Estimate the mass of the Moon:

To find the Moon's mass we need to know its size. I know that during an eclipse the Moon covers the Sun, so they have the same angular diameter, and I know the Sun's diameter is $\Theta \simeq 0.5°$. The Moon's radius is then

$$r = (\Theta/2)R$$

where R is the Moon's distance from the Earth. Since I know the Moon's period is $T = 28\ \text{days} \simeq \pi \times 10^7/13.5$ and the mass of the Earth is $M_\oplus \simeq 6 \times 10^{24}$ kg, I can work out R from Kepler's third law

$$\frac{GM_\oplus}{R^3} = \left(\frac{2\pi}{T}\right)^2$$

$$R^3 = \left(\frac{T}{2\pi}\right)^2 GM_\oplus$$

The mass of the Moon is

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

$$= \frac{4\pi}{3}\frac{\Theta^3}{8}R^3\rho$$

$$= \frac{\pi\Theta^3}{6}\left(\frac{T}{2\pi}\right)^2 GM_\oplus\rho$$

We need an estimate for the density ρ: I know quartz has density $\rho_{\text{quartz}} = 2650\ \text{kg m}^{-3}$, the Earth has density

$$\rho_\oplus = \frac{3M_\oplus}{4\pi R_\oplus^3}$$

$$= 3 \times 6 \times 10^{24} / 4\pi (6.4 \times 10^6)^3$$

$$\simeq \frac{18\times10^{24}}{4\pi(2^6\times10^5)^3}$$
$$\simeq \frac{18\times10^{24}}{\pi(2^{10})^2\times10^{15}}$$
$$\simeq \frac{18\times10^{9}}{\pi\times10^{6}}$$
$$\simeq 6\times10^3\ \text{kg m}^{-3}$$

The Moon will have a density somewhere inbetween: quartz is a light mineral, but the Moon doesn't have the Earth's iron core. I think the density would be closer to quartz, so let's guess $\rho \sim 3.5\times10^3\ \text{kg m}^{-3}$.

$$M \simeq \frac{\pi}{6}\left(\frac{\pi}{360}\right)^3\left(\frac{10^7}{26}\right)^3(6.67\times10^{-11})(6\times10^{24})(3.5\times10^3)$$
$$\simeq \frac{\pi^4\times40\times3.5\times10^{30}}{6\times3.6^3\times2.6^3\times10^6}$$
$$\simeq \frac{10^2\times4\times10^{23}}{6\times3.6^3\times2.6^3}$$
$$\simeq \frac{4\times10^{25}}{6\times13\times25/4}$$
$$\simeq \frac{16\times4\times10^{23}}{80}$$
$$\simeq 8\times10^{22}\ \text{kg}$$

[Exact: $M = 7.3483\times10^{22}$ kg; $\rho = 3.345\times10^3\ \text{kg m}^{-3}$]