

## UNIT 17 *Units of Measure*

## Activities

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### Activities

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## ACTIVITY 17.1

## Estimating Your Volume

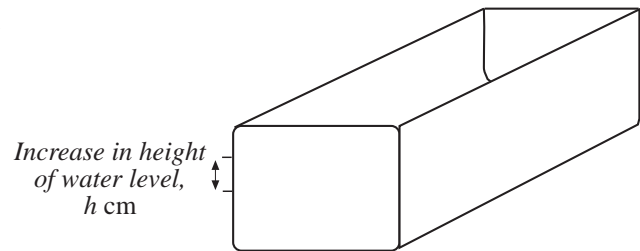
Here are two methods of finding the approximate volume of your body. Use both methods (and any others that you can think of!) to estimate your volume.

**(A) Bath Method** (you will need some assistance with this)

Fill a bath, up to about  $\frac{1}{2}$  full, and note the level of the water.

Totally submerge yourself (head included) in the water, and get someone to note the new water level.

Assuming the cross section of the bath is a rectangle  $a$  cm by  $b$  cm, your body's volume is  $(h \times a \times b)$  cm<sup>3</sup>.

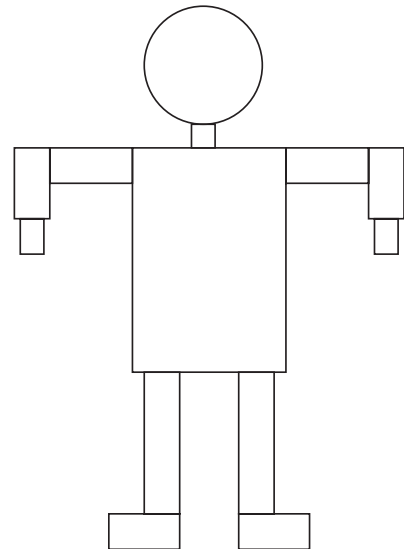


**(B) Component Method**

Think of your body as a sphere (head) and a series of cylinders or cuboids (neck, trunk, arms, legs, hands and feet).

(You can find the volume of each cylinder by first measuring the average circumference, i.e.  $2\pi r$ , which gives you an estimate of  $r$ , etc.)

Add all the components together, doubling up where there is a left and a right component.



### Extension

1. Compare the two values. Which is the more accurate measurement of your volume?
2. Estimate the *density* of your body (density =  $\frac{\text{mass}}{\text{volume}}$ ).

## ACTIVITY 17.2

## Conversions

There are numerous different systems of measurement in use throughout the world; this situation is gradually changing as countries move towards a single system,

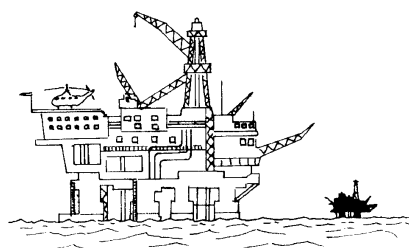
le Système International d'Unités (or S.I.)  
but progress is slow and uneven.

Even when a single system is used, there will still be some exceptions. For instance, in the UK the only legal system of measures since 1 January 2000 has been that of S.I., with 4 exceptions:

- miles, yards, etc.
- pints
- acres
- troy weights (a system used for weighing precious metals and gems)

and each of those may be used only for certain specified purposes. For a variety of reasons there will always be a need to change units of measurement in one system into units of another. Activity Sheet 17.2a gives information about units and their values for conversion purposes.

In conversion problems you need to isolate each part of the question, taking it stage by stage as demonstrated in the first question below.



1. An oilfield has an output of 200 barrels per hour. How many cubic metres are produced each day?

The problem can be solved in four stages:

- (a) How many *barrels* of oil are produced in one day?
- (b) How many *US gallons* of oil are produced in one day?
- (c) Convert your answer to litres.
- (d) Change litres to cubic metres.

Solve the following conversion problems: read each question carefully and think about the required stages *before* actually starting on the calculations.

2. Petrol is sold in litres. However, fuel consumption figures are often still quoted in miles per gallon. How many miles per litre should you expect to get from a car for which the fuel consumption is given as 50 mpg?
3. In order to help with exports, a business based in London wishes to open an office in France. The office manager is instructed to find suitable premises and to help her make comparisons, she wants to know what the equivalent rent would be for her own office. Her current London rent is £12 per square foot. What would be the equivalent in francs per square metre? (Take the rate of exchange as 9.5 francs to the £.)
4. A farmer has a 17-acre field on which a new EC fertilizer has to be spread at the rate of 850 kg per hectare. How many tonnes of fertilizer will be needed?
5. Fuel consumption of a vehicle is sometimes stated in miles per gallon and at other times in litres per 100 km – that is, the number of litres of fuel needed to travel 100 km.  
Change a fuel consumption of 40 mpg into litres/100 km.



Plenary session

# ACTIVITY 17.2a

# Conversion Sheet

<b>Measures of WEIGHT</b> (UK and USA)			
437.5	grains	=	1 ounce
480	grains	=	1 troy ounce
7000	grains	=	1 pound
16	ounces	=	1 pound
14	pounds	=	1 stone
<b>In UK</b>			
112	pounds	=	1 hundredweight
20	cwt	=	1 ton (long ton)
2240	pounds	=	1 ton (long ton)
<b>In USA</b>			
100	pounds	=	1 hundredweight
20	cwt	=	1 ton (short ton)
2000	pounds	=	1 ton (short ton)
* 1	pound	=	0.453 592 37 kg

<b>Measures of LENGTH</b> (UK and USA)	
12	inches = 1 foot
3	feet = 1 yard
22	yards = 1 chain
10	chains = 1 furlong
8	furlongs = 1 mile
5280	feet = 1 mile
1760	yards = 1 mile
* 1	yard = 0.9144 metres

<b>Measures of AREA</b> (UK and USA)	
144	sq. inches = 1 sq. foot
9	sq. feet = 1 sq. yard
4840	sq. yards = 1 acre
640	acres = 1 sq. mile

<b>Measures of CAPACITY</b> (UK)	
20	fluid ounces = 1 pint
4	gills = 1 pint
2	pints = 1 quart
8	pints = 1 gallon
* 1	gallon = 4.546 09 litres

= means *exactly* equal to  
 ≈ means *approximately* equal to  
 \* indicates the defining measure from which all others in the table are derived

<b>Measures of WEIGHT</b> (Metric)	
1000	grams = 1 kilogram
1000	kg = 1 tonne

<b>USA DRY MEASURES</b>	
2	pints = 1 quart
8	quarts = 1 peck
4	pecks = 1 bushel
* 1	bushel = 2150.42 cubic inches ≈ 35.239 070 litres

<b>USA LIQUID MEASURES</b>	
16	fluid ounces = 1 pint
4	gills = 1 pint
2	pints = 1 quart
4	quarts = 1 gallon
42	gallons = 1 barrel
* 1	gallon = 231 cubic inches = 3.785 411 784 litres

<b>Useful CONVERSION FACTS</b>			
1	inch	=	2.54 cm
1	foot	=	30.48 cm
1	mile	=	1.609 344 km
1	sq. yard	≈	0.836 127 sq. metres
1	acre	≈	0.404 686 hectares
1	sq. mile	≈	2.589 988 sq. km
1	pint (UK)	≈	0.568 261 litres
1	cubic foot	≈	28.316 847 litres
1	ounce	≈	28.349 523 grams
1	cm	≈	0.393 701 inches
1	metre	≈	3.280 840 feet
1	km	≈	0.621 371 miles
1	hectare	≈	2.471 054 acres
1	litre	≈	1.759 754 pints (UK)
		≈	0.219 969 gallons (UK)
		≈	61.023 744 cubic inches
1	kg	≈	2.204 623 pounds

## ACTIVITIES 17.1 - 17.2

## *Notes for Solutions*

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*Notes and solutions given only where appropriate.*

- 17.2**
1.
    - (a) 4800 barrels per day
    - (b) 201 600 US gallons per day
    - (c) 763 139 litres (nearest litre)
    - (d) 763 cubic metres per day (nearest cubic metre)
  2. 50 mpg is 11.0 miles per litre (1 d.p.)
  3. £12 per square foot is £129.17 per square metre or 1227 francs per square metre (to nearest integer).
  4. 6.88 hectares need 5848 kg or 5.85 tonnes (2 d.p.)
  5. 7.06 litres per 100 km (2 d.p.)