

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. What is the main mechanism by which the lower atmosphere of Earth is heated?
  - A) Sunlight heats Earth's surface and the resultant heat is transferred to the atmosphere by infrared radiation and convective gas motions.
  - B) Conduction carries heat from Earth's interior to the surface where conduction in the lower atmosphere transfers this heat to the higher layers.
  - C) friction between the winds in the atmosphere and the mountain ranges and land masses of Earth
  - D) absorption of sunlight by molecules of the gases of the atmosphere
  
2. Which of the following molecular species plays a major role in the greenhouse effect in planetary atmospheres?
  - A) ozone
  - B) nitrogen
  - C) carbon dioxide
  - D) oxygen
  
3. Aurorae on Earth are caused by
  - A) electrical currents in the ionosphere, generated by dynamo action in Earth's core.
  - B) charged particles from the sun moving through Earth's magnetic field and striking the upper atmosphere.
  - C) the reflection of sunlight from arctic and antarctic ice into the polar night skies
  - D) ultraviolet radiation from the Sun ionizing atoms in the upper atmosphere.
  
4. The large amount of free oxygen in Earth's present atmosphere is primarily a result of
  - A) splitting of  $\text{CO}_2$  into carbon and oxygen by solar ultraviolet light.
  - B) a biological process such as photosynthesis.
  - C) the outgassing by volcanoes and other geological processes.
  - D)  $\text{CO}_2$  becoming dissolved in the oceans, releasing  $\text{O}_2$ .
  
5. The albedo of a planet is the fraction of energy that is
  - A) reradiated into space as infrared radiation by the planet.
  - B) reflected by the whole planet, including atmosphere and surface.
  - C) absorbed.
  - D) reflected by clouds in the atmosphere.

6. The surface temperature of Earth is actually warmer than expected from the amount of sunlight received. This is a result of
- A) Earth's magnetic field.
  - B) the greenhouse effect.
  - C) a large outflux of heat from Earth's interior.
  - D) the force of gravity on Earth's atmosphere.
7. Why has the greenhouse effect been much more effective in raising the surface temperature on Venus than on Earth?
- A) The solar wind, the major cause of heating in the greenhouse effect, is far more intense at Venus's distance from the Sun and Venus has no magnetic field to deflect it.
  - B) The oceans on Earth have acted as a thermostat in absorbing much of the heat that would otherwise have raised Earth's temperature significantly.
  - C) CO<sub>2</sub>, which traps heat from the planet's surface, is the major component in the very dense Venusian atmosphere but only a minor constituent of Earth's atmosphere.
  - D) The surface of Venus is much more effective than that of Earth in absorbing solar visible and UV radiation.
8. On the basis of the surface and atmospheric conditions existing on Mars today, why could there be no permanent liquid water on its surface?
- A) The water would boil and evaporate rapidly under the low atmospheric pressure or freeze to ice at the low surface temperatures.
  - B) It would have reacted chemically with the surface rocks.
  - C) The UV radiation from the Sun would have dissociated the water molecules into hydrogen (which would leave the planet) and oxygen, which is still present.
  - D) It would have soaked into the porous surface of Mars.
9. The polar caps on Mars are most likely made up of
- A) water and CO<sub>2</sub> ices.
  - B) light-colored dust blown there by intense dust storms and large dust devils.
  - C) volcanic outflow of light-colored lava and dust similar to that produced by Earth-based volcanoes.
  - D) sulfur dioxide and sulfur compounds.

10. Much of the water on Earth, Venus, and Mars has come from outgassing of water vapor from volcanoes. Much of the remainder is believed to have come from
- A) chemical reactions which have produced water from more complex molecules.
  - B) the combination of elemental hydrogen and oxygen in the atmosphere, the reaction powered by high energy ultraviolet rays.
  - C) baking of rocks containing water.
  - D) the impacts of comets.
11. The chemical constituent that absorbs UV radiation in the intermediate layers of Earth's atmosphere (the stratosphere and mesosphere), thereby heating these layers to relatively high temperatures, is
- A) ozone,  $O_3$ .
  - B)  $N_2$ .
  - C)  $H_2O$ , water vapor.
  - D)  $CO_2$ .
12. The circulation in Earth's atmosphere is dominated by
- A) a random distribution of transient storms and high-pressure areas, with no permanent overall pattern.
  - B) one large convection cell in each hemisphere, with air rising at the equator due to solar heating, moving toward the poles at high altitude and returning along the surface.
  - C) three large convection cells in each hemisphere, with surface winds toward the equator in the tropics and away from the equator at temperate latitudes.
  - D) bands of winds blowing parallel to the equator, from the east in the tropics and from the west at temperate latitudes.
13. The temperature in the stratosphere increases with increasing altitude because
- A) it is heated by solar infrared radiation absorbed by carbon dioxide and water vapor.
  - B) it is heated by the absorption of solar ultraviolet radiation by ozone.
  - C) charged particles from the magnetosphere collide with atoms in the stratosphere, depositing energy.
  - D) these higher altitudes are closer to the Sun.

14. On Venus, large amounts of carbon dioxide have come from the planet's interior to form a thick CO<sub>2</sub> atmosphere. What is the carbon dioxide situation on Earth?
- A) Earth, too, has an atmosphere which is mostly CO<sub>2</sub>.
  - B) Earth's interior is entirely different from that of Venus, so that it never produced much carbon dioxide.
  - C) Earth's carbon dioxide is mostly dissolved in the oceans and locked up in carbonate rocks.
  - D) Earth's carbon dioxide has mostly escaped because Earth's gravity is so much weaker than that of Venus..
15. What protects us from the damaging radiation effects of the high-speed solar wind that flows through interplanetary space?
- A) the rapid rotation of Earth, which deflects most of the solar wind
  - B) the Moon, whose gravitational field shields us from the solar wind
  - C) Earth's atmosphere
  - D) Earth's magnetic field
16. What is the status of the greenhouse effect on Mars at the present time?
- A) It no longer exists at all.
  - B) It is very weak and raises the planet's temperature only a few degrees above the temperature it would have with no atmosphere at all.
  - C) It is weak but becoming stronger as Martian volcanoes continue to dump large amounts of CO<sub>2</sub> into the atmosphere.
  - D) It is very strong and has caused the temperature to be at least 100 degrees above the temperature it would have been with no atmosphere at all.
17. How did the inner planets, Venus and Earth, acquire their original atmospheres?
- A) capture of solar wind gases from the Sun as they stream past the planets
  - B) the impact and melting of icy comets and asteroids from the planetary system and perhaps beyond
  - C) gravitational capture of material from the original solar nebula by the planets
  - D) outgassing of the planets through volcanoes and other vents