

**Answer all questions in the space provided. If you have any questions, raise your hand. 100 points possible. No calculators.**

**0** (3 pts) Rocks have a density of about \_\_\_\_\_  $g/cm^3$ , iron has a density of about \_\_\_\_\_  $g/cm^3$ , and water has a density of \_\_\_\_\_  $g/cm^3$ .

The table below shows the properties of four planets orbiting a star that is identical to our Sun. Use these data to answer the questions on the next two pages.

Planet	Mass [2Moon = 1]	Diameter [Moon = 1]	Uncompressed Density [ $g/cm^3$ ]	Moment of Inertia Factor [K]	Orbital Period [years]
VELMA	1	1	5.8	0.40	0.47
SHAGGY	9	3	2.1	0.30	2.83
DAPHNE	4	2	3.0	0.32	1.00
FRED	1/4	1/2	7.5	0.38	0.16

**1** (4 pts) List the four planets in order of **increasing** distance from the central star.

**2** (2 pts) Explain how you determined the distances from the information in the table.

**3** (4 pts) If we assume that these planets are made of the same materials as our solar system (ice, rock, and iron) what is the most likely composition of the planet FRED?

**4** (8 pts) Show that the gravity on all four of these planets is the same.

**5** (5 pts) How does the distribution of mass in the interior of the planet DAPHNE compare with the distribution of mass in the interior of planet VELMA?

**6** (6 pts) Explain why we **cannot** use crater counting to determine the absolute age of any of these surfaces.

The table below shows the atmospheric properties of the four planets. Use these data to answer the questions on this page.

Planet	Surface Pressure [atm]	Composition	Axial Tilt [degrees]	Orbital Period [years]
VELMA	...	No Atmosphere	80	0.47
SHAGGY	2.0	96% CO <sub>2</sub>	23	2.83
DAPHNE	1.0	95% CO <sub>2</sub>	0	1.00
FRED	...	No Atmosphere	10	0.16

**7** (5 pts) All of these planets have the same gravity (thus, escape velocity). Explain why the planets DAPHNE and SHAGGY have atmospheres while the others do not.

**8** (5 pts) Are the atmospheres of SHAGGY and DAPHNE **Primary** or **Secondary** atmospheres? Explain your answer.

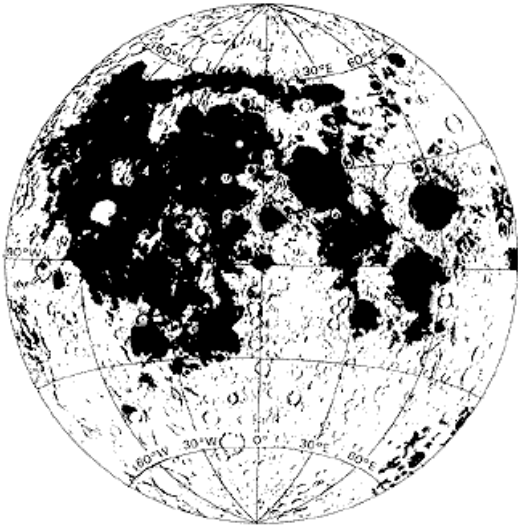
**9** (6 pts) Describe how the seasons on DAPHNE would differ from the seasons on the Earth.

Not all impact events are necessarily bad for life on the Earth. Describe how the two following impact events have been beneficial to life (at least mammals) on the Earth.

**10** (6 pts) A Mars-sized planet hit the Earth, leading to the formation of a large moon in orbit about the Earth.

**11** (5 pts) 65 million years ago a 10 km asteroid hit the Earth.

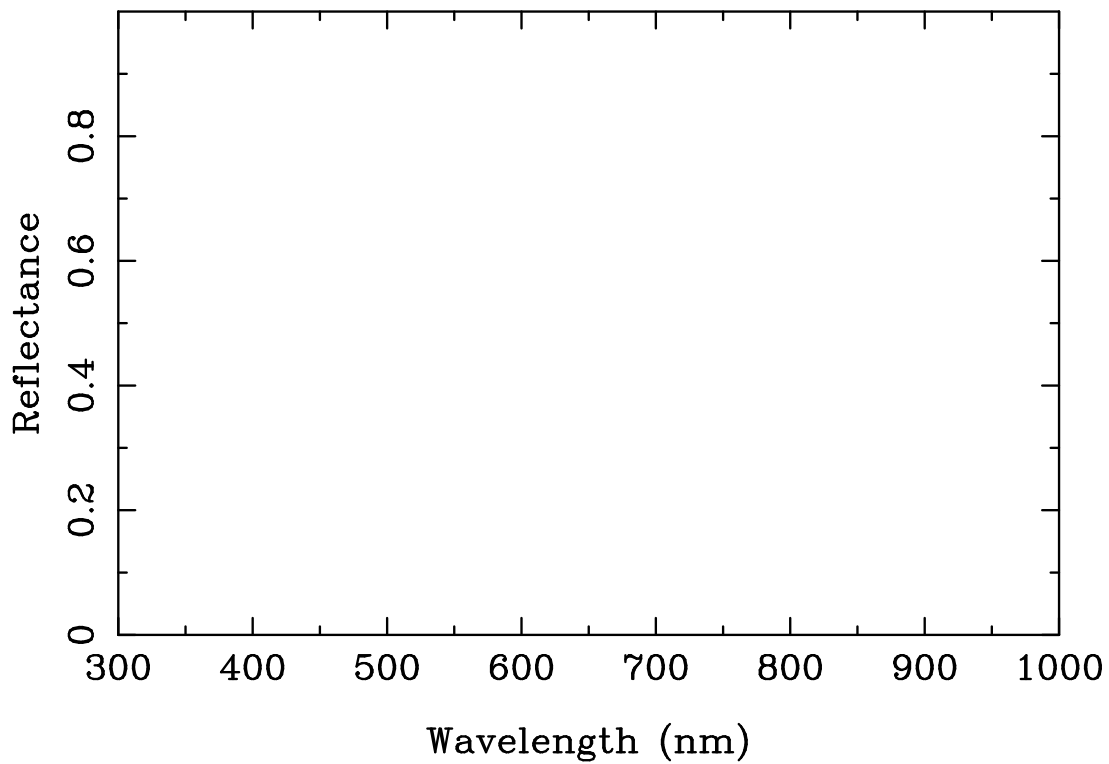
**12** (6 pts) Describe how life on Earth has modified the composition of the Earth's atmosphere.



**13** (7 pts) Describe how the mare surfaces on the Moon formed, what their albedo is like, and what type of rock they are primarily composed of.

**14** (5 pts) Explain how we know that not all of the mare surfaces on the Moon were formed at the same time.

**15** (5 pts) The planet DAPHNE is twice the size of the Moon. Would you expect DAPHNE to have greater or fewer mare-like surfaces? Explain your answer.



Human eyes are sensitive to light of wavelengths between 400 nm (Blue) and 800 nm (Red).

**16** (2 pts) On the graph above, indicate the visible portion of the spectrum.

**17** (3 pts) On the graph above, **sketch and label** the reflectance spectrum of a bright red ball.

**18** (3 pts) On the graph above, **sketch and label** the reflectance spectrum of a dark green ball.

**19** (8 pts) Now assume that you are wearing glasses with lenses that are opaque to radiation longer than 600 nm. Describe the appearance (color and brightness) of the two balls as seen through the glasses.