

**GRADE 10 ESSENTIAL
UNIT C – MEASUREMENT
WORKBOOK**

Key

Name: Mr T 1

Instructions

Use any conversion ratios you have available.

CONVERT METRIC (SI) SYSTEM TO METRIC (SI) SYSTEM

1. Complete the table (use decimal values of course since it is metric)

metres (m)	centimetres (cm)
1	100
2	200
3	300
4	400
4.5	450
7	700
1,245	124,500
7,100	710,000
4.38	438
0.57	57.0
0.057	5.7

3. Complete the table (use decimal values of course since it is metric)

kilograms (kg)	grams (g)
1	1,000
2	2,000
3	3,000
4	4,000
4.5	4,500
7	7,000
4.165	4,165
8.1	8,100
7.32	7,320
0.076	76.0
0.0073	7.3

2. Convert using proportions (solve for x):

a. $\frac{100 \text{ cm}}{1 \text{ m}} = \frac{x \text{ cm}}{3 \text{ m}}$; $\therefore x = \underline{\underline{300 \text{ cm}}}$

b. $\frac{100 \text{ cm}}{1 \text{ m}} = \frac{400 \text{ cm}}{x \text{ m}}$; $\therefore x = \underline{\underline{4 \text{ m}}}$

c. $\frac{1 \text{ m}}{100 \text{ cm}} = \frac{x \text{ m}}{400 \text{ cm}}$; $\therefore x = \underline{\underline{4 \text{ m}}}$

4. Convert using proportions (solve for x):

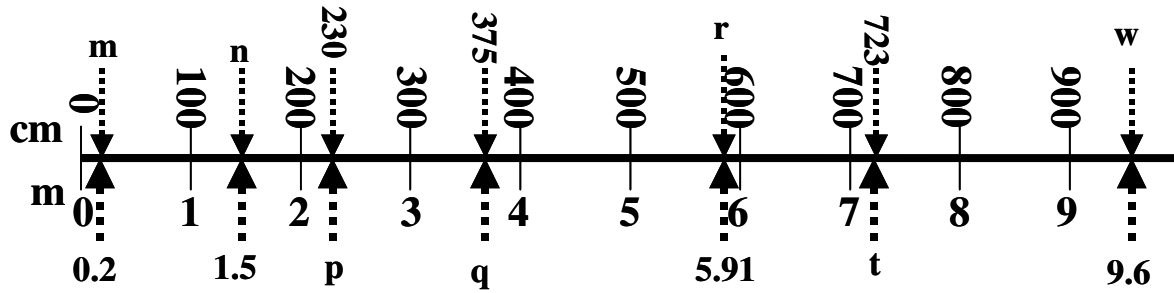
a. $\frac{1000 \text{ g}}{1 \text{ kg}} = \frac{x \text{ g}}{3 \text{ kg}}$; $\therefore x = \underline{\underline{3,000 \text{ g}}}$

b. $\frac{1000 \text{ g}}{1 \text{ kg}} = \frac{76 \text{ g}}{x \text{ kg}}$; $\therefore x = \underline{\underline{0.076 \text{ kg}}}$

c. $\frac{1 \text{ kg}}{1,000 \text{ g}} = \frac{x \text{ kg}}{76 \text{ g}}$; $\therefore x = \underline{\underline{0.076 \text{ kg}}}$

note: check b & c $\hat{!}$; easier if unknown unit is in top of proportion; less 'swapping'!

5. Convert using a number line:



State the measure of the following positions on the number line ↑.

m = 20 cm; n = 150 cm; p = 2.3 m; q = 3.75 m

r = 591 cm; t = 7.23m; w = 960 cm

6. Convert the following metric lengths using proportions:

a. $\frac{100 \text{ cm}}{1 \text{ m}} = \frac{'m' \text{ cm}}{0.2 \text{ m}}$

b. $\frac{100 \text{ cm}}{1 \text{ m}} = \frac{'n' \text{ cm}}{1.5 \text{ m}}$

c. $\frac{100 \text{ cm}}{1 \text{ m}} = \frac{230 \text{ cm}}{'p' \text{ m}}$

Answers above

d. $\frac{'q' \text{ m}}{375 \text{ cm}} = \frac{1 \text{ m}}{100 \text{ cm}}$

e. $\frac{'r' \text{ cm}}{5.91 \text{ m}} = \frac{100 \text{ cm}}{1 \text{ m}}$

f. you do the rest elsewhere

7. Convert using unit factors: (put the new **wanted** unit in the top of the conversion factor)

Example: $0.2 \text{ m} = 0.2 \cancel{\text{m}} * \frac{100 \text{ cm}}{1 \cancel{\text{m}}} = 20 \text{ cm}$

a. $1.5 \text{ m} = 1.5 \cancel{\text{m}} * \frac{100 \text{ cm}}{1 \cancel{\text{m}}} = 150 \text{ cm}$

b. $230 \text{ cm} = 230 \cancel{\text{cm}} * \frac{1 \text{ m}}{100 \cancel{\text{cm}}} = 2.3 \text{ m}$

c. $375 \text{ cm} = 375 \cancel{\text{cm}} * \frac{1 \text{ m}}{100 \cancel{\text{cm}}} = 3.75 \text{ m}$

d. $5.91 \text{ m} = 5.91 \cancel{\text{m}} * \frac{100 \text{ cm}}{1 \cancel{\text{m}}} = 591 \text{ cm}$

CONVERT IMPERIAL SYSTEM TO IMPERIAL SYSTEM



Imperial, or British, or Customary System of measurement. The 'old' system we do not use anymore! (?)

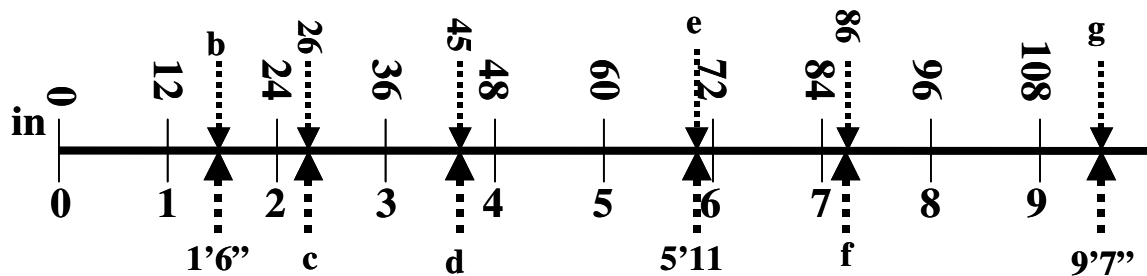
8. Complete the table (**do not use** decimal values of course, that is *mainly* for the metric system!)

feet (ft) and inches	inches (in)
1 ft	12 in
2 ft	24 in
3 ft	36 in
4 ft	48 in
4' 2" or 4 ft 2 in	50 in
10 ft	120 in
10 ft 11 in	131 in
5' 10" or 5ft 10 in	70 in
5'10"	70 in or 70"
8' 3 $\frac{3}{4}$ "	99 $\frac{3}{4}$ inches
8 ft 6 $\frac{3}{8}$ in	102 $\frac{3}{8}$ "

9. Complete the table (**do not use** decimal values of course, that is *mainly* for the metric system!)

pounds (lb) and oz	ounces (oz)
1 lb	16 oz
2 lb	32 oz
3 lb	48 oz
3 lb	48 oz
5lb 7oz	87oz
7.5 lb or 7lb 8 oz	120 oz
12 lb 5 oz	197 oz
8.125 lbs	130 oz
$\frac{1}{4}$ lb or 0.25 lb	4 oz
$\frac{1}{2}$ lb or 0.5 lb	8 oz
12.4 lbs no such thing really!	198 oz to nearest oz

10. Convert using the number line:



11. State the measure of the following positions on the number line $\hat{\uparrow}$.

b = **18"** ; c = **2 ft 2 in**; d = **3' 9"** ; e = **71 in** _____

f = **7 ft 2 in**; g = **115"** _____

12. Convert the following imperial (ie: 'British' or 'conventional') lengths using proportions. There is no such thing as a decimal foot; only whole feet! So the remaining inches are just leftover inches and sometimes fractions of inches.

a. $\frac{12 \text{ in}}{1 \text{ ft}} = \frac{x \text{ in}}{1 \text{ ft}}$; convert the
ft; so 1'6" is 1' plus the 6"
= 18 in

b. $\frac{1 \text{ ft}}{12 \text{ in}} = \frac{x \text{ ft}}{26 \text{ in}}$;
so 2 whole feet and
 2 inches remainder

So: **2ft 2 in**

c. $\frac{1 \text{ ft}}{12 \text{ in}} = \frac{x \text{ ft}}{45 \text{ in}}$
so 3 whole feet and
 9 inches remainder

d. $\frac{12 \text{ in}}{1 \text{ ft}} = \frac{x \text{ in}}{5 \text{ ft}}$;
so 5ft 11in is 5ft plus 11in
= 71 in

e. $\frac{1 \text{ ft}}{12 \text{ in}} = \frac{x \text{ ft}}{86 \text{ in}}$
so 7 whole feet and
 2 inches remainder

So: **7ft 2 in**

f. you do the rest elsewhere:

CONVERT BETWEEN IMPERIAL SYSTEM AND METRIC SYSTEM

13. Complete the table (convert metres to the nearest 0.01 or better, express imperial units as feet and *nearest inch* where indicated).

metres (m)	feet (ft) and inches
1	3.2808 but just use 3.28
2	<u> 6 </u> ft <u> 7 </u> in
3.5	<u> 11 </u> ft <u> 6 </u> in
1.37 m	4ft 6 inches
137.20 m	450 ft
231.79 m	70 ft 8 in
1,245 m	<u> 4,084 </u> ft
7,100 m	<u> 23,288 </u> ft
133.53 m	438 ft
17.38 m	57 ft
1.75 m	5 ft 9 in
0.45 m	<u> 1 </u> ft <u> 6 </u> in

14. Complete the table (convert kilograms to nearest 0.01, calculate ounces to the nearest oz)

pounds (lb) and oz	kilograms (kg)
2.205 just use 2.2 here	1.000
4.4 lb <i>no such thing really</i>	2 kg
6.6 lb <i>no such thing really</i>	3 kg
8.8 lb or 8 lb 13 oz	4.00 kg
10 lb 2 oz <i>ie: 10²/₁₆</i>	4.60 kg
17.49 lb or 17 lb 8oz	7.95 kg
4 lb 5 oz <i>ie: 4 and 5/16</i>	1.96 kg
8 lb 8 oz (<i>ie: 8.5lb</i>)	3.86 kg
172.52 lb 172 lb 8oz	78.42 kg
167.40 lb 167 lb 6 oz	76.09
73 lbs 9 oz <i>ie: 73⁹/₁₆</i>	33.44 kg

15. Convert using proportions (ie: cross multiplying) **Round properly**

a. 2 m = 6 ft and 7 inches?

b. 40 ft = _____ m ?

$$\frac{3.28 \text{ ft}}{1 \text{ m}} = \frac{x \text{ ft}}{2 \text{ m}}; \text{ to find the whole feet}$$

$$\frac{3.28 \text{ ft}}{1 \text{ m}} = \frac{40 \text{ ft}}{x \text{ m}}; \therefore x = \underline{12.20 \text{ m}}$$

$\therefore x =$ 6 whole feet
plus 7 twelfths of a foot **since**
0.56 of 12 is 7 when rounded

So **6 ft 7 in**

c. 7,100 m = 23,288 ft? (to nearest foot)

d. 40 ft = 12.20 m ?

$$\frac{3.28 \text{ ft}}{1 \text{ m}} = \frac{x \text{ ft}}{7,100 \text{ m}}; \therefore x = \underline{23,288}$$

$$\frac{1 \text{ m}}{3.28 \text{ ft}} = \frac{x \text{ m}}{40 \text{ ft}}; \therefore x = \underline{12.20}$$

e. 70 ft 8 inches = _____ m

f. 5 ft 9 inches = _____ m

$$\frac{1 \text{ m}}{3.28 \text{ ft}} = \frac{x \text{ m}}{70\frac{8}{12} \text{ ft}}; \therefore x = \underline{21.54 \text{ m}}$$

$$\frac{1 \text{ m}}{3.28 \text{ ft}} = \frac{x \text{ m}}{5\frac{9}{12} \text{ ft}}; \therefore x = \underline{1.75 \text{ m}}$$

$$x = (70 + 8 \div 12) \div 3.28 = 21.54$$

$$x = (5 + 9 \div 12) \div 3.28 = 1.75$$

g. 10 lb 2oz = 4.6 kg

h. 4.6 kg = 10.12 lb ; so:
10 lbs and 12/100 of a pound which is 10 lbs
and how many 16^{ths}?

$$\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{x \text{ kg}}{10\frac{2}{16} \text{ lb}}; \therefore x = \underline{4.6 \text{ kg}}$$

$$\frac{2.2 \text{ lb}}{1 \text{ kg}} = \frac{x \text{ lb}}{4.6 \text{ kg}};$$

$$x = (10 + 2 \div 16) \div 2.2 = 4.6$$

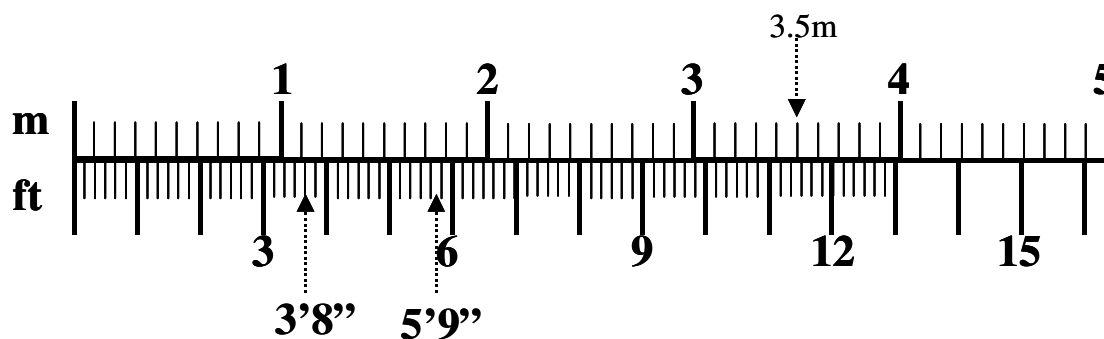
$$\therefore x = \underline{10} \text{ whole pounds} +$$

$$\underline{2} \text{ 'sixteenths' of a pound}$$

since 0.12 of 16 is 2 rounded

so: **10 lb 2 oz**

16. Use this number line to help you see (*conceptualize*) some conversions between measures in feet and inches to and from metres.



Notice that few of the units of measure line up nicely, so a number line for converting between different systems is only good for a rough idea

17. CONVERTING (INVERTING) CONVERSION RATIOS

I have told you that there are **0.6214** miles in **1 kilometre (km)**! A secret recipe to make one kilometre!

But you may have seen elsewhere that there is **1.609** kilometres in one mile!

We are saying the same thing!! If there are 0.6214 miles in one km, then how many km are there in one mile?

$$\frac{1 \text{ km}}{0.6214 \text{ mi}} = \frac{x \text{ km}}{1 \text{ mi}}; \text{ so } \frac{1 * 1}{0.6214} = x = 1.609; \text{ so there is 1.609 km in one mile.}$$

It is like saying that if there are **4 raisins for every muffin** then there is a **quarter of a muffin for every raisin**! We are saying the same thing. (*it is called the reciprocal in math!*)

I bathe my dog 3 times ever 5 months or every 5 months I bathe my dog 3 times

If there are **2.205 lbs** in **1 kg** (even though technically there is no such thing as 0.205 lbs since it would really be 3/4 ounces!) then how many kg are there in one pound?

$$\frac{1 \text{ kg}}{2.205 \text{ lb}} = \frac{x \text{ kg}}{1 \text{ lb}}; \text{ so one pound (lb) is the same as } \underline{\underline{0.4535}} \text{ kg}$$

so **1 kg is 2.205 lbs** or if you prefer **1 lb is 0.435 kg**.

18. CONVERT USING (UNIT) CONVERSION FACTORS

A factor is something that you multiply another value by! The best factors are one that convert one unwanted unit of measure to a desired unit of measure.

a. **Example 1:** 3 ft = _____ inches

$$3 \cancel{\text{ft}} * \frac{12 \cancel{\text{inches}}}{1 \cancel{\text{ft}}} = 36 \text{ inches}; \text{ so multiply by: } \frac{\text{wanted units}}{\text{unwanted units}}; \text{ make sure they cancel.}$$

b. **Example 2:** 37 weeks = _____ minutes;

$$\therefore 37 \text{ weeks} = 37 \text{ weeks} * \frac{7 \text{ days}}{1 \text{ week}} * \frac{24 \text{ hr}}{1 \text{ day}} * \frac{60 \text{ min}}{1 \text{ hr}} = 372,960 \text{ minutes}$$

c. 17 ft = _____ m; $\therefore 17 \text{ ft} * \frac{1 \text{ m}}{3.28 \text{ ft}} = 5.18 \text{ m}$

d. 183 lb = _____ kg;

$$\text{so: } 183 \text{ lbs} = 183 \text{ lb} * \frac{1 \text{ kg}}{2.205 \text{ lb}} = 82.99 \text{ kg}$$

e. 4.3 km = _____ m

$$\text{so: } 4.3 \text{ km} = 4.3 \text{ km} * \frac{1,000 \text{ m}}{1 \text{ km}} = 4,300 \text{ m}$$

f. 4.3 km = _____ cm

$$\text{so: } 4.3 \text{ km} = 4.3 \text{ km} * \frac{1,000 \text{ m}}{1 \text{ km}} * \frac{100 \text{ cm}}{1 \text{ m}} = 4.3 * 1,000 * 100 = 430,000 \text{ metres}$$

g. 57 litres = _____ ImpGal (note US gallons and Imperial gallons are different volumes!)

$$57 \text{ L} = 57 \text{ L} * \frac{1 \text{ ImpGal}}{4.55 \text{ L}} = 12.53 \text{ gallons}$$

h. 2.3 miles = _____ inches (omg; a lot!)

$$2.3 \text{ miles} = 2.3 \text{ mi} * \frac{5,280 \text{ ft}}{1 \text{ mi}} * \frac{12 \text{ in}}{1 \text{ ft}} = 145,728 \text{ inches}$$

i. 7.119 tons = _____ grams (the weight of a small airplane is how many grapes!)

$$\text{so: } 7.119 \text{ tons} = 7.119 \text{ t} * \frac{2000 \text{ lb}}{1 \text{ t}} * \frac{16 \text{ oz}}{1 \text{ lb}} * \frac{28.3 \text{ g}}{1 \text{ oz}} = 6,446,966 \text{ grams (a lot of grapes!)}$$

Advanced ↓:

j. 30 km / hr = 0.83 m / sec

$$30 \text{ km / hr} = \frac{30 \text{ km}}{1 \text{ hr}} * \frac{1,000 \text{ m}}{1 \text{ km}} * \frac{1 \text{ hr}}{60 \text{ min}} * \frac{1 \text{ min}}{60 \text{ sec}} = 0.83 \text{ m/sec or } 83 \text{ cm per second}$$

k. 299,000,000 m / sec = _____ miles per hour [mi/hr] (the speed of light)

works out to about 670,000,000 miles per hour or so! So 670 million miles per hour Race ya!