

MULTIPLE CHOICE

1. When doing a physics problem, you were asked to calculate how fast a car was going in a particular situation. You came up with an answer of 230 m/s. You want to check if this is plausible, by converting this number into more familiar units: kilometres per hour. What is 230 m/s when converted into kilometres per hour, and is this a plausible speed for a car?
- 230 km/hr: not plausible
 - 828 km/hr: not plausible
 - 64 km/hr: plausible
 - 2.3 km/hr: plausible
 - 23 km/hr: plausible

ANS: b PTS: 2 DIF: Average

2. The density of an object is defined as:
- the volume occupied by each unit of mass.
 - the amount of mass for each unit of volume.
 - the weight of each unit of volume.
 - the amount of the substance that has unit volume and unit mass.
 - the amount of the substance that contains as many particles as 12 grams of the carbon-12 isotope.

ANS: B PTS: 1 DIF: Easy

3. If you drove day and night without stopping for one year without exceeding the legal freeway speed limit in Australia (110 km/hr), the maximum number of kilometres you could drive would be closest to:
- 8700.
 - 300 000.
 - 500 000.
 - 1 000 000.
 - 32 000 000.

ANS: D PTS: 2 DIF: Average

4. The term $\frac{1}{2} \rho v^2$ occurs in Bernoulli's equation in Chapter 15, with ρ being the density of a fluid and v its speed. The dimensions of this term are:
- $M^{-1}L^5T^2$
 - MLT^2
 - $ML^{-1}T^{-2}$
 - $M^{-1}L^9T^{-2}$
 - $M^{-1}L^3T^{-2}$

ANS: C PTS: 2 DIF: Average

5. Which of the following quantities has the same dimensions as kinetic energy, $\frac{1}{2}mv^2$?
- Note: $[a] = [g] = LT^{-2}$; $[h] = L$ and $[v] = LT^{-1}$.
- ma
 - mvx

- c. mvt
- d. mgh
- e. mgt

ANS: D

PTS: 2

DIF: Average

6. The quantity with the same units as force times time, Ft , with dimensions MLT^{-1} is:
- a. mv
 - b. mvr
 - c. mv^2r
 - d. ma
 - e. $\frac{mv^2}{r}$

ANS: A

PTS: 2

DIF: Average

7. The equation for the change of position of a train starting at $x = 0$ m is given by $x = \frac{1}{2}at^2 + bt^3$. The dimensions of b are:
- a. T^{-3}
 - b. LT^{-3}
 - c. LT^{-2}
 - d. LT^{-1}
 - e. $L^{-1}T^{-1}$

ANS: B

PTS: 2

DIF: Average

8. One mole of the carbon-12 isotope contains 6.022×10^{23} atoms. What volume in m^3 would be needed to store one mole of cube-shaped children's blocks 2.00 cm long on each side?
- a. 4.8×10^{18}
 - b. 1.2×10^{22}
 - c. 6.0×10^{23}
 - d. 1.2×10^{24}
 - e. 4.8×10^{24}

ANS: A

PTS: 2

DIF: Average

9. Which of the following products of ratios gives the conversion factors to convert metres per second $\left(\frac{m}{s}\right)$ to parsecs per year $\left(\frac{\text{Parsec}}{\text{Year}}\right)$? A parsec is a unit of distance used in astrophysics, and is equal to 3.26 light years. A light year is 9.46×10^{15} m.
- a. $\frac{1 \text{ parsec}}{3.26 \text{ light years}} \frac{1 \text{ light year}}{9.46 \times 10^{15} m} \frac{365 \text{ days}}{1 \text{ year}} \frac{24 \text{ hours}}{1 \text{ day}} \frac{3600 s}{1 \text{ hour}}$
 - b. $\frac{1 \text{ parsec}}{3.26 \text{ light years}} \frac{1 \text{ light year}}{9.46 \times 10^{15} m} \frac{365 \text{ days}}{1 \text{ year}} \frac{3600 s}{1 \text{ hour}}$
 - c. $\frac{1 \text{ hour}}{3600 s} \frac{24 \text{ hours}}{1 \text{ day}} \frac{1 \text{ year}}{365 \text{ days}} \frac{9.46 \times 10^{15} m}{1 \text{ light year}} \frac{3.26 \text{ light years}}{1 \text{ parsec}}$

- d. $\frac{1 \text{ parsec}}{3.26 \text{ light years}} \frac{1 \text{ light year}}{9.46 \times 10^{15} m} \frac{1 \text{ hour}}{3600 s} \frac{24 \text{ hours}}{1 \text{ day}} \frac{1 \text{ year}}{365 \text{ days}}$
- e. $\frac{1 \text{ parsec}}{3.26 \text{ light years}} \frac{1 \text{ light year}}{9.46 \times 10^{15} m} \frac{365 \text{ days}}{1 \text{ year}} \frac{24 \text{ hours}}{1 \text{ day}} \frac{60 s}{1 \text{ hour}}$

ANS: A PTS: 2 DIF: Average

10. You are trying to compare the fuel efficiency of two cars, one made in the US and one made in Australia. You know that the Australian car will use 14 litres of fuel per 100 km of driving. The US car has been tested as getting 10 miles per gallon of fuel used. A mile is 1.609 km and a US gallon is 3.785 litres. How many litres will the US car use per 100 km of driving?
- 23.5
 - 14.5
 - 14.0
 - 13.2
 - 10.0

ANS: A PTS: 3 DIF: Challenging

11. At the end of a year, a motor car company announces that sales of a pickup are down 43% for the year. If sales continue to decrease by 43% in each succeeding year, how long will it take for sales to decrease to zero?
- 1 year
 - 2 years
 - 3 years
 - 4 years
 - More than 4 years

ANS: E PTS: 2 DIF: Average

12. John and Linda are arguing about the definition of density. John says the density of an object is proportional to its mass. Linda says the object's mass is proportional to its density and to its volume. Which one, if either, is correct?
- They are both wrong.
 - John is correct, but Linda is wrong.
 - John is wrong, but Linda is correct.
 - They are both correct.
 - They are free to redefine density as they wish.

ANS: D PTS: 1 DIF: Easy

13. Spike claims that dimensional analysis shows that the correct expression for change in velocity is

$\vec{v}_f - \vec{v}_i$, is $\vec{v}_f - \vec{v}_i = \frac{mt}{F}$, where m is mass, t is time, and F is the magnitude of force. Carla says

that can't be true because the dimensions of force are $\left[\frac{ML}{T^2} \right]$. Which one, if either, is correct?

- Spike, because $[\vec{v}] = \left[\frac{ML}{T} \right]$.
- Spike, because $[\vec{v}] = \left[\frac{T^2}{L} \right]$.

- c. $[\vec{v}] = \left[\frac{L}{T} \right]$.
Carla, because
- d. $[\vec{v}] = \left[\frac{L}{MT} \right]$.
Carla, because
- e. $[\vec{F}] = \left[\frac{T^2}{ML} \right]$.
Spike, because the dimensions of force are

ANS: C PTS: 2 DIF: Average

14. Which one of the quantities below has dimensions equal to $\left[\frac{ML}{T^2} \right]$?
- mv
 - mv^2
 - $\frac{mv^2}{r}$
 - mr^2v
 - $\frac{mv^2}{r^2}$

ANS: C PTS: 2 DIF: Average

15. The standard exam page is 210 mm by 297 mm. Its area in cm^2 is:
- 62 400.
 - 36.8.
 - 93.5.
 - 237.
 - 624.

ANS: E PTS: 2 DIF: Average

16. A standard exam page is 210 mm by 297 mm. An exam that is 2.0 mm thick has a volume of:
- $1.9 \times 10^4 \text{ mm}^3$.
 - $4.7 \times 10^4 \text{ mm}^3$.
 - $1.2 \times 10^5 \text{ mm}^3$.
 - $3.1 \times 10^5 \text{ mm}^3$.
 - $3.1 \times 10^3 \text{ mm}^3$.

ANS: C PTS: 2 DIF: Average

17. Which quantity can be converted to the SI system by the conversion factor?
- $$\frac{1000m}{km} \frac{1hr}{3600s}$$

- kilometers per hour
- metres per second
- miles per hour
- kilometres per second
- kilometers per minute

ANS: A PTS: 2 DIF: Average

18. The answer to a question is $[MLT^{-1}]$. The question is ‘What are the dimensions of:
- $mr?$
 - $mvr?$
 - $ma?$
 - $mat?$
 - $\frac{mv^2}{r}?$

ANS: D

PTS: 2

DIF: Average

19. Five people measure the length of a car. The values they obtain are 2.38 m, 2.36 m, 2.41 m, 2.36 m and 2.37 m. What is the approximate uncertainty in their measurement of the length of the car?
- 5 cm
 - 1 m
 - 1 cm
 - 0.01 cm
 - 0.5 cm

ANS: C

PTS: 2

DIF: Average

20. At a recent sporting event, an athlete ran a distance of 100 ± 0.2 m in a time of 9.8 ± 0.1 seconds. What was their speed?
- 10.20 ± 0.2 m/s
 - 10.20 ± 0.3 m/s
 - 10.20 ± 0.01 m/s
 - 10.20 ± 0.12 m/s
 - 10.20 ± 0.05 m/s

ANS: D

PTS: 2

DIF: Average

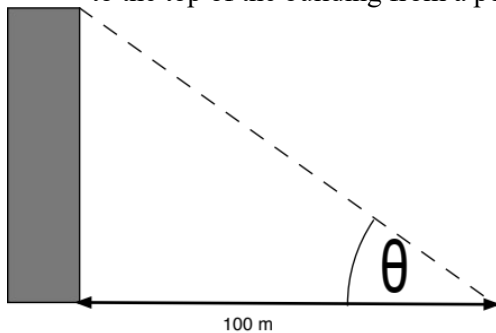
21. Two rocket engineers are trying to see whether a changed nozzle design makes their rockets go faster. The first rocket travels at a speed of 1000 ± 3 m/s, while the second rocket travels at a speed of 1005 ± 2 m/s. How much faster is the second rocket?
- 5 ± 2 m/s
 - 5 ± 3 m/s
 - 5 ± 4 m/s
 - 5 ± 5 m/s
 - 5 ± 6 m/s

ANS: D

PTS: 2

DIF: Average

22. You measure the height of a building using your knowledge of trigonometry, by measuring the angle to the top of the building from a point on the ground 100.0 m away.



You measure an angle $\theta = 20.0^\circ \pm 1.0^\circ$. How high is the building?

- a. 36.4 ± 1.0 m
- b. 36.4 ± 2.0 m
- c. 36.4 ± 0.5 m
- d. 36.4 ± 3.0 m
- e. 36.4 ± 3.6 m

ANS: B

PTS: 3

DIF: Challenging

23. If each frame of a motion picture film is 35 cm high, and 24 frames go by in a second, estimate how many frames are needed to show a two-hour-long movie.
- a. 1400
 - b. 25 000
 - c. 50 000
 - d. 170 000
 - e. This cannot be determined without knowing how many reels were used.

ANS: D

PTS: 2

DIF: Average

24. One number has three significant figures and another number has four significant figures. If these numbers are added, subtracted, multiplied, or divided, which operation can produce the greatest number of significant figures?
- a. the addition
 - b. the subtraction
 - c. the multiplication
 - d. the division
 - e. All the operations result in the same number of significant figures.

ANS: A

PTS: 2

DIF: Average

25. A rectangle has a length of 1.323 m and a width of 4.16 m. Using significant figure rules, what is the area of this rectangle?
- a. $5.503\ 68\ \text{m}^2$
 - b. $5.503\ 7\ \text{m}^2$
 - c. $5.504\ \text{m}^2$
 - d. $5.50\ \text{m}^2$
 - e. $5.5\ \text{m}^2$

ANS: D

PTS: 2

DIF: Average

PROBLEM

26. The standard kilogram is a platinum-iridium cylinder 39 mm in height and 39 mm in diameter. What is the density of the material?

ANS:

$21\ 475\ \text{kg/m}^3$

PTS: 2

DIF: Average

27. A 2.00 m by 3.00 m plate of aluminium has a mass of 324 kg. What is the thickness of the plate? (The density of aluminium is $2.70 \times 10^3\ \text{kg/m}^3$.)

ANS:

2.00 cm

PTS: 2

DIF: Average

28. What is the mass of air in a room that measures $5.0 \text{ m} \times 8.0 \text{ m} \times 3.0 \text{ m}$? (The density of air is $1/800$ that of water).

ANS:

150 kg

PTS: 2

DIF: Average

29. The basic function of a carburettor of an automobile is to atomise the petrol and mix it with air to promote rapid combustion. As an example, assume that 30 cm^3 of petrol is atomised into N spherical droplets, each with a radius of $2.0 \times 10^{-5} \text{ m}$. What is the total surface area of these N spherical droplets?

ANS:

$45\,000 \text{ cm}^2$

PTS: 3

DIF: Challenging