

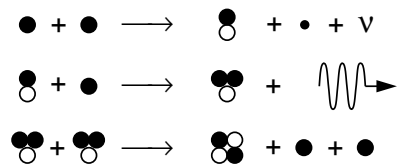
Except for questions 28 and 32 marks/answers on these sheets are not graded.

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

1. The lava that comes out of Earth's volcanoes, wells up from the liquid core.
2. Generally, felsic rocks are found in the core and ultra mafic rocks are found in the mantle.
3. Among the terrestrial planets only the Earth currently has a magnetic field.
4. The heavily cratered lunar maria represent the oldest surface on the Moon.
5. The surfaces of Moon and Mercury look similar; furthermore the evidence suggests the interiors are also much the same.
6. A strong Coriolis force combined with a hot dense atmosphere results in huge thunderstorms on Venus.
7. 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.
8. Volcanoes are particularly large on Mars due to its small gravitational force.
9. The fact that Jupiter's density is greater than Saturn's tells us that Jupiter includes a greater proportion of heavy materials like iron.
10. Among the giant planets, Uranus is odd both in terms of its nearly absent internal heat source and in its spin-axis direction.
11. Neptune's atmosphere is unusual: as you move up in the atmosphere the air pressure at first declines, but then increases.
12. All the giant planets have magnetic fields, but the convecting, conducting fluid responsible for the field is different for Saturn, Neptune, and Earth.
13. All the giant planets have rings.
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)

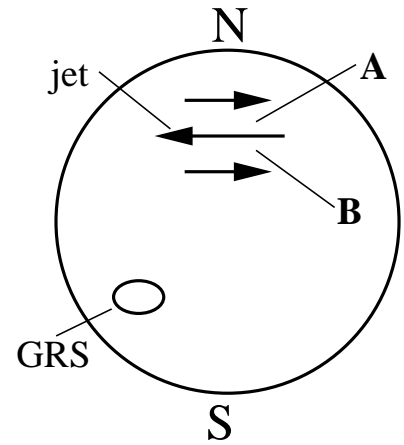
17. Define and give an example of two of the following three rock types: sedimentary, metamorphic, igneous.
18. Describe astronomers' best guess as to how the Moon formed.
19. Name and describe two surface features of the Moon.
20. What evidence points to a liquid iron/nickel core inside Mercury?
21. 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 why the Earth and Venus developed differently.
 - (a) Venus has a carbon dioxide atmosphere.
 - (b) Venus has much less water.
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 what the surface of either Venus or Mars looks like.
24. Describe the internal structure of the giant planets. What *evidence* points to a difference in internal structure between the gas giants and ice giants?
25. Report (in order) the two primary constituents of the atmosphere of:
 - (a) Earth
 - (b) Mars
 - (c) Neptune
26. Define and give an example of *resonance* in the Solar System.
27. Rank the bulk densities of the following objects from highest to lowest: Neptune, Saturn, Mars, Earth, Moon.
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. 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.

30. The diagram right shows the direction of winds in the northern hemisphere of Jupiter's atmosphere. Focus on the wind labeled 'jet' and the adjacent regions labeled **A** and **B**.



- (a) In which direction does the Coriolis force act on jet?
 - (b) At the same altitude as the jet, which has a higher pressure **A** or **B**?
 - (c) In the the atmosphere below **A** and **B**, which has the higher temperature?
 - (d) Which region **A** or **B** is an upwelling in Jupiter's atmosphere.
 - (e) Which region **A** or **B** is likely to have ammonia clouds?
 - (f) Convective regions, like the areas around **A** and **B**, are named for a meteorologist who saw evidence for similar patterns on Earth. What was the last name of this meteorologist?
 - (g) Regions like this on Jupiter make a visible pattern in Jupiter's clouds features. What is this pattern called?
 - (h) The Great Red Spot (GRS) is a high pressure region in the southern hemisphere of Jupiter. Which way do the winds blow around the Spot: clockwise or counter-clockwise?
31. 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 (positive feedback), and an explanation of why you haven't seen anything explode recently.
32. On the following page find displayed the part of the sky called the winter hexagon. Circle and name the eight "important" stars. (Answer directly on the diagram.)

