Scalar magnitudes and vectors

Definition: Physical magnitudes are properties of objects that can be measured by comparison with a standard unit.

- A scalar magnitude is expressed with a number and the associated unit e.g. a time of 3 minutes.
- A vector is a quantity that possesses both a scalar magnitude but with a direction e.g. a car driving east with a velocity of 35 m/s.

SI Units

In 1960 the Système International d´Unités (SI) was agreed upon to enhance scientific communication.

The table on the left (Marshscience.blogspot.com.es, 2014) shows the 7 fundamental units agreed upon by this convention.

SI Base Units	
Quantity Measured	**Unit (symbol)**
Length	meter (m)
Mass	kilogram (kg)
Time	second (s)
Electric current	ampere (A)
Temperature	Kelvin (K)
Substance amount	mole (mol)
Light intensity	candela (cd)

Prefixes	
Prefix	**Meaning**
Mega- (M)	1,000,000 (10^6)
Kilo- (k)	1,000 (10^3)
Hecto- (h)	100 (10^2)
Deka- (da)	10 (10^1)
Deci- (d)	0.1 (10^{-1})
Centi- (c)	0.01 (10^{-2})
Milli- (m)	0.001 (10^{-3})
Micro- (μ)	0.000 001 (10^{-6})

Why are some units CAPITAL letters and some in lowercase?

All other units are actually made of a combination of these base units:

Speed -->

Acceleration -->

Energy --> 1 Joule

Are these units correctly written?

96.7hm

8 newtons

10.00 ccd

273.15 K

47200 secs

12 μ m

1 megaA

Weebly questions:

Task 1a: Identify which of the following units are written incorrectly and rewrite them. in your PCD.

- 1000Mm
- 5 Candela
- 25.06 ccd
- 94 K
- 74888 m seconds
- 0.004Moles
- 20 hm
- 12 μ m

Which other units exist for temperature?

What relevance do the 2 following objects have in this topic? Click on the photos to find out more.

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Making measurements - Precision

Which of these is the most precise instruments?

beaker

measuring cylinder

Significant figures and decimal places

Task 1d: How many significant figures are found in the following numbers?

100

2.82

450000.2

0.000072

4.00×10^5

Write the following in scientific notation:

1001

0 . 000087

98 . 1

267544

54 . 54

Dealing with significant figures and decimal places

1. If you are multiplying or dividing values then we consider the number of sig figs. The lowest number of significant figures used in the calculation should be given in the result.

2. If you are adding or subtracting values then we consider the number of decimal places. The lowest number of decimal places used in the calculation should be given in the result.

3. Numbers that are NOT from your data can be ignored when using the rules above. So when calculating an average from 3 numbers, you may ignore the `3´ that is used to divide them - it is an exact number.

4.80 + 2.60 + 1.2 = 8.6 (Lowest number of decimal places is 1)

3.5 x 19.36 = 68 (Lowest number of significant figures is 2)

Calculating an average: (1.68 + 8.52 + 7.31) / 3 =
2 as the `3´ can be ignored)

Task 1e: Calculate the answers to these questions taking into account significant figures and decimal places. (Assume all numbers are experimentally obtained)

a. 5.8 + 4.56 + 12 =

b. 0.008 – 0.0456 + 0.9 =

c. 11 x 222 x 333 =

d. 19.30 / 182.3 =

e. (4.5 x 10^3) x (18.93 + 2.07) =

f. What is the average of these data points – 42.66, 43.810, 43.0

IB Style Questions

1. Which one of the following is given to 4 s.f.?

a) 0.00040 b) 4.000 c) 0.0040 d) 4000

2. How many s.f. are there in 0.040930?

a) 7 b) 5 c) 4 d) 3

3. How many s.f. in 5.010×10^{3}?

a) 4 b) 2 c) 5 d) 6

4. Calculate the following and give the correct accuracy to the answer.

48.2 + 3.87 + 48.4394

5. Calculate the following and give the correct accuracy to the answer.

451 - 15.46

6. Calculate the following and give the correct accuracy to the answer.

45.8 x 0.12

Conversion factors

Convert these values using conversion factors:

1. 6 days into hours → 144h
2. 12 mins into seconds → 720s
3. 1825 days into years → 5 y

4. 700 dm into hm → 0.7 hm
5. 3.7 km into cm → $3.7\ km \times \frac{10^5\ cm}{1\ km}$
6. 9 dam into mm → $9\ dam \times \frac{1\ km}{10^4\ mm} =$ dam

7. 20 m/s into km/h
8. 144 km/h into m/s
9. 5 m/s into dm/min
10. 6 hm/h into m/min

Ans
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

$1825\ d \times \frac{1\ y}{365\ d} = 5\ y$

$20\ \frac{m}{s} \times \frac{1\ km}{10^3\ m} \times \frac{3.6 \cdot 10^3\ s}{1\ h} = 72\ \frac{km}{h}$

$\frac{144\ km}{h} \times \frac{1000\ m}{km} \times \frac{1\ h}{3600\ s} = \frac{144000}{3600} = 40\ m/s$

$5\ \frac{m}{s} \times \frac{10\ dm}{1\ m} \times \frac{6 \times 10^1\ s}{1\ min} = 300\ \frac{dm}{min}$

$6\ hm/h \rightarrow m/min = \frac{6\ hm}{h} \times \frac{100\ m}{1\ hm} \times \frac{1\ h}{60\ min} = \frac{100}{60} \times 6 =$

$10\ \frac{m}{min}$

$mL = cm^3$

$L = dm^3$