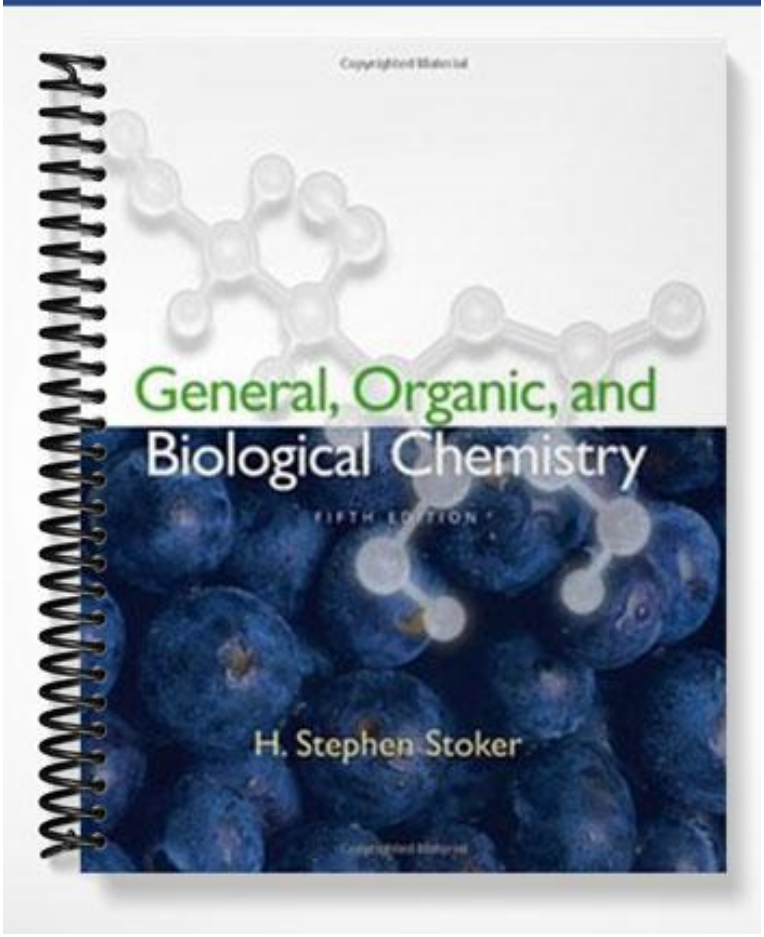
TEST BANK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General, Organic, and
Biological Chemistry
FIFTH EDITION
H. Stephen Stoker

Chapter 2: Measurements In Chemistry

Student: _____

1. The “mathematical meaning” associated with the metric system prefixes *centi*, *milli*, and *micro* is, respectively,
A. 10^{-2}, 10^{-4}, and 10^{-6}

B. 10^{-2}, 10^{-3}, and 10^{-6}

C. 10^{-3}, 10^{-6}, and 10^{-9}

D. 10^{-3}, 10^{-9}, and 10^{-12}

2. In which of the following sequences are the metric system prefixes listed in order of *decreasing* size?
A. kilo mega giga
B. milli nano micro
C. kilo deci micro
D. pico kilo deci

3. To what decimal position should a measurement be recorded if the smallest markings on the measurement scale are tenths of a centimeter?
A. to the closest centimeter
B. to the tenths of a centimeter
C. to the hundredths of a centimeter
D. to the thousandths of a centimeter

4. In which one of the following measure numbers are *all* of the zeros significant?
A. 0.0276
B. 1,900,000
C. 0.000740
D. 7.403600

5. In which of the following pairs of measured numbers does each member of the pair contain the same number of significant figures?
A. 28.1 and 28.10
B. 400.0 and 40
C. 0.01600 and 0.0160
D. 0.00005 and 500,000

6. In which of the following cases is the given measurement correctly rounded to three significant figures?
A. 978,000 becomes 978
B. 0.06455 becomes 0.0645
C. 43.67 becomes 43.7
D. 54.600 becomes 54,600

7. Which of the following would involve an *exact* number?
A. the length of a car
B. the mass of a sack of potatoes
C. the number of seconds in a minute
D. the surface area of a curtain

8. The measurement 807.90 expressed in scientific notation becomes
A. 0.8079×10^{2}
B. 8.079×10
C. 8.079×10^{3}
D. 8.079×10^{2}

9. What is the uncertainty associated with the measurement of 6.02×10^{4}?
A. 100
B. 10
C. 0.1
D. 0.01

10. The calculator answer obtained from multiplying the measurements 98.93 and 7.25 is 717.24. Given the operational rules governing significant figures, this answer
A. is correct as written
B. should be rounded to 717.2
C. should be rounded to 717
D. could be written as 7.2×10^{2}

11. The correct answer obtained from adding the measurements 9.3, 8.95, and 9.325 contains
A. two significant figures
B. three significant figures
C. four significant figures
D. five significant figures

12. The correct answer obtained by dividing the measurement 7.42×10^{-3} by the measurement 1.91×10^{2} is
A. 0.39×10^{-5}
B. 3.88×10^{-5}
C. 3.88×10^{-6}
D. 3.88×10^{-4}

13. According to dimensional analysis, which of the following is the correct setup for the problem "How many milligrams are there in 47 kilograms?"
A. $47\ \text{kg}\times\left(\frac{1\ \text{g}}{10^{3}\ \text{kg}}\right)\times\left(\frac{1\ \text{mg}}{10^{-3}\ \text{mg}}\right)$
B. $47\ \text{kg}\times\left(\frac{10^{3}\ \text{g}}{1\ \text{kg}}\right)\times\left(\frac{1\ \text{mg}}{10^{-3}\ \text{mg}}\right)$
C. $47\ \text{kg}\times\left(\frac{10^{3}\ \text{mg}}{1\ \text{kg}}\right)\times\left(\frac{10^{-3}\ \text{mg}}{1\ \text{mg}}\right)$
D. $47\ \text{kg}\times\left(\frac{1\ \text{g}}{10^{3}\ \text{kg}}\right)\times\left(\frac{10^{-3}\ \text{kg}}{1\ \text{mg}}\right)$

14. How many conversion factors can be derived from the equality 100 years = 1 century?
A. two
B. three
C. four
D. an unlimited number

15. The density of an object is the ratio of its
A. length to volume
B. mass to height
C. mass to volume
D. length to mass

16. If object A weighs 10.0 grams and has a volume of 5.0 mL and object B weighs 15.0 grams and has a volume of 3.75 mL
A. B is less dense than A.
B. A and B have equal densities.
C. B is twice as dense as A.
D. B is four times as dense as A.

17. What is the mass, in grams, of 41.9 mL of a liquid if its density is 0.99 g/mL?
A. 4.2
B. 41
C. 4
D. 415

18. Which of the following comparisons of the size of a degree on the major temperature scales is *correct*?
A. A Kelvin degree is larger than a Celsius degree.
B. A Fahrenheit degree and a Celsius degree are equal in size.
C. A Fahrenheit degree is larger than a Kelvin degree.
D. A Celsius degree and a Kelvin degree are equal in size.

19. Which of the following would be a correct set of units for *specific heat*?
A. J/g
B. J/°C
C. J/g°C
D. J°C/g

20. How many joules of heat are required to raise the temperature of a 28.5 g Al bar from 25.1ºC to 55.4ºC? The specific heat of Al is 0.908 J/g ºC.
A. 25.9
B. 652
C. 784
D. 144

21. In which of the following pairings of metric system prefix and power of ten is the pairing *incorrect*?
A. kilo- and 10^{-3}

B. micro- and 10^{-6}

C. deci- and 10^{1}

D. more than one correct response
E. no correct response

22. In which of the following pairs of units is the first listed unit 1000 times *larger* than the second?
A. milligram and nanogram
B. liter and centiliter
C. kilometer and megameter
D. more than one correct response
E. no correct response

23. In which of the following sequences of measured numbers do all members of the sequence contain three significant figures?
A. 3.03 and 3.30 and 0.033
B. 78,000 and 0.00780 and 780
C. 30.0 and 0.300 and 30,100
D. more than one correct response
E. no correct response

24. Which of the following statements concerning the measured number 0.3030 is correct?
A. Only one of the zeros in the number is significant.
B. Rounded off to two significant figures the number becomes 0.30.
C. Expressed in scientific notation the number becomes 3.03×10^{-1}.
D. More than one correct response.
E. No correct response.

25. Which of the following mathematical expressions is correctly evaluated?

A. $\frac{10^3}{10^{-4}} = 10^7$

B. $10^3 \times 10^4 = 10^{12}$

C. $\frac{10^3}{10^4} = 10^{-7}$

D. more than one correct response

E. no correct response

26. Which of the following measured numbers contains three significant figures and has a magnitude of less than one?

A. 3.30×10^5

B. 3.00×10^{-3}

C. 3.20×10^{-4}

D. more than one correct response

E. no correct response

27. When expressed in scientific notation, the measured numbers 3200 and 3200.0 become, respectively,

A. 3.2×10^3 and 3.200×10^3

B. 3.2×10^3 and 3.2000×10^3

C. 3.200×10^3 and 3.2000×10^3

D. more than one correct response

E. no correct response

28. Which of the following measured numbers has an uncertainty of 0.01 associated with it?

A. 32.930

B. 3.02×10^6

C. 3.0×10^{-1}

D. more than one correct response

E. no correct response

29. Which of the following conversion factors would limit a calculation to three significant figures?

A. $\frac{453.6\ \text{g}}{1\ \text{lb}}$

B. $\frac{1\ \text{in.}}{2.54\ \text{cm}}$

C. $\frac{24\ \text{hr}}{1\ \text{day}}$

D. more than one correct response

E. no correct response

30. Density can be used as a conversion factor to convert from

A. mass to volume

B. volume to mass

C. metric unit mass to English unit mass

D. more than one correct response

E. no correct response

31. The density of table sugar is 1.59 g/mL. It is true that

A. 2.00 g of table sugar occupies a volume of 1.17 mL.

B. 3.00 g of table sugar occupies a volume of 1.97 mL.

C. 5.00 g of table sugar occupies a volume of 3.14 mL.

D. More than one correct response

E. No correct response

32. Which of the following statements concerning the three major temperature scales is *correct*?

A. Kelvin temperatures are always positive.

B. The equation for converting from Celsius to Kelvin involves the number 273.

C. The freezing point of water has a lower numerical value on the Kelvin scale than on the Fahrenheit scale.

D. More than one correct response.

E. No correct response.

33. In which of the following pairs of temperature readings are the two members of the pair equivalent to each other?

A. 32°F and 273 K

B. 0°C and 373 K

C. 0°C and 40°F

D. more than one correct response

E. no correct response

34. The heat energy needed to raise the temperature of 10.0 g of metal by 10.0°C would exceed 25 calories for which of the following metals?

A. $\text{gold, specific heat} = \frac{0.031 \text{ cal}}{\text{g°C}}$

B. $\text{silver, specific heat} = \frac{0.057 \text{ cal}}{\text{g°C}}$

C. $\text{aluminum, specific heat} = \frac{0.21 \text{ cal}}{\text{g°C}}$

D. more than one correct response

E. no correct response

35. Which of the following statements concerning specific heats is *correct*?

A. Specific heat can be measured only when a substance is in the solid state.

B. Under similar conditions, substances with low specific heats increase in temperature more when heated than do substances with high specific heats.

C. A correct set of units for specific heat is cal/°C.

D. More than one correct response.

E. No correct response.

36. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices

a) All three statements are true.

b) Two of the three statements are true.

c) Only one of the statements is true.

d) None of the statements is true. Reference: Ref 2-1

Statements:

(1) The meaning of a metric system prefix is independent of the base unit it modifies.

(2) “Trailing zeros” at the end of a measured number are never significant.

(3) The answer to the problem $10^5/10^{-3}$ is 10^2.

A. All three statements are true.

B. Two of the three statements are true.

C. Only one of the statements is true.

D. None of the statements is true.

37. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) In outer space, an astronaut may be weightless but never massless.
(2) The metric system prefixes *milli* and *micro* differ in mathematical meaning by a factor of 1000.
(3) The addition of 273 to a Fahrenheit temperature reading will convert it to a Kelvin temperature reading.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

38. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The measured number 2.410×10^{-3} contains three significant figures.
(2) The specific heat of water is higher than that of most other substances.
(3) The equation 1 kg = 10^6 mg is a correct mathematical statement.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

39. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The answer to the addition problem 3.21 + 32 + 3.22 should have an uncertainty of hundredths.
(2) The measurement 653,899, when rounded to five significant figures, becomes 65,390.
(3) The higher the specific heat of a substance, the more its temperature will change when it absorbs a given amount of heat.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

40. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The conversion factor 10^3 m/1 km contains an unlimited number of significant figures.
(2) Density may be used as a conversion factor to convert from mass to volume.
(3) The equation 2.33 lb = 625 g is a correct mathematical statement.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

41. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) A deciliter is equal to 100 milliliters.
(2) The Kelvin temperature scale is closely related mathematically to the Celsius temperature scale.
(3) Measurements cannot be exact because two estimated digits are always recorded as part of any measurement.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

42. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The answer to the calculation $12.00 \times (6.00 \times 10^{23})$ should contain three significant figures.
(2) A meter is slightly larger than a yard, and a liter is slightly larger than a quart.
(3) The numbers 3.30×10^{-1} and 3.30×10^{1} both have a magnitude of less than one.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

43. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The size of the degree is the same on the Fahrenheit and Celsius temperature scales.
(2) The measurement 62,300 has an uncertainty of ± 100.
(3) The answer to the calculation 8.45 + 10.40 should contain four significant figures.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

44. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The measured numbers 244,000 and 0.000244 contain the same number of significant figures.
(2) One cubic centimeter is equal to ten milliliters.
(3) The conversion factor 1 in/2.54 cm, when used as written, would decrease unit size.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

45. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) Normal human body temperature has an average value of 98.2^{o}F.
(2) A rapid fall in human body temperature of 2^{o}F to 3^{o}F produces “shivering.”
(3) Fat cells, unlike most other human body cells and fluids, are less dense than water.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

46. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
0.000320

47. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
0.30003

48. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
2,300,100

49. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
93,100,000

50. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
3215.000

51. For each of the calculator-completed calculations, determine the correct number of significant figures that the answer should have using the response. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) two
b) three
c) four
d) five Reference: Ref 2-3
$4.35 \times 2.17 = 9.4395$

52. $2.311 + 23.420 = 25.731$

53. $273.2 - 33 = 240.2$

54. $\frac{9.000}{3.0} = 3$

55. $\frac{0.00030}{0.000300} = 1$

56. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
The number of significant figures is the same in both numbers.

57. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
All zeros are significant in both numbers.

58. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
The uncertainty is the same in both numbers.

59. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
The uncertainty is greater than 0.1 in both numbers.

60. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
Scientific notation for both numbers involves the same power of ten.

61. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Celsius equivalent of 273 K

62. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Fahrenheit equivalent of 0°C

63. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Kelvin equivalent of –20°C

64. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Celsius equivalent of 32°F

65. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Fahrenheit equivalent of 273 K

66. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Density (in g/mL) when m = 12.0 g and V = 3.0 mL

67. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Volume (in mL) when m = 2.0 g and d = 2.0 g/mL

68. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Mass (in g) when V = 2.0 mL and d = 2.0 g/mL

69. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Specific heat (in cal/g°C) when heat = 20.0 cal, m = 10.0 g and $\Delta T = 2.0°C$

70. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Mass (in g) when heat = 80.0 cal, sp. ht. = 0.50 cal/g°C and $\Delta T = 40°C$

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B. 10^{-2}, 10^{-3}, and 10^{-6}

C. 10^{-3}, 10^{-6}, and 10^{-9}

D. 10^{-3}, 10^{-9}, and 10^{-12}

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C. kilo deci micro
D. pico kilo deci

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7. Which of the following would involve an *exact* number?
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8. The measurement 807.90 expressed in scientific notation becomes
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C. 3.88×10^{-6}
D. 3.88×10^{-4}

13. According to dimensional analysis, which of the following is the correct setup for the problem "How many milligrams are there in 47 kilograms?"
A. $47\ \text{kg}\times\left(\frac{1\ \text{g}}{10^{3}\ \text{kg}}\right)\times\left(\frac{1\ \text{mg}}{10^{-3}\ \text{mg}}\right)$
B. $47\ \text{kg}\times\left(\frac{10^{3}\ \text{g}}{1\ \text{kg}}\right)\times\left(\frac{1\ \text{mg}}{10^{-3}\ \text{mg}}\right)$
C. $47\ \text{kg}\times\left(\frac{10^{3}\ \text{mg}}{1\ \text{kg}}\right)\times\left(\frac{10^{-3}\ \text{mg}}{1\ \text{mg}}\right)$
D. $47\ \text{kg}\times\left(\frac{1\ \text{g}}{10^{3}\ \text{kg}}\right)\times\left(\frac{10^{-3}\ \text{kg}}{1\ \text{mg}}\right)$

14. How many conversion factors can be derived from the equality 100 years = 1 century?
A. two
B. three
C. four
D. an unlimited number

15. The density of an object is the ratio of its
A. length to volume
B. mass to height
C. mass to volume
D. length to mass

16. If object A weighs 10.0 grams and has a volume of 5.0 mL and object B weighs 15.0 grams and has a volume of 3.75 mL
A. B is less dense than A.
B. A and B have equal densities.
C. B is twice as dense as A.
D. B is four times as dense as A.

17. What is the mass, in grams, of 41.9 mL of a liquid if its density is 0.99 g/mL?
A. 4.2
B. 41
C. 4
D. 415

18. Which of the following comparisons of the size of a degree on the major temperature scales is *correct*?
A. A Kelvin degree is larger than a Celsius degree.
B. A Fahrenheit degree and a Celsius degree are equal in size.
C. A Fahrenheit degree is larger than a Kelvin degree.
D. A Celsius degree and a Kelvin degree are equal in size.

19. Which of the following would be a correct set of units for *specific heat*?
A. J/g
B. J/°C
C. J/g°C
D. J°C/g

20. How many joules of heat are required to raise the temperature of a 28.5 g Al bar from 25.1ºC to 55.4ºC? The specific heat of Al is 0.908 J/g ºC.
A. 25.9
B. 652
C. 784
D. 144

21. In which of the following pairings of metric system prefix and power of ten is the pairing *incorrect*?
A. kilo- and 10^{-3}

B. micro- and 10^{-6}

C. deci- and 10^{1}

D. more than one correct response
E. no correct response

22. In which of the following pairs of units is the first listed unit 1000 times *larger* than the second?
A. milligram and nanogram
B. liter and centiliter
C. kilometer and megameter
D. more than one correct response
E. no correct response

23. In which of the following sequences of measured numbers do all members of the sequence contain three significant figures?
A. 3.03 and 3.30 and 0.033
B. 78,000 and 0.00780 and 780
C. 30.0 and 0.300 and 30,100
D. more than one correct response
E. no correct response

24. Which of the following statements concerning the measured number 0.3030 is correct?
A. Only one of the zeros in the number is significant.
B. Rounded off to two significant figures the number becomes 0.30.
C. Expressed in scientific notation the number becomes 3.03×10^{-1}.
D. More than one correct response.
E. No correct response.

25. Which of the following mathematical expressions is correctly evaluated?

A. $\frac{10^3}{10^{-4}} = 10^7$

B. $10^3 \times 10^4 = 10^{12}$

C. $\frac{10^3}{10^4} = 10^{-7}$

D. more than one correct response

E. no correct response

26. Which of the following measured numbers contains three significant figures and has a magnitude of less than one?

A. 3.30×10^5

B. 3.00×10^{-3}

C. 3.20×10^{-4}

D. more than one correct response

E. no correct response

27. When expressed in scientific notation, the measured numbers 3200 and 3200.0 become, respectively,

A. 3.2×10^3 and 3.200×10^3

B. 3.2×10^3 and 3.2000×10^3

C. 3.200×10^3 and 3.2000×10^3

D. more than one correct response

E. no correct response

28. Which of the following measured numbers has an uncertainty of 0.01 associated with it?

A. 32.930

B. 3.02×10^6

C. 3.0×10^{-1}

D. more than one correct response

E. no correct response

29. Which of the following conversion factors would limit a calculation to three significant figures?

A. $\frac{453.6\ \text{g}}{1\ \text{lb}}$

B. $\frac{1\ \text{in.}}{2.54\ \text{cm}}$

C. $\frac{24\ \text{hr}}{1\ \text{day}}$

D. more than one correct response

E. no correct response

30. Density can be used as a conversion factor to convert from

A. mass to volume

B. volume to mass

C. metric unit mass to English unit mass

D. more than one correct response

E. no correct response

31. The density of table sugar is 1.59 g/mL. It is true that

A. 2.00 g of table sugar occupies a volume of 1.17 mL.

B. 3.00 g of table sugar occupies a volume of 1.97 mL.

C. 5.00 g of table sugar occupies a volume of 3.14 mL.

D. More than one correct response

E. No correct response

32. Which of the following statements concerning the three major temperature scales is *correct*?

A. Kelvin temperatures are always positive.

B. The equation for converting from Celsius to Kelvin involves the number 273.

C. The freezing point of water has a lower numerical value on the Kelvin scale than on the Fahrenheit scale.

D. More than one correct response.

E. No correct response.

33. In which of the following pairs of temperature readings are the two members of the pair equivalent to each other?

A. 32°F and 273 K

B. 0°C and 373 K

C. 0°C and 40°F

D. more than one correct response

E. no correct response

34. The heat energy needed to raise the temperature of 10.0 g of metal by 10.0°C would exceed 25 calories for which of the following metals?

A. gold, specific heat $= \frac{0.031 \text{ cal}}{\text{g°C}}$

B. silver, specific heat $= \frac{0.057 \text{ cal}}{\text{g°C}}$

C. aluminum, specific heat $= \frac{0.21 \text{ cal}}{\text{g°C}}$

D. more than one correct response

E. no correct response

35. Which of the following statements concerning specific heats is *correct*?

A. Specific heat can be measured only when a substance is in the solid state.

B. Under similar conditions, substances with low specific heats increase in temperature more when heated than do substances with high specific heats.

C. A correct set of units for specific heat is cal/°C.

D. More than one correct response.

E. No correct response.

36. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices

a) All three statements are true.

b) Two of the three statements are true.

c) Only one of the statements is true.

d) None of the statements is true. Reference: Ref 2-1

Statements:

(1) The meaning of a metric system prefix is independent of the base unit it modifies.

(2) “Trailing zeros” at the end of a measured number are never significant.

(3) The answer to the problem $10^5/10^{-3}$ is 10^2.

A. All three statements are true.

B. Two of the three statements are true.

C. Only one of the statements is true.

D. None of the statements is true.

37. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) In outer space, an astronaut may be weightless but never massless.
(2) The metric system prefixes *milli* and *micro* differ in mathematical meaning by a factor of 1000.
(3) The addition of 273 to a Fahrenheit temperature reading will convert it to a Kelvin temperature reading.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

38. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The measured number 2.410×10^{-3} contains three significant figures.
(2) The specific heat of water is higher than that of most other substances.
(3) The equation 1 kg = 10^6 mg is a correct mathematical statement.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

39. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The answer to the addition problem 3.21 + 32 + 3.22 should have an uncertainty of hundredths.
(2) The measurement 653,899, when rounded to five significant figures, becomes 65,390.
(3) The higher the specific heat of a substance, the more its temperature will change when it absorbs a given amount of heat.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

40. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The conversion factor 10^3 m/1 km contains an unlimited number of significant figures.
(2) Density may be used as a conversion factor to convert from mass to volume.
(3) The equation 2.33 lb = 625 g is a correct mathematical statement.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

41. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) A deciliter is equal to 100 milliliters.
(2) The Kelvin temperature scale is closely related mathematically to the Celsius temperature scale.
(3) Measurements cannot be exact because two estimated digits are always recorded as part of any measurement.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

42. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The answer to the calculation $12.00 \times (6.00 \times 10^{23})$ should contain three significant figures.
(2) A meter is slightly larger than a yard, and a liter is slightly larger than a quart.
(3) The numbers 3.30×10^{-1} and 3.30×10^{1} both have a magnitude of less than one.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

43. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The size of the degree is the same on the Fahrenheit and Celsius temperature scales.
(2) The measurement 62,300 has an uncertainty of ± 100.
(3) The answer to the calculation 8.45 + 10.40 should contain four significant figures.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

44. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) The measured numbers 244,000 and 0.000244 contain the same number of significant figures.
(2) One cubic centimeter is equal to ten milliliters.
(3) The conversion factor 1 in/2.54 cm, when used as written, would decrease unit size.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

45. In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices
a) All three statements are true.
b) Two of the three statements are true.
c) Only one of the statements is true.
d) None of the statements is true. Reference: Ref 2-1
Statements:
(1) Normal human body temperature has an average value of 98.2^{o}F.
(2) A rapid fall in human body temperature of 2^{o}F to 3^{o}F produces “shivering.”
(3) Fat cells, unlike most other human body cells and fluids, are less dense than water.
A. All three statements are true.
B. Two of the three statements are true.
C. Only one of the statements is true.
D. None of the statements is true.

46. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
0.000320

b

47. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
0.30003

c

48. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
2,300,100

c

49. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
93,100,000

b

50. For each of the measured numbers, determine the number of significant figures present. Specify your answers using the response. Responses may be used more than once or need not be used at all.
a) one
b) three
c) five
d) seven Reference: Ref 2-2
3215.000

d

51. For each of the calculator-completed calculations, determine the correct number of significant figures that the answer should have using the response. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) two
b) three
c) four
d) five Reference: Ref 2-3
$4.35 \times 2.17 = 9.4395$

b

52. $2.311 + 23.420 = 25.731$

d

53. $273.2 - 33 = 240.2$

b

54. $\frac{9.000}{3.0} = 3$

a

55. $\frac{0.00030}{0.000300} = 1$

a

56. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
The number of significant figures is the same in both numbers.

d

57. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
All zeros are significant in both numbers.

c

58. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
The uncertainty is the same in both numbers.

b

59. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
The uncertainty is greater than 0.1 in both numbers.

b

60. For each of the characterizations, select the correct pair of numbers from the response list. Responses may be used more than once or need not be used at all. Note that all numbers are measurements.
a) 0.31300 and 0.3130
b) 233,200 and 17,100
c) 37.210 and 220.3
d) 0.00010 and 110,000 Reference: Ref 2-4
Scientific notation for both numbers involves the same power of ten.

a

61. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Celsius equivalent of 273 K

a

62. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Fahrenheit equivalent of 0°C

b

63. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Kelvin equivalent of –20°C

c

64. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Celsius equivalent of 32°F

a

65. For each of the temperature scale comparisons, select the correct numerical temperature value from the response list. Responses may be used more than once or need not be used at all.
a) 0
b) 32
c) 253
d) 273 Reference: Ref 2-5
Fahrenheit equivalent of 273 K

b

66. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Density (in g/mL) when m = 12.0 g and V = 3.0 mL

b

67. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Volume (in mL) when m = 2.0 g and d = 2.0 g/mL

a

68. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Mass (in g) when V = 2.0 mL and d = 2.0 g/mL

b

69. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Specific heat (in cal/g°C) when heat = 20.0 cal, m = 10.0 g and $\Delta T = 2.0°C$

a

70. Select the correct numerical answer for each of the calculations using the response. Responses may be used more than once or need not be used at all.
a) 1.0
b) 4.0
c) 8.0
d) 12.0 Reference: Ref 2-6
Mass (in g) when heat = 80.0 cal, sp. ht. = 0.50 cal/g°C and $\Delta T = 40°C$

b