[PHYSICS]

[A Review]

[The following review is on the topics discussed on the unit Motion from book “Science 10” by Nelson Ltd.]

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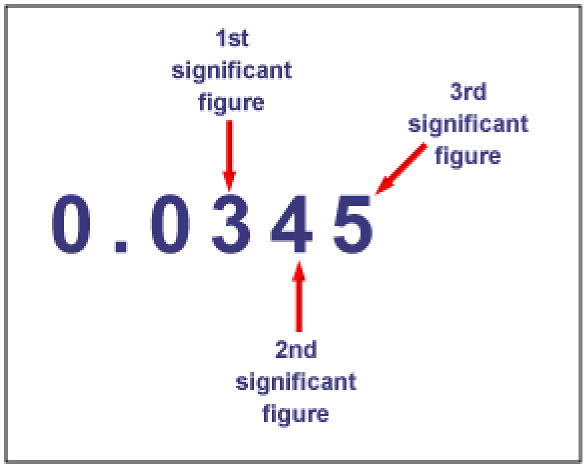
Measurements and Calculations

Significant Figures:-

The certainty of an amount, whether it is mass, distance or time, can be measured by the number of Significant Figures (Sig Figs). Significant Figures allow us to evaluate how precise a measurement is and the greater the number of Sig Figs, the greater the certainty of the measurement.



In order to figure out how many Sig Figs there are, these rules must be followed:

- Zeroes placed before other digits are not significant; 0.046 has two significant digits.
- Zeroes placed between other digits are always significant; 4009 kg has four significant digits.
- Zeroes placed after other digits but behind a decimal point are significant; 7.90 has three significant digits.
- Zeroes at the end of a number are significant only if they are behind a decimal point.

Examples:- 5.870 = 4 Sig Figs   0.0079 = 2 Sig Figs   5.0 = 2 Sig Figs

Addition & Subtraction:

Rule : When quantities are being added or subtracted, the number of *decimal places* (not significant digits) in the answer should be the same as the least number of decimal places in any of the numbers being added or subtracted.

Examples:- 5.67 J (two decimal places)   1.1 J (one decimal place)
0.9378 m (four decimal place)   7.7 J (one decimal place)

Subtraction & Division

Rule : In a calculation involving multiplication and division, the number of significant digits in an answer should equal the least number of significant digits in any one of the numbers being multiplied, divided etc.

Example:- 1.2 kg {2 Sig Fig} $\times$ 2.000 {4 Sig Fig} = 2.4 kg {2 Sig Fig}

Solving Equations:-

Solving an equation means to simply the equation and isolate a specified variable in that equation. When rearranging and isolating a variable, you must keep the equation equal by performing the same operation on both sides of the equation such as multiplying or dividing both sides of the equation by the same value or variable.

Examples:- **Solve for b**

Defining the equation: $A = \frac{1}{2} bh$

Multiply by 2: $2A = bh$

Divide by h: $\frac{2A}{h} = b$

Rewrite: $b = \frac{2A}{h}$

Solve for x

Defining the equation: 12a + 6 = 6x – 9

Add 6 on both sides: 12a + 6 + 9 = 6x

Simplify: 12a + 15 = 6x

Divide by 6: $\frac{12a}{6} + \frac{15}{6} = x$

Simplify: $2a + \frac{15}{6} = x$

Rewrite: $x = 2a + \frac{15}{6}$

Distance and Speed

Scalar Quantity: **A quantity that involves magnitude but no direction.**

Vector Quantity: **A quantity that involves magnitude and direction.**

Average Speed

If a car is travelling and we know the distance travelled along with the time it took, we can find a scalar quantity known as Average Speed. Average Speed tells us how much a car travels in a given amount of time and it can be calculated in many units.

The formula

The formula for average speed is:

$v_{av} = \frac{\Delta d}{\Delta t}$, where v_{av} is read as average speed

Δd is the distance travelled

Δt is the elapsed time

This formula tells us that the average speed is the change in distance divided by change in time.

Manipulation and Examples

Nawaz skates to school, a total distance of 4.5 km. He has to slow down to cross streets but the overall journey takes about .62 h. What is his average speed during this trip?

Given $\Delta d = 4.5$ km

$\Delta t = .62$ hours

Required V_{av}

Analysis $V_{av} = \frac{\Delta d}{\Delta t}$

Solution $V_{av} = \frac{\Delta d}{\Delta t}$

$V_{av} = \frac{4.5km}{.62km}$

$V_{av} = 7.3\ {km}/{h}$

Statement Therefore, Nawaz's average speed is $7.3\ {km}/{h}$.

Janna has a summer job helping with bison research. She notes that they graze at an average speed of about 110m/h for about 7 h/d. What distance in kilometers, will the herd travel in two weeks (14d)?

Given $V_{av} = 110m/h$

$\Delta t = 7\frac{h}{d} \times 14d = 98h$

Required Δd

Analysis $V_{av} = \frac{\Delta d}{\Delta t}$

$V_{av} \times \Delta t = \frac{\Delta d}{\cancel{\Delta t}} \times \cancel{\Delta t}$

$V_{av} \times \Delta t = \Delta d$

Solution $\Delta d = V_{av} \times \Delta t$

$\Delta d = 110\frac{m}{\cancel{h}} \times 98\cancel{h}$

$\Delta d = 11km$

Statement According to Janna's observations, after two weeks the bison will have covered a distance of about 11km.

Distance Time Graphs

Graphs are a really easy way to interpret a given data. When drawing a graph, make sure that:

1. the is a **title**
2. there are **units along the axis**
3. the scale on vertical and horizontal axis increase by **same factor.**
4. If there is more than one data plotted on the graph, make a **legend.**

The graph above can be represented by the equation:

y = mx + b

When interpreting Distance – Time graphs, the variables in y = mx + b can also represent s = d/t

y = distance

m = velocity

x = time

b = initial distance

In order to find out the velocity from a distance – time graph, we use the following formula to find the slope which is the average velocity:

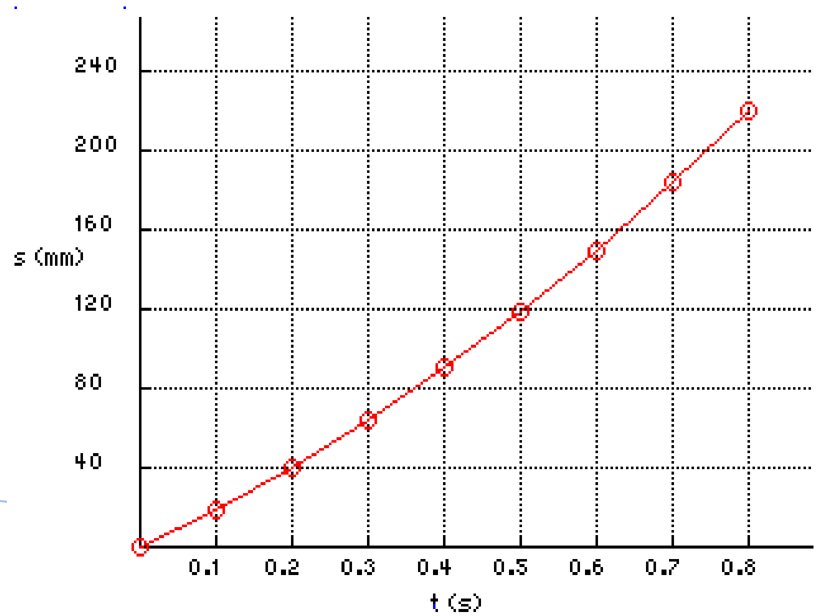
Slope: rise / run

Or

Slope: y2 –fc…….

Examples:

Find the slope of the graph:



Acceleration

Acceleration is the change in velocity over time. The formula is:

$$a_{av} = \frac{\Delta v}{\Delta t}$$

So from the formula, u can calculate the acceleration of the body. Suppose that a car speeds up from 0 m/s to 9m/s in 2.0 s. therefore your change in velocity is 9m/s the change in time is 2.0s. With this information given, you can calculate the average acceleration:

$\Delta v = 9.0 m/s$

$\Delta t = 2.0\ s$

$a_{av} = ?$

$a_{av} = \Delta v / \Delta t$

$$= \frac{9.0 m/s}{2.0 s}$$

$= 4.5 m/s^2$

A skier accelerates at an average 2.5m/s² for 1.5s. What is her change in velocity after 1.5s?

a_{av} **= 2.5 m/s²**

$\Delta t = 1.5 s$

$\Delta v = ?$

$$a_{av} = \frac{\Delta v}{\Delta t}$$

$\Delta v = a_{av} \times \Delta t$

$= 2.5\ m/s^2 \times 1.5\ s$

$= 3.8\ m/s$