Accuracy of Numbers:-

(1.) Approximate numbers:- There are two types of numbers exact & approximate. Exact no's are $2, 4, 9, 13, \frac{7}{2}, \ldots$. But there are no's such as $\frac{4}{3} (= 1.333\ldots)$, $\sqrt{2} = (1.414213, \ldots)$ & $\pi = (= 3.141592\ldots)$ which cannot be expressed by a finite no. of digits. These may be approximated by numbers 1.3333, 1.4142 & 3.1416 resp. Such no's which represent the given no's to a certain degree of accuracy are called approximate no's.

(2.) Significant figures:- The digits used to express a no. are called significant digits (figures).

e.g. 7845, 3.589, 0.4758 contains 4 significant figures. While 0.00386, 0.000587, 0.0000296 contains 3 significant figures.

Note:- The following statements describe the notion of significant digits:-

(1.) All non-zero digits are significant

(2.) All zero occuring blw non-zero digits are significant digits.

(3.) Zeros blw decimal point & precedily a non-zero digit are not significant

(4). Trailing zeros following a decimal point are significant

e.g. 3.50, 65.01, 0.230 → have 3 significant digits.

(5) When the decimal point is not written, trailing zeros are not considered to be significant

e.g 4500 has 2 significant digits.

(3.) Rounding off:-

Rules to round off a no. to n significant figures:-

(1.) Discard all digits to the right of the nth digit

(2.) If the discarded no. is

(a.) less than half a unit in the nth place, leave the nth digit unchanged.

(b.) greater than half a unit in the nth place, increase the nth digit by unity.

(c.) exactly half a unit in the nth place, increase the nth digit by unity if it is odd otherwise leave it unchanged.

Ex:- 7.893 rounded off to 3 significant figures → 7.89

6.4356 to 6.44

Ex:- Round off 37.897456 to 5 sig. figure
Discard all digits to the right of 5th place
ie 456. Assume that the discarded no. is
0.456 < 0.5 & hence leaving the 5th place
unchanged ie 37.897

Ex:- Round off 3.567 to 3 sign. figure
Discard 7 ie discarded no. is 0.7 > 0.5
& hence add 1 to the 3rd place
ie 3.567 changed to 3.57

Q. Find the percentage error if $625.4\overset{83}{\cancel{80}}$ is approximated to three significant figures

Soln:- $x = 625.4\overset{83}{\cancel{80}}$, $x' = 625$.

$$E_a = |x - x'| = 0.483$$

$$E_r = \frac{|x - x'|}{|x|} = \frac{0.483}{625.483} = 0.000772$$

$$E_p = 100\, E_r = 0.077$$