Sect 7.2 – Converting U.S. Customary Units of Time, Weight, and Capacity

Objective a: Common Conversions

We will expand our list of conversions to include Time, Liquid Capacity, and weight:

Length	**Time**
1 ft = 12 in 1 yd = 3 ft = 36 in 1 mi = 5280 ft = 1760 yd	1 min = 60 sec 1 h = 60 min = 3600 sec 1 day = 24 hr 1 year = 365 days
Liquid Capacity	**Weight**
3 tsp = 1 T 1 c = 8 fl oz 1 pt = 2c 1 qt = 2 pt = 4 c 1 gal = 4 qt	1 lb = 16 oz 1 ton = 2000 lb

Objective b: Converting Units of Time.

Convert each unit as indicated and simplify:

Ex. 1 588 hr = _____ wk

Solution:

We will need to first convert the hours into days:

$$\frac{588\text{hr}}{1} \bullet \frac{1\text{day}}{24\text{hr}} = \frac{588}{24} \text{ days} = 24.5 \text{ days}$$

Now, we can convert the days into weeks:

$$\frac{24.5\text{days}}{1} \bullet \frac{1\text{wk}}{7\text{days}} = \frac{24.5}{7} \text{ wk} = 3.5 \text{ wk}$$

Ex. 2 3.41 hr = ___ hr ___ min ___ sec

Solution:

3.41 hr = 3 hr + 0.41 hr

Now, convert the 0.41 hr to minutes:

$\frac{0.41\text{hr}}{1} \bullet \frac{60\text{min}}{1\text{hr}} = 24.6 \text{ min}$

Hence, 3.41 hr = 3 hr 24.6 min = 3 hr 24 min + 0.6 min

Now, convert 0.6 min to seconds:

$\frac{0.6\text{min}}{1} \bullet \frac{60\text{sec}}{1\text{min}} = 36 \text{ sec}$

Therefore, 3 hr 24 min + 0.6 min = 3 hr 24 min 36 sec or 3:24:36.

Ex. 3 (27 days 6 hr 8 min) ÷ 11

Solution:

We begin by dividing 11 into 27 days:

```
    2 days              But, 5 days = 5(24) = 120 hr,
11 | 27 days  6 hr  8 min   so we need to add 120 hr to 6 hr
   – 22 days                and continue the division:
     5 days  6 hr           5 days + 6 hr = 120 hr + 6 hr = 126 hr.
```

Now, divide 126 hr by 11:

```
    2 days 11 hr        But, 5 hr = 5(60) = 300 min,
11 | 27 days  6 hr  8 min   so we need to add 300 min to 8 min
   – 22 days                and continue the division:
     5 days  6 hr           5 hr + 8 min = 300 min + 8 min
        = 126 hr        = 308 min.
        – 121 hr
            5 hr   8 min
```

Now, divide 308 min by 11:

```
    2 days 11 hr  28 min
11 | 27 days  6 hr  8 min
   – 22 days
     5 days  6 hr
        = 126 hr
        – 121 hr
            5 hr   8 min
              = 308 min
              – 308 min
                    0
```

Objective c: Converting U.S. Units of Weight.

Convert each unit as indicated and simplify:

Ex. 4 Convert 4.8 ton to ___ lb

Solution:

Use 1 ton = 2000 lb to convert the tons to lbs:

4.8 ton = $\frac{4.8\,\text{ton}}{1} \bullet \frac{2000\,\text{lb}}{1\,\text{ton}}$ = 9600 lb.

Ex. 5 Convert $\frac{\$9.12}{\text{lb}}$ to $\frac{\$}{\text{oz}}$

Solution:

Use 1 lb = 16 oz to convert the lb to oz. When writing the unit conversion factor, the 1 lb goes on top so that the lbs divide out:

$\frac{\$9.12}{\text{lb}} = \frac{\$9.12}{\text{lb}} \bullet \frac{1\,\text{lb}}{16\,\text{oz}} = \frac{\$9.12}{16\,\text{oz}} = \frac{\$0.57}{\text{oz}}$.

Ex. 6 (1 ton 850 lb 15 oz) × 6

Solution:

First, distribute: (1 ton 850 lb 15 oz) × **6**

= 1 Ton × **6** 850 lb × **6** 15 oz × **6** = 6 ton 5100 lb 90 oz

Now, convert 90 oz into __ lb ___ oz:

$\frac{90\,\text{oz}}{1} \bullet \frac{1\,\text{lb}}{16\,\text{oz}} = \frac{90}{16}$ lb, and then divide:

$$\begin{array}{r} 5 \\ 16 \overline{)\,90} \\ -\,80 \\ \hline 10 \end{array}$$

So, 90 oz = 5 lb 10 oz. Add 5 lb to the 5100 lb to get:

6 ton 5100 lb 90 oz = 6 ton 5105 lb 10 oz.

Now, convert 5105 lb to ___ ton ___ lb:

$\frac{5105\,\text{lb}}{1} \bullet \frac{1\,\text{ton}}{2000\,\text{lb}} = \frac{5105}{2000}$, and then divide:

$$\begin{array}{r} 2 \\ 2000 \overline{)\,5105} \\ -\,4000 \\ \hline 1105 \end{array}$$

So, 5105 lb = 2 ton 1105 lb. Add 2 ton to the 6 ton to get:

6 ton 5100 lb 90 oz = 6 ton 5105 lb 10 oz = 8 ton 1105 lb 10 oz.

Objective d: Converting U.S. Units of Capacity.

Convert each unit as indicated and simplify:

Ex. 7 Convert 85 qt to ____ gal

Solution:

Use 4 qt = 1 gal to convert the qt to gal:

85 qt = $\frac{85\,\text{qt}}{1} \bullet \frac{1\,\text{gal}}{4\,\text{qt}} = \frac{85}{4}$ gal = 21.25 gal

Ex. 8 Convert $\frac{\$2.45}{\text{pt}}$ to $\frac{\$}{\text{fl oz}}$.

Solution:

First, use 1 pt = 2 c to convert pt to c:

$$\frac{\$2.45}{\text{pt}} = \frac{\$2.45}{\text{pt}} \bullet \frac{1\text{pt}}{2\text{c}} = \frac{\$2.45}{2\text{c}} = \frac{\$1.225}{\text{c}}.$$

Now, use 1 c = 8 fl oz to convert c to fl oz.

$$\frac{\$1.225}{\text{c}} = \frac{\$1.225}{\text{c}} \bullet \frac{1\text{c}}{8\,\text{floz}} = \frac{\$1.225}{8\,\text{floz}} = \frac{\$0.153125}{\text{floz}} \approx \frac{\$0.15}{\text{floz}}.$$

Ex. 9 Convert 2 gal 3 qt 1 c to ___ fl oz.

Solution:

Now, we are going in the opposite direction. We will convert 2 gal to qt and add 3 qt to our result:

$$2 \text{ gal} = \frac{2\text{gal}}{1} = \frac{2\text{gal}}{1} \bullet \frac{4\text{qt}}{1\,\text{gal}} = 8 \text{ qt}.$$

So, 2 gal 3 qt 1 c = 8 qt 3 qt 1 c = 11 qt 1 c.

Next, we will convert the 11 qt to c and add 1 c to our result:

$$11 \text{ qt} = \frac{11\text{qt}}{1} = \frac{11\text{qt}}{1} \bullet \frac{4\text{c}}{1\,\text{qt}} = 44 \text{ c}.$$

So, 2 gal 3 qt 1 c = 8 qt 3 qt 1 c = 11 qt 1 c = 44 c + 1 c = 45 c.

Finally, we will convert the 45 c to fl oz:

$$45 \text{ c} = \frac{45\text{c}}{1} \bullet \frac{8\,\text{floz}}{1\text{c}} = 360 \text{ fl oz}.$$

Ex. 10

3 qt 2 c 7 fl oz
+ 5 qt 3 c 5 fl oz

Solution:

First add and then take care of the carries:

3 qt 2 c 7 fl oz
+ 5 qt 3 c 5 fl oz
8 qt 5c 12 fl oz
= 8 qt 6c 4 fl oz
= 9 qt 2 c 4 fl oz.

But, 12 fl oz = 1 c 4 fl oz, so add one to the 5 c:

But, 6 c = 1 qt 2 c, so add one to the 8 qt:

Objective e: Other Conversions

Here are some more conversions

Area	**Volume**
$1\ ft^2 = 144\ in^2$ $1\ yd^2 = 9\ ft^2 = 1296\ in^2$ $1\ rod^2 = 30.25\ yd^2$ $1\ acre = 160\ rod^2 = 4840\ yd^2$ $1\ acre = 43{,}560\ ft^2$ $1\ mi^2 = 640\ acres$	$1\ ft^3 = 1728\ in^3$ $1\ gal = 231\ in^3$ $1\ bu \approx 2150.42\ in^3 \approx 1.24446\ ft^3$ $1\ pt = 28.875\ in^3$ $1\ yd^3 = 27\ ft^3 = 46{,}656\ in^3$ $1\ fl\ oz \approx 1.805\ in^3$ $1\ ft^3 \approx 7.48052\ gal$

Convert each unit as indicated and simplify:

Ex. 11 Convert $\frac{\$9.27}{yd^2}$ to $\frac{\$}{ft^2}$.

Solution:

Use $9\ ft^2 = 1\ yd^2$ to convert ft^2 to yd^2: $\frac{\$9.27}{yd^2} \bullet \frac{yd^2}{9\,ft^2} = \frac{\$9.27}{9\,ft^2} = \frac{\$1.03}{ft^2}$.

Ex. 12 Convert $\frac{1.33\,euro}{qt}$ to $\frac{\$}{gal}$ (hint: 1 euro = $1.43)

Solution:

First, convert the euro into $:

$\frac{1.33\,euro}{qt} = \frac{1.33\,euro}{qt} \bullet \frac{\$1.43}{1\,euro} = \frac{\$1.9019}{qt}$.

Now, convert the qt to gal:

$\frac{\$1.9019}{qt} = \frac{\$1.9019}{qt} \bullet \frac{4\,qt}{1\,gal} = \frac{\$7.6076}{gal} \approx \frac{\$7.61}{gal}$.