



2) Not on the main sequence:

- Deneb, Rigel, Canopus, Antares, Betelgeuse, are all supergiants
- Arcturus, Aldebaran, Capella, Pollox, are all Giants

+5

3. $\rho = \frac{M}{V}$ and $V = \frac{4}{3}\pi R^3$, hence

$$\rho = \frac{3M}{4\pi R^3}$$

+5 a) Earth $M_{\oplus} = 5.974 \times 10^{24} \text{ kg}$
 $R_{\oplus} = 6.378 \times 10^6 \text{ m}$

$$\rho = \frac{3(5.974 \times 10^{24} \text{ kg})}{4\pi (6.378 \times 10^6 \text{ m})^3} \approx \underline{5500 \text{ kg/m}^3}$$

+5 b) Sun $M_{\odot} = 1.989 \times 10^{30} \text{ kg}$
 $R_{\odot} = 6.960 \times 10^8 \text{ m}$

$$\rho = \frac{3(1.989 \times 10^{30} \text{ kg})}{4\pi (6.960 \times 10^8 \text{ m})^3} = \underline{1400 \text{ kg/m}^3}$$

+5 c) White Dwarf:

$$\rho = \frac{3(1.989 \times 10^{30} \text{ kg})}{4\pi (6.378 \times 10^6 \text{ m})^3} = \underline{1.8 \times 10^9 \text{ kg/m}^3}$$

+5 d) Neutron Star

$$\rho = \frac{3(1.989 \times 10^{30} \text{ kg})}{4\pi (13 \times 10^3 \text{ m})^3} = \underline{2.16 \times 10^{17} \text{ kg/m}^3}$$

4.

+5

a) $10^{-6} \text{ m}^3 \times 5500 \text{ kg/m}^3 = 0.0055 \text{ kg}$
which is 5.5 grams

+5

b) $10^{-6} \text{ m}^3 \times 1400 \text{ kg/m}^3 = 0.0014 \text{ kg}$
which is 1.4 grams

+5

c) $10^{-6} \text{ m}^3 \times 1.8 \times 10^9 \text{ kg/m}^3 = 1800 \text{ kg}$
which is about the mass of a
large car or small truck

+5

d) $10^{-6} \text{ m}^3 \times 2.16 \times 10^{17} \text{ kg/m}^3 = 2.16 \times 10^{11} \text{ kg}$
which is the mass of more than
35 Hoover dams, or 36 times
the mass of The Great Pyramid at Giza

All that in 1 cubic centimeter!

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