## Ch. 1 practice questions

1. The statement "The total mass of materials is not affected by a chemical change in those materials" is called a(n)
   A) observation
   B) measurement
   C) theory
   D) natural law
   E) experiment

2. Which of the following metric relationships is incorrect?
   A) 1 microliter = $10^{-6}$ liters
   B) 1 gram = $10^{3}$ kilograms
   C) $10^{3}$ milliliters = 1 liter
   D) 1 gram = $10^{2}$ centigrams
   E) 10 decimeters = 1 meter

3. Convert 0.3980 m to mm.
   A) 398.0 mm
   B) $3.980 \times 10^{-3}$ mm
   C) $3.980 \times 10^{-4}$ mm
   D) 0.03980 mm
   E) none of these

4. 6.1 seconds contain this many picoseconds.
   A) $6.1 \times 10^{12}$
   B) $6.1 \times 10^{-12}$
   C) $6.1 \times 10^{-9}$
   D) $6.1 \times 10^{9}$
   E) $6.1 \times 10^{15}$

5. The degree of agreement among several measurements of the same quantity is called _____. It reflects the reproducibility of a given type of measurement.
   A) accuracy
   B) error
   C) precision
   D) significance
   E) certainty

6. You measure water in two containers: a 10-mL graduated cylinder with marks at every mL, and a 1-mL pipet marked at every 0.1 mL. If you have some water in each of the containers and add them together, to what decimal place could you report the total volume of water?

   A) 0.01 mL
   B) 0.1 mL
   C) 1 mL
   D) 10 mL
   E) none of these

7. A scientist obtains the number 0.045006700 on a calculator. If this number actually has four (4) significant figures, how should it be written?

   A) 0.4567
   B) 0.4501
   C) 0.0450
   D) 0.04500
   E) 0.04501

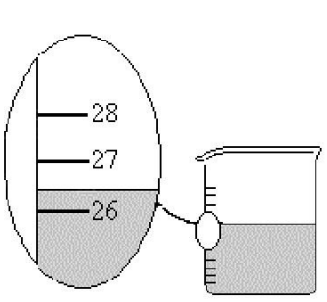
8. Express the number 0.0810 in scientific notation.

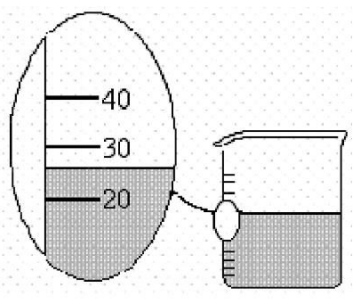
   A) $810 \times 10^{-4}$
   B) $8.10 \times 10^{2}$
   C) $8.1 \times 10^{-2}$
   D) $8.10 \times 10^{-2}$
   E) $0.810 \times 10^{-1}$

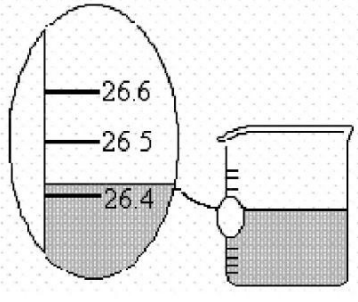
9. Express the number $6.49 \times 10^{-3}$ in common decimal form.

   A) 0.00649
   B) 6.49
   C) 6490
   D) 0.0649
   E) 0.000649

10. The beakers shown below have different precisions as shown.




Suppose you pour the water from these three beakers into one container. What would be the volume in the container reported to the correct number of significant figures?

A) 78.817 mL  B) 78.82 mL  C) 78.8 mL  D) 73.4 mL  E) 79 mL

11. Using the rules of significant figures, calculate the following:

$$\frac{6.167 + 68}{5.10}$$

A) 14.5
B) 16
C) 15
D) 82
E) 14.54

12. How many significant figures should be reported for the difference between 18.6172 mL and 18.57 mL?
A) 1
B) 2
C) 3
D) 4
E) 6

13. What is the best answer to report for $\frac{3.478 \times 1.164 \text{ g}}{2 \text{ mL}} - 0.169 \text{ g/mL}$
A) 1.8510 g/mL
B) 1.851 g/mL
C) 1.85 g/mL
D) 1.9 g/mL
E) 2 g/mL

14. Express the volume 781.2 $cm^3$ in liters.
A) 781.2 L
B) 78.12 L
C) 7.812 L
D) 0.7812 L
E) 0.07812 L

15. In 1928, 29.3 g of a new element was isolated from 660 kg of the ore molybdenite. The percent by mass of this element in the ore was:
A) 44 %
B) 6.6 %
C) 29.3 %
D) 0.0044 %
E) 19.3 %

16. 409 Kelvin equals
A) 136°F
B) 273°F
C) 682°F
D) 136°C
E) 682°C

17. –48.2°C equals
    A) –86.8°F
    B) –119°F
    C) –54.8°F
    D) 119°F
    E) 224.8°F

18. A piece of zinc with a mass of 12.14 g is submerged in 46.3 $cm^3$ of water in a graduated cylinder. The water level increases to 48.0 $cm^3$. The correct value for the density of zinc from these data is:
    A) 7.141 $g/cm^3$
    B) 7.1 $g/cm^3$
    C) 0.14 $g/cm^3$
    D) 0.253 $g/cm^3$
    E) 3.95 $g/cm^3$

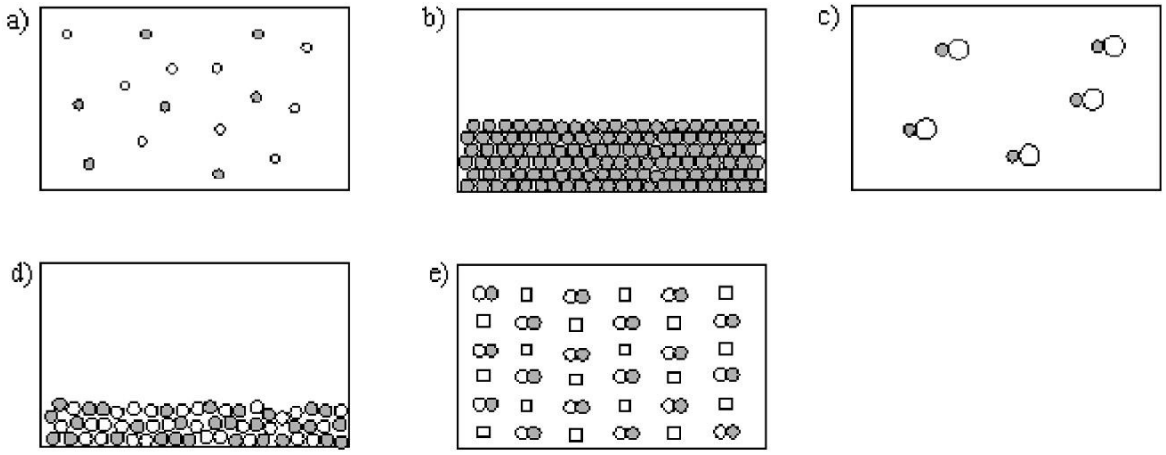
19. The density of a liquid is determined by successively weighing 25, 50, 75, 100, and 125 mL of the liquid in a 250-mL beaker. If volume of liquid is plotted along the horizontal axis, and total mass of beaker plus liquid is plotted on the vertical axis:
    A) The *X*, or horizontal, intercept is the negative value of the weight of the beaker.
    B) The *Y*, or vertical, intercept is the weight of the empty beaker.
    C) The slope of the line is 1.0.
    D) The line will pass through the origin.
    E) The slope of the line is independent of the identity of the liquid.

20. The boiling of water is a
    A) physical change because the water merely disappears
    B) physical change because the gaseous water is chemically the same as the liquid
    C) chemical change because heat is needed for the process to occur
    D) chemical change because a gas (steam) is given off
    E) chemical and physical damage

21. The state of matter for an object that has a definite volume but not a definite shape is
    A) solid state
    B) liquid state
    C) gaseous state
    D) elemental state
    E) mixed state

22. A method of separation that employs a system with two phases of matter, a mobile phase and a stationary phase, is called
    A) filtration
    B) chromatography
    C) distillation
    D) vaporization
    E) homogenization

23. Which of the following statements is false?
    A) Solutions are always homogeneous mixtures.
    B) Some molecules may be composed of only one kind of atom.
    C) Elements can exist as atoms or molecules.
    D) Compounds can exist as atoms or molecules.
    E) At least two of the above statements (A-D) are false.




24. Which of the pictures above best represents a homogeneous mixture of an element and a compound?
    A) option a
    B) option b
    C) option c
    D) option d
    E) option e

Answer Key to practice questions for Ch. 1

1. D
2. B
3. A
4. A
5. C
6. B
7. E
8. D
9. A
10. E
11. C
12. A
13. E
14. D
15. D
16. D
17. C
18. B
19. B
20. B
21. B
22. B
23. D
24. E

# Solutions to Practice Questions for Ch. 1

(1) The statement is a generalization about mass, rather than a particular observation, measurement, or experiment. And it states <u>what</u> happens, rather than explaining <u>why</u> it happens. Therefore it is a <u>law</u> (and not a theory).

(2) 1 gram = $10^{-3}$ kilogram, rather than $10^{3}$ kilograms.

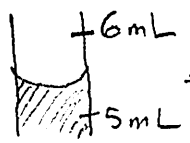
(3) $0.3980\,\text{m} \times \frac{1\,\text{mm}}{10^{-3}\,\text{m}} = 0.3980 \times 10^{3}\,\text{mm} = 398.0\,\text{mm}$

(4) $6.1\,\text{s} \times \frac{1\,\text{ps}}{10^{-12}\,\text{s}} = 6.1 \times 10^{12}\,\text{ps}$

(5) The degree of agreement among several measurements of the same quantity is <u>precision</u>.

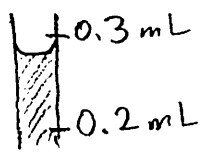
(6) Since the two measured volumes are <u>added</u>, the result will have the same number of digits after the decimal point as the volume with the <u>fewest</u> digits after the decimal point.

10 mL cylinder with 1 mL marks ⇒ can give one digit after decimal point

e.g. 

⇒ ~5.4 mL

1 mL pipet with 0.1 mL marks ⇒ can give two digits after decimal point

e.g. 

⇒ ~0.28 mL

We report the total volume to a precision of 0.1 mL (corresponding to the less precise 10 mL cylinder)

(7) 0.04500 6700 ⇒ 0.04501
not sig. | sig. | use only for rounding

(8) 0.0810 ⇒ 2 leading zeros, including the one before decimal point ⇒ $10^{-2}$
sig.

⇒ $0.0810 = 8.10 \times 10^{-2}$

(9) $10^{-3}$ shifts the decimal point to the left by 3 places. If the decimal is pushed beyond an existing digit, a zero is placed between it and the existing digit every time it happens.

$\overset{\curvearrowleft}{0}\ \overset{\curvearrowleft}{0}\ \overset{\curvearrowleft}{6}.49$

When done with pushing the decimal point, we can add another zero in front of it.

0.00649

Note that the number of zeros to the left of the number in scientific notation format (6.49 in this case) is equal to the magnitude of the exponent (3 in this case)

(10) The number of digits after the decimal point for the value of <u>total</u> volume is equal to the <u>smallest</u> number of digits after the decimal point <u>among the volumes added</u>.

The middle picture corresponds to the least precise volume in terms of no. of digits after the decimal point (volume $\simeq$ 27. mL, with <u>no</u> digits after the decimal point)

Total volume = 26.4 + 26 + 26.42 = 78.82 $\simeq$ 79 mL

(11.) $\dfrac{6.167 + 68}{5.10}$

first we deal with the numerator before we do the division

For addition/subtraction, we keep the smallest number of digits after the decimal point. Since 68 has no digits after the point, the sum will have no digits after the point either. We can keep one digit to prevent accumulation of round-off errors, but 6.167 + 68 = <u>74</u>.167 should be seen as having 2 sig. figs.

$\dfrac{\overbrace{74.167}^{\text{2 sig. figs}}}{\underbrace{5.10}_{\text{3 sig. figs}}} = 14.54 \simeq 15$ we can only keep 2 sig. figs.

(12) 18.6172 ← 4 digits after decimal point
$-\ 18.57$ ← only 2 digits after decimal point
0.0472 ← we can only keep 2 digits after decimal point

$0.0472 \simeq 0.05$ only 1 significant digit

(13) $\dfrac{3.478 \times 1.164}{2} - 0.169$

(a) (b) (c)

First we take care of (a) so that we can proceed with (b), and finally we handle the subtraction in (c).

(a) $\underbrace{3.478}_{4\text{ sig. fig.}} \times \underbrace{1.164}_{4\text{ sig. fig.}} = \underbrace{4.048}_{4\text{ sig. fig.}}$

(b) $\dfrac{\overbrace{4.048}^{4\text{ sig. fig.}}}{\underbrace{2}_{1\text{ sig. fig.}}} = \underbrace{2.}_{1\text{ sig. fig.}}$ ← we cannot treat 2 mL as a count with infinite sig. figs. It is just a volume with only 1 sig. fig.

(c) $2 - 0.169 = 1.821 \simeq 2$

- 2: no digits after decimal point
- 0.169: 3 digits after decimal point
- 1.821: can't have any digits after decimal point

(14) $781.2\ \text{cm}^3 \times \dfrac{1\ \text{mL}}{1\ \text{cm}^3} \times \dfrac{10^{-3}\ \text{L}}{1\ \text{mL}} = 0.7812$

(15) $\%\text{ by mass} = \dfrac{\text{mass of element}}{\text{mass of ore}} \times 100$

We must pay attention to units. The mass of the element is given in grams, whereas the mass of the ore is given in kg.

$\text{mass of ore} = 660\ \text{kg} \times \dfrac{10^3\ \text{g}}{1\ \text{kg}} = 6.6 \times 10^5\ \text{g}$

$\%\text{ by mass} = \dfrac{29.3}{6.6 \times 10^5} \times 100 = 0.0044\%$

(16) $T_{°C} = 409 - 273.15 = 136\,°C$

$T_{°F} = \frac{9}{5}T_{°C} + 32 = \frac{9}{5}(136) + 32 = 277\,°F$

(17) $T_{°F} = \frac{9}{5}T_{°C} + 32 = \frac{9}{5}(-482) + 32 = -54.8\,°F$

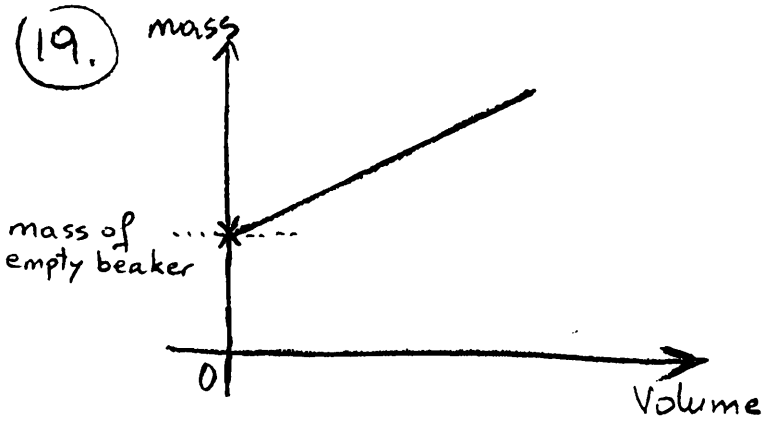
(18) The increase in volume is due to the volume of the zinc sample.

$V_{zinc} = 48.0 - 46.3 = 1.7\,cm^3$

$d_{zinc} = \frac{mass_{zinc}}{V_{zinc}} = \frac{12.14\,g}{1.7\,cm^3} = 7.1\,g/cm^3$

The reason for not selecting $7.141\,g/cm^3$ is that it has too many significant figures.

(19.)




y-intercept

Even if there is no liquid (so zero volume) the beaker has a mass, so the mass at zero volume is the mass of empty beaker

Slope

Afterwards, mass increases proportional to volume. The proportionality factor is the slope, given by the density of the fluid.

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(20) The boiling of water is a physical change because no chemical bonds are broken or formed, and gaseous water is the same chemical as liquid water

(23) Compounds <u>cannot</u> exist as atoms, since they are formed by the atoms of different elements (i.e. more than one kind of atom) and are made up of combinations of atoms, rather than a single type of atoms.

(24) □: an element existing as individual atoms (such as a noble gas)

●●: a compound formed from element ○ and element ●

□ and ●● are intermingling at molecular level with no "clumps" ⇒ homogeneous mixture