STEM FROM THE START™

DISCOVERY GUIDE

LESSON
MISSION: MATERIALS

PRE-K-2 STEM LESSONS
FEATURING ONLINE VIDEO + ACTIVITIES

LEARNIVERSE
Educational Media

NEW HAMPSHIRE PUBLIC TELEVISION

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Take a Short Survey - Tell Us What You Think!

STEM from the START Overview

MEET THE QUINKS
Each video lesson in STEM from the START features the Quinks, three curious explorers from outer space – Quazar, Neutrina and Fluxx – who have come to Earth to learn more about how things on the planet work! With the help of a human friend, they explore basic principles of physical science.

SCIENTIFIC METHOD
Each lesson in STEM from the START is presented as a mission. In each mission students are asked to observe, research, develop hypotheses, make predictions, experiment and reach conclusions – just like real scientists!

DISCOVERY BREAKS
Each video lesson includes short segments where a concept or idea is introduced and explored and followed by a Discovery Break. Each Discovery Break features a question posed directly to students. The video lesson is designed to be paused or stopped at this point so students can engage in an activity or exploration found in the Discovery Guide. Activities and explorations in the Discovery Guide are designed so that they can easily be done with items found in most classrooms or homes.

DISCOVERY QUIZ
In addition to Discovery Breaks, the video lessons include a Discovery Quiz. These present a series of questions to the students, with time after each question to pause the video lesson for students to respond.

STEM IN THE REAL WORLD
The Quinks visit real scientists and engineers, who explain the concepts covered in each video lesson.

Each Discovery Guide is a template for using the lessons with young learners. Educators and parents are encouraged to adapt and extend the ideas found in this guide and to share their experiences at **nhptv.org/stem**.

MISSION: MATERIALS

Lesson Introduction

OVERVIEW

Willow and the Quinks learn all about the materials different things are made of and the properties some materials have. The Quinks learn that the properties a material has can be very important when deciding what materials to use when you are making something. They also explore ways they can group objects based on their properties and how it is important to choose the right materials for different jobs. They meet a civil engineer, Meghan, who explains why she need to pick the right materials when she is building roads.

SCIENCE FOUNDATIONS

Every thing you can taste, feel, touch, and see is made up of matter. Matter can be described by its material properties, like color, how hard or soft it is, how heavy or light it is, or how stretchy it is.

This lesson lays a foundation for latter exploration of atoms and the four states of matter in later grades. **Fun Science Fact:** 5th century Greek philosopher Leucippus is thought to be the first person to develop the theory of atomism - the idea that everything was made up of atoms.

OBJECTIVES

At the end of the lesson learners will:

- Identify properties of different materials.
- Identify the materials different objects are made of.
- Group materials based on observable properties.
- Explain or demonstrate how it's important to select the right materials for different jobs.

Key Vocabulary	
Property A special quality that something has.	
Material What objects are made of.	
Flexible	Quiver
Force	Waterproof
Pressure	Rubber
Transparent	Civil Engineer
Incandescent	Elastic
Materials	Gravel
Weightless	Pavement

Next Generation Science Standards

Matter and Its Interactions - K-2

2-PS1-1 Matter and Its Interactions
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
[*Clarification Statement:* Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

Disciplinary Core Ideas
PS1.A: Structure and Properties of Matter
Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.

2-PS1-2 Matter and Its Interactions
Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. [*Clarification Statement:* Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.]

Disciplinary Core Ideas
PS1.A: Structure and Properties of Matter
Different properties are suited to different purposes.

Discovery Break One

OVERVIEW
The Quinks have made Willow a chair for her birthday. But Willow is reluctant to sit in it because it is made out of cardboard and doesn't look very sturdy.

Objectives

- Students will identify the different materials a chair is made of.
- Students will describe some of the properties a chair should have.
- Students will predict what will happen if an object is not made of the right material.

Previewing Activity
Ask students to examine their chairs to see what the different parts of a chair are and what their chair is made of.

Ask them why they think their chairs are made of what they are made of.

Viewing
Play the video and pause at ***Discovery Break One - What's the problem with the chair the Quinks made?***

Post-Viewing
Ask students:
What do you think will happen if Willow sits in the chair?

What materials do you think the Quinks might have used to make a stronger chair?

What is it about the chair that might make it break if Willow sits on it?

Video Extras
When Willow enters the classroom, the room is dark, but the word "light" is on the wall next to the light switch. Some students might point this out during viewing, acknowledge them!

When Neutrina describes a chair, she points out that a chair has legs, a seat and a back, you might have students take an inventory of the classroom or home and see if all the chairs have those three things. Do some chair have more features?

Literature Extra
A Chair for My Mother by Vera B. Williams
In this Caldecott Honor book, Rosa and her family save their money to buy a comfortable chair after their home was destroyed by fire.

Peter's Chair by Ezra Jack Keats
Everything changes when Peter gets a new baby sister. All his old furniture has been painted pink. Determined to save his favorite chair, Peter runs away with his dog Willie, only to discover that he is now too big for his old chair.

Arts Extra
Two of Vincent van Gogh's most famous paintings are of chairs, *Vincent's Chair with His Pipe* and *Gauguin's Armchair.* You can show students both paintings and have them describe the properties of both chairs - what is the same, what is different. You can challenge them to create their own painting or drawing of a chair!

Discovery Break Two

OVERVIEW
Willow tells the Quinks that the chair needs to be made of something stronger if it is going to hold her up. She then explains that something that is strong can withstand great force or pressure and that strong is a property a chair should have. She goes on to explain what a property is and give examples of colorful, flexible, transparent, incandescent, and weightless. She then describes some of the properties of her stuffed gorilla.

Objectives
Students will describe how something that is strong can withstand great force or pressure.

Students will identify some of the properties of objects around them.

Vocabulary	
Force	Flexible
Pressure	Transparent
Property	Incandescent

Previewing Activity
Ask students if they have ever heard the word property before? What do they think a property is?

Say to Students:
Let's rejoin Willow and the Quinks and see if they figured out what was wrong with the chair and then find out what Willow has to share about properties!

Viewing
Resume the video. Pause at ***Discovery Break Two - How much do you know about the properties of things?***

Post-viewing
Say to students:
Willow wants to know how much we know about properties! Let's figure it out!

I am going to name a property, let's see if you can show me something in the room with that property.

Suggested properties:
Hard, soft, transparent, flexible, round, square, shiny, sticky, rough, smooth, red, blue, green, sharp, fluffy.

Literature Extra
Koko's Kitten by Dr. Francine Patterson
The true story of Koko the Gorilla who communicates using sign language and who loved and lost a tailless tabby kitten she named All Ball. (Properties!)

Writing Extra
Have students write a description of an objet by naming its properties. Each student can choose a different item and then see if the other students can guess what they are describing or all the students can describe the properties of the same object. Object might be a pencil, a paper clip, a piece of paper, a book, a rubber band, etc.

Arts Extra
Create a collage using a variety of materials with different properties like sandpaper, cotton balls, feathers, glitter, etc.

Discovery Break Three

OVERVIEW
The Quinks have brought back a number of items that all look different. Willow challenges them to identify properties of the items that are the same. They identify color as a property. Fluxx tries to organize the items by color, but he gets it wrong. He tries again and gets it right this time.

Objectives
Students will group objects based on their properties.

Students will describe how one object may have more than one property.

Previewing Activity
Ask the students if they have ever organized things in groups. Have them give some examples. How did they decide what the groups would be?

Say to the students:
When we left the Quinks they were off to discover everything they could about properties. Let's see what they discovered.

Viewing
Resume the video. Pause at ***Discovery Break Three - Can you group objects by their properties?***

Post-viewing
Say to students:
Willow and the Quinks grouped their objects by color. Let's see if we can identify other properties that we can use to group objects! You can do this as a class, group or individual activity.

Suggested items:
paper clips, buttons, chalk, pens, pencils, crayons, rubber bands, note cards, paper, sticky notes, cotton balls

Call out categories for grouping - for example: hard, soft, bendy, stretchy, color.

See if students can come up with other categories.

Have students use their observation skills to look around the room to see if there are things in the room organized by properties.

Video Extras
You might pause the video when Fluxx first groups the items by color and have students check to see if he got it right.

You can pause the video a second time when he groups the items and have the students check again.

Fluxx does not group the items correctly by color the first time, but he gets it right the second time. This is a good place to talk with students about how scientists almost never get things right the first time, but that they look at what didn't work and what did work and then they try again - sometimes many, many, many times. You can introduce them to the proverb, "If at first you don't succeed, try, try again."

Discovery Break Four

OVERVIEW
The Quinks have grouped objects by properties they can see and feel - hard and soft, big and little. They think they now know everything about grouping objects, Willow challenges their conclusion and groups the objects by the material they are made of - plastic, metal, and wood.

Objectives
Students will describe how objects can be grouped the material they are made of.

Students will group objects by the material that they are made of.

Previewing
Say to the students:
We just grouped our objects by lots of different properties! Let's see how the Quinks have grouped their objects.

Viewing
Resume the video. Pause at ***Discovery Break Four - What are these objects grouped by?***

Post-viewing
Say to students:
How do you think Willow grouped the objects? (by material)

Ask the students to look at the objects they just organized by properties. Ask them if they can reorganize their objects by the material they are made of.

Ask the students to look around the room and identify some of the materials objects are made of. (wood, plastic, glass, metal, cloth, paper, cardboard, foam, wax, etc.

Discovery Break Five

OVERVIEW
The Quinks figure out that Willow has organized the objects by the materials they are made of. Willow explains what the word material means. Fluxx starts to quiver - that's what Quinks do when they have a question. He wants to know why things are made of different materials.

Objectives
Students will explain how different materials have different properties.

Students will test different materials and record their observations to determine which material would make the best boat.

Vocabulary	
Material	Quiver

Previewing Activity
Say to the students:
We used observation to figure out that Willow organized the objects by the materials they we made of, do you think the Quinks used observation to come up with the same answer or conclusion?

Viewing
Resume the video. Pause at ***Discovery Break Five - Why are things made of different materials?***

Post-viewing
Say to the students:
Flux wants to know why some things are made of different materials. Why do you think things are made of different materials?

Hands-on Activity
In this activity students will test a variety of materials for three properties - transparency, strength, and whether it is waterproof.

Materials:
Paper or plastic cups, water, pennies, eye dropper, Testing Materials Worksheet

Materials to test:
plastic wrap, playing card, note card, aluminum foil, construction paper, tissue, paper towel, or any other kid-friendly material you like.

Procedure:
Place each material over a paper cup, one material at a time and record observations on the recording sheet on the Testing Materials Worksheet.

1. Test the transparency of each material by seeing if you can see through it to the bottom of the cup.

2. Test the strength of each material by seeing if it will hold 10 pennies.

3. Test how waterproof the material is by putting 10 drops of water on it and seeing if it absorbs or repels the water.

Vocabulary Extras
In the clip, Fluxx starts to shake. Quazar explains that Quinks "quiver" when they have a question. You could pause the video here and ask students what they think quiver means.

What Happens to the Colors? by Jack Prelutsky
This poem for children wonders what happens to colors at night and includes the word quiver! You can find it online.

Testing Materials Worksheet

After you test a material put an **X** in the right column for each property the material has. If you are testing materials not on the worksheet, add the name of new materials to the sheet.

Materials	**Transparent** Can you see through it?	**Strong** Will it hold 10 pennies?	**Waterproof** Does it repel water?
Plastic Wrap			
Playing Card			
Aluminum Foil			
Construction Paper			
Bathroom Tissue			
Paper Towel			

Discovery Quiz

OVERVIEW
In this segment, the Quinks observe four objects, a window, a bridge, raincoats, and a balloon. For each object they make observations about how the object is being used and then ask a question about why the material the object is made of is right for the job.

Objectives
Students will list the properties different materials have that make them right for particular jobs.

Students will identify objects made of the different materials and explain why those objects might be made of those materials.

Vocabulary	
Transparent	Waterproof

Viewing
Discovery Questions
Pause the video when you see the spinning question mark and have student answer the questions.

1. Why is glass the right material for the job? (object window)

2. Why is wood the right material for the job? (object bridge)

3. Why is plastic the right material for the job? (raincoat)

4. Why is rubber the right material for the job? (balloon)

Post-viewing
Have students identify the materials objects in the room are made of and explain what properties those materials have that might make them perfect for that object. You can focus on the materials that were used in the question - glass, wood, plastic and rubber or add more materials to the list!

MISSION: MATERIALS

Discovery Break Six

OVERVIEW
The Quinks meet Meghan, a civil engineer. She explains how she builds things like roads and how it is important that she pick the right materials so the road are strong and smooth enough for cars to drive on.

Meghan challenges students to use tape and construction paper to build a bridge between books.

Objectives
Students use trial and error and problem solving skills to construct a "bridge" using only paper and tape.

Vocabulary	
Civil Engineer	Pavement
Gravel	

Previewing Activity
Ask the students:
How many of you have driven on a road? What are roads used for? What properties do you think a road should have? What materials to you think could be used to make a road?

Say to the students:
The Quinks are going to meet a civil engineer who is building a road let's see what they learn!

Viewing
Resume the video. Pause at ***Discovery Break Six - Can you build a book bridge?***

Post-viewing
Say to the students:
Do you think you can build a bridge between two books that will hold a cupful of pennies using just paper and tape?

Hands-on Activity
Students build a paper bridge that can hold 100 pennies.

Materials	
Tape	Rolls of pennies
Scissors	Rulers
Books or blocks at least 3 inches in height	Construction paper, newspaper, or copy paper
Paper or plastic cups	

Procedure:
Pass out three pieces of paper, tape, two books, two rolls of pennies, a ruler, a cup and scissors to each group.

Tell the children that they will be building a paper bridge that will go over the books and will be able to hold a paper cup full of 100 pennies.

Have the students use their rulers to place the books eight inches apart.

Tell them they can do anything they want to the paper to build their bridge - fold it, cut it, roll it, layer it, tape it, etc.

You should not tell them how to build their bridge, but you might ask them "Is there something you can do to the paper to make it stronger?"

Once they have a bridge they think will do the job, have them place their cup on the "bridge" and begin filling it with five pennies at a time - the goal is to get all 100 pennies in the cup with out having the bridge collapse.

Review

OVERVIEW
In the last segment, the Quinks have made another chair for Willow, this time they chose the right material. The lesson ends with the Quinks singing the *Explorers Song*.

We're Explorers

We're explorers.
Explorers!
The world that's what we explore!
We're explorers.
Explorers!
Day after day...
Learning more and more!

Review Questions
1. The Quinks discovered that objects can be grouped by color, by harness or softness, and a whole bunch of other things. What do we call the special qualities and object has?
Answer: Properties

2. What are things made of?
Answer: Materials

3. Why is it important to use just the right materials when you are making something?
Answer: Because you need the right materials for the job.

Literature Extra
The story of the three little pigs is the perfect fairy tale for this lesson on materials and properties!

Picking the wrong materials (straw and sticks) resulted in disaster for two of the pigs! You can share the story with your students and discuss how picking the right and wrong materials made a difference in the story.

You might challenge your students to re-tell the classic tale using other materials or changing other details!

Resources
The Three Little Bigs retold by Steven Kellogg
In this retelling of the classic story, three pigs run a family waffle-making business and live in their own little homes, a straw bungalow, a log cabin, and a brick cottage. All is well until Tempesto the wolf comes looking for more than waffles.

The True Story of the Three Little Pigs by Jon Scieszka
In this retelling of the tale, readers get the wolf's side of the story.

You will find an animated online version of *The Three Little Pigs* from PBS children's show, **Between the Lions**.
nhptv.pbslearningmedia.org/resource/btl07.rla.early.aloud.pigs/the-three-little-pigs/

MISSION: MATERIALS

STEM from the START is an innovative, online video-plus-activities curriculum for PreK-2 learners available at www.nhptv.org/STEM.
Featuring kid-friendly animated characters called QUINKS, the goal of STEM from the START is to nurture students' natural curiosity and love of discovery, while laying the groundwork for ongoing success in STEM (Science, Technology, Engineering and Math) subjects.

DISCOVERY GUIDE
Authors
Dennis Neil Kleinman
Susan Adams, Educational Services Manager, NHPB

Editor
Grace Lessner

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CERTIFICATE OF ACHIEVEMENT

This certifies that

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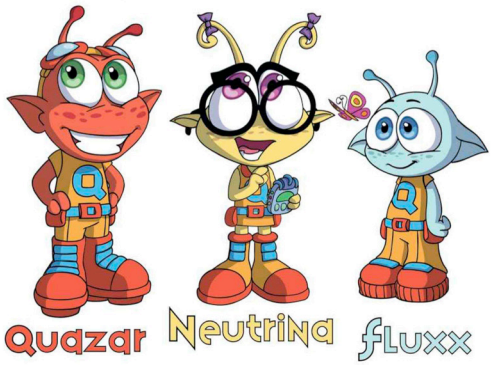
is an Explorer and knows all about

MATERIALS



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