Physics Chapter 1
Assignment 1.1
Estimate that how many floating point operations can a super computer do in 1 day?
Solution:
It takes 1×10^{-15} seconds for a supercomputer to complete one floating-point operation.
Number of Seconds in One Day:
24×60×60 = 86,400 seconds/day
Total Floating-Point Operations in One Day:
Time per operation: 1×10^{-15} seconds
Number of operations per second = $1/1\times10^{-15} = 1\times10^{15}$ operations/second.
Total operations in one day = $1\times10^{15} \times 86{,}400$
$= 8.64\times10^{19}$ operations/day.

Exercise short questions

1.

Quantity	Estimate Description	Estimate Value
Length	Height of an average human	1.75 meters
Mass	Mass of an average adult human	70 kilograms
Time	Time for a typical heartbeat	1 second

3.

Using an instrument with the smallest resolution is important because it:

- **Increases Precision**: Measures small differences more accurately.
- **Reduces Uncertainty**: Minimizes measurement errors.
- **Enhances Sensitivity**: Detects smaller changes in the quantity measured.
- **Improves Accuracy**: Provides more reliable data.

This ensures more accurate and dependable measurements.

4.

Increasing the number of readings improves accuracy and reliability by reducing errors and providing a clearer, more consistent result.

6.

The principle of homogeneity of dimensions states that in a physical equation, all terms must have the same dimensions on both sides of equation. This ensures that the equation is dimensionally consistent and valid. For example, in an equation for force, all terms should have dimensions of force (ML/T^2).

7.

Given:
6.2s, 6.0s, 6.4s, 6.1s, 5.8s
Uncertainty:

Mean Time:
Mean = (6.2 + 6.0 + 6.4 + 6.1 + 5.8) / 5 = 30.5 / 5 = 6.1 s
Deviation:

6.2 - 6.1 = 0.1
6.0 - 6.1 = -0.1
6.4 - 6.1 = 0.3
6.1 - 6.1 = 0.0
5.8 - 6.1 = -0.3

Average Deviation:
Average Deviation = (|0.1| + |-0.1| + |0.3| + |0.0| + |-0.3|) / 5
= (0.1 + 0.1 + 0.3 + 0.0 + 0.3) / 5
= 0.8 / 5 = 0.16 s
Result: 6.1 s ± 0.16 s

8.

In the equation E=hf:

E is the energy.
h is Planck's constant.
f is the frequency.

To find the dimension of h, we need the dimensions of E and f.

Dimension of Energy (E):
$[E]=ML^2T^{-2}$ (E=W=F.d=ma.d)
Dimension of Frequency (f):
$[f]=T^{-1}$ (f = 1 / T)

Substituting the dimensions:
[h] = [E] / [f]
$[h] = [ML^2T^{-2}] / T^{-1}$
$[h] = [ML^2T^{-1}]$