

# Chapter 1 Concepts of Motion

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## 1.1 Conceptual Questions

- 1) The current definition of the standard meter of length is based on
- A) the distance between the earth's equator and north pole.
  - B) the distance between the earth and the sun.
  - C) the distance traveled by light in a vacuum.
  - D) the length of a particular object kept in France.

Answer: C

*Var: 1*

- 2) The current definition of the standard second of time is based on
- A) the frequency of radiation emitted by cesium atoms.
  - B) the earth's rotation rate.
  - C) the duration of one year.
  - D) the oscillation of a particular pendulum kept in France.

Answer: A

*Var: 1*

- 3) The current definition of the standard kilogram of mass is based on
- A) the mass of the earth.
  - B) the mass of the sun.
  - C) the mass a particular object kept in France.
  - D) the mass of a cesium-133 atom.

Answer: C

*Var: 1*

- 4) If a woman weighs 125 lb, her mass expressed in kilograms is  $x$  kg, where  $x$  is
- A) less than 125.
  - B) greater than 125.

Answer: A

*Var: 1*

- 5) If a tree is 15 m tall, its height expressed in feet is  $x$  ft, where  $x$  is
- A) less than 15.
  - B) greater than 15.

Answer: B

*Var: 1*

- 6) If a flower is 6.5 cm wide, its width expressed in millimeters is  $x$  mm, where  $x$  is
- A) less than 6.5.
  - B) greater than 6.5.

Answer: B

*Var: 1*

- 7) If an operatic aria lasts for 5.75 min, its length expressed in seconds is  $x$  s, where  $x$  is
- A) less than 5.75.
  - B) greater than 5.75.

Answer: B

Var: 1

- 8) Scientists use the metric system chiefly because it is more accurate than the English system.
- A) True
  - B) False

Answer: B

Var: 1

- 9) When adding two numbers, the number of significant figures in the sum is equal to the number of significant figures in the least accurate of the numbers being added.
- A) True
  - B) False

Answer: B

Var: 1

- 10) When determining the number of significant figures in a number, zeroes to the left of the decimal point are never counted.
- A) True
  - B) False

Answer: B

Var: 1

## 1.2 Problems

- 1) Convert  $1.2 \times 10^{-3}$  to decimal notation.
- A) 1.200
  - B) 0.1200
  - C) 0.0120
  - D) 0.0012
  - E) 0.00012

Answer: D

Var: 5

- 2) Write out the number  $7.35 \times 10^{-5}$  in full with a decimal point and correct number of zeros.
- A) 0.00000735
  - B) 0.0000735
  - C) 0.000735
  - D) 0.00735
  - E) 0.0735

Answer: B

Var: 5

3) 0.0001776 can also be expressed as

- A)  $1.776 \times 10^{-3}$ .
- B)  $1.776 \times 10^{-4}$ .
- C)  $17.72 \times 10^4$ .
- D)  $1772 \times 10^5$ .
- E)  $177.2 \times 10^7$ .

Answer: B

Var: 5

4)  $0.00325 \times 10^{-8}$  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.
- E)  $3.25 \times 10^{-8}$  mm.

Answer: C

Var: 1

5) If, in a parallel universe,  $\pi$  has the value 3.14149, express  $\pi$  in that universe to four significant figures.

- A) 3.141
- B) 3.142
- C) 3.1415
- D) 3.1414

Answer: A

Var: 1

6) The number 0.003010 has

- A) 7 significant figures.
- B) 6 significant figures.
- C) 4 significant figures.
- D) 2 significant figures.

Answer: C

Var: 1

7) What is  $\frac{0.674}{0.74}$  to the proper number of significant figures?

- A) 0.91
- B) 0.911
- C) 0.9108
- D) 0.9

Answer: A

Var: 50+

8) What is the value of  $\pi(8.104)^2$ , written with the correct number of significant figures?

- A) 206.324
- B) 206.323
- C) 206.3
- D) 206
- E) 200

Answer: C

Var: 1

9) What is the sum of 1123 and 10.3 written with the correct number of significant figures?

- A)  $1.13 \times 10^3$
- B) 1133.3000
- C)  $1.1 \times 10^3$
- D) 1133.3
- E) 1133

Answer: E

Var: 1

10) What is the sum of  $1.53 + 2.786 + 3.3$  written with the correct number of significant figures?

- A) 8
- B) 7.6
- C) 7.62
- D) 7.616
- E) 7.6160

Answer: B

Var: 3

11) What is the difference between 103.5 and 102.24 written with the correct number of significant figures?

- A) 1
- B) 1.3
- C) 1.26
- D) 1.260
- E) 1.2600

Answer: B

Var: 3

12) What is the product of 11.24 and 1.95 written with the correct number of significant figures?

- A) 22
- B) 21.9
- C) 21.92
- D) 21.918
- E) 21.9180

Answer: B

Var: 3

13) What is the result of  $1.58 \div 3.793$  written with the correct number of significant figures?

- A)  $4.1656 \times 10^{-1}$
- B)  $4.166 \times 10^{-1}$
- C)  $4.17 \times 10^{-1}$
- D)  $4.2 \times 10^{-1}$
- E)  $4 \times 10^{-1}$

Answer: C

Var: 3

14) What is  $34 + (3) \times (1.2465)$  written with the correct number of significant figures?

- A) 37.7
- B) 37.74
- C)  $4 \times 10^1$
- D) 38
- E) 37.7395

Answer: D

Var: 5

15) 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

Var: 1

16) Add 3685 g and 66.8 kg and express your answer in milligrams (mg).

- A)  $7.05 \times 10^7$  mg
- B)  $7.05 \times 10^4$  mg
- C)  $7.05 \times 10^5$  mg
- D)  $7.05 \times 10^6$  mg

Answer: A

Var: 50+

17) Express  $(4.3 \times 10^6)^{-1/2}$  in scientific notation.

- A)  $4.8 \times 10^{-4}$
- B)  $2.1 \times 10^3$
- C)  $2.1 \times 10^{-5}$
- D)  $2.1 \times 10^4$

Answer: A

Var: 40

18) What is  $0.205^{2/3}$ , expressed to the proper number of significant figures?

- A) 0.348
- B) 0.35
- C) 0.3
- D) 0.3477

Answer: A

Var: 50+

19) 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)  $0.7 \text{ m}^2$ .
- B)  $0.68 \text{ m}^2$ .
- C)  $0.682 \text{ m}^2$ .
- D)  $0.6818 \text{ m}^2$ .
- E)  $0.68175 \text{ m}^2$ .

Answer: C

Var: 1

20) The following exact conversion equivalents are given:  $1 \text{ m} = 100 \text{ cm}$ ,  $1 \text{ in} = 2.54 \text{ cm}$ , and  $1 \text{ ft} = 12 \text{ in}$ . If a computer screen has an area of  $1.27 \text{ ft}^2$ , this area is closest to

- A)  $0.00284 \text{ m}^2$ .
- B)  $0.0465 \text{ m}^2$ .
- C)  $0.118 \text{ m}^2$ .
- D)  $0.284 \text{ m}^2$ .
- E)  $4.65 \text{ m}^2$ .

Answer: C

Var: 1

21) In addition to  $1 \text{ m} = 39.37 \text{ in}$ ., the following exact conversion equivalents are given:

$1 \text{ mile} = 5280 \text{ ft}$ ,  $1 \text{ ft} = 12 \text{ in}$ ,  $1 \text{ hour} = 60 \text{ min}$ , and  $1 \text{ min} = 60 \text{ s}$ . If a particle has a velocity of 8.4 miles per hour, its velocity, in m/s, is closest to

- A) 3.8 m/s.
- B) 3.0 m/s.
- C) 3.4 m/s.
- D) 4.1 m/s.
- E) 4.5 m/s.

Answer: A

Var: 50+

22) A weight lifter can bench press 171 kg. How many milligrams (mg) is this?

- A)  $1.71 \times 10^8 \text{ mg}$
- B)  $1.71 \times 10^9 \text{ mg}$
- C)  $1.71 \times 10^7 \text{ mg}$
- D)  $1.71 \times 10^6 \text{ mg}$

Answer: A

Var: 50+

23) How many nanoseconds does it take for a computer to perform one calculation if it performs  $6.7 \times 10^7$  calculations per second?

- A) 15 ns
- B) 67 ns
- C) 11 ns
- D) 65 ns

Answer: A

Var: 50+

24) The shortest wavelength of visible light is approximately 400 nm. Express this wavelength in centimeters.

- A)  $4 \times 10^{-5}$  cm
- B)  $4 \times 10^{-7}$  cm
- C)  $4 \times 10^{-9}$  cm
- D)  $4 \times 10^{-11}$  cm
- E)  $400 \times 10^{-11}$  cm

Answer: A

Var: 1

25) The wavelength of a certain laser is 0.35 micrometers, where 1 micrometer =  $1 \times 10^{-6}$  m. Express this wavelength in nanometers.

- A)  $3.5 \times 10^2$  nm
- B)  $3.5 \times 10^3$  nm
- C)  $3.5 \times 10^1$  nm
- D)  $3.5 \times 10^4$  nm

Answer: A

Var: 50+

26) A certain CD-ROM disk can store approximately  $6.0 \times 10^2$  megabytes of information, where  $10^6$  bytes = 1 megabyte. If an average word requires 9.0 bytes of storage, how many words can be stored on one disk?

- A)  $6.7 \times 10^7$  words
- B)  $5.4 \times 10^9$  words
- C)  $2.1 \times 10^7$  words
- D)  $2.0 \times 10^9$  words

Answer: A

Var: 9

27) A plot of land contains 5.8 acres. How many square meters does it contain? [1 acre = 43,560 ft<sup>2</sup>]

- A)  $2.3 \times 10^4$  m<sup>2</sup>
- B)  $7.1 \times 10^3$  m<sup>2</sup>
- C)  $7.0 \times 10^4$  m<sup>2</sup>
- D)  $5.0 \times 10^4$  m<sup>2</sup>

Answer: A

Var: 50+

28) A person on a diet loses 1.6 kg in a week. How many micrograms/second ( $\mu\text{g/s}$ ) are lost?

- A)  $2.6 \times 10^3 \mu\text{g/s}$
- B)  $1.6 \times 10^5 \mu\text{g/s}$
- C)  $44 \mu\text{g/s}$
- D)  $6.4 \times 10^4 \mu\text{g/s}$

Answer: A

Var: 11

29) Albert uses as his unit of length (for walking to visit his neighbors or plowing his fields) the albert (A), the distance Albert can throw a small rock. One albert is 92 meters. How many square alberts is equal to one acre? (1 acre =  $43,560 \text{ ft}^2 = 4050 \text{ m}^2$ )

Answer: 1.29 A<sup>2</sup>

Var: 50+

30) Convert a speed of 4.50 km/h to units of ft/min. (1.00 m = 3.28 ft)

- A) 0.246 ft/min
- B) 82.3 ft/min
- C) 165 ft/min
- D) 246 ft/min
- E) 886 ft/min

Answer: D

Var: 1

31) The exhaust fan on a typical kitchen stove pulls 600 CFM (cubic feet per minute) through the filter. Given that 1.00 in. = 2.54 cm, how many cubic meters per second does this fan pull?

- A)  $0.283 \text{ m}^3/\text{sec}$
- B)  $0.328 \text{ m}^3/\text{sec}$
- C)  $3.05 \text{ m}^3/\text{sec}$
- D)  $32.8 \text{ m}^3/\text{sec}$

Answer: A

Var: 1

32) The mass of a typical adult woman is closest to

- A) 20 kg.
- B) 35 kg.
- C) 75 kg.
- D) 150 kg.

Answer: C

Var: 1

33) The height of the ceiling in a typical home, apartment, or dorm room is closest to

- A) 100 cm.
- B) 200 cm.
- C) 400 cm.
- D) 500 cm.

Answer: B

Var: 1



34) Approximately how many times does an average human heart beat in a year?

- A)  $4 \times 10^5$
- B)  $4 \times 10^6$
- C)  $4 \times 10^7$
- D)  $4 \times 10^8$
- E)  $4 \times 10^9$

Answer: C

Var: 1

35) Approximately how many times does an average human heart beat in a lifetime?

- A)  $3 \times 10^{11}$
- B)  $3 \times 10^{10}$
- C)  $3 \times 10^9$
- D)  $3 \times 10^8$
- E)  $3 \times 10^7$

Answer: C

Var: 1

36) Approximately how many pennies would you have to stack to reach an average 8-foot ceiling?

- A)  $2 \times 10^2$
- B)  $2 \times 10^3$
- C)  $2 \times 10^4$
- D)  $2 \times 10^5$
- E)  $2 \times 10^6$

Answer: B

Var: 1

37) Estimate the number of times the earth will rotate on its axis during a human's lifetime.

- A)  $3 \times 10^4$
- B)  $3 \times 10^5$
- C)  $3 \times 10^6$
- D)  $3 \times 10^7$
- E)  $3 \times 10^8$

Answer: A

Var: 1

38) Estimate the number of pennies that would fit in a box one foot long by one foot wide by one foot tall.

- A)  $5 \times 10^2$
- B)  $5 \times 10^3$
- C)  $5 \times 10^4$
- D)  $5 \times 10^5$
- E)  $5 \times 10^6$

Answer: C

Var: 1

39) A marathon is 26 mi and 385 yd long. Estimate how many strides would be required to run a marathon. Assume a reasonable value for the average number of feet/stride.

- A)  $4.5 \times 10^4$  strides
- B)  $4.5 \times 10^3$  strides
- C)  $4.5 \times 10^5$  strides
- D)  $4.5 \times 10^6$  strides

Answer: A

Var: 1

40) 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,  $\ell$ , what combination of  $g$  and  $\ell$  must the period be proportional to? (Acceleration has SI units of  $\text{m} \cdot \text{s}^{-2}$ ).

- A)  $g/\ell$
- B)  $g\ell^2$
- C)  $g\ell$
- D)  $\sqrt{g\ell}$
- E)  $\sqrt{\ell/g}$

Answer: E

Var: 1

41) The speed of a wave pulse on a string depends on the tension,  $F$ , in the string and the mass per unit length,  $\mu$ , of the string. Tension has SI units of  $\text{kg} \cdot \text{m} \cdot \text{s}^{-2}$  and the mass per unit length has SI units of  $\text{kg} \cdot \text{m}^{-1}$ . What combination of  $F$  and  $\mu$  must the speed of the wave be proportional to?

- A)  $F / \mu$
- B)  $\mu / F$
- C)  $\sqrt{\mu / F}$
- D)  $\sqrt{\mu F}$
- E)  $\sqrt{F / \mu}$

Answer: A

Var: 1

42) The position  $x$ , in meters, of an object is given by the equation  $x = A + Bt + Ct^2$ , where  $t$  represents time in seconds. What are the SI units of  $A$ ,  $B$ , and  $C$ ?

- A) m, m, m
- B) m, s, s
- C) m, s,  $\text{s}^2$
- D) m, m/s,  $\text{m}/\text{s}^2$
- E) m/s,  $\text{m}/\text{s}^2$ ,  $\text{m}/\text{s}^3$

Answer: A

Var: 1