Introduction to science learning & Smartivity- 10 minutes

Introduce yourself. Tell the children your name, your field of study, and a list of superlatives they must use when addressing you, such as _____

Who is a smart kid?
Gather answers from students and then tell them **the definition of a smart kid.**

What is smartivity?

What is science?
Science refers to a system of acquiring knowledge. This system uses observation and experimentation to describe and explain natural phenomena.

What is technology?
Technology is the application of science, or scientific knowledge for everyday use… or what we call practical purposes.

What is engineering?
Engineering is the branch of science and technology that deals with the design, building, and use of engines, machines, and structures…

What is mathematics?
Mathematics is not just about numbers and addition and subtraction and multiplication and division… Math and science go hand in hand. Math is a subject that helps us think about and experiment with science, technology and engineering concepts, before we actually build something.

What is STEM?
STEM is a shortform of Science, Technology, Engineering and Math… all the modern advances that we as humans have made is a result of these four subjects. These four subjects not only help us discover and invent new things, but also help us look at life in a different way - help us question why and why not… show us a way to find new solutions.

What is a Scientist?

"A scientist is a person who asks questions and tries different ways to answer them."

Then I show a PowerPoint I made, **What is a Scientist?**

Science in Life- 5 minutes

Science has invaded every branch of modern life. It is the noise of machines, cars, mills and factories, etc. which awakens us every-day in the morning. The food we eat, the clothes we wear, the books and papers we read, the recreations we enjoy, the games we play – all have something or other to do with the application of science.

Every person feels the effects of science in every sphere of life. It is not merely the electric light or the electric fan, the radio or the cinema that displays the power of science in our daily life, but everything we do or is done to us is in some way or another connected with science.

The things that we use in our daily life are mostly due to science. Our forefathers put on clothes woven by hand. Our clothes are made in large factories where scientific methods are used. We get so much paper to write on only because the piper mills can turn out huge quantities of it. Cloth and paper we had even before science came on the scene but no one could then think of the huge quantities in which they are produced now.

Science has conquered time and distance. We can travel from one place to another with a quickness which our forefathers could not have dreamt of. In the morning, we get news of events that happened yesterday in all parts of the world. Why should we talk of yesterday? With the help of the radio, we can listen to an American speaking. It would seem that he is before us and we are part of his audience. If we want to send a message to a person in America, we can send an email and he will get it in a few hours. If we want to speak to our friends far from us, there is the telephone that will connect us.

Effect of science of human life: It is, indeed, true that science has added tremendously to the comforts and conveniences of mankind. Unless one is an ascetic, one has no reason to reject the things science offers. By conquering time and distance science has brought mankind together and so far made life richer. By inventing medicines it has made our day-to-day existence relatively free from disease, and has, indeed, added to our length of life.

Examples of use of Science in everyday life: This fan and light works from the application of electricity. Electricity is one of the wonders of modern science. The bus which has an engine works with petroleum. The train is driven by the power of coal. This is possible only because of the application of science. My doctor gives certain injections and the patient soon well enough to come here. Medical science is another achievement of modern science, the marvel of medicine.

From the above, it is clear that science is playing an important part in our everyday life.

Scientists Stay Safe

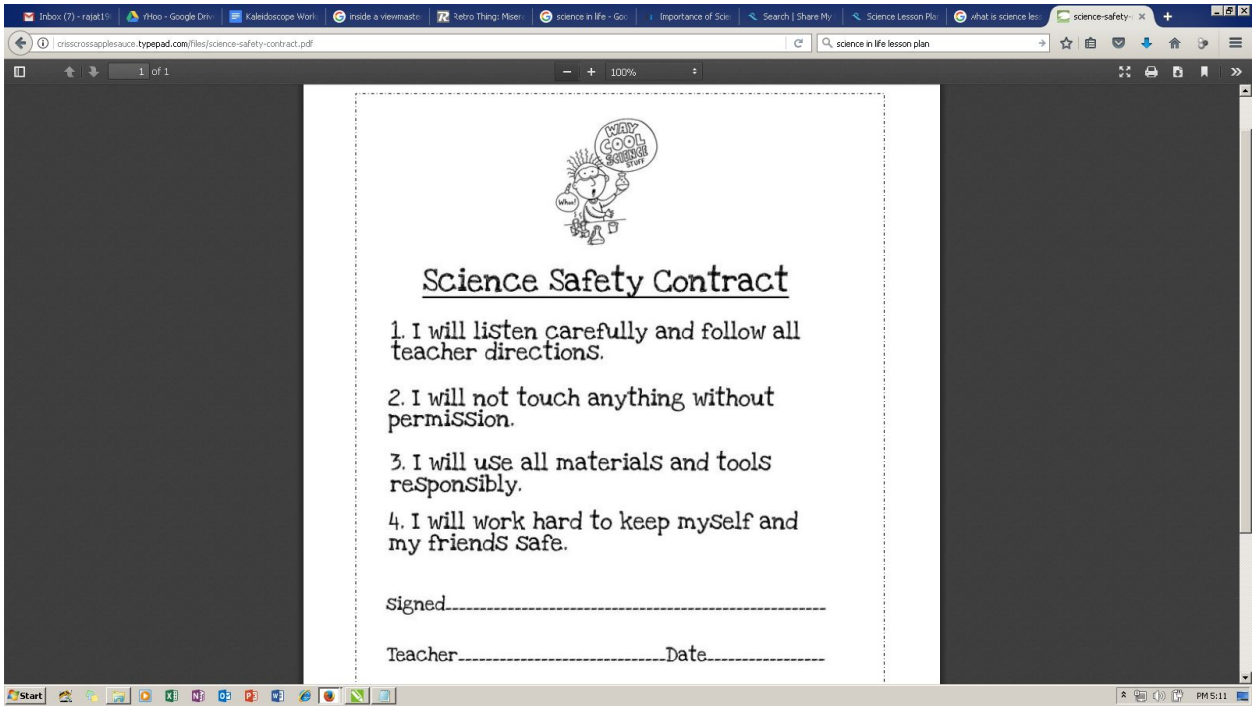
Today we take some time to go over all of the safety expectations in the Science Safety Contract. I start by asking the kids "Why is it important for scientists stay safe? What kinds of things do scientists do to stay safe?"

We watch the PowerPoint What is a Scientist? again. I ask the kids to look for things that these scientists are doing to stay safe. (The chemist is wearing gloves and goggles; The geologist is wearing a hard hat; etc.)

Then I ask the kids about specific slides, for example-- "Do you think the volcanologist plays around with the hot lava? Do you think the chemist tastes the chemicals? Why not?"

We take a few minutes to discuss all the horrible catastrophes that could befall these scientists if they are not safe (the kids are very imaginative that way!) Then I tell the kids that, although we will not be near any volanoes or tornados, it is still very important that ***we*** stay safe while doing science!

I hand out the Science Safety contracts. We go over each expectation--one by one. We talk about why that expectation is important and what could happen if we didn't follow them. When we are done, we sign them and glue them in our notebooks!



Guide students to the scientific concept they will be learning through the activity which is

What is a catapult?
A catapult is a **ballistic** device used to throw a **projectile** across a great distance.
Catapult = Greek words: 'kata' (downwards) + 'pallō' (to toss or hurl)

Who invented catapults?
Catapults were invented by the ancient **Greeks**.

Where were catapults used?
In **medieval** times (between 1500 to 600 years ago), catapults were used as a weapon to surround and attack **castles** and walled-cities. Soldiers used catapults to throw big stones at the walls of the city or castles. These stones would hit and break the walls. They also used catapults to throw burning balls inside the castle or city to scare the people inside and force them to surrender.

Where can we see catapults in use today?
Today, the word catapult is used to describe various **devices** such as:

- 'Aircraft Catapults' used to launch airplanes from ships when the runway is too short for an airplane to take-off
- Slingshot we use to pluck fruits from trees

Reading Instruction Manual and identifying parts

(10 minutes)

Constructing the CATAPULT - 100 minutes

ELASTICITY/STRETCHINESS- 15 minutes

Elasticity means stretchiness, simple.
Have you noticed that when you pull (or stretch) a rubber-band, how it goes back to its original shape when you leave it? Or, when you push (or press) a rubber-ball and leave it, how it becomes round again? Well, that is because of elasticity.

Elasticity is the ability of an object to regain its original shape when it is pulled or pushed (and then released).

Different things are elastic to different extent. Remember, when mommy pulls your cheek, how your cheek stretches (and how it annoys you!). That is because our skin on the cheek is quite

elastic. However, if mommy were to pull your nose, it won't stretch, right? But when you make faces, you can feel it pinch a little bit. That is because nose is not as elastic as cheek.

Some things like (object or things) rubber-band or springs are very elastic (let's call them easy-peasy-elastic). We can see a rubber-band or a spring stretch and come back to its original position. But some things like wooden block or iron rod are not as visibly elastic. That does not mean they are not elastic. Everything has elasticity (remember how when it rains, your cupboard door does not shut easily? But when you push it hard, it shuts. That is because there is a little elasticity in everything).

Our catapult uses the elasticity of the thread. Though the thread does not seem to be as elastic as a rubber-band, in our catapult, it provides sufficient elasticity to make the catapult work.

ACTIVITY
ELASTIC AND NOT-SO-ELASTIC
Classify the following objects into Easy-Peasy-Elastic and Tough-Elastic

Insert table for classification:

Easy-Peasy-Elastic	Tough-Elastic

Rubber-band
Wood
Plastic ball
Rubber ball
Spoon
Squeezy Toy

ACTIVITY

In my catapult, the thread twists around the Arm. The thread of my catapult is Stretchy.
Question: How do I find out stretchiness of the thread used in my catapult?

I need: ruler, thread used in your catapult, rubber band, woollen cloth

Steps

1. Divide the class in groups of 3
2. 2 in each group stretch each material one by one as much as they can
3. The third person measures initial length of material and final length of material.

Measure how much each material has stretched. Write 1 in the box under the material that stretched to the longest length; write 2 under the strip that stretched to the next longest length; and so on.

Answer:
The thread of my catapult stretches more than _____. I call this thread “The Rigid thread”.
The thread of my catapult stretches less than _____. I call this thread “The Elastic thread”

ENERGY

The definition of energy is very simple. Energy is defined as “the ability to do work”. You know how we do not feel like doing homework in the night after we have played all evening. We do not have the energy. Got it? The same applies to everything.

We get energy from the food we eat. So do cats and dogs and cows and all animals. And fishes too! Even non-living things need energy to work. Cars get energy from fuel or gas. Torches get energy from batteries. TV and electric bulbs and washing machine, all require electrical energy to work. From roller-coasters to rockets, every thing requires energy to work.

Video: https://www.youtube.com/watch?v=Q0LBegPWzrg

Our catapult has three critical components: the arm where we place the pom-pom (also called projectile), the winding mechanism (thread) and the base with stopper. The winding mechanism of a catapult provides the energy required to make it work.

The winding mechanism is based on elasticity. In our catapult, we use the elasticity of the thread to fling projectiles (pom-pom ball) to long distances. How does that happen? When you wind up the spoked plates to tighten the thread, the potential energy stored in you is transferred to the thread. So, the potential energy in your hand muscles is transformed into the elastic (potential) energy in the thread. Just like when a rubber-band is stretched and then released, it goes back to its original shape; the elasticity of the wound-up thread tries to bring the thread back to original (unwound) state. The arm of the catapult is held by this thread. When we lock the arm, it prevents the thread from going back to its original (unwound) state. This means, the elastic energy of the thread is stored as potential energy in the arm. When we place the pom-pom on the arm, and release the arm, the elasticity of the thread jumps into action. It tries to bring the thread to its original (unwound) state. This rotates the arm (and the pom-pom ball on it). As the arm rotates, the pom-pom ball moves with it for a small distance and then thrown into air because of Law of Conservation of Energy. When the pom-pom flies in the air, the potential energy of the arm is changed into kinetic energy of the pom-pom ball. In this way, the

elastic energy in the thread is changed into potential energy of the arm, and the potential energy of the arm is transformed into kinetic energy. When the pom-pom ball hits the castle, the kinetic energy of the pom-pom ball is suddenly transformed into potential energy and transferred to the castle wall or the soldier/knight/king, and this energy makes them topple.

ACTIVITY

In my catapult, when I rotate the Spoked Plates the thread twists around the Arm.
Question: How do these twists impact the power of my catapult?
I need: My catapult, Red paper strip, Blue paper Strip, Green paper strip

Steps:

1. Turn the Spoked Plates of Catapult 3 times. Launch the pompom. Place the red paper strip where pompom falls.
2. Repeat the process by turning the Spoked Plates 5 times and 7 times. Use Green and Blue paper strips respectively.

Colour the appropriate circles in table below.

Spoked Plates Turns	Far	Farther	Farthest
3	O	O	O
5	O	O	O
7	O	O	O

Answer: Use words (**more/less**) to fill in the blanks.
The more I turn the Spoked Plates, the _____the thread twists. The more the thread twists, the _____ powerful my Catapult becomes.

MOMENTUM

ACTIVITY

Launch small pompom and big pompom at the castle. Which one is able to topple the army?

Launch pompom at different speeds towards the castle. In which case is the pompom able to topple the army?

RACK AND PINION MECHANISM

A toothed wheel (Wavy Gear) has Beak Plate stuck in between its teeth. These teeth allow rotation in one direction but do not allow the Beak Plate to rotate in reverse direction.

Colouring a project - 20 minutes

Pop Quiz - 10 minutes

Catapult

1. Who invented the catapult? (c)

a) Germans
b) Indians
c) Greeks
d) Chinese

2. A catapult is a _____ device used to throw a projectile across a great distance. (c)

a) Funny
b) Electrical
c) Ballistic
d) Magnetic

3. In medieval times, catapults were used as- (weapons)

a) Toys
b) Weapons
c) Transport System
d) All of the above

4. _____ is the ability of an object to regain its original shape when it is pulled or pushed. (d)

a) Energy
b) Inertia
c) Entropy
d) Elasticity

5. Is our skin elastic? (yes)

a) Yes
b) No

6. Which of these things are elastic? (all of the above)
a) Iron Rod
b) Rubber Band
c) Wood
d) Spring
e) All of the above

7. _____ is defined as “the ability to do work”. (energy)
a) Motivation
b) Energy
c) Motion
d) Elasticity

8. In a catapult as the arm rotates, the pom-pom ball moves with it for a small distance and then gets thrown into air because of which principle? (Law of Conservation of Energy)
a) Law of Gravity
b) Newton’s Third Law of Motion
c) Law of Conservation of Energy
d) None of the above.

9. The primary type of energy storage mechanisms used in a catapult - (d)
a) Tension
b) Torsion
c) Gravity
d) All of the above
e) None of the above

10. An aircraft catapult is used to launch airplanes from a _____. (c)
a) Island
b) Runway
c) Ship
d) All of the above