Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question. Each correct answer is worth 0.5 points.

1. Which of the following is a physical change?
   a. burning of fuel oil
   b. melting of ice
   c. both (a) and (b)
   d. neither (a) nor (b)

2. The quotation, "Chance favors the prepared mind," is attributed to the great French scientist Louis Pasteur. This most closely means which of the following?
   a. A careful experimenter will obtain reliable results.
   b. A careful experimenter will sometimes make an unexpected but significant observation.
   c. Intense study is required to obtain good examination grades.
   d. Nothing can be accomplished without appropriate preparation.

3. The area of Asia is approximately 16.8 million square miles. Which of the following is the correct way to express this number in scientific notation?
   a. $1.68 \times 10^5$
   b. $1.68 \times 10^6$
   c. $1.68 \times 10^7$
   d. none of these

4. How many milligrams (mg) are there in 1 kilogram (kg)?
   a. $1 \times 10^{12}$
   b. $1 \times 10^6$
   c. $1 \times 10^6$
   d. $1 \times 10^{12}$

5. How many liters (L) are there in 1 microliter (µL)?
   a. $1 \times 10^{12}$
   b. $1 \times 10^6$
   c. $1 \times 10^6$
   d. $1 \times 10^{12}$

6. One long distance Olympic race is the 10,000 meter run. Which of the following is most nearly the length of this run in feet? [1 meter is slightly longer than 39 inches]
   a. $6.09 \times 10^3$ feet
   b. $6.22 \times 10^3$ feet
   c. $1.00 \times 10^4$ feet
   d. $3.28 \times 10^4$ feet
7. The length of an American football field is 100 yards. Which of the following is most nearly this distance expressed in meters? [1 meter is slightly longer than 39 inches]
   a. 9.14 meters
   b. 10.9 meters
   c. 91.4 meters
   d. 109 meters

8. The dimensions of a room are typically given in feet, but carpeting is sold by the square yard. How many square yards of carpet are required to cover the floor of a room which is 12 feet by 18 feet?
   a. 12 square yards
   b. 18 square yards
   c. 24 square yards
   d. 216 square yards

9. What is the mass of a quarter pound hamburger, expressed in the metric system? [1 pound = 453.6 grams]
   a. 113 mg
   b. 113 g
   c. 1814 g
   d. 0.1814 kg

10. At what temperature do the temperatures on the Celsius and Fahrenheit scales have the same numerical value?
    a. -40
    b. 0
    c. 32
    d. at no value

11. The boiling point of octane is 126°C. What is this temperature on the Fahrenheit scale?
    a. 52.2°F
    b. 102°F
    c. 259°F
    d. 284°F

12. The boiling point of liquid nitrogen is 77K. What is this temperature on the centigrade scale?
    a. 350°C
    b. 171°C
    c. 25°C
    d. -196°C

13. A particular model of "hybrid" car can travel 53.0 miles/gallon of gas. What is this fuel efficiency expressed in the metric system? [1 quart = 0.946 liter; 1 mile = 1.609 km]
    a. 8.71 km/liter
    b. 20.2 km/liter
    c. 22.5 km/liter
    d. 90 km/liter

14. The unit of weight used for precious stones is the carat (1 carat = 200 mg, exactly). If a particular 1.25 carat diamond cost $7000, what is the cost of a collection of identical diamonds which weighs 1.00 ounce? [1 ounce = 28.35 grams]
    a. $28,000
    b. $35,000
    c. $15,876
    d. $793,800
15. Which state of matter retains its volume but adapts its shape to that of its container is?
   a. solid
   b. liquid
   c. gas
   d. none of these

16. Which state of matter is most compressible?
   a. gas
   b. liquid
   c. both liquid and gas
   d. neither liquid nor gas

17. Which of the following is(are) the fluid state(s) of matter?
   a. only gas
   b. only liquid
   c. both liquid and gas
   d. neither liquid nor gas

18. Which of the following is true of ice, water and steam?
   a. they are three different chemical substances
   b. they are the same substance in different chemical states
   c. they are the same substance in different physical states
   d. they are the same substance in different chemical and physical states

19. The densities of the coinage metals (copper, silver and gold) are as follows:
   
   copper = 8.95 g/cm³ silver = 10.49 g/cm³ gold = 19.32 g/cm³
   
   A sample of material is found to weigh 14.03 grams, and have a volume of 1.20 cm³. This is a sample of
   which of the coinage metals?
   
   a. copper
   b. silver
   c. gold
   d. it is not one of the coinage metals

20. Aluminum has a density of 2.70 g/cm³. What volume is occupied by a block of aluminum which weighs 4.32
   kg?
   a. 0.000625 cm³
   b. 0.625 cm³
   c. 1.60 cm³
   d. 1.60 L

21. Iron has a density of 7.874 g/cm³. What is the mass of a rectangular block of iron with dimensions of 3.000
   cm by 4.000 cm by 5.000 cm?
   a. 7.629 g
   b. 60.00 g
   c. 94.48 g
   d. 472.4 g
22. Iron has a density of 7.874 g/cm$^3$. What is the volume of a block of iron which weighs 15.321 g?
   a. 0.008289 cm$^3$
   b. 0.5139 cm$^3$
   c. 1.946 cm$^3$
   d. 120.6 cm$^3$

23. Which of the following is true about specific gravity of a material?
   a. it has units of g/mL
   b. it is defined as the density of the material divided by the density of water
   c. both (a) and (b) are true
   d. both (a) and (b) are false

24. If specific densities were defined by reference to oil (density = 0.89 g/mL) rather than water (density = 1.0 g/mL) which of the following would be true?
   a. the specific densities of all materials would be larger than those given in tables in handbooks
   b. the specific densities of all materials would be smaller than those given in tables in handbooks
   c. the specific densities of some objects would be larger and of other objects would be smaller than those given in tables in handbooks
   d. the question is meaningless since water is the only permissible reference material

25. A particular material has a specific gravity of 1.04 at 20°C. As this material is heated from 20°C to 30°C its volume increases faster than does the volume of water. Which of the following statements is true of the specific gravity of this material at 30°C?
   a. its specific gravity decreases
   b. its specific gravity increases
   c. its specific gravity remains the same
   d. there is insufficient information to answer the question

26. Which of the following statements is true about a swinging pendulum?
   a. its kinetic energy is greatest when it is vertical (at the midpoint of its swing)
   b. its potential energy is greatest when it is vertical (at the midpoint of its swing)
   c. its kinetic energy does not change as it swings
   d. its potential energy does not change as it swings

27. Which of the following statements is true about a swinging pendulum?
   a. its kinetic energy is greatest when it is at the extreme (the highest point) of its swing
   b. its potential energy is greatest when it is at the extreme (the highest point) of its swing
   c. its kinetic energy does not change as it swings
   d. its potential energy does not change as it swings

28. The Law of Conservation of Energy states which of the following?
   a. kinetic energy is conserved
   b. potential energy is conserved
   c. the sum of kinetic energy and potential energy is conserved
   d. all of the above
29. Which of the following is not a form of kinetic energy?
   a. chemical energy
   b. electrical energy
   c. light energy
   d. mechanical energy

30. Which of the following is a form of potential energy?
   a. chemical energy
   b. nuclear energy
   c. both (a) and (b)
   d. neither (a) nor (b)

31. When dividing these numbers, how many significant digits should be in your answer?
   \[
   \frac{3.185}{2.08}
   \]
   a. 3
   b. 2
   c. 1
   d. 0

32. When multiplying these numbers, how many significant digits should be in your answer?
   \[
   0.0035 \times 7.348
   \]
   a. 5
   b. 4
   c. 3
   d. 2

33. Which of the following is the largest unit of heat?
   a. calorie
   b. Calorie
   c. joule
   d. kilojoule

34. Which of the following is the smallest unit of heat?
   a. calorie
   b. Calorie
   c. decijoule
   d. joule

35. On a stove we have two pots of boiling water. Pot 1 contains 1 liter of water and pot 2 contains 2 liters of water. Which of the following statements is true?
   a. pot 2 is hotter than pot 1
   b. pot 2 has a larger heat content than pot 1
   c. both (a) and (b) are true
   d. both (a) and (b) are false
36. Water and carbon tetrachloride are both liquids at room temperature. The specific heat of water is 1.00 cal/g-°C. The specific heat of carbon tetrachloride is 0.21 cal/g-°C. When equal amounts of heat are added to samples of water and carbon tetrachloride, each of which weighs 5.00 grams, it was observed that the temperature of the water increased from 25.0°C to 30.0°C. If the initial temperature of the carbon tetrachloride sample was also 25.0°C what is the final temperature of the carbon tetrachloride sample?
   a. 23.8°C  
   b. 25.0°C  
   c. 30.0°C  
   d. 48.8°C

37. If a certain amount of heat is added to a 30.0 gram sample of water the temperature of the sample increases from 27.0°C to 57.0°C. If this same amount of heat is added to a 90.0 gram sample of water initially at 40.0°C what will be the final temperature of the water?
   a. 30°C  
   b. 50°C  
   c. 70°C  
   d. 90°C

38. How much energy is required to heat 40.0 grams of copper from 25.0°C to 75.0°C? [specific heat of copper = 0.092 cal/g-°C]
   a. 92 calories  
   b. 184 calories  
   c. 200 calories  
   d. 276 calories

39. If 47.0 calories of energy raised the temperature of a lead sample from 28.3°C to 30.1°C what is the mass of the sample? [specific heat of lead = 0.0380 cal/g-°C]
   a. 26.1 g  
   b. 687 g  
   c. 1.24 × 10³ g  
   d. 2.27 × 10³ g

40. Which of the following is true about the specific heat of water?
   a. it is much smaller than that of most other materials  
   b. it is about the same as that of most other materials  
   c. it is much larger than that of most other materials  
   d. it depends on the size of the sample