1. During a laboratory activity to investigate reaction rate, a student reacts 1.0-gram samples of solid zinc with 10.0-milliliter samples of HCl(aq). The table below shows information about the variables in five experiments the student performed.

Reaction of Zn(s) with HCl(aq)

Experiment	Description of Zinc Sample	HCl(aq) Concentration (M)	Temperature (K)
1	lumps	0.10	270.
2	powder	0.10	270.
3	lumps	0.10	290.
4	lumps	1.0	290.
5	powder	1.0	280.

Which two experiments can be used to investigate the effect of the concentration of HCl(aq) on the reaction rate?

A) 1 and 3   B) 1 and 5   C) 4 and 2   D) 4 and 3

2. 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

A) conclusion   B) observation
C) hypothesis   D) inference

3. 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?
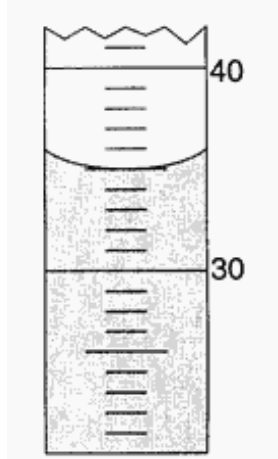
A) The gas is colorless.
B) The gas is carbon dioxide.
C) When the gas is bubbled into limewater, the liquid becomes cloudy.
D) When placed in the gas, a flaming splint stops burning.

4. Which of the following statements contained in a student's laboratory report is a conclusion?

A) A gas is evolved.
B) The gas is insoluble in water.
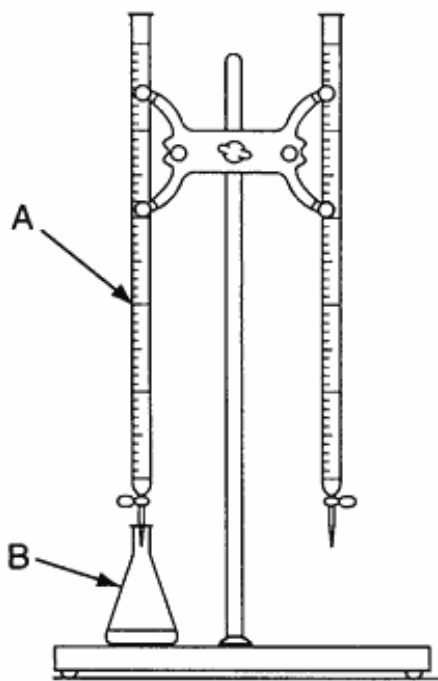C) The gas is hydrogen.
D) The gas burns in air.

5. The diagram below represents a portion of a 100-milliliter graduated cylinder.

What is the reading of the meniscus?

A) 35.0 mL   B) 36.0 mL
C) 44.0 mL   D) 45.0 mL

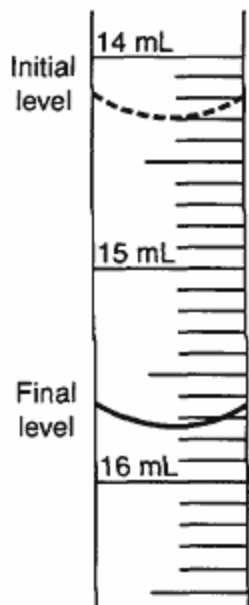6. The diagram below shows a laboratory setup that can be used in a titration.

Which pieces of equipment are indicated by arrows *A* and *B*, respectively?

A) buret and Erlenmeyer flask
B) buret and volumetric flask
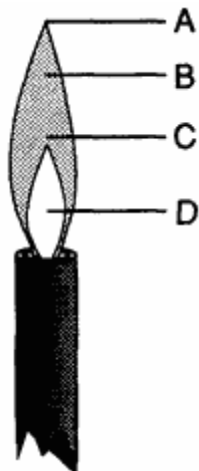C) pipet and Erlenmeyer flask
D) pipet and volumetric flask

7. The diagram below represents a section of a buret containing acid used in an acid-base titration.

| 14 mL
Initial level
| 15 mL
Final level
| 16 mL

What is the total volume of acid that was used?

A) 1.10 mL   B) 1.30 mL
C) 1.40 mL   D) 1.45 mL

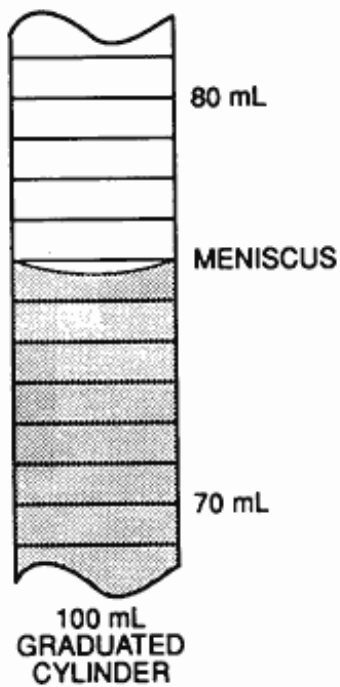8. The diagram below shows the upper part of a laboratory burner.

A
B
C
D

Which letter represents the hottest part of the burner flame?

A) *A*   B) *B*   C) *C*   D) *D*

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


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80 mL

MENISCUS

70 mL
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100 mL
GRADUATED
CYLINDER
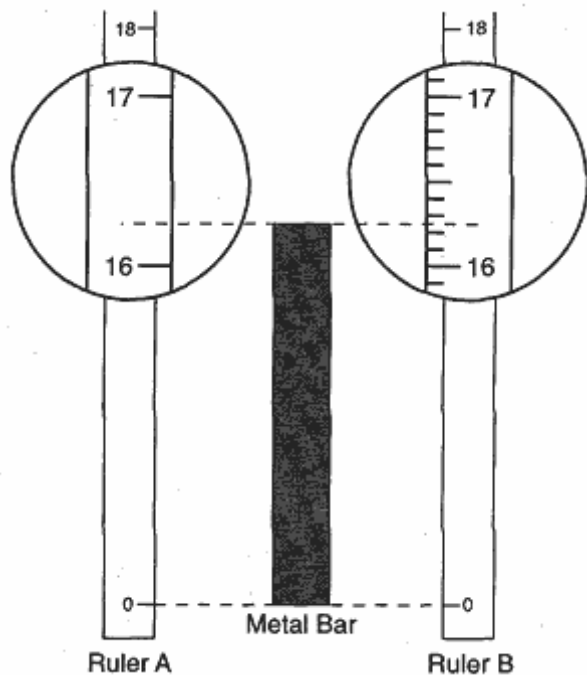
When the meniscus is read to the correct number of significant figures, the volume of water in the cylinder would be recorded as

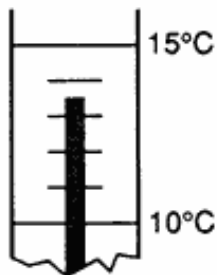A) 75.7 ml   B) 75.70 ml
C) 84.3 ml   D) 84.30 ml

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

Ruler A   Metal Bar   Ruler B

What is the greatest degree of precision to which the metal bar can be measured by ruler *A* and by ruler *B* ?

A) to the nearest tenth by both rulers

B) to the nearest hundredth by both rulers

C) to the nearest tenth by ruler *A* and to the nearest hundredth by ruler *B*

D) to the nearest hundredth by ruler *A* and to the nearest tenth by ruler *B*

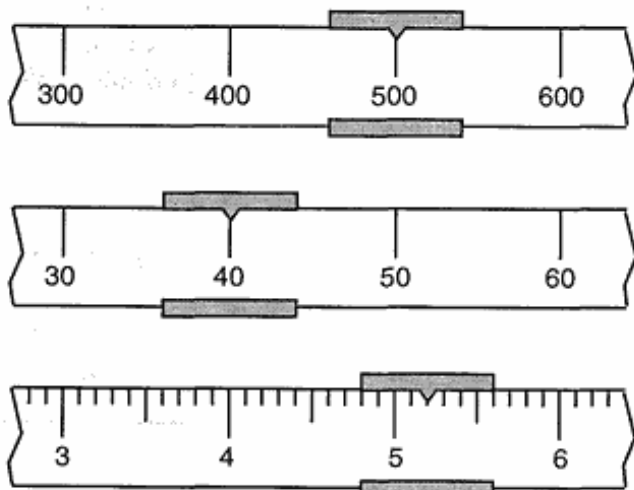11. The diagram below represents a portion of a thermometer that is measuring the temperature of a solution.

According to the thermometer, the temperature of the solution is

A) 13.50°C   B) 13.5°C

C) 16.50°C   D) 16.5°C

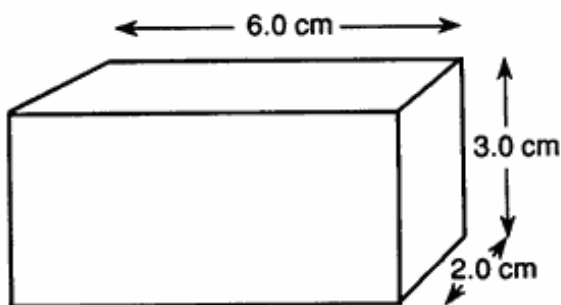12. The diagram below represents a portion of a triple-beam balance.

If the beams are in balance with the riders in the positions shown, what is the total mass of the object?

A) 540.20 g   B) 540.52 g

C) 545.20 g   D) 545.52 g

13. A sample of an element has a mass of 34.261 grams and a volume of 3.8 cubic centimeters. To which number of significant figures should the calculated density of the sample be expressed?

A) 5   B) 2   C) 3   D) 4

14. Which quantity of heat is equal to 200. joules?

A) 20.0 kJ   B) 2.00 kJ

C) 0.200 kJ   D) 0.0200 kJ

15. A temperature of 37°C is equivalent to a temperature of

A) 98.6 K   B) 236 K

C) 310. K   D) 371 K

16. Which kelvin temperature is equal to 56°C?

A) -329 K   B) -217 K

C) 217 K   D) 329 K

17. Which mass measurement contains four significant figures?

A) 0.086 g   B) 0.431 g

C) 1003 g   D) 3870 g

18. Expressed to the correct number of significant figures, the sum of two masses is 445.2 grams. Which two masses produce this answer?

   A) 210.10 g + 235.100 g
   B) 210.100 g + 235.10 g
   C) 210.1 g + 235.1 g
   D) 210.10 g + 235.10 g

19. A solution contains 12.55 grams of a solid dissolved in 50.0 milliliters of water. What is the number of grams of solid dissolved per milliliter of water, rounded to the correct number of significant figures?

   A) 0.25 g/mL   B) 0.251 g/mL
   C) 0.3 g/mL   D) 0.2510 g/mL

20. Which measurement contains a total of three significant figures?

   A) 0.12   B) 012   C) 120   D) 120.

21. The mass of a solid is 3.60 grams and its volume is 1.8 cubic centimeters. What is the density of the solid, expressed to the correct number of significant figures?

   A) 2 g/cm³   B) 2.0 g/cm³
   C) 0.5 g/cm³   D) 0.50 g/cm³

22. 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?

   A) 0.22 g/cm³   B) 0.2219 g/cm³
   C) 4.5 g/cm³   D) 4.505 g/cm³

23. The following weighings were made during a laboratory exercise:

    Mass of evaporating dish.....59.260 g
    Mass of sugar sample ....1.61 g

    What is the total mass of the evaporating dish plus the sample, expressed to the proper number of significant figures?

    A) 60.870 g   B) 60.87 g
    C) 60.9 g   D) 61 g

24. A cube has a volume of 8.0 cm³ and a mass of 21.6 grams. The density of the cube, in grams per cubic centimeter, is best expressed as

    A) 2.7   B) 2.70
    C) 0.37   D) 0.370

25. A student measures the mass and volume of a piece of aluminum. The measurements are 25.6 grams and 9.1 cubic centimeters. The. student calculates the density of the aluminum. What is the percent error of the student's calculated density of aluminum?

    A) 1%   B) 2%   C) 3%   D) 4%

26. A student calculated the percent by mass of water in a hydrate as 14.2%. A hydrate is a compound that contains water as part of its crystal structure. If the accepted value is 14.7%, the student's percent error was

    A) $\frac{0.5}{14.2} \times 100$ B) $\frac{14.7}{14.2} \times 100$
    C) $\frac{0.5}{14.7} \times 100$ D) $\frac{14.2}{14.7} \times 100$

27. A student determined that the percent of H_2O in a hydrate was 39.0%. The percent of H_2O in this hydrate is 36.0% according to an accepted chemistry reference. What is the student's percent of error?

    A) 9.1% B) 8.3% C) 3.0% D) 11%

28. What is the safest method for diluting concentrated sulfuric acid with water?

    A) add the acid to the water quickly
    B) add the water to the acid quickly
    C) add the acid to the water slowly while stirring
    D) add the water to the acid slowly while stirring

29. Which activity is considered a proper laboratory technique?

    A) heating the contents of an open test tube held vertically over a flame
    B) heating the contents of a test tube that has been closed with a stopper
    C) adding water to concentrated acids
    D) adding concentrated acids to water

30. A student wishes to prepare approximately 100 milliliters of an aqueous solution of 6 M HCl using 12 M HCl. Which procedure is correct?

    A) adding 50 ml of 12 M HCl to 50 ml of water while stirring the mixture steadily
    B) adding 50 ml of 12 M HCl to 50 ml of water, and then stirring the mixture steadily
    C) adding 50 ml of water to 50 ml of 12 M HCl while stirring the mixture steadily
    D) adding 50 ml of water to 50 ml of 12 M HCl, and then stirring the mixture steadily