



Master Lesson Plan

For

How Big How Heavy

Board	Standard	Subject	Chapter	Language	Reference Link	Creation Date
CBSE	STD V	Mathematics	How Big How Heavy	English	How Big? How Heavy?	2020-08

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How Big How Heavy

1. MS_Objectives-How Big? How Heavy?

This asset lays down the proposed plan for transacting this chapter. It states the asset objective of the MLP.

This asset is for teacher's reference and need not be taught to the students.

Students will be able to -

- Identify volume, mass, weight of objects and their differences
- Identify the different units in measurement of volume
- Identify Right prisms
- Apply formulae to find volume of some known solids
- Calculate volume of some known solids using the formulae
- Compare volume and capacity
- Apply the Archimedes Principle to find volume of general shapes
- Appreciate the inquisitive mind of Archimedes
- Calculate the weight of objects
- Recognize and use Volume and Weight in daily life
- Discriminate while choosing friends

Time to teach	Asset Type	Theme	SubTheme
2 Minutes	Main Script	Surface Area & Volume	Volume , Volume

2. IQ_What is Volume? What is Weight?

1) What is volume?

Volume of an object is the measurement of space occupied by the object.

2) What is mass of an object? What is the unit used to measure mass?



Mass of an object is the amount of matter it contains.

The standard unit of mass is Kilogram denoted by Kg. $\frac{1}{1000}$ th part of a kilogram is known as gram denoted by g.

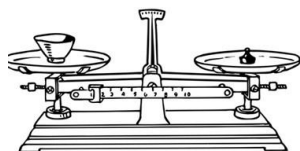
3) What is the weight of an object?



The weight of an object explains how heavy the object is.

It is the downward force exerted by the gravity on the object. So, in Physics, units of force are used to measure weight.

4) What are the units used to measure weight in daily life?

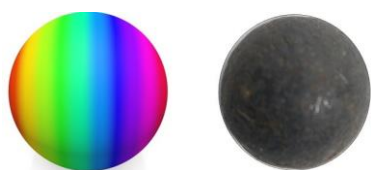


In a region of constant acceleration due to gravity, if two objects have the same mass then they have the same weight.

Also, weighing scales are designed to estimate the mass of objects sitting on them using the units kilograms, grams etc.

Thus, it is common to use units of mass kilograms, grams etc. to measure weight.

5) If two objects have the same volume, do they have same weight?



No, volume and weight are independent.

E.g. a hollow ball of rubber and a solid iron ball of same radius have same volume, but their weights are different

Source:

Weighing machine: <https://pixabay.com/de/illustrations/waage-k%C3%BCche-wiegen-gewicht-2241642/>

Balance: <https://pixabay.com/de/vectors/waage-gerechtigkeit-wiegen-gekippt-307248/>

Scale: <https://publicdomainvectors.org/en/free-clipart/Scale-with-weights/50272.html>

Balls:

<https://www.needpix.com/photo/download/616429/ball-about-colorful-rainbow-color-gradient-free-pictures-free-photos-free-images>

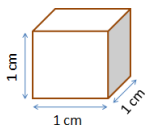
[https://commons.wikimedia.org/wiki/File:Ball,_shrapnel_\(AM_2014.90.8-4\).jpg](https://commons.wikimedia.org/wiki/File:Ball,_shrapnel_(AM_2014.90.8-4).jpg)

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Inquisitive Questions	Surface Area & Volume	

3. MS_Units in measurement of volume

What are the units used to measure volume?

To measure small quantities, the unit cubic cm is used



It is the volume occupied by a cube of side 1 cm

- Litre is also used to measure volume



1 cubic cm = $\frac{1}{1000}$ of a litre = 1 millilitre (1 ml)

Thus, 1 litre = 1000 cubic cm

$$= 10 \text{ cm} \times 10 \text{ cm} \times 10 \text{ cm}$$

In other words 1 litre is the volume occupied by a cube of side 10 cm

- The SI unit of volume is the cubic metre which is the volume occupied by a cube that measure 1 m on each side

Note that 1 cubic metre = 1000 litres

Source:

Litre: <https://pixabay.com/vectors/cup-kitchen-liter-litre-measuring-1300565/>

Time to teach	Asset Type	Theme	SubTheme
5 Minutes	Main Script	Surface Area & Volume	Volume , Volume

4. MS_Right Prism

What is a right prism?

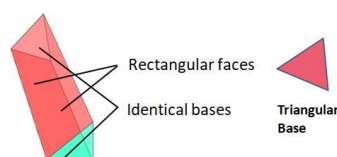
A right prism is a solid with two parallel faces called bases. The bases of a right prism are identical.

Depending on the shape of bases it has several rectangular faces.

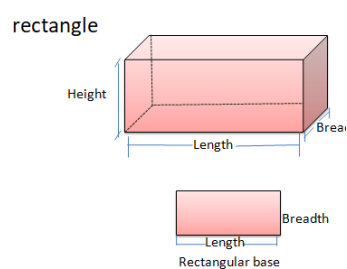
They are called right prisms because the edges of rectangular faces are lines perpendicular to bases.

Examples:

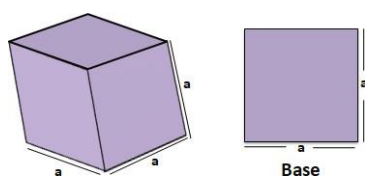
Right prism with triangular base:



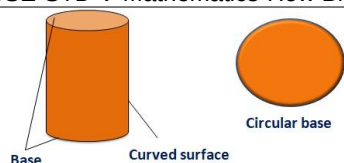
Cuboid: Cuboid is a right prism in which base is a rectangle



Cube: When length, breadth and height all are equal to "a" in a Cuboid, we get a cube with side 'a'



Cylinder: Cylinder is a type of right prism with two parallel circular bases joined by a curved surface



Source:

All images are self drawn by Venkanna Babu

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Main Script	Solid Geometry	Solid objects(2D and 3D), and 3D)

5. MS_Volume of some known shapes

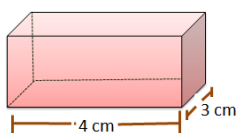
We can find the volume of Cuboids and Cubes in terms of the area of base as follows:

Result

Volume of a right prism = Area of the base $\times$ height

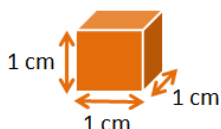
Let us prove the result by taking one example

Consider a cuboid with length = 4 cm and breadth = 3 cm as the dimensions of the base



The base of the cuboid is a rectangle of side 4 cm and breadth = 3 cm and area of the base = $4 \times 3 = 12$ square cm.

Step1: Build a right prism on the grid by placing unit cubes of volume of 1 cubic cm, as shown in the fig:

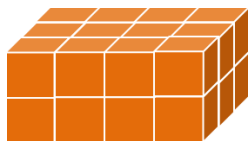


Volume of the prism formed = Number of unit cubes occupied by the prism = 12 cubic cm

Area of the base = 12 square cm and height of the prism = 1 cm

Area of the base $\times$ Height = $12 \times 1 = 12$ = Volume of the prism

Step 2: Now construct a prism that has a height of 2 cubes

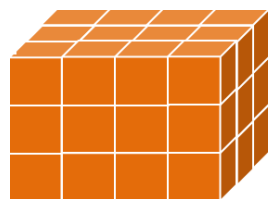


Volume of the prism formed = Number of unit cubes occupied by the prism = 24 cubic cm

Area of the base = 12 square cm and height of the prism = 2 cm

Area of the base $\times$ Height = $12 \times 2 = 24$ = Volume of the prism

Step 3: Now construct a prism that has a height of 3 cubes



Volume of the prism formed = Number of unit cubes occupied by the prism = 36 cubic cm

Area of the base = 12 square cm and height of the prism = 3 cm

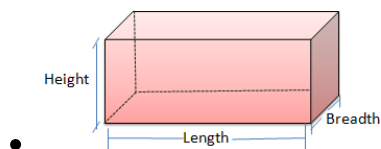
Area of the base $\times$ Height = $12 \times 3 = 36$ = Volume of the prism

Continuing like this, when height is h,

Volume of the right prism or cuboid = $12 \times h$ = Base area $\times$ Height of the cuboid

Using the above result, we have the following formulae to find volumes of cuboid, cube and cylinder:

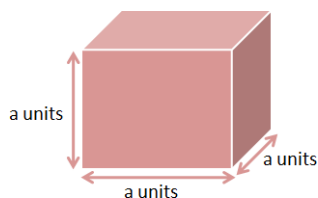
- **Consider a cuboid with length of the base = l units, breadth = b units and height = h units. Then its volume = $V = l \times b \times h$ cubic units**



Proof: Base area of the cuboid = $l \times b$ square units

$V = \text{Base area} \times \text{height} = l \times b \times h$ cubic units

- **Volume of a cube with side = 'a'**



Cube of side 'a' is a cuboid with length $l = a$, breadth $b = a$ and height $h = a$

Volume $V = l \times b \times h = a \times a \times a = a^3$ cubic units

Source:

All images are self drawn by Venkanna Babu

Time to teach	Asset Type	Theme	SubTheme
15 Minutes	Main Script	Surface Area & Volume	Volume , Volume

6. QA_Find the volume

1) Find the volume of the cube whose edge is

a) 3 m b) 5 cm c) 4 mm

Solution:

a) Volume $V = 3 \times 3 \times 3 = 27$ cubic metre

b) Volume $V = 5 \times 5 \times 5 = 125$ cubic cm

c) Volume $V = 4 \times 4 \times 4 = 64$ cubic mm

2) A water tank in the shape of a cuboid is 9 m long, 6 m wide and 2 m deep. Find the capacity of the water tank in litres.

Solution: The dimensions of the water tank are:

Length $l = 9$ m, Breadth $b = 6$ m and height $h = 2$ m

Volume $V = l \times b \times h = 9 \times 6 \times 2 = 54 \times 2 = 108$ cubic metres

1 cubic metre = 1,000 litres

Capacity of the water tank in litres = $108 \times 1000 = 1,08,000$ litres

3) A cuboid is 8 cm long, 6 cm wide and 9 cm high and the side of a cube is 8 cm. Which one has greater volume?

Solution:

Volume of the cuboid = $l \times b \times h = 8 \times 6 \times 9 = 48 \times 9 = 432$ cubic cm

Volume of the cube = $8^3 = 8 \times 8 \times 8 = 64 \times 8 = 512$ cubic cm

Cube has greater volume

4) Find the height of the cylinder if its volume is 2,512 cubic metres and base area is 314 square metres

Solution:

Let height of the cylinder be h metres

Base area = 314 square metres and volume $V = 2,512$ cubic metres

Base area $\times h = V$

$314 \times h = 2,512$

$h = \frac{2512}{314}$

$$\begin{array}{r} 8 \\ 314 \overline{) 2512} \\ \underline{2512} \\ 0000 \end{array}$$

Height of the cylinder $h = 8$ m

Time to teach	Asset Type	Theme	SubTheme
15 Minutes	Assessments	Surface Area & Volume	Volume , Volume

7. MS_Volume and Capacity

Volume:

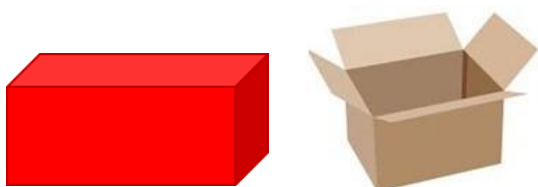
Volume of a substance, like a solid, a liquid or a gas is the space occupied by the substance

E.g volume occupied by the liquid in the container is 200 ml

Capacity:

Capacity is the maximum amount a container can hold. It is fixed for a container. Capacity of the container in the figure is 250 ml.

NOTE: Solid things have volume only because it's not possible to use them as container



But hollow things have both volume and capacity

Difference between Volume and Capacity:

- **Volume of a substance is the amount of space occupied by the substance**
- **Capacity is the amount of space available in a container for holding a substance like a solid, a liquid or a gas**



Example with different capacity but same volume

These beakers have different capacity

But volume of liquid in two beakers is same (200 ml)

Example with same capacity but different volume

These containers have same capacity but volume of liquids in the containers is different

Source:

Beaker: Self Taken

Sphere: <https://www.publicdomainpictures.net/en/view-image.php?image=131294&picture=red-ball>

Measuring cup: 1. https://en.m.wikipedia.org/wiki/File:Simple_Measuring_Cup.jpg

Solid box: Self drawn

Hollow box: 2 <https://www.publicdomainpictures.net/en/view-image.php?image=56626&picture=cardboard-box-white-background>

Container with substance: <https://www.flickr.com/photos/jimmiehomeschoolmom/6107539855>

Beakers with different capacity: Self Taken

Containers with same capacity: Self Taken

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Main Script	Surface Area & Volume	Volume , Volume

8. SA_Volume of general shapes

Aim: To find volume of general shapes

Materials Required: Note book, pen, pencil, ruler (Each student)

Cuboid shaped container, an object e.g. A toy car, a piece of colour tape, Marker, a towel (one for each group)

Note that that the size of container should be such that, the object can comfortably fit inside the container.

Choose the object which does not absorb water and water will not damage it.

Setting for the Activity: Indoor

Type of Activity: Group

Instructions to Teacher:

Two days before the activity, the teacher will explain Archimedes Principle to students.

We know to find volume of regular shapes like Cubes, Cuboids and Cylinders using formulae, by doing some simple calculations.

But how can you find the space occupied by an irregular objects, e.g. A toy car?

When you immerse an object in water, some amount of water is displaced. According to Archimedes Principle, volume of body immersed in water is equal to the volume of water displaced.

So, we can find the volume of irregular objects by immersing them in water container

Procedure:

On the Day of the activity, the teacher will divide the class into two groups and gives the following instructions to each group

Step 1: Add water to the container sufficient enough to submerge the object. But leave enough space between the

surface of water and top of container

Step 2: Using the piece of colour tape, mark the water level inside. If the container is transparent make a marking

outside the container using the marker

Step 3: Sink the object completely in water. Observe that there is a rise in water level. Mark the new water level as

explained in step 2

Step 4: Measure the height h between the two water marks in cm. The space in the container between the two water

marks is the volume of the displaced water, which is equal to the volume of the immersed object.

Note that h is not the height of the entire container, just the height from one water mark to another



Find length l and breadth b of the container in cm using scale. The teacher will approximate the values of l, b, h to the nearest integer

Volume of the object = The measure of the space in the container between the two water marks

= Volume of a cuboid of dimensions l, b and h

= $l \times b \times h$ cubic cm approximately

Note: The activity can be repeated by taking different objects

Conclusion: Students will be able to find volume of general shapes

Source:

Cuboid: Self drawn by Prabha Acharya

Time to teach	Asset Type	Theme	SubTheme
20 Minutes	Suggested Activity	Surface Area & Volume	Volume , Volume

9. IA_The story behind the theory of Archimedes principle

We used Archimedes principle to find the volume of objects which are not regular.

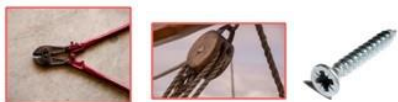
Who is Archimedes?

About 2000 years ago, Archimedes lived in Syracuse, an Iceland of Sicily, which was a famous city and a hub of Arts, Commerce and Science at that time.

After studying Geometry and Astronomy in Alexandria, Archimedes settled down in Syracuse to pursue a life o invention.

He was the world's greatest scientist and many of his inventions and theories are still in use.

His important inventions are the lever, the compound pulley and Archimedes screw



After the discovery of lever, expressing the power of leverage, his statement "Give me but one firm spot on which to stand, and I will move the earth." is very famous.

In History he is famous as a person who ran from the bathtub through the streets of Syracuse shouting "Eureka!", "Eureka!" which means "I have found it" in Greek.



The story behind that event is here

A goldsmith claimed that the new gold crown made for king of Syracuse was not of pure gold. Archimedes was charged with proving it.



He tried but could not find a method for proving that the gold was not pure.

After sometime he filled his bathtub with water and as he got in, realized that the water displaced by his body was equal to the volume of his body.



With this idea, he was able to find the volume of the gold crown.

As Gold was heavier than other metals, even though the weight of the crown was identical to the weight of the gold that the king gave to the crown maker,

volumes were different. Volume of crown was more.

Thus Archimedes was able to find out that the crown was not of pure gold.

As soon as he came to this conclusion, he went running through the streets from his home to the king shouting "Eureka!"

Lever, Pulley, Screw

<https://unsplash.com/photos/pM9pkc9J918>

<https://pixabay.com/photos/pulley-block-equipment-rigging-3584318/>

<https://pixabay.com/photos/cross-screw-woodscrew-metal-iron-273655/>

Running man

<https://openclipart.org/detail/322038/a-black-man-running>

Crown, Bathtub

<https://pixabay.com/vectors/vintage-crown-king-royal-monarch-3745383/>

<https://openclipart.org/detail/320458/man-in-a-bathtub>

Time to teach	Asset Type	Theme	SubTheme
10 Minutes	Interesting Asides	Surface Area & Volume	

10. QA_How Heavy?

1) The total weight of two boxes is 16 Kg 300 grams. The weight of bigger box is 9 Kg 200 grams. What is the weight of

smaller box?

Solution:



The total weight of two boxes is 16 Kg 300 grams

The weight of bigger box is 9 Kg 200 grams

The weight of smaller box = 16 Kg 300 grams - 9 Kg 200 grams

kg	gms
16300	
- 9200	
7100	

The weight of smaller box = 7 Kg 100 grams

2) A box contains 9 bags of sugar with equal amount of sugar. The total weight of all 9 bags is 7 Kg 200 grams

Find the weight of sugar in each bag in grams.



Solution:

Total weight of sugar in 9 bags = 7 Kg 200 grams

$$= 7 \times 1000 + 200 \text{ grams} = 7200 \text{ grams}$$

$$\text{Weight of sugar in 1 bag} = \frac{7200}{9} = 800$$

	800
9) 7200	
72	
00	
00	
00	
00	
00	
00	

Weight of each bag = 800 grams

3) Nidhi has a new baby brother. He weighs 2 Kg 800 grams. Doctor said the baby should gain at least 200 grams per

week. At this rate, what will be the weight of the baby after 3 months (12 weeks)?



Solution:

If the gain is 200 grams per week, after 12 weeks the total gain is

$$= 200 \times 12 = 2400 \text{ grams}$$

$$= 2000 \text{ grams} + 400 \text{ grams} = 2 \text{ Kg } 400 \text{ grams}$$

Weight of the baby after 12 weeks would be 2 Kg 800 grams + 2 Kg 400 grams

$$= (2 + 2) \text{ Kg} + (800 + 400) \text{ grams}$$

$$= 4 \text{ Kg} + 1200 \text{ grams}$$

$$= 4 \text{ Kg} + 1 \text{ Kg} + 200 \text{ grams} = 5 \text{ Kg } 200 \text{ grams}$$

4) Gopi packed 8 flower pots and arranged them in a box. Weight of each flower pot is 2 Kg 100 grams and the weight of

the box is 1 Kg 600 grams. Find the total weight of the box after packing

Solution:



Weight of one flower pot = 2 Kg 100 grams

Total weight of 8 flower pots = (2 Kg 100 grams) x 8

$$(2 \text{ Kg} + 100 \text{ grams}) \times 8 = 2 \times 8 \text{ Kg} + 100 \times 8 \text{ grams}$$

$$= 16 \text{ Kg} + 800 \text{ grams}$$

Total weight of the box after packing = 16 Kg + 800 grams + 1 Kg + 600 grams

$$= 17 \text{ Kg} + 1400 \text{ grams}$$

$$= 17 \text{ Kg} + 1 \text{ Kg} + 400 \text{ grams}$$

$$= 18 \text{ Kg} + 400 \text{ grams}$$

Source:

Boxes: 1. <https://publicdomainvectors.org/en/free-clipart/Dark-brown-open-cardboard-box-vector-illustration/20708.html>

2. <https://www.publicdomainpictures.net/en/view-image.php?image=58277&picture=gift-box-with-lid>

Sugar Bags: <https://freesvg.org/sugar-bag>

Baby: <https://unsplash.com/photos/w-RTffXK9tM>

Pot: <https://pixabay.com/photos/flowers-flower-pot-nature-flower-3804998/>

Time to teach	Asset Type	Theme	SubTheme
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15 Minutes

Assessments

Measurement(Length,weight,capacity)

11. DD_Use of Volume and Weight in daily life

We use measurement of volume and weight all the time in daily life. Without the ability to measure volume and weight, Scientists cannot conduct experiments.

It is important in farming, engineering and construction of building, manufacturing, research etc.

The following are few examples in daily life where we use measurement of volume and weight:



- Without the measurement of volume and weight we cannot do the shopping of grocery items, vegetables, fruits and milk products



- We use volume to measure drinking items like water, milk, juice etc



- In cooking, using correct amount of ingredients as stated in the recipe is necessary. For this, we need to measure the volume and weight of the ingredients



- When we are ill, we need to take medicine in proper amount to get benefit of it. For this, accurate measurement of volume/weight of medicine is necessary



- When you travel, measurement of volume is used to measure fuels like petrol, diesel and natural gas

Sources:

Grocery, vegetables, fruits, milk products etc

<https://pixabay.com/de/photos/einzelhandel-lebensmittelgesch%C3%A4ft-1424041/>

<https://pixabay.com/de/photos/gem%C3%BCse-markthalle-palma-2732589/>

<https://pixabay.com/de/photos/fr%C3%BCchte-markt-stand-gem%C3%BCse-257343/>

<https://www.flickr.com/photos/30478819@N08/45490908735-> Marco Verch

Measuring Jars

[https://commons.wikimedia.org/wiki/File:Volume_measurements_from_The_New_Student%27s Reference Work.svg](https://commons.wikimedia.org/wiki/File:Volume_measurements_from_The_New_Student%27s_Reference_Work.svg)

<https://publicdomainvectors.org/en/free-clipart/Measuring-beakers/52138.html>

<https://www.flickr.com/photos/dinnerseries/20579081940-> attribute to Didriks

Cooking

<https://www.pexels.com/photo/chef-cooking-in-kitchen-2544829/>

Medicine

<https://pixnio.com/science/chemistry/experiment-laboratory-glass-chemistry-liquid-research-medicine-science>

<https://www.needpix.com/photo/1820696/bottles-pills-medicine-bottle-medication-medical-health-pharmaceutical-asprin>

Travelling

<https://publicdomainvectors.org/en/free-clipart/Gas-station-attendant/47289.html>

<https://pixabay.com/da/illustrations/tankstation-diesel-benzin-br%C3%A6ndstof-3946663/>

Time to teach	Asset Type	Theme	SubTheme
5 Minutes	Day-to-day Relevance	Surface Area & Volume	

12. VC_Fake friends and real friends

“A fake note may differ in size, quality of paper and printing or the style in which numbers are written.”

The cashier in the lesson saved the bank by showing that the currency they received from someone were fake by weighing them. The fake notes weighed more than the real ones.

So, it is in our life. There are fake friends and real friends. We need to be careful in choosing our friends.

Rajesh hailed from a wealthy family. His father was a rich businessman. The boy himself used to get good pocket money from his father. Unfortunately, he became friendly with some students whose intentions were not so good and who used to misguide him. They made him spend all the money he obtained as pocket money and even made him tell lies to his father to get more.

One day, the boys took Rajesh to a shop and showed him a Play Station that was quite expensive. Rajesh wanted to own that very badly but his pocket money was not enough for buying it. Sensing how eager Rajesh was to own that piece, his friends tempted him to steal that from the shop. Rajesh yielded to their misguidance.

Unfortunately, he was caught red handed while doing so. The matter was reported to the school and Rajesh

was dismissed from the school.

On the day of the incident, none of those friends were around him to support him. They behaved as if they did not know him even.

Rajesh's friends were fake and ruined his life. He paid a heavy price for undesirable association that he kept.

How do you distinguish the fake from the real? How do you save your lives from fake friends?

Finding the difference between a real friendship and a fake one may not be easy at times. However, there are ways you can recognize when a friendship is no good.

- **A fake friend acts in a manipulative way to change your belief system, drains you financially, mentally and emotionally.**
- **A real friend points out when you go wrong and tries to bring you back on the right path, even if it means that you get angry with him for correcting you.**

Children! What have you done to be a real friend to somebody else? Please tell about your experience.

- **How does it make you feel if somebody is a fake friend to you?**
- **How do you feel if somebody is a real friend to you?**
- **How do you think others will feel if you are a fake friend to them and if you are a real friend to them?**

Time to teach	Value Type	Value Sub Type	Value Attribute
5 Minutes	Truth		Stories

13. MS_Summary-How Big? How Heavy?

- **Volume, mass, weight etc are defined and their differences are listed**
- **Different units of measurement of volume are defined**
- **Right prisms are explained with examples**
- **Formulae to find volumes of known solids like Cuboid, Cube and Cylinders are derived**
- **Volumes of known solids are calculated using the formulae**

- Capacity is defined and differences between volume and capacity are listed
- The method of finding volume of unknown shapes using Archimedes principle is explained
- The story behind the theory of Archimedes principle is narrated
- The weights of objects are calculated in different examples
- The uses of volume and weight in daily life are listed
- The need to distinguish fake friends from real friends is explained through a story

Time to teach	Asset Type	Theme	SubTheme
5 Minutes	Main Script	Surface Area & Volume	Volume , Volume