

PROBLEM SET 8

Physics 2021

1. Compute the percentage of the **volume** of the (a) core, (b) mantle, and (c) crust of the Earth.
2. Compute the fraction of the total mass of the Earth that lies within the inner core? [Use a density of 13 g/cm^3 .]
3. Compute and verify that the average density of the Earth is 5.5 g/cm^3 .
4. Africa and South America are separating at a rate of about 3 cm per year. Assuming that this rate has been constant, calculate when these two continents must have been in contact. Today the two continents are 6600 km apart.
5. The Earth's primordial atmosphere probably contained an abundance of methane (CH_4) and ammonia (NH_3), whose molecules were broken apart by ultraviolet light from the Sun and particles in the solar wind. What happened to the atoms of carbon, hydrogen, and nitrogen that were liberated by this dissociation?
6. The total power in sunlight that reaches the top of our atmosphere is $1.75 \times 10^{17} \text{ W}$.
 - (a) How many watts of power are reflected back into space due to the Earth's albedo?
 - (b) In equilibrium, the heated surface would act as a blackbody that radiates as much power as it absorbs from the Sun. How much power would the entire Earth radiate?
 - (c) How much power would one square meter of the surface radiate?
 - (d) What would be the average temperature of the surface? Give your answer in both the Kelvin and Celsius scales.
 - (e) Why is the Earth's actual average temperature higher than the value you calculated in (d)?