

## The Pencil Challenge (Or the Mystery of the Leak Proof Bag)

The goal of building science knowledge is to develop an understanding of the general ideas and principles that influence our world. We can use this knowledge to engineer or design solutions to problems that arise from phenomena. What do you know about plastics? Think of the physical properties of plastics. What are some of their advantages and disadvantages? How can you use the properties of plastics to solve other problems?

### Think About *IT!*

**Why didn't the bag leak?** Plastics are made up of long chains of molecules called polymers. Think of a polymer as having superhuman strength. Although they are smaller than the width of a single hair, these polymer chains are light-weight, flexible and can be very long. Now take those chains, mush them together with a little bit of heat and you have a plastic sheet that can be made into a bag with unique properties that are useful for different purposes.

So, how do the polymer chains allow a pencil to poke through and still not cause a wet mess? Think of the long threads of yarn that make up a sweater. These threads are woven together to take the shape of the sweater, yet they keep their flexible nature and strength. However, you can still poke a finger through the overlapping threads of yarn. The yarn threads stretch apart as your finger pushes between them and forms a seal around your finger. Poke something too large between the threads and they get stretched too much and make a hole. Just as the sweater forms around your finger, when you poke the pencil through the plastic it conforms to the sides of the pencil creating a tight seal and prevents the water from escaping.



**Extend IT!**

**What questions do you have? Does the size of the plastic bag matter? Does the amount of water in it matter? Do all plastic bags behave the same way? What happens when the pencils are removed?** Think about all the different types of plastic bags you use. There are garbage bags, sandwich bags, grocery bags, and bags for parts of games or toys. Each of these bags has their own, purpose, characteristics, thickness, strength, and levels of flexibility.

Conduct the same experiment using several different types of bags. Design a chart to record and compare your data. Perhaps try passing through different types of items such as a needle and thread, toothpicks, or eating utensils. What will your data reveal?

**Dare to Change IT!**

**How can your knowledge of plastics make a difference in your school and community?**

**Scenario:** In your neighborhood you and your friends notice several bags floating around in the streets, ditches, and stuck in shrubs. Neighbors are complaining that these bags are a menace because they are preventing healthy plant growth, causing the value of homes and business to decline due to the unappealing view to visitors, and causing flooding in the streets due to the bags blocking up sewer drains. You and your friends decide to ban together to make a change resulting in creating a lush environment, increasing curb appeal for homes and businesses, and improving water drainage.

**Challenge:** Research and design a campaign around ways to recycle or reuse plastic bags. Collaborate with your committee on ways to educate your community and encourage change. Your idea should include ways to establish and maintain funding for future campaigns. How will you share your solution? Ask yourself after you practice, do I need to make changes and try again?

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