2.12

```
u=symunit;

h=120*u.m    %height
```

h = 120 m

```
d=180*u.m    %diameter
```

d = 180 m

```
rho=1.20*u.kg/u.m^3    %density
```

rho =

$\frac{6}{5}\frac{\mathrm{kg}}{\mathrm{m}^3}$

```
V=pi*(d/2)^2*h;    %Governing equation for volume of cylinder
M_air=vpa(V*rho,3);     %Governing for mass, given volume and density
W=vpa(M_air*u.g_n,3)   %W=Mg
```

W = 3.66e+6 g_n kg

```
W=vpa(unitConvert(W,u.MN),2)   %Convert to MN with 2 significant digits.
```

W = 36.0 MN

2.13

```
g_m=3.71*u.m/u.s^2;
A_mass=90*u.kg;
A_weight=A_mass*g_m;                              % W=mg
A_weight=vpa(unitConvert(A_weight,u.N),3)     % Weight in N,    sig figs
```

A_weight = 333.9 N

```
A_weigth=vpa(unitConvert(A_weight,u.lbf),3)   % Weight in lbf, 3 sig figs
```

A_weigth = 75.1 lbf

2.14

```
R=4*u.lbm    %Mass of the rock
```

R = 4 lbm

```
g_m=3.71*u.m/u.s^2 ; %Gravity of Mars
```

```
W_b=R*u.g_n;      % Balance beam - balances with equal mass -calibrated to earth gravit
W_b=vpa(unitConvert(W_b,u.lbf),3)  %lbm=lbf on earth.   local gravity is irrelevant.
```

W_b = 4.0 lbf

```
W_s=R*g_m;    %Spring is compressed due to local gravity.  earth gravity is irrelevant.
W_s=vpa(unitConvert(W_s,u.lbf),3)
```

W_s = 1.51 lbf

2.18

```
rho=2800*u.kg/u.m^3
```

rho =

$$2800\,\frac{\mathrm{kg}}{\mathrm{m}^3}$$

```
thick=7*u.mm
```

thick = 7 mm

```
d_hole=5*u.cm;
area_hole=pi*(d_hole/2)^2
```

area_hole =

$$\frac{25\,\pi}{4}\,\mathrm{cm}^2$$

```
v_hole=unitConvert(area_hole*thick,u.m^3)
```

v_hole =

$$\frac{7\,\pi}{1600000}\,\mathrm{m}^3$$

```
w_hole=unitConvert(rho*v_hole,u.kg)
```

w_hole =

$$\frac{49\,\pi}{4000}\,\mathrm{kg}$$

```
n_exact=vpa(8*u.kg/w_hole,3)
```

n_exact = 208.0

```
n=ceil(n_exact)
```

n = 208

2.19

```
Sprint=10.2*u.m/u.s;
Sprint=vpa(unitConvert(Sprint,u.mi/u.hr),3)
```

Sprint =

$$22.8\,\frac{\mathrm{mi}}{\mathrm{h}}$$

2.20

```
Miler=4*u.min/u.mi
```

Miler =

$$4\,\frac{\mathrm{min}}{\mathrm{mi}}$$

```
Miler=unitConvert(Miler,u.mi/u.hr)
```

Miler =

$$\frac{1}{15}\,\frac{\mathrm{h}}{\mathrm{mi}}$$

```
Miler=vpa(1/Miler,3)
```

Miler =

$$15.0\,\frac{\mathrm{mi}}{\mathrm{h}}$$

```
Miler=vpa(unitConvert(Miler,u.m/u.s),3)
```

Miler =

$$6.71\,\frac{\mathrm{m}}{\mathrm{s}}$$

2.21

```
Heat=175000*u.Btu/u.hr
```

Heat =

$$175000\,\frac{\mathrm{Btu_{IT}}}{\mathrm{h}}$$

```
Heat=vpa(unitConvert(Heat,u.kW),3)
```

Heat = $51.3\,\mathrm{kW}$

2.23

```
M_bearings=3250*u.lbm
```

M_bearings = $3250\,\mathrm{lbm}$

```
W_bearings=M_bearings*u.g_n
```

W_bearings = $3250\ g_n\ \mathrm{lbm}$

```
W_bearings=vpa(unitConvert(W_bearings,u.kN),3)
```

W_bearings = $14.5\ \mathrm{kN}$

2.24

```
HL=65*u.Btu/(u.hr*u.ft^2) %HL=heat loss.  The problem statement should have used parent
```

HL =

$$65\,\frac{\mathrm{Btu_{IT}}}{\mathrm{ft}^2\,\mathrm{h}}$$

```
h=5.8*u.ft;
t=1*u.h
```

t = h

```
d=10*u.in   %Umm... seems kinda skinny, don't you think?
```

d = $10\ \mathrm{in}$

```
SA=2*pi*(d/2)*h+2*(pi*(d/2)^2);   %SA=surface area of cylinder including ends
TH=HL*t*SA;   %Governing equation - btw, this may not be obvious.
SA=vpa(unitConvert(TH,u.MJ),3)
```

SA = $1.12\ \mathrm{MJ}$

2.25

```
rho=7860*u.kg/u.m^3;
Atop=350*u.mm*30*u.mm %cross sectional area of top of I-beam
```

Atop = $10500\ \mathrm{mm}^2$

```
Abottom=Atop;   %top and bottom have the same shape
Avertical=350*u.mm*40*u.mm;   %cross sectional area of vertical portion of I-beam;

Atotal=Atop+Abottom+Avertical; %
W=Atotal*rho*u.g_n; %In general, this should be volume... but the problem asks for weig
W=vpa(unitConvert(W,u.kN/u.m),3)   %so if we use area instead of volume the dimensions
```

W =

$$2.7\,\frac{\mathrm{kN}}{\mathrm{m}}$$

```
W=vpa(unitConvert(W,u.lbf/u.ft),3) %which is what we want.
```

W =

$185.0\,\frac{\mathrm{lbf}}{\mathrm{ft}}$

2.26

```
FR=6*u.kg/u.s  %FR=flow rate
```

FR =

$6\,\frac{\mathrm{kg}}{\mathrm{s}}$

```
FR=vpa(unitConvert(FR,u.slug/u.hr),3)
```

FR =

$1488.0\,\frac{\mathrm{slug}}{\mathrm{h}}$

```
FR=vpa(unitConvert(FR,u.lbm/u.s),3)
```

FR =

$13.2\,\frac{\mathrm{lbm}}{\mathrm{s}}$

```
D=1*u.ft
```

D = ft

```
D=vpa(unitConvert(D,u.mm),4)
```

D = $304.8\,\mathrm{mm}$

```
rho=790*u.kg/u.m^3
```

rho =

$790\,\frac{\mathrm{kg}}{\mathrm{m}^3}$

```
rho=vpa(unitConvert(rho,u.lbm/u.in^3))
```

rho =

$0.028540560680066113105033049828418\,\frac{\mathrm{lbm}}{\mathrm{in}^3}$