

1. The masses of the planets in the Solar System and factors to adjust from planetary to solar compositions (F) are given in the table below.

Planet	Mass (x10 ²⁶ g)	F	Distance (AU)
Mercury	3.3	350	0.387
Venus	48.7	270	0.723
Earth	59.8	235	1
Mars	6.4	235	1.524
Asteroids	0.1	200	2.7
Jupiter	19,040	5	5.203
Saturn	5,695	8	9.523
Uranus	870	15	19.208
Neptune	1,032	20	30.087

- i) Calculate the mass of solar composition material required to form each of the planets. Plot your results using IDL or Python.
- ii) Calculate the surface density in g/cm² of solar nebula material for each of the planets. Plot your results using IDL or Python.
- iii) Fit the surface density with a function of the form, $\sigma(r) = \sigma_0 r^{-\alpha}$. What best-fit values do you obtain for σ_0 and α ?
- iv) The mass of solar nebula material required to form the planets can be estimated using

$$M = \int \sigma(r) dA = \int_0^{2\pi} \int_{R_s}^{R_F} \sigma(r) r dr d\theta$$

Evaluate this integral numerically over an appropriate distance range, using the best-fit surface density values from (iii).