Name: _____

1) In the laboratory, a student determined the percent by mass of water in a hydrated salt to be 17.3 percent. What is the percent error if the accepted value is 14.8 percent?

A) 27.1%   C) 2.50%
B) 16.9%   D) 5.92%

2) Matter is defined as anything that occupies space and has

A) color   C) mass
B) odor   D) a definite shape

3) Which milligram quantity contains a total of four significant figures?

A) 3,100 mg   C) 0.3010 mg
B) 3,010 mg   D) 30,001 mg

4) In the laboratory a student determined the atomic mass of an element to be 28.02. The accepted value is 28.086. What is the difference between the student's observed value and the accepted value, expressed to the correct number of significant figures?

A) 0.10   C) 0.066
B) 0.07   D) 0.1

5) Using the rules for significant figures, the sum of 0.027 gram and 0.0023 gram should be expressed as

A) 0.0293 gram   C) 0.029 gram
B) 0.03 gram   D) 0.030 gram

A student collected the data shown below to determine experimentally the density of distilled water.

Mass of graduated cylinder + distilled H_2O sample..... 163 g
Mass of empty graduated cylinder..... 141 g
Mass of distilled H_2O sample..... ? g
Volume of distilled H_2O sample..... 25.3 mL

Based on the experimental data collected, what is the density of the distilled water?

A) 1.15 g/mL   C) 1.0 g/mL
B) 0.253 g/mL   D) 0.87 g/mL

7) Given: (52.6 cm)(1.214 cm)

What is the product expressed to the correct number of significant figures?

A) 63.9 cm^2 C) 63.86 cm^2
B) 63.8564 cm^2 D) 64 cm^2

8) A student has to measure the diameter of a test tube in order to calculate the tube's volume. Based on the diagram below, the tube's diameter is *closest* to
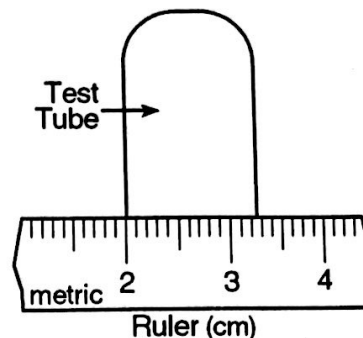

A) 2.32 cm   C) 12.5 cm
B) 3.25 cm   D) 1.25 cm

9) What is the number 0.00034 expressed in proper scientific notation with the correct number of significant digits?

A) 3.40×10^{-4} C) 3.40×10^4
B) 3.4×10^{-4} D) 3.4×10^4

10) A student determined the melting point of a substance to be 55.2°C. If the accepted value is 50.1°C, what is the percent error in the student's determination?

A) 12.0   C) 10.2
B) 9.24   D) 5.10

11) A cube has a volume of 8.0 cm^3 and a mass of 21.6 grams. The density of the cube, in grams per cubic centimeter, is *best* expressed as

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

12) In determining the volume of a mole of gas at STP in the laboratory, a student's experimental value was 3.36 liters *greater* than the accepted value (22.4 L). The percent error contained in the student's value is *closest* to

A) 15.0   C) 19.0
B) 3.36   D) 25.8

13) Which measurement contains three significant figures?

A) 0.05 g   C) 0.056 g
B) 0.050 g   D) 0.0563 g

A

14) The diagram below shows a section of a 100-milliliter graduated cylinder.
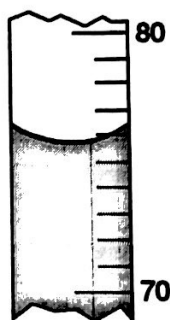
When the meniscus is read to the correct number of significant figures, the volume of water in the cylinder would be recorded as

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

15) To determine the density of an irregularly shaped object, a student immersed the object in 21.2 milliliters of H_2O in a graduated cylinder, causing the level of the H_2O to rise to 27.8 milliliters. If the object had a mass of 22.4 grams, what was the density of the object?

A) 27.8 g/mL   C) 3.4 g/mL
B) 3.0 g/mL   D) 6.6 g/mL
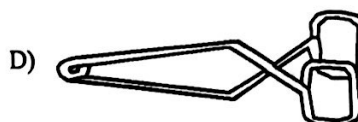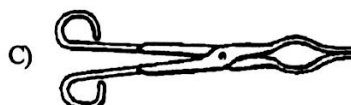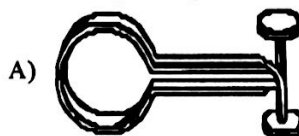
16) Which diagram represents a graduated cylinder?
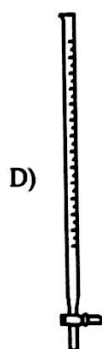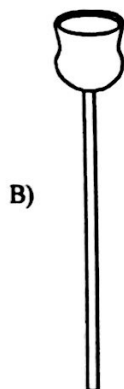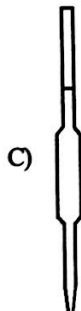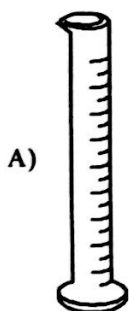
17) The diagram below represents a portion of a triple beam balance.
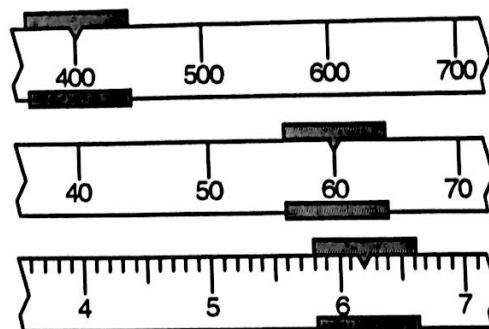
If the beams are in balance, with the riders in the position shown, what is the total mass in grams of the object being massed?

A) 460.62   C) 466.62
B) 466.20   D) 460.20

18) Which diagram represents a test tube holder (clamp)?

19) 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) 60.9 g   C) 61 g
B) 60.87 g   D) 60.870 g

Arsenic is often obtained by heating the ore arsenopyrite, FAsS. The decomposition of FeAsS is represented by the balanced equation below.

$$FeAsS(s) \xrightarrow{heat} FeS(s) + As(g)$$
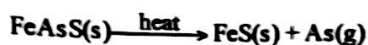
In the solid phase, arsenic occurs in two forms. One form, yellow arsenic, has a density of 1.97 g/cm^3 at STP. The other form, gray arsenic, has a density of 5.78 g/cm^3 at STP. When arsenic is heated rapidly in air, arsenic(*III*) oxide is formed.

Although arsenic is toxic, it is needed by the human body in very small amounts. The body of a healthy human adult contains approximately 5 milligrams of arsenic.

20) Using the information from the reading passage, convert the mass of arsenic found in the body of a healthy human adult to grams.

21) The distance between the earth and the sun is 85.0 million miles. (1 km= 0.62 miles). How many kilometers is this? *[Express your answer to the correct number of significant figures.]*

22) A student reports three trials to measure the density of an unknown metal. The percent error in these trials is given in the table below.

Trial Count	Trial 1	Trial 2	Trial 3
Percent Error	0.01%	0.05%	0.02%

Indicate the most accurate value and explain your answer.

23) 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. Include the appropriate number of significant figures and proper units. [*Show your work.*]

(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?

24) A hydrated compound contains water molecules within its crystal structure. The percent composition by mass of water in the hydrated compound $CaSO_4 \cdot H_2O$ has an accepted value of 20.9%. A student did an experiment and determined that the percent composition by mass of water in $CaSO_4 \cdot H_2O$ was 21.4%.

Calculate the percent error of the student's experimental result. [*Your response must include both a correct numerical setup and the calculated result.*]

25) A piece of Mg(s) has a volume of 0.0640 cubic centimeters. The volume of the piece of Mg(s) is expressed to what number of significant figures?

Regents Chem Math & Equipment Review Key

1) B $\frac{mv - av}{av} \times 100 = \frac{17.3 - 14.8}{14.8} \times 100$

2) C

3) C 0.3010 ̲

4) B $28.086 - 28.02 = 0.066 = 0.07$ Round to the least # of dec. places

5) C $0.027 + 0.0023 = 0.0293 = 0.029 \, g$ ←

6) D   mass $H_2O = 163g - 141g = 22g$; $D = \frac{m}{V} = \frac{22g}{25.3mL} = 0.87 \, g/mL$
       $V \, H_2O = 25.3mL$

7) A $(52.6)(1.214) = 63.8564 = 63.9 \, cm^2$ Round to the least # of sig figs

8) D

9) B $0.00034 \rightarrow 3.4 \times 10^{-4}$ ←   -negative exponent, # is less than 1
       (2 s.f.)   (2 s.f.)   -decimal moved 4 places until one nonzero digit is to the left of it

10) C $\frac{55.2°C - 50.1°C}{50.1°C} \times 100 = 10.1796 = 10.2\%$

11) A $D = 21.6g / 8.0cm^3 = 2.7 \, g/cm^3$ 2 s.f.

12) A $mv = 22.4 + 3.36$ $\% \, error = \frac{25.8L - 22.4L}{22.4L} \times 100 = 15.1\%$
       $mv = 25.8L$

13) D $0.0563g$ ̲ ̲

14) B   you must estimate one place beyond the smallest readable increment. The grad cyl. could be read to the "ones" place so estimate the "tenth" place.

15) C $V = 27.8mL - 21.2mL = 6.6mL$ $D = \frac{m}{V} = \frac{22.4g}{6.6mL} = 3.4 \, g/mL$

16) A

17) B

18) D

19) B $59.260g + 1.61g = 60.87g$ ← See rule in Q # 4

20) $5 mg \times \dfrac{1g}{1000 mg} = \boxed{0.005g}$

21) 85.0 million mi = 85,000,000 mi

$85,000,000 mi \times \dfrac{1 km}{0.62 mi} = 137,096,774.2 km$

$\downarrow$

$$\boxed{140,000,000 \, km \\ OR \\ 1.4 \times 10^8 \, km}$$

22) Trial I was the most accurate b/c it had the least percent error, therefore the measured value was closest to the accepted value.

23)
a) $V_{sample} = 21.5 mL - 20.0 mL = 1.5 mL$ $D = \dfrac{m}{V} = \dfrac{10.23g}{1.5 mL}$

   $m_{sample} = 10.23g$

$D = 6.82 g/mL$

$\downarrow$

$\boxed{6.8 g/mL}$

b) $\% error = \dfrac{6.8 - 6.93}{6.93} \times 100 = -1.9\%$

$\downarrow$

$\boxed{1.9\%}$

c) The sample's mass would change from being wet.

24) $\dfrac{21.4\% - 20.9\%}{20.9\%} \times 100 = \boxed{2.39\%}$

25) 0.0640 cm³

$\boxed{3 \text{ sig figs}}$