

Grade 8 Science – Fluids Unit – Identifying Materials through Density

Name: Key Class: _____

Use the following table of **Densities of Common Substances** to answer the question on the following pages.

Material	Density (g/cm ³)	State of Matter
hydrogen (at STP)	0.00009	gas
helium (at STP)	0.000178	gas
carbon monoxide (at STP)	0.00125	gas
nitrogen (at STP)	0.001251	gas
air (at STP)	0.001293	gas
carbon dioxide (at STP)	0.001977	gas
lithium	0.534	solid
ethanol (grain alcohol)	0.810	liquid
benzene	0.900	liquid
ice	0.920	solid
water at 20°C	0.998	liquid
water at 4°C	1.000	liquid
seawater	1.03	liquid
milk	1.03	liquid
coal	1.1-1.4	solid
blood	1.600	liquid
magnesium	1.7	solid
granite	2.6-2.7	solid
aluminum	2.7	solid
steel	7.8	solid
iron	7.8	solid
copper	8.3-9.0	solid
lead	11.3	solid
mercury	13.6	liquid
uranium	18.7	solid
gold	19.3	solid
platinum	21.4	solid
osmium	22.6	solid
iridium	22.6	solid
white dwarf star	10 ⁷	solid

Source: <https://www.thoughtco.com/table-of-densities-of-common-substances-603976>

Using the table on the front side of this sheet, try to identify the substance in each of these situations.

1. Scientists discover a gas that they isolate. They have 3000mL of the gas in a container and the gas weighs 0.534 grams. What is the gas?

$$\begin{aligned}\text{Density} &= m/\text{vol} \\ &= 0.534 \text{ g} / 3000\text{cm}^3 \\ &= 0.000178 \text{ g/cm}^3 \quad \therefore \text{The gas has the same characteristic density as Helium.}\end{aligned}$$

2. A group of scientists isolate a liquid that has a volume of 300 cm³. It has a mass of 4080 g. What is the substance?

$$\begin{aligned}\text{Density} &= m/\text{vol} \\ &= 4080 \text{ g} / 300 \text{ cm}^3 \\ &= 13.6 \text{ g/cm}^3 \quad \therefore \text{The liquid has the same characteristic density as Mercury.}\end{aligned}$$

3. If the volume of a substance is 2.5 Litres and the mass is 4 kg, what is the substance according to the table? Remember to convert to g and cm³.

$$(2.5 \text{ litres} = 2500\text{cm}^3) \quad (4\text{kg} = 4000\text{g})$$

$$\begin{aligned}\text{Density} &= m/\text{vol} \\ &= 4000 \text{ g} / 2500 \text{ cm}^3 \\ &= 1.6 \text{ g/cm}^3 \quad \therefore \text{The substance has the same characteristic density as blood.}\end{aligned}$$

4. A lump of material has the same mass as 222.6 g of osmium. If the volume was the same as 84 mL of water, what is the substance?

$$\begin{aligned}\text{Density} &= m/\text{vol} \\ &= 222.6 \text{ g} / 84 \text{ cm}^3 \\ &= 2.65 \text{ g/cm}^3 \quad \therefore \text{The substance has the same characteristic density as granite.}\end{aligned}$$

5. Two sister scientists were isolating a metal. they found that it was heavy and melted at a high temperature (5555°C). They were able to form a cube that is 6cm on one side and the mass of the cube was 4.158kg. It was not gold. What was it? (It is not in table so you will have to look online). Show all work and try to be organized.

$$\begin{aligned}d &= m / \text{vol} & \text{vol} &= l^3 \\ &= 4158\text{g} / 216 \text{ cm}^3 & &= 6\text{cm} \times 6\text{cm} \times 6\text{cm} \\ &= 19.25 \text{ g/cm}^3 & &= 216 \text{ cm}^3\end{aligned}$$

Googling 'What metal has a density of 19.25 and a melting point of 5555?' I came up with Tungsten.

<https://www.newworldencyclopedia.org/entry/Tungsten>

6. The average human has 5 litres of blood and is 120 pounds. What percentage of their body weight is blood? Remember that there are 2.2 pounds per kilogram. Use the density of blood to figure this out. Show all work and try to be organized.

The density of blood is 1.6 g/cm^3 and there are 5L or 5000cm^3 of blood so that would be 8000g ($m = d \times \text{vol}$) ($1.6 \text{ g/cm}^3 \times 5000\text{cm}^3$) of blood this is 8 kg.

In order to get pounds, multiply by 2.2 pounds per kg ($8 \text{ kg} \times 2.2 \text{ pounds/kg} = 17.6 \text{ pounds}$)

To get the percentage, you take the weight of blood/body weight $\times 100\%$

Percentage = $17.6 \text{ lb}/120\text{lb} \times 100\%$

= $0.147 \times 100\%$

= 14.7% The average human is 14.7% blood by body weight.

7. A gold coin is being tested to see if it is pure gold. It has a mass of 1oz (28.35 g) and a volume of 3.335 cm^3 . Is it gold? What could it be?

$d = m / \text{vol}$

= $28.35 \text{ g} / 3.335\text{cm}^3$

= 8.5 g/cm^3

This could be copper since copper has a density range of $8.3 - 9.0 \text{ g/cm}^3$.

On this sheet, try to come up with your own questions on identifying materials with the density. If you have a really good one, email it to me and I may use it on the up-coming test. Don't try to make it insanely difficult. Everything needed to solve the problem should be on the density table or given by you in the question.

ANSWERS WILL VARY