MAE 303 – HW#1 – Solutions

1.20

1.20 Make use of Table 1.3 to express the following quantities in SI units: **(a)** 10.2 in./min, **(b)** 4.81 slugs, **(c)** 3.02 lb, **(d)** 73.1 ft/s², **(e)** 0.0234 lb·s/ft².

(a) $10.2\ \frac{in.}{min} = \left(10.2\ \frac{in.}{min}\right)\left(2.540\times10^{-2}\ \frac{m}{in.}\right)\left(\frac{1\ min}{60\ s}\right)$

$= 4.32\times10^{-3}\ \frac{m}{s} = \underline{\underline{4.32\ \frac{mm}{s}}}$

(b) $4.81\ slugs = \left(4.81\ slugs\right)\left(1.459\times10\ \frac{kg}{slug}\right) = \underline{\underline{70.2\ kg}}$

(c) $3.02\ lb = \left(3.02\ lb\right)\left(4.448\ \frac{N}{lb}\right) = \underline{\underline{13.4\ N}}$

(d) $73.1\ \frac{ft}{s^2} = \left(73.1\ \frac{ft}{s^2}\right)\left(3.048\times10^{-1}\ \frac{\frac{m}{s^2}}{\frac{ft}{s^2}}\right) = \underline{\underline{22.3\ \frac{m}{s^2}}}$

(e) $0.0234\ \frac{lb\cdot s}{ft^2} = \left(0.0234\ \frac{lb\cdot s}{ft^2}\right)\left(4.788\times10\ \frac{\frac{N\cdot s}{m^2}}{\frac{lb\cdot s}{ft^2}}\right)$

$= \underline{\underline{1.12\ \frac{N\cdot s}{m^2}}}$

1.21

1.21 Make use of Table 1.4 to express the following quantities in BG units: **(a)** 14.2 km, **(b)** 8.14 N/m³, **(c)** 1.61 kg/m³, **(d)** 0.0320 N·m/s, **(e)** 5.67 mm/hr.

(a) $14.2\ km = (14.2\times10^{3}\ m)\left(3.281\ \frac{ft}{m}\right) = \underline{4.66\times10^{4}\ ft}$

(b) $8.14\ \frac{N}{m^3} = \left(8.14\ \frac{N}{m^3}\right)\left(6.366\times10^{-3}\ \frac{\frac{lb}{ft^3}}{\frac{N}{m^3}}\right) = \underline{5.18\times10^{-2}\ \frac{lb}{ft^3}}$

(c) $1.61\ \frac{kg}{m^3} = \left(1.61\ \frac{kg}{m^3}\right)\left(1.940\times10^{-3}\ \frac{\frac{slugs}{ft^3}}{\frac{kg}{m^3}}\right) = \underline{3.12\times10^{-3}\ \frac{slugs}{ft^3}}$

(d) $0.0320\ \frac{N\cdot m}{s} = \left(0.0320\ \frac{N\cdot m}{s}\right)\left(7.376\times10^{-1}\ \frac{\frac{ft\cdot lb}{s}}{\frac{N\cdot m}{s}}\right)$

$= \underline{2.36\times10^{-2}\ \frac{ft\cdot lb}{s}}$

(e) $5.67\ \frac{mm}{hr} = \left(5.67\times10^{-3}\ \frac{m}{hr}\right)\left(3.281\ \frac{ft}{m}\right)\left(\frac{1\ hr}{3600\ s}\right)$

$= \underline{5.17\times10^{-6}\ \frac{ft}{s}}$

1.22

1.22 Express the following quantities in SI units: (a) 160 acre, (b) 15 gallons (U.S.), (c) 240 miles, (d) 79.1 hp, (e) 60.3 °F.

(a) $160\ \text{acre} = (160\ \text{acre})\left(4.356 \times 10^{4}\ \frac{\text{ft}^2}{\text{acre}}\right)\left(9.290 \times 10^{-2}\ \frac{\text{m}^2}{\text{ft}^2}\right)$

$= \underline{6.47 \times 10^{5}\ \text{m}^2}$

(b) $15\ \text{gallons} = (15\ \text{gallons})\left(3.785\ \frac{\text{liter}}{\text{gallon}}\right)\left(10^{-3}\ \frac{\text{m}^3}{\text{liter}}\right) = \underline{56.8 \times 10^{-3}\ \text{m}^3}$

(c) $240\ \text{mi} = (240\ \text{mi})\left(5280\ \frac{\text{ft}}{\text{mi}}\right)\left(3.048 \times 10^{-1}\ \frac{\text{m}}{\text{ft}}\right) = \underline{3.86 \times 10^{5}\ \text{m}}$

(d) $79.1\ \text{hp} = (79.1\ \text{hp})\left(550\ \frac{\text{ft} \cdot \text{lb}}{\text{s} \cdot \text{hp}}\right)\left(1.356\ \frac{\text{J}}{\text{ft} \cdot \text{lb}}\right) = 5.90 \times 10^{4}\ \frac{\text{J}}{\text{s}}$

and $1\ \frac{\text{J}}{\text{s}} = 1\ \text{W}$ so that

$79.1\ \text{hp} = \underline{5.90 \times 10^{4}\ \text{W}}$

(e) $T_c = \frac{5}{9}(60.3^{\circ}\text{F} - 32) = 15.7^{\circ}\text{C}$

$= 15.7^{\circ}\text{C} + 273 = \underline{289\ \text{K}}$