Vision: Effective, efficient biology education and quality assessment for the future generations.

IMPROVING BIOLOGY TEACHING SKILLS || THE ICT CAMPAIGN - MAY 2023

FOREWORD

It has become extremely hard for all of us to keep abreast with the constantly evolving computer-based technology. This is especially the case with educators who are now, out of sheer necessity, required to stay a step ahead to preserve their relevance in their careers.

Nowadays teachers have to make use of desktop PCs, laptop PCs, and even mobile devices like tablets while carrying out their core duties. Also, these professionals must be knowledgeable of computer related technologies. This, of course, includes the World Wide Web, email, desktop conferencing, video conferencing to name but a few among other skills for resume. **As a skilled Educator, you will have to aim for uncommon excellence and proficiency in this computer oriented era**.

1. Word Processing Skills💻

Word processors are certainly some of the most ancient applications all modern computers now feature. As a teacher, you will have to be skillful in utilizing the best word processors, which are currently available in the market. This will let you undertake and ultimately complete all your written communications with both your colleagues and students in a markedly time efficient manner. You will have to learn just how to check spelling, create tables, and even insert hyperlinks into your word documents. All in all, you will need to be in an excellent position of creating lengthy and well-formatted documents.

2. Spreadsheet Skills 💻

An excellent mastery of spreadsheets applications is also among the top ones in 21st century skills list for educators. Such an invaluable software will let you conduct some of the most pertinent aspects of your teaching duties in a convenient and highly methodological way e.g. **Plotting, curve sketching and analysis of Biology data**. ☞ Some of the most notable of these duties are compiling grades for your students and even masterfully charting any critical data you might wish to pass to them.

3. Database Management Skills

As a teacher, you will have to learn just how you can use databases. This includes been able to create database tables, storing, and retrieving data from those tables. While also knowing just how you can create the right queries for the information found in your institute's databases.

4. Electronic Presentation Skills

☞ Electronic presentation applications are, in essence, part and parcel of an educator's various teaching duties.

As such, you will have to find a way to master the art of **creating electronic presentations for your classes: (power point presentations to save time of drawing on the chalk board and Imaging while teaching and assessment).** While more to the point, just how you can showcase them to your students and even colleagues and superiors.

5. Internet Navigation Skills 💻

As you might probably be aware the World Wide Web is a great repository of all manner of information, which can definitely make your life as a teacher much easier. ☞ Generally speaking, you will have to find a good way of been able to efficiently navigate the internet for the exact data or teaching resources you stand in need of. **E.g. Setting unique items set elsewhere in other curricular but similar scope with that of Uganda.**

To mention, Edexcel assessment, IGCSE-CIE assessment, WJEC/EDUQAS, JCQ assessment, SQA assessment include research articles, Journals etc. You will also have to be well conversant with the basics of advanced search, including the utilization of Boolean operators within your search engine queries.

6. Email Management Skills 📨

Email is now the most preferred means of written communication for most of us, in both our professional and personal lives. As an educator, you will have to be highly skilled in sending and receiving email messages and the various applications you need to utilize. You will also be required to be conversant with the variety of features and functionalities that these computer applications boast of. This includes mass mailing, link insertions, and even the utilization of email attachments in your communications with both your colleagues and students.

7. Networking Skills.

Teachers who wish to remain relevant in their given fields must also find the necessary time to fully grasp the basics of computer networking. If applicable, ☞ they should also try their level best to totally understand just how their institution's computer network functions and exactly how it can be of benefit to them

8. Touch Typing 💻

Finally, touch typing is yet another essential computer skill, which all 21st century educators must take time to master. ☞ **This particular skill lets you significantly improve typing speed as well as accuracy. Biologically art genes are modified to better ones.** This is brought about by simply relying on your motor reflexes as opposed to sight while typing.

✹By mastering touch typing, you will find it infinitely easier to draft highly detailed and accurate texts, plotting graphs, drawing objects in a quicker manner than you previously did. You will also learn how to integrate the right typing 'best practices' to prevent injuries and fatigue. This includes using the ideal typing posture and the right finger placement on your keyboard.

SYSTEMATIC PROCEDURE TO: PLOTTING BIOLOGY GRAPHS AUTOMATICALLY IN MICROSOFT OFFICE WORD.

PLOTTING DATA WITH TWO or THREE DEPENDENT VARIABLES AND ONE INDEPENDENT VARIABLE

SERIE 1: DATA REQUIRING ONE VERTICAL AXIS AND ONE HORIZONTAL AXIS.

❖ PART ONE: PLOTTING THE CRUDE GRAPH

Step 1:

- Open Microsoft office word blank document on your computer. Then type the data based question with value you intend to plot.

Question (I): *In an experiment to determine the effect of auxin treatment on the length of axillary shoot, the following procedures were carried out on five groups of pea seedlings as follows.*

A. Apical bud removed.

B. apical bud removed and auxin placed on cut stump.

C. apical bud removed and gibberellin acid placed on cut stump.

D. apical bud removed and cytokinin placed on cut stump.

E. plants left intact.

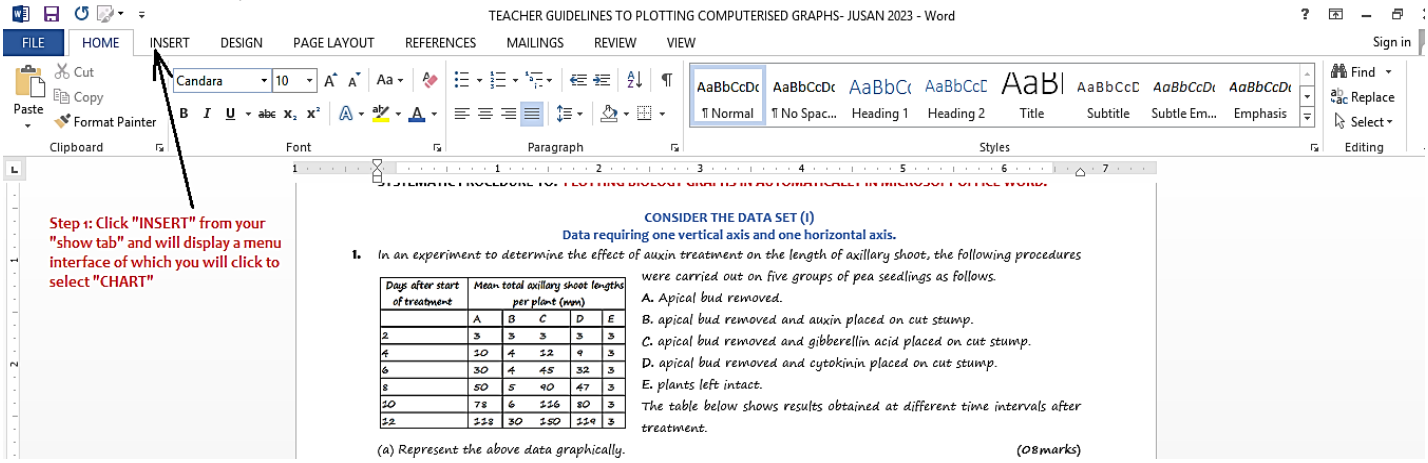
The table below shows results obtained at different time intervals after treatment.

(a) Represent the above data graphically. **(08marks)**

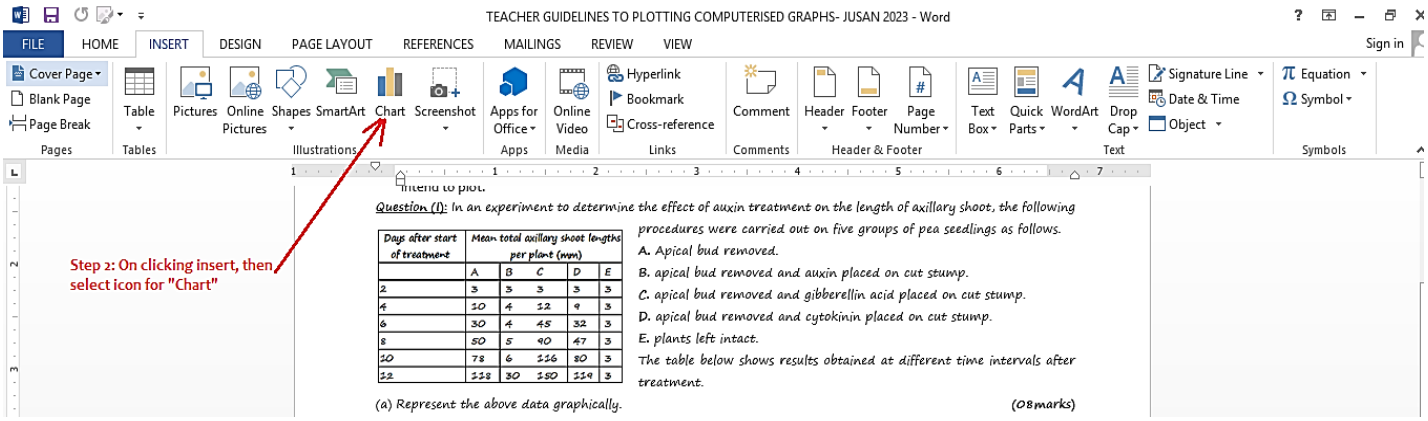
Days after start of treatment	Mean total axillary shoot lengths per plant (mm)				
	A	B	C	D	E
2	3	3	3	3	3
4	10	4	12	9	3
6	30	4	45	32	3
8	50	5	90	47	3
10	78	6	116	80	3
12	118	30	150	119	3

Step 2:

- Introduce the cursor/ pointer to where you want to plot the graph, preferably below the question in the same word document.
- Click "INSERT" on your 'show tabs', then click to select **"Chart"**

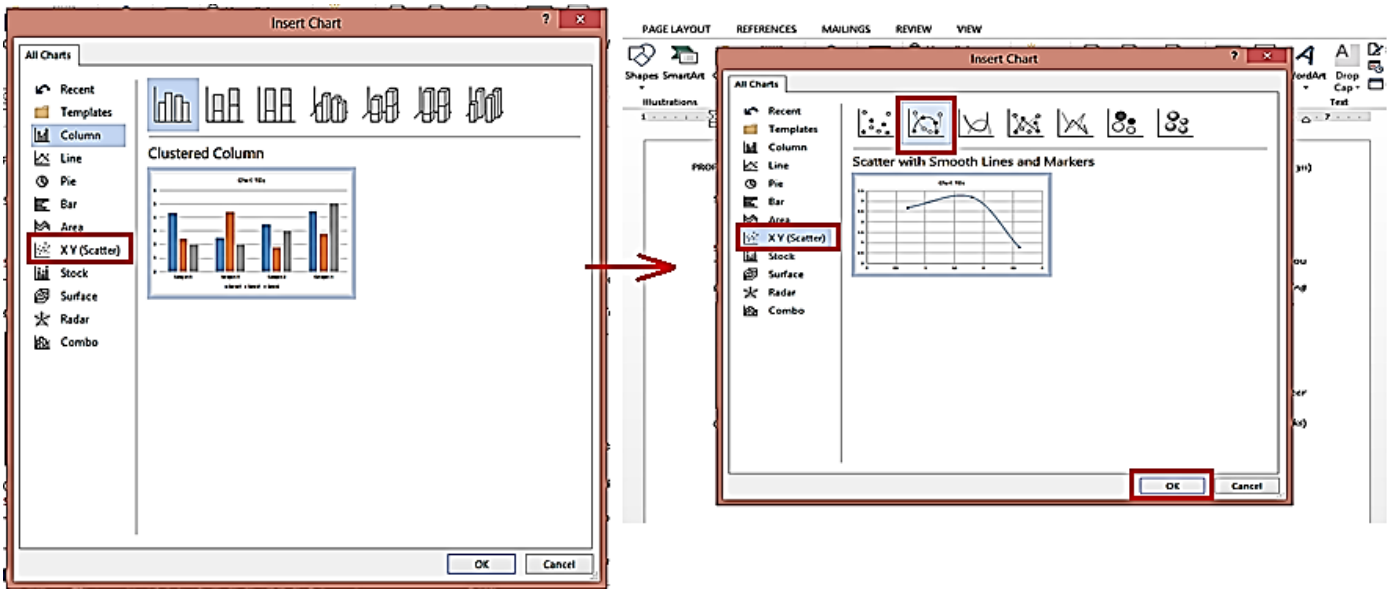


then click to select **"Chart"**



Step 3:

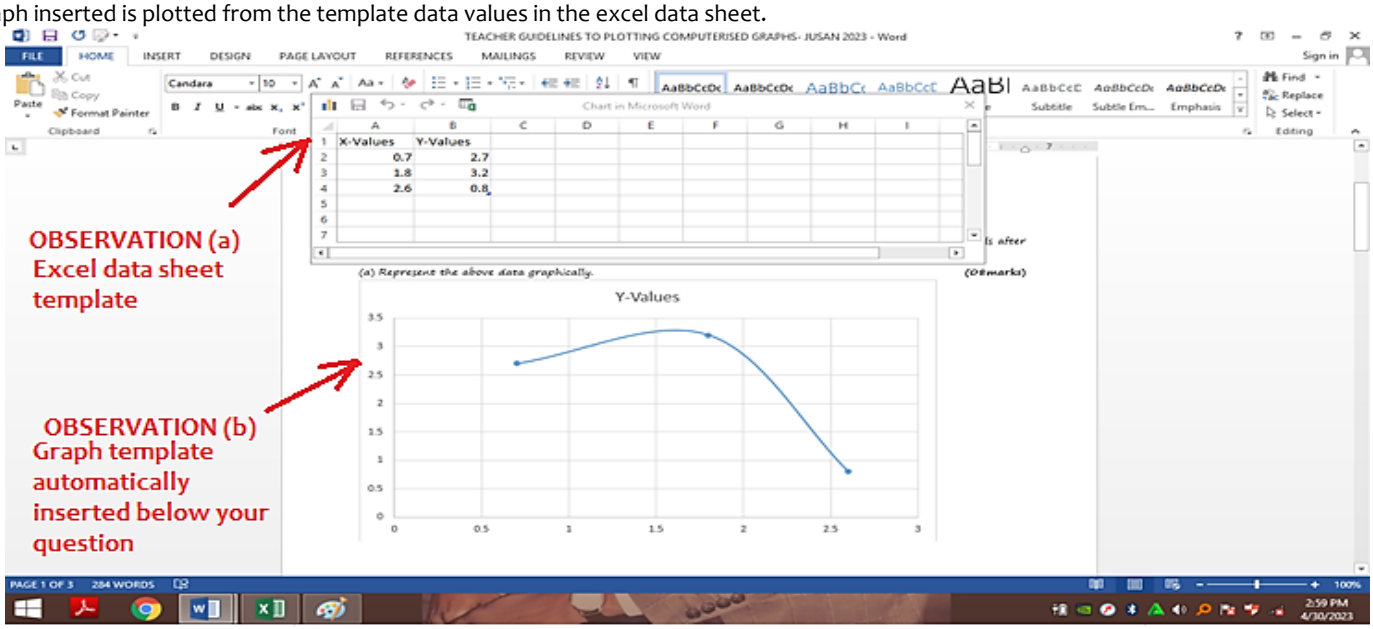
A menu bar **"ALL CHARTS"** is displayed. Proceed and SELECT by Clicking **"X Y (scatter).** Option of XY scatter will be displayed, SELECT "Scatter with smooth Lines and Markers", then Click OK as guided below.



INTERPRETATION OF OBSERVATIONS:

(a) An automated Mini Excel template date sheet immediately appears, with two columns for X and Y values; as templates.

(b) An automated plotted graph is inserted automatically in the Microsoft office word where you previously placed the cursor. The graph inserted is plotted from the template data values in the excel data sheet.

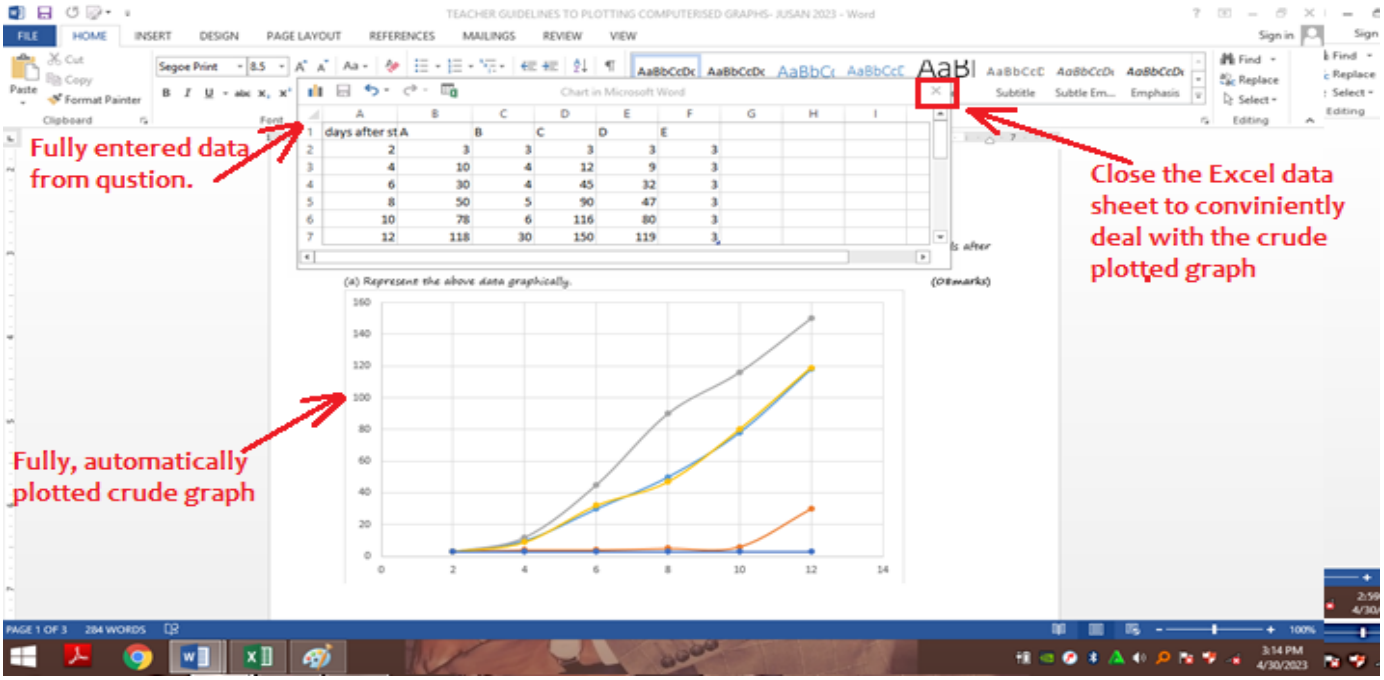


Step 4:

- Now deal with the excel date sheet template, by editing to insert your values in question.
- Change the heading of the columns/ variables instead of X and Y values. E.g.
  For X values: **Days after start of treatment**.
  For Y values: **Mean total lengths of A, B, C, D and E. these are obtained from question.**
- Continue entering the values. You notice that for each value entered, it is immediately and automatically plotted in the word document graph template.
- Once all values are entered, the graph too is fully plotted.

  NOTE:

  1. The plotted graph is a raw/ crude/ non-refined graph, hence needs refining/ purifying it.
  2. The data in the Excel is safely and automatically saved and kept in the Excel, and can't be lost as you processing the graph, even when we close the Excel data sheet.



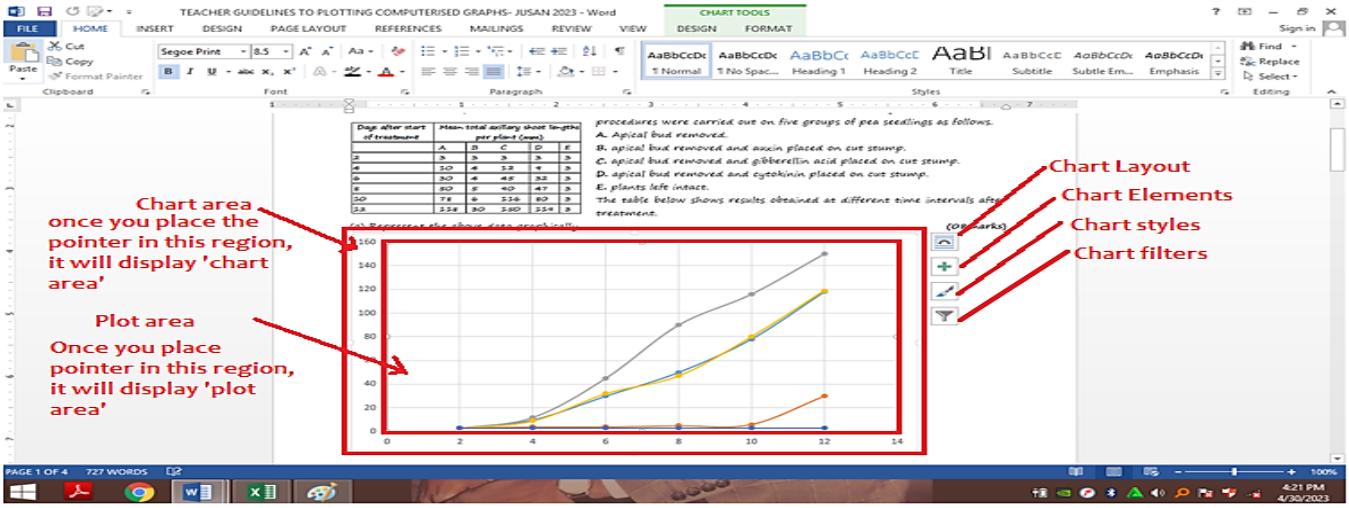
❖ PART TWO: REFINING/ PROCESSING THE CRUDE GRAPH

What features of the graph to be processed?

PROCESSING LEVEL 1: Labelling axes ‖ Inserting Title ‖ Inserting Grid lines ‖Inserting key ('Legend")
PROCESSING LEVEL 2: Tick marks ‖ change chart type ‖ Pattern fill ‖Markers
NB: We shall follow the above order to process the above plotted crude graph.

UNDERSTAND THE FOLLOWING BEFORE WE PROCEED TO REFINE THE GRAPH!

1. Chart area: includes charts to represent the data, includes all the title section, axis label sections, data values on the axes, key. It occupies the bigger space since the plot area is simply its sub set.
2. Plot area: includes only the graphical representation of the chart, includes the trend lines/ curves, markers, data labels, grid lines. It occupies less spaces since it is a subset of the chart area.
NB: you must always click in either the chart area or plot area, and specifically on the feature to be processed.
3. The major tools/ icons for processing the crude graph. They are Four but may vary depending on the windows being used. These are displayed on the Right top corner of the chart as soon as you click in either the chart area or plot area.
These four major icons according to order of vertical arrangement from top to bottom include;
Icon 1: "Lay out options", enables you to choose how your object interacts with the text.
Icon 2: "Chart Elements", enables you to add, remove, or change chart elements such as title, legend, gridlines, data labels. **NB: This is the most important icon during this stage of graph processing.**
Icon 3: "Chart styles", allows you to set a style, and color scheme for your chart.
Icon 4: "Chart filters", enables you to edit what data points and names are visible on your chart.

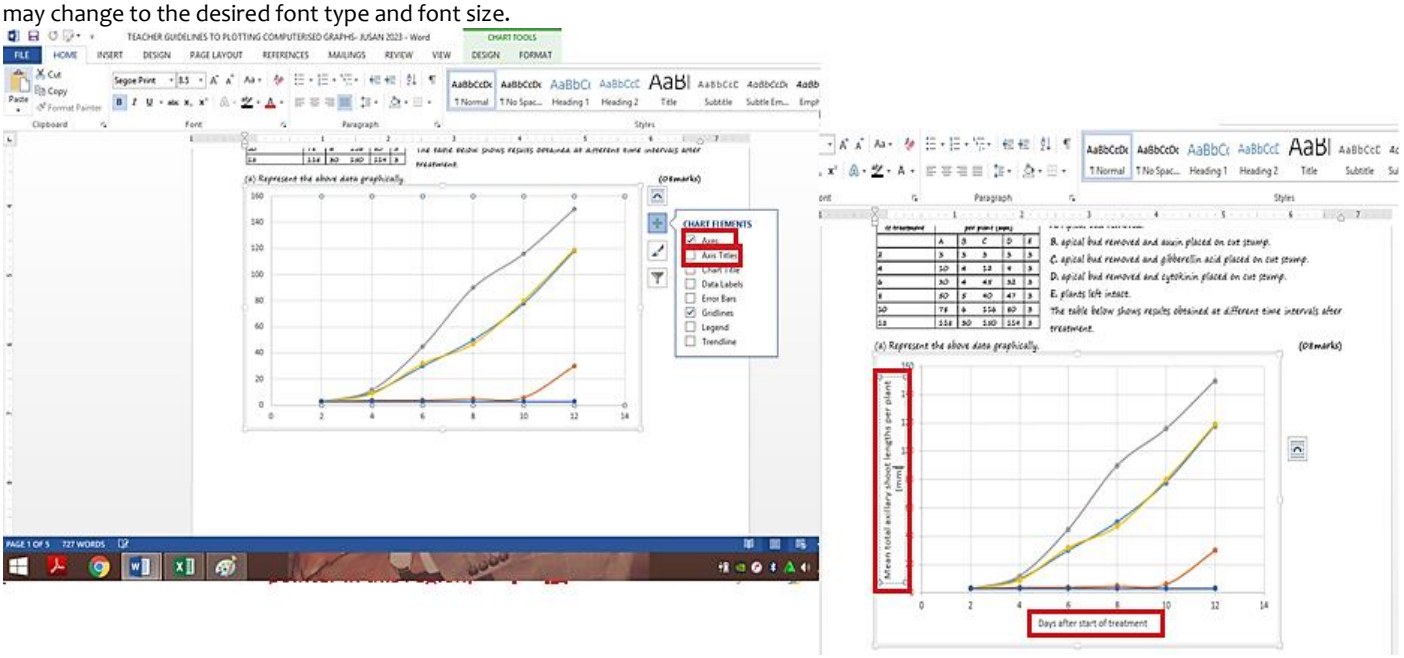


Step 1: Inserting Axes and Labeling.

Click "CHART ELEMENTS", Select

(1) <u>Axes</u>: Primary vertical axis and **Primary horizontal axis,** since the data has one dependent variable and one independent variable respectively to insert axes.

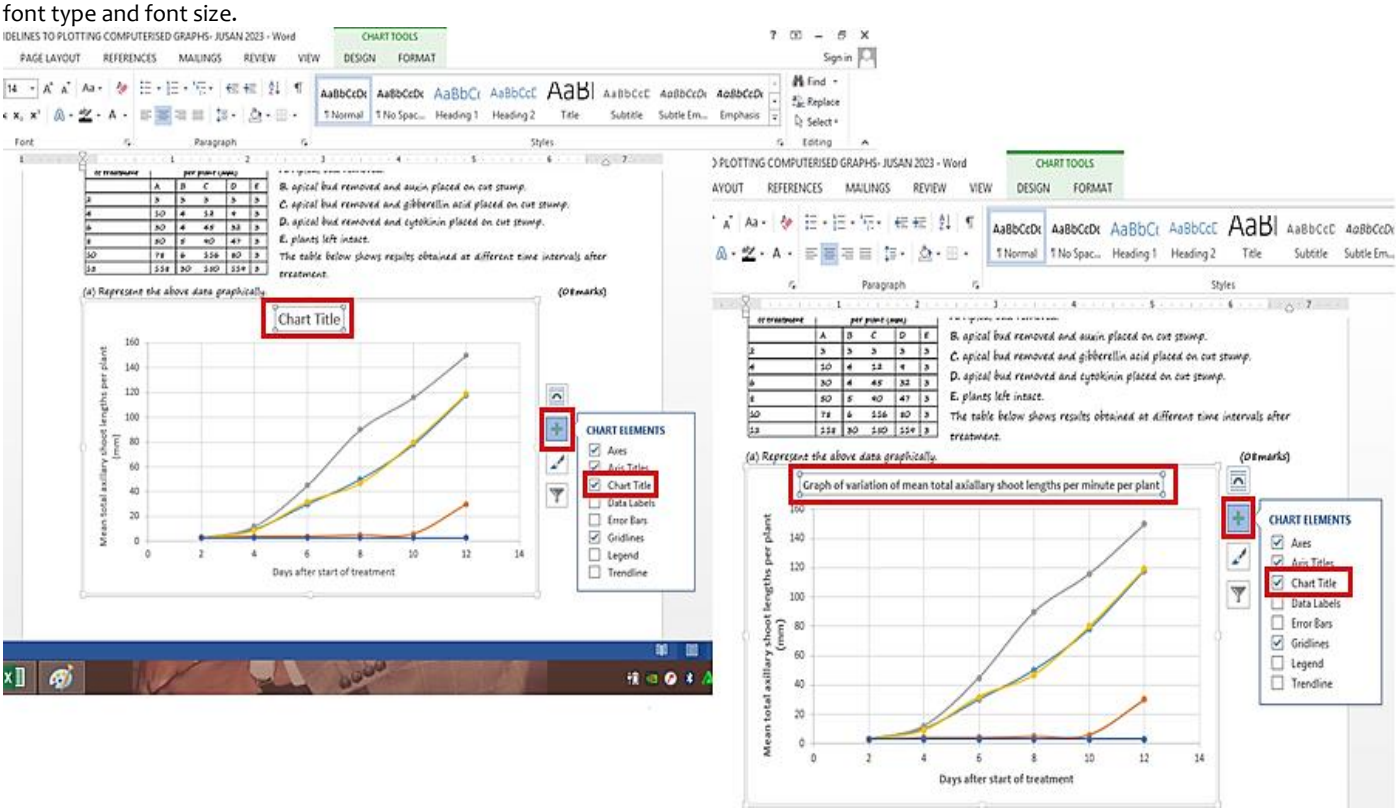
(2) <u>Axis titles</u>: Text boxes will be displayed on the respective axes, then type the actual dependent and independent variables. You may change to the desired font type and font size.



Step 2: Inserting Chart Title

Click "CHART ELEMENTS", Select

'<u>Chart title</u>': Text boxes will be displayed on the top of chart, then type the actual title of your graph. You may change to the desired font type and font size.

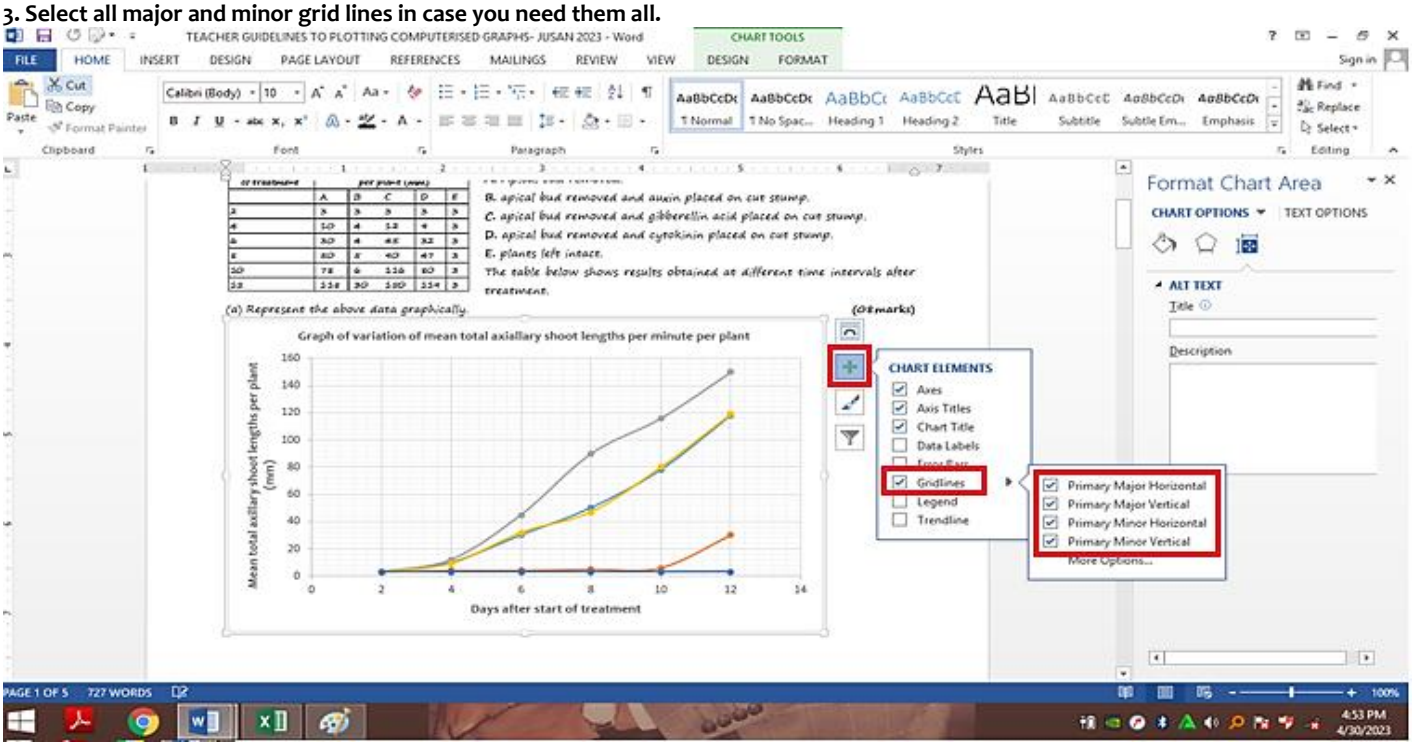


Step 3: Inserting Grid Lines

Click "CHART ELEMENTS", Select '<u>Grid Lines</u>';

1. If you don't want grid lines to appear on the graph, then don't select them.

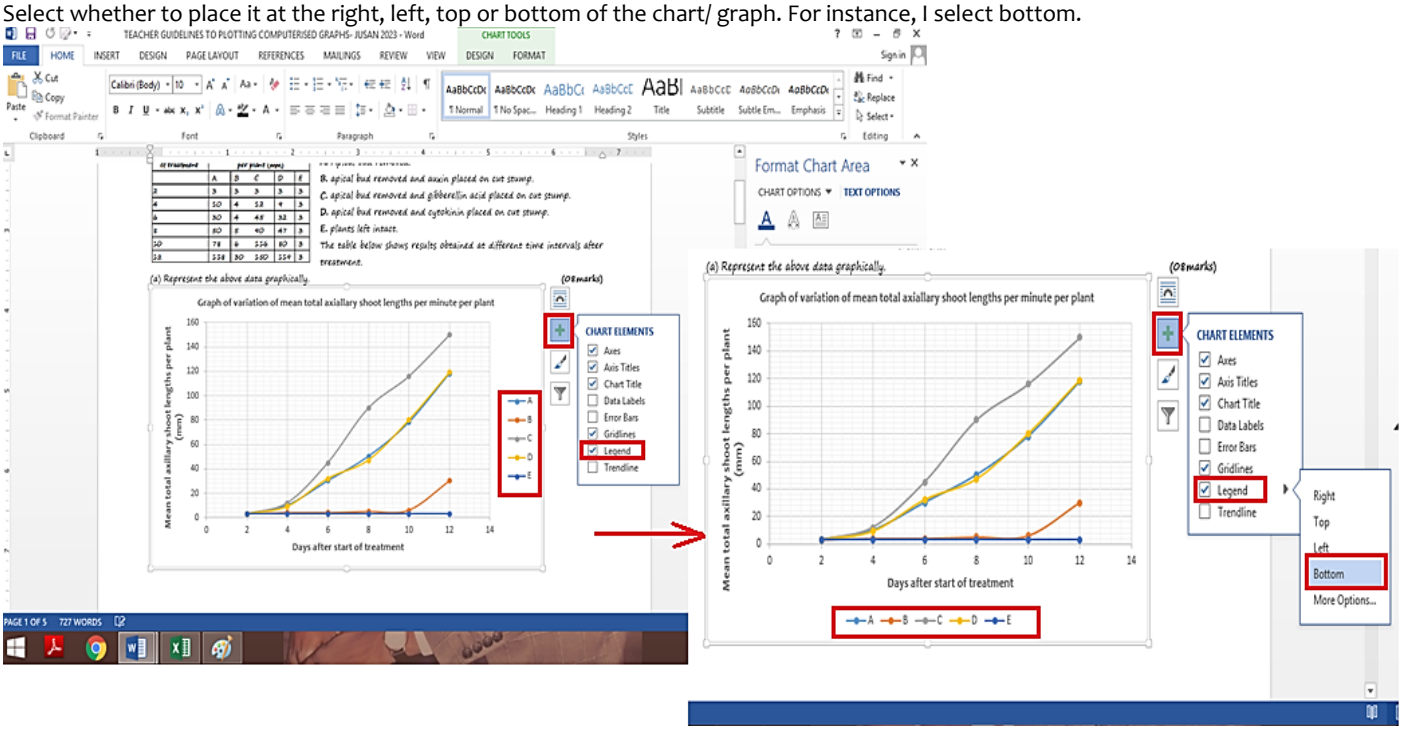
2. If you need grid lines in the background just to appear as a graph paper, then select.
3. Select all major and minor grid lines in case you need them all.



Step 4: Inserting the Key ("Legend"-Computer Language)

Click "CHART ELEMENTS", Select 'Grid Lines';

Select whether to place it at the right, left, top or bottom of the chart/ graph. For instance, I select bottom.



PROCESSING LEVEL 2:

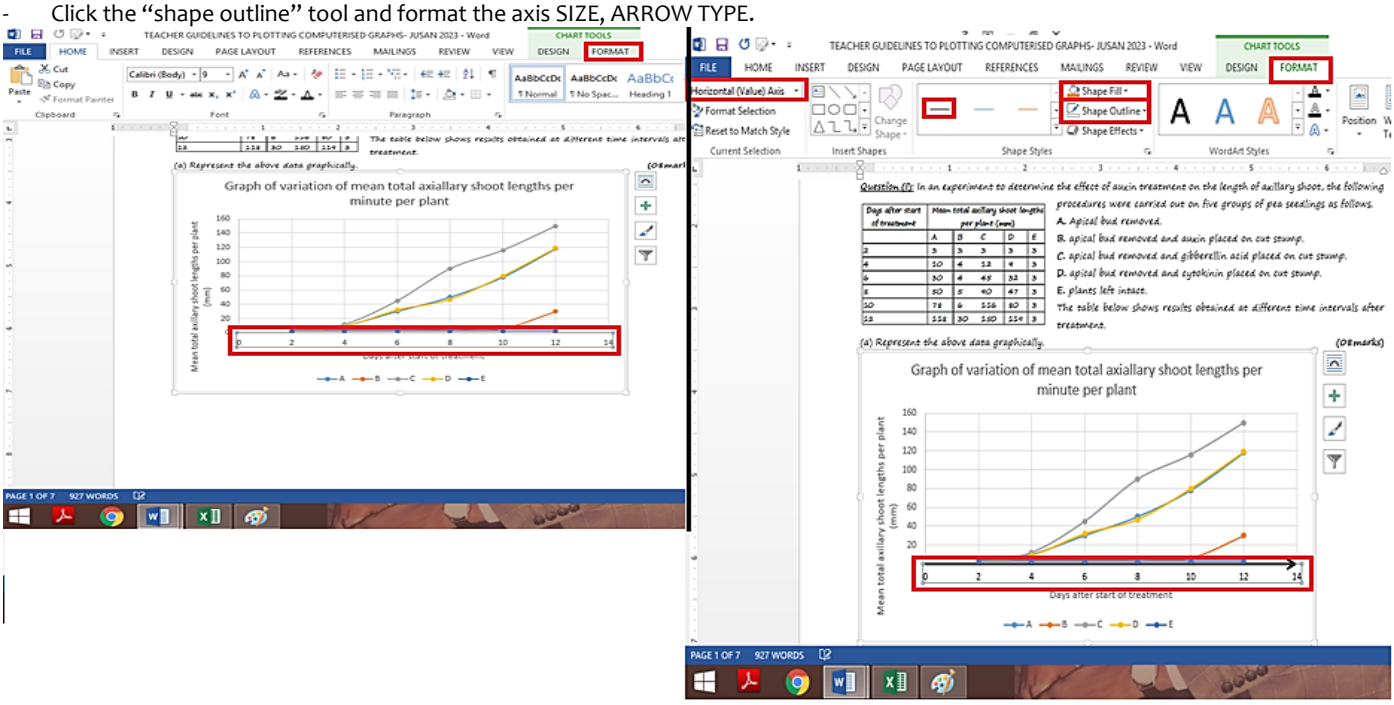
1. FINAL PROCESSING OF AXES. Formatting color ‖ Attaching arrows ‖Inserting tick marks

Procedure 1: Formatting color and attaching arrows.

Click chart section, specifically within the axis area, e.g. at the horizontal axis;
Click FORMAT up in the CHART TOOLS;
Formatting tools will be provided as below;

- Click the "shape fill" tool and select the color of the axis e.g. Black

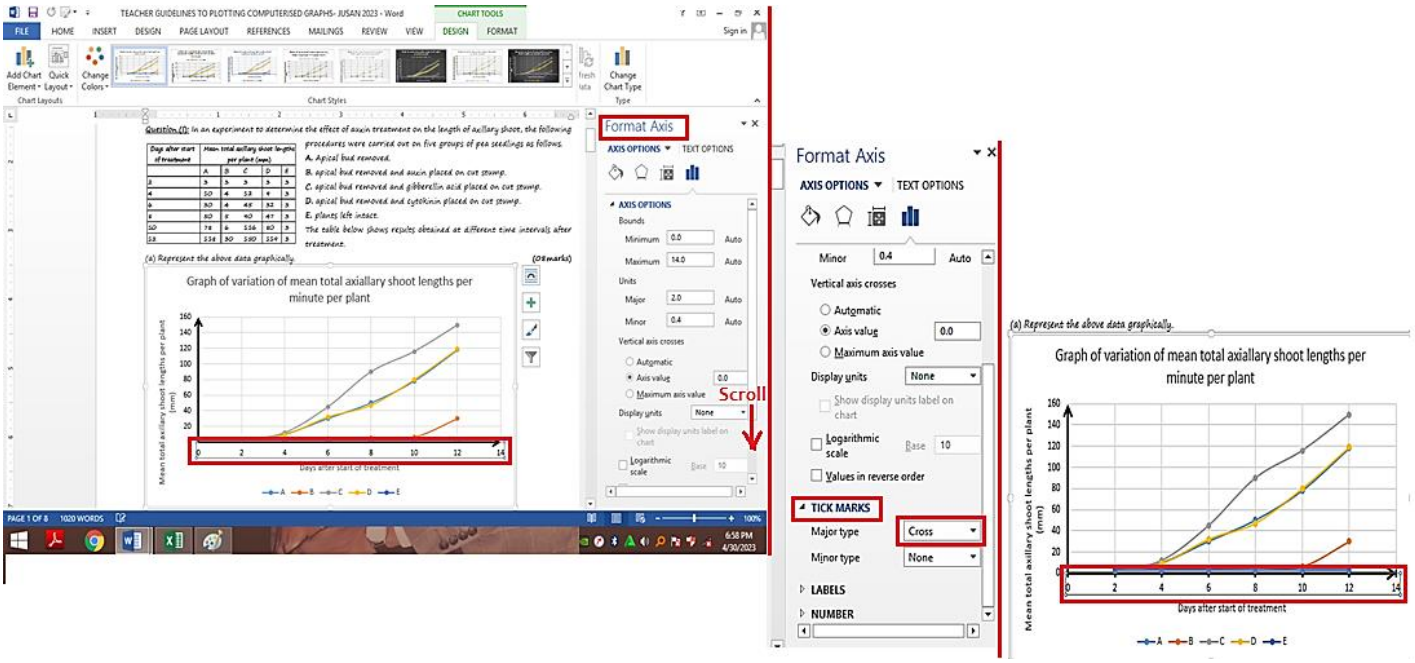
- Click the "shape outline" tool and format the axis SIZE, ARROW TYPE.



- Repeat the above procedure for the vertical axis too.

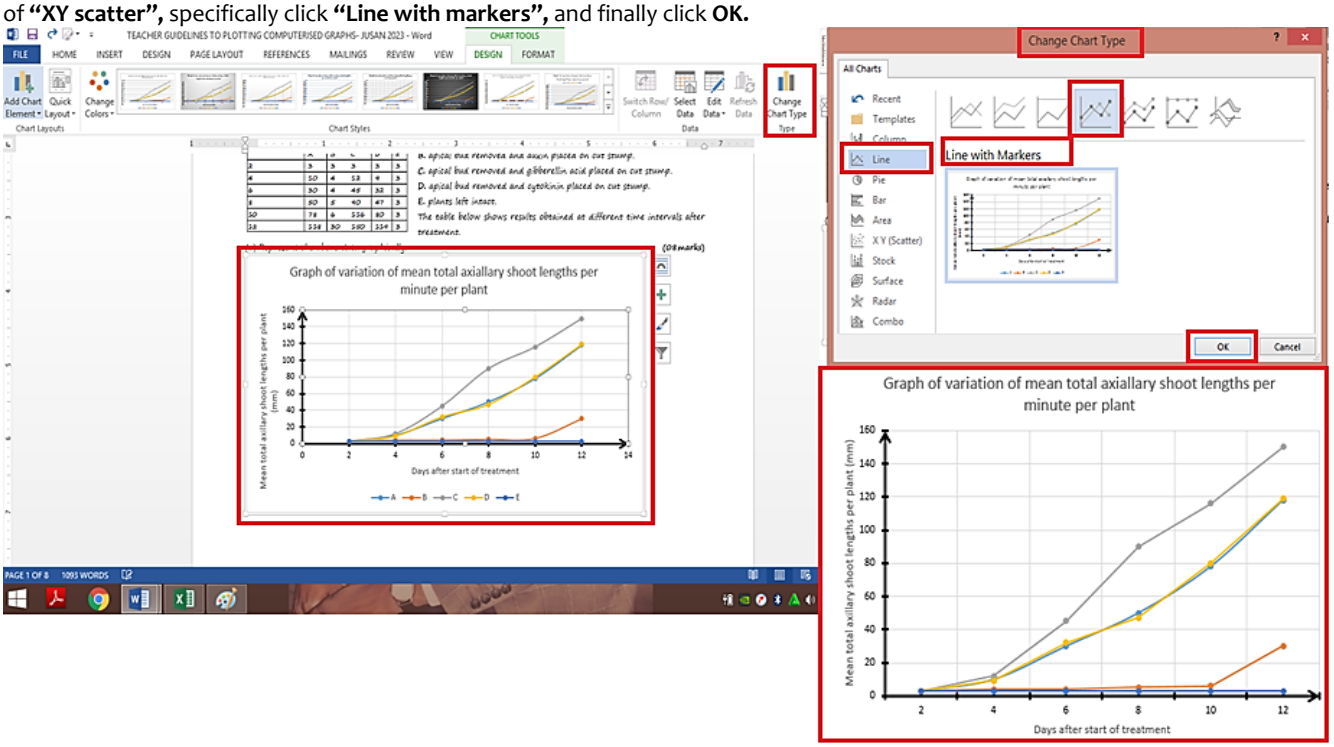
<u>Procedure 2</u>: Inserting TICK MARKS.

- Click on the horizontal axis; right click to a menu bar, select **"FORMAT AXIS"**
- **"FORMAT AXIS"** menu is displayed on the right of the chart; SCROLL to select **"TICK MARKS".**
- Choose a desirable orientation of the tick mark by clicking on it. They will automatically be inserted on the axis.
- Repeat step 3 above for the vertical axis, by clicking on vertical axis, to insert tick marks there to..



2. FINAL PROCESSING OF CHART TYPE.

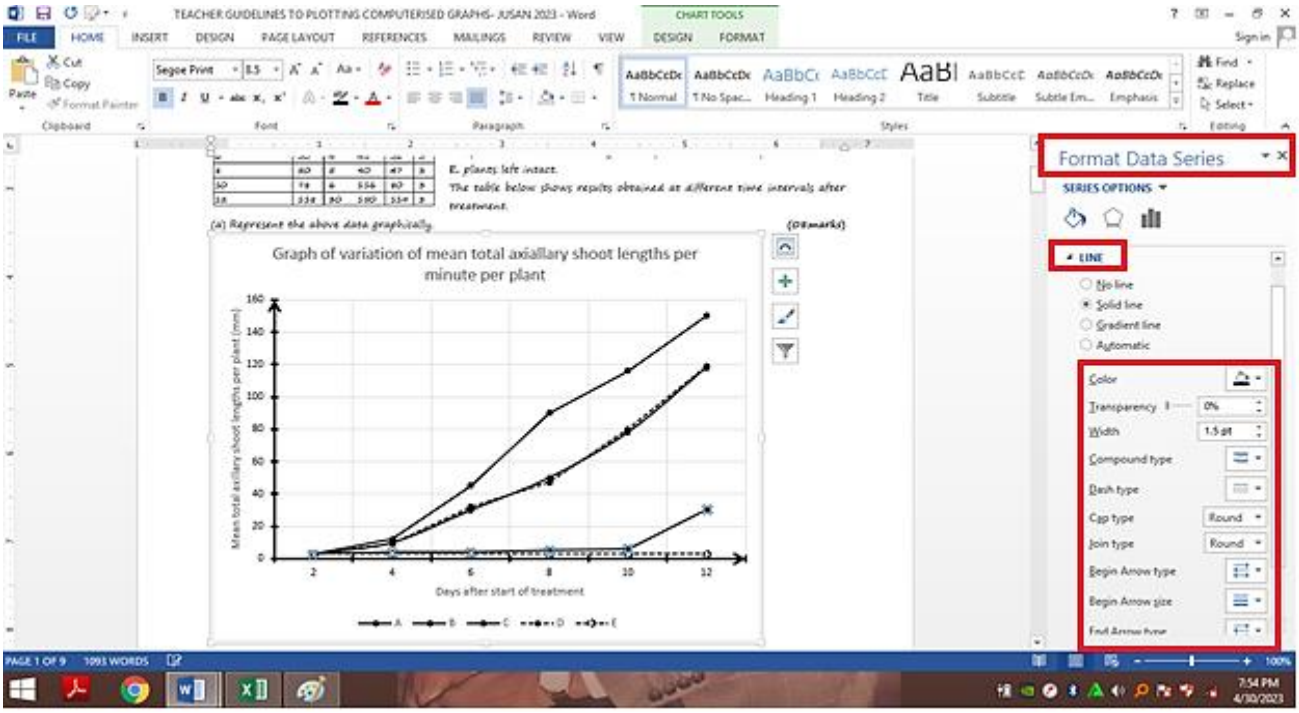
Click in the plot area, select **"Change Chart Type".** From the "Change chart type" menu bar, SELECT **"Line";** this time round instead of **"XY scatter",** specifically click **"Line with markers",** and finally click **OK.**

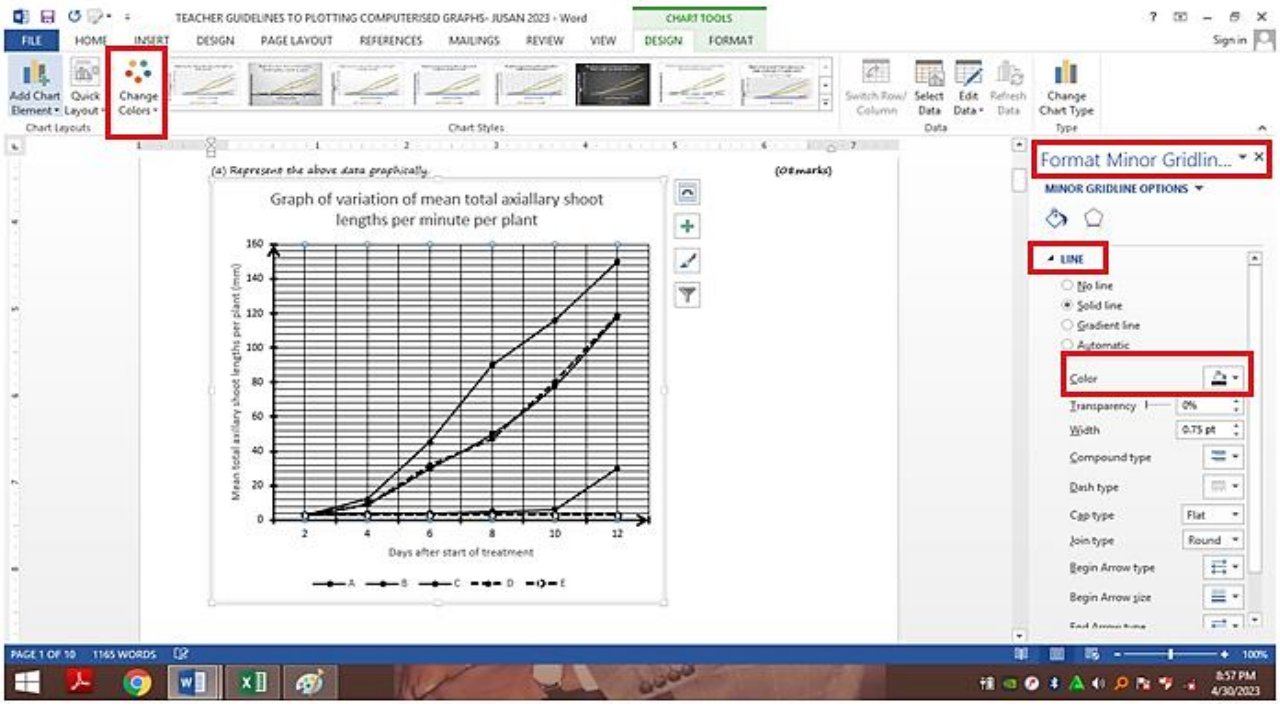


3. FINAL PROCESSING OF THE INTERPOLATING LINES AND GRID LINES AND MARKERS. (Colour, size, solid or broken) and color of grid lines.

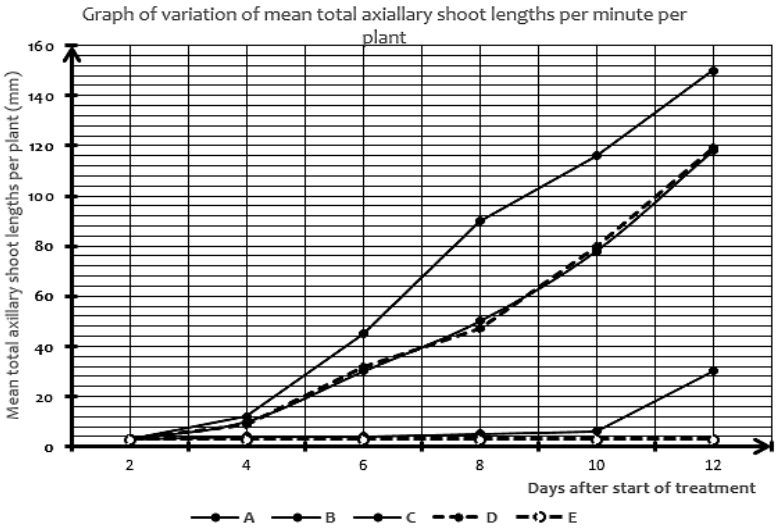
Procedure.

Left click on the line, or marker; then right to select "FORMAT DATA SERIES". A menu for "Format data series" is displayed on the right off the chart. Select colors of markers, grid lines (minor and major grid lines), interpolating lines, preferably to black.





At this stage the graph is fine for use as seen below.

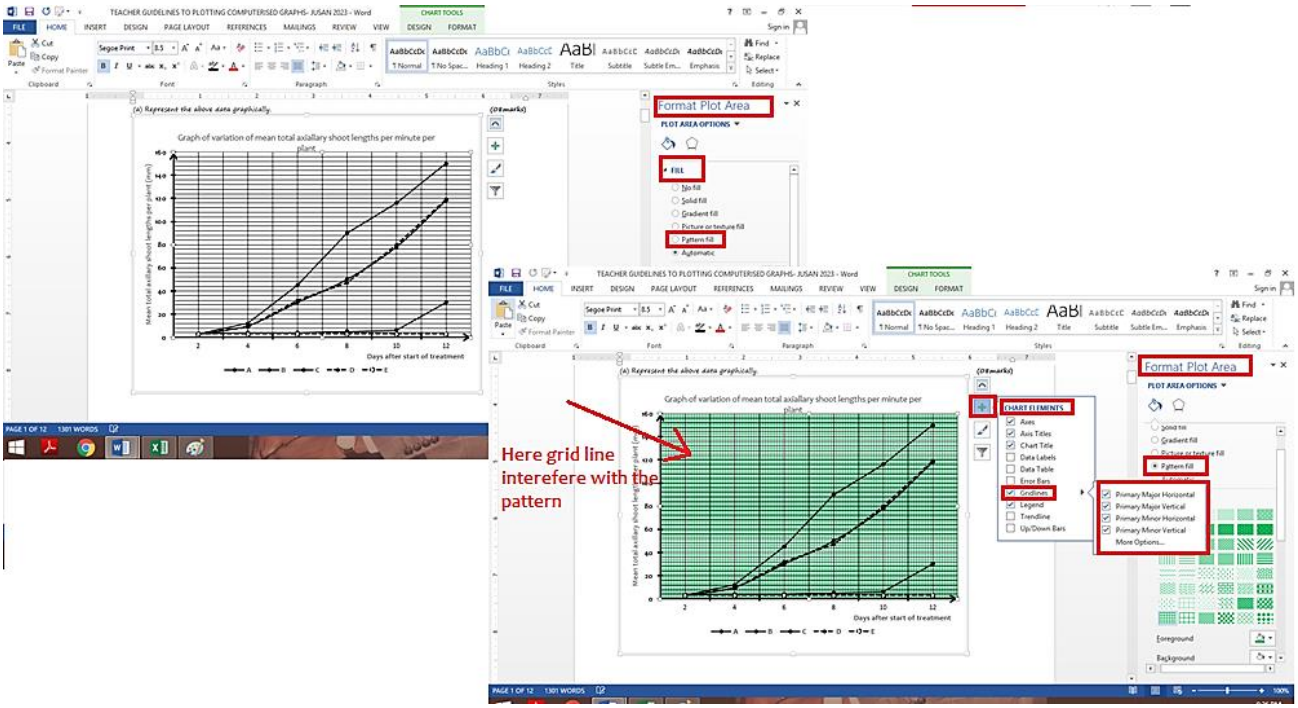


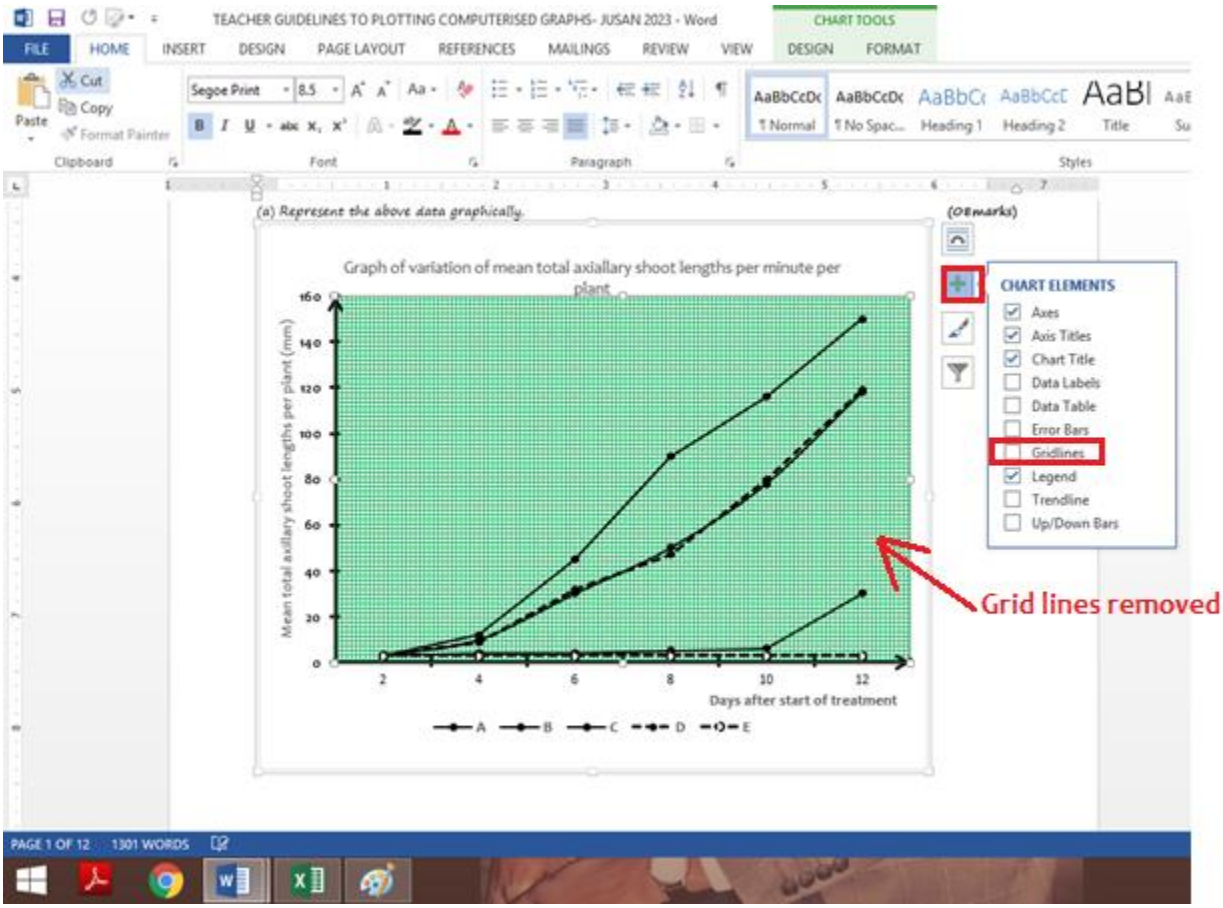
4. FINAL PROCESSING OF PLOT AREA. (Color and pattern fill)

Pattern filling is an advanced and fine/ ultimate processing of graphs in Microsoft word, to pattern fill you have to remove all grid lines, since patterns are in built.

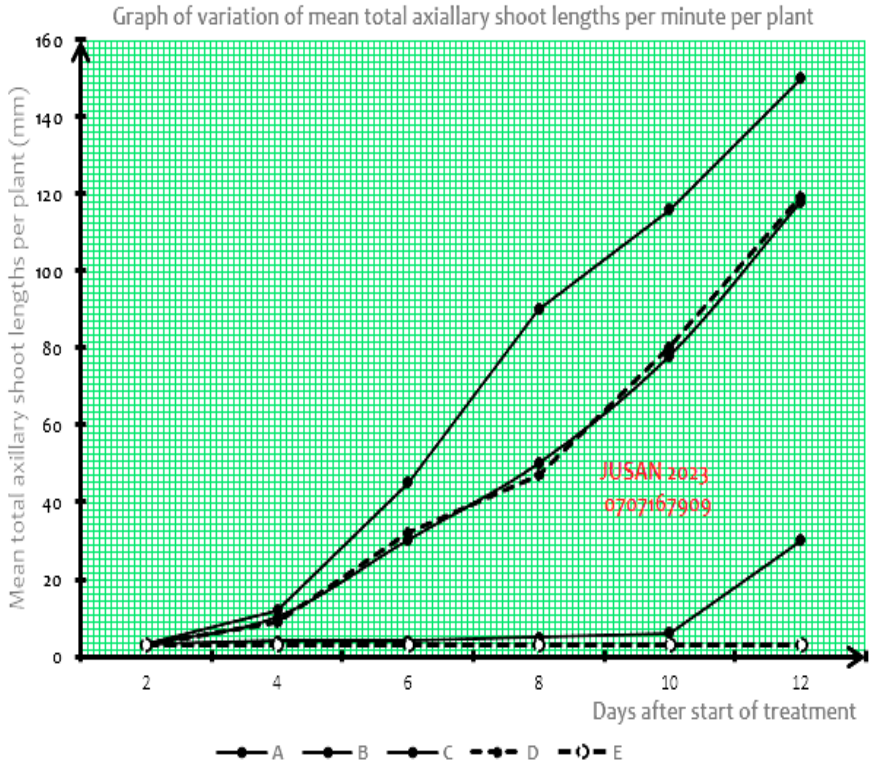
Procedure:

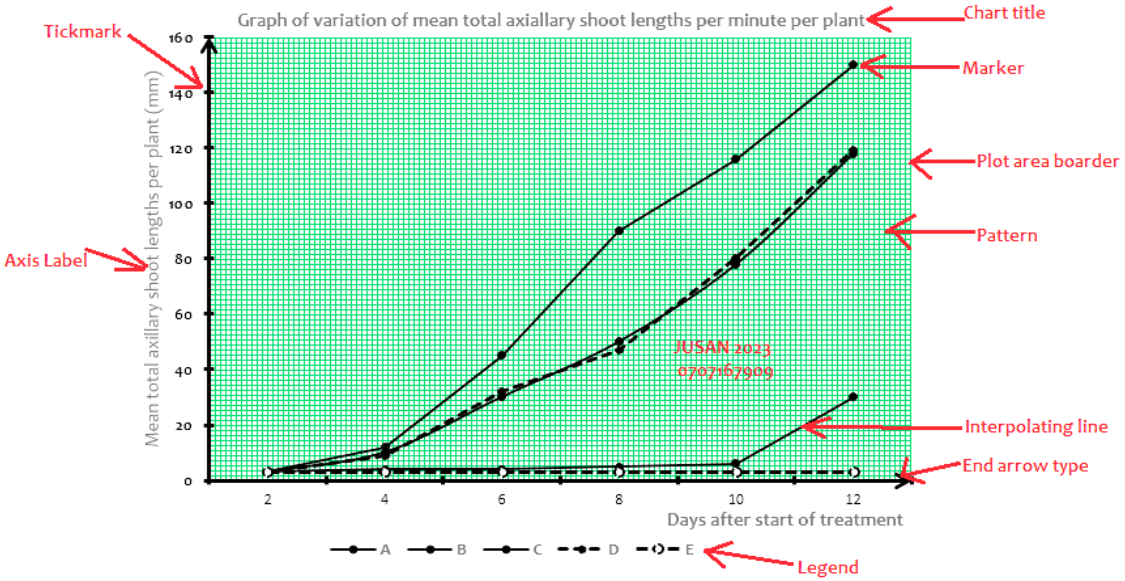
- Right click in the plot area, from the menu displayed select "**FORMAT PLOT AREA**", PLOT options are displayed, from which you select "**PATTERN FILL**",
- Selected the desired pattern preferably small grid lines and color, preferably green (for soft copy use), black is better for black and white printing.
- Proceed in the **Chart elements** and undo/ remove the automatic grid lines and maintain only the pattern inserted to avoid interference.





FINAL LOOK.





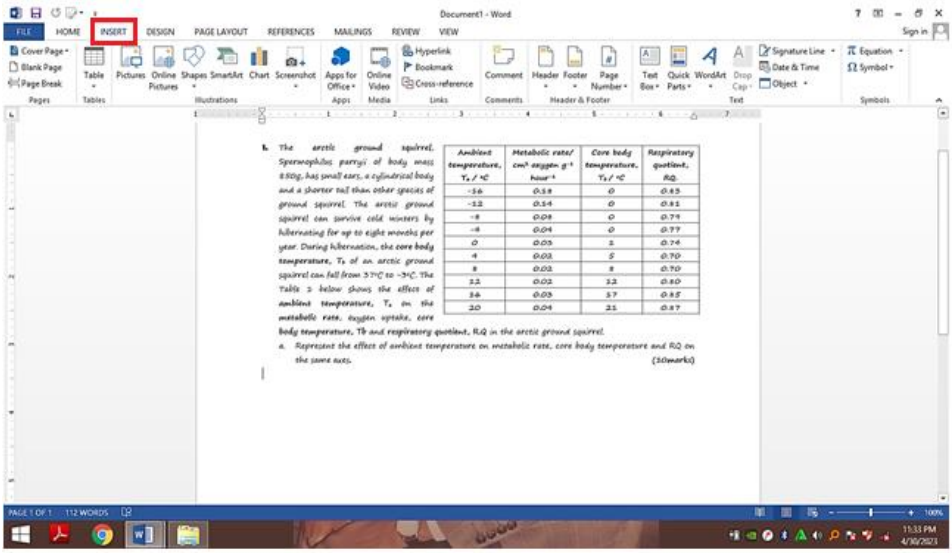
SERIE 2: DATA REQUIRING TWO VERTICAL AXES AND ONE HORIZONTAL AXIS. (1 VERTICAL PRIMARY AXIS, 1 VERTICAL SECONDARY AXES AND 1 HORIZONTAL PRIMARY AXIS)

Steps in this manuscript have been summarized, though ably followed by any colleague who has fully and keenly followed the first series of plotting graphs with one vertical and one horizontal axis.

Consider data in question below.

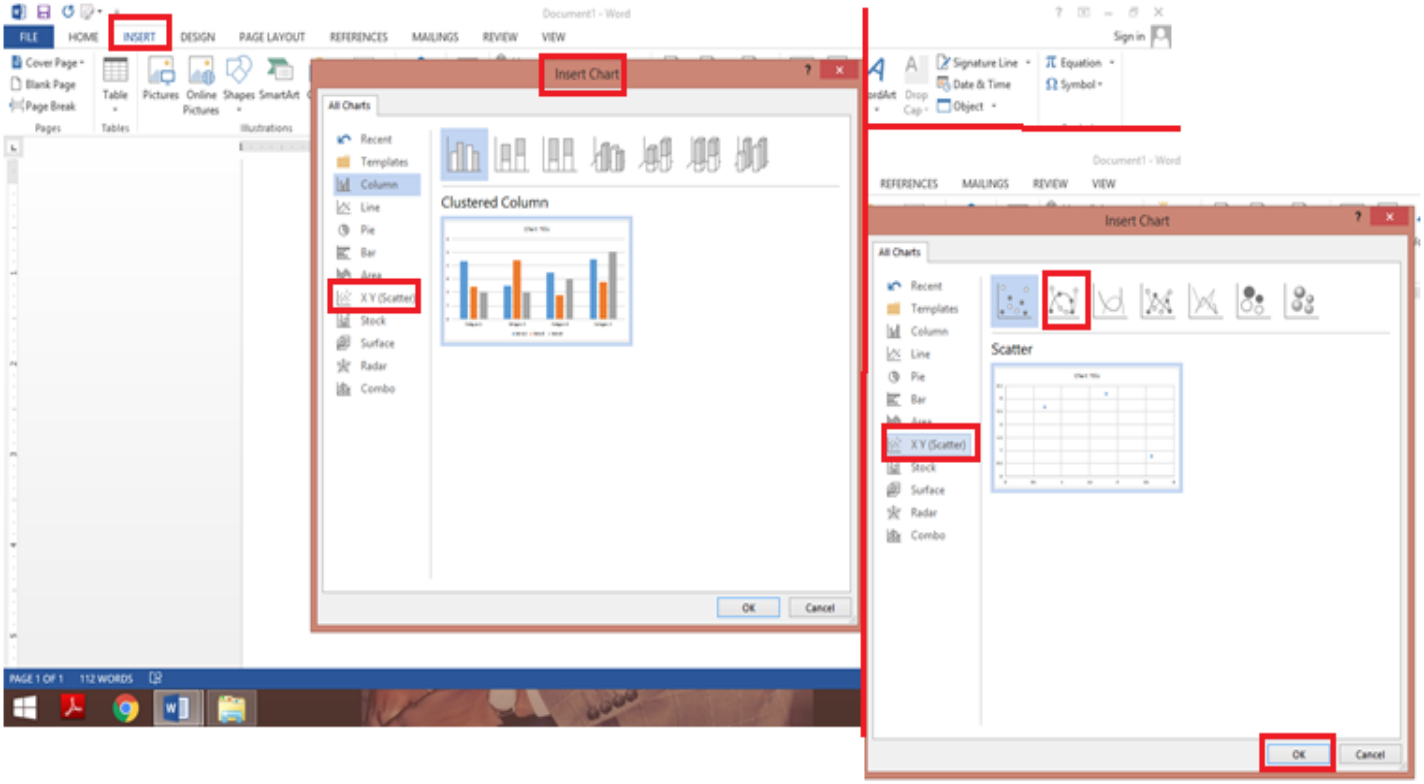
1. *The **arctic ground squirrel**, Spermophilus parryii of body mass 850g, has small ears, a cylindrical body and a shorter tail than other species of ground squirrel. The arctic ground squirrel can survive cold winters by hibernating for up to eight months per year. During hibernation, the **core body temperature,** T_b of an arctic ground squirrel can fall from 37°C to -3°C. The Table 1 below shows the effect of **ambient temperature,** T_a on the **metabolic rate,** oxygen uptake, **core body temperature, Tb** and **respiratory quotient, R.Q** in the arctic ground squirrel.*

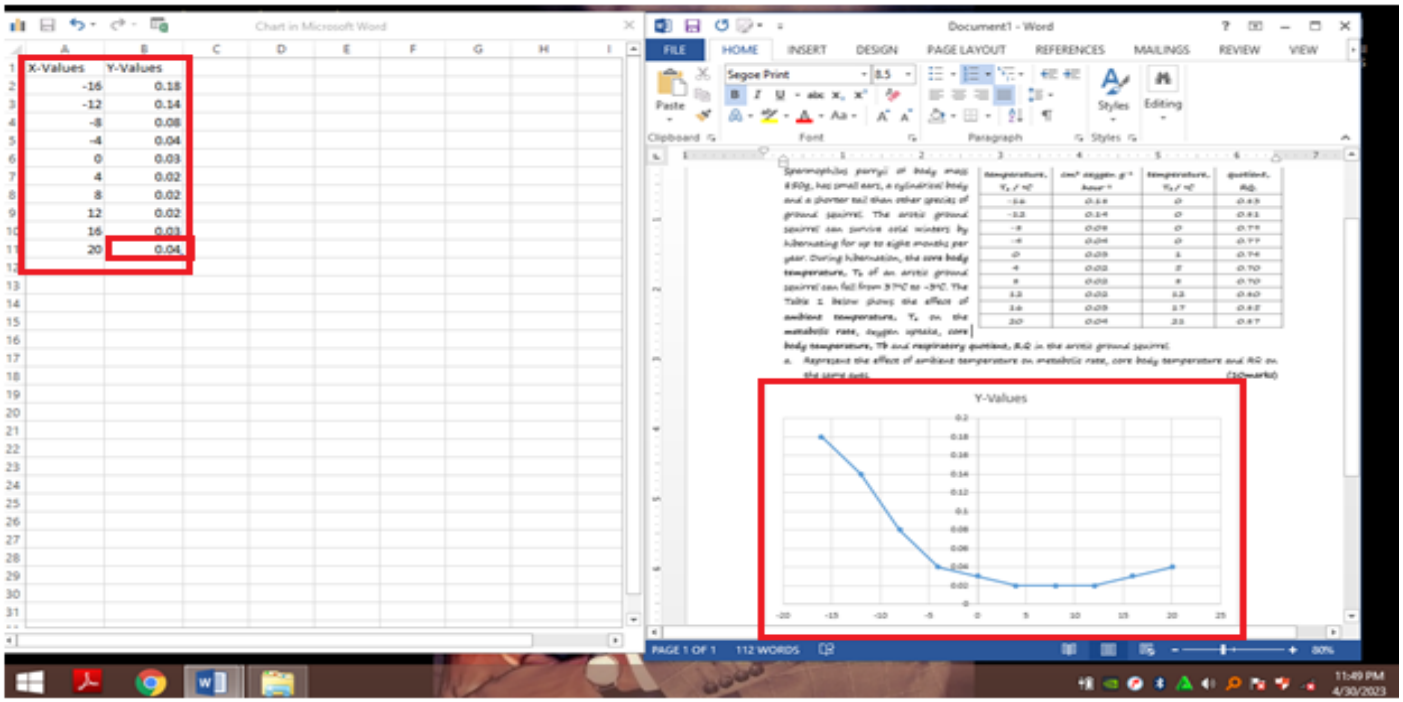
Ambient temperature, T_a / °C	Metabolic rate/ cm^3 oxygen g^{-1} $hour^{-1}$	Core body temperature, T_b / °C	Respiratory quotient, RQ.
-16	0.18	0	0.83
-12	0.14	0	0.81
-8	0.08	0	0.79
-4	0.04	0	0.77
0	0.03	1	0.74
4	0.02	5	0.70
8	0.02	8	0.70
12	0.02	12	0.80
16	0.03	17	0.85
20	0.04	21	0.87

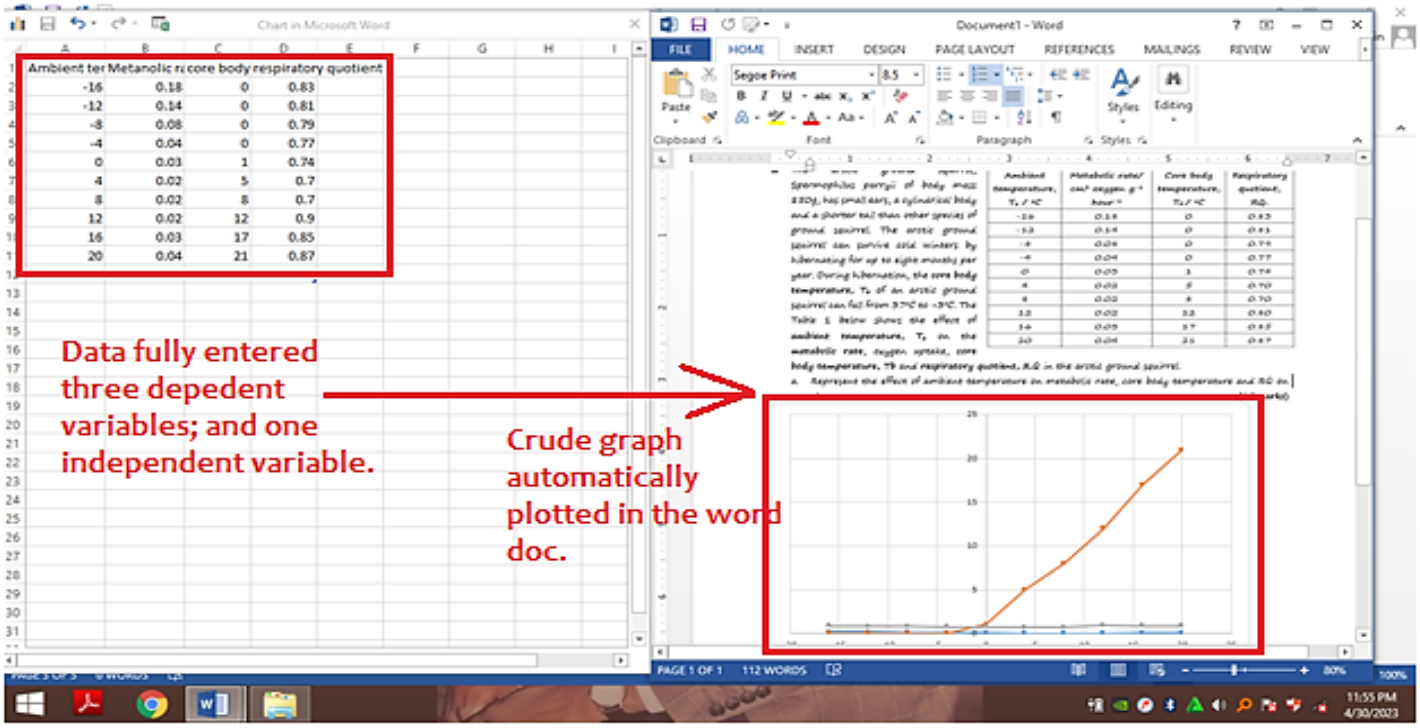


a. Represent the effect of ambient temperature on metabolic rate, core body temperature and RQ on the same axes. **(10marks)**

Entering data in excel sheet, as graph is being plotted automatically,

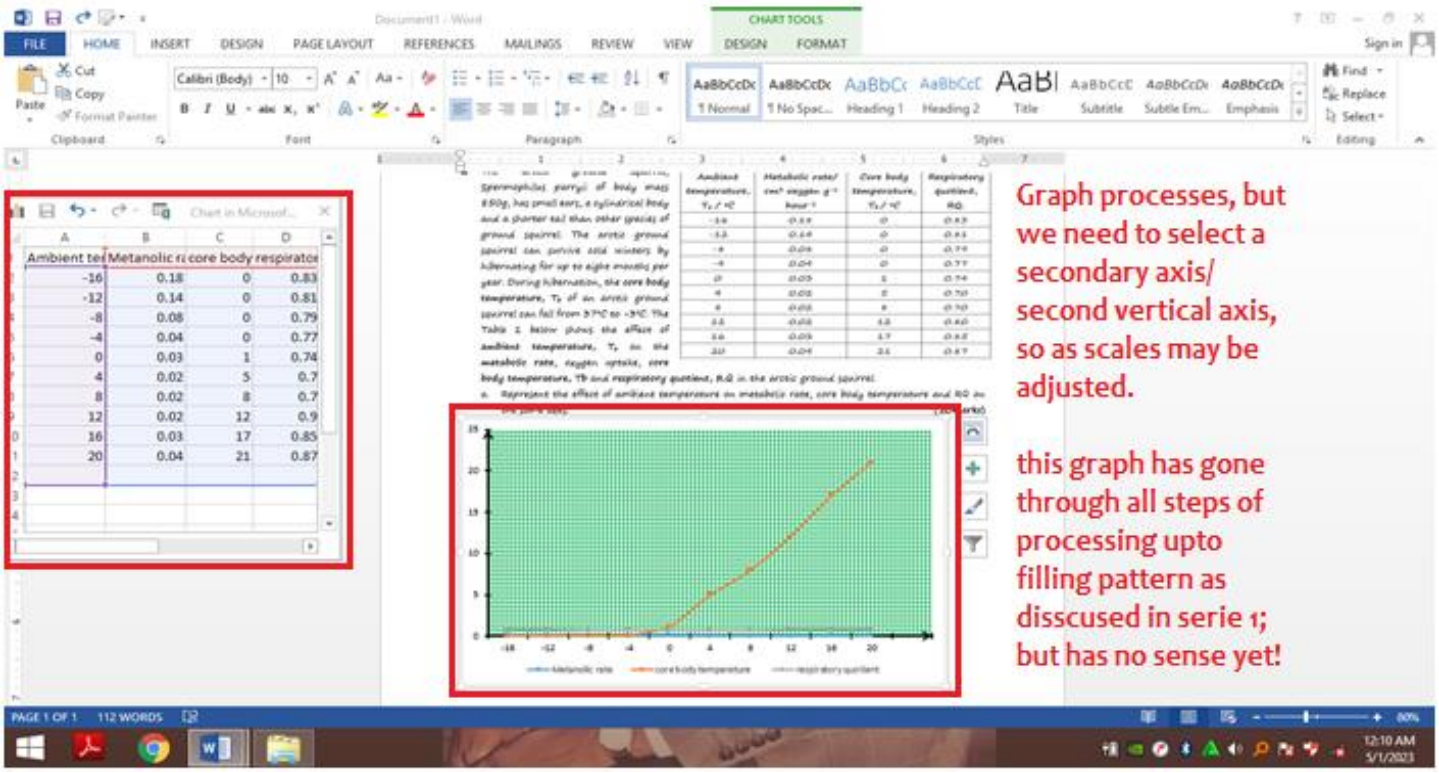




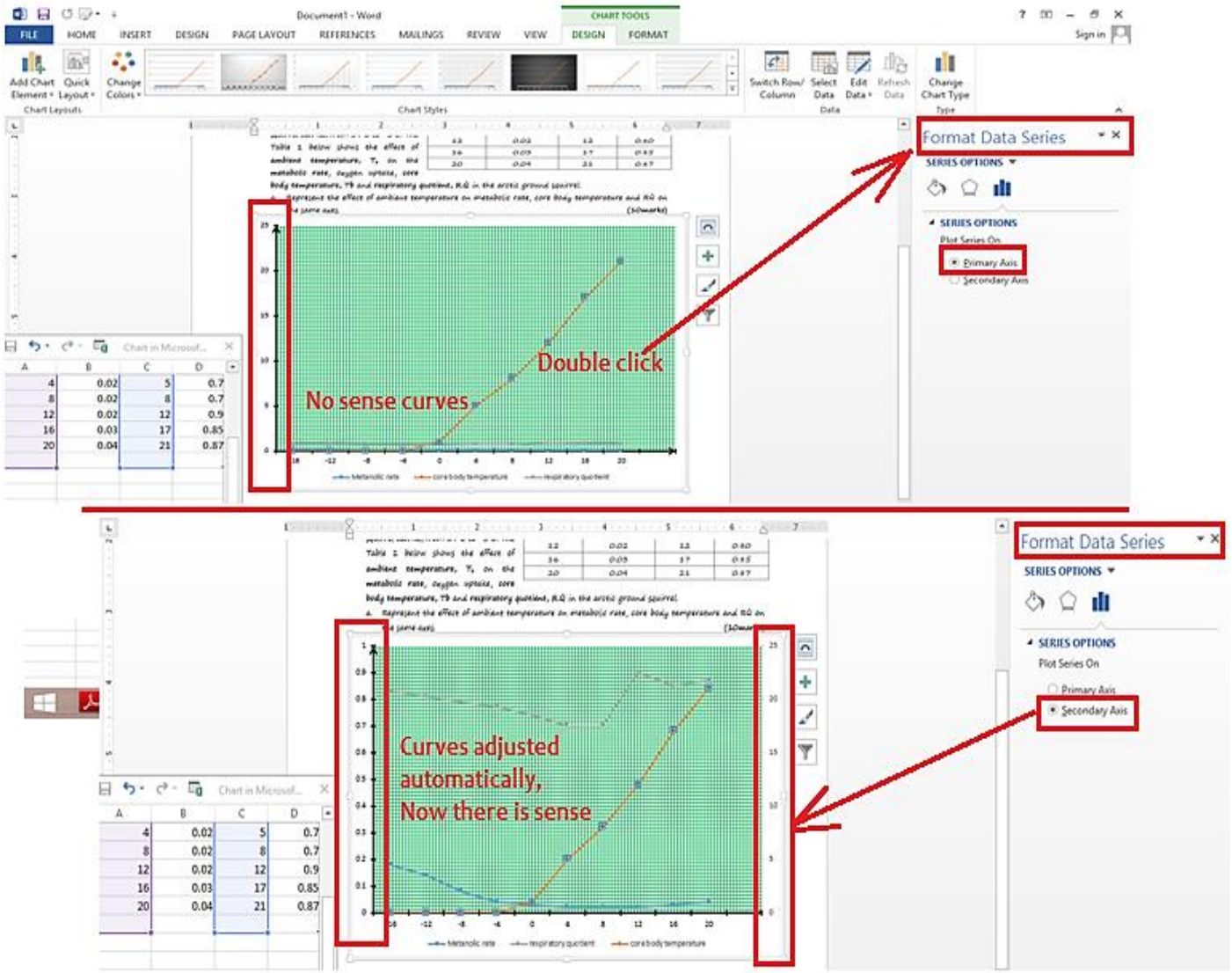


Processing the crude graph!

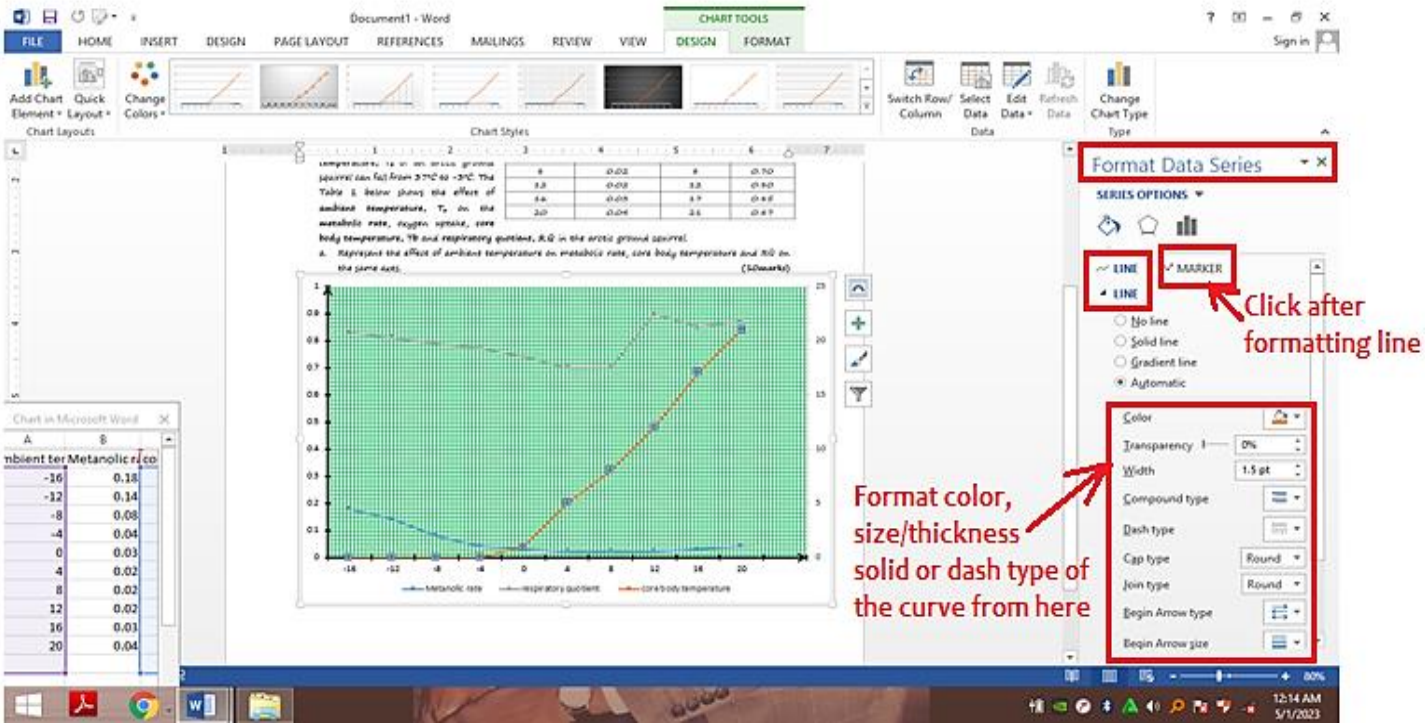
INSERTING SECONDARY AXIS;

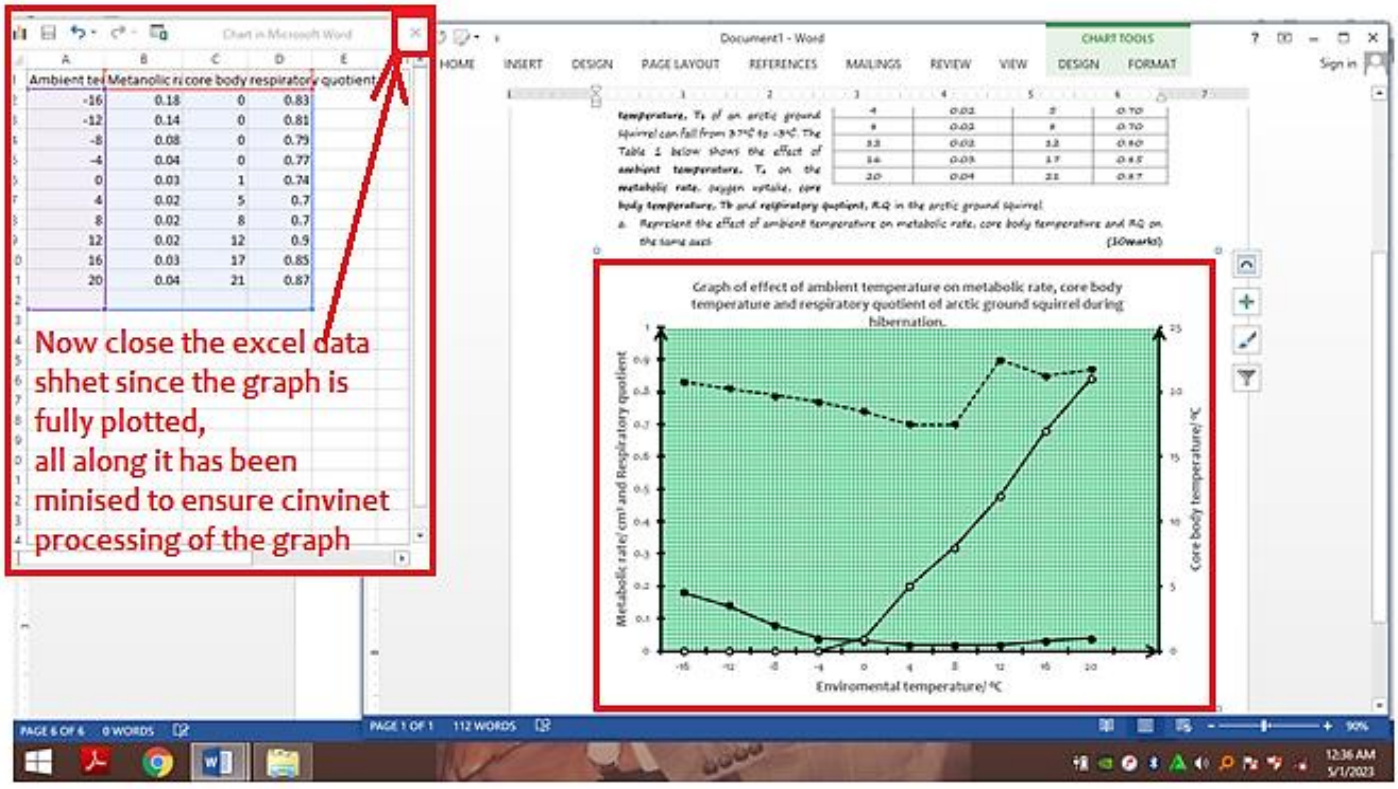


Double click on the interpolating line, a "FORMAT DATA SERIES" menu bar appears on the right side of the chart, Click to select "SECONDARY AXIS". Automatically one or two of the vertical variables' scale(s) is (or are) adjusted.

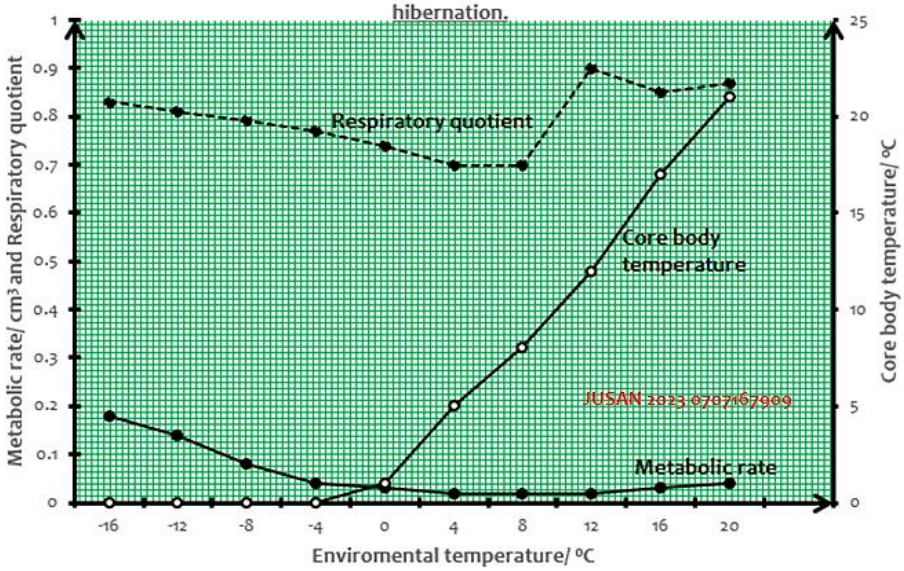


Let's not also not forget to change the colors of the axes, formatting markers, by double clicking on the interpolating line, then selecting options from **"FORMAT DATA SERIES"**, Choose either **"LINE"** or **"MARKER"** and format one at a time.





Graph of effect of ambient temperature on metabolic rate, core body temperature and respiratory quotient of arctic ground squirrel during hibernation.



PLOTTING BAR GRAPHS- BASIC SKILLS.

Consider data results from UNEB 2019 P530/3 practical results.

Qn. You are provided with **specimen P** and **sucrose solutions** of different concentrations labelled **A, B, C, D** and **E.** you are required to carry out tests on the specimen using the solutions.

Label 5 petri dishes as A, B, C, D and E and put 10cm³ of the corresponding solution in each. Cut two pieces of stem from specimen P, each measuring 3cm long preferably from the same internode or from internodes next to each other. Cut each petri piece longitudinally into four equal pieces. Put a piece into each petri dish containing the sucrose solutions and leave for 40 minutes.

Meanwhile, peel off strips of lower epidermis from the leaf of specimen P. Put a strip in each of the petri dishes containing solutions A, B, C, D and E, and leave for 10 minutes.

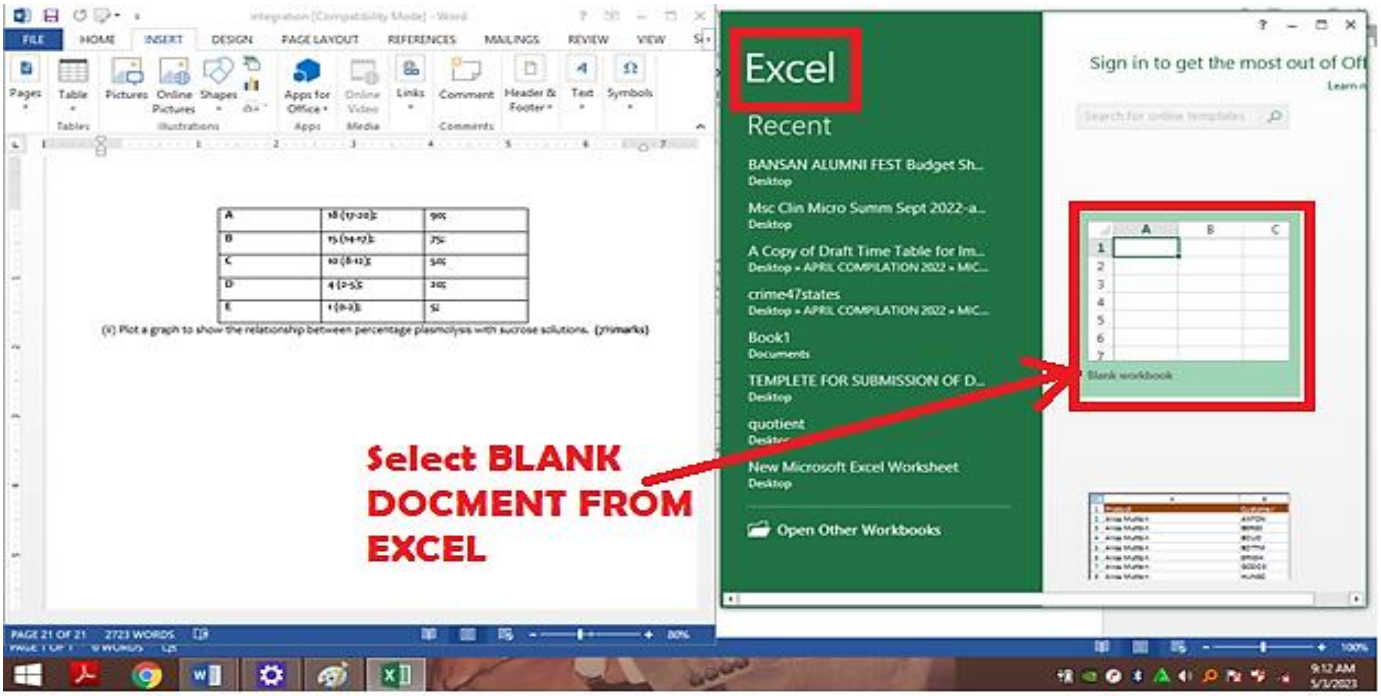
After 10 minutes, mount epidermal strip from each solute one at a time, onto a slide in a drop of its corresponding solution and view under medium power of a microscope. Count 20 purple coloured cells, and count the number of plasmolysed cells out of the 20.

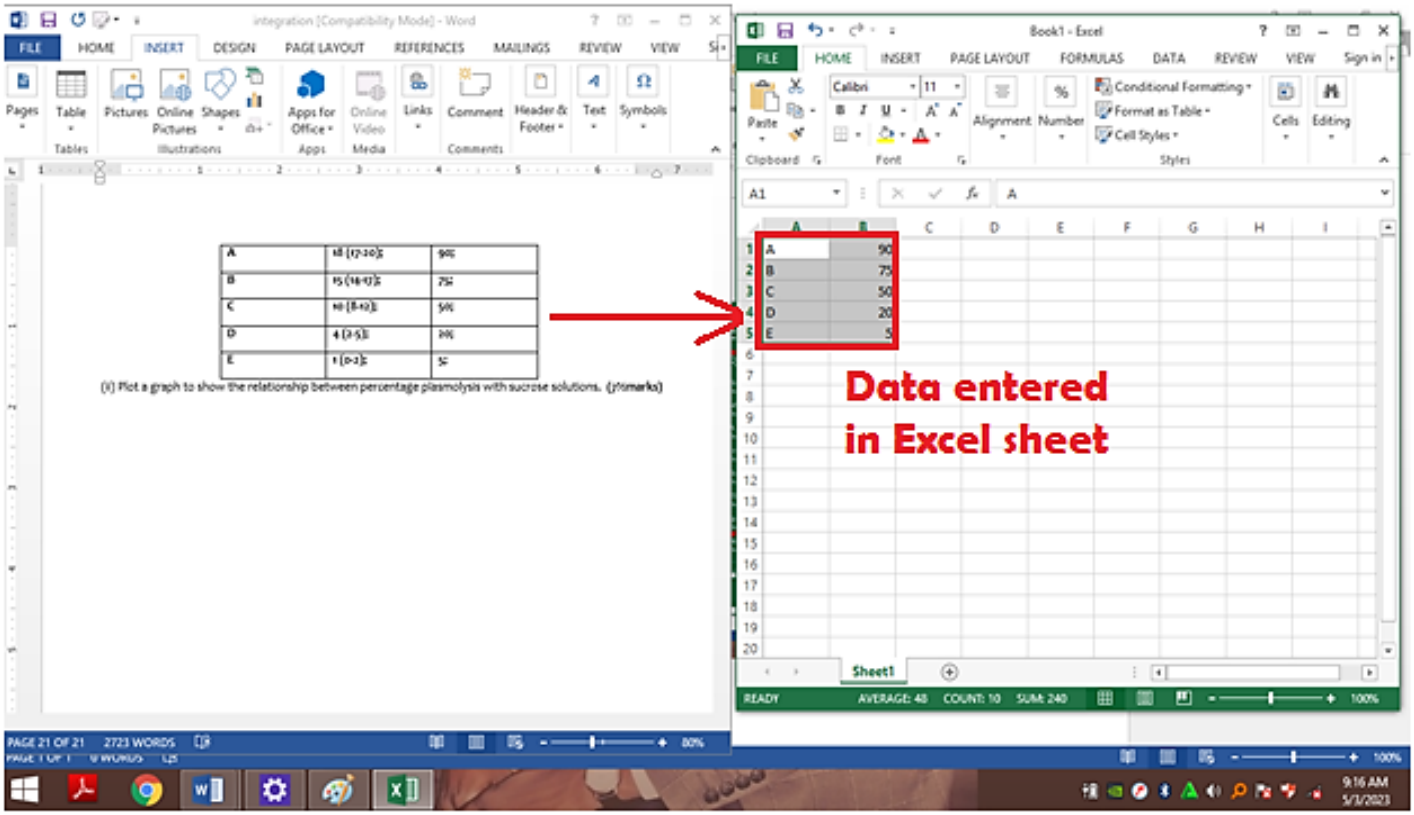
(a) (i) Compute the percentage of plasmolysis for the strips from each solution and enter results in Table 1.

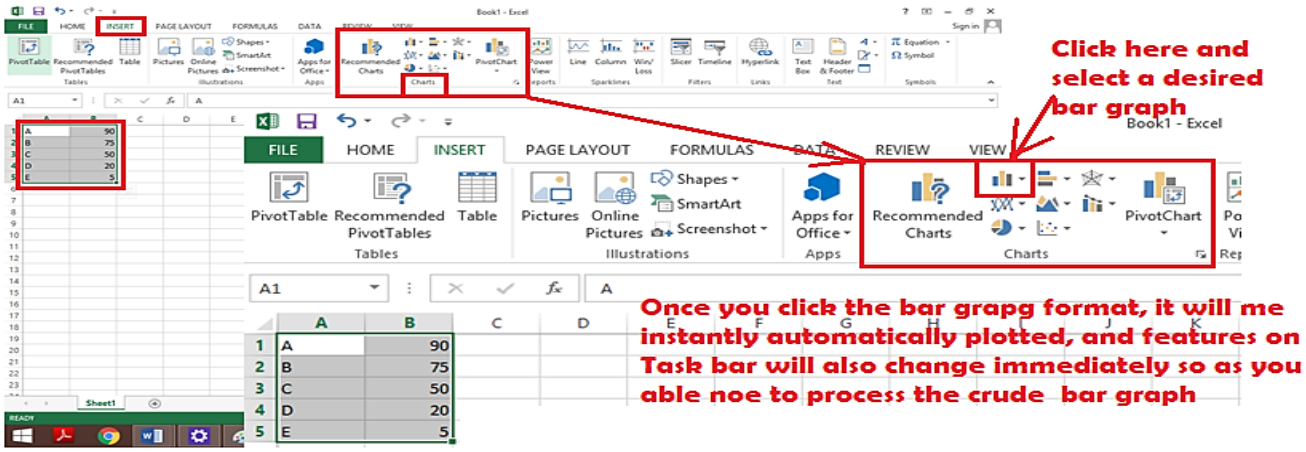
Sucrose solution	Number of plasmolysed cells	Percentage of plasmoly
A	18 (17-20);	90;
B	15 (14-17);	75;
C	10 (8-12);	50;
D	4 (2-5);	20;
E	1 (0-2);	5;

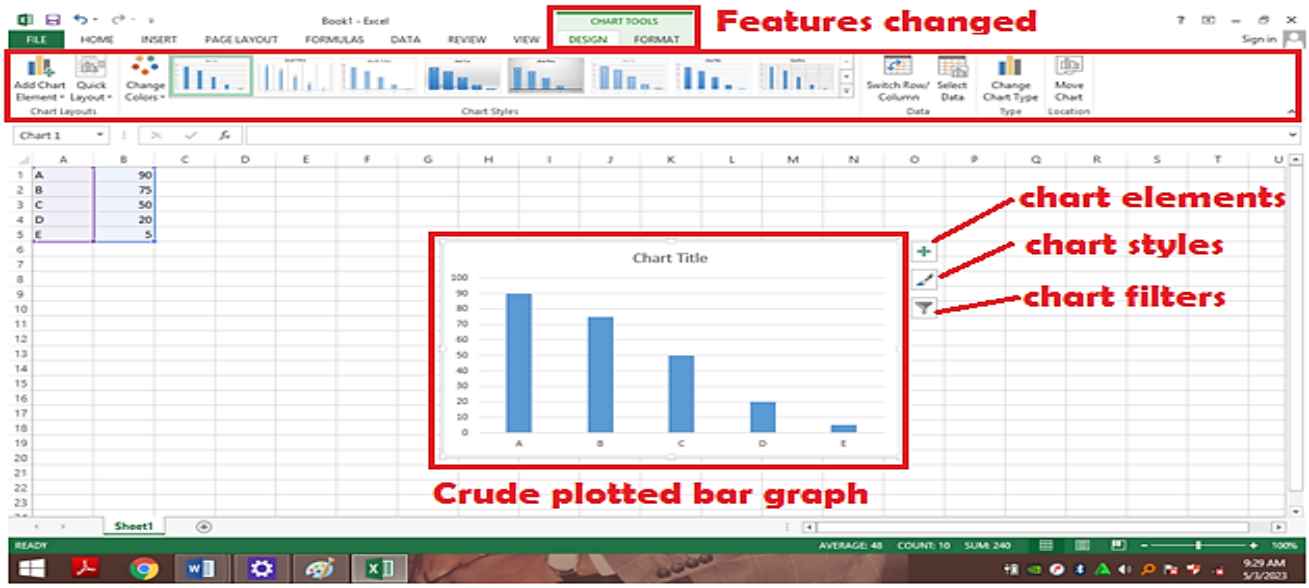
(ii) Plot a graph to show the relationship between percentage plasmolysis with sucrose solutions. **(7½marks)**

Though still same procedure to use word processing enables us achieve the bar graphs, LETS TRY OUT EXCEL SPREAD SHEET

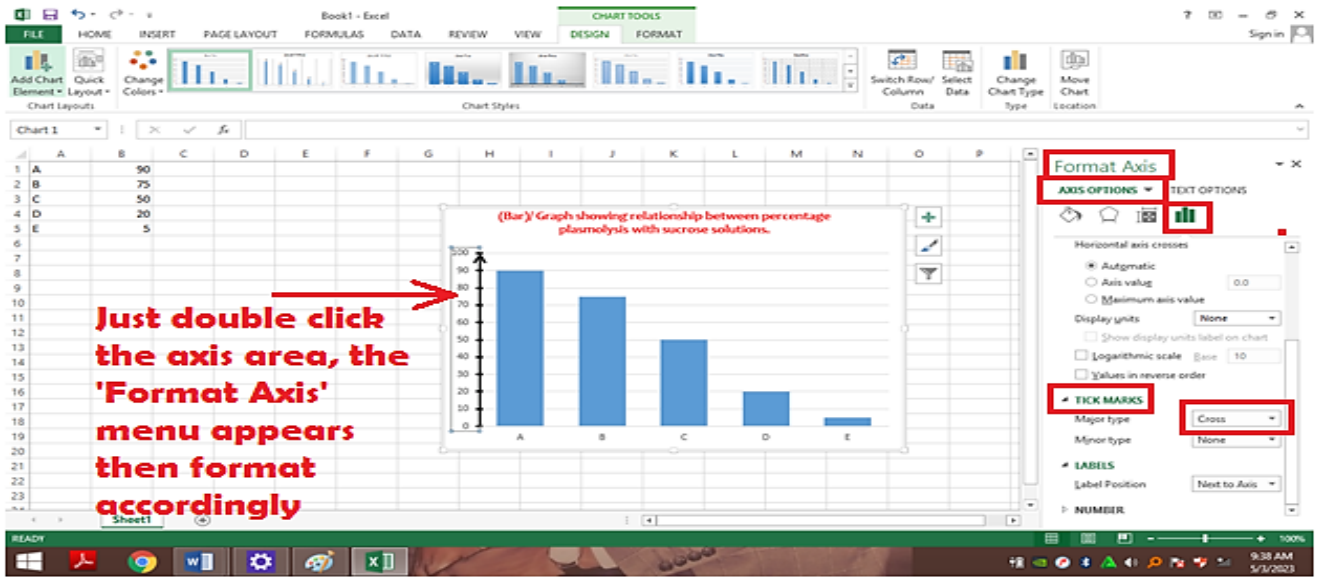


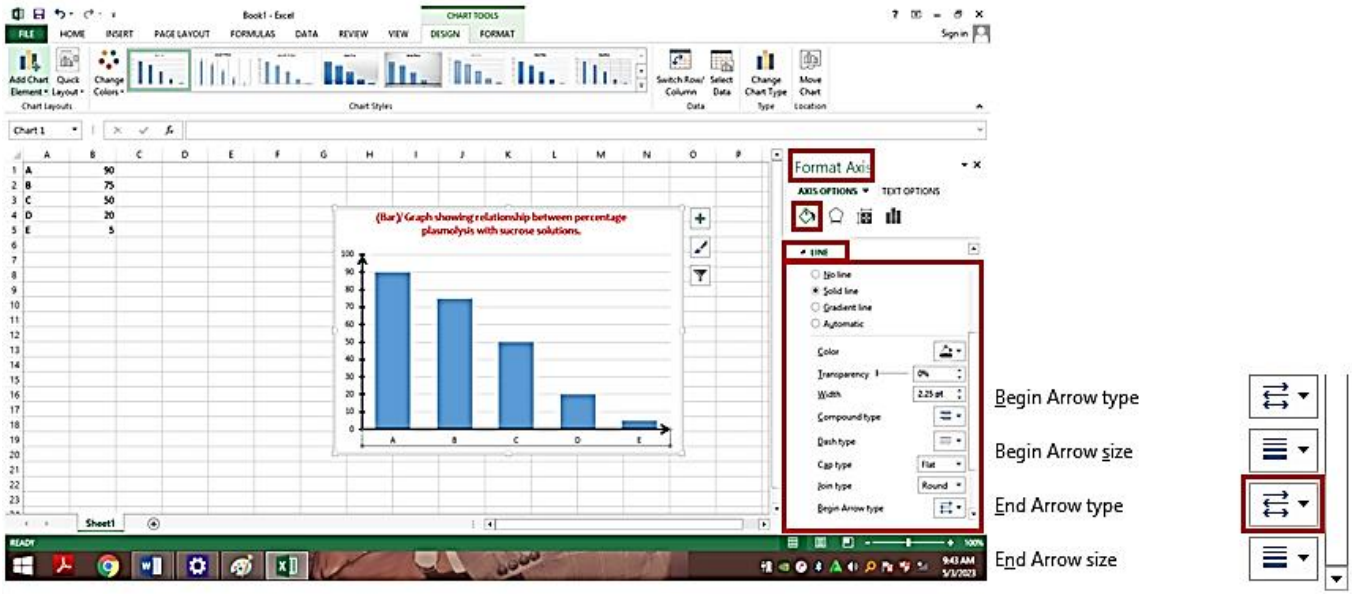


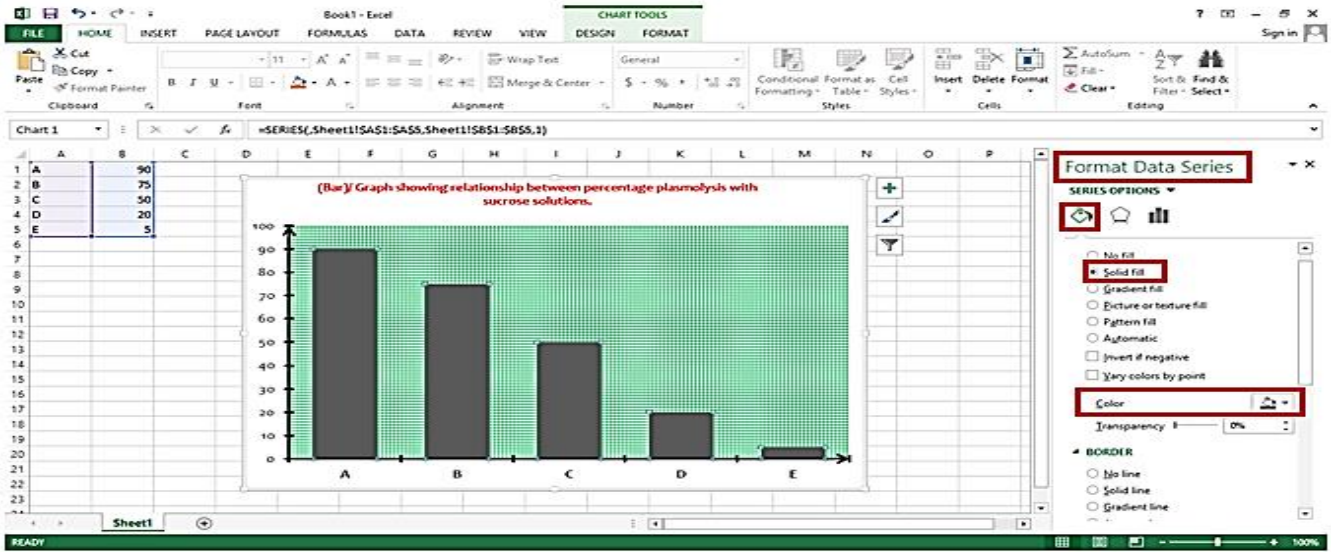


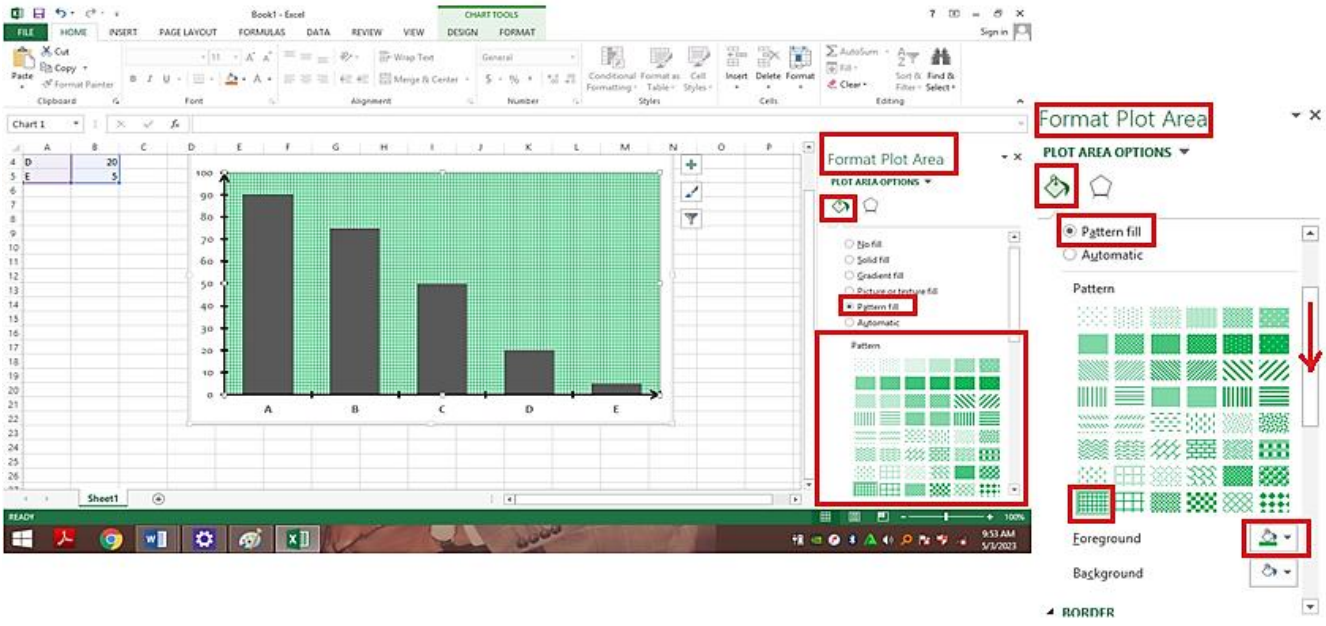


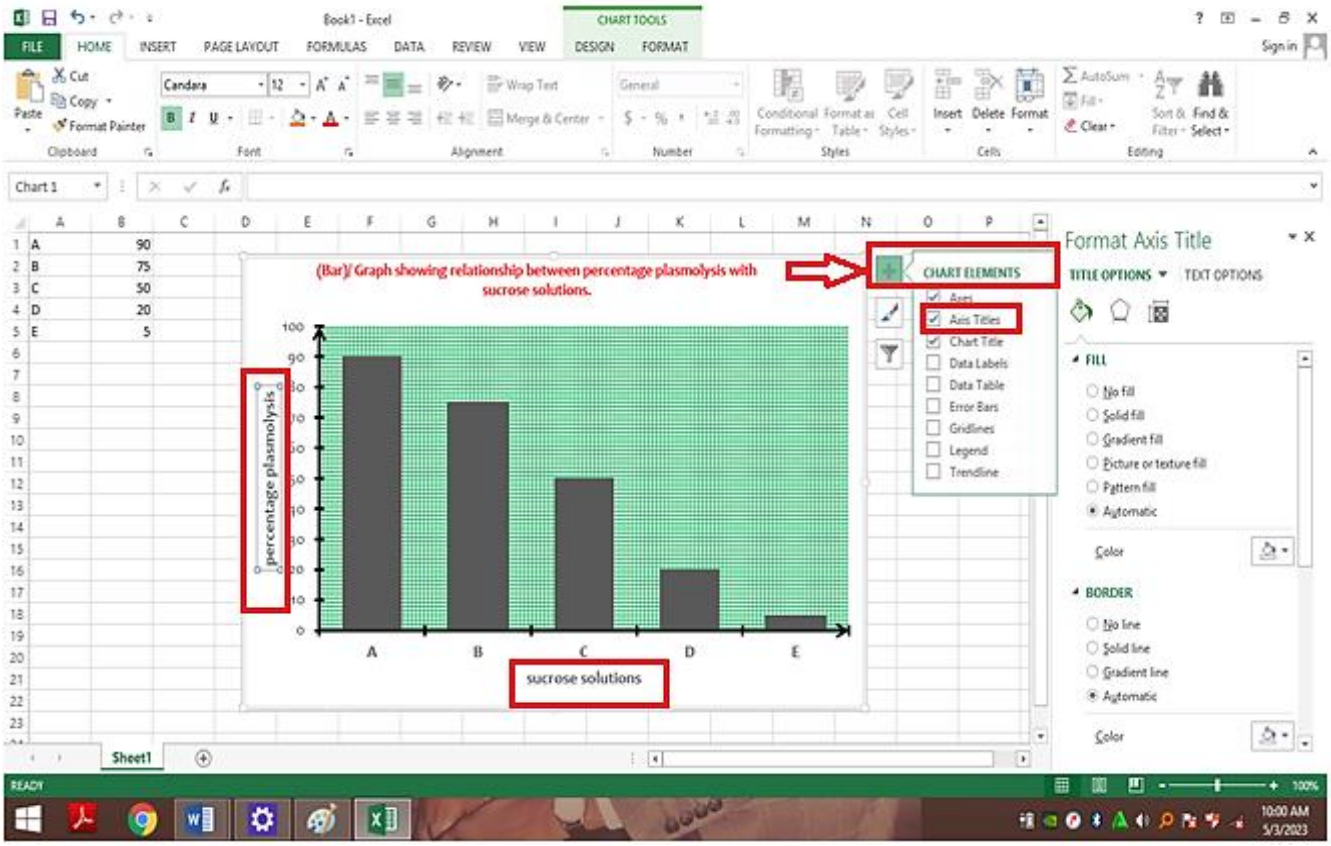
Processing the crude graph

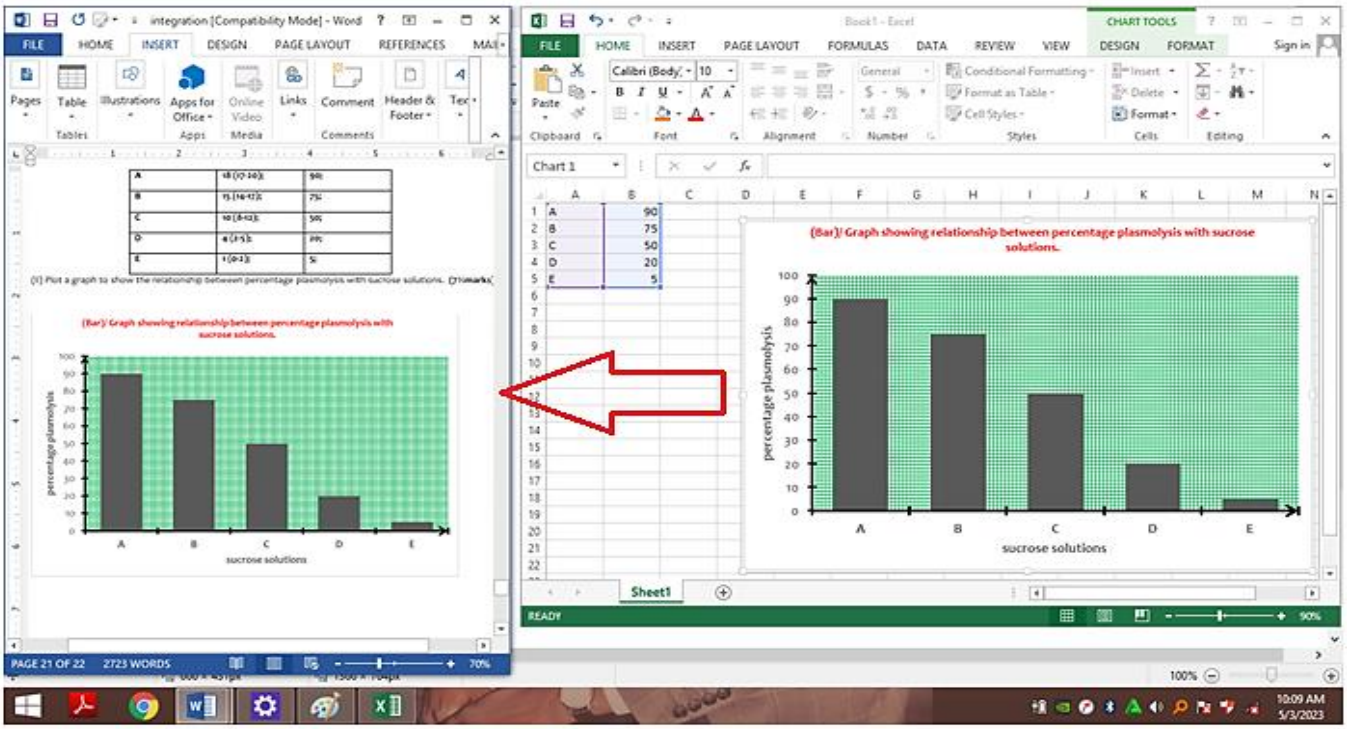






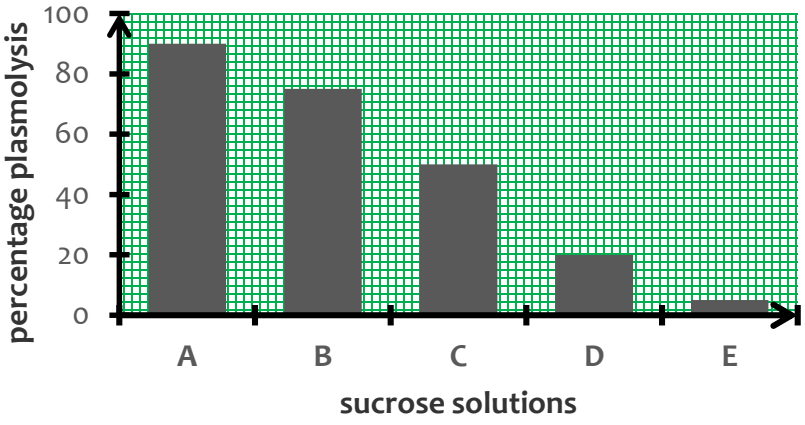






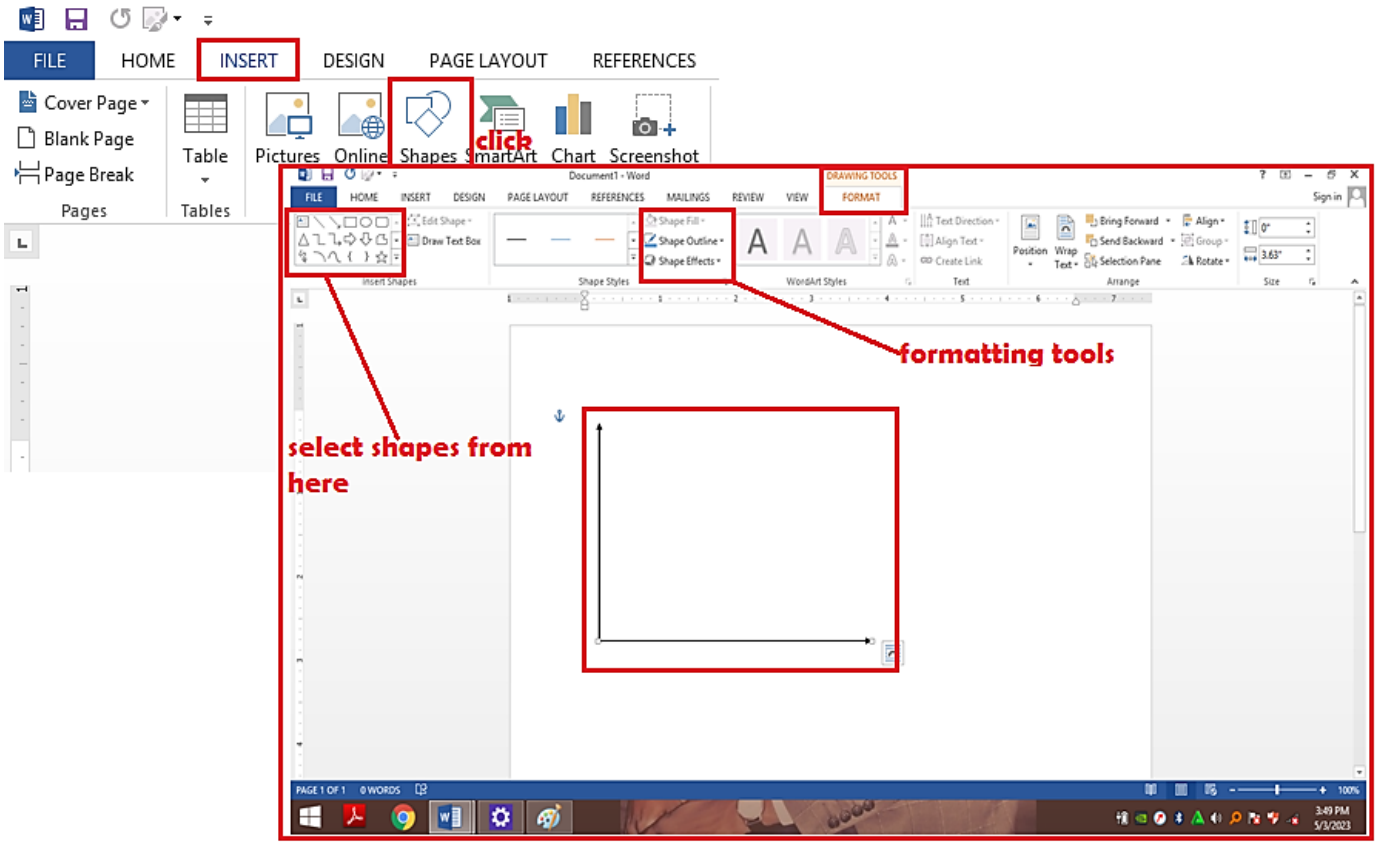
Click in the chart area to copy the graph form excel, and past in word.

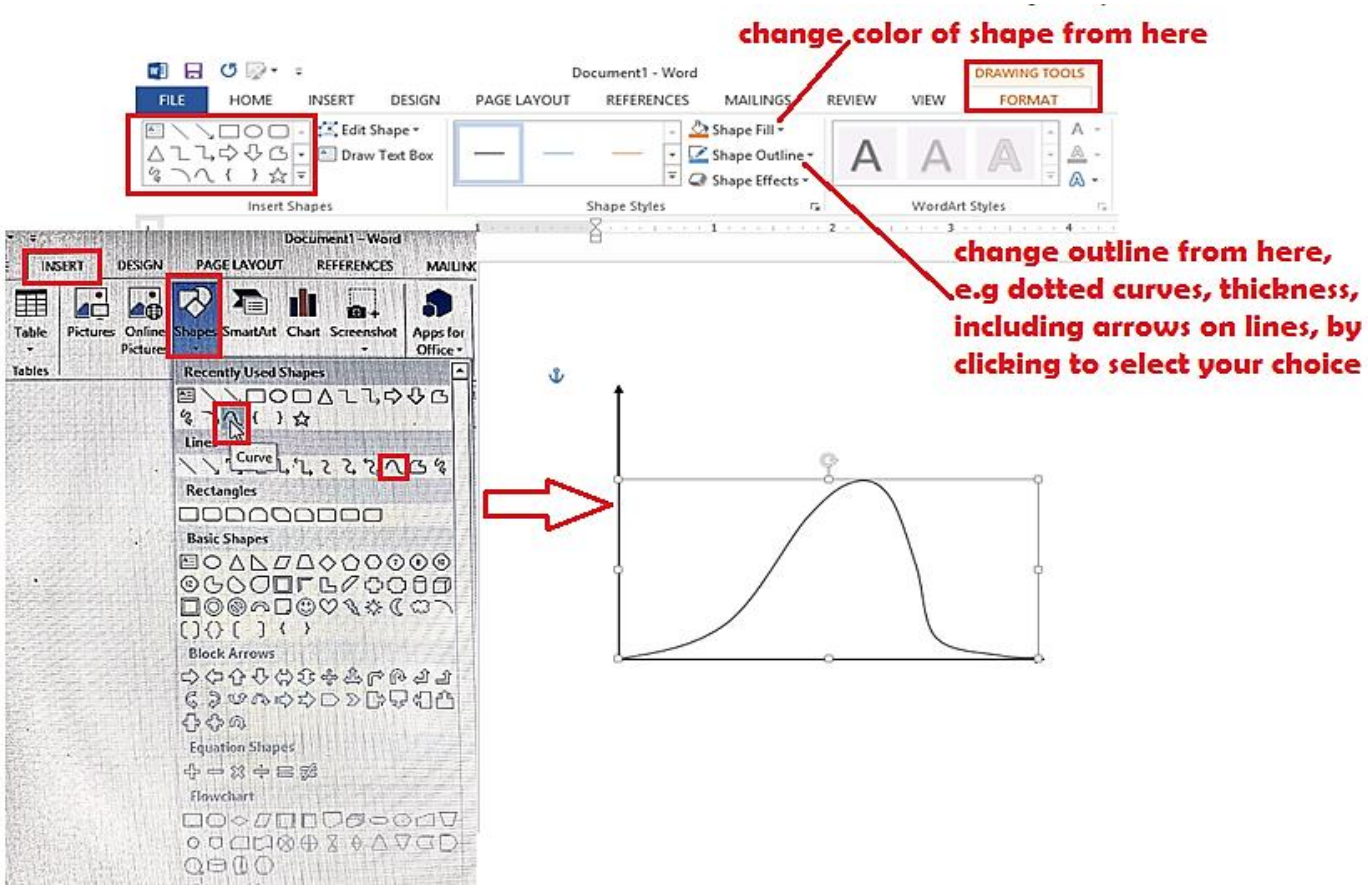
(Bar)/ Graph showing relationship between percentage plasmolysis with sucrose solutions.

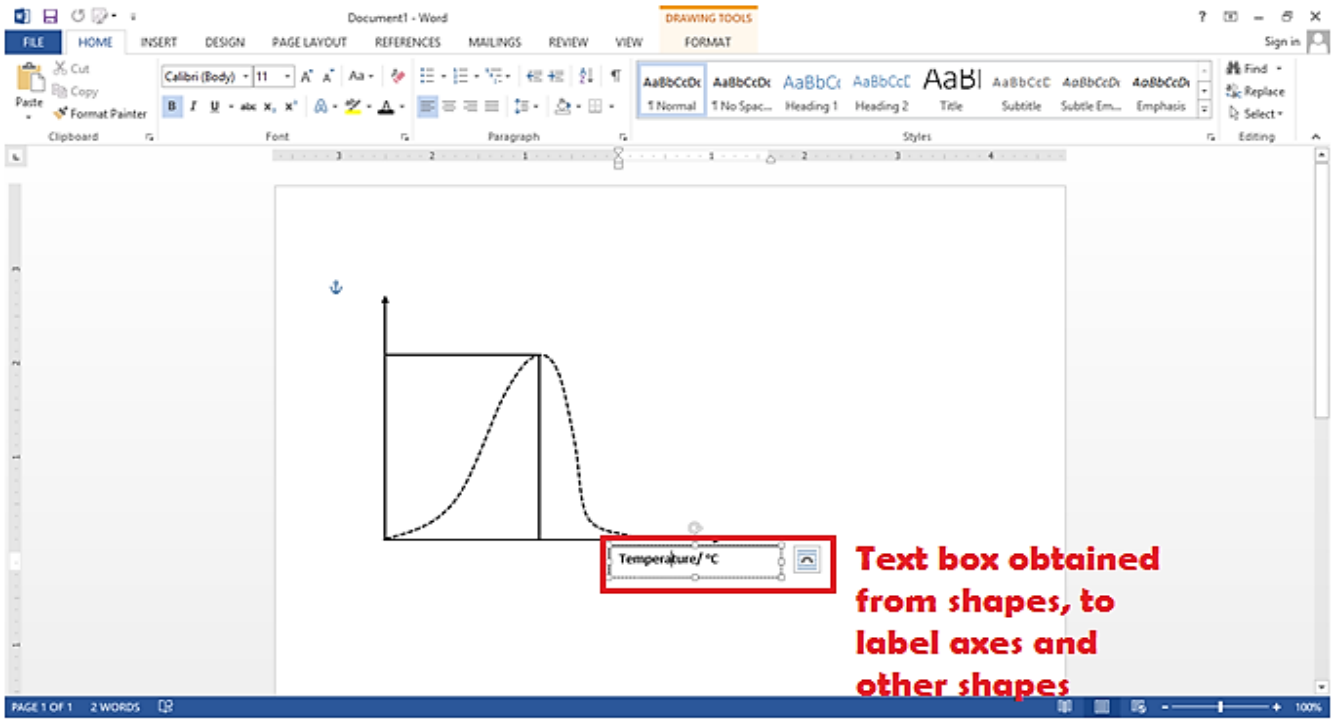


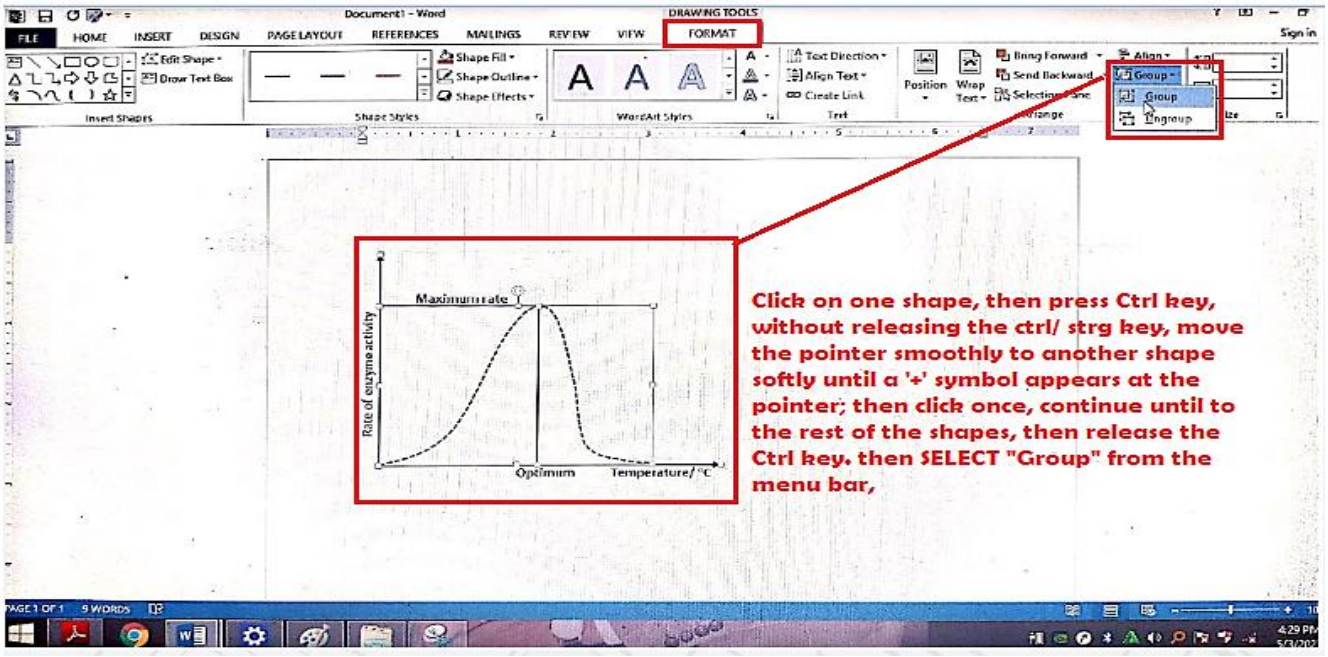
SYSTEMIC PROCEDURE – CURVE/ LINE GRAPH SKETCHING IN MICROSOFT OFFICE WORD PROCESSING.

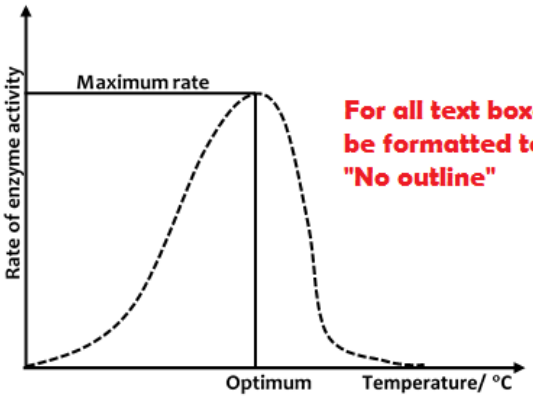
Drawing a curve: (1) On the Insert tab, Click shapes. (2) Under lines, click Curve. (3) Click where you want the curve to start, drag, and drag and then click wherever you want to add the curve. (4) To end a shape, do one of the following; (a) To leave the shape open, double click at any time. (b) To close the shape, click near its starting point.







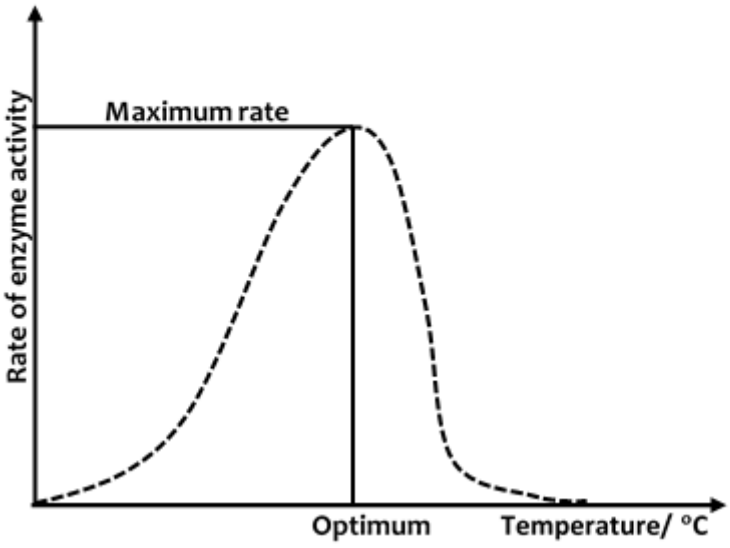




For all text boxes must be formatted to color to "No outline"

FINAL SKETCH

Graph showing effect of temperature on enzyme activity



To draw an OVAL OR CIRCLE;

Drawing a curve:

(1) On the Insert tab, Click shapes.

(2) Under Basic shapes, click Oval.

(3) Click where you want the curve to start, drag, and then click wherever you want to draw the shape.

(4) To end a shape, do one of the following;
(a) You can change the look of your circle, by adding a shape fill or effect or changing the boarder.

(b) Circles and ovals are filled automatically. If you don't want the shape to obscure anything underneath it, such as text or cells, select the shape, and on the Format tab, click Shape Fill, and then click No Fill.

Jusan || Biology Educator – (ABE)