pair of tongs to remove it.

Place the end of the wire, with the small amount of plastic on it, into the flame. The flame should burn green, yellow/orange, or blue depending on the type of plastic.

Acetone Test

This test should be used on the samples that produced a yellow/orange flame. Ensure that you are working in a well ventilated area.

Place the plastic sample in the bottom of a small bowl and pour in sufficient acetone to just cover it. Leave the sample in the acetone for 30 seconds.

Using tongs, remove the sample and press firmly between your fingers. A positive reaction has occurred if the plastic sample is soft and sticky. Scrape the sample with your fingernail to see if the outer layer has softened. If the sample is unchanged, this means that no reaction has taken place.

Polymer Identification

Question Two: The Plastic Has An Identification Code

If there is a code on the plastic, then you are in luck! The producer of the plastic has taken the time to identify the plastic for you. It helps with recycling, and allows consumers to quickly figure out whether the plastic is recyclable. The following chart identifys the various symbols:

- 01 PET — Polyethylene Terephthalate
- 02 PE-HD — High Density Polyethylene
- 03 PVC — Polyvinyl Chloride
- 04 PE-LD — Low Density Polyethylene
- 05 PP — Polypropylene
- 06 PS — Polystyrene
- 07-20 — Unallocated References

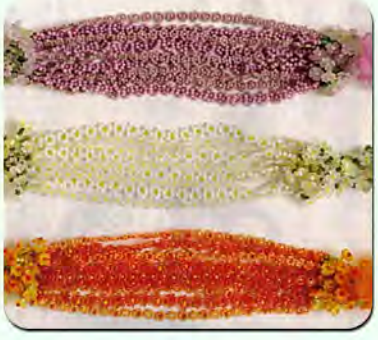
*Note: The look and design of the codes may vary from product to product. The important constant is the symbol number, which will always represent the plastic type.

BACK

Question Three: Powdery Chips are Formed

If you have noticed powdery chips forming, your plastic is probably a thermoset. Thermosetting plastics (thermosets) are polymer materials that irreversibly cure form. The cure may be done through heat (generally above 200 degrees Celsius), through a chemical reaction (ex. two-part epoxy), or irradiation such as electron beam processing.

Thermoset materials are usually liquid or malleable prior to curing and designed to be molded into their final form, or used as adhesives. Others are solids like that of the molding compound used in semiconductors and integrated circuits (IC's).



Polymer Identification

Question Five: YES!, the sample floats in Vegetable Oil

If the sample does float in vegetable oil, then it is likely to be Polypropylene. (05 PP) This plastic has an excellent chemical resistance, high melting point and is hard, but fairly flexible. It has a waxy surface, and a translucent finish. PP is found in everything from flexible and rigid packaging to fibres for fabrics and carpets and large moulded parts for automotive and consumer products, such as automobile battery casings. Most bottle tops are made from PP. Other common uses include ketchup and pancake syrup bottles, yoghurt and margarine containers, potato crisp bags, drinking straws, hinged lunch boxes, refrigerated containers, medicine bottles, crates, plant pots, and heavy gauge woven bags or tarps.

BACK

Question Five: NO!, the sample does not float in Vegetable Oil

If the sample does float in vegetable oil, then it is likely to be Polyethylene. (02 PE-HD 04 PE-LD) There are different types of PE depending on their strength which ranges from High Density (HDPE) to Low Density (LDPE). HDPE provides excellent moisture barrier properties, and chemical resistance. It is strong, semi-flexible and permeable to gas. HDPE film crinkles to the touch. The excellent chemical resistance of HDPE makes it ideal for packaging household and industrial chemicals, such as detergents, bleach and acids. Its moderate stretch and high strength characteristics make it especially suitable for grocery bags, as found in most supermarkets. Due to its flexibility and other properties LDPE is used predominantly to manufacture films such as garment and produce bags, agricultural films, refuse sacks, and packaging films, foams and bubble wrap. Other uses include flexible lids, flexible bottles, wire and cable applications, some bottle tops, and irrigation pipes.

Polymer Identification

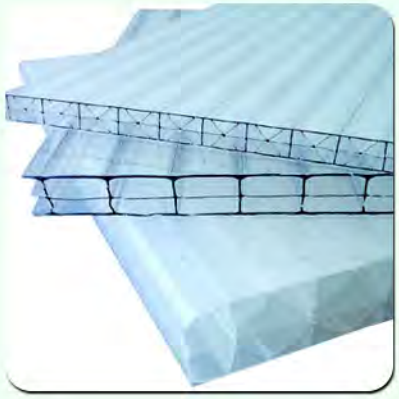
Question Six: The color of the flame is Green

If the sample emits a green flame, then it is likely to be Polyvinyl Chloride (03 PVC). Also known as PVC, Polyvinyl Chloride has excellent transparency, good chemical resistance and long term stability. It is hard, and rigid which gives it formidable weathering ability. In addition, it has stable electrical properties. PVC has been successfully used for pipes and fittings due to its imperviousness to attack by bacteria or organisms, corrosion resistance and strength. It is frequently used in food contact applications. Other common uses include carpet backing, windows, water, shampoo and vegetable oil bottles, credit cards, wire and cable sheathing, floor coverings and blood bags.

BACK

Question Six: The color of the flame is Blue

If the sample emits a blue flame, then it is another polymer not identified with the six most common plastics. (07) There are many polymers other than the six most common, that have a very wide range of uses, often in the engineering sector. Examples include nylon (PA), acrylonitrile butadiene styrene (ABS), and polycarbonate (PC). Items that are layered, or have a mix of polymers also fall into this category.



Polymer Identification

Question Seven: The sample does react

If the sample reacts to the acetone test, then the plastic could either be Acrylonitrile-Butadiene-Styrene (as discussed HERE) or Polystyrene. (06 PS) PS ranges from clear to opaque with a glassy surface. It is generally rigid, hard and brittle. The clarity of polystyrene is high and it is affected by fats and solvents. PS is a versatile plastic that can be rigid or foamed. Common uses of rigid PS include yoghurt containers, fast food trays, disposable cutlery, video cases, vending cups, laboratory ware, seed trays, coat hangers, and low-cost brittle toys.

BACK

Question Seven: The sample does not react

If the sample does not react, then the plastic is either a number seven 'other' or Polyethylene Terephthalate (01 PET). PET is clear, hard, tough, solvent resistant and has very good gas and moisture barrier properties. It also has high heat resistance and microwave transparency. The good gas and moisture properties of PET, together with the fact that it is tough and clear, make it ideal for fizzy drink and beer bottles. Its high heat resistance makes it especially suitable for pre-prepared food trays and boil-in-bag food pouches. Other common uses include soft drink and water bottles, fibre for clothing and carpets, strapping, and mouthwash bottles. PET is now replacing HDPE in many applications, such as shampoo bottles etc.