

STEAM Investigation #3 – Physical Qualities of Rubber Material

What qualities does rubber material have? What can rubber material achieve? What are the tradeoffs?

STEAM Terminology:

Sneaker outsoles are made of blends of **synthetic man-made rubber** (polyurethane), inexpensive plastic (polyvinylchloride) compounds and **natural rubber** (gum).

Fillers are combined with rubber to alter its properties.

Directions: Analyze three sneaker outsoles and respond with Yes (Y) or No (N).

Action	Trends 1 2 3	Qualities of rubber material	Application of STEAM (Science Technology Engineering and Mathematics)
1. Hold the sneaker at both ends and gently twist it in opposite directions	– – –	Outsole twists a little	For stability and walking
	– – –	Outsole twists completely into a spiral	Good for short walks
2. Hold the sneaker at both ends and gently try to bend it by pushing the heel upward toward the toes	– – –	Bends only at the forefoot (upper third of the sole)	Ideal for walking (too stiff for many runners)
	– – –	Bends at the middle and forefoot	Ideal for most runners
	– – –	Folds in half	Short walks, for some runners
	– – –	Does not Bend at all (too stiff)	Unacceptable
3. Is your outsole thin or thick?	– – –	Thin outsoles reduce weight	Ideal for indoor use
	– – –	Thick outsoles are heavier	Ideal for outdoor use
	– – –	Influences energy absorption	Comfort, cushioning
4. Evaluate outsoles, do they seem to change shape and rebound?	– – –	Rubber can change shape and spring back.	To cushion, conforms to the shape of the ground



5. Slide or drag your foot along the floor.	- - -	Soft rubber materials is sticky enough to grip a surface by mere contact alone? (adhesion)	Provides friction, reduces sliding, not as durable
6. Push down on the curved end. The other end will rise	- - -	Can be Molded , one or both ends of the sneaker outsole curve upward, (rocker sole)	Help the foot to roll inward naturally with each step. Less stable
7. Are the outsoles made of more than one blend of rubber material?	- - -	Sneakers prices can increase 25-35% when outsoles use multiple blends of rubber	Needed to meet outsole requirements (Fashion, wear, weight etc.)

Conclusion:

What were the most surprising things that you learned about rubber material? Add these thoughts to your list of what you know for later use.. (See Investigation #1)

Do you have any new questions that you would like to have answered? (See Investigation #1)

STEAM Investigation #4 – Physics & Chemistry of Rubber Material

What qualities does rubber material have? What can rubber material achieve? What are the tradeoffs?

STEAM Terminology:

Compounding or formulating refers to adding ingredients to the rubber in order to obtain desired properties.

Foam Rubber ethylene vinyl acetate (EVA) is a tough outsole grade foam that withstands repeated contact with the ground.

(Research - vulcanization, elastomers, abrasion resistance, tear resistance and friction)

Directions: Analyze three sneaker outsoles and respond with Yes (Y) or No (N)