E1

(a) $390\,463 = 3.904\,63 \times 10^5$,

$0.000\,705\,8 = 7.058 \times 10^{-4}$.

(b) To three significant figures, $3.904\,63 \times 10^5 = 3.90 \times 10^5$, $7.058 \times 10^{-4} = 7.06 \times 10^{-4}$.

(c) To the nearest order of magnitude $3.90 \times 10^5 \sim 10^5$,

$7.06 \times 10^{-4} \sim 10^{-3}$.

(Reread Subsections 2.1, 2.4 and 2.5 if you had difficulty with this question.)

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E2

$3\,678 \times 2.45 \times 10^{12}/(9.43 \times 10^{-3}) = 9.56 \times 10^{17}$.

(The answer displayed on a calculator would have been more like $9.555\,794\,27 \times 10^{17}$)
(Reread Subsections 2.2 and 2.4 if you had difficulty with this question.)

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E3

$$F_{\text{grav}} = 6.67 \times 10^{-11}\ \text{N m}^2\ \text{kg}^{-2} \times 7.4 \times 10\ \text{kg} \times$$
$$\times 5.6 \times 10\ \text{kg}/(6 \times 10^{-1}\ \text{m})^2$$

so $$F_{\text{grav}} \approx \frac{7 \times 7 \times 6 \times 10^{-11} \times 10^2}{6 \times 6 \times 10^{-2}}\ \text{N} \approx 7 \times 10^{-7}\ \text{N}$$

To the nearest the order of magnitude $F_{\text{grav}} \sim 10^{-6}$ N.
(Reread Subsections 2.1, 2.5, 3.1 and 3.2 if you had difficulty with this question.)

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E4

Since $B = F/(Il)$ a suitable unit for B would be $\mathrm{N\,A^{-1}\,m^{-1}}$. (An equivalent but more widely used SI unit for B is the tesla (T)).
(Reread Subsections 3.1 and 3.2 if you had difficulty with this question.)

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E5

(a) $T = 2\pi\sqrt{6.6 \times 10^6\ \mathrm{m}/9.8\ \mathrm{m\ s^{-2}}}$

$$= 5.2 \times 10^3 \sqrt{\mathrm{m/m\ s^{-2}}}$$

The units are $\sqrt{\mathrm{m/m\ s^{-2}}} = \sqrt{\mathrm{l/s^{-2}}} = \sqrt{\mathrm{s^2}} = \mathrm{s}$ and since only two figures are significant $T = 5.2 \times 10^3$ s.

(b) $[T] = \mathrm{T}$ and

$$[2\pi\sqrt{r/g}\,] = \left[\sqrt{\frac{\text{length}}{\text{length / time}^2}}\right] = [\text{time}] = \mathrm{T},$$

thus the two sides have the same dimensions and the equation is plausible.
(Reread Subsections 2.4, 3.2 and 3.3 if you had difficulty with this question.)

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E6

(b), (d) and (f) are always true. (a) is false if b is greater than a, for example, (c) is false because a may be negative, and (e) is false because the elements of $\mathbb{R}$ are numbers, not sets of numbers.
(Reread Subsections 2.3 and 2.6 if you had difficulty with this question.)

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