Answer key

III. Density of Matter

Density - Measures how tightly packed a material is.

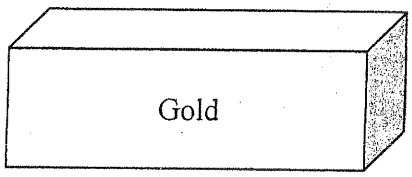
Formula:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} \quad \frac{g}{cm^3}$$

A. Density Proprieties:

- Density of a uniform material is constant, does NOT change.
- Cutting an object, changing its shape or size; does NOT affect density
  * The only way to change a material's density is by changing Temperature or Pressure. *

Example:

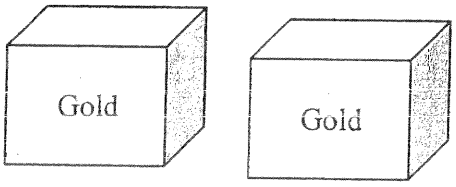


Mass = 162 g
Volume = 8.4 cm^3

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{162\ g}{8.4\ cm^3}$$

Density = 19.3 g/cm^3

If you take that sample of gold and break it into two exact halves, the mass and volume is half of the original, but the density remains the same.



Mass = 81 g
Volume = 4.2 cm^3

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{81\ g}{4.2\ cm^3}$$

Density = 19.3 g/cm^3

Practice questions:

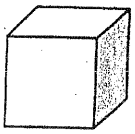
1) If a wooden block were cut into eight identical pieces, the density of each piece compared to the density of the original block would be
   (1) less (2) greater (3) the same

   ↑ cutting changes shape/size; does NOT affect density

2) Under the same conditions of temperature and pressure, three different samples of the same uniform substance would have the same density
   (1) shape (2) density (3) mass (4) volume

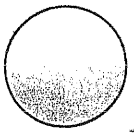
Base your answers to questions 3 through 6 on the diagrams below which represent four solid objects made of the same uniform material. The volume of the sphere and the mass of the bar are not given. * same density

Cube



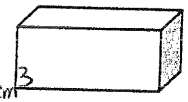
Mass 81 g
Volume 27 cm³
Density = 3g/cm³

Sphere $D = \frac{M}{V}$ $V = \frac{M}{D}$ $\frac{75g}{3g/cm^3} = 25cm^3$



Mass 75 g
Volume ?
Density = 3g/cm³

Bar $D \times V = M$



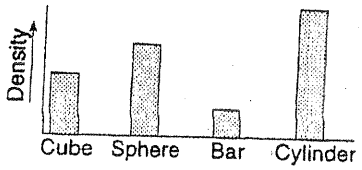
Mass ?
Volume 30 cm³
Density = 3g/cm³

Cylinder

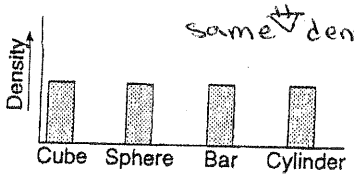
Mass 60 g
Volume 20 cm³
Density = 3g/cm³

3) What is the density of the bar?
(1) 9.9 g/cm³ (2) 30.0 g/cm³ (3) 3.0 g/cm³ (4) 90.0 g/cm³
Read introductory paragraph!
SAME as the CUBE = $\frac{81g}{27cm^3} = 3g/cm^3$

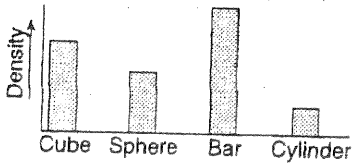
4) Which graph best represents the relative densities of the objects?
same uniform material
same ↓↓ density



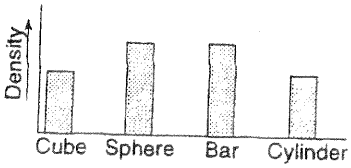
(1)



(3)



(2)



(4)

5) What is the mass for the bar? $D = \frac{M}{V}$ $M = D \times V$ $M = \frac{3g}{cm^3} \times 30cm^3 = 90g$
(1) 90 g (2) 10 g (3) 30 g (4) 3 g

6) What is the volume of the sphere? $V = \frac{M}{D} = \frac{75g}{3g/cm^3} = 25cm^3$
(1) 5 cm³ (2) 15 cm³ (3) 25 cm³ (4) 35 cm³

7) An unknown sample has a density of 6.0 grams per cubic centimeter. If the sample were cut in half, each half would have a density of Cutting does NOT change density.
(1) 12.0 g/cm³ (2) 9.0 g/cm³ (3) 3.0 g/cm³ (4) 6.0 g/cm³

8) The original sample A is cut into several pieces. When compared with the density of the original sample, the density of each piece will be the same
(1) less (2) greater (3) the same