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ENVI.2020 - PRINCIPLES OF EARTH & ENVIRONMENTAL SYSTEMS I

 STUDY QUESTIONS III

ORIGIN OF THE EARTH AND ITS ATMOSPHERE

1. What are three possible sources of heat energy during the early history of the earth?
2. Consider a particular planet. If a particle has an initial speed which is great enough so that it can escape from the planetary body, it is said to have achieved escape velocity. This velocity can be calculated by noting that at an infinite distance the gravitational potential energy will be zero, and that at this point the kinetic energy is also zero. Mathematically we can express this as follows:

$$E= \frac{1}{2}mv\_{e}^{2}- \frac{GMm}{R}=0$$

Re-arranging gives

$$v\_{e}= \left[2\frac{GM}{R}\right]^{\frac{1}{2}}=Escape velocity$$

Calculate the escape velocity for the earth. M = 5.983 x 1024 kg and R = 6.371 x 106 m.

The average thermal velocity of an atom or molecule can be calculated from the relationship

$$v\_{i}=2\sqrt{\frac{2kT}{πm\_{i}}}$$

Given that the mean temperature of the earth is 15oC, calculate the average velocity of a helium atom at the earth's surface. Mass of a helium atom = 6.645 x 10-27 kg. k = 1.38 x 10-23 J/K. Will helium escape from the earth's atmosphere? Explain your answer.

1. Compare and contrast the atmospheres of Venus, Earth and Mars. Explain why the atmospheres are different.