Casa Grande Invitational
Science Olympiad
October 29, 2011

Names _____

School _____

Keep the Heat Test

Modified True/False
Indicate whether the sentence or statement is true or false. If false, change the identified word or phrase to make the sentence or statement true.

____ 1. Heating a substance causes its molecules to slow down. _____

____ 2. Thermal energy is an average value. _____

____ 3. When two containers at the same temperature are brought together, no heat is transferred. _____

____ 4. If you put your hand above a burner on a stove, your hand becomes hotter than if you put your hand beside the burner. The heat is transferred to your hand above the burner by radiation. _____

____ 5. Radiation transfers energy by moving matter. _____

____ 6. Air is a good conductor of heat. _____

____ 7. Compared to water, most metals have low specific heats. _____

____ 8. Fans moving hot air is an example of forced convection. _____

____ 9. When a substance is cooled it usually expands. _____

____ 10. In a four stroke engine, the fuel is actually burned during the compression stroke. _____

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 11. Temperature is a measure of ____ of the particles in an object.
a. the difference between the potential and kinetic energy
b. the sum of the potential and kinetic energy
c. the average potential energy
d. the average kinetic energy

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____ 12. The lowest possible temperature is ____.
a. 0°
b. –273°F
c. 0°K
d. –273°K

____ 13. A liquid thermometer works because liquid ____ when warmed.
a. expands
b. contracts
c. solidifies
d. condenses

____ 14. The thermal energy of an object is ____.
a. its potential energy
b. its average kinetic energy
c. its potential energy minus its kinetic energy
d. its kinetic energy plus its potential energy

____ 15. Heat is thermal energy transferred from one object to another because of a difference in ____.
a. mass
b. temperature
c. volume
d. potential energy

____ 16. Fast food restaurants keep food hot with infrared lamps. The heat is transferred to the food by ____.
a. condensation
b. conduction
c. convection
d. radiation

____ 17. When a pot of water is put on a stove, the water at the top gets hot primarily by ____.
a. radiation
b. conduction
c. convection
d. condensation

____ 18. When a cold can of soda is insulated, the heat flow into the can on a hot day ____.
a. increases
b. decreases
c. stays the same
d. both b and c

____ 19. Heat is ____ energy that is transferred from one object at a certain temperature to another at a different temperature.
a. kinetic
b. thermal
c. solar
d. electromagnetic

____ 20. Most materials ____ when they are heated.
a. condense
b. freeze
c. expand
d. contract

____ 21. Temperature is a measure of the ____ of atoms and molecules.
a. heat
b. average kinetic energy
c. potential energy
d. thermal energy

____ 22. Water boils at 100° on the _____ temperature scale.
a. Kelvin
b. Fahrenheit
c. Celsius
d. Molecular

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____ 23. Which of the following is ordered from the least thermal energy to the most?

a. ice to steam to water
c. ice to water to steam
b. water to ice to steam
d. steam to water to ice

____ 24. An increase in heat in a system _____.

a. has less kinetic energy
c. increases entropy
b. decreases entropy
d. reduces temperature

____ 25. Heat spontaneously flowing from a cold body to a hot body violates the _____.

a. law of conservation of energy
c. first law of thermodynamics
b. kinetic-molecular law
d. second law of thermodynamics

____ 26. The first law of thermodynamics is a restatement of which law?

a. gravity
c. conservation of energy
b. second law of thermodynamics
d. kinetic-molecular law

____ 27. Water has a higher specific heat than clay. Water would ____ than clay.

a. heat up faster
c. heat more slowly
b. cool down faster
d. freeze more rapidly

____ 28. The specific latent heat of melting for lead is 22.4 kJ/kg and that of oxygen is 13.9 kJ/kg. This means:

a. Lead melts at a high temperature.
c. More energy is needed to heat lead than is needed to heat the same mass of oxygen by the same amount.
b. More energy is needed to melt lead than is needed to melt oxygen.

____ 29. What is 56° C in Farenheit?

a. 133°F
c. 85°
b. 100°F
d. 212°

____ 30. What letter is generally used to denote heat in equations?
a. T
b. Q
c. H
d. X

____ 31. A small candy bar has 52 calories. If all of its energy were converted to heat, by how much would it raise the temperature of 1 L of water?
a. 1° C
b. 104° C
c. 52° C
d. 0° C

____ 32. What is the specific heat capacity of dry air in J/g·K at 0 °C ?
a. -5
b. -1
c. 1
d. 5

____ 33. Who discovered the mechanical equivalent of heat?
a. Robert Boyle
b. James Joule
c. Antoine Lavoisier
d. James Watt

____ 34. In what year was the concept of Absolute Zero first postulated?
a. 1949
b. 1835
c. 1492
d. 1702

____ 35. If a cylinder containing water, topped by a fixed piston is heated by a bunsen burner, what is the thermodynamic process?
a. Isochoric
b. Isobaric

Completion
Complete each sentence or statement.

36. Heat always moves from _____ objects to _____ objects.

37. The amount of heat required to raise the temperature of 1 kg of a substance by 1°C is its _____.

Short Answer

38. A comfortable summer day is 77°F. What is this on the Celsius scale?

39. If you add 200 mL of water at 20°C to another 200 mL of water at the same temperature, what happens to the kinetic energy and thermal energy of the combustion?

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Matching

Match the terms with the correct phrase below.

a. Celsius scale
b. conduction
c. conductor
d. convection
e. heat engine
f. Fahrenheit scale
g. heat
h. thermometer
i. two-stroke
j. insulator
k. internal combustion engine
l. radiation
m. specific heat
n. temperature
o. thermal energy
p. thermal pollution

____ 40. the sum of the kinetic and potential energy of the molecules of a substance

____ 41. a material through which heat does not easily flow

____ 42. transfer of heat by the movement of a gas or a liquid

____ 43. transfer of energy by electromagnetic waves

____ 44. a device that converts thermal energy into mechanical energy

____ 45. temperature scale with 100 degrees between the freezing and boiling of H_2O

____ 46. temperature scale with 180 degrees between the freezing and boiling of H_2O

____ 47. the average kinetic energy of the particles of a substance

____ 48. transfer of heat by particles colliding with each other

____ 49. an instrument used to measure temperature

____ 50. a body of water warms from adding water

____ 51. a substance that conducts heat

____ 52. amount of heat to raise 1 kg of a substance 1°C

____ 53. thermal energy transferred because of a difference in temperature

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Keep the Heat
Answer Section

MODIFIED TRUE/FALSE

1. ANS: F, speed up

   DIF: B OBJ: 1/1 STO: 5SC-E3 PO3
2. ANS: F, a total

   DIF: B OBJ: 3/1
3. ANS: T DIF: B OBJ: 4/2
4. ANS: T DIF: B OBJ: 5/2
   STO: 1SC-E3 PO3
5. ANS: F, electromagnetic waves

   DIF: B OBJ: 5/2 STO: 1SC-E3 PO3
6. ANS: F, a poor

   DIF: B OBJ: 6/2
7. ANS: T DIF: B OBJ: 6/2
8. ANS: T DIF: B OBJ: 5/2
   STO: 1SC-E3 PO3
9. ANS: F, contracts

   DIF: B OBJ: 1/1 STO: 5SC-E3 PO3
10. ANS: F, power

    DIF: B OBJ: 8/3 STO: 5SC-E3 PO1

MULTIPLE CHOICE

11. ANS: D DIF: B OBJ: 1/1 STO: 5SC-E3 PO3
12. ANS: C DIF: B OBJ: 2/1
13. ANS: A DIF: B OBJ: 2/1
14. ANS: D DIF: B OBJ: 3/1
15. ANS: B DIF: B OBJ: 4/2
16. ANS: D DIF: B OBJ: 5/2 STO: 1SC-E3 PO3
17. ANS: C DIF: B OBJ: 5/2 STO: 1SC-E3 PO3
18. ANS: B DIF: B OBJ: 6/2
19. ANS: B DIF: B OBJ: 3/1
20. ANS: C DIF: B OBJ: 2/1
21. ANS: B
22. ANS: C

23. ANS: C
24. ANS: C
25. ANS: D
26. ANS: C
27. ANS: C
28. ANS: C
29. ANS: A
30. ANS: B
31. ANS: C
32. ANS: B
33. ANS: B
34. ANS: D
35. ANS: A

COMPLETION

36. ANS: warmer, cooler

    DIF: B OBJ: 5/2 STO: 1SC-E3 PO3
37. ANS: specific heat

    DIF: B OBJ: 6/2

SHORT ANSWER

38. ANS:
    C = 5/9(F–32) = 5.9(45°F) = 25°C

    DIF: A OBJ: 2/1
39. ANS:
    The kinetic energy stays the same; the thermal energy doubles.

    DIF: A OBJ: 3/1

MATCHING

40. ANS: O
41. ANS: J
42. ANS: D
43. ANS: L
44. ANS: E
45. ANS: A
46. ANS: F

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47. ANS: N
48. ANS: B
49. ANS: H
50. ANS: P
51. ANS: C
52. ANS: M
53. ANS: G