

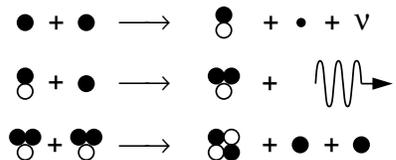
Except for questions 28 & 32 marks/answers on these sheets are not graded.  
Record your answers on your answer sheets unless the question states otherwise!

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

1. The Earth used to have an atmosphere rich in CO<sub>2</sub>, but that gas has ended up in carbonate rocks.
2. The far side of the Moon looks quite different from the near side: it has fewer maria.
3. Pictures of Venus from Earth using visible light show only a featureless cloud deck; no surface features can be seen using visible light.
4. Venus has concentrated sulfuric acid clouds, but acid rain does not fall on its surface.
5. Seismometers left on the surface of the Mars suggest that the Martian lithosphere is thicker than the Earth's.
6. The fact that Jupiter's density is greater than Saturn's tells us that Jupiter includes a greater proportion of heavy materials like iron.
7. Among the gas giants, Uranus is odd both in terms of its nearly absent internal heat source and in its spin-axis direction.
8. From space Uranus and Neptune appear as nearly featureless blue balls as a result of CH<sub>4</sub> clouds in their atmosphere.
9. Since refractory elements are the last to vaporize as the temperature rises, we think Io is less icy than Callisto.
10. The Oort cloud holds billions of the comet nuclei.
11. Meteor: a flash of light in the sky. Meteorite: a rock that fell from the sky that you might hold in your hand.
12. Iron meteorites lack the chondrules found in more primitive meteorites.
13. The Kuiper belt is beyond Neptune and includes Pluto.
14. *Nuclear fission*: breaking big nuclei apart; *Nuclear fusion*: putting small nuclei together.
15. The Sun's magnetic field reverses much more frequently than does Jupiter's.
16. Sunspot: magnetically sequestered from the convection zone, it cools but remains hotter than the filament of an incandescent light bulb.

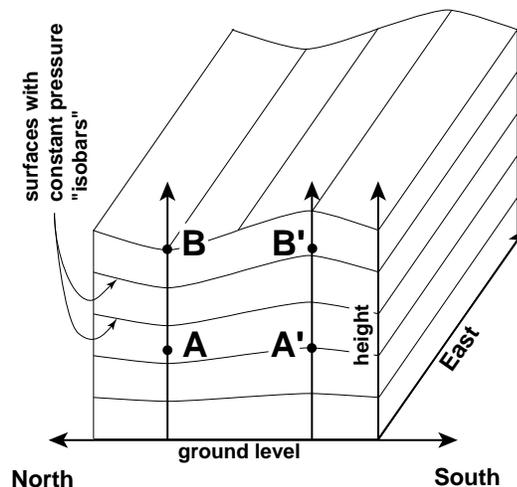
**Give a short explanation (5 pts each)**

17. Define and give an example of two of the following three rock types: sedimentary, metamorphic, igneous.
18. List four terrestrial planets. List four gas giant (Jovian) planets.
  - (a) Report one characteristic that the Earth *lacks* but all the gas giant planets have.
  - (b) Report one characteristic that the Earth *has* but all the other terrestrial planets lack.
19. *Describe* (provide more than just a name, e.g., what does it look like and how did it form) two surface features of the Moon
20. The Moon and Mercury look much the same, but differences exist. *Describe* (provide more than just a name, e.g., what does its presence imply) one feature they both have. Describe one feature only one has.
21. 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 how and why the Earth and Venus differ.
  - (a) magnetic field
  - (b) plate tectonics (continental drift).
22. 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.
23. 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?
24. Report the two primary constituents of the atmosphere of:
  - (a) Venus
  - (b) Jupiter
  - (c) Earth
25. Rank order from “dead” to “quite active” the current tectonic (“geologic”) activity of Venus, Moon, Mars, Io, Earth.
26. How do we learn about the interior of the Sun?
27. Sketch a cross-section of the Sun and show where the following are located: chromosphere, convection zone, corona, photosphere, radiation zone, solar wind.
28. The cartoon to the right is a representation of the reactions that power the Sun. On this sheet label/name at least five (5) distinct participants.



Write out a complete answer (10 pts each)

29. Describe why the Sun doesn't explode. Your explanation should include a full statement (hypothesis and conclusion) of the Virial theorem, an explanation of the chain of events that produces explosions, and an explanation of why you haven't seen anything explode recently.
30. Make a sketch of the cross section of the upper layers of rock on the Earth. The sketch should accurately show how pieces of the Earth's crust are created and destroyed. Label: mid-ocean rift zone, oceanic crust, continental crust, lithosphere, asthenosphere, mantle, convection cell, subduction, area of mountain building, and which way the plates are moving.
31. The below shows a three dimensional slice of a gas giant's "zone and belt" atmosphere in the *northern* hemisphere with surfaces with constant air pressure ("isobars") displayed. North is to the left; south is to the right; up the page is vertically up through the planet's atmosphere; into the page is east. Two vertical columns starting at "ground" level are displayed: the leftmost has altitudes labeled **A** and **B**, the rightmost has altitudes labeled **A'** and **B'**. The labels **A** and **A'** represent exactly the same altitude; similarly for **B** and **B'**. Answer the following data using this sketch and your knowledge of the atmospheres.
- Consider the pressure at the four locations (**A**, **B**, **A'**, **B'**). Sort the locations by pressure, i.e., list the location with the highest pressure first, second highest second, . . . .
  - Consider the density of the air: (I) below **A** and (II) below **A'**. Which air is the more dense? *Why?* (i.e., cite evidence supporting your conclusion.)
  - Applying the thermal wind approximation, report which way the wind in the region between **B'** & **B** is blowing and why. What forces are present? Which way are they pushing?
  - Typically the 'zones' consist of rising warm air but the temperature measured from satellites shows cooler temperatures than the belts of cooler descending air. Explain why! (Hint: what/why is the relative altitude of the cloud tops whose temperature will be measured by satellites.)



32. Below is that part of the sky called the winter hexagon. Circle and name the “important” stars. (Answer on this sheet.)

