Numbers cont'd..... The rules for Indices, if m and n are positive integers and a $\neq 0, b \neq 0$:

(a) $a^m \times a^n = a^{m+n}$ $\quad e.g.\ 10^2 \times 10^4 = 10^6$
(b) $a^m \div a^n = a^{m-n}$ $\quad e.g.\ 10^5 \div 10^2 = 10^3$
(c) $(a^m)^n = a^{mn}$ $\quad e.g.\ (10^3)^4 = 10^{12}$
(d) $a^m \times b^m = (ab)^m$ $\quad e.g.\ 5^3 \times 2^3 = 10^3$
(e) $a^m \div b^m = (\frac{a}{b})^m$ $\quad e.g.\ 10^3 \div 5^3 = 2^3$
(f) $a^0 = 1$ $\quad e.g.\ 10^0 = 1$
(g) $a^{-n} = \frac{1}{a^n}$ $\quad e.g.\ 10^{-4} = \frac{1}{10^4}$
(h) $a^{\frac{1}{n}} = \sqrt[n]{a}$ $\quad e.g.\ 27^{\frac{1}{3}} = \sqrt[3]{27} = 3$
(i) $a^{\frac{m}{n}} = \sqrt[n]{a^m}\ or\ \left(\sqrt[n]{a}\right)^m$ $\quad e.g.\ 27^{\frac{2}{3}} = \sqrt[3]{27^2} = \sqrt[3]{729} = 9$
or $\quad 27^{\frac{2}{3}} = (\sqrt[3]{27})^2 = 3^2 = 9$

The Standard Form of numbering is $A \times 10^n$, where n is an integer and $1 \leq A < 10$
Example:
(1) $200 \div 0.01 = 20000 = 2 \times 10^4$
(2) $(2 \times 10^3) \times (8 \times 10^5) = 16 \times 10^8 = 1.6 \times 10^9$
(3) $0.02 \div 5000 = 20 \times 10^{-3} \div 5 \times 10^3 = 4 \times 10^{-6}$

Common prefixes for very large numbers are:
Kilo (K) = 10^3, mega (M) = 10^6, giga (G) = 10^9, tera (T) = 10^{12}
And prefixes for very small number are :
milli (m) = 10^{-3}, micro (μ)= 10^{-6}, nano(n) = 10^{-9}, pico (p) = 10^{-12}

Example :
(1) 5× 10^{11} Bytes (computer harddisk memory) = 500 GB memory
(2) 0.9× 10^{-8} m = 9×10^{-9} m = 9 nm

Try these questions :
(1) Simplify $\frac{32a^2}{7b^5} \times \frac{49a^3b^3}{2}$
(2) Simplify $\frac{10}{\sqrt{5}} \times \frac{2}{\sqrt{5}} - \frac{\sqrt{12}}{\sqrt{3}} + \sqrt[3]{9} \times \sqrt[6]{9}$
(3) Find the value of r, when
   (a) $100^3 \times 10^2 \div 10^r = 1$
   (b) $0.0001 \div 10^3 = \frac{1}{10^r}$
(4) The mass of electron is $9.1094 \times 10^{-31}\ Kg$.
   The mass of proton is $1.6726 \times\ 10^{-27} Kg$
   The mass of neutron is $1.6749 \times 10^{-27} Kg$
   (a) Find the difference between the mass of proton and neutron, giving your answer in standard form.
   (b) How many times more massive is the proton as compared to the electron ? Giving your answer in standard form.