Comparing the densities of glass and sand

Aim:

My aim for this experiment is to determine as precisely as possible, with the apparatus provided, the densities of glass and sand

Apparatus:

The apparatus I will be provided for this experiment is as follow:-
- Glass block
- Ruler
- Plastic cup
- Dry sand
- 250ml measuring cylinder
- Access to balance and water

Predictions:

For this experiment I will predict that the densities of glass and sand will be equal. This is because glass is made from sand. So if the experiment is performed accurately both the densities will be equal.

Method:

- At the start of the experiment we set up all the equipment. After that we measured the glass block. In order to make our measurements accurate we used a vernier caliper instead of a standard 30cm ruler. We used the vernier caliper to measure the height, the width and the thickness which are the 3 measurements we need in order to calculate the volume of the glass block. We also took precautions while measuring the glass block. This was basically repetition. We measured it 3 times and then worked out an average for the width, height and thickness

- After that we weighed the glass block. We used digital measuring balance to find out the mass. We weighed the glass once and didn't have to do it repeatedly because it was a digital balance.

- Next, we measured the sand in the container. In order to make sure that we find out the accurate mass of the sand, we put the container on the digital measuring balance and then zeroed the balance. This ensured that it was zero with the container and weighed the sand accurately.

- After that we used the measuring cylinder to get the volume of the sand. We filled the measuring cylinder with pure water and then checked the reading on the cylinder. We chose the bottom of the meniscus to take the reading. Then we added the sand slowly into the measuring cylinder making sure that no bubbles were formed and once all of it had been added we checked the reading again.

- To find the volume we found out the difference between the reading of the cylinder with only pure water and the reading when we added the sand into the cylinder.

- Calculated the density using the formula Density = Mass/Volume.

- Compare the two densities of sand and glass.

Diagram:

Results:

Measurements of glass block:

Height (cm)	1.87, 1.90, 1.90
Average Height (cm)	1.89
Width (cm)	6.57, 6.57, 6.57
Average Width (cm)	6.57
Length (cm)	11.42, 11.42, 11.42
Average Length (cm)	11.42
Volume (cm3)	1.89 x 6.57 x 11.42 = 141.805566
Mass (g)	347.50

I used the values in this table to find the density of the glass block. I found the density using the following formula

Density (g/cm³) = Mass (g) / Volume (cm³)
= 347.50/141.805566
= 2.4504444816
= 2.45 g/cm³ (3 significant figures)

Measurements of sand:

Mass of sand (g)	170.50
Volume of water (cm³)	80
Volume of water + sand (cm³)	148
Difference between volume of water and volume of water + sand (cm³)	68

I used these values to find the density of sand

= 170.50/68
= 2.5 g/cm³

Uncertainties:

The uncertainties for the glass block are as follow

Height = 0.025 / 1.89 x 100 = 1.32 %
Width = 0.09 / 6.57 x 100 = 1.37 %
Length = 0.03 / 11.42 x 100 = 0.26 %

Mass = 0.005 / 347.50 x 100 = 0.0014 %

The uncertainties for the Sand are as follow

Volume = 0.5/ 68 x 100% = 0.74 %
Mass = 0.005 / 170 x 100 % = 0.0029 %

Percentage Difference

I shall take the calculated density of the glass block to be the actual density of glass. Therefore, I can calculate the percentage difference between the calculated density for sand and the calculated density for glass.

% difference = (2.5-2.43813)/ 2.43813 x 100
     = 2.54 %

Conclusion

The calculated values for density of the glass block and sand show that they are similar. This confirms that glass is made from sand. There is, however, a small difference of 2.54% between the two values. This may be due to several factors which include the fact that the glass block was not a perfect cuboid shape.

Evaluation

The results show that the density for glass and sand are similar therefore confirming glass is made from sand. There was a small difference of 2.54% between the two densities. This shows that the experiment was not perfect.

This may have been caused due to the fact the glass block was not a perfect cuboid shape. This would have caused the mass to be less than it should be according to the calculated volume. Therefore the density would not be correct. Also due to the fact it was not a perfect shape, the measurements of the lengths width and height was not accurate. An average had to be taken. This shows that it is probably not accurate. To overcome this a vernier callipers was used and multiple readings taken.

Also while measuring the volume of sand; there were bubbles in the measuring cylinder which would cause the reading to be increased. The error causes the actual density to be wrong.

Therefore due to these errors, the differences between the two calculated densities could have been increased from what it should be.