ASSIGNMENT 5

1.(a) $5.5\,cm^3 = 5.5 \cdot (0.3937)^3\,in^3 \approx 0.3356\,in^3$

(b) $1.8\,m^2 = 1.8\,(100)^2\,cm^2 = 1.8 \cdot 10^4\,cm^2 = 18000\,cm^2$

$1.8\,m^2 = 1.8\,(1000\,mm)^2 = 1.8 \cdot 10^6\,mm^2$
$= 1800000\,mm^2$

(c) $1.069\,oz/in^3 = 1.069\,\dfrac{28.35\,g}{(2.54\,cm)^3} \approx 1.849\,\dfrac{g}{cm^3}$

(d) $750\,\dfrac{ml}{min} = 750 \cdot \dfrac{0.001\,l}{60\,s} \approx 0.0125\,\dfrac{l}{s}$

$1000\,\dfrac{ml}{min} = 1000 \cdot \dfrac{0.001\,l}{60\,s} \approx 0.0167\,\dfrac{l}{s}$

(e) $0.03\,\dfrac{miles}{h} = 0.03\,\dfrac{1{,}609.3}{3600} \approx 0.0134\,\dfrac{m}{s}$

(f) $\dfrac{6.5}{120}\,\dfrac{in}{min} = \dfrac{6.5 \cdot 2.54\,cm}{2\,h} = \dfrac{6.5 \cdot 2.54 \cdot 10^{-5}}{2}\,\dfrac{km}{h}$

$= 8.255 \cdot 10^{-5}\,\dfrac{km}{h}$

$= 0.00008255\,\dfrac{km}{h}$

2.(a) $1\,day = 24 \cdot 60 \cdot 60 = 86{,}400\,s$

number of blinks $= \dfrac{86400}{2.8} \approx 30{,}857$

(b) $2{,}500$ per cm^2 $\xrightarrow{\boxed{1cm^2 = 100\ mm^2}}$ $\frac{2{,}500}{100} = 25$ per mm^2

so in $50\,mm^2$ there are $50 \cdot 25 = \underline{1250}$ receptors

$\boxed{\text{or:}}$ $50\,mm^2$ is $\frac{1}{2}$ of $1\,cm^2$

so the number of receptors in $50\,mm^2$ is $\frac{1}{2}$ of the number in $1\,cm^2$ $= \frac{2500}{2} = \underline{1250}$

(c) $0.35\,\frac{ml}{min} = 0.35 \cdot \frac{0.001}{\frac{1}{60}}\,\frac{l}{h} = 0.021\,\frac{l}{h}$

so in 4 hours, it is $0.021(4) = 0.084\,l$

3. (a) (i) $I = m \cdot T = 4\,[kg] \cdot 30\,[min] = 120$

(ii) $I = m \cdot T = 4000\,[g] \cdot 30\,[min] = 120000$

(iii) $J = \underline{\text{some number}} \cdot m \cdot T$

the number in (ii) is 1000 times too big, so

$$\boxed{J = \frac{1}{1000} \cdot m \cdot T}$$

check: $m = 4$ kg, $T = 30$ min $\rightarrow I = 4 \cdot 30 = 120$

$m = 4000$ g, $T = 30$ min $\rightarrow J = \frac{1}{1000} \cdot 4000 \cdot 30 = 120$

(b) (i) $I = \overset{\text{kg}}{m} \cdot \overset{\text{min}}{T} = 4 \cdot 30 = 120$

(ii) $I = m\,[g] \cdot T\,[h] = \underbrace{4 \cdot 1000}_{\text{grams}} \cdot \underbrace{30 \cdot \frac{1}{60}}_{\text{hours}} = 2{,}000$

(iii) $$\begin{aligned} I &= m\,[kg] \cdot T\,[min] \\ &= m \cdot 1000\,[g] \cdot T \cdot \frac{1}{60}\,[h] \\ &= \frac{100\cancel{0}}{6\cancel{0}}\, m\,[g] \cdot T\,[h] = \frac{50}{3}\, m\,[g]\, T\,[h] \end{aligned}$$

have to eliminate this factor, so

$$\boxed{J = \frac{3}{50} m T}$$

check: $m = 4$ kg, $T = 30$ min $\to I = 4 \cdot 30 = 120$

$m = 4000$ g, $T = 0.5$ h $\to J = \frac{3}{5\cancel{0}} \cdot 400\cancel{0} \cdot 0.5 = 120$

(c) (i) $BMI = \frac{m}{h^2} = \frac{62}{1.5^2} \approx 27.56$

(ii) $$\begin{aligned} BMI &= \frac{m\,[kg]}{h^2\,[m^2]} = \frac{m \cdot 1000\,[g]}{h^2\,[m^2]} \\ &= 1000 \cdot \frac{m\,[g]}{h^2\,[m^2]} \end{aligned}$$

so $\boxed{BMJ = \frac{1}{1000} \frac{m}{h^2}}$ m ← in grams, h^2 ← in m^2

to get rid of this factor, divide

check: when $m = 62{,}000$ g and $h = 1{,}5$ m, then

$$BMJ = \frac{1}{\cancel{1{,}000}} \cdot \frac{62{,}\cancel{000}}{1{,}5^2} = \frac{62}{1{,}5^2} \approx 27{,}56$$

(iii) $$BMI = \frac{m\ [kg]}{h^2\ [m^2]} = \frac{m\ [kg]}{h^2 \cdot 100^2\ [cm^2]}$$

$$= \frac{1}{10{,}000} \cdot \frac{m}{h^2} \frac{[kg]}{[cm^2]}$$

so define $\boxed{BMK = 10{,}000 \cdot \frac{m}{h^2} \frac{[kg]}{[cm^2]}}$

check: when $m = 62$ kg and $h = 150$ cm,

$$BMK = 10{,}000 \cdot \frac{62}{(150)^2} \approx 27.56$$