

Answer TRUE or FALSE (not T or F) (2 pts each)

1. The Earth's surface is heated more by the troposphere than direct sunlight.
2. *Nuclear winter*: if the Earth's surface is not heated by direct sunlight it will cool to the temperature of the upper troposphere.
3. *Geostrophic balance*: the Coriolis force from moving air (i.e., a wind) is balanced by a pressure force.
4. *Isostatic balance*: mountains float high above an asthenosphere because of deep roots.
5. *Lapse rate*: geologic faults caused when stresses exceed the strength of rock.
6. By absorbing IR light, homo-nuclear diatomic molecules like CO₂ can cause of a greenhouse effect.
7. If Earth's sky looked red rather than blue, sunsets would look blue rather than red.
8. The heavily cratered lunar maria represent the oldest surface on the Moon.
9. The Moon's sinuous rilles are believed to have carried water from the highlands to the maria back when the Moon had an atmosphere.
10. Venus has concentrated sulfuric acid clouds, but acid rain does not fall on its surface.
11. A strong Coriolis force combined with a hot dense atmosphere results in huge thunderstorms on Venus.
12. On the surface of Mars, heated ice would sublime. On the surface of Venus, ice left at ambient temperature would melt and the resulting water would boil.
13. Because the Martian atmosphere lacks carbon dioxide, UV light can sterilize the Martian surface.
14. Olympus Mons is the largest known volcano in the Solar System.
15. Earlier in its history we think Saturn had more helium in its atmosphere, but instead of escaping, it sank.
16. Uranus's atmosphere is unusual: as you move up in the atmosphere the air pressure at first declines, but then increases.
17. Triton, a moon of Neptune, is believed to be similar to the planet Pluto.
18. Most planets with atmospheres have super-rotating jetstreams around their equator, but Earth and Neptune are exceptions.
19. Asteroids are the broken remains of a giant planet that once existed between Mars and Jupiter.
20. The Kuiper belt is between Neptune and Pluto.

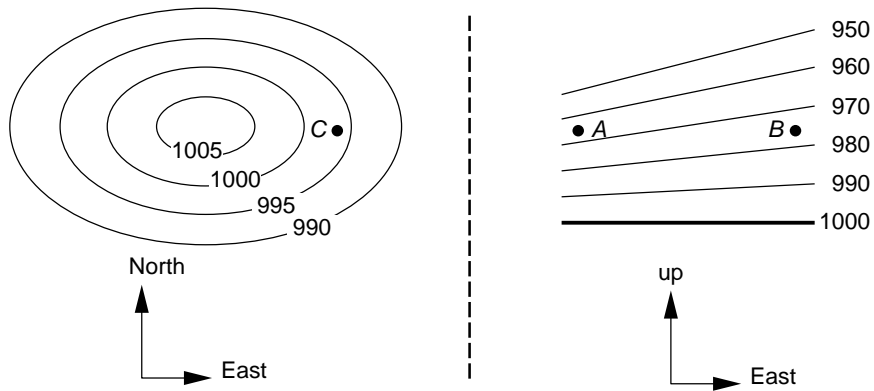
Give a short explanation (5 pts each)

21. Define *convection*.
22. If you increase the amount of CO₂ in the Earth's atmosphere what is the feared consequence? If you decrease the amount of O₃ in the Earth's atmosphere, what is the feared consequence?
23. Three factors that control whether a particular molecule is retained or lost from a planet's atmosphere are the planet's _____, the atmosphere's _____ and the molecule's _____. Report these factors, and state how each factor would need to change to make it more likely that the particular molecule is *lost*.
24. Starting from ground level, report the four layers of the Earth's atmosphere. The majority of planet atmospheres have just two layers. Why the difference?
25. The surfaces of the Moon and Mercury look much the same, but differences exist. Describe (provide more than just a name, e.g., what does it look like or how did it form) one surface feature they both have. Describe one surface feature only one has.
26. In old books Venus is often called "Earth's Twin", but it turns out to be quite different from Earth. Pick *one* of the below aspects and explain why the Earth and Venus differ.
 - (a) Venus has a carbon dioxide atmosphere.
 - (b) Venus has much less water.
27. What evidence could be given to indicate that Mars once had a much more massive atmosphere? Clearly explain how your evidence "measures" the size-of-atmosphere.
28. Jupiter's atmosphere displays features called *zones* and *belts*. Describe the appearance of zones and belts. Describe the physical difference between zones and belts.
29. Describe the internal structure of the four gas giant planets. What *evidence* points to a difference in structure between the inner and outer giant planets?
30. The Galilean moons of Jupiter form an interesting set of large moons. Name and describe two of them, pointing out the unique features of both.
31. What is the difference between moons orbiting within the Roche limit and those orbiting outside the Roche limit, i.e., what is the Roche limit?
32. Report two types of asteroids. How do we determine the type of asteroid from Earth?
33. Draw a picture showing what a comet would look like when it is near the Sun. Draw another picture showing what it would look like when it is far from the Sun. Why the difference?
34. Report the two primary constituents of the atmosphere of:
 - (a) Earth
 - (b) Jupiter
 - (c) Titan
35. Rank order from large to small the size (i.e., radius) of Earth, Uranus, Moon, Pluto, Jupiter.

Write out a complete answer (10 pts each)

36. Consider the below left “bull’s eye” diagram which shows a set of surface isobars in the Earth’s northern hemisphere. What is the pressure at the point *C*? Which way would the wind end up blowing at *C*?

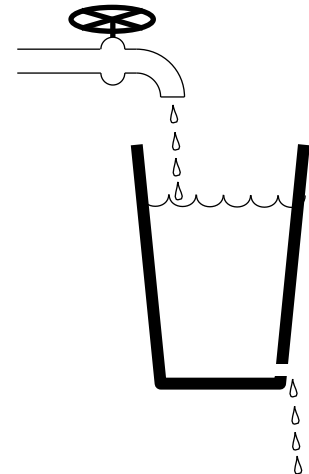
Consider the below right diagram which shows a vertical cut through the Earth’s atmosphere. Points *A* and *B* are at exactly the same altitude above the ground (the ground here is at the 1000-level isobar). Of the two points (*A* and *B*), which is at the higher *temperature*? Of the two points, which is at the higher *pressure*? Which way will the wind end up blowing in the region between *A* and *B*?



37. Greenhouse analogy described in class:

Water flows at a steady rate into a bucket with a small leak. The water level in the bucket rises until as much water leaves the bucket through the leak as flows in.

- The inflow is analogous to _____; the outflow is analogous to _____; the water depth is analogous to _____. (As usual report your answers on your answer sheet!)
- For the bucket: if we shrink the size of the hole, the water level will rise. What change in the atmosphere would be analogous to a shrinkage in hole size?
- For the bucket: if we allow greater inflow, the water level will rise. What change in the atmosphere would be analogous to an increase in inflow?
- How does a runaway greenhouse effect differ from the usual greenhouse effect?



38. We classify the terrestrial planets together because of their similarities, but of course there are differences too. Explain *three* (3) of the similarities/differences listed below.
- What are the similarities between the Earth and Mercury that cause the presence of a magnetic field on both?
 - What are the differences between the Earth and Venus that stall continental drift on Venus?
 - What are the differences between the Earth and its Moon that result in a heavily cratered Moon, but few craters on Earth?
 - What are the differences between the Earth and Mars that explain the absence of a magnetic field on Mars?
39. We classify the giant planets together because of their similarities, but of course there are differences between the the various giant planets too. For *five* (5) of the below, describe briefly how the four giant planets differ.
- | | |
|--------------------------|----------------------------------|
| (a) magnetic field | (e) jetstreams in the atmosphere |
| (b) internal heat source | (f) appearance |
| (c) internal structure | (g) rings |
| (d) spin | (h) moons |
40. Below is that part of the sky called the winter hexagon. Label any constellation you should know. Circle and name the “important” stars. (Answer on this sheet.)

