$>$ Speed $=[$ Distance $/$ Time $]$, Time $=[$ Distance $/$ Speed $]$, Distance $=\left(\right.$ Speed ${ }^{*}$ Time $)$
$>X \mathrm{~km} / \mathrm{hr}=\left[\mathrm{x}^{*} 5 / 18\right] \mathrm{m} / \mathrm{sec}$.
> If the ratio of the speeds of A and B is a : b , then the ratio of the times taken by them to cover $\quad$ the same distance is $1 / a: 1 / b$ or $b: a$.
$>X \mathrm{~m} / \mathrm{sec}=\left[\mathrm{x}^{*} 18 / 5\right] \mathrm{km} / \mathrm{hr}$.
$>$ Suppose a man covers a certain distance at $\mathrm{xkm} / \mathrm{hr}$ and an equal distance at $\mathrm{y} \mathrm{km} / \mathrm{hr}$. then, the average speed during the whole journey is $[2 x y / x+y] k m / h r$.

## PROFIT AND LOSS - IMPORTANT FACTS AND FORMULAE:

$>$ Cost Price: The price, at which an article is purchased, is called its cost price, abbreviated as C.P.
$>$ Selling Price: The price, at which an article is purchased, is called its cost price, abbreviated as C.P.
> Profit or Gain: The price, at which an article is purchased, is called its cost price, abbreviated as C.P.

Loss: If S.P is less than C.P., the seller is said to have incurred a loss.
i. $\quad$ Gain $=(S . P)-.(C . P$.
ii. Loss or gain is always reckoned on C.P.
iii. Gain $\%=$ [Gain*100/C.P.]
iv. Loss = (C.P.) - (S.P.)
v. Loss $\%=[$ Loss*100/C.P.]
vi. S.P. $=(100+$ Gain $\%) / 100{ }^{*}$ C.P.
vii. S.P. $=(100-$ Loss $\%) / 100$ * C.P.
viii. C.P. $=100 /(100+$ Gain $\%)$ * S.P.
ix. C.P. $=100 /(100-$ Loss $\%) ~ * S . P$.
x. If an article is sold at a gain of say, $35 \%$, then S.P. $=135 \%$ of C.P.
xi. If an article is sold at a loss of say, $35 \%$, then S.P. $=65 \%$ of C.P.
I. CUBIOD

Let length $=\mathrm{I}$, breadth $=\mathrm{b}$ and height $=\mathrm{h}$ units. Then,

- Volume $=(\mathrm{I} \times \mathrm{b} \times \mathrm{h})$ cubic units.
- Surface area $=2(\mathrm{lb}+\mathrm{bh}+\mathrm{lh})$
II. CUBE

Let each edge of a cube be of length $a$. Then, 1 Volume $=a^{3}$ cubic units.

- Surface area $=6 a^{2}$ sq. units.
- $\quad$ Diagonal $=\sqrt{ } 3$ a units.
III. CYLINDER

Let radius of base $=r$ and Height $($ or length $)=h$ Then,

- Volume $=\left(\Pi r^{2} h\right)$ cubic units.
- Curved surface area $=(2 \Pi r h)$ sq. units.
- 3. Total surface area $=\left(2 \Pi r h+2 \Pi r^{2}\right.$ sq. units $)=2 \Pi r(h+r)$ sq. units.
IV. CONE

Let radius of base $=r$ and Height $=h$. Then,

- Slant height, $I=\sqrt{ } h^{2}+r^{2}$ units.
- Volume $=\left[1 / 3 \Pi r^{2} h\right]$ cubic units.
- Total surface area $=\left(\Pi r l+\Pi r^{2}\right)$ sq.units.


## V. SPHERE

Let the radius of the sphere be r . Then,

- Volume $=[4 / 3$ Пr3] cubic units.
- Surface area $=\left(4 \Pi r^{2}\right)$ sq. units.
VI. HEMISPHERE

Let the radius of a hemisphere be r . Then,

- Volume $=[2 / 3 ~ П r 3]$ cubic units.
- Curved surface area $=\left(3 \Pi r^{2}\right)$ sq. units.
- Total surface area $=\left(3 \prod r^{2}\right)$ sq. units.
- 1 litre $=1000 \mathrm{~cm}^{3}$.


## BOATS AND STREAMS -IMPORTANT FACTS AND FORMULAE:

I. In water, the direction along the stream is called downstream. And, the direction against the stream is called upstream.
II. If the speed of a boat in still water is $u \mathrm{~km} / \mathrm{ht}$ and the speed of the stream is $v \mathrm{~km} / \mathrm{hr}$, then:

- Speed downstream $=(u+v) k m / h r$
- Speed upstream (u-v) km/hr.
III. If the speed downstream is a km/hr and the speed upstream is $b \mathrm{~km} / \mathrm{hr}$, then:
- Speed in strill water $=1 / 2(a+b) k m / h r$
- Rate of stream $=1 / 2(a-b) k m / h r$


## BANKERS DISCOUNT -> IMPORTANT FORMULAE:

I. B.D. = S.I. on bill for unexpired time
II. B.G. $=($ B.D. $)-($ T.D. $)=$ S.I. on T.D. $=(\text { T.D. })^{2} /$ R.W.
III. T.D. $=\sqrt{ }$ P.W. * B.G.
IV. B.D. $=[$ Amount * Rate $*$ Time $/$ 100]
V. T.D. $=[$ Amount * Rate * Time / $100+($ Rate * Time $)]$
VI. Amount = [B.D. * T.D. / B.D. - T.D.]
VII. T.D. $=$ [B.G. * $100 /$ Rate * Time]

CLOCKS - IMPORTANT FORMULAE:
The face or dial of a watch is a circle whose circumference is divided into 60 equal parts, called minute spaces.

A clock has two hands; the smaller one is called the hour hand or short hand while the larger one is
called the minute hand or long hand.
I. In 60 minutes, the minute hand gains 55 minutes on the hour hand.
II. In every hour, both the hands coincide once.
III. The hands are in the same straight line when they are coincident or opposite to each other.
IV. When the two hands are at right angles, they are 15 minute spaces apart.

V . When the hands are in opposite directions, they are 30 minute spaces apart.
VI. Angle traced by hour hand in $12 \mathrm{hrs}=360^{\circ}$.
VII. Angle traced by minute hand in $60 \mathrm{~min} .=360^{\circ}$.

Too fast and too slow: If a watch or a clock indicates 8.15 , when the correct time is 8 , it is said to be 15 minutes too fast.

On the other hand, if it indicates 7.45 , when the correct time is 8 , it is said to be 15 minutes too slow.

## PROBLEMS ON TRAINS -> IMPORTANT FORMULAE:

1. $\mathrm{a} \mathrm{km} / \mathrm{hr}=[\mathrm{a}$ * $5 / 18] \mathrm{m} / \mathrm{s}$.
2. $\mathrm{a} \mathrm{m} / \mathrm{s}=[\mathrm{a}$ * 18/5] km$/ \mathrm{hr}$.
3. Time taken by a train of length I meters to pass a pole or a standing man or a signal post is equal to the time taken by the train to cover I meters.
4. Time taken by a train of length I meters to pass a stationary object of length b meters is the time
taken by the train to cover $(\mathrm{l}+\mathrm{b})$ meters.
5. Suppose two trains or two bodies are moving in the same direction at $u \mathrm{~m} / \mathrm{s}$ and $\mathrm{v} \mathrm{m} / \mathrm{s}$, where $u>v$, then their relatives speed $=(u-v) \mathrm{m} / \mathrm{s}$.
6. Suppose two trains or two bodies are moving in opposite directions at $u \mathrm{~m} / \mathrm{s}$ and $\mathrm{v} \mathrm{m} / \mathrm{s}$, then their relative speed is $=(u+v) \mathrm{m} / \mathrm{s}$
7. If two trains of length a meters and $b$ meters are moving in opposite directions at $u$

If two trains of length a meters and $b$ meters are moving in the same direction at $u \mathrm{~m} / \mathrm{s}$ and $\mathrm{v} \mathrm{m} / \mathrm{s}$, then the time taken by the faster train to cross the slower train $=(a+b) /(u-v)$ sec.
9. If tow trains (or bodies) start at the same time from points $A$ and $B$ towards each other and after crossing they take $a$ and $b$ sec in reaching $B$ and $A$ respectively, then
$(A ’ s$ speed $):(B ' s$ speed $)=(\sqrt{ } b: \sqrt{ } a)$.

## SIMPLE INTEREST -> IMPORTANT FORMULAE:

1. Principal: The money borrowed or lent out for a certain period is called the principal of the sum.
2. Interest: Extra money paid for using other's money is called interest.
3. Simple Interest (S.I.): If the interest on a sum borrowed for a certain period is reckoned uniformly, then it is called simple interest.

Let Principal $=\mathrm{P}$, Rate $=\mathrm{R} \%$ per annum (p.a.) and Time $=\mathrm{T}$ years, Then,
(i) S.I. $=[P * R * T / 100]$
(ii) $\mathrm{P}=[100$ * S.I. / R *T]
$R=[100$ * S.I / P * T] and T = [100 * S.I. / P * R]

## PROBLEMS ON NUMBERS -DESCRIPTION:

In this section, questions involving a set of numbers are put in the form of a puzzle. You have to analyze the given conditions, assume the unknown the numbers and form equations accordingly, which on solving yield the unknown numbers.

## AVERAGE - IMPORTANT FACTS AND FORMULAE:

I. Average = [Sum of observations / Number of observations]
II. Suppose a man covers a certain distance at $x$ kmph and an equal distance at $y \mathrm{kmph}$. Then, the average speed during the whole journey is $[2 x y / x+y] k m p h$.

Numbers -> IMPORTANT FACTS AND FORMULAE:

Natural Numbers:

Counting numbers $1,2,3,4,5 \ldots$ are called natural numbers.
I. Whole Numbers:

All counting numbers together with zero form the set of whole numbers. Thus, I. 0 is the only whole
number which is not a natural number.
II. Every natural number is a whole number.
III. III. Some Important Formulae :

- $(1+2+3+\ldots . .+n)=n(n+1) / 2$
- $(12+22+32+\ldots .+n 2)=n(n+1)(2 n+1) / 6$
- $(13+23+33+\ldots . .+n 3)=n 2(n+1) 2 / 4$


## SURDS ADN INDICES -> IMPORTANT FACTS AND FORMULAE:

1. LAWS OF INDICES:
(i) $a m$ * $a n=a m+n$
(ii) $a m / a n=a m-n$
(iii) $(a m) n=a m n$
(iv) (ab) $\mathrm{n}=\mathrm{anbn}$
(v) $(a / b) n=a n / b n$
(vi) $\mathrm{a} 0=1$
2. SURDS : Let a be rational number and $n$ be a positive integer such that $a(1 / n)=n \sqrt{ } a$

LAWS OF SURDS :
i. $\quad n \sqrt{ } a=a(1 / n)$
ii. $\quad \mathrm{n} \sqrt{ } \mathrm{ab}=\mathrm{n} \sqrt{ } \mathrm{a} \times \mathrm{n} \sqrt{ } \mathrm{b}$
iii. $\quad n \sqrt{ } a / b=n \sqrt{ } a / n \sqrt{ } b$
iv. $\quad(\mathrm{n} \sqrt{ } \mathrm{a}) \mathrm{n}=\mathrm{a}$

