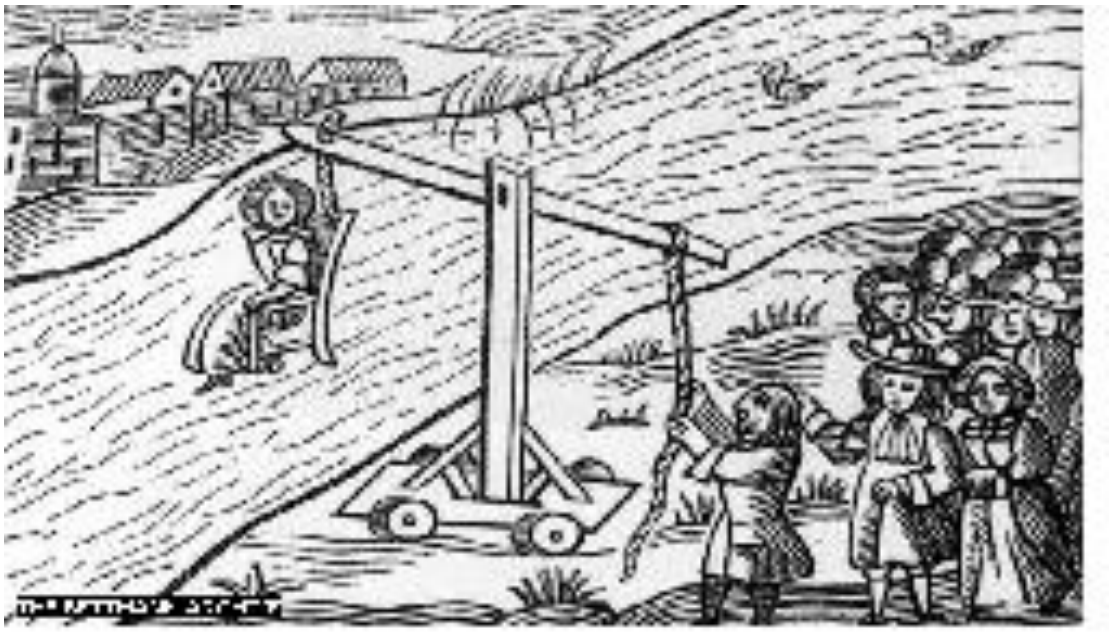
Grade 7 Natural Science Worksheet

Assessment Task: Physical sciences destiny

Density



In the 17th century, women suspected of witchcraft in Europe and America, were tied to a ducking stool and lowered into the water a number of times, depending on the severity of the punishment. One way of deciding whether the woman was guilty of witchcraft in the first place was to throw her, hands tied and fully clothed, into a body of water. The magistrate would say “Let her sink or swim”. If she sank, she was innocent; if she swam, she was guilty.

What do you think would happen to a woman dressed in heavy clothing, whose hands were tied? No doubt she would sink. The superstitious people would say it was because she was innocent, but you are a scientist – why do you think she would sink?

Things float or sink in water depending on the **density** of the object **relative** to the **density of water**.

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Part One: Density calculations

You are going to do some density calculations. Work with a calculator and round your answers off to one decimal place. Remember to use units in your answers.

1. Write down the formula you use for calculating the density of an object.
2. Calculate the density of iron if 25 cm^3 of iron has a mass of 190 g.
3. Calculate the density of copper if 15 cm^3 of copper has a mass of 133.5 g.
4. The mass of 60 cm^3 of paraffin is 48 g. Calculate the density of paraffin.
5. The volume of 20 g of water is 20 cm^3. Calculate the density of water.
6. From your calculations in 4 and 5 above, will paraffin float or sink if it is poured into water?
7. Give reasons for 6 above.
8. The density of mercury is 13.6 g/cm^3. What is the mass of 50 cm^3 of mercury?
9. The density of lead is 11.2 g/cm^3. What is the volume of 120 g of lead?
10. The density of oil is 0.89 g/cm^3. What is the volume of 10 g of oil?

[20]

Part Two: Practical work with clay

For this activity you will need:

a ball of clay/plasticine/playdough about the size of a golf ball

a beaker of water

What you must do:

- Divide the clay in half.
- Roll one piece of clay into a ball and place it in the beaker of water.

a. What do you observe? [2]

b. Here is your challenge – make the other ball of clay float. You cannot use anything else to help you – just the clay!

Can you recognise a practical application of this demonstration?

[4]

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Part Three: Write a paragraph

Why is density called a 'relationship measurement'?

Write a paragraph using examples to explain your answer. [9]

[35 marks]

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Suggested Solutions

Question number	Possible marks	Solution
1	2 marks per question, 1 for answer, 1 for units = 20 marks	1. $\frac{mass}{volume} = density$ 2. 7,6 g/cm^3 3. 8,9 g/cm^3 4. 0,8 g/cm^3 5. 1 g/cm^3 6. Paraffin will float on water. 7. The density of paraffin is less than the density of water, therefore it floats. 8. 680 g 9. 10,7 cm^3 10. 11,2 cm^3
2a	2	The ball of clay sinks to the bottom of the beaker.
2b	4	By flattening the clay and moulding it into a bowl shape, it will float. This is due to the principle of upthrust. It is why ships float instead of sink.
3	9	**Assess learner answer according to the following information:** When you perform a calculation in which one value is measured as a ratio of another value, then the measurement is called a relationship measurement. Mass divided by volume produces the relationship of density. The density depends on the mass and the volume. If you change the value of either the mass or the volume in the formula, the density will also change. Say a substance, A, has a mass of 20 g and takes up a volume of 5 cm^3. What is the density of substance A? The density of A is 4 g/cm^3. Now, if substance B has a mass of 40 g, but also takes up a volume of 5 cm^3, what is the density of substance B? Substance B has a density of 8 g/cm$^{3.}$ From this it can be seen that **increasing the mass while keeping the volume constant** brings about an **increase in density.** Thus we can say that density and mass are **directly proportional** to each other. If two substances have the same volume, their density depends on their respective masses. What about the relationship between density and volume? Recall: substance A has a mass of 20 g and takes up a volume of 5 cm^3 and

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		thus has a density of 4g/cm^3. If substance C has a mass of 20 g but a volume of 10 cm^3, what is its density? Substance C has a density of 2 g/cm^3. From this it can be seen that an **increase in volume while keeping the mass constant** brings about a **decrease in density**. Thus we can say that density and volume are **inversely proportional** to each other.