

Lesson Checklist

	Treasure Hunt
	Treasure Hunt discussion
	Density of Solids
	Discussion of the canisters and practice dividing mass by volume
	Pennies graph
	Pennies plan (for the pennies where the year is scratched)
	Dancing raisins observations
	Densinometer Activity
	Task

Self Reflection:

What I understand:

What I need more help with:

Sequence of Lesson:

Teacher Notes

Introduction

Treasure Hunt

Write a description of an object so that your learning partner can find your object in the container filled with all the objects. You cannot say that the object is a top or a rock you can use terms like, it is round like a circle with a straight post sticking through it or it is gray and shaped like a bean.

► Discuss results as a group.

Density of solids

Each of you will have the chance to hold 5 film canisters in your hands and rank them from the heaviest to the lightest and then describe your thinking to the class about how you decided how to rank them. We will then measure them as a class and check our results.

● Mathematical Moment: measure the mass and the volume of the canisters and work the division on the board.

You have 10 pennies in front of you. Notice that all of them are newer pennies (that will be important later on). Each penny has a volume of _____. You are to weigh the one penny, then 2 pennies, then 3, then 4, then 5 until you have the masses of 10 pennies together.

Now let's make a graph:

Put mass on the y axis (vertical) and volume on the X axis (horizontal). Graph the point where you find the line that represents the mass of one penny with the line from the volume of one penny. Now, since you will be working with the mass of two pennies you must add the volume of two pennies together. Find the lines for two pennies mass and volume and place your point.

Describe your graph. As the mass goes up does the volume go up an equal amount?

Here is your chance to practice a little division. Take each pair of numbers that represents a point on your graph and divide those two numbers. Place those numbers in the chart.

That number is the density of a penny. Record an observation that you can use later in your explorer's journal.

If I gave you 100 pennies what would the density be?

Pennies before 1982 had more copper in them. Newer pennies have a center of zinc (a less dense metal) and a thin coating of copper (a more dense metal). So, when I had you notice that the pennies were all newer it was important. Pennies from before 1982 had a density of about _____.

If I gave you 10 pennies and we could not read the dates because of scratches, how could you use density to tell me which pennies were new and which were old?

Write your plan in your explorer's journal.

Density of gasses

Almost all gasses are less dense than liquids. You fill an intertube to float on the water. Some lifejackets use little inflators to help people float in emergencies. You are going to observe some dancing raisins and tell me what you observe that helps show that gasses are less dense than liquids.

Fill the plastic cup with the lemon lime soda. Now place 4 or 5 raisins in the liquid. Make careful observations in your journal about what you notice/observe. Explain why the raisins are floating and then why are they sinking. What does this have to do with the density of gasses?

► Discuss this and write on board.

Density of liquids

When a mechanic checks to see if a car has enough antifreeze he or she uses a tool called a densinometer. A person who is checking to see if grape juice or orange juice has enough sugar uses the same tool.

What can you tell me about the tool from the term "densinometer"?

Break it down to dense and meter.

(a device, meter, that measures density, dense)

You will use a pencil, a little clay and a thumbtack to make a densinometer. First we need to ask a few questions:

1. Does wood usually float or sink in water?
(Teacher may need to demo wood floating as most woods float but not all)
2. Do thumbtacks usually float or sink in water?
3. Does clay usually float or sink in water?

A meter is used to measure so we need to put some measurement lines on our densinometer. Make 1 cm marks down the side of the pencil. Use a pen so that the marks are easy to see and won't come off in the water. Begin your marks at the pencil point.

Now that your pencil is marked put one thumbtack into the eraser and slide the pencil. Test the pencil to make certain if floats in the water glass. To do this, place the pencil in the water eraser first. If it floats with more than a few markings above the surface of the water you may need to add a little clay to the bottom of the eraser to help it sink a little.

Scientists usually "calibrate" a measuring device. In that process they test the device against something that they know the value of. In this case we will use water. We know that water has a density of 1 g/ml. All that means is that one ml of water weighs 1 gram. We are just interested in how high our pencil floats. Once again it should float with at least two markings above the water level. If the pencil is in water or something with the same density as water it should float at the same level it did in our water. If we test it in some solution that has a density greater than water it should float higher (more markings out of the liquid).

Now that the devices are made and calibrated we can use them to explore some liquids that do not have a density of 1 g/ml.

Try your densinometer in each of the three sugar/water mixtures. Make a prediction before you test the device and then record both your prediction and the results of your test. Record your predictions, tests and any notes on the densinometer data sheet.

Task:

1. How could you use your densinometer to tell how much sugar there is in a liquid like Kool Aid?
2. Oil in a bottle of salad dressing will float. But it is thick like syrup. Where would the pencil float in oil compared to syrup?
3. Below is some data. Show where you think the densinometer will float in the last mixture. (see task)
4. Your e-mail pen pal is doing a science project on density and needs your help to get started. They sent you the following message. Write them a reply that helps them understand density.

Dear Friend,

My science teacher has assigned a project on density. She wants us to be able to predict which things will float and which will sink in water and then she wants us to use a different liquid. She says we can use sugar water as the other liquid if we do not make too big a mess. I don't know the first thing about density. Can you answer a couple of questions and help me understand?

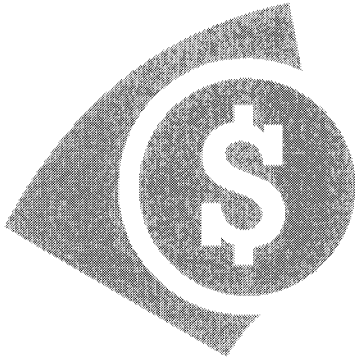
What is density?

How is it measured?

How am I going to use floating and sinking to tell which objects are more dense than others?

HELP!!!!

Christie



Penny Density

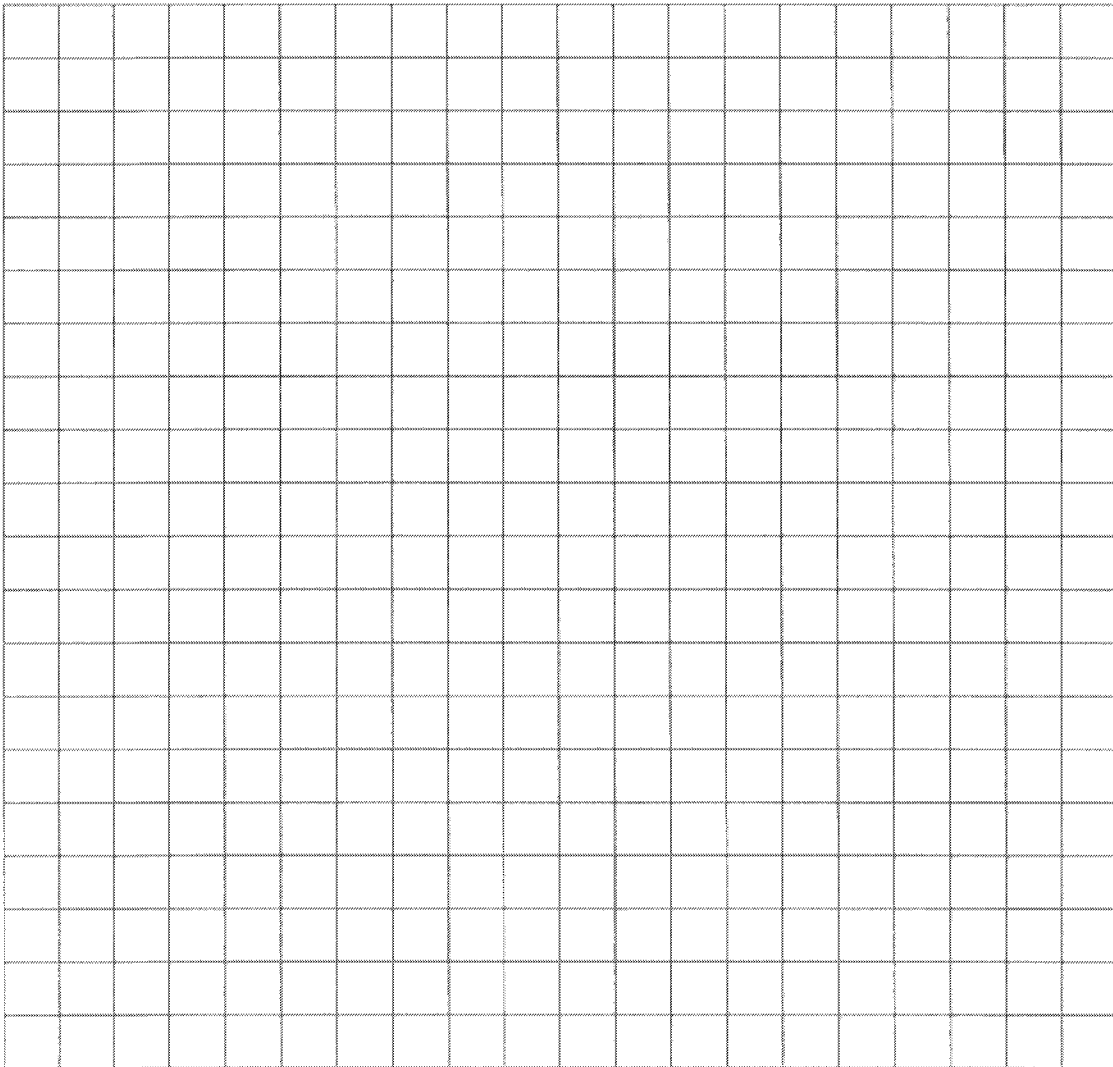
Number of pennies tested	Mass	Volume	Density m/v
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Notes:

Remember that density can be found by dividing mass by volume

$$D = M/V$$

Penny Graph



Explorer's Journal:

Date:

Exploration Description:

My Notes and diagrams:

Explorer's Journal:

Date: 4/22/04

Exploration Description:

I explored pennies and density

My Notes and diagrams:

Stuff I know already: Pennies have years and these pennies have scratches where the years were so we don't know the years

Pennies that were made in 1982 up to now have a different metal in the middle part of the penny.

Pennies made before 1982 have different metal that is just copper in the middle

Copper is more denser than the stuff in the new pennies (I think it is zink).

My test idea:

I would see if the volume of the pennies was about the same by checking the volume. If it was I just need to check the mass on the scale. The heaviest pennies are the older ones.

If that doesn't work I will just take the volume and mass of each penny and do the math to find the density of each and every one. The ones with the less density will be the new pennies and the ones with the more will be the older. That way I can tell which are old and which are new.

Explorer's Journal:

Date: 4/22/04

Exploration Description:

I explored the density of pennies

My Notes and diagrams:

Pennies that were made in 1982 and before 1982 were made of different metal. They will be more dense. Pennies made after 1982, like 1983 and 1984 and 2000 will be less dense.

I think this is because the pennies in 1982 and up to now have a metal inside that is less dense than what is inside the 1982 and 1981 pennies.

So to test them I would measure the mass of each penny and the volume too and then I would take the mass and divide it by the volume to get density and that number would help me figure out the solution to the penny problem.

Explorer's Journal:

Date: 4/22/04

Exploration Description:

I explored pennies and density

My Notes and diagrams:

I would look at the pennies and see which ones look older then I would weigh them and then I would find the density.

It doesn't matter if I have lots of pennies they all will have the same density.

Task:

5. How could you use your densinometer to tell how much sugar there is in a liquid like Kool Aid?

6. Oil in a bottle of salad dressing will float. But it is thick like syrup. Where would the pencil float in oil compared to syrup?

7. Below is some data. Show where you think the densinometer will float in the last mixture. Liquid 1 has the least sugar and liquid 5 has the most. Explain why you put the mark where you did.

Marks above the liquid	Liquid 1	Liquid 2	Liquid 3	Liquid 4	Liquid 5
1					
2	X				
3		X			
4					
5			X		
6				X	
7					
8					
9					
10					
11					

The workshop presentations and materials from the U.S. Department of Education Teacher-to-Teacher Summer Workshops were developed by various individuals and are being provided as illustrative examples of what might be useful to teachers. The Department is not requiring or encouraging the use of any particular methods or materials in the classroom, and the use of the methods and materials in these sessions does not constitute an endorsement by the U.S. Department of Education.

8. Your e-mail pen pal is doing a science project on density and needs your help to get started. They sent you the following message. Write them a reply that helps them understand density.

Dear Friend,
My science teacher has assigned a project on density. She wants us to be able to predict which things will float and which will sink in water and then she wants us to use a different liquid. She says we can use sugar water as the other liquid if we do not make too big a mess. I don't know the first thing about density. Can you answer a couple of questions and help me understand?
What is density?
How is it measured?
How am I going to use floating and sinking to tell which objects are more dense than others?
HELP!!!!
Christie

Dear Christie,

Task:

9. How could you use your densinometer to tell how much sugar there is in a liquid like Kool Aid?

You have to look at the densinometer and put it in water first then see where it floats and then put it in the kool aid and see where it floats. Then you should make koolaid with just a little sugar and another one with lots of sugar. If the densinometer floats like in the little sugar then your kool aid has a little sugar. If it floats like in the losts of sugar then it has lots. If it is in the middle then it has inbetween lots and little sugat. You could make a chart or a graph and have it come out just exactly.

10. Oil in a bottle of salad dressing will float in water. That means it is less dense than water. Where would the pencil float in oil compared to water?

Well, since oil has less density then the pencil will float lower than in water. The water has lots of density and the pencil floated high in that. So, the pencil will float lower in the water. But to be sure you should test it because oil is thick.

11. Below is some data. Show where you think the densinometer will float in the last mixture. Liquid 1 has the least sugar and liquid 5 has the most. Explain why you put the mark where you did.

Marks above the liquid	Liquid 1	Liquid 2	Liquid 3	Liquid 4	Liquid 5
1					
2	X				
3		X			
4					
5			X		
6				X	
7					
8					X
9					
10					
11					

The workshop presentations and materials from the U.S. Department of Education Teacher-to-Teacher Summer Workshops were developed by various individuals and are being provided as illustrative examples of what might be useful to teachers. The Department is not requiring or encouraging the use of any particular methods or materials in the classroom, and the use of the methods and materials in these sessions does not constitute an endorsement by the U.S. Department of Education.

12. Your e-mail pen pal is doing a science project on density and needs your help to get started. They sent you the following message. Write them a reply that helps them understand density.

Dear Friend,

My science teacher has assigned a project on density. She wants us to be able to predict which things will float and which will sink in water and then she wants us to use a different liquid. She says we can use sugar water as the other liquid if we do not make too big a mess. I don't know the first thing about density. Can you answer a couple of questions and help me understand?

What is density?

How is it measured?

How am I going to use floating and sinking to tell which objects are more dense than others?

HELP!!!!

Christie

Dear Christie,

Density is kind of confusing. Like you think it will be just how heavy it is but it is not. Some really big things that are really heavy have less density than littler things that are really heavy. Like a log is really heavy compared to a little rock but the log will float and the little rock will sink and that's density.

If you had two boxes and they were both the same size and one had rocks in it and the other had wadded up paper they would be the same size but the rock box would be heavier. The rock box would be more dense and the paper box would be less dense. And the rock box would sink and the paper box would float.

You can put things in water and if they float they are less dense than water and if they sink they are more dense than water. Like you could test fruits and some fruits with lots of sweetness and sugar will sink and those with less sweet will sink. You could try apples that floated and kiwis that sink.

To figure out the density you need to take the mass from a scale and divide it by the volume from a measuring thing.

Here is an example if you had a penny with a mass of 4 g and a volume of 2 ml it would have a density of 2g/ml.

I hope this helps. It was fun to help you.

Beth

Task:

13. How could you use your densinometer to tell how much sugar there is in a liquid like Kool Aid?

You would put the densinometer in the kool aid and see where it floats and that would tell you how much sugar there is.

14. Oil in a bottle of salad dressing will float in water. That means it is less dense than water. But oil is thick like syrup. Where would the pencil float in oil compared to syrup?

Since oil is thick it will make the pencil float higher.

15. Below is some data. Show where you think the densinometer will float in the last mixture. Liquid 1 has the least sugar and liquid 5 has the most. Explain why you put the mark where you did.

Marks above the liquid	Liquid 1	Liquid 2	Liquid 3	Liquid 4	Liquid 5
1					
2	X				
3		X			
4					
5			X		
6				X	
7					X
8					
9					
10					
11					

The workshop presentations and materials from the U.S. Department of Education Teacher-to-Teacher Summer Workshops were developed by various individuals and are being provided as illustrative examples of what might be useful to teachers. The Department is not requiring or encouraging the use of any particular methods or materials in the classroom, and the use of the methods and materials in these sessions does not constitute an endorsement by the U.S. Department of Education.

16. Your e-mail pen pal is doing a science project on density and needs your help to get started. They sent you the following message. Write them a reply that helps them understand density.

Dear Friend,
My science teacher has assigned a project on density. She wants us to be able to predict which things will float and which will sink in water and then she wants us to use a different liquid. She says we can use sugar water as the other liquid if we do not make too big a mess. I don't know the first thing about density. Can you answer a couple of questions and help me understand?
What is density?
How is it measured?
How am I going to use floating and sinking to tell which objects are more dense than others?
HELP!!!!
Christie

Dear Christie,
Density is how heavy something is. If it is heavier than another thing it is more dense. Like a rock and a cheese puff. The rock is heavier than the cheese puff so it is more dense. You can put a cheese puff in water and it will float and a rock will sink so that is another way you can tell.

You just put the stuff in water and the stuff that floats is less dense than the stuff that sinks. You can put sugar in the water and make the stuff that floats float more higher.
I think you should use pencils and clay and put the clay on the pencil and make it float.

Task:

17. How could you use your densinometer to tell how much sugar there is in a liquid like Kool Aid?

You could use a densinometer. You take a pencil and put some clay on the eraser end and watch it float. If it floats low that is less dense and if it floats high that is more dense. So you look at where it floats.
You could test it with different kool aids. If you had lots of sugar in one and not so much in the other you could tell how much sugar was in yours by the float.

18. Oil in a bottle of salad dressing will float in water. That means it is less dense than water. Where would the pencil float in oil compared to water?

Oil floats because it is thicker. So the pencil will float higher in the oil because it is thicker.

19. Below is some data. Show where you think the densinometer will float in the last mixture. Liquid 1 has the least sugar and liquid 5 has the most. Explain why you put the mark where you did.

Marks above the liquid	Liquid 1	Liquid 2	Liquid 3	Liquid 4	Liquid 5
1					
2	X				
3		X			
4					
5			X		
6				X	
7					
8					X
9					
10					
11					

The workshop presentations and materials from the U.S. Department of Education Teacher-to-Teacher Summer Workshops were developed by various individuals and are being provided as illustrative examples of what might be useful to teachers. The Department is not requiring or encouraging the use of any particular methods or materials in the classroom, and the use of the methods and materials in these sessions does not constitute an endorsement by the U.S. Department of Education.

20. Your e-mail pen pal is doing a science project on density and needs your help to get started. They sent you the following message. Write them a reply that helps them understand density.

Dear Friend,
My science teacher has assigned a project on density. She wants us to be able to predict which things will float and which will sink in water and then she wants us to use a different liquid. She says we can use sugar water as the other liquid if we do not make too big a mess. I don't know the first thing about density. Can you answer a couple of questions and help me understand?
What is density?
How is it measured?
How am I going to use floating and sinking to tell which objects are more dense than others?
HELP!!!!
Christie

Dear Christie,
What is density? Density is how heavy something is and how large or small it is. You can find it with division by taking the mass and dividing it by the volume.
 $\text{Mass/volume} = \text{density}$

How is it measured? It is measured by finding the volume in ml and the mass in grams and dividing them $\text{mass/volume} = \text{density}$

How am I going to use floating and sinking to tell which objects are more dense than others? You are going to put objects in water and see if they float. Then you are going to put objects in sugar water and see if they float higher. If they float higher then the sugar water is more dense.