28/06/2018

- EXAMPLE 2-2 IRON ENGINE block — HOW MUCH MASS AN AIRPLANE DESIGNER WOULD SAVE IF THE SAME BLOCK WERE CAST IN MAGNESIUM? R: 122 kg

MASS = 157 kg

DENSITY (IRON) = 7860 kg/m³

$$\text{DENSITY} = \frac{\text{MASS}}{\text{VOLUME}}$$

$$\text{VOLUME} = \frac{\text{MASS}}{\text{DENSITY}} = \frac{157\ \text{kg}}{7860\ \text{kg/m}^3} = 0{,}020\ \text{m}^3$$

WHEN THE BLOCK IS CAST IN MAGNESIUM, ITS VOLUME IS STILL 0,020 m³.

$$\text{MASS} = (\text{DENSITY})(\text{VOLUME}) = (1730\ \text{kg/m}^3)(0{,}020\ \text{m}^3) = 35\ \text{kg}$$

WEIGHT DIFFERENCE = 157 − 35 = 122 kg

PIT 12/07/2018 — 7,86 g/cm³ → 10⁶ × 7,86 = 7860 kg/m³

→ 0,019774554 = 0,020

* FOR MANY PURPOSES, IT IS CONVENIENT TO COMPARE SUBSTANCES WITH ONE ANOTHER. PURE WATER AT 0°C (OR AT SOME OTHER STANDARD FIXED TEMPERATURE) IS OFTEN USED AS A STANDARD SUBSTANCE, AND WE DEFINE SPECIFIC GRAVITY AS A RATIO:

$$\text{SPECIFIC GRAVITY} = \frac{\text{DENSITY OF SUBSTANCE}}{\text{DENSITY OF WATER}}$$

↳ SPECIFIC GRAVITY IS A PURE NUMBER SINCE IT IS A RATIO OF TWO SIMILAR QUANTITIES. BECAUSE ITS DEFINITION IN TERMS OF WATER, AND BECAUSE WATER HAS A DENSITY OF 1,00 g/cm³, THE SPECIFIC GRAVITY OF ANY SUBSTANCE IS NUMERICALLY EQUAL TO THE DENSITY IN cgs UNITS.

0,14 × 1 = 0,14 g/cm³

↳ IT IS POSSIBLE TO DEFINE WEIGHT DENSITY WICH IS WEIGHT PER UNIT VOLUME. BUT WEIGHT IS NOT AN ABSOLUTE PROPERTY OF A BODY, DEPENDING ON THE GRAVITATIONAL FIELD IN WICH THE BODY FINDS ITSELF. EX.: WEIGHT DENSITY OF WATER (OR EARTH) AT 0°C = 62 lb/ft³

1 lb = 453,6 g = 0,4536 kg

1 ft = 0,3048 m; 1 ft² = 0,0929 m²

→ 1 ft³ = 28,32 Liters

1 Liter = 1000 cm³ = 0,001 m³ = 61,03 in³ = 0,353 ft³

2-3 THE STRUCTURE OF MATTER

THE CRYSTAL STRUCTURES OF VARIOUS ELEMENTS, ALLOYS, AND COMPOUNDS DIFFER IN BOTH THE ARRANGEMENT AND SPACING OF THEIR ATOMS. THUS, THE DENSITY OF A SOLID DEPENDS IN PART ON ITS CRYSTAL STRUCTURE.

→ A CRYSTAL IS AN COLLECTION OF ATOMS IN A SYMMETRICAL ARRANGEMENT.

THE ATOMIC NUMBER (WEIGHT) OF IRON IS 56, AND THE OF ALUMINUM IS 27, MEANING THAT EACH OF IRON ATOM IS OVER TWICE AS HEAVY AS EACH ALUMINUM ATOM. SINCE THE DENSITY OF IRON IS ALMOST 3 TIMES THAT OF ALUMINUM, WE SEE THAT THE FACT THAT EACH IRON ATOM IS TWICE AS HEAVY AS EACH ALUMINUM ATOM IS NOT ENOUGH TO ACCOUNT FOR THE DIFFERENCE IN DENSITY. THEREFORE, THE IRON ATOMS