1. Convert the following quantities into SI units and also give your answer in standard form.

Quantity	Quantity in SI unit and standard form.
18 mm	18×10^{-3} = 1.80×10^{-2} m = 0.018 m
19 cm	19×10^{-2} = 1.90×10^{-1} m = 0.19 m
9 g	$9 \div 10^{3}$ = 9.00×10^{-3} kg = 0.009 kg
30 mg	$30 \times \frac{10^{-3}}{10^{3}}$ = 3.00×10^{-5} kg = 0.00003 kg
53 min	53×60 = 3.18×10^{3} s = 3180 s
304 mA	304×10^{-3} = 3.04×10^{-1} A = 0.304 A
29 mV	29×10^{-3} = 2.90×10^{-2} V = 0.029 V
166 ms	166×10^{-3} = 1.66×10^{-1} s = 0.166 s
34 µm	34×10^{-6} = 3.40×10^{-5} m = 0.000034 m
300 nm	300×10^{-9} = 3.00×10^{-7} m = 0.0000003 m
800 MW	800×10^{6} = 8.00×10^{8} W = 8 00 000 000 W
45 GW	45×10^{9} = 4.50×10^{10} W = 45 000 000 000 W
142 cm^2	$142 \times (10^{-2})^2$ = $1.42 \times 10^{-2}\ m^2$ = 0.0142 m^2
6000 cm^3	$6000 \times (10^{-2})^3$ = $6.00 \times 10^{-3}\ m^3$ = 0.006 m^3
94 mm^2	$94 \times (10^{-3})^2$ = $9.40 \times 10^{-5}\ m^2$ = 0.000094 m^2
399 mm^3	$399 \times (10^{-3})^3$ = $3.99 \times 10^{-7}\ m^3$ = 0.000000399 m^3
800 mm^{-3}	$800(10^{-3})^{-3}$ = $8.00 \times 10^{11}\ m^{-3}$ = 8 000 000 000 00 m^{-3}

2. In an experiment to determine the density of a liquid, 100 g of the liquid has a volume of 80 cm^3.

(a) what is the density of the liquid in g cm^{-3}

solution

Density (ρ) = $\frac{m}{V}$ = $\frac{100}{80}$ = 1.25 g cm^{-3}

(b) express the density in kg m^{-3}

Density (ρ) = 1.25 g cm^{-3} = 1.25 x 1000 = 1.25 x 10^3 kg m^{-3}

3. A metal sphere has a radius of 3.0 mm and a mass of 0.96 g, calculate the volume of the sphere and determine the density of the metal.

Solution

Volume (sphere) = $\frac{4}{3}\pi r^3$ = $\frac{4}{3}\pi\ 0.003^3$ = 1.13 x 10^{-7} m^3

Density (ρ) = $\frac{m}{V}$ = $\frac{0.96 \div 10^3}{1.13 \text{ x } 10^{-7}}$ = 8.50 x 10^3 kg m^{-3}

4. The diameter of a copper wire is 0.72 mm. Calculate the cross-sectional area of the wire.

Solution

A = $\frac{\pi d^2}{4}$ = $\frac{(\pi \text{ x } 0.72 \text{ x } 10^{-3})^2}{4}$ = 4.07 x 10^{-7} m^2

5. A student takes the following three measurements of the diameter in mm of a ball bearing.

4.21, 4.20, 4.21

Which one of the following should be stated as the average result?

A. 4.2 mm **B.** 4.20 mm **C.** 4.207 mm **D.** 4.21 mm

Average diameter = $\frac{4.21+4.20+4.21}{3}$ = 4.2066 mm = 4.21 mm

6. Write the number of significant figures in following values.

(a) 2.308 cm 4

(b) 0.02308 m 4

(c) 23.08 mm 4

(d) 23080 µm 4

(e) 3.500 4

(f) 0.06900 4

7. Rearrange the following equations

$E = \frac{1}{2} m v^2$: : $m = \frac{E \times 2}{v^2}$ $v = \sqrt{\frac{E \times 2}{m}}$

1. F = 6 π η r v (F= frictional force, η =coefficient of viscosity, r=radius, v= velocity)

$\eta = \frac{F}{6 \pi r v}$

2. v= u + at

u = v – at: $a = \frac{v - u}{t}$ $t = \frac{v - u}{a}$

3. $V = \frac{4}{3} \pi r^3$ (V=volume)

$r = \sqrt[3]{\frac{3V}{4\pi}}$

4. $s = ut + \frac{1}{2} a t^2$

$u = \frac{s - \frac{1}{2} a t^2}{t}$: $a = \frac{s - (ut)}{\frac{1}{2} t^2}$ $t = \sqrt{\frac{s - (ut)}{\frac{1}{2} a}}$

5. $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$

$v_2 = \frac{m_1 u_1 + m_2 u_2 - m_1 v_1}{m_2}$

6. $T = 2\pi \sqrt{\frac{l}{g}}$ (T=time period, l=length, g= acceleration due to gravity)

square on both sides

$(T)^2 = (2\pi \sqrt{\frac{l}{g}})^2$

$T^2 = 4 \pi^2 \frac{l}{g}$: $l = \frac{T^2 x g}{4 \pi^2}$

8. Simplify the following using to rules of indices

#	Unit substituted in term	Simplified version
1.	$\frac{kg\ m\ s^{-1}}{\text{s}}$	$\text{kg m } s^{-2}$ kg (1) m (1) s (-1-1)
2	$\text{kg m } s^{-2}\ s$	$\text{kg m } s^{-1}$ kg (1) m (1) s (-2+1)
3	$\frac{\text{kg } (\text{m } s^{-1})^2}{\text{m}}$	kg $m\ s^{-2}$ kg (1) m (2-1) s (-2)
4	$\frac{\text{kg m } s^{-2} m^2}{A\ s\ A\ s}$	kg $m^3\ s^{-4}\ A^{-2}$ kg (1) m (1+2) s (-2-1-1) A (-1-1)
5	$\frac{\text{kg m } s^{-2}}{\text{A s}}$	kg m $s^{-3}\ A^{-1}$ kg (1) m (1) s (-2-1) A (-1)
6	$\frac{\text{kg } m^2 s^{-2}}{\text{A s m}}$	kg $m\ s^{-3}\ A^{-1}$ kg (1) m (2-1) s (-2-1) A (-1)
7	$\sqrt{\frac{m^3}{kg^{-1}\ m^3 s^{-2}\ kg}}$	$\sqrt{s^2} = s$ kg (1-1) m (3-3) s (2)
8	$\sqrt{\frac{m}{m\ s^{-2}}}$	$\sqrt{s^2} = s$ m (1-1) s (2)
9	$\sqrt{\frac{kg^{-1}\ m^3 s^{-2}\ kg}{m}}$	$\sqrt{m^2\ s^{-2}} = m\ s^{-1}$ kg (-1+1) m (3-1) s (-2)
10	$\sqrt{\frac{kg\ m}{\text{kg m } s^{-2}}}$	$\sqrt{s^2} = s$ kg (1-1) m (1-1) s (2)
11	$\sqrt{\frac{\text{kg m } s^{-2}}{kg\ m^{-1}}}$	$\sqrt{m^2\ s^{-2}} = m\ s^{-1}$ kg (1-1) m (1+1) s (-2)
12	$\frac{(kg\ m^{-1})^2}{kg}$	kg m^{-2} kg (2-1) m (-2)
13	$\frac{kg^{-1}\ m^3 s^{-2}\ \text{kg}}{\text{m}^2}$	$m\ s^{-2}$ kg (-1+1) m (3-2) s (-2)
14	$\frac{(\frac{\text{kg } m^2 s^{-2}}{s^{-1}})}{m^2}$	kg s^{-1} kg (1) m (2-2) s (-2+1)