Homework due Sept 18 on Edmodo

Units & Unit conversation

Page 28: Exercise 10: 3, 4, & 6
Page 30-31: all
32-33: all

Homework due Sept 22 on Edmodo

Imperial System versus SI?

- IB uses the "*Systeme International*":
  - **Distance** metres (m)
  - **Mass** kilograms (kg)
  - **Time** seconds (s)
  - **Temperature** Kelvin (K)
- You must know the prefixes!

Factor	10^{9}	10^{6}	10^{3}	10^{2}	10^{1}	10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}
Name	Giga	Mega	Kilo	Hecto	Deka	Deci	Centi	Mili	Micro	Nano
Symbol	G	M	k	h	da	d	c	m	μ	n

* *

10^9	10^6	10^3	10^2	10^1		10^{-1}	10^{-2}	10^{-3}	10^{-6}	10^{-9}
giga	mega	kilo	hecta	deca	metre SI unt	deci	centi	milli	micro	nano
Gm	Mm	km	hm	dam		dm	cm	mm	μm	nm

$1\,m = 1000\,mm$ $\quad 10^{-3}\,m = 1\,mm$

$10^{6}\,\ell = 1\,M\ell$

$10^{-6}\,m = 1\,\mu m$

Ratios of "1"

$\frac{1\,m}{1000\,mm}$ $\quad \frac{1000\,mm}{1\,m}$ $\quad \frac{1000\,g}{1\,kg}$

$\frac{1\,m}{100\,cm}$ $\quad \frac{100\,cm}{1\,m}$

Examples: Convert.....

- 123 m into mm

$$123\,m \times \frac{1000\,mm}{1\,m} \Rightarrow 123000\,mm$$

- 95 m into hm

$$95\,m \times \frac{1\,hm}{100\,m} \Rightarrow 0.95\,hm$$

- 123456 mm into Mm

$$123456\,mm \times \frac{1\,m}{1000\,mm} \times \frac{1\,Mm}{10^6\,m} \rightarrow 0.000123456\,Mm$$

- 2.78 X 10^4 megalitres into litres

$$2.78 \times 10^4\,Ml \times \frac{10^6\,l}{1\,Ml} \Rightarrow 2.78 \times 10^{10}\,l$$

Examples of Converting in the Imperial system

6 feet and 2 inches into metre. knowing that 1 inch = 2.54 cm

First you need to convert, all into inches or feet.

① $6\,ft \times \frac{12\,in}{1\,ft} = 72in.$

② $72\,in \times \frac{2.54\,cm}{1\,in} = 182.88cm$

③ $182.88\,cm \times \frac{1\,m}{100\,cm} = 1.8288\,m$

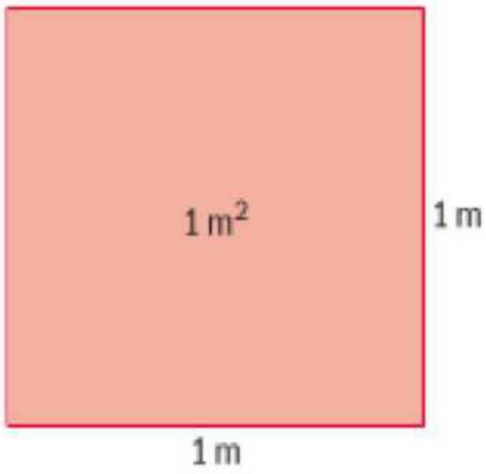
136 ounces into Kg. Knowing 16ounces = 1pound and 1Kg=2.20pounds

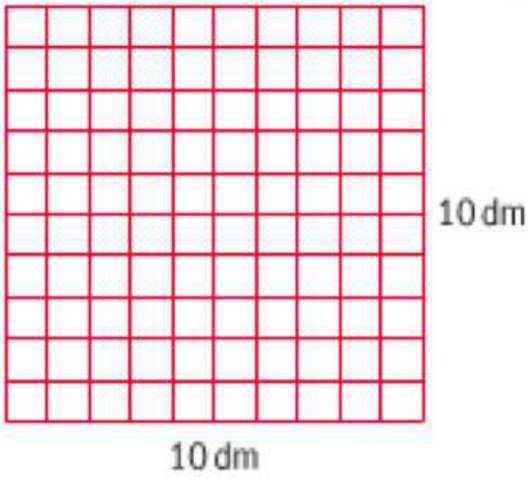
$$136\,oz \times \frac{1\,pound}{16\,oz} \times \frac{1\,kg}{2.20\,pounds} \Rightarrow 3.86\,kg$$

Perimeter, Area, and Volume

- Perimeter: It is a distance so the official unit is m, but you will see often km, cm
- Area: m^2
- Volume m^3

Area



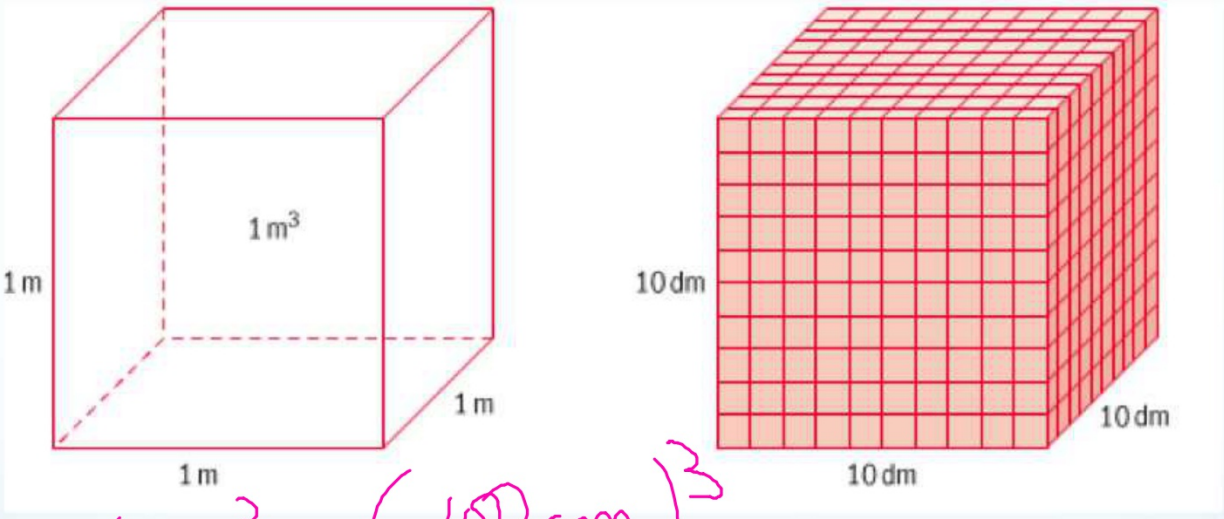


$$1\,m^2 \times \left(\frac{10\,dm}{1\,m}\right)^2$$

$$1\,m^2 \times \frac{10^2\,dm^2}{1^2\,m^2} \Rightarrow 100\,dm^2$$

Volume

Convert into cm^3



$$1\ m^3 \times \left(\frac{100\ cm}{1\ m}\right)^3$$

$$1\ \cancel{m^3} \times \frac{10^6\ cm^3}{1\ \cancel{m^3}} = 1\,000\,000\ cm^3$$

Classroom width = 550 cm

length = 620 cm

Calculate the area in m^2

1st step width $\Rightarrow 550\ \cancel{cm} \times \frac{1\ m}{100\ \cancel{cm}}$

$\Rightarrow 5.50\ m$

length $\Rightarrow 620\ \cancel{cm} \times \frac{1\ m}{100\ \cancel{cm}}$

$\Rightarrow 6.20\ m$

2nd step

$A = w \times l$

$= 5.50 \times 6.20$

$= 34.1\ m^2$

page 30

HW due Sept 18

#1.a) $2.36\ m^2$ into cm^2

1st $\left(\frac{1\ m}{100\ cm}\right)^2 \Rightarrow \frac{1\ m^2}{10000\ cm^2}$

2nd $2.36\ m^2 \times \frac{10000\ cm^2}{1\ m^2}$

$23600\ cm^2$

page 32

4a)

$1\ l = 1\ dm^3$ $\left(\frac{10\ cm}{1\ dm}\right)^3$ $\frac{1000\ cm^3}{1\ dm^3}$

500 l into cm^3

$500\ dm^3 \times \frac{1000\ cm^3}{1\ dm^3}$

$500\,000\ cm^3$

page 32 #7

a) $V = 1.5 \times 1.5 \times 1.5$ $\left(\text{or } (1.5)^3\right)$

$=$

b) $1.5\ m \longrightarrow 15\ dm$

$V = 15 \times 15 \times 15$

$= 3375\ dm^3$

How do you convert between Units

- 134 cm into millimeters.

$$134\ cm \times \frac{10\ mm}{1\ cm} \Rightarrow \boxed{1340\ mm}$$

- Tricky: 12345 cm^2 into m^2

$$\left(\frac{1\ m}{100\ cm}\right)^2 \Rightarrow \frac{1\ m^2}{10^4\ cm^2}$$

$$12345\ cm^2 \times \frac{1\ m^2}{10^4\ cm^2} \Rightarrow 1.2345\ m^2 \quad (\text{exact})$$

$$1.23\ m^2 \ (3\text{ s.f.})$$

- 0.234 m^3 into cm^3

$$\left(\frac{100\ cm}{1\ m}\right)^3 \Rightarrow \frac{10^6\ cm^3}{1\ m^3}$$

$$0.234\ m^3 \times \frac{10^6\ cm^3}{1\ m^3} \Rightarrow \boxed{234000\ cm^3}$$

Time: SI unit is "s" for second, but ...

Example:

It took Prof. Plum 93 hours to write his doctoral thesis. Can you calculate how many seconds it took him?

Name	Symbol	Equivalent
Microsecond	μs	
Nanosecond	ns	
Minute	m	60s
Hour	h	3600s
Day	Day	
? week	week	
? year	year	
decade		

two ways

$93\ \text{hours} \times \frac{3600\ \text{s}}{1\ \text{hour}} \Rightarrow \therefore 93\ \text{hours} = 334800\ \text{s}$

or

$93\ \text{hours} \times \frac{60\ \text{min}}{1\ \text{hour}} \times \frac{60\ \text{s}}{1\ \text{min}} \Rightarrow \therefore 93\text{h} = 334800\ \text{s}$

Temperature: Kelvin (K)

- Farenheit (°F)
- Celsius (°C)
- Kelvin (K)

$$F = \frac{9}{5}C + 32$$

$$t_C = t_K - 273.15$$

Water:	°C	°F	K
Freezing pt.	0	32	273.15
Boiling Pt.	100	212	373.15

Examples:

1. How many F° are 25 C°?

$F = \frac{9}{5}\left(\frac{25}{1}\right) + 32$

$F = 77°$

2. How many C° are 45 F°

$45 = \frac{9}{5}C + 32$

$45 - 32 = \frac{9C}{5}$

$13 = \frac{9C}{5}$

$C = 7.22°$

Get the formula for Celsius in terms of F

$$F = \frac{9}{5}C + 32$$

$$F - 32 = \frac{9}{5}C$$

$$5(F - 32) = 9C$$

$$\frac{5(F-32)}{9} = C$$

Speed and Density

Speed Formula:

$$S = \frac{d}{t}$$

Density Formula:

$$D = \frac{\text{Mass}}{\text{Volume}}$$

Units: SI: m/s ($m\,s^{-1}$)

But we often see km/h ($km\,h^{-1}$)

Units: SI: kg/m^3 ($kg\,m^{-3}$)

But we often see: _____ (_____)

38780 $m\,s^{-1}$ into $km\,h^{-1}$

I do it in 2 steps - but it's your choice

$$38780\ \frac{m}{s} \times \frac{1\ km}{1000\ m} \times \frac{3600\ s}{1\ hour} \Rightarrow 139608\ \frac{km}{h}$$

or simply multiply by 3.6

Example of Speed

- Paula runs 15km in 2.5h. Find Paula's average speed in ms^{-1}

Since the answer has to be in ms^{-1}, you should first convert the givens and then calculate the speed.

1st step

$15\,km \times \frac{1000\,m}{1\,km} = 15000\,m$

$2.5\,hours \Rightarrow 2\,hours \times \frac{3600\,s}{1\,h} = 7200\,s$

$30\,min \Rightarrow 30\,m \times \frac{60\,s}{1\,m} = 1800\,s$

$time = 9000\,s$

2nd step

$s = \frac{D}{t}$

$s = \frac{15000\,m}{9000\,s} = 1.66\,ms^{-1}$

- A race track is 5000 m long, Fernando Alonso drives at an average speed of 220 km/h, how long would it take him to race, when he must cover 10 laps?

Since the speed is given at km/h, and teh length is given in m, you know you must convert at least one of them. I choose to convert 5000 m into km first. Then I will apply the formula of speed to solve for time.

1st step

$5000\,m \times \frac{1\,km}{1000\,m} = 5\,km$ and he does 10 laps $= 50\,km$

2nd Step

$s = \frac{D}{t}$

$\therefore t = \frac{D}{S}$

$t = \frac{50\,km}{220\,km/h}$

$t = 0.227\,hours$ or 13.6 minutes

Examples to Try (based on prior learning)

HINT don't forget to give answers w/ units

A rectangular swimming pool is 12 m wide and 35 m long.

a) Calculate the perimeter of the pool in metres.

b) Calculate the area of the pool in square metres

c) Calculate the area of the pool in square centimetres

d) The pool is 75 cm deep.

Calculate the volume of the pool in cubic metres.

a) $P = (2)(12) + (2)(35)$

$P = 94\,m$

b) $A = 12 \times 35$

$A = 420\,m^2$

c) 1st step change the dimensions

$12\,m \longrightarrow 1200\,cm$

$35\,m \longrightarrow 3500\,cm$

$A = 1200 \times 3500$

$= 4200000\,cm^2$ or $4.2 \times 10^6\,cm^2$

d) $75\,cm \longrightarrow 0.75\,m$

$Volume = 12 \times 35 \times 0.75$

$V = 315\,m^3$

Example to try on your own

365.25 days

6. A *light-year* is a unit of distance. It is the distance that light can travel in one year. Light moves at a velocity of about 300,000 km/s.

   Show that one light year is 946×10^{12} km.

Note: This question is a "show that", which means it is all about the steps.

1st $365.25\,\text{days} \times \frac{24\,\text{hours}}{1\,\text{day}} \times \frac{3600\,s}{1\,h} = 31557600\,s$

2nd $s = \frac{D}{t} \therefore D = (S)(t)$

$D = (300000)(31557600)$

$D = 9467280000000$

$D = 9.47 \times 10^{12}\,km/s$

Note: I am not getting the same answer as the question 6. This is probably, because the examiner took a year as exactly 365 days instead of 365.25 days.
Repeat the question using 365 days instead

Example to try on your own

a A rocket travels in space at 4×10^5 km/h. How far does it travel in:

i 30 days **ii** 20 years?

b A satellite travels 5×10^3 km in 2×10^{-5} hours. Find its average speed in kilometres per hour.

Question a) is about knowing how to transfer days & years into hours, because this is what you do first.

$$30 \text{ days} \times \frac{24 \text{ hours}}{1 \text{ day}} = 720 \text{ hours}$$

$$S = \frac{D}{t} \Rightarrow \therefore D = (S)(t)$$

$$D = (4 \times 10^5)(720)$$

$$D = 2.88 \times 10^8 \text{ km}$$

$$20 \text{ years} \times \frac{365.25 \text{ days}}{1 \text{ year}} \times \frac{24 \text{ hours}}{1 \text{ day}} = 175\,320 \text{ hours}$$

$$D = (S)(t)$$

$$= (4 \times 10^5)(175320)$$

Question b) is about knowing how to enter scientific notation in your GDC!!!!

$$S = \frac{D}{t}$$

$$S = \frac{5 \times 10^3}{2 \times 10^{-5}} = 2.5 \times 10^8 \frac{\text{km}}{\text{h}}$$