

# Paper 1 Cheat Sheet

## 1 Measurements and their errors

**Precision** - There is very little spread around the mean value

**Repeatability** - If the same experimenter repeats the investigation using the same method and equipment and obtains the same results

**Reproducibility** - If a different experimenter repeats the investigation, or uses a different experiment or technique, the same results are obtained

**Accuracy** - Close to the true value

Combination	Operation
Adding or subtracting $a = b + c$	Add the absolute uncertainties $\Delta a = \Delta b + \Delta c$
Multiplying values $a = b \times c$	Add the percentage uncertainties $\epsilon a = \epsilon b + \epsilon c$
Dividing values $a = \frac{b}{c}$	Add the percentage uncertainties $\epsilon a = \epsilon b + \epsilon c$
Power rules $a = b^c$	Multiply the percentage uncertainty by the power $\epsilon a = c \times \epsilon b$

## 2 Particles and radiation

### 2.1 Constituents of the atom

Protons and neutrons in the centre, with shells of electrons around them

$$\text{Specific charge} = \frac{Q}{m}$$

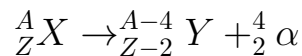
**Isotope** - An atom with the same number of protons and electrons as an element, but a different number of neutrons

### 2.2 Stable and unstable nuclei

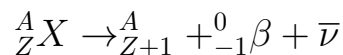
#### 2.2.1 The strong nuclear force

$< 0.5fm$	Repulsion
$0.5 - 3fm$	Attraction
$3fm+$	No force

#### 2.2.2 Alpha decay



#### 2.2.3 Beta decay



Neutrinos were hypothesised to allow for energy to be conserved in the interaction

### 2.3 Particles, antiparticles and photons