Introduction to Chemical Principles, 11e (**Stoker**)
Chapter 2   Numbers from Measurements

2.1   Multiple Choice

1) Which statement contains an exact number?
A) A gross of paper contains 144 sheets.
B) One sheet of paper is 0.0042 inches thick.
C) One sheet of paper measures 8.5 x 11 inches.
D) A ream of medium weight paper weighs 20 pounds.
Answer: A
Section List: 2-2
Learning Obj: 2.2
Global LO: G4

2) Which of the following is an *inexact* number?
A) There are 12 eggs in a dozen.
B) The conversion 1000 mm = 1 m.
C) This card measures 3.1 inches x 4.2 inches.
D) There are 2 cups in one pint.
Answer: C
Section List: 2-2
Learning Obj: 2.2
Global LO: G4

3) A lab technician was assigned the task of determining the density of a sample of blood plasma. The technician performed three replicate measurements of the density of the sample and reported the following results.
        0.810 g/mL   1.375 g/mL   2.046 g/mL
The actual density of blood plasma is 1.027 g/mL. In evaluating the technician's job performance in terms of accuracy and precision, it can be said that the technician _____.
A) was neither accurate nor precise
B) was both accurate and precise
C) was accurate but not precise
D) was precise but not accurate
Answer: A
Section List: 2-3
Learning Obj: 2.3
Global LO: G4

4) Which of the following contain three significant figures?
    I. 326.0   II. 0.00310   III. 46,900   IV. 1.070   V. 0.020
A) II, III and V
B) II and III
C) IV and V
D) I, III and IV
Answer: B
Section List: 2-3
Learning Obj: 2.3
Global LO: G4

5) A lab technician was assigned the task of determining the pH of a sample of blood. The technician performed three replicate measurements of the pH and reported the following results.
        pH = 6.98   pH = 6.99   pH = 6.98
The actual pH of blood is 7.40. In evaluating the technician's job performance in terms of accuracy and precision, it can be said that the technician _____.
A) was neither accurate nor precise
B) was both accurate and precise
C) was accurate but not precise
D) was precise but not accurate
Answer: D
Section List: 2-3
Learning Obj: 2.3
Global LO: G4

6) If the accepted value for the length of an object is 6.78 cm, which of the following sets of experimental results is best described as both precise *and* accurate?
A) 6.78 cm, 6.38 cm, 6.48 cm (average = 6.55 cm)
B) 6.79 cm, 6.78 cm, 6.77 cm (average = 6.78 cm)
C) 6.71 cm, 6.71 cm, 6.72 cm (average = 6.71 cm)
D) 6.88 cm, 6.88 cm, 6.58 cm (average = 6.78 cm)
Answer: B
Section List: 2-3
Learning Obj: 2.3
Global LO: G4

7) Which of the following sources of experimental error would properly be classified as a *systematic error*?
A) momentary changes in air currents within the instrument room
B) accidental miscalibration of the instrument being used
C) variances in the angle from which the instrument scale is read
D) momentary changes in the temperature of the instrument room
Answer: B
Section List: 2-3
Learning Obj: 2.3
Global LO: G4

8) Which of the following sources of experimental error can be classified as *random error*?
A) The balance was not properly zeroed before weighing each sample.
B) The temperature in the room is not consistent.
C) The pipet used to measure a sample was not calibrated properly.
D) None of the above
Answer: B
Section List: 2-3
Learning Obj: 2.3
Global LO: G4

9) Which measurement is consistent with a graduated cylinder which has an uncertainty of 0.1 mL?
A) 21.14 mL
B) 21 mL
C) 21.1 mL
D) 21.140 mL
Answer: C
Section List: 2-4
Learning Obj: 2.4
Global LO: G4

10) Which device below is the most accurate for measuring volume?
A) a beaker calibrated in 1 milliliter units
B) a graduated cylinder calibrated in 0.5 milliliter units
C) a graduated pipet calibrated in 0.1 milliliter units
D) a buret calibrated in 0.02 milliliter units
Answer: D
Section List: 2-4
Learning Obj: 2.4
Global LO: G4

11) A balance has an accuracy of 0.001 grams. Which mass reading below was read from this balance?
A) 49.1009 g
B) 49.10 g
C) 49.10090 g
D) 49.101 g
Answer: D
Section List: 2-4
Learning Obj: 2.4
Global LO: G4

12) If you were recording the volume of liquid in the graduated cylinder depicted, what volume would you record (to the correct number of significant figures)?
A) 25.700 mL
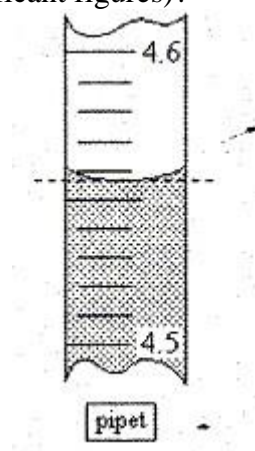B) 25.7 mL
C) 25 mL
D) 25.70 mL
Answer: B
Section List: 2-4
Learning Obj: 2.4
Global LO: G4

13) If you were recording the volume of liquid in the pipet depicted, what volume would you record (to the correct number of significant figures)?

A) 4.557 mL
B) 4.56 mL
C) 5 mL
D) 4.6 mL
Answer: A
Section List: 2-4
Learning Obj: 2.4
Global LO: G4

14) Which of the following statements concerning the "significance" of zeros in recorded measurements is *incorrect*?
A) leading zeros are never significant
B) confined zeros are always significant
C) trailing zeros are not always significant
D) trailing and leading zeros are not always significant
Answer: D
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

15) Which one of the following numbers contains 4 significant figures?
A) 6.43
B) 39.4
C) 0.04840
D) 0.0257
Answer: D
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

16) In which one of the following numbers are *none* of the zeros significant?
A) 298.010
B) 3100
C) 0.00001470
D) 2.70400
Answer: B
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

17) In which of the following pairs of numbers does each member of the pair contain the *same number* of significant figures?
A) 39 and 3090
B) 9900.0 and 60.01
C) 0.05700 and 0.0570
D) 45010 and 0.09871
Answer: D
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

18) Which of the following numbers contains 2 significant figures?
A) 3.741
B) 190
C) 0.02
D) 90.60
Answer: B
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

19) How many of the following numbers has 4 significant figures?

$19.00 \qquad 0.00006 \qquad 1.609 \times 10^8 \qquad 13,600$

A) 0
B) 1
C) 2
D) 3
Answer: C
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

20) A balance has an accuracy of ±0.01 grams. A beaker weighed 15 grams when weighed on this balance. Using the correct number of significant figures, the weight of the beaker should be recorded as _____.
A) 15.000 g
B) 15 g
C) 15.0 g
D) 15.00 g
Answer: D
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

21) Which of the following numbers contains three significant figures?
A) 1.050
B) 85.967
C) 8.90
D) 350
Answer: C
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

22) The number 0.090804, when rounded off to 4 significant figures, would appear as _____.
A) 0.091
B) 0.0908
C) 0.09080
D) 0.090
Answer: C
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

23) The number 80710, when rounded off to 2 significant figures, would appear as _____.
A) 80700
B) 81000
C) 8100
D) 8070
Answer: B
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

24) When the number 0.0047896 is rounded to two significant figures it would appear as _____.
A) 0.00479
B) 0.004790
C) 0.0048
D) 0.0050
Answer: C
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

25) What are the correct number of significant figures in the answer for the following sum:
        8.650 + 19.6 + 44.05 + 88
A) 2
B) 3
C) 4
D) 5
Answer: B
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

26) The calculator answer obtained from multiplying 21.08 x 1.9634 is 41.388472. The answer to the correct number of significant figures is _____.
A) 41.388
B) 41.4
C) 41.39
D) 41.3884
Answer: C
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

27) The correct answer obtained from subtracting 1.2 from 123.96 contains _____.
A) 2 significant figures
B) 3 significant figures
C) 4 significant figures
D) 5 significant figures
Answer: C
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

28) Do the following calculation. How many significant figures are justified for the answer?

$$5.02 \ + \ 6.119 \ + \ 0.04117$$

A) 4
B) 3
C) 5
D) 7
Answer: A
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

29) The correct answer for the calculation

$$\frac{126 \times 1.364}{135 \times 0.8951}$$

where 126 and 135 are counted numbers and 1.364 and 0.8951 are measured numbers is

_____.

A) 1.422
B) 1.4
C) 1.42
D) 1.4220
Answer: A
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

30) Do the following calculation and express the answer using the correct scientific notation:

$$\frac{(6.00 \times 10^{23}) \ (3.00)}{284}$$

A) 6.34×10^{21}
B) 1.58×10^{-22}
C) 6.34×10^{-2}
D) 15.8
Answer: A
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

31) Perform the following mathematical operation, and express the answer to the correct number of significant figures.

$$12.47 \text{ g}$$
$$1.026 \text{ g}$$
$$\underline{135.8 \text{ g}}$$

A) 149.296
B) 150.
C) 149.3
D) 149.30
Answer: C
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

32) The numerical value for $(5.6 \times 10^4) \div (7.89 \times 10^2)$ is, with the proper number of significant figures, equal to:
A) 70.976
B) 71
C) 7.098×10^1
D) 71.0
Answer: B
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

33) Carry out the following calculations. Express your answer to the proper number of significant figures:

$$(21.648 + 89)/0.00201$$

A) 55223
B) 55220
C) 55000
D) 55200
Answer: B
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

34) Which of the following statements is *true*?

1. 0.0206	2. 81.30	3. 29007
4. 123,000	5. 906.0	6. 300

A) Numbers that contain three significant figures are 1, 3, and 6.
B) Numbers in which all zeros are significant are 2, 3, 4, and 5.
C) Numbers in which none of the zeros are significant are 1 and 2.
D) Number with one significant figure is 6.
Answer: D
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

35) A rubber band is found to weigh 0.0978 g. What is the total mass of 106 such identical rubber bands?
A) 10.37 g
B) 10.367 g
C) 10.4 g
D) 10. g
Answer: C
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

36) Perform the following mathematical operations. Express your answer to the proper number of significant figures.   (93.789 − 5.40) x 18.057 =
A) 1600
B) 1596.239
C) 1590
D) 1596.0
Answer: D
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

37) A student cut 1200 pieces of copper wire, each weighing 1.769 grams. Calculate the total mass of the pieces of copper to the correct number of significant figures.
A) 2123
B) 2100
C) 2120
D) 2122.8
Answer: A
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

38) A penny weighs 1.575g. What is the total mass of 150 pennies?
A) 236.25
B) 236.2
C) 236
D) 240
Answer: B
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

39) The average mass of a Vitamin C tablet is 0.653 g. What would be the total mass of 125 tablets?
A) 81.625 g
B) 81.6 g
C) 81.62 g
D) 82.0 g
Answer: B
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

40) Water and vitamin C were added to a beaker. Calculate the mass of the beaker and its contents, and choose the answer with the appropriate number of significant figures.

146.20 g beaker + 23.1 g water + 0.34 g vitamin C =

A) 169.64 g
B) 169 g
C) 169.6 g
D) 170 g
Answer: C
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

41) What mathematical operation is represented by the exponential notation of 10^{-4}?
A) 10 x 10 x 10 x10
B) 10 + 10 + 10 + 10
C) 1/10 x 1/10 x 1/10 x 1/10
D) 1/10 + 1/10 + 1/10 + 1/10
Answer: C
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

42) The number 3009.1 expressed in scientific notation to the correct number of significant figures becomes _____.
A) 3.01×10^3
B) 3.009×10^4
C) 3.0091×10^{-3}
D) 3.0091×10^3
Answer: D
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

43) The number 0.00309 expressed in scientific notation to the correct number of significant figures becomes _____.
A) 3.090×10^3
B) 3.09×10^{-3}
C) 3.09×10^3
D) 3.090×10^{-4}
Answer: B
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

44) The number 12.68×10^2, when expressed in correct scientific notation, becomes _____.
A) 1268×10^4
B) 0.1268×10^0
C) 1.268×10^3
D) 1.268×10^{-3}
Answer: C
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

45) When 0.0005760 is written in proper scientific notation with the correct number of significant figures the number is:
A) 57.60×10^{-5}
B) 5.760×10^{-4}
C) 5.760×10^4
D) 5.76×10^{-4}
Answer: B
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

46) What is the correct exponential term for the following mathematical operation?
$$\frac{10^8 \div 10^3}{10^4 \times 10^5} =$$
A) 10^{-6}
B) 10^2
C) 10^{-2}
D) 10^{-4}
Answer: D
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

47) How many numbers will be in the coefficient when 0.0090110 is expressed in scientific notation?
A) 2
B) 3
C) 4
D) 5
Answer: D
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

48) The number 1.987×10^6 in normal decimal notation is _____.
A) 1,987,000
B) 198,700
C) 19,870
D) 19,870,000
Answer: A
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

49) The number 9080000 written in scientific notation to the correct number of significant figures is _____.
A) 9.1×10^7
B) 9.08×10^7
C) 9.08×10^6
D) 9.1×10^6
Answer: C
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

50) The number 7.134×10^7 in normal decimal notation is _____.
A) 0.0000007134
B) 7,134,000
C) 713,400
D) 71,340,000
Answer: D
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

51) Which one of the following mathematical expressions is *not* evaluated correctly?
A) $10^{-3}/10^6 = 10^{-9}$
B) $10^8/10^6 = 10^2$
C) $10^{-2}/10^{-4} = 10^2$
D) $10^{-3}/10^{-6} = 10^9$
Answer: D
Section List: 2-8
Global LO: G4

52) The correct answer obtained by dividing 4.65×10^5 by 9.4×10^{-2} together is _____.
A) 2.0×10^{-7}
B) 2.02×10^{-7}
C) 4.9×10^6
D) 4.95×10^6
Answer: C
Section List: 2-8
Learning Obj: 2.8
Global LO: G4

53) The correct answer obtained by dividing the measurement (6.00×10^4) by the measurement (2.0×10^2) is _____.
A) 3×10^1
B) 3×10^{-2}
C) 3.00×10^2
D) 3.0×10^2
Answer: D
Section List: 2-8
Learning Obj: 2.8
Global LO: G4

54) Perform the indicated mathematical operations and express the answer in scientific notation rounded off to the proper number of significant figures.

$$[2.098 \times 10^{14} / 74.5 \times 10^{-6}] (1.0900 \times 10^4)$$

A) 3.0696×10^{22}
B) 3.0696×10^{-23}
C) 3.1×10^{23}
D) 3.07×10^{22}
Answer: D
Section List: 2-8
Learning Obj: 2.8
Global LO: G4

2.2 Short Answer

1) A pipet is calibrated with the smallest scale markings of 0.1 milliliters. Indicate to what uncertainty readings should be recorded for measurements made with this device.
Answer: 0.01 milliliters
Section List: 2-4
Learning Obj: 2.4
Global LO: G4

2) For each of the measurements on the left, determine the number of significant figures present.

A)	1.0010	_____
B)	30901	_____
C)	620200	_____
D)	0.02060	_____

Answer: A) 3 B) 3 C) 2   D) 2
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

3) How many significant figures are found in each of the following measurements?

A)	300 grams	_____
B)	0.0207 pounds	_____
C)	66,900,000 miles	_____
D)	20.10 liters	_____

Answer: A) 1   B) 3   C) 3   D) 4
Section List: 2-5
Learning Obj: 2.5
Global LO: G4

4) Do the following multiplications and divisions, expressing your answers to the proper number of significant figures.

   A) 86.40/12.095   _____

   B) $(2.00 \times 10^2) \times (2.00 \times 10^{-4})$ _____

   C) $(7.0 \times 10^{-6}) \times (3.00 \times 10^4)$ _____

   D) $(8.00 \times 10^6)/(4.00 \times 10^4)$ _____

Answer: A) 7.143   B) 4.00×10^{-2} C) 2.1×10^{-1} D) 2.00×10^2

Section List: 2-6, 2-8

Learning Obj: 2.6, 2.8

Global LO: G4

5) Do the following additions or subtractions, expressing your answers to the proper number of significant figures.

   A) $4.63 + 7.014 - 1.200$ _____

   B) $200 + 0.09$ _____

   C) $3.070 - 3.050$ _____

   D) $(6.3 \times 10^7) + (4.5 \times 10^3)$ _____

Answer: A) 10.44   B) 200   C) 0.020   D) 6.3×10^7

Section List: 2-6, 2-8

Learning Obj: 2.6, 2.8

Global LO: G4

6) Round off each of the following numbers to 3 significant figures.

   A) 397.48   _____

   B) 145,120   _____

   C) 0.00860   _____

   D) 1900   _____

Answer: A) 397   B) 145,000   C) 0.00860   D) 1.90×10^3

Section List: 2-6

Learning Obj: 2.6

Global LO: G4

7) Round off the following numbers to 4 significant figures.

   A) 398.845   _____

   B) 245,864   _____

   C) 0.00065298   _____

   D) 15000   _____

Answer: A) 398.8   B) 2.459×10^5 C) 6.530×10^{-4} D) 1.500×10^4

Section List: 2-6, 2-8

Learning Obj: 2.6, 2.8

Global LO: G4

8) For each of the calculator-completed calculations on the left, determine the correct number of significant figures that the answer should have.

A)	3.54 2.17 = 7.6818	_____
B)	231 + 23.42 = 254.42	_____
C)	273.2 − 33 = 240.2 (33 is an exact number)	_____
D)	6.00/2.0 = 3	_____

Answer: A) 2   B) 2   C) 3   D) 1
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

9) Round off each of the following numbers to the number of significant figures indicated in parenthesis.

   A) 652,387 (two)
   B) 431.50 (three)
   C) 0.003010 (two)
   D) 0.45 (one)

Answer: A) 650,000   B) 432   C) 0.0030   D) 0.4
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

10) Round off each of the following numbers to the number of significant figures indicated in parenthesis.

   A) 652,387 (two)
   B) 431.50 (three)
   C) 0.003010 (two)
   D) 0.45 (one)

Answer: A) 650,000   B) 432   C) 0.0030   D) 0.4
Section List: 2-6
Learning Obj: 2.6
Global LO: G4

11) Perform the following mathematical operations and express the answers to the correct number of significant figures.

A) $74.632 + 23 - 1.01 =$

B) $[(3.9780 \times 10^{-2}) \times (1.010 \times 10^{4})] / [(3.290 \times 10^{-5}) \times (7.85 \times 10^{2})] =$

C) $[(2.1 \times 10^{-4} / 6.89 \times 10^{-3})] - (1.59 \times 10^{-2}) =$

D) $[400 \times 1719] / [56.1 \times 97] =$

E) $[10^{-7} \times 10^{6} \times 10^{4}] / [10^{-5} \times 10^{9}] =$

F) $(235.8 + 15940 + 6.17) / 1.987 =$

Answer: A) 97   B) 1.56×10^{4} C) 1.4×10^{-2} D) 100   E) 10^{-1} F) 8143

Section List: 2-6, 2-8
Learning Obj: 2.6, 2.8
Global LO: G4

12) Express the following numbers in scientific notation.

A)	6,473	_____
B)	0.0004081	_____
C)	6,970,000	_____
D)	0.00021	_____

Answer: A) 6.473×10^{3} B) 4.081×10^{-4} C) 6.97×10^{6} D) 2.1×10^{-4}

Section List: 2-7
Learning Obj: 2.7
Global LO: G4

13) Express the following numbers in scientific notation:

A) 5489   _____

B) 0.0000653   _____

C) 623,000,000   _____

D) 0.005300   _____

Answer: A) 5.489×10^{3} B) 6.53×10^{-5} C) 6.23×10^{8} D) 5.300×10^{-3}

Section List: 2-7
Learning Obj: 2.7
Global LO: G4

14) Convert the following numbers from scientific notation to ordinary decimal notation.

A) 3.01×10^{-3} _____

B) 9.0×10^{-3} _____

C) 9.91×10^{5} _____

D) 6.429×10^{8} _____

Answer: A) 0.00301   B) 0.0090   C) 991,000   D) 642,900,000

Section List: 2-7
Learning Obj: 2.7
Global LO: G4

15) Express the following exponential expressions in correct scientific notation.
A) 430×10^{-2} _____
B) 13.30×10^{8} _____
C) 0.000330×10^{-2} _____
D) 0.123×10^{6} _____
Answer: A) 4.30×10^{0} B) 1.330×10^{9} C) 3.30×10^{-6} D) 1.23×10^{5}
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

16) Using scientific notation, express the number five million five hundred thousand to 4 significant figures.
Answer: 5.500×10^{6}
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

17) Using scientific notation, express the number four thousand three hundred fifty to 3 significant figures.
Answer: 4.35×10^{3}
Section List: 2-7
Learning Obj: 2.7
Global LO: G4

18) Perform the following mathematical operations. Express your answer to the proper number of significant figures.

$$\frac{[(2.1 \times 10^{6}) \times (8.49 \times 10{-11}) \times (6.983 \times 103)]}{[(4 \times 10^{14}) \times (7.02 \times 10^{-9})]} =$$

Answer: 4×10^{-7}
Section List: 2-8
Learning Obj: 2.8
Global LO: G4