1. In a laboratory experiment, the melting point of compound *A* was determined to be 82.6°C. If the accepted value is 80.5°C, what is the percent error in this determination? (Show proper significant figures)
   (1) 2.5 (3) 2.71
   (2) 2.6 (4) 2.54

2. The accepted value for the molar volume of a gas is 22.4 liters. In a laboratory experiment, a student determines the value to be 24.8 liters. What is the percent error of the student's measurement?
   (1) 0.107% (3) 12.0%
   (2) 0.120% (4) 10.7%

3. Which temperature represents absolute zero?
   (1) 0 K (3) 273 K
   (2) 0°C (4) 273°C

4. What is the sum of 0.0421 g + 5.263 g + 2.13 g to the correct number of significant digits?
   (1) 7 g (3) 7.44 g
   (2) 7.4 g (4) 7.435 g

5. The volume of a gas sample is 22.4 liters at STP. The density of the gas is 1.34 grams per liter. What is the mass of the gas sample, expressed to the correct number of significant figures?
   (1) 30.0 g (3) 17 g
   (2) 16.7 g (4) 30 g

6. In a laboratory exercise to determine the density of a substance, a student found the mass of the substance to be 6.00 grams and the volume to be 2.0 milliliters. Expressed to the correct number of significant figures, the density of the substance is
   (1) 3.000 g/ml (3) 3.0 g/ml
   (2) 3.00 g/ml (4) 3 g/ml

7. The measurement 0.41006 gram, rounded to three significant figures, is expressed as
   (1) 0.41 g (3) 0.4100 g
   (2) 0.410 g (4) 0.4101 g

8. Which quantity expresses the sum of the given masses to the correct number of significant figures?

$$\begin{array}{r} 22.1\ \text{g} \\ 375.66\ \text{g} \\ +\ 5400.132\ \text{g} \\ \hline \end{array}$$

   (1) 5800 g (3) 5797.9 g
   (2) 5798 g (4) 5797.892 g

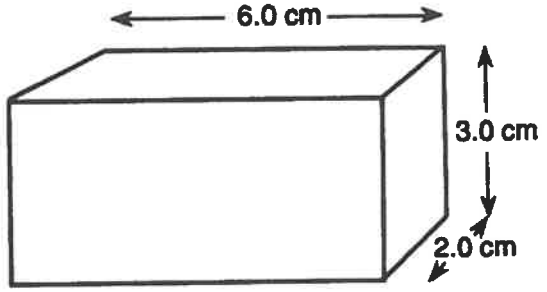
9. Which measurement has the greatest number of significant figures?
   (1) 6.060 mg (3) 60600 mg
   (2) 606 mg (4) 60.6 mg

10. How many kiloJoules are equivalent to 10 Joules?
    (1) 1000 kJ (3) 0.001 kJ
    (2) 10,000 kJ (4) 0.01 kJ

11. Which of the following substances is made up of particles with the highest average kinetic energy?
    (1) $CO_2(g)$ at 25°C (3) $Br_2(\ell)$ at 20°C
    (2) $H_2O(\ell)$ at 30°C (4) Fe(s) at 35°C

12. Which Kelvin temperature is equal to –73°C?
    (1) 200 K (3) 100 K
    (2) 346 K (4) 173 K

13. The solid object shown below has a mass of 162.2 grams.



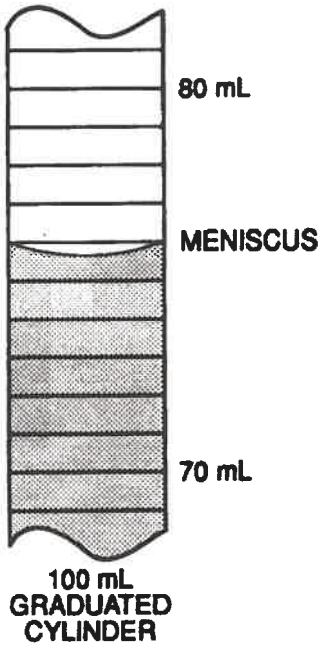
    What is the density of the object to the correct number of significant figures?
    (1) 4.505 g/cm^3 (3) 0.2219 g/cm^3
    (2) 4.5 g/cm^3 (4) 0.22 g/cm^3

14. Which mass measurement contains four significant figures?
    (1) 0.086 g (3) 1003 g
    (2) 0.431 g (4) 3870 g

15. Which of the following statements contained in a student's laboratory report is a conclusion?
    (1) The gas is hydrogen.
    (2) The gas burns in air.
    (3) A gas is evolved.
    (4) The gas is insoluble in water.

16. As ice cools from 273 K to 263 K, the average kinetic energy of its molecules will
    (1) decrease
    (2) increase
    (3) remain the same

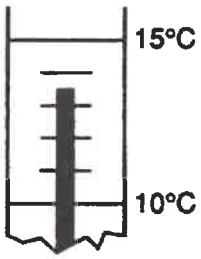
17. The diagram below shows a section of a 100-milliliter graduated cylinder.



When the meniscus is read to the correct number of significant figures, the volume of water in the cylinder would be recorded as
    (1) 75.7 ml
    (2) 75.70 ml
    (3) 84.3 ml
    (4) 84.30 ml

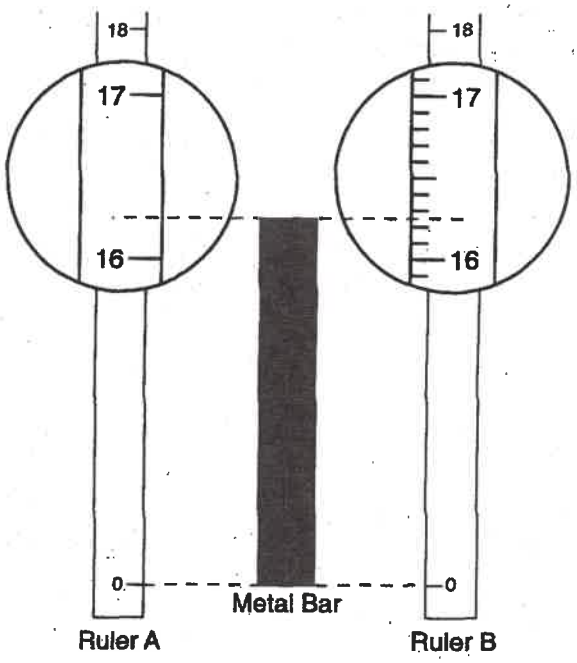
18. Which measurement contains three significant figures?
    (1) 0.05 g
    (2) 0.050 g
    (3) 0.056 g
    (4) 0.0563 g

19. The diagram below represents a portion of a thermometer that is measuring the temperature of a solution.



According to the thermometer, the temperature of the solution is
    (1) 16.5°C
    (2) 13.50°C
    (3) 16.50°C
    (4) 13.5°C

20. The diagram below represents a metal bar and two centimeter rulers, *A* and *B*. Portions of the rulers have been enlarged to show detail.



What is the greatest degree of precision to which the metal bar can be measured by ruler *A* and by ruler *B*?
    (1) to the nearest tenth by both rulers
    (2) to the nearest hundredth by both rulers
    (3) to the nearest tenth by ruler *A* and to the nearest hundredth by ruler *B*
    (4) to the nearest hundredth by ruler *A* and to the nearest tenth by ruler *B*

21. Energy is being added to a given sample. Compared to the Celsius temperature of the sample, the Kelvin temperature
    (1) will always be 273° greater
    (2) will always be 273° lower
    (3) will have the same reading at 273°
    (4) will have the same reading at 0°

22. In an experiment the gram atomic mass of magnesium was determined to be 24.7. Compared to the accepted value 24.3, the percent error for this determination was
    (1) 98.4 (3) 1.65
    (2) 0.400 (4) 24.7

23. Which temperature is equal to +20 K?
    (1) –253°C (3) 253°C
    (2) –293°C (4) 293°C

24. If the rules for significant figures are observed in the addition example, how should the total for this addition be rewritten?

$$\begin{array}{r} 35.7 \\ 432.33 \\ 5,142.312 \\ \hline 5,610.342 \end{array}$$

    (1) 5,610.3 (3) 5,610.340
    (2) 5,610.34 (4) 5,610.00

25. A student investigated the physical and chemical properties of a sample of an unknown gas and then identified the gas. Which statement represents a conclusion rather than an experimental observation?
    (1) When placed in the gas, a flaming splint stops burning.
    (2) The gas is colorless.
    (3) When the gas is bubbled into limewater, the liquid becomes cloudy.
    (4) The gas is carbon dioxide.

26. Which quantity is equivalent to 50 kiloJoules?
    (1) 5×10^4 J (3) 5000 J
    (2) 5×10^3 J (4) 0.05 J

27. Different masses of copper and iron have the same temperature. Compared to the average kinetic energy of the copper atoms, the average kinetic energy of the iron atoms is
    (1) less (3) the same
    (2) greater

28. During a laboratory activity, a student combined two solutions. In the laboratory report, the student wrote "A yellow color appeared." The statement represents the student's recorded
    (1) inference (3) observation
    (2) hypothesis (4) conclusion

29. A liquid's freezing point is –38°C and its boiling point is 357°C. What is the number of Kelvin between the boiling point and the freezing point of the liquid?
    (1) 668 (3) 319
    (2) 395 (4) 592

30. At which temperature would the molecules in a one gram sample of water have the *lowest* average kinetic energy?
    (1) 5°C (3) –100°C
    (2) 5 K (4) 100 K