Name _____ Class _____ Date _____

Skills Worksheet

Directed Reading 29.1 (ODD)

Section: Structure of the Sun

1. People once believed that the sun's energy came from

_____

2. About how long ago did scientists discover that the sun's energy is quite different from fire?

_____

_____

THE SUN'S ENERGY

_____ 3. What does the sun look like to the unaided eye?
   a. a dazzling, brilliant ball that has no distinct features
   b. a bright disc with ridges and valleys
   c. a dazzling ball with seas and dark areas
   d. a softly glowing sphere with flaming edges

_____ 4. Why do astronomers use special filters to look at the sun?
   a. The sun seems only one color otherwise.
   b. No telescope can view the sun otherwise.
   c. The sun's brightness can damage one's eyes.
   d. They view the sun only at night.

_____ 5. What do scientists use to break up the sun's light into a spectrum?
   a. a spectrometer
   b. a spectrograph
   c. a spectrareader
   d. a light graphometer

_____ 6. What causes dark lines to form in the spectra of stars?
   a. Gases in the stars' interiors emit specific wavelengths of light.
   b. Gases in the stars' outer layers absorb specific wavelengths of light.
   c. Magnetic currents in the stars' outer layers distort wavelengths of light.
   d. Gases in the stars' outer layers emit specific wavelengths of light.

_____ 7. To identify the elements in a star's atmosphere, scientists
   a. match the spectral lines of starlight against the spectra from known stars.
   b. match the spectral lines of starlight to those of Earth's elements.
   c. match the spectral lines of starlight against the spectra of gases in Earth's atmosphere.
   d. match the spectral lines of starlight to one another.

_____ 8. Why does matching the spectral lines of starlight to those of Earth's elements enable scientists to identify the elements in a star's atmosphere?
   a. Groups of elements have the same spectral lines.
   b. Individual elements may have the same spectral lines.
   c. Each element has a unique pattern of spectral lines.
   d. Each group of elements has unique spectral lines.

_____ 9. What element makes up about 75% of the sun's mass?
   a. helium
   b. iron
   c. hydrogen
   d. radium

_____ 10. How much of the sun's total mass is composed of hydrogen and helium?
   a. about 75%
   b. about 85%
   c. about 90%
   d. about 99%

_____ 11. The sun's spectrum reveals that it contains
   a. almost nothing besides hydrogen.
   b. traces of almost all chemical elements.
   c. only hydrogen and helium.
   d. hydrogen, helium, oxygen, and carbon.

_____ 12. What atomic process combines nuclei of small atoms to form more-massive nuclei?
   a. nuclear fission
   b. nuclear fusion
   c. nuclear half-life
   d. nuclear decay

_____ 13. Nuclei of which atoms are the primary fuel for the sun?
   a. hydrogen
   b. helium
   c. protons
   d. electrons

14. What is the common makeup of a hydrogen atom?

_____

15. What happens inside the sun to the electrons in hydrogen atoms?

_____

Name _____ Class _____ Date _____

Directed Reading *continued*

16. How many steps occur in nuclear fusion inside the sun?

17. Describe the first step of nuclear fusion.

18. What happens to the charge of one hydrogen proton?

19. What is a particle that is emitted by one proton?

20. What is the result of the first step of fusion?

21. Describe the second step of nuclear fusion.

22. Describe the third step of nuclear fusion.

23. What is released in the fusion of two two-proton-one-neutron nuclei?

24. What particles are fused together to form a helium nucleus?

25. How often is energy released during nuclear fusion?

26. When hydrogen fusion occurs in the sun, what is always one of the final products?

27. How does the mass of a helium nucleus compare with the mass of the hydrogen nuclei that fused to form it?

28. What is converted into energy during the series of fusion reactions that form helium nuclei inside the sun?

_____

_____

29. What causes the sun to shine and gives the sun its high temperature?

_____

_____

MASS CHANGING INTO ENERGY

_____ 30. In 1905, Albert Einstein proposed that a
- a. small amount of matter yields a large amount of energy.
- b. large amount of matter was equal to a large amount of energy.
- c. large amount of matter yields a small amount of energy.
- d. small amount of matter was equal to a small amount of energy.

_____ 31. At the time of Einstein's 1905 proposal, what two factors were unknown?
- a. nuclear fission and electrons
- b. energy and an atom's nucleus
- c. energy and matter
- d. nuclear fusion and the nucleus of the atom

_____ 32. Einstein's proposal was
- a. part of his special theory of relativity.
- b. part of his general theory of physics.
- c. his basic theory about the makeup of atoms.
- d. part of his special theory of energy.

_____ 33. What equation is part of Einstein's theory?
- a. $E = mc$
- b. $E^2 = mc$
- c. $E = mc^2$
- d. $E = m^2 c$

_____ 34. In the equation $E = mc^2$, E represents
- a. mass, or the amount of matter.
- b. a constant.
- c. matter.
- d. energy produced.

_____ 35. In the equation $E = mc^2$, m represents
a. the total mass in the universe.
b. the mass of one ounce of lead.
c. mass, or the amount of matter that is changed.
d. the amount of matter that remains.

_____ 36. In the equation $E = mc^2$, c represents
a. energy.
b. matter.
c. the diameter of the sun.
d. the speed of light.

_____ 37. What is the speed of light?
a. 300,000 km/hr
b. 300,000 km/s
c. 300,000 m/hr
d. 300,000 m/s

38. What can Einstein's equation be used to calculate?

_____

_____

39. How much mass is changed into energy in the sun every second?

_____

40. What subatomic particle is given off during fusion?

_____

41. How long does it take neutrinos that escape from the sun to reach Earth?

_____

42. What does the study of neutrinos indicate?

_____

_____

THE SUN'S INTERIOR

In the space provided, write the letter of the temperature that matches the part of the sun.

_____ 43. core

_____ 44. chromosphere

_____ 45. sunspot

_____ 46. radiative zone

_____ 47. corona

_____ 48. photosphere

_____ 49. convective zone

a. 3,800 °C
b. 6,000 °C
c. 6,000 °C to 50,000 °C
d. >1,000,000 °C
e. 2,000,000 °C
f. 2,000,000 °C to 7,000,000 °C
g. 15,000,000 °C

_____ 50. What has revealed what the invisible layers of the sun may be like?
a. the solar wind
b. neutrinos
c. computer models
d. the sun's corona

_____ 51. In recent years, more detail has been learned about what is happening inside the sun by careful studies of
a. motions in the sun's corona.
b. motions on the sun's surface.
c. movement of sunspots.
d. changes in energy from the sun.

_____ 52. What is the size of the sun's core?
a. 25% of 1,390 km
b. 25% of 13,900 km
c. 25% of 139,000 km
d. 25% of 1,390,000 km

53. What is the sun's core made up of?

_____

54. How does the mass of the sun compare with the mass of Earth?

_____

55. What effect does the sun's large mass have on the density of the sun's core?

_____

_____

56. Compare the nuclei of atoms on Earth and in the sun's core.

57. What factors in the sun's core force nuclei close enough to fuse?

58. What is the most common nuclear reaction inside the sun?

59. What zone in the sun's interior surrounds the core, and what is its temperature?

60. In the radiative zone, in what form does energy move outward?

61. What zone surrounds the radiative zone, and what is its temperature?

62. Describe how energy produced in the sun's core moves through the convective zone. Compare the movement to an example on Earth.

63. Describe the movement of gases in the convective zone.

THE SUN'S ATMOSPHERE

_____ 64. To what does the word *atmosphere* refer when applied to the sun?
a. the sheath of air surrounding the sun
b. all the gases that make up the sun
c. the uppermost region of solar gases
d. the regions of gases above the sun's core

_____ 65. What are the three layers of the sun's atmosphere?
a. ionosphere, troposphere, stratosphere
b. photosphere, chromosphere, convective zone
c. photosphere, chromosphere, corona
d. core, corona, photosphere

_____ 66. What is the innermost layer of the solar atmosphere called?
a. photosphere
b. chromosphere
c. corona
d. solar wind

67. What is the sun's photosphere?

_____

68. Why are we able to see the photosphere from Earth?

_____

_____

69. What are sunspots?

_____

_____

70. What layer lies above the photosphere? How did this layer get its name?

_____

_____

_____

71. How do gases move in the chromosphere?

_____

72. Describe the upward movement of gas in the chromosphere.

_____

_____

73. How do spacecraft study the sun?

74. What is the outermost layer of the sun's atmosphere called?

75. Describe the size and temperature of the corona.

76. How can the corona stop most subatomic particles from escaping into space, even though it is not very dense?

77. Under what condition may the corona be visible during the day?