

1-1.

What is the weight in newtons of an object that has a mass of (a) 8 kg, (b) 0.04 kg, and (c) 760 Mg?

SOLUTION

(a) $W = 9.81(8) = 78.5 \text{ N}$

Ans.

(b) $W = 9.81(0.04)(10^{-3}) = 3.92(10^{-4}) \text{ N} = 0.392 \text{ mN}$

Ans.

(c) $W = 9.81(760)(10^3) = 7.46(10^6) \text{ N} = 7.46 \text{ MN}$

Ans.

Ans:
 $W = 78.5 \text{ N}$
 $W = 0.392 \text{ mN}$
 $W = 7.46 \text{ MN}$

1-2.

Represent each of the following combinations of units in the correct SI form: (a) $\text{kN}/\mu\text{s}$, (b) Mg/mN , and (c) $\text{MN}/(\text{kg} \cdot \text{ms})$.

SOLUTION

(a) $\text{kN}/\mu\text{s} = 10^3\text{N}/(10^{-6})\text{s} = \text{GN}/\text{s}$

Ans.

(b) $\text{Mg}/\text{mN} = 10^6\text{g}/10^{-3}\text{N} = \text{Gg}/\text{N}$

Ans.

(c) $\text{MN}/(\text{kg} \cdot \text{ms}) = 10^6\text{N}/\text{kg}(10^{-3}\text{s}) = \text{GN}/(\text{kg} \cdot \text{s})$

Ans.

Ans:
GN/s
Gg/N
GN/(kg · s)

1-3.

Represent each of the following combinations of unit in the correct SI form: (a) Mg/ms, (b) N/mm, (c) mN/(kg · μs).

SOLUTION

$$(a) \quad \frac{\text{Mg}}{\text{ms}} = \frac{10^3 \text{ kg}}{10^{-3} \text{ s}} = 10^6 \text{ kg/s} = \text{Gg/s} \quad \text{Ans.}$$

$$(b) \quad \frac{\text{N}}{\text{mm}} = \frac{1 \text{ N}}{10^{-3} \text{ m}} = 10^3 \text{ N/m} = \text{kN/m} \quad \text{Ans.}$$

$$(c) \quad \frac{\text{mN}}{(\text{kg} \cdot \mu\text{s})} = \frac{10^{-3} \text{ N}}{10^{-6} \text{ kg} \cdot \text{s}} = \text{kN}/(\text{kg} \cdot \text{s}) \quad \text{Ans.}$$

Ans:
Gg/s
kN/m
kN/(kg · s)

***1-4.**

Convert: (a) $200 \text{ lb} \cdot \text{ft}$ to $\text{N} \cdot \text{m}$, (b) $350 \text{ lb}/\text{ft}^3$ to kN/m^3 , (c) $8 \text{ ft}/\text{h}$ to mm/s . Express the result to three significant figures. Use an appropriate prefix.

SOLUTION

$$\text{a) } (200 \text{ lb} \cdot \text{ft}) \left(\frac{4.4482 \text{ N}}{1 \text{ lb}} \right) \left(\frac{0.3048 \text{ m}}{1 \text{ ft}} \right) = 271 \text{ N} \cdot \text{m}$$

Ans.

$$\text{b) } \left(\frac{350 \text{ lb}}{1 \text{ ft}^3} \right) \left(\frac{1 \text{ ft}}{0.3048 \text{ m}} \right)^3 \left(\frac{4.4482 \text{ N}}{1 \text{ lb}} \right) = 55.0 \text{ kN}/\text{m}^3$$

Ans.

$$\text{c) } \left(\frac{8 \text{ ft}}{1 \text{ h}} \right) \left(\frac{1 \text{ h}}{3600 \text{ s}} \right) \left(\frac{0.3048 \text{ m}}{1 \text{ ft}} \right) = 0.677 \text{ mm}/\text{s}$$

Ans.

Ans:
 $271 \text{ N} \cdot \text{m}$
 $55.0 \text{ kN}/\text{m}^3$
 $0.677 \text{ mm}/\text{s}$

1-5.

Represent each of the following as a number between 0.1 and 1000 using an appropriate prefix: (a) 45 320 kN, (b) $568(10^5)$ mm, and (c) 0.00563 mg.

SOLUTION

(a) $45\,320\text{ kN} = 45.3\text{ MN}$

Ans.

(b) $568(10^5)\text{ mm} = 56.8\text{ km}$

Ans.

(c) $0.00563\text{ mg} = 5.63\ \mu\text{g}$

Ans.

Ans:
45.3 MN
56.8 km
5.63 μg

1-6.

Round off the following numbers to three significant figures: (a) 58 342 m, (b) 68.534 s, (c) 2553 N, and (d) 7555 kg.

SOLUTION

a) 58.3 km b) 68.5 s c) 2.55 kN d) 7.56 Mg

Ans.

Ans:
58.3 km
68.5 s
2.55 kN
7.56 Mg

1-7.

Represent each of the following quantities in the correct SI form using an appropriate prefix: (a) 0.000 431 kg, (b) $35.3(10^3)$ N, and (c) 0.005 32 km.

SOLUTION

a) $0.000\ 431\ \text{kg} = 0.000\ 431(10^3)\ \text{g} = 0.431\ \text{g}$

Ans.

b) $35.3(10^3)\ \text{N} = 35.3\ \text{kN}$

Ans.

c) $0.005\ 32\ \text{km} = 0.005\ 32(10^3)\ \text{m} = 5.32\ \text{m}$

Ans.

Ans:
0.431 g
35.3 kN
5.32 m

***1-8.**

Represent each of the following combinations of units in the correct SI form using an appropriate prefix: (a) Mg/mm, (b) mN/ μ s, (c) μ m \cdot Mg.

SOLUTION

$$\text{a) Mg/mm} = \frac{10^3 \text{ kg}}{10^{-3} \text{ m}} = \frac{10^6 \text{ kg}}{\text{m}} = \text{Gg/m}$$

Ans.

$$\text{b) mN}/\mu\text{s} = \frac{10^{-3} \text{ N}}{10^{-6} \text{ s}} = \frac{10^3 \text{ N}}{\text{s}} = \text{kN/s}$$

Ans.

$$\begin{aligned} \text{c) } \mu\text{m} \cdot \text{Mg} &= [10^{-6} \text{ m}] \cdot [10^3 \text{ kg}] = (10)^{-3} \text{ m} \cdot \text{kg} \\ &= \text{mm} \cdot \text{kg} \end{aligned}$$

Ans.

Ans:
Gg/m
kN/s
mm \cdot kg

1-9.

Represent each of the following combinations of units in the correct SI form using an appropriate prefix: (a) m/ms, (b) μkm , (c) ks/mg, and (d) $\text{km} \cdot \mu\text{N}$.

SOLUTION

$$\text{a) } \text{m/ms} = \left(\frac{\text{m}}{(10)^{-3} \text{ s}} \right) = \left(\frac{(10)^3 \text{ m}}{\text{s}} \right) = \text{km/s} \quad \text{Ans.}$$

$$\text{b) } \mu\text{km} = (10)^{-6}(10)^3 \text{ m} = (10)^{-3} \text{ m} = \text{mm} \quad \text{Ans.}$$

$$\text{c) } \text{ks/mg} = \left(\frac{(10)^3 \text{ s}}{(10)^{-6} \text{ kg}} \right) = \left(\frac{(10)^9 \text{ s}}{\text{kg}} \right) = \text{Gs/kg} \quad \text{Ans.}$$

$$\text{d) } \text{km} \cdot \mu\text{N} = [(10)^3 \text{ m}][(10)^{-6} \text{ N}] = (10)^{-3} \text{ m} \cdot \text{N} = \text{mm} \cdot \text{N} \quad \text{Ans.}$$

Ans:
km/s
mm
Gs/kg
mm · N

1–10.

Represent each of the following combinations of units in the correct SI form: (a) $\text{GN} \cdot \mu\text{m}$, (b) $\text{kg}/\mu\text{m}$, (c) N/ks^2 , and (d) $\text{kN}/\mu\text{s}$.

SOLUTION

(a) $\text{GN} \cdot \mu\text{m} = 10^9(10^{-6}) \text{N} \cdot \text{m} = \text{kN} \cdot \text{m}$

Ans.

(b) $\text{kg}/\mu\text{m} = 10^3 \text{g}/10^{-6} \text{m} = \text{Gg}/\text{m}$

Ans.

(c) $\text{N}/\text{ks}^2 = \text{N}/10^6 \text{s}^2 = 10^{-6} \text{N}/\text{s}^2 = \mu\text{N}/\text{s}^2$

Ans.

(d) $\text{kN}/\mu\text{s} = 10^3 \text{N}/10^{-6} \text{s} = 10^9 \text{N}/\text{s} = \text{GN}/\text{s}$

Ans.

Ans:
 $\text{kN} \cdot \text{m}$
 Gg/m
 $\mu\text{N}/\text{s}^2$
 GN/s

1-11.

Represent each of the following with SI units having an appropriate prefix: (a) 8653 ms, (b) 8368 N, (c) 0.893 kg.

SOLUTION

a) $8653 \text{ ms} = 8.653(10)^3(10^{-3}) \text{ s} = 8.653 \text{ s}$

Ans.

b) $8368 \text{ N} = 8.368 \text{ kN}$

Ans.

c) $0.893 \text{ kg} = 893(10^{-3})(10^3) \text{ g} = 893 \text{ g}$

Ans.

Ans:
8.653 s
8.368 kN
893 g