Name_____

Homework-4 Mars 2024

Name_____

1. One-word answers for how the environment on Mars today differs from Noachian Mars (>3.8 billion years ago)
    a. The atmosphere is _____
    b. The sun is _____
    c. The magnetosphere is _____
    d. The cryosphere is _____
    e. The impact rate is _____

2. The first successful robotic mission to Mars (Mariner 4) discovered:
    a. Martian canals are _____
    b. The atmospheric pressure is less than ____% that of Earth
    c. The southern hemisphere has lots of this landform: _____

3. How long does it take a solar flare, traveling at the speed of light, to reach Mars when it is closest to the Sun in its orbit? _____.

4. Which times of day on equatorial Mars have the highest relative humidities:

5. Compare and briefly explain the mean bulk densities of Earth and Mars

6. Describe the hemispheric dichotomy of Mars in term of:
    a. Elevations
    b. Crustal thickness
    c. Terrain (surface) ages based on crater counts:

7. List 3 hypotheses for how the hemispheric dichotomy might have formed:

8. List at least 2 sources of energy for melting and differentiation of early Mars:

9. Fill out this table about the major geologic time periods on Mars

Characteristic	Noachian	Hesperian	Amazonian

Name_____

Ages in years			
Impact cratering rate			
Fluvial/water activity			
Flood lava volcanism			
Altered minerals according to Bibring et al. 2006			

10. Describe the active gullies on Mars in terms of

    a. Seasonal activity
    b. Surface temperatures
    c. Latitudinal distribution

11. The hydrostatic equation is $dP = -\rho g dZ$ where dP is the difference in pressure between 2 depths (dZ), ρ is density of the crustal section, and g is the acceleration of gravity (Mars or Earth). Ignoring atmospheric pressure and assuming the same crustal density, the pressure would change _____ times faster/slower (circle one) with depth in Mars than in Earth. What are the implications for porosity with depth?

12. How does Mars' eccentric orbit around the sun affect
    a. Lengths (durations) of the 4 seasons

    b. Abundance of CO_2 on the ground and in the atmosphere:

    c. Dust devil and dust storm activity

    d. Sand ripple and dunes migration rates with season

13. List 2 theories for the origin of Phobos and Deimos:

14. Briefly summarize the evidence from Perseverance rover that Jezero Crater contained an ancient lake.

Name_____

15. The diameter of impact craters is proportional to kinetic energy (mv^2, mass x velocity squared). Calculate the kinetic energy of:
    a. A water ice sphere 2 km in diameter and velocity of 25 km/s

    b. An iron sphere 2 km in diameter and velocity 8 km/s

    c. Which one should make a smaller crater?

16. Describe 2 ways to explain the bright basal radar reflector in the south pole region (interpreted as subsurface water by sone) without invoking water.