

# Chapter 1 Introduction, Measurement, Estimating

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## Conceptual Questions

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

Student	A	B	C	D
Mass (g )	49.06	49	50	49.2

Which student used the least precise scale?

- A) A
- B) B
- C) C
- D) D

Answer: C

Diff: 1      Page Ref: Sec. 1.4

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

Student	A	B	C	D
Mass (g )	49.06	49	50	49.2

Which student used the most precise scale?

- A) A
- B) B
- C) C
- D) D

Answer: A

Diff: 1      Page Ref: Sec. 1.4

- 3) A useful method of expressing very small or very large numbers is

- A) scientific notation.
- B) arabic numerals.
- C) the metric system.
- D) roman numerals.

Answer: A

Diff: 1      Page Ref: Sec. 1.4

4) All of the following are base units of the SI system except:

- A) kilogram.
- B) kelvin.
- C) meter.
- D) volt.

Answer: D

Diff: 1      Page Ref: Sec. 1.5-1.6

5) 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

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

6) How many basic units does the SI system have?

- A) four
- B) five
- C) seven
- D) ten

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

7) The base SI unit of time is

- A) hour.
- B) minute.
- C) second.
- D) millisecond.

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

8) In the CGS system, what are the fundamental units?

- A) Newton, centimeter, second
- B) kilogram, meter, second
- C) gram, centimeter, minute
- D) gram, centimeter, second

Answer: D

Diff: 2      Page Ref: Sec. 1.5-1.6

9) The metric prefix for one one-thousandth is

- A) milli.
- B) centi.
- C) kilo.
- D) mega.

Answer: A

Diff: 1      Page Ref: Sec. 1.5-1.6

10) The metric prefix for one one-hundredth is

- A) milli.
- B) centi.
- C) kilo.
- D) mega.

Answer: B

Diff: 1      Page Ref: Sec. 1.5-1.6

11) The metric prefix for one thousand is

- A) milli.
- B) centi.
- C) kilo.
- D) mega.

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

12) Express the number 0.02 days using a prefix of Table 1-4.

- A) 2 decadays
- B) 2 centidays
- C) 2 millidays
- D) 2 microdays

Answer: B

Diff: 1      Page Ref: Sec. 1.5-1.6

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

- A) 0.0278 m/s
- B) 0.278 m/s
- C) 3.60 m/s
- D) 16.7 m/s

Answer: B

Diff: 1      Page Ref: Sec. 1.5-1.6

14) What is the conversion factor between  $\text{km/h}^2$  and  $\text{m/s}^2$ ?

- A)  $7.72 \times 10^{-6} \text{ m/s}^2$
- B)  $2.78 \times 10^{-1} \text{ m/s}^2$
- C)  $1.30 \times 10^4 \text{ m/s}^2$
- D)  $3.60 \text{ m/s}^2$

Answer: A

Diff: 1      Page Ref: Sec. 1.5–1.6

15) What is the conversion factor between  $\text{cm}^2$  and  $\text{m}^2$ ?

- A)  $0.01 \text{ m}^2/\text{cm}^2$
- B)  $0.0001 \text{ m}^2/\text{cm}^2$
- C)  $100 \text{ m}^2/\text{cm}^2$
- D)  $10000 \text{ m}^2/\text{cm}^2$

Answer: B

Diff: 1      Page Ref: Sec. 1.5–1.6

16) 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,  $\text{time}^2$
- C) distance, distance/time, distance/ $\text{time}^2$
- D) distance/time, distance/ $\text{time}^2$ , distance/ $\text{time}^3$

Answer: C

Diff: 2      Page Ref: Sec. 1.8

## Quantitative Problems

1) What is the percent uncertainty in the measurement  $2.58 \pm 0.15 \text{ cm}$ ?

- A) 2.9%
- B) 5.8%
- C) 8.7%
- D) 12%

Answer: B

Diff: 2      Page Ref: Sec. 1.4

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

- A) 1%
- B) 2%
- C) 3%
- D) 4%

Answer: B

Diff: 2      Page Ref: Sec. 1.4

3) What is the percent uncertainty in the area of a circle whose radius is  $1.8 \times 10^4$  cm?

- A) 1.1%
- B) 5.6%
- C) 11%
- D) 56%

Answer: C

Diff: 3      Page Ref: Sec. 1.4

4) What is the volume, and its approximate uncertainty, of a sphere of radius  $1.96 \pm 0.01$  m?

- A)  $31.5 \pm 0.2$  m<sup>3</sup>
- B)  $31.5 \pm 0.3$  m<sup>3</sup>
- C)  $31.5 \pm 0.4$  m<sup>3</sup>
- D)  $31.5 \pm 0.5$  m<sup>3</sup>

Answer: D

Diff: 3      Page Ref: Sec. 1.4

5) The number of significant figures in 10001 is

- A) two.
- B) three.
- C) five.
- D) six.

Answer: C

Diff: 1      Page Ref: Sec. 1.4

6) The number of significant figures in 0.01500 is

- A) two.
- B) three.
- C) four.
- D) five.

Answer: C

Diff: 1      Page Ref: Sec. 1.4

7) The number of significant figures in 0.040 is

- A) one.
- B) two.
- C) three.
- D) four.

Answer: B

Diff: 1      Page Ref: Sec. 1.4

8) Which of the following has three significant figures?

- A) 305.0 cm
- B) 0.0500 mm
- C) 1.00081 kg
- D)  $8.060 \times 10^{11} \text{ m}^2$

Answer: B

Diff: 1      Page Ref: Sec. 1.4

9) What is the sum of  $2.67 + 1.976 + 2.1$ ?

- A) 6.7
- B) 6.75
- C) 6.746
- D) 6.7460

Answer: A

Diff: 1      Page Ref: Sec. 1.4

10) What is the difference between 103.5 and 102.24?

- A) 1.3
- B) 1.26
- C) 1.260
- D) 1.2600

Answer: A

Diff: 1      Page Ref: Sec. 1.4

11) What is the product of 12.56 and 2.12?

- A) 27
- B) 26.6
- C) 26.23
- D) 26.627

Answer: B

Diff: 1      Page Ref: Sec. 1.4

12) What is the result of  $2.43 \div 4.561$ ?

- A)  $5.3278 \times 10^{-1}$
- B)  $5.328 \times 10^{-1}$
- C)  $5.33 \times 10^{-1}$
- D)  $5.3 \times 10^{-1}$

Answer: C

Diff: 1      Page Ref: Sec. 1.4

13) What is the cosine of  $55^\circ$ ?

- A) 0.6
- B) 0.57
- C) 0.574
- D) 0.5736

Answer: B

Diff: 1      Page Ref: Sec. 1.4

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) 0.68 m<sup>2</sup>.
- B) 0.682 m<sup>2</sup>.
- C) 0.6818 m<sup>2</sup>.
- D) 0.68175 m<sup>2</sup>.

Answer: B

Diff: 1      Page Ref: Sec. 1.4

15) The length and width of a rectangle are 1.125 m and 0.606 m, respectively. You calculate the rectangle's perimeter by adding these and multiplying by two. Your calculator's display reads 3.462. To the correct number of significant figures, this should be written as

- A) 3.5 m.
- B) 3.46 m.
- C) 3.462 m.
- D) 3.4620 m.

Answer: C

Diff: 1      Page Ref: Sec. 1.4

16) A rectangle is 3.25 m long and 1.5 m wide. What is its area?

- A) 4.875 m<sup>2</sup>
- B) 4.87 m<sup>2</sup>
- C) 4.80 m<sup>2</sup>
- D) 4.9 m<sup>2</sup>

Answer: D

Diff: 2      Page Ref: Sec. 1.4

- 17) A rectangular garden measures 15 m long and 13.7 m wide. What is the length of a diagonal from one corner of the garden to the other?

A) 18 m  
B) 19 m  
C) 20 m  
D)  $4.1 \times 10^2$  m

Answer: C

Diff: 2      Page Ref: Sec. 1.4

- 18) Select the smallest value.

A)  $15 \times 10^{-3}$   
B)  $0.15 \times 10^0$   
C)  $0.00015 \times 10^3$   
D)  $0.00000015 \times 10^6$

Answer: A

Diff: 1      Page Ref: Sec. 1.4

- 19) Write the number 0.00045 in power of ten notation.

A)  $4.5 \times 10^{-4}$   
B)  $4.5 \times 10^{-3}$   
C)  $4.5 \times 10^{-2}$   
D)  $4.5 \times 10^{-1}$

Answer: A

Diff: 1      Page Ref: Sec. 1.4

- 20) 0.0001776 can also be expressed as

A)  $1.776 \times 10^{-4}$ .  
B)  $17.72 \times 10^4$ .  
C)  $1772 \times 10^5$ .  
D)  $177.2 \times 10^7$ .

Answer: A

Diff: 1      Page Ref: Sec. 1.4

- 21) 4567.89 is properly expressed in scientific notation as

A)  $4.56789 \times 10^3$ .  
B)  $45.6789 \times 10^2$ .  
C)  $456.789 \times 10^1$ .  
D)  $4567.89 \times 10^0$ .

Answer: A

Diff: 1      Page Ref: Sec. 1.4



22) Convert  $1.2 \times 10^{-3}$  to decimal notation.

- A) 1.200
- B) 0.1200
- C) 0.0120
- D) 0.0012

Answer: D

Diff: 1      Page Ref: Sec. 1.4

23) Write out the number  $8.42 \times 10^{-5}$  in full with a decimal point and correct number of zeros.

- A) 0.00000842
- B) 0.0000842
- C) 0.000842
- D) 0.00842

Answer: B

Diff: 1      Page Ref: Sec. 1.4

24) What is the result of  $(0.410 + 0.021) \times (2.20 \times 10^3)$ ?

- A) 880
- B) 946
- C) 948
- D) 950

Answer: C

Diff: 2      Page Ref: Sec. 1.4

25) Write the number 13.5 gigameters as full (decimal) numbers with standard units.

- A) 135,000 m
- B) 135,000,000 m
- C) 135,000,000,000 m
- D) 13,500,000,000 m

Answer: D

Diff: 1      Page Ref: Sec. 1.5-1.6

26) 100 mL is equivalent to which of the following?

- A) 1 kL
- B)  $10^{-6}$   $\mu$ L
- C) 0.1 L
- D) 0.01 ML

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

27) How many grams is forty milligrams?

- A) 0.000040 g
- B) 0.00040 g
- C) 0.040 g
- D) 40000 g

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

28) How many meters is sixty kilometers?

- A) 600,000 m
- B) 60,000 m
- C) 60 m
- D) 0.06 m

Answer: B

Diff: 1      Page Ref: Sec. 1.5-1.6

29) 1 angstrom =  $10^{-10}$  m and 1 fermi =  $10^{-15}$  m, what is the relationship between these units?

- A) 1 angstrom =  $10^5$  fermi
- B) 1 angstrom =  $10^{-5}$  fermi
- C) 1 angstrom =  $10^{-25}$  fermi
- D) 1 angstrom =  $10^{+25}$  fermi

Answer: A

Diff: 1      Page Ref: Sec. 1.5-1.6

30)  $0.00325 \times 10^{-8}$  cm can also be expressed in mm as

- A)  $3.25 \times 10^{-12}$  mm.
- B)  $3.25 \times 10^{-11}$  mm.
- C)  $3.25 \times 10^{-10}$  mm.
- D)  $3.25 \times 10^{-9}$  mm.

Answer: C

Diff: 2      Page Ref: Sec. 1.5-1.6

31) Which one of the following is not equivalent to 2.50 miles? (1 mi = 1.609 km = 5280 ft, 1 ft = 12 in.)

- A)  $1.32 \times 10^4$  ft
- B)  $1.58 \times 10^5$  in.
- C)  $4.02 \times 10^3$  km
- D)  $4.40 \times 10^3$  yd

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

- 32) If you are 5'10" tall, what is your height in meters? (1 in = 2.54 cm.)

A) 1.5 m  
B) 1.6 m  
C) 1.7 m  
D) 1.8 m

Answer: D

Diff: 1      Page Ref: Sec. 1.5-1.6

- 33) If 1 inch = 2.54 cm, and 1 yd = 36 in., how many meters are in 7.00 yd?

A) 6.40 m  
B) 36.3 m  
C) 640 m  
D)  $1.78 \times 10^3$  m

Answer: A

Diff: 2      Page Ref: Sec. 1.5-1.6

- 34) A hot air balloon rises to an altitude of 600 fathoms. What is this height, in feet? (1 fathom = 6 ft.)

A) 100 ft  
B) 600 ft  
C) 1200 ft  
D) 3600 ft

Answer: D

Diff: 1      Page Ref: Sec. 1.5-1.6

- 35) The average life of an animal is 70 years. Assume one numerical figure, write this in power of ten in seconds.

A)  $3 \times 10^7$  s  
B)  $2 \times 10^7$  s  
C)  $2 \times 10^9$  s  
D)  $3 \times 10^9$  s

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

- 36) The mass of an electron is  $9.1 \times 10^{-31}$  kg. How many electrons will make a mass of 1.0 kg?

A)  $9.1 \times 10^{30}$   
B)  $1.1 \times 10^{30}$   
C)  $9.1 \times 10^{31}$   
D)  $1.1 \times 10^{31}$

Answer: B

Diff: 1      Page Ref: Sec. 1.5-1.6

37) How many m/s is 50 mi/h equivalent to? (1 mi = 1609 m.)

- A) 49 m/s
- B) 2.2 m/s
- C) 22 m/s
- D) 45 m/s

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

38) How much longer (percentage) is a 100 m dash than a 100 yd dash? (1 yd = 0.9146 m.)

- A) 3.5%
- B) 6.5%
- C) 8.5%
- D) 12%

Answer: C

Diff: 1      Page Ref: Sec. 1.5-1.6

39) Which is the largest area?

- A) 2,500,000 cm<sup>2</sup>
- B) 100,000 cm<sup>2</sup>
- C) 7.5 m<sup>2</sup>
- D) 0.75 m<sup>2</sup>

Answer: B

Diff: 1      Page Ref: Sec. 1.5-1.6

40) If 1 inch = 2.54 cm, how many square centimeters are in 1.00 square in.?

- A) 1.59
- B) 2.54
- C) 5.08
- D) 6.45

Answer: D

Diff: 2      Page Ref: Sec. 1.5-1.6

41) Express the following sum with the correct number of significant figures: 1.00 kg + 1531 g + 2.54 × 10<sup>4</sup> mg.

- A) 2.56 kg
- B) 27.9 kg
- C) 2.53 kg
- D) 2.79 kg

Answer: A

Diff: 2      Page Ref: Sec. 1.5-1.6

- 42) A football field is 120 yd long and 50 yd wide. What is the area of the football field, in  $\text{m}^2$ , if 1 yd = 91.44 cm?

A)  $2.4 \times 10^3 \text{ m}^2$   
B)  $3.7 \times 10^3 \text{ m}^2$   
C)  $4.2 \times 10^3 \text{ m}^2$   
D)  $5.0 \times 10^3 \text{ m}^2$

Answer: D

Diff: 2 Page Ref: Sec. 1.5-1.6

- 43) A ball has a radius of 3.23 cm. What is the volume of the ball in  $\text{m}^3$ ?

A)  $1.41 \times 10^{-4}$   
B) 1.41  
C)  $4.23 \times 10^{-4}$   
D) 4.23

Answer: A

Diff: 2 Page Ref: Sec. 1.5-1.6

- 44) A thick-walled metal pipe of length 20.0 cm has an inside diameter of 2.00 cm and an outside diameter of 2.40 cm. What is the total surface area of the pipe, counting the ends, in  $\text{m}^2$ ?

A) 276  
B) 277  
C) 278  
D) 279

Answer: D

Diff: 3 Page Ref: Sec. 1.5-1.6

- 45) The radius of the Earth is 3963 mi. What is the surface area of the Earth in square meters? (1 mi = 1609 m.)

A)  $4.9 \times 10^7 \text{ m}^2$   
B)  $1.3 \times 10^{14} \text{ m}^2$   
C)  $2.6 \times 10^{14} \text{ m}^2$   
D)  $5.1 \times 10^{14} \text{ m}^2$

Answer: D

Diff: 2 Page Ref: Sec. 1.5-1.6

- 46) The average density of blood is  $1.06 \times 10^3 \text{ kg/m}^3$ . If you donate a pint of blood to the Red Cross, what mass of blood have you donated, in grams? (1 pt = 1/2 L, 1 L = 1000 cm<sup>3</sup>.)
- A) 530 g
  - B) 0.530 g
  - C) 5300 g
  - D)  $5.30 \times 10^5 \text{ g}$

Answer: A

Diff: 2      Page Ref: Sec. 1.5-1.6

- 47) The mass of Mars,  $6.40 \times 10^{23} \text{ kg}$ , is about one-tenth that of the Earth, and its radius, 3395 km, is about half that of Earth. What is the mean density of Mars in kg/m<sup>3</sup>?
- A)  $9.76 \times 10^2$
  - B)  $1.95 \times 10^3$
  - C)  $3.90 \times 10^3$
  - D)  $7.81 \times 10^3$

Answer: C

Diff: 2      Page Ref: Sec. 1.5-1.6

- 48) Concrete is sold by the cubic yard. What is the mass, in kilograms, of one cubic yard of concrete that is five times as dense as water? (1 m = 1.094 yd, and 1 m<sup>3</sup> of water has a mass of 1,000 kg.)
- A) 764 kg
  - B)  $2.42 \times 10^3 \text{ kg}$
  - C)  $3.82 \times 10^3 \text{ kg}$
  - D)  $6.55 \times 10^3 \text{ kg}$

Answer: C

Diff: 2      Page Ref: Sec. 1.5-1.6

- 49) An average human has a heart rate of 70 beats per minute. If someone's heart beats at that average rate over a 70-yr lifetime, how many times would it beat?
- A)  $7 \times 10^5$
  - B)  $2 \times 10^6$
  - C)  $2 \times 10^7$
  - D)  $3 \times 10^9$

Answer: D

Diff: 2      Page Ref: Sec. 1.7

- 50) A large school district has 300 school buses. If each school bus is used 3 hours each day, the average speed of the school buses is 15 mi/h, and the fuel economy of the buses is 10 mi/gal. How much does it cost to run these buses in 22 school days if gasoline costs \$1.20 a gallon?

A) \$600  
B) \$1200  
C) \$1800  
D) \$2400

Answer: B

Diff: 2      Page Ref: Sec. 1.7

- 51) 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. 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) 80 m

Answer: B

Diff: 2      Page Ref: Sec. 1.7

- 52) Starting from city A, a car drives 250 miles east to city B, then 300 miles north to city C, and finally 700 miles west to city D. What is the distance between city A and city D?

A) 300 mi  
B) 400 mi  
C) 500 mi  
D) 600 mi

Answer: C

Diff: 2      Page Ref: Sec. 1.7

- 53) The last page of a book is numbered 764. The book is 3.00 cm thick. What is the average thickness of a sheet of paper in the book, in centimeters?

A)  $4 \times 10^{-3}$   
B)  $8 \times 10^{-3}$   
C) 100  
D) 200

Answer: B

Diff: 2      Page Ref: Sec. 1.7

- 54) Wall posters are usually sold curled up in cylindrical cardboard tubes. If the length of the tube is 84.5 cm, and the diameter of the tube is 2.40 cm, what is the area of the poster, in  $\text{cm}^2$ ? (Assume the poster doesn't overlap itself.)

- A)  $200 \text{ cm}^2$
- B)  $400 \text{ cm}^2$
- C)  $600 \text{ cm}^2$
- D)  $2000 \text{ cm}^2$

Answer: C

Diff: 2      Page Ref: Sec. 1.7