1. 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) conclusion
   2) observation
   3) hypothesis
   4) inference

2. 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) The gas is colorless.
   2) The gas is carbon dioxide.
   3) When the gas is bubbled into limewater, the liquid becomes cloudy.
   4) When placed in the gas, a flaming splint stops burning.

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

4. A student intended to make a salt solution with a concentration of 10.0 grams of solute per liter of solution. When the student's solution was analyzed, it was found to contain 8.90 grams of solute per liter of solution. What was the percent error in the concentration of the solution?
   1) 1.10%
   2) 8.90%
   3) 11.0%
   4) 18.9%

5. A student determined in the laboratory that the percent by mass of water in $CuSO \cdot 5H_2O$ is 40.0%. If the accepted value is 36%, what is the percent of error?
   1) 0.11%
   2) 1.1%
   3) 11%
   4) 4.0%

6. A student found the boiling point of a liquid to be 80.4ºC. If the liquid's actual boiling point is 80.6ºC, the experimental percent error is equal to
   1) $\frac{80.6 - 80.4}{80.6} \times 100$
   2) $\frac{80.6 - 80.4}{80.4} \times 100$
   3) $\frac{80.5 - 80.4}{80.5} \times 100$
   4) $\frac{80.5 - 80.4}{80.4} \times 100$

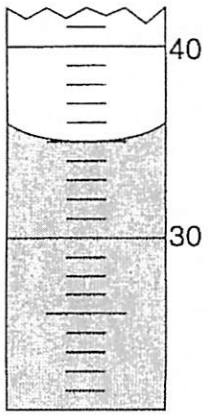
7. A student determined the percentage of water of hydration in $BaCl_2 \cdot 2H_2O$ by using the data in the table below.

Quantity Measured	Value Obtained
mass of $BaCl_2 \cdot 2H_2O$	3.80 grams
mass of $BaCl_2$	3.20 grams
% of water calculated	15.79%

   The accepted percentage value for the water of hydration is 14.75%. What is the student's percent error?
   1) 1.04%
   2) 6.00%
   3) 6.59%
   4) 7.05%

8. A student calculated the percent by mass of water in a sample of $BaCl_2 \cdot 2H_2O$ to be 16.4%, but the accepted value is 14.8%. What was the student's percent error?
   1) $\frac{14.8}{16.4} \times 100\%$
   2) $\frac{16.4}{14.8} \times 100\%$
   3) $\frac{1.6}{14.8} \times 100\%$
   4) $\frac{14.8}{1.6} \times 100\%$

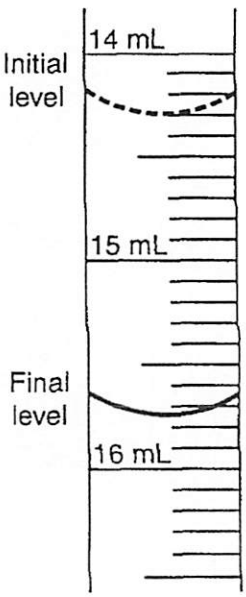
9. The diagram below represents a portion of a 100-milliliter graduated cylinder.



What is the reading of the meniscus?

1) 35.0 mL
2) 36.0 mL
3) 44.0 mL
4) 45.0 mL

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



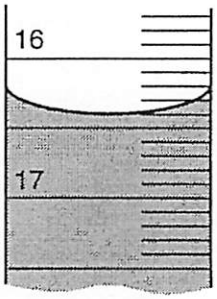
What is the total volume of acid that was used?

1) 1.10 mL
2) 1.30 mL
3) 1.40 mL
4) 1.45 mL

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

1) –329 K
2) –217 K
3) 217 K
4) 329 K

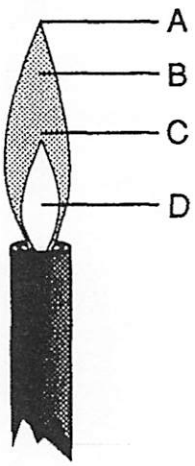
12. The diagram below shows a portion of a buret.



What is the meniscus reading in milliliters?

1) 16.00
2) 16.40
3) 17.00
4) 17.60

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



Which letter represents the hottest part of the burner flame?

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

14. Which kelvin temperature is equivalent to -24ºC?

1) 226 K
2) 249 K
3) 273 K
4) 297 K

15. A student calculates the density of an unknown solid. The mass is 10.04 grams, and the volume is 8.21 cubic centimeters. How many significant figures should appear in the final answer?

1) 1
2) 2
3) 3
4) 4

16. A sample of water is being heated from 20ºC to 30ºC , and the temperature is recorded every 2 minutes. Which table would be most appropriate for recording the data?

1)

Time (min)	Temp (°C)
0	
2	
4	
6	
8	
10	

2)

Time (min)	Temp (°C)
20	
22	
24	
26	
28	
30	

3)

Temp (°C)	Time (min)
0	
2	
4	
6	
8	
10	

4)

Temp (°C)	Time (min)
20	
22	
24	
26	
28	
30	

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

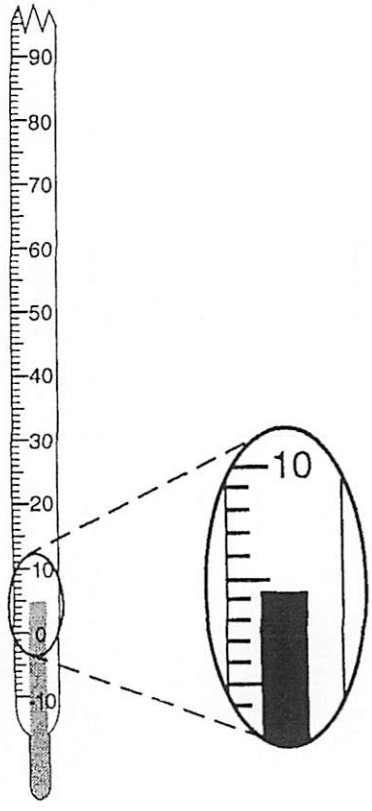
18. Expressed to the correct number of significant figures, the sum of two masses is 445.2 grams. Which two masses produce this answer?
    1) 210.10 g + 235.100 g
    2) 210.100 g + 235.10 g
    3) 210.1 g + 235.1 g
    4) 210.10 g + 235.10 g

19. During a laboratory experiment, a sample of aluminum is found to have a mass of 12.50 grams and a volume of 4.6 milliliters.

    What is the density of this sample, expressed to the correct number of significant figures?
    1) 2.717 g/mL
    2) 2.72 g/mL
    3) 3 g/mL
    4) 2.7 g/mL

20. What is the safest method for diluting concentrated sulfuric acid with water?
    1) add the acid to the water quickly
    2) add the water to the acid quickly
    3) add the acid to the water slowly while stirring
    4) add the water to the acid slowly while stirring

21. The diagram below represents a Celsius thermometer recording a certian temperature.



What is the correct reading of the thermometer?
    1) 5ºC
    2) 4.3ºC
    3) 0.3ºC
    4) 4ºC

22. A student wishes to prepare approximately 100 milliliters of an aqueous solution of 6 M HCl using 12 M HCl. Which procedure is correct?
    1) adding 50 ml of 12 M HCl to 50 ml of water while stirring the mixture steadily
    2) adding 50 ml of 12 M HCl to 50 ml of water, and then stirring the mixture steadily
    3) adding 50 ml of water to 50 ml of 12 M HCl while stirring the mixture steadily
    4) adding 50 ml of water to 50 ml of 12 M HCl, and then stirring the mixture steadily

23. Which activity is considered a proper laboratory technique?
    1) heating the contents of an open test tube held vertically over a flame
    2) heating the contents of a test tube that has been closed with a stopper
    3) adding water to concentrated acids
    4) adding concentrated acids to water

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

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

26. 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?
    1) 0.25 g/mL
    2) 0.251 g/mL
    3) 0.3 g/mL
    4) 0.2510 g/mL

27. Which measurement contains a total of three significant figures?
    1) 0.12
    2) 012
    3) 120
    4) 120.

28. What is the product of (2.324 cm × 1.11 cm) expressed to the correct number of significant figures?
    1) 2.58 cm^2
    2) 2.5780 cm^2
    3) 2.5796 cm^2
    4) 2.57964 cm^2

29. 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?
    1) 9.1%
    2) 8.3%
    3) 3.0%
    4) 11%

30. In an experiment, a student found that the percent of oxygen in a sample of $KClO_3$ was 42.3%. If the accepted value is 39.3%, the experimental percent error is
    1) $\frac{42.3}{39.3} \times 100\%$
    2) $\frac{39.3}{42.3} \times 100\%$
    3) $\frac{3.0}{42.3} \times 100\%$
    4) $\frac{3.0}{39.3} \times 100\%$

31. Base your answer to the following question on the information below.

    A lightbulb contains argon gas at a temperature of 295 K and at a pressure of 75 kilopascals. The lightbulb is switched on, and after 30 minutes its temperature is 418 K.

    What Celsius temperature is equal to 418 K?

32. A student determines the density of zinc to be 7.56 grams per milliliter. If the accepted density is 7.14 grams per milliliter, what is the student's percent error?
    - Show a correct numerical setup.
    - Record your answer.

Base your answers to questions **33** and **34** on the information below.

Archimedes (287–212 BC), a Greek inventor and mathematician, made several discoveries important to science today. According to legend, Hiero, the king of Syracuse, commanded Archimedes to find out if the royal crown was made of gold, only. The king suspected that the crown consisted of a mixture of gold, tin and copper.

Archimedes measured the mass of the crown and the total amount of water displaced by the crown when it was completely submerged. He repeated the procedure using individual samples, one of gold, one of tin, and one of copper. Archimedes was able to determine that the crown was not made entirely of gold without damaging it.

33. Determine the volume of a 75-gram sample of gold at STP.

34. Identify *one* physical property that Archimedes used in his comparison of the metal samples.

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35. A plan is being developed for an experiment to test the effect of concentrated strong acids on a metal surface protected by various coatings. Some safety precautions would be the wearing of chemical safety goggles, an apron, and gloves. State one additional safety precaution that should be included in the plan.

36. A student used a balance and a graduated cylinder to collect the following data:

Sample mass	10.23 g
Volume of water	20.0 mL
Volume of water and sample	21.5 mL

a Calculate the density of the element. Show your work. Include the appropriate number of significant figures and proper units.

b If the accepted value is 6.93 grams per milliliter, calculate the percent error.

c What error is introduced if the volume of the sample is determined first?

37. Using a triple beam balance and a graduated cylinder, a student collected data on a sample of an element:

Mass of sample -	10.9 g
Volume of water -	30.0 ml
Volume of water and sample -	34.0 ml

a) Calculate the density of the sample. Show all work and use significant figures and units.

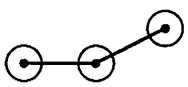
b) Based on Reference Table S, what element might the sample be?

Base your answers to questions **38** through **40** on the information below.

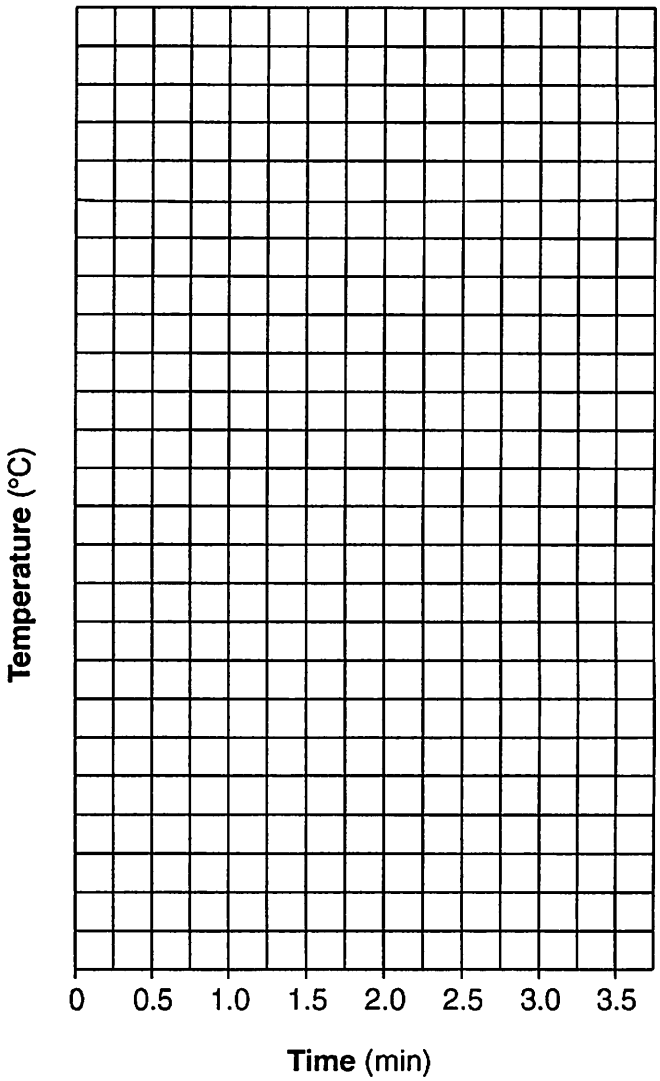
In a laboratory experiment, 10.00 grams of an unknown solid is added to 100.0 milliliters of water and the temperature of the resulting solution is measured over several minutes, as recorded in the table below.

Data Table

Time (minutes)	Temperature (°C)
0	24.0
0.5	28.5
1.0	31.0
1.5	34.5
2.0	41.0
2.5	45.5
3.0	46.5

Example: 

Change in Temperature During the Dissolving of a Solid



38. On the grid provided, mark an appropriate scale on the axis labeled "Temperature (°C)." An appropriate scale is one that allows a trend to be seen.

39. Given the statement:

The unknown solid is either sodium hydroxide or lithium bromide, and both of these compounds dissolve in water exothermically.

a) Explain how the experimental data support the statement.

b) State specific information from Reference Table *I* to support the statement.

40. Plot the data from the data table. Circle and connect the points.