Sports Helmets and Impact Testing of Polymers – Student Worksheet

Exploration 1

Sample Type	Did the Sample Break? Yes	No	If yes, Breaking Height	If No, Maximum Testing Height	Impact In-lb

Questions:

1. Which sample had the greatest impact resistance? Which had the least?

2. If you could choose any of the samples for use in the manufacture of the outer shell of a football helmet, which would you choose? Which product(s) would most likely result in product failure? How does your data support theses conclusions?

Answers for Teachers:

1. *Answers will vary depending on the samples used. Lexan and ABS will not "fail" or will show only a small indentation at the greater heights. Polyethylene will show deformation on the back of the sample. Plexiglass will crack or break.*

2. *Answers will vary depending on the samples tested. Lexan is the material commonly used in the outer shell of helmets. Plexiglass is too brittle. Polyethylene is too soft.*

Exploration 2

Product Tested	Amount of Indentation of the Foam Material	Does the Foam Surface Recover?	Effects of the Drop on the Candy Bar

Questions:

1. Which product(s) seemed to do a better job of protecting the candy bar? Which product(s) did the worst?

2. What properties did the products that performed the best have in common?

3. Do you think any of these products could be used for the interior of sports helmets? Why or why not?

4. Which product(s) would be best suited for a helmet that is designed to protect in only one collision?

5. Which product(s) would work best in a helmet that needs to protect in numerous collisions?

Answers for teachers

1. *Answers will vary depending on the materials tested. A stiff foam such as polystyrene, or any foam, which is difficult to compress between your fingers, will probably do the best job protecting the candy bar. A soft, easily compressed foam will do a poor job protecting the candy bar*.
2. *Foams will be difficult to compress between your fingers. Many will show a permanent indentation.*
3. *The foams that protect the candy bars from damage would possibly work as helmet interiors. Students can support this with data stating that no damage occurred from a 30 inch drop for any given foam material chosen.*
4. *The stiff foams that have a small, but permanent indentation, would be the best used in helmets that can withstand only one collision.*
5. *The slightly softer foams that have some surface recovery are more suitable for helmets that must withstand numerous collisions.*