Natural Sciences Grade 8
Marks: 25 converted to 20

Practical Task / Investigation
Worksheet

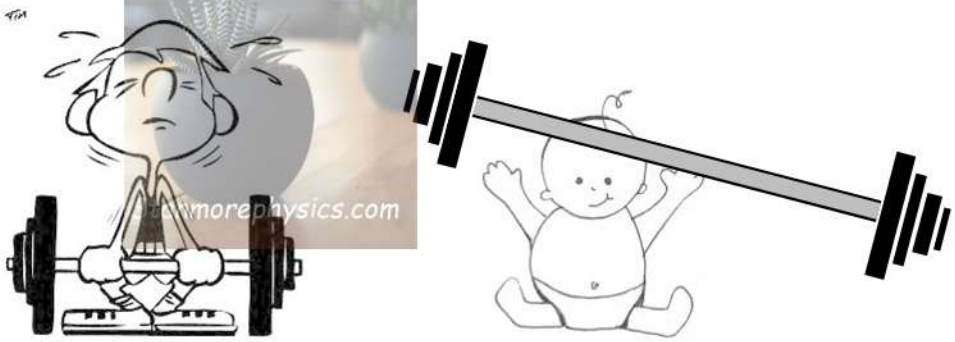
DENSITY

Background knowledge:

All substances, such as water, air, wood and glass are made up of matter. Matter is made up of tiny particles, e.g., atoms. Matter is any substance which has mass and takes up space (has a volume).

Density is described as "the compactness'' of matter within a substance.
Density of a material describes the amount of mass in a given volume of that material.

The formula that can be used to calculate density: $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$



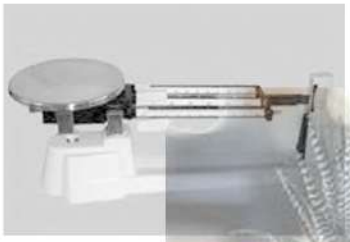
Study the pictures above. The man struggles to pick up the weight, but the baby easily holds an even bigger weight in one hand above his head. How is this possible? Try to give an explanation.

_____

_____

Apparatus for measuring volume and mass:

A B C D



	Name of apparatus	What does it measure?
A		
B		
C		
D		

Practical investigation

Aim:
To compare the densities of different substances such as sand, flour, cotton wool and water.

Investigative question:

_____

_____(2)

Hypothesis:

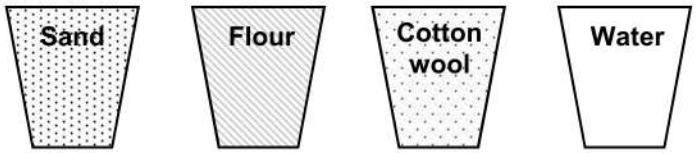
Hypothesise by arranging the substances from the lowest density to the highest density.

_____(1)

Part 1: Comparing densities by hand

1.1 Get 4 cups (or any other container) of the same size made of the same material.

1.2 Fill each cup to the same level with sand, flour, cotton wool and water.



1.3 Pick up each cup in turn and compare their masses.

1.4 Which variables must be controlled (kept constant) to make this a fair test?

_____

_____(2)

1.5 Arrange the substances in the cups from least dense to densest.

_____(1)

Part 2: Calculation of densities

2.1 Repeat steps 1.1 and 1.2.

2.2 Determine the mass of each cup with its contents by using a scale. Use the table below for recording the results.

2.3 Explain how the volume of the cups can be determined practically.

_____

_____(2)

2.4 **Results:**
Complete the table. Show all calculations. Round answers to 2 decimal places.

Substance	Mass (g)	Volume (cm^3)	Density = ———— (g/cm^3)

(10)

2.5 Identify the dependent variable. _____ (1)

2.6 Identify the independent variable. _____(1)

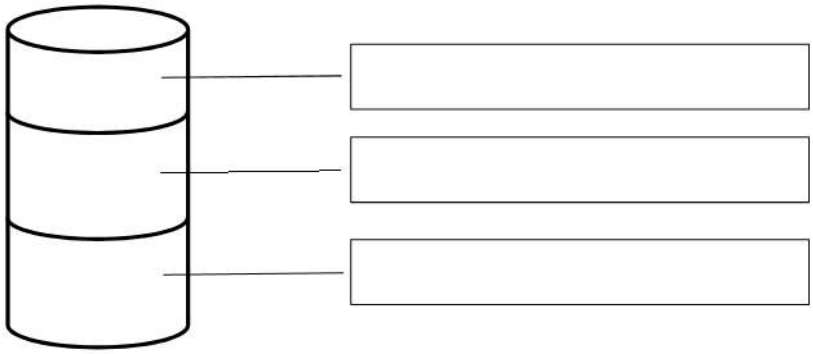
2.7 **Formulate the conclusion**. (What is the answer to the investigative question?)

_____

_____(1)

2.8 To summarise, underline the correct word in brackets:
Equal volumes of different substances have (the same / different) masses and therefore (the same / different) densities. (2)

3. **Application:** Less dense substances float on more dense substances. Three liquids, **water**, **syrup** and **vegetable oil**, are poured into a glass cylinder. Water is less dense than syrup, but denser than vegetable oil. Syrup is denser than water and oil. A dried maize kernel is also dropped into the cylinder. A dried maize kernel is less dense than syrup, but more dense than water. Label the diagram below to indicate the position of the three liquids in the cylinder. Draw a dot to indicate the position of the maize kernel.



(2)
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Natural Sciences Grade 8
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Practical Task / Investigation
Memorandum

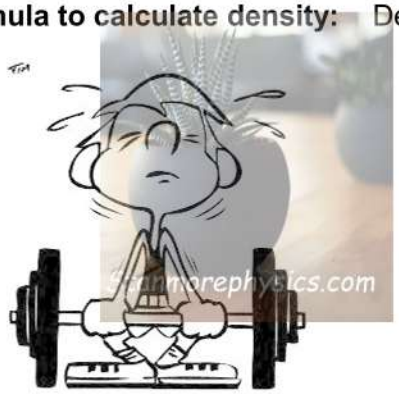
DENSITY

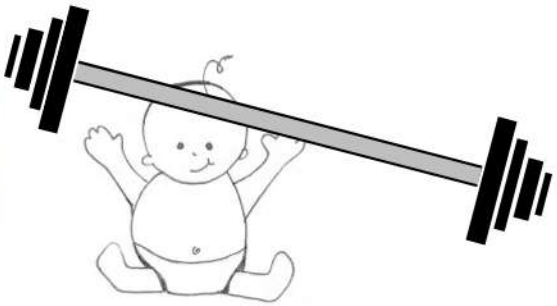
Background knowledge:

All substances, such as water, air, wood and glass are made up of matter. Matter is made up of tiny particles, e.g., atoms. Matter is any substance which has mass and takes up space (has a volume).

Density is described as "the compactness'' of matter within a substance.
Density of a material describes the amount of mass in a given volume of that material.

The formula to calculate density: $\text{Density} = \frac{\text{Mass}}{\text{Volume}}$





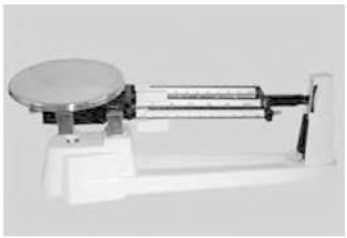
Study the pictures above. The man struggles to pick up the weight, but the baby easily holds an even bigger weight in one hand above his head. How is this possible? Try to give an explanation.

The weight the man is trying to pick up is a weight made or iron. The toy weight the baby is holding is probably made of plastic/sponge. The genuine weight made of iron is much heavier/has a greater mass because iron has a higher density than plastic/sponge.

Apparatus for measuring volume and mass:

A

B



C

D

	Name of apparatus	What does it measure?
A	*Digital scale*	*Mass*
B	*Double beam balance*	*Mass*
C	*Measuring cylinder*	*Volume*
D	*Measuring beaker*	*Volume*

Practical investigation

Aim:
To compare the densities of different substances such as sand, flour, cotton wool and water.
(Note: Any available substances can be used, for e.g. table salt, air, oil, etc.)

Investigative question:

How does the densities✓ *of sand, flour, cotton wool and water compare?* ✓ (2)

Hypothesis:

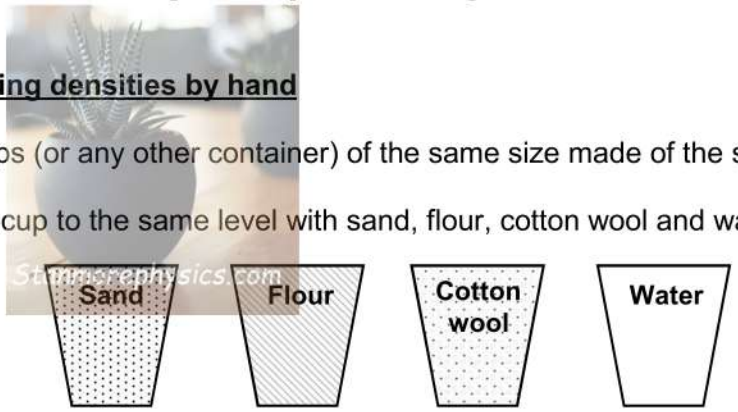
Hypothesise by arranging the substances from the lowest density to the highest density.

*The substances can be arranged in **any** order, for e.g. cotton wool, sand, water, flour.*✓ (1)

Part 1: Comparing densities by hand

1.1 Get 4 cups (or any other container) of the same size made of the same material.

1.2 Fill each cup to the same level with sand, flour, cotton wool and water.



1.3 Pick up each cup in turn and compare their masses.

1.4 Which variables must be controlled (kept constant) to make this a fair test?

*The cups must all be of the same size **OR** have the same volume.* ✓
*The cups must all be made of the same material **OR** have the same mass.* ✓ (2)

1.5 Arrange the substances in the cups from least dense to densest.

Correctly arranged: cotton wool, flour, water, sand ✓ (1)

Part 2: Calculation of densities

2.1 Repeat steps 1.1 and 1.2.

2.2 Determine the mass of each cup with its contents by using a scale. Use the table below for recording the results.

2.3 Explain how the volume of the cups can be determined practically.

Fill one of the cups/containers with water.✓ *Pour the water into a measuring cylinder/ measuring beaker*✓ *and determine the volume.* (2)

2.4 **Results:**

Complete the table. Show all calculations. Round answers to 2 decimal places.

Substance	Mass (g)	Volume (cm^3)	Density = $\frac{Mass}{Volume}$ ✓ (g/cm^3) to 2 decimal places.
Sand	*280 g ✓*	*✓ 250 cm^3*	$\frac{280}{250}$ = 1,12 g/cm^3 ✓
Flour	*150 g ✓*	*250 cm^3*	$\frac{150}{250}$ = 0,60 g/cm^3 ✓
Cotton wool	*20 g ✓*	*250 cm^3*	$\frac{20}{250}$ = 0,08 g/cm^3 ✓
Water	*250 g ✓*	*250 cm^3*	$\frac{250}{250}$ = 1,00 g/cm^3 ✓

**Results depend on the substances used, volume of containers, masses measured.*

Marking kriteria for table	Marks
4 masses correctly measured in gram	✓✓✓✓
4 volumes of the same magnitude	✓
Formula of density	✓
4 correct calculations	✓✓✓✓

(10)

2.5 Identify the dependent variable. *Mass* ***OR*** *Density*✓ (1)

2.6 Identify the independent variable. *Substance used* ✓ (1)

2.7 **Formulate the conclusion**. (What is the answer to the investigative question?)

The densities of the different substances differ. The least dense substance is cotton wool, then flour, then water and the substance with the highest density is sand. ✓
(Answer must correspond with the calculated densities in the table.) (1)

2.8 To summarise, underline the correct word in brackets:

Equal volumes of different substances have (the same / **different**) ✓ masses and therefore (the same / **different**) ✓ densities. (2)

3. **Application:** Less dense substances float on more dense substances. Three liquids, **water**, **syrup** and **vegetable oil**, are poured into a glass cylinder. Water is less dense than syrup, but denser than vegetable oil. Syrup is denser than water and oil. A dried maize kernel is also dropped into the cylinder. A. dried maize kernel is less dense than syrup, but more dense than water. Label the diagram below to indicate the position of the three liquids in the cylinder. Draw a clear dot to indicate the position of the maize kernel.

Marking kriteria for diagram	Marks
3 layers correctly labelled and in the correct order	✓
Maize kernel (dot) between the water and syrup layers	✓

(2)
[25]