Physics for Scientists and Engineers, 4e **(Giancoli)**

Chapter 1 Introduction, Measurement, Estimating

1.1 Conceptual Questions

1) State the general rule for significant figures when multiplying or dividing numbers.
Answer: The final result of a multiplication or division problem should have only as many digits as the number with the least number of significant figures used in the calculation.
Diff: 1 Page Ref: Sec. 1-3

2) State the general rule for significant figures when adding or subtracting numbers.
Answer: The final result of an addition or subtraction problem should be no more precise than the least precise number used in the calculation.
Diff: 1 Page Ref: Sec. 1-3

3) List the SI base quantities.
Answer: Length, Time, Mass, Electric current, Temperature, Amount of substance, Luminous intensity
Diff: 1 Page Ref: Sec. 1-4

4) List the SI base units.
Answer: meter, second, kilogram, ampere, kelvin, mole, candela
Diff: 1 Page Ref: Sec. 1-4

5) Describe an order-of-magnitude estimate.
Answer: A rough estimate made by rounding off all numbers to one significant figure and its power of ten, and after the calculation is made, again only one significant figure is kept.
Diff: 1 Page Ref: Sec. 1-5

6) Theories are derived directly from observations.
Answer: FALSE
Diff: 1 Page Ref: Sec. 1-1

7) A theory cannot be absolutely verified.
Answer: TRUE
Diff: 1 Page Ref: Sec. 1-1

8) There is an uncertainty associated with every measurement.
Answer: TRUE
Diff: 1 Page Ref: Sec. 1-3

9) The number of reliably known digits in a number is called the number of estimated uncertainty.
Answer: FALSE
Diff: 1 Page Ref: Sec. 1-3

10) Accuracy refers to the repeatability of a measurement using a given instrument.
Answer: FALSE
Diff: 1 Page Ref: Sec. 1-3

11) Accuracy refers to how close a measurement is to the true value.
Answer: TRUE
Diff: 1 Page Ref: Sec. 1-3

12) Estimated uncertainty is meant to take into account precision but not accuracy.
Answer: FALSE
Diff: 1 Page Ref: Sec. 1-3

13) Dimensional analysis can tell you whether an equation is physically correct.
Answer: FALSE
Diff: 1 Page Ref: Sec. 1-7

14) A kind of analogy or mental image of a phenomenon in terms of something we are familiar with is referred to as a
A) model. B) theory. C) law. D) principle. E) hypothesis.
Answer: A
Diff: 1 Page Ref: Sec. 1-2

15) A statement found to be experimentally valid over a wide range of observed phenomena is referred to as a
A) model. B) theory. C) law. D) principle. E) hypothesis.
Answer: C
Diff: 1 Page Ref: Sec. 1-2

16) When multiplying several quantities, the number of significant digits in the result must always be
A) larger than the number of significant digits in the most accurate of the quantities.
B) equal to the number of significant digits in the most accurate of the quantities.
C) equal to the average number of significant digits in the most and least accurate of the quantities.
D) equal to the number of significant digits in the least accurate of the quantities.
E) smaller than the number of significant digits in the least accurate of the quantities.
Answer: D
Diff: 1 Page Ref: Sec. 1-3

17) When dividing several quantities, the number of significant digits in the result must always be
A) larger than the number of significant digits in the most accurate of the quantities.
B) equal to the number of significant digits in the most accurate of the quantities.
C) equal to the average number of significant digits in the most and least accurate of the quantities.
D) equal to the number of significant digits in the least accurate of the quantities.
E) smaller than the number of significant digits in the least accurate of the quantities.
Answer: D
Diff: 1 Page Ref: Sec. 1-3

18) When adding several quantities, the number of decimal places in the result must always be
A) larger than the number of decimal places in the most accurate of the quantities.
B) equal to the number of decimal places in the most accurate of the quantities.
C) equal to the average number of significant digits in the most and least accurate of the quantities.
D) equal to the number of decimal places in the least accurate of the quantities.
E) smaller than the number of decimal places in the least accurate of the quantities.
Answer: D
Diff: 1 Page Ref: Sec. 1-3

19) When subtracting several quantities, the number of decimal places in the result must always be
A) larger than the number of decimal places in the most accurate of the quantities.
B) equal to the number of decimal places in the most accurate of the quantities.
C) equal to the average number of significant digits in the most and least accurate of the quantities.
D) equal to the number of decimal places in the least accurate of the quantities.
E) smaller than the number of decimal places in the least accurate of the quantities.
Answer: D
Diff: 1 Page Ref: Sec. 1-3

20) A useful method of expressing very small or very large numbers is
A) scientific notation.
B) arabic numerals.
C) roman numerals.
D) significant figures.
E) greek letters.
Answer: A
Diff: 1 Page Ref: Sec. 1-3

21) Four students measure the mass of an object, each using a different scale. They record their results as follows:

Student	A	B	C	D	E
Mass (g)	49.06	49	50	49.1	49.061

Which student used the least precise scale?
A) A B) B C) C D) D E) E
Answer: C
Diff: 1 Page Ref: Sec. 1-3

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Student	A	B	C	D	E
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Which student used the most precise scale?
A) A B) B C) C D) D E) E
Answer: E
Diff: 1 Page Ref: Sec. 1-3

23) The metric prefix for one one-thousandth is
A) milli. B) centi. C) kilo. D) mega. E) giga.
Answer: A
Diff: 1 Page Ref: Sec. 1-4

24) The metric prefix for one one-hundredth is
A) milli. B) centi. C) kilo. D) mega. E) giga.
Answer: B
Diff: 1 Page Ref: Sec. 1-4

25) The metric prefix for one thousand is
A) milli. B) centi. C) kilo. D) mega. E) giga.
Answer: C
Diff: 1 Page Ref: Sec. 1-4

26) How many basic units does the SI system have?
A) three B) four C) five D) seven E) ten
Answer: D
Diff: 1 Page Ref: Sec. 1-4

27) The base SI unit of length is
A) millimeter. B) centimeter. C) meter. D) kilometer. E) megameter.
Answer: C
Diff: 1 Page Ref: Sec. 1-4

28) All of the following are base units of the SI system except:
A) kilogram. B) kelvin. C) meter. D) volt. E) candela.
Answer: D
Diff: 1 Page Ref: Sec. 1-4

29) Select the list which contains only SI basic units.
A) liter, meter, second, watt
B) joule, kelvin, kilogram, watt
C) candela, kelvin, meter, second
D) joule, newton, second, watt
E) candela, joule, second, meter
Answer: C
Diff: 1 Page Ref: Sec. 1-4

30) What precision should you expect for a quantity that you determine by estimation in which variables used in the calculation are rounded to the nearest power of ten?
A) Two significant figures will always be correct.
B) the correct order of magnitude
C) Anywhere from two to three significant figures will always be correct.
D) One significant figure will always be correct.
E) Three significant figures will always be correct.
Answer: B
Diff: 2 Page Ref: Sec. 1-6

1.2 Quantitative Problems

1) How many significant figures are in 0.00054?
A) 2 B) 3 C) 4 D) 5 E) 6
Answer: A
Diff: 1 Page Ref: Sec. 1-3

2) How many significant figures are in 0.0067?
A) 1 B) 2 C) 3 D) 4 E) 5
Answer: B
Diff: 1 Page Ref: Sec. 1-3

3) How many significant figures are in 10,002?
A) ambiguous B) 2 C) 3 D) 4 E) 5
Answer: E
Diff: 1 Page Ref: Sec. 1-3

4) How many significant figures are in 120.07?
A) 6 B) 5 C) 4 D) 3 E) 2
Answer: B
Diff: 1 Page Ref: Sec. 1-3

5) How many significant figures are in 576,000?
A) 3 B) 4 C) 5 D) 6 E) ambiguous
Answer: E
Diff: 1 Page Ref: Sec. 1-3

6) What is the sum of 1123 and 10.3 written with the correct number of significant figures?
A) 1.13×10^3 B) 1133.3000 C) 1.1×10^3 D) 1133.3 E) 1133
Answer: E
Diff: 1 Page Ref: Sec. 1-3

7) What is the sum of 1.49 + 3.212 + 1.9?
A) 7 B) 6.6 C) 6.60 D) 6.602 E) 6.6020
Answer: B
Diff: 1 Page Ref: Sec. 1-3

8) What is the difference between 105.3 and 101.12?
A) 4 B) 4.2 C) 4.18 D) 4.180 E) 4.1800
Answer: B
Diff: 1 Page Ref: Sec. 1-3

9) What is the product of 12.56 and 2.12?
A) 27 B) 26.6 C) 26.23 D) 26.627 E) 26.6270
Answer: B
Diff: 1 Page Ref: Sec. 1-3

10) What is the result of 2.43 ÷ 4.561?
A) 5.3278×10^{-1}
B) 5.328×10^{-1}
C) 5.33×10^{-1}
D) 5.3×10^{-1}
E) 5×10^{-1}
Answer: C
Diff: 1 Page Ref: Sec. 1-3

11) What is the cosine of 45°?
A) 0.7 B) 0.71 C) 0.707 D) 0.7071 E) 0.70710
Answer: B
Diff: 1 Page Ref: Sec. 1-3

12) What is 34 + (4) × (1.2465) written with the correct number of significant figures?
A) 39.0 B) 38.99 C) 4×10^1 D) 39 E) 38.986
Answer: D
Diff: 1 Page Ref: Sec. 1-3

13) What is 56 + (32.00)/(1.2465 + 3.45) written with the correct number of significant figures?
A) 62.8 B) 62.812 C) 62.81 D) 63 E) 62.8123846
Answer: D
Diff: 1 Page Ref: Sec. 1-3

14) The length and width of a rectangle are 1.125 m and 0.606 m, respectively. Multiplying, your calculator gives the product as 0.68175. Rounding properly to the correct number of significant figures, the area should be written as

A) 0.7 m^2. B) 0.68 m^2. C) 0.682 m^2. D) 0.6818 m^2. E) 0.68175 m^2.

Answer: C
Diff: 1 Page Ref: Sec. 1-3

15) Write the number 0.00056 in power of ten notation.

A) 5.6×10^{-5} B) 5.6×10^{-4} C) 5.6×10^{-3} D) 5.6×10^{-2} E) 5.6×10^{-1}

Answer: B
Diff: 1 Page Ref: Sec. 1-3

16) 0.0001895 can also be expressed as

A) 1.895×10^{-3}. B) 1.895×10^{-4}. C) 18.95×10^{4}. D) 1895×10^{5}. E) 189.5×10^{7}.

Answer: B
Diff: 1 Page Ref: Sec. 1-3

17) Convert 4.5×10^{-3} to decimal notation.

A) 4.500 B) 0.4500 C) 0.0450 D) 0.0045 E) 0.00045

Answer: D
Diff: 1 Page Ref: Sec. 1-3

18) Write out the number 9.45×10^{-5} in full with a decimal point and correct number of zeros.

A) 0.00000945 B) 0.0000945 C) 0.000945 D) 0.00945 E) 0.0945

Answer: B
Diff: 1 Page Ref: Sec. 1-3

19) What is the percent uncertainty in the measurement 2.58 ± 0.15 cm?

A) 2.9% B) 5.8% C) 8.7% D) 12% E) 15%

Answer: B
Diff: 2 Page Ref: Sec. 1-3

20) What, approximately, is the percent uncertainty for the measurement 5.2?

A) 1% B) 2% C) 3% D) 4% E) 5%

Answer: B
Diff: 2 Page Ref: Sec. 1-3

21) What is the percent uncertainty in the area of a circle whose radius is 1.8×10^{4} cm?

A) 1.1% B) 5.6% C) 11% D) 24% E) 56%

Answer: C
Diff: 3 Page Ref: Sec. 1-3

22) What is the volume, and its approximate uncertainty, of a sphere of radius 1.96 ± 0.01 m?

A) 31.5 ± 0.1 m^3
B) 31.5 ± 0.2 m^3
C) 31.5 ± 0.3 m^3
D) 31.5 ± 0.4 m^3
E) 31.5 ± 0.5 m^3

Answer: E
Diff: 3 Page Ref: Sec. 1-3

23) How many minutes is 182 days?

A) 1.31×10^5 min

B) 2.62×10^5 min

C) 7.86×10^7 min

D) 1.57×10^7 min

E) 127 min

Answer: B

Diff: 1 Page Ref: Sec. 1-5

24) How many seconds in 5.24 days?

A) 3.77×10^3 s B) 4.98×10^7 s C) 4.53×10^5 s D) 2.26×10^5 s E) 7.55×10^3 s

Answer: C

Diff: 1 Page Ref: Sec. 1-5

25) What is the conversion factor between km/h and m/s?

A) 7.72×10^{-5} (m/s)/(km/h)

B) 2.78×10^{-1} (m/s)/(km/h)

C) 1.30×10^4 (m/s)/(km/h)

D) 3.60 (m/s)/(km/h)

E) 16.7 (m/s)/(km/h)

Answer: B

Diff: 1 Page Ref: Sec. 1-5

26) What is the conversion factor between km/ h^2 and m/ s^2?

A) 7.72×10^{-5} (m/ s^2)/(km/ h^2)

B) 2.78×10^{-1} (m/ s^2)/(km/ h^2)

C) 1.30×10^4 (m/ s^2)/(km/ h^2)

D) 3.60 (m/ s^2)/(km/ h^2)

E) 16.7 (m/ s^2)/(km/ h^2)

Answer: A

Diff: 1 Page Ref: Sec. 1-5

27) What is the conversion factor between cm^2 and m^2?

A) 0.01 m^2/ cm^2

B) 0.0001 m^2/ cm^2

C) 10 m^2/ cm^2

D) 100 m^2/ cm^2

E) 10000 m^2/ cm^2

Answer: B

Diff: 1 Page Ref: Sec. 1-5

28) 0.00325×10^{-8} cm can also be expressed in mm as

A) 3.25×10^{-12} mm.

B) 3.25×10^{-11} mm.

C) 3.25×10^{-10} mm.

D) 3.25×10^{-9} mm.

E) 3.25×10^{-8} mm.

Answer: C

Diff: 2 Page Ref: Sec. 1-5

29) Approximately how many times does an average human heart beat in a year?
A) 4×10^5 B) 4×10^6 C) 4×10^7 D) 4×10^8 E) 4×10^9
Answer: C
Diff: 1 Page Ref: Sec. 1-6

30) Approximately how many times does an average human heart beat in a lifetime?
A) 3×10^{11} B) 3×10^{10} C) 3×10^9 D) 3×10^8 E) 4×10^7
Answer: C
Diff: 1 Page Ref: Sec. 1-6

31) Approximately how many pennies would you have to stack to reach an average 8-foot ceiling?
A) 2×10^3 B) 2×10^2 C) 2×10^4 D) 2×10^5 E) 2×10^6
Answer: A
Diff: 1 Page Ref: Sec. 1-6

32) Estimate the number of times Earth will rotate on its axis during a human's lifetime.
A) 3×10^4 B) 3×10^5 C) 3×10^6 D) 3×10^7 E) 3×10^8
Answer: A
Diff: 1 Page Ref: Sec. 1-6

33) A person stands 35.0 m from a flag pole. With a protractor at eye level, he finds that the angle at the top of the flag pole makes with the horizontal is 25.0 degrees. Approximately how high is the flag pole? (The distance from his feet to his eyes is 1.7 m.)
A) 10 m B) 20 m C) 30 m D) 50 m E) 80 m
Answer: B
Diff: 2 Page Ref: Sec. 1-6

34) Estimate the number of pennies that would fit in a box one foot across by one foot wide by one foot tall.
A) 5×10^2 B) 5×10^3 C) 5×10^4 D) 5×10^5 E) 5×10^4
Answer: C
Diff: 2 Page Ref: Sec. 1-6

35) Estimate how many times you would have to fold a sheet of paper until it becomes as thick as a large dictionary (approximately 10 cm thick).
A) 10 times B) 50 times C) 100 times D) 500 times E) 1000 times
Answer: A
Diff: 3 Page Ref: Sec. 1-6

36) In solving a physics problem you end up with m in the numerator and m/s in the denominator. The units for your answer are
A) m^2/s. B) m^2. C) m. D) s. E) 1/s.
Answer: D
Diff: 1 Page Ref: Sec. 1-7

37) The density of a solid object is defined as the ratio of the mass of the object to its volume. The dimension of density is
A) [M]/[L]. B) $[L]^3/[M]$. C) $[M][L]^{-3}$. D) [M][L][T]. E) [M][L].
Answer: C
Diff: 1 Page Ref: Sec. 1-7

38) The period of a pendulum is the time it takes the pendulum to swing back and forth once. If the only dimensional quantities that the period depends on are the acceleration of gravity, g, and the length of the pendulum, L, what combination of g and L must the period be proportional to? Acceleration has dimensions of $[L][T^{-2}]$.

A) g/L B) gL^2 C) gL D) $\sqrt{gL}$ E) $\sqrt{L/g}$

Answer: E
Diff: 1 Page Ref: Sec. 1-7

39) Impulse is a quantity that is equal to force multiplied by time. If the dimensions of force are $[M][L][T^{-2}]$, what are the dimensions of impulse?

A) $[M][L][T^{-3}]$
B) $[M][L^2][T]$
C) $[M][L^2][T^{-2}]$
D) $[M][L][T^{-1}]$
E) $[M][L]$

Answer: D
Diff: 1 Page Ref: Sec. 1-7

40) Power is defined as the rate of work per time, power = work/time. If the dimensions of power are $[ML^2T^{-3}]$, what are the dimensions of work?

A) $[MLT^{-3}]$ B) $[ML^2T^{-1}]$ C) $[ML^3T^{-3}]$ D) $[ML^2T^{-2}]$ E) $[ML^2T^{-4}]$

Answer: D
Diff: 2 Page Ref: Sec. 1-7

41) The position, x, of an object is given by the equation $x = A + Bt + Ct^2$, where t refers to time. What are the dimensions of A, B, and C?

A) distance, distance, distance
B) distance, time, time
C) distance, time, time^2
D) distance, distance/time, distance/ time^2
E) distance/time, distance/time^2, distance/ time^3

Answer: D
Diff: 2 Page Ref: Sec. 1-7