

# ASTR 1010 Exam 3 Review Session

April 15, 2020

## 1 Planetary Geology

First, let's jot down some key features of the main rocky objects in our inner-solar system:

- Mercury and the Moon
  - Heavily cratered due to the period of \_\_\_\_\_.
  - Some volcanic plains, a few cliffs, and ridges
- Venus
  - Volcanoes and bulges
  - Few visible craters
- Mars
  - Volcanoes and canyons
  - Dry riverbeds that might be indicative of \_\_\_\_\_ in the past.
- Earth
  - Liquid water
  - Not much visible cratering

The Anatomy of a Planet:

- By composition:
  - Core: made of \_\_\_\_\_.
  - Mantle: made of medium-density rocks.
  - Crust: made of low-density rocks.
- By strength:
  - **Lithosphere** - \_\_\_\_\_.
  - Everything else: warmer, softer rock that lies beneath

Table of Densities:

Material	Density g/cm <sup>3</sup>
Water ice	0.94
Liquid water	1.0
Rock	2.7 - 3.7
Metal	7.9

Note: you won't have to memorize these numbers, but you should probably know these categories of material in order of densities.

Explain in your own words how we use planetquakes to study the inside of planets:

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What three things are required for a magnetic field?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

**Differentiation -**

For differentiation to have happened, we need all the material in the core and mantle to have once been \_\_\_\_\_.

Why is a significant portion of the core and mantle solid despite the extremely high temperatures?

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What are the three main processes that heat planets?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

What are the three main processes of heat transportation?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

$$\text{Time to cool} \propto \frac{V}{A} \propto r$$

**Remember: larger objects take longer to cool!**

Explain in your own words why larger worlds have a thinner lithosphere:

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What are the planets' three most fundamental properties? Rank our Solar System planets in order from largest to smallest for each one.

1. \_\_\_\_\_

Rank: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_

2. \_\_\_\_\_

Rank: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_

3. \_\_\_\_\_

Rank: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,  
\_\_\_\_\_

These three fundamental properties affect:

- gravity
- pressure
- internal and surface temperatures
- atmosphere/weather

Those, in turn, affect the four main geological processes. What are they?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

Volcanic outgassing results in the creation of the \_\_\_\_\_.

What is the heat transport process (that occurs in the mantle) most responsible for volcanism and tectonics?  
\_\_\_\_\_.

With regards to tectonics,

- \_\_\_\_\_ time-scale, \_\_\_\_\_ temperature  $\implies$  flows and bends
- \_\_\_\_\_ time-scale, \_\_\_\_\_ temperature  $\implies$  breaks and cracks

**Erosion -**

Weather is very important for erosion. What things are required for weather to occur?

- \_\_\_\_\_
- \_\_\_\_\_

Impact craterings were mainly created during the period of \_\_\_\_\_.

How do the number of small craters compare to the number of large craters?

\_\_\_\_\_

How is volcanism affected by:

- size? \_\_\_\_\_
- distance? \_\_\_\_\_
- rotation rate? \_\_\_\_\_

How are tectonics affected by:

- size? \_\_\_\_\_
- distance? \_\_\_\_\_
- rotation rate? \_\_\_\_\_

How is erosion affected by:

- size? \_\_\_\_\_
- distance? \_\_\_\_\_
- rotation rate? \_\_\_\_\_

How is impact cratering affected by:

- size? \_\_\_\_\_
- distance? \_\_\_\_\_
- rotation rate? \_\_\_\_\_

Internal temperature is determined by \_\_\_\_\_ whereas surface temperature is determined by \_\_\_\_\_.

## 2 Light

What are the four ways electromagnetic waves can interact with matter? Describe each process briefly.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_
4. \_\_\_\_\_  
\_\_\_\_\_

**Wave-particle duality -**

**Wavelength -**

**Frequency -**

**Amplitude -**

$$c = \lambda \times f$$

$$E = h \times f$$

But what does that mean?

$$E \propto f \propto 1/\lambda$$

What can we learn from a spectrum?

- composition
- temperature
- velocity

Explain in your own words how the energy levels in atoms correspond to spectral lines:

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What are the three main types of spectra? For each one, describe in what physical situation they are seen.

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_

What law tells us that bluer stars are hotter than redder stars? \_\_\_\_\_

$$\lambda_{\text{peak}} \propto 1/T$$

### 3 Terrestrial Atmospheres

Briefly describe the atmospheric situation of each rock object in our inner-Solar System:

- Moon and Mercury: \_\_\_\_\_
- Mars and Venus: \_\_\_\_\_
- Earth: \_\_\_\_\_

What are the effects of atmosphere on a planet? Again, briefly describe each and exactly what affect it has.

- \_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_
- \_\_\_\_\_  
\_\_\_\_\_

$$P = F/A$$

What are the four major layers of the Earth's atmosphere?

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

In the troposphere, temperature drops with altitude and it is warmed by \_\_\_\_\_ light and convection.

In the stratosphere, temperature rises than drops and it is warmed by absorption of \_\_\_\_\_ light.

In the thermosphere, temperature rises with altitude and \_\_\_\_\_ heat and ionize gases.

In the absence of greenhouse gases, the surface temperature depends on \_\_\_\_\_ and \_\_\_\_\_.

Why do planets have a double hump in their spectrum?

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### **Magnetosphere -**

What are the three main sources of an atmosphere?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Explain in your own words what caused Mars's atmosphere to look like the way it is today:

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Explain in your own words what caused Venus's atmosphere to look like the way it is today:

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