1. MEASUREMENT

In this first unit, we look at some of the different ways of expressing the function of ***measurement****. Why start with measurement? As Lord Kelvin[1] wrote in 1890, "without quantification there is no scientific subject", and it is true to say that the history of scientific progress has run parallel to, and been dependent on, the ever-increasing precision in measurement.*

Self evaluation – entry test

■ *Fill in the gaps in the sentences according to the definitions. The first two letters are given.*

Example:
How ***de*** ..... *is the Pacific ocean?* (distance from the surface to the bottom)
→ *How* ***deep*** *is the Pacific ocean?*

1. In 1841, Sir George Everest, a colonial official, recorded the location and the **he** ..... of the most famous mountain in the world. *(altitude)*
2. GIS (geographic information systems) are designed to process massive **am** ..... of data. *(quantities)*
3. The hearing **ra** ..... of bats is enormous; it goes from 50 to 100,000 cycles. *(from the lowest to the highest limit, extent)*
4. It is said that Galileo dropped objects from the leaning tower of Pisa to prove that the speed of fall is not proportional to **we** ..... . *(a force measured in kg)*
5. Colonial power depended on navigation. In 1714, the British Parliament offered a prize of £20,000 to the first man to develop an **ac** ..... marine chronometer. *(exact, precise)*
6. A six-year-old, male alligator has a **le** ..... of approximately 190 centimetres. *(longitudinal dimension)*
7. Xavier LePichon, a French seismologist, was able to **wo** ..... the basic geometry of plate tectonics from seismic evidence. *(calculate – 2 words)*
8. As a meteorite enters the atmosphere, it **sl** ..... . *(decelerates – 2 words)*
9. The **av** ..... brain temperature of animals hibernating in the Arctic may drop to 6°C. *(statistically normal, mean)*
10. The notion of square **ro** ..... was invented in the 9th century by Arabian mathematicians. *(a factor of a number that when multiplied by itself gives the number)*

1 Lord Kelvin: 1824-1907, British physicist who introduced the absolute scale of temperature.

Functions & Grammar

KEY POINTS – MEASUREMENT

1. Adjectives

deep ≠ shallow · far ≠ near · fast ≠ slow · heavy ≠ light · high ≠ low · long ≠ short · odd ≠ even · thick ≠ thin · wide / broad ≠ narrow

➢ *All prime numbers are* ***odd*** *numbers.*

accurate ≠ inaccurate · average / mean · standard ≠ sub-standard

➢ *The* ***mean*** *density of Mercury is similar to that of the Earth.*

2. Nouns

amount · extent · measurement · range · size · span · speed

accuracy · average · level · mean · rate · scale · stage · step

➢ *The* ***rate*** *of acceleration is expressed in metres per second per second.*

check · study · survey

area · circumference · cross-section · diameter · radius

➢ *The* ***cross-section*** *of the wire is 0.22 mm^2. (nought point two two square millimetres)*

▮ *Rules for noun formation – suffixes*

ADJ / VERB + -th / -t (+ VOWEL CHANGE)

dep**th** · heig**ht** · long / leng**th** · weig**ht** · wid**th**

ADJ + -ness

hard**ness** · heavy / heavi**ness** · near**ness** · thick**ness**

VERB + -ment

to develop / develop**ment** · measure**ment** · move**ment**

3. Verbs

▮ *Rules for forming verbs*

NOUN/ADJ + Ø (NO CHANGE)

to narrow ≠ to thin · to range / to span / to extend[G. Notes 1] / to reach · to rate / to check / to monitor · to record / to plot

➢ *The trajectory of the missile was **plotted** on a graph.*

*NOUN/ADJ + **-en***

to deep**en** · to length**en** · to short**en** · to thick**en** · to wid**en**

➢ *The river **widens** when it leaves the canyon.*

*NOUN/ADJ + **adv particle***

to check **up** · to level **off** · to slow **down** ≠ to speed **up** · to step **up** · to work **out**

➢ *The speed of the neutrons is **slowed down** by the beryllium moderator.*

4-Structures

Dimensions can be expressed by 4 different structures.

- It is 56 m in height(width, depth, diameter);
- It is 56 m high (wide, long, thick);
- It has a diameter of 10 m(length, weight);
- Its radius is 5 m(length, cross-section, circumference).

5.Other measurements

- **Area**

To obtain the area you **multiply** the length **by** the width**.**

The area of a rectangle is its height **times** its width.

It measures 10 cm **by** 10 cm. The area is 100 cm^2 (a hundred **square** cm).
πr^2 (**pi r squared**)[G. Notes 2] · $\sqrt{x}$ (the **square root** of x)

▮ *Volume*

The volume is 1,000 cm^3 (a thousand **cubic centimetres**).
x^3 (x **cubed**) · $\sqrt[3]{y}$ (the **cube root** of y)

▮ *Power*

x^9 (x **to the power** nine / x **to the** ninth)
x^{-9} (x to the **power minus** nine / x to the **minus ninth**)

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6. Approximate measurements

These can be expressed by means of **adverbial modifiers**

It is **approximately** 5 cm long.

It is **about / roughly** 5 cm long.

It is 5 cm long, **more or less** / It's 500 kilos, **more or less**/ more or less symmetrical.

It is **almost** 5 cm long/ It is **nearly** 5 cm long.

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7. Questions

Note the question forms.

It weighs 10 kg → **How heavy** is it? / **How much** does it **weigh**?
What does it **weigh**?

It is 5 km away → **How far** (away) is it? / **How many** kilometres **away** is it?
What is the **distance**?

8.checkpoints

- **Simple definitions:** the simplest way of defining a word is by using the verb **"to be".**

Example: a woman

A woman **is** an adult, female human being.

The following words are the most used in Microbiology, define them: Bacterium (plural: Bacteria); fungus (plural: funguses, fungi). Virus (plural: viruses).

- **Asking questions:** are you sure you **never** make a mistake?

Write a question about the words in ***bold****.*

1. It became extinct about **8 million years ago**.
2. An emu weighs slightly more than **50 kg**.
3. Specialists examined **the bones**.
4. **An ostrich** runs very fast.