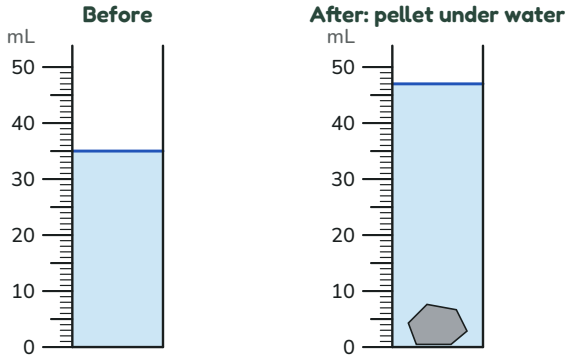
Density: Measure, Divide, Compare

Grades 6-8

Name _____ Date _____

Directions: Density = mass ÷ volume (D = m ÷ V). Do each division on scratch paper, give every density to the nearest hundredth and write the unit. One milliliter and one cubic centimeter are equal volumes. Use the cylinders and the table for items 4 to 8.



Reference densities, g/cm³ (same number in g/mL)

water	**1.000**
sulfur	**2.000**
calcium sulfate	**2.960**
germanium	**5.323**
zirconium	**6.506**
chromium	**7.180**
molybdenum	**10.22**

Table values: NIST X-Ray Mass Attenuation Coefficients, Tables 1 and 2 (physics.nist.gov/PhysRefData/XrayMassCoef). The cylinder levels and all masses on this page are invented practice readings.

1. A rubber stopper: 16.8 g on the balance, 12.0 cm³ of space filled. Find its density. _____

2. A lab group pours 50.0 mL of cooking oil into a cup. The mass of the oil alone is 46.0 g. Work out how dense the oil is, with g/mL as the unit. _____

3. The three edges of a pine block are 6.0, 4.0 and 2.5 centimeters. On the balance it reads 31.2 g. Volume: _____ cm³ Density: _____

4. Read the water level in each cylinder. First level: _____ mL Second level: _____ mL Space taken up by the metal pellet: _____ cm³

5. Dried off, the pellet from item 4 reads 78.1 g on a balance. Density: _____ Which material in the table is it most likely made of? _____

6. A shiny metal slug: the balance shows 43.1 g, and it takes up 6.0 cm³. Density: _____ Material from the table: _____

7. Compare your answers to items 1, 2 and 3 with the density of water. For each one write **sinks** or **floats** in water. Stopper: _____ Oil: _____ Pine block: _____

8. Rearrange the formula to find a mass. What would the balance show for a piece of calcium sulfate whose volume is 15.0 cm³? Write the formula you used and your result.

_____

_____

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Answer key

One point for each blank in items 1 to 7 (the unit is part of a density answer). Item 8: two points, one for the rearranged formula and one for the mass.

1. **1.40 g/cm³**
   16.8 ÷ 12.0 = 1.40.

2. **0.92 g/mL**
   46.0 ÷ 50.0 = 0.92. A liquid measured in milliliters gets the unit g/mL.

3. **Volume 60.0 cm³; density 0.52 g/cm³**
   6.0 × 4.0 × 2.5 = 60.0; 31.2 ÷ 60.0 = 0.52.

4. **First level 35.0 mL; second level 47.0 mL; pellet 12.0 cm³**
   47.0 − 35.0 = 12.0 mL = 12.0 cm³. Both levels sit on a printed 1 mL tick; accept each level within 0.5 mL. Give the third point when the pellet volume equals the student's own second level minus first level. The second level alone is water plus pellet, not the pellet.

5. **6.51 g/cm³; zirconium**
   78.1 ÷ 12.0 = 6.51, closest to zirconium (6.506). A measured value rarely lands exactly on the table value. If the student's pellet volume in item 4 is not 12.0 cm³, score the density as 78.1 ÷ that volume (11.5 cm³ gives 6.79 and 12.5 cm³ gives 6.25, both still closest to zirconium; 11.0 cm³ gives 7.10, closest to chromium).

6. **7.18 g/cm³; chromium**
   43.1 ÷ 6.0 = 7.18, closest to chromium (7.180).

7. **Stopper sinks; oil floats; pine block floats**
   Water is 1.000 g/cm³. 1.40 is greater, so the stopper sinks; 0.92 and 0.52 are less, so the oil forms a layer on top and the block floats.

8. **m = D × V = 2.960 × 15.0 = 44.4 g**
   Multiplying both sides of D = m ÷ V by V gives m = D × V. Accept 44 g if the class rounds to whole grams.