IGCSE Biology Paper 6 Alternative to Practical Notes:

Contents:

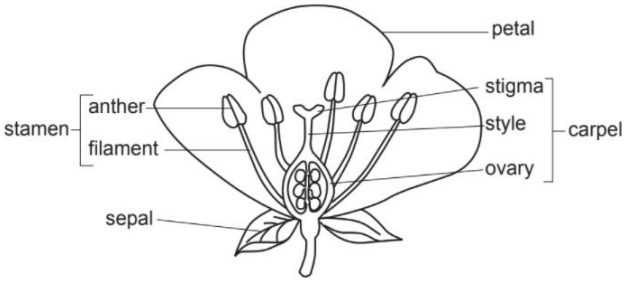
Drawing Diagrams:

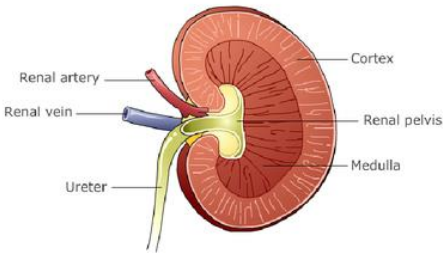
- Use a sharp pencil
- Clear outline
- NO SHADING
- Make your drawing as large as the space provided
- NO sketching – one thin line only

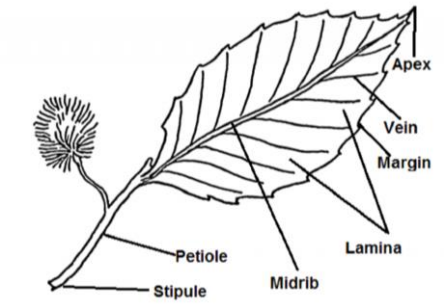
Labelling:

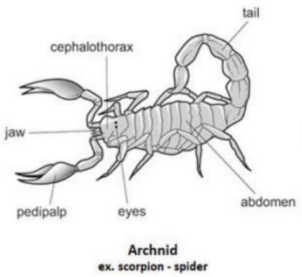
- Labels should point directly to the component (NO ARROW HEADS)
- Use a ruler to draw the label line

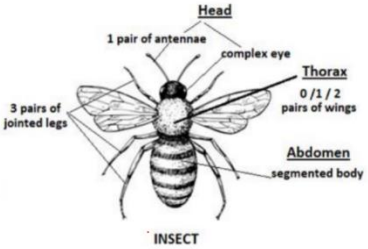
Common Hard diagrams (remember some labels in case)











Calculating Magnification:

Magnification = Image Size / Actual Size

Conversions:

1m = 100cm 1cm = 10mm 1mm = 1000µm

Rearranged Equation:

- Image Size = Actual Size x Magnification
- Actual Size = Image size/Magnification

Remember! – the units for magnification is X…(always add a "X" before the number)

Safety Issues

Safety Issue	Ways to minimize the risk
Hot test tube from hot water bath may cause burns	Use tongs to hold the test tube Use heat-resistant gloves
Cutting – may cut the skin and cause bleeding	Cut on a solid flat surface Cut away from the fingers to avoid cutting the fingers
Exercise – dangerous for people with health issues. People may trip/fall	People with **CHD/health problems** should not participate Wear exercise footwear Avoid doing in extreme weather conditions
Food – may cause allergic reactions	People allergic to that substance should not participate
Iodine solution – may stain clothes	Wear gloves and aprons
Ethanol – it is flammable	don't use near Bunsen burner flame because ethanol is **flammable**
Chemical substances – may be corrosive/irritant etc…	Wear gloves and safety goggles

Chemical Tests:

Testing For…	Test	Positive Test	Negative Test
Starch	Add Iodine solution	Turns blue-black	Stays yellowish brown
Protein	Add Biuret solution	Turns lilac	Stays blue
Glucose (reducing sugar)	Add Benedict's solution Heat to 80'C	Turns brick red, orange, yellow, green (in order of increasing glucose concentration)	Stays blue
Vitamin C	Add DCPIP solution	Turns clear	Stays blue
Fats	Add ethanol and water Shake	Cloudy white emulsion forms	Stays clear
Carbon Dioxide	Hydrogencarbonate indicator	yellow	purple
	Limewater	Turns cloudy/milky white	Stay clear

TIP: Memorize this to perfection! This is most commonly asked and is often worth 2-3 easy marks!

Making Comparisons:

- Make sure the points you identified are **visible** on the diagram
- Do NOT compare size unless given a scale
- Use the labels on the diagram as guidance

Identifying Errors and Improvements:

Error	Improvement
No repeats – only done once *	Repeat 3 times
Loss of gas while connecting the bung while using a delivery tube	Use a three-way tap
Inconsistent shaking	Use a machine to shake
Subjective nature (colour change) *	Use a colorimeter
Using the same dropping pipette can lead to contamination *	Use different dropping pipettes
Drops from the dropping pipette could have been different volumes	Measure volumes instead using a measuring cylinder or other measuring apparatus
Timing intervals too long	Use smaller time intervals
Temperature may have changed throughout the experiment *	Use a thermostatically-controlled water bath to maintain the same temp
Could have miscounted the number of gas bubbles produced	Use a gas syringe to measure volume instead
Gas bubbles produced are different sizes	Use a gas syringe to measure volume instead
Measurement error	Use graduated pipette
Test tubes different distances away from the lamp so the light intensity is different	Arrange them to be equidistant from the lamp
Adding past the endpoint during a titration	Add smaller quantities (drop by drop) of solution

TIP: Remember the common examples marked with an *. (Recommended to write the "repeat" error because it nearly always comes up!)

If the question asks for the effect of the error on the result, use this answer structure:
It may increase/decrease the [IV] so the [DV] may be measured to be higher/lower than the actual value

Drawing Tables:

Independent variable goes here. Remember to include the units too!	Dependent Variable goes here. Remember to include the units too!			
	Trial 1	Trial 2	Trial 3	Average
	The number of trials goes here.			If it is numerical values, add an average column
Values for the IV goes here	The data goes here. Make sure it is to the same number of decimal places! Sometimes they may ask you to leave it blank			The average values goes here. Use a calculator and present it to the same number of decimal places

*Sometimes the average column is not needed

Sample Table:

Temperature (°C)	Time taken for the blue colour to disappear (s)			
	Trial 1	Trial 2	Trial 3	Average
10	120	125	123	123
20	82	85	85	84
30	50	51	53	51
40	25	26	23	25
50	20	19	15	18
60	13	10	9	11

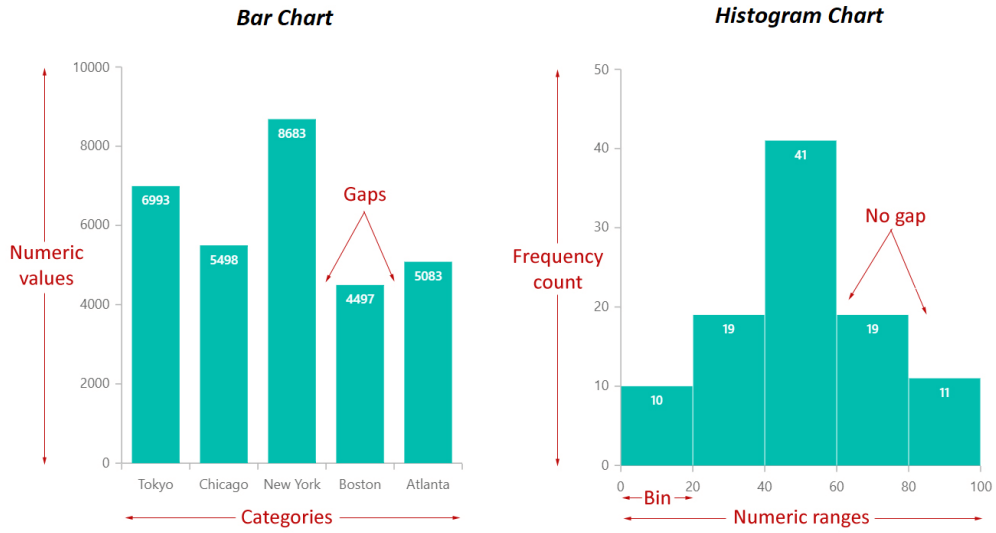
Drawing Graphs:

- Use a sharp pencil
- Label both axes with units (IV on x-axis, DV on y-axis)
    - Labels should be in the form "quantity/units"
- Choose appropriate scale
- Use crosses "x" to mark the data points (for scatter graphs)
- Graph should cover at least half the grid
- Include an appropriate title

Line of Best Fit:

- Draw a line of best fit that can fit through most of points as possible (for scatter graphs)
- Join the data points (for line graph)

Bar-chart VS Histogram (for IV that is qualitative)



Describing the trend in the Graph:

- Use words like increase/decrease
- Use data to support your point
- Identify peaks/max/min

Miscellaneous Questions from Past Papers:

Q: Why should we repeat the investigation?
A: To identify any anomalies/To calculate an average

Q: How can we find the surface area of an irregularly-shaped object?
A: Put on a grid and use a pencil to trace the shape of the object. Then, count the number of squares the object occupies and multiply by the area of the square.
Q: How can we increase the accuracy of this method?
A: Use grids with smaller squares

Q: Why did the scientist use large samples of leaves?
A: To obtain representative leaf sizes/To identify any anomalous results

Q: Why were the leaves selected at RANDOM from the sample size?
A: Avoid bias so it gains a representative sample/So valid comparisons can be made

Q: Why does chlorophyll need to be removed when testing for starch?
A: To be able to see the colour change easily

Q: Why do we need to use eye protection when handling substances at high temperatures?
A: The heating liquid may spill out of the test tube.

Q: Why do we need to carry out a control experiment?
A: IF it is an experiment involving colour change = to observe the colour when no [IV] is added so it allows the comparison of colour with other test tubes
(other experiments: "To confirm that [IV] is the cause of the [DV]")

Q: Suggest why the test tubes must be kept in the water bath at the same temp before the experiment?
A: Give enough time for the test tubes to reach the temperature of the water (idea of equilibration)

Q: If the experiment is not repeated, what will be the effect on the results?
A: Cannot identify any anomalies

Q: Why is it necessary to record the percentage change in mass rather than final mass?
A: The initial masses may be different.

Q: Why is the result anomalous?
A: It does not fit the general trend.

Examples of Control Variables

Control Variable	How to control them?
Temperature	Use thermostatically controlled water bath to keep substances at same temperature, monitored using a thermometer.
Type/Species of organism used	Use same type/species (name it!)
Concentration of…	Use same concentration (___mol/dm^3) of …
Volume of…	Use same volume (___cm^3) of …, measured using a measuring cylinder
pH	Use buffer solution
Duration	Use stopwatch to time for ____s

Plan an experiment: (6 mark question)

Independent Variable: The variable you will **change**

Dependent Variable: The variable you will **measure**.

Control Variable: Variables that you will **keep the same.**

Format: (IDCSRA – I Don't Care So Run Away)

Mnemonic		Criteria
I	**Independent Variable**	1. State the Independent variable 2. Describe how you are going to change it (include names of the equipment) 3. State the values with units
Don't	**Dependent Variable**	4. State the dependent variable 5. State the units 6. State how you are going to measure it (include names of the equipment)
Care	**Control Variable**	7,8,9. State three different control variables 10,11,12. Describe how you are going to control them
So	**Safety**	13. State a safety measure 14. Describe how you will eliminate the risk
Run	**Repeat**	15. State that you will repeat the experiment 3 times
Away	**Average**	16. State that you will calculate an average. (only for numerical data)

Independent Variable	How to change it?
Temperature	Use a thermostatically-controlled water bath and a thermometer to measure the temperature. **Possible Range**: 10'C, 20'C, 30'C, 40'C, 50'C, 60'C
Humidity	With or without plastic bag (with plastic bag = higher humidity)
Light Intensity	Put the lamp at different distances away, measured using a rule **Possible Range**: 10cm, 20cm, 30cm, 40cm, 50cm, 60cm, 70cm
Air Flow	Use fan or don't use a fan (with fan = more air flow)
Carbon Dioxide Concentration	Use different concentrations of sodium Hydrogencarbonate solution that is a source of CO2

Example Answer:

Q: Plan an investigation to determine the effect of temperature on the breakdown of starch by enzymes. 6/6

The independent variable is the temperature the reaction between the starch and enzyme is carried out at. A thermostatically-controlled water bath will be used to change the temperature and the temperature values that will be used are: 10'C, 20'C, 30'C, 40'C, 50'C, 60'C. (1) The dependent variable is the time taken for the iodine solution to remain brown (1). This will be measured by using a dropping pipette to extract a drop of the enzyme and starch solution onto a spotting tile every 10 seconds (1) and testing the mixture with a drop of iodine solution. (1) When the solution remains yellow brown, this means starch is absent and all the starch has been broken down by the enzyme. A stopwatch will be used to measure the time and the units will be in seconds. A control variable is the pH (1) of the enzyme and starch solution, which will be kept the same by using the same solutions of starch and enzyme throughout the investigation so the pH will be the same. Another is the concentration of starch solution (1), which will be controlled by using 1mol/dm^3 of starch solution. Another is the type of enzyme (1), which will be controlled by using amylase. A safety measure is that the test tubes may be hot at high temperatures so tongs (1) should be used to eliminate the risk of getting burns. This experiment will be repeated 3 times (1) and an average will be calculated.

Optional: Include a control experiment if possible.

Possible Topics:

1) How does [factor of photosynthesis] affect the rate of photosynthesis?

Possible factors: temperature, light intensity, carbon dioxide concentration

How to measure the rate of photosynthesis: Measure volume of gas released using gas syringe in a set period of time. (the gas = O2 because O2 is product of photosynthesis)
Apparatus: Use gas syringe OR count number of bubbles

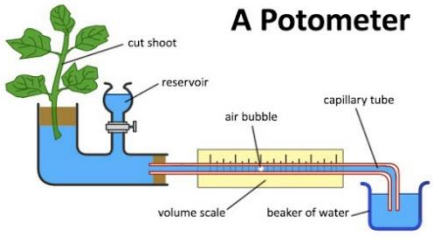
Possible control variables:

- ANY of the possible factors above (exclude the factor for IV)
- Species/type of leaf
- Duration carried out for

2) How does [factor] affect rate of water uptake?

Possible factors: temperature, humidity, air flow, light intensity, leaf area

How to measure the rate of water uptake: Use a potometer – distance bubble travels in set period of time



Possible control variables:

- ANY of the factors above (exclude the factor for IV)
- Type/species of plant
- Duration carried out for

3) How does [factor] affect rate of germination?

Possible factors: temperature, oxygen concentration, volume of water

Possible control variables:

- ANY of the factors above (exclude the factor for IV)
- Type/species of seed
- Duration carried out for

Percentage germination = number of seeds germinated/total number of seeds x 100%

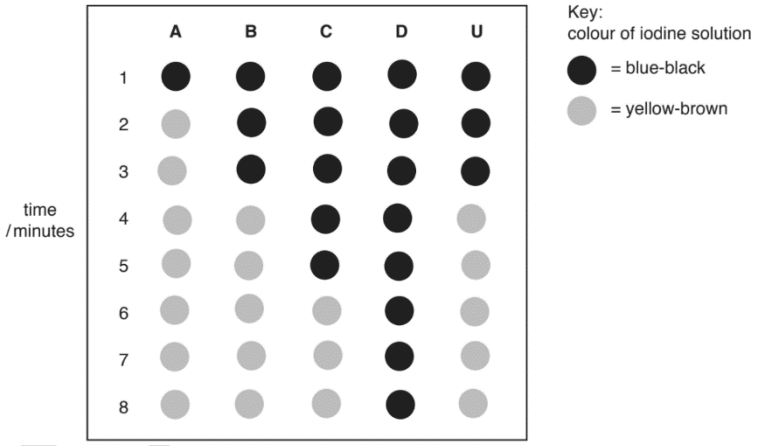
4) How does [factor] affect the rate of enzyme activity?

Possible factors: temperature, pH, concentration/volume of enzyme/substrate,

Possible control variables:

- ANY of the possible factors above (exclude the factor for IV)
- Type/species of enzyme
- Duration carried out for

Commonly used method: use dropping pipette to put the starch-and-enzyme solution on the spotting tile and then add iodine solution at set timed intervals and measure the time taken for the iodine solution to stop turning blue-black (= indicates all starch broken down)



5) Effect of exercise on heart rate

IV: Intensity of exercise – change number of jumping jacks (10, 20, 30, 40, 50, 60)
DV: Measure change in heart rate (after-exercise heart rate – before-exercise heart rate) in bpm

Possible control variables:

- Same person (same age/weight/dietary intake)
- Same resting period between each trial
- Same room temperature

Safety: those with CHD/other health issues should not participate/wear sport footwear…

6) Effect of exercise on breathing rate

IV: Intensity of exercise – change number of jumping jacks (10, 20, 30, 40, 50, 60)
DV: Measure change in breathing rate (use spirometer)

Possible control variables:

- Same person (same age/weight/dietary intake)
- Same resting period between each trial
- Same room temperature

Safety: those with CHD/other health issues should not participate/wear sport footwear…

Important Information on graphs/tables from the syllabus:

The solidus (/) is to be used for separating the quantity and the unit in tables, graphs and charts, e.g. time/s for time in seconds.

(a) Tables

• Each column of a table should be headed with the physical quantity and the appropriate unit, e.g. time/s.
• The column headings of the table can then be directly transferred to the axes of a constructed graph.

(b) Graphs

• Unless instructed otherwise, the independent variable should be plotted on the *x*-axis (horizontal axis) and the dependent variable plotted on the *y*-axis (vertical axis).
• Each axis should be labelled with the physical quantity and the appropriate unit, e.g. time / s.
• Unless otherwise instructed the scales for the axes should allow more than half of the graph grid to be used in both directions, and be based on sensible ratios, e.g. 2 cm on the graph grid representing 1, 2 or 5 units of the variable.
• The graph is the whole diagrammatic presentation, including the best-fit line when appropriate. It may have one or more sets of data plotted on it.
• Points on the graph should be clearly marked as crosses (×) or encircled dots (⊙).
• Large 'dots' are penalised. Each data point should be plotted to an accuracy of better than one half of each of the smallest squares on the grid.
• A best-fit line (trend line) should be a single, thin, smooth straight line or curve. The line does not need to coincide exactly with any of the points; where there is scatter evident in the data, Examiners would expect a roughly even distribution of points either side of the line over its entire length. Points that are clearly anomalous should be ignored when drawing the best-fit line.

(c) Numerical results

• Data should be recorded so as to reflect the precision of the measuring instrument.
• The number of significant figures given for calculated quantities should be appropriate to the least number of significant figures in the raw data used.

(d) Pie charts

• These should be drawn with the sectors in rank order, largest first, beginning at 'noon' and proceeding clockwise. Pie charts should preferably contain no more than six sectors.

(e) Bar charts

• These should be drawn when one of the variables is not numerical. They should be made up of narrow blocks of equal width that do **not** touch.

(f) Histograms

• These should be drawn when plotting frequency graphs with continuous data. The blocks should be drawn in order of increasing or decreasing magnitude and they **should** touch.