**TEST #1**
**Sep 29, 2020**

1. Why did the geocentric system maintain such strong footing for 2 millenia? Name at least two main protagonists of the geocentric system and explain their role and reasoning. What notions had to be overcome to finally make way to the heliocentric system? Finally, does the geocentric system constitute a valid scientific model?

2. The nebular theory predicts two types of planets: rocky and gaseous.

   a) Other than composition, what is the principal difference between rocky and gaseous planets?

   b) Where in the solar system do rocky and gaseous planets form? Why?

   c) Why do gaseous planets have numerous moons, and rocky planets do not?

   d) How do hot jupiters (gaseous planets close to the star) fit into this whole picture?

3. Besides distance from the Sun, what three fundamental processes drive the long-term habitability of Earth? Explain the significance of each. Choose one of the three and discuss what would happen if it ceased to function on Earth.

4. Sediments are geologically the most useful type of rock for fossil analysis.

   a) Name the three types of sedimentary rock.

   b) Why are minerals better than rocks for radiometric dating?

   c) Explain why fossils typically have no organic matter left.

   d) In what two independent ways can we determine the ages of fossils in sedimentary rock?

5. Radioactive iodine, $^{131}_{53}\mathrm{I}$, decays into $^{131}_{54}\mathrm{Xe}$. It is used predominantly in medicine, for treating thyroid cancer because of the thyroid's affinity to absorb it.

   a) Is this an $\alpha$, $\beta$ or $\gamma$ decay? Explain why by explaining *only* the chosen decay.

   b) If 10% of $^{131}_{53}\mathrm{I}$ decays in 1.219 days, what is the half-life of $^{131}_{53}\mathrm{I}$?

   c) After what time will there be 99% $^{131}_{54}\mathrm{Xe}$?

   d) Is $^{131}_{53}\mathrm{I}$ decay practical for modern forensic analysis (i.e. examining teeth or hair of *recently* deceased victims)? Why?

6. How do we define life using the six-prong test? How do biologists define life? Name an exception that fails the six-prong test but can be considered alive and explain why.