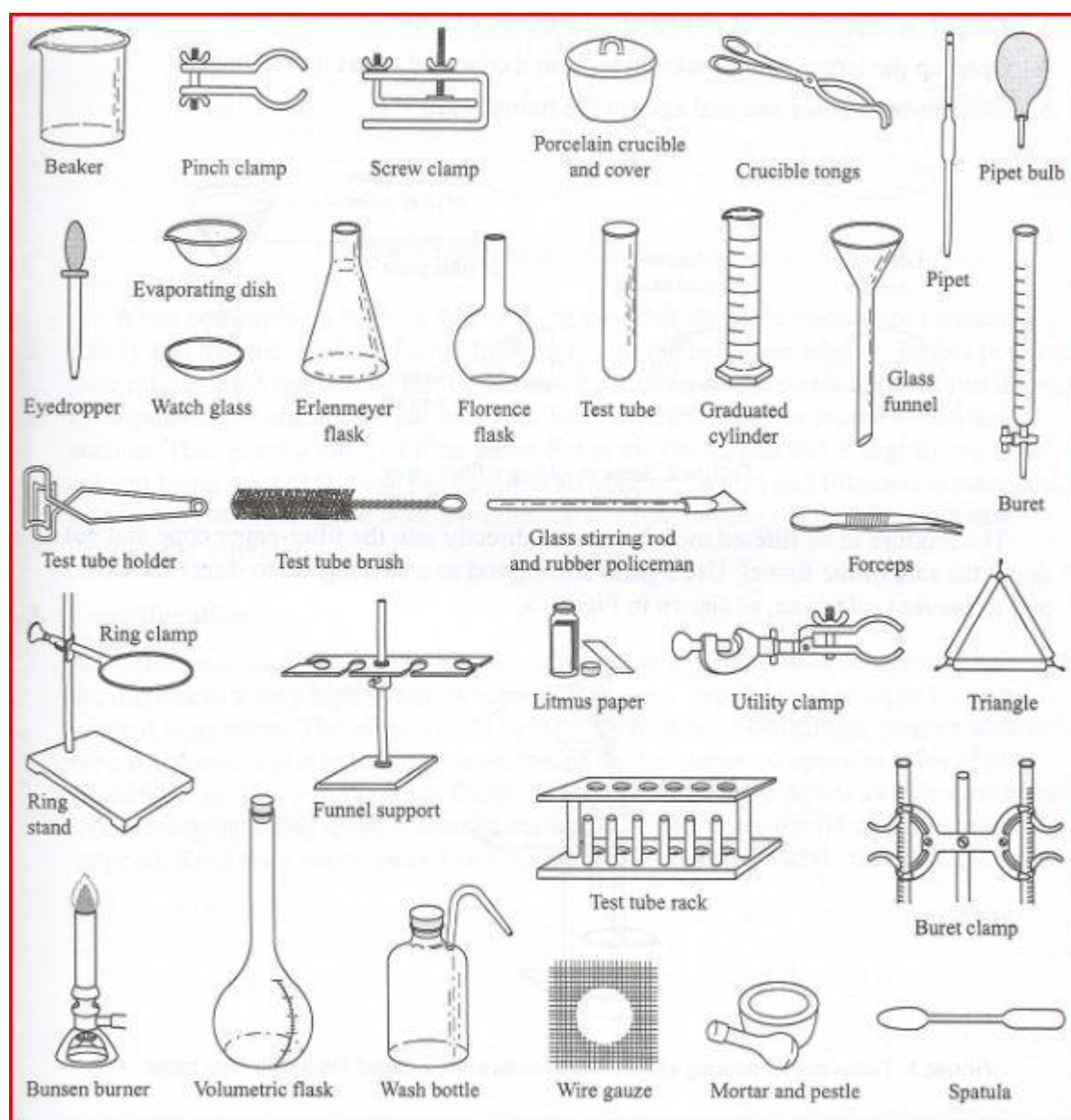


Skills for Practical assessment tasks: Paper 3

Basic Lab rules

- Hair must be tied and away from the face/ eyes.
- No loose clothing or jewellery.
- Closed shoes must be worn.
- Gloves/ goggles, forceps, masks used when necessary.
- Never taste or smell chemicals.
- No eating or drinking in the lab.
- Report breakages/ spills immediately

Apparatus



Always wash equipment when it is being used on different samples. This will prevent **cross contamination** between samples and ensure accurate results.

Identifying variables

Independent variable: the variable/ factor/ thing that is being changed or manipulated.

Dependent variable: the variable/ factor that is being measured or observed.

Controlled/ Fixed variable: factors that must remain the same within the investigation. (Do not confuse this with a control)

The Control:

Not to be confused with the controlled variable!

The control of the experiment does not contain the thing/ factor that you are investigating.

e.g. If you are investigating the effect that light intensity has on seedling growth, then the control would be to put a seedling in a dark cupboard.

Hypotheses:

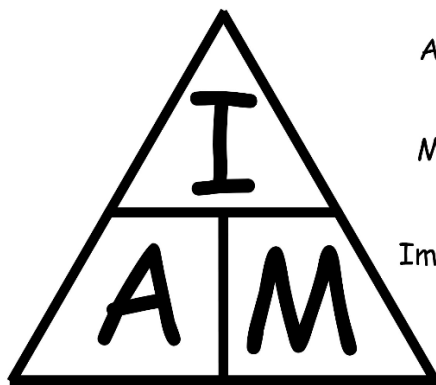
A hypothesis is a **guess** or **prediction** about the outcome of the investigation. It must refer to both the dependent and independent variable of the experiment. *Note: The hypothesis that is formulated does not have to be correct.*

Scientific drawings

- Drawings must be at least four lines in size, not bigger than half a page.
- Drawing must be on the left-hand side, with labels on the right.
- Label lines must be drawn in pencil, parallel. No crossing of lines.
- Labels must be written in pen.
- No sketching, shading or colouring is allowed.
- There must be a title written and underlined below the diagram.
- Only draw what is visible in the image.

Magnification calculations

Formula:



$$\text{Actual Image} = \frac{\text{Image Size}}{\text{Magnification}}$$

$$\text{Magnification} = \frac{\text{Image Size}}{\text{Actual Image}}$$

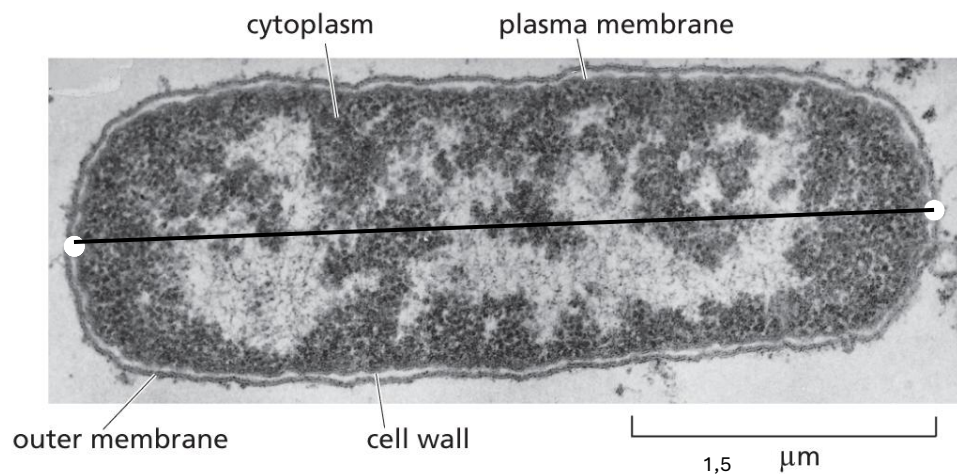
$$\text{Image Size} = \text{Actual} \times \text{Magnification}$$

Examples:

- Calculate the actual size on image that is 3cm, that has been magnified 400x.

- ii. Calculate the image size when a bacterium of $500\mu\text{m}$ is magnified $1000\times$.
- iii. What is the magnification of an image that is 5cm , when the actual size is $30\mu\text{m}$.

Calculating actual size using line scale:



Step one: Use a ruler to measure the image in mm. (X)

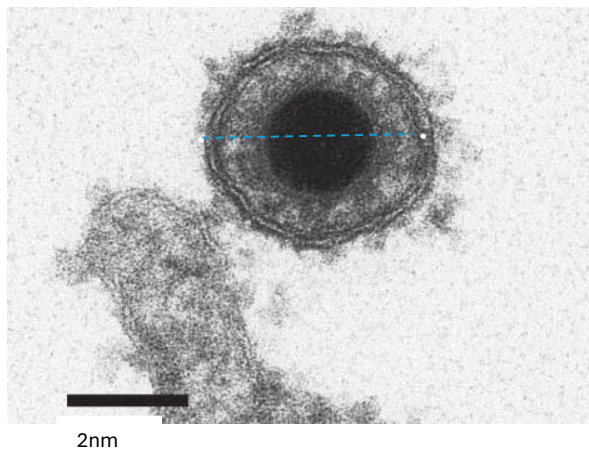
Step two: Use a ruler to measure the line drawn next to the image in mm. (Y)

Step 3: Divide these two values by each other, that is $\frac{X}{Y}$

Step 4: Multiply this by the value that is written below the line scale. (in this case 1,5)

Note that the unit of measurement for your final answer will be the same as the unit of the line scale (in this case μm)

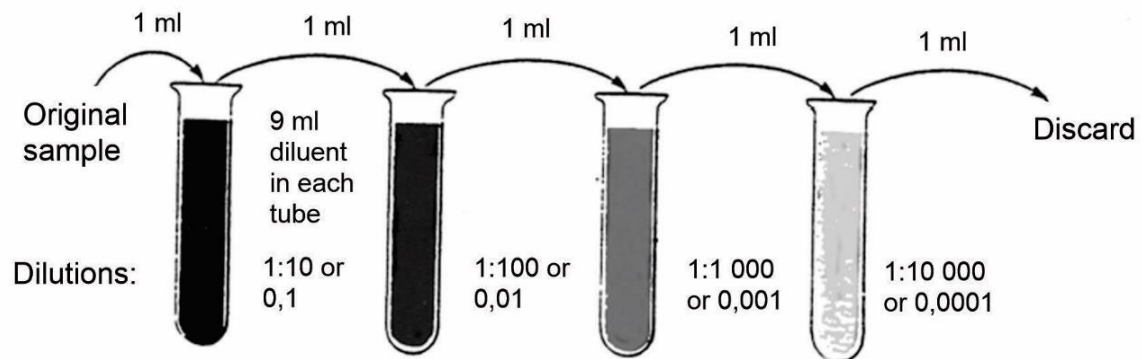
Example:



Calculate the actual size of the virus above:

Dilutions and concentration

Serial dilutions are often used to dilute samples by a dilution factor of say 10. For example, if you add 1 ml sample to 9 ml of a diluent (solution used to dilute), to get to 10 ml of total solution, this is a one in ten (1:10) dilution. Similarly, 2 ml sample added to 18 ml of a diluent, to get to 20 ml of total solution, is also 1:10 dilution. Repeating this from one tube or beaker to the next, results in repeated dilutions (e.g. 1:100 or 1:1 000 etc. with each successive dilution).



Concentration: 2ml of glucose syrup is added to 18ml of water.

Calculate the concentration of the solution:

$$\frac{\text{Amount of solvent}}{\text{Total volume}} \times 100$$

$$= \frac{2\text{ml}}{20\text{ml}} \times 100$$

$$= 10\% \text{ concentration}$$

Qualitative and Quantitative data.

- Qualitative data refers to observable data, that is not measured. For example, seeing if there is a colour change, or observing if bubbles form or not, seeing if a drop floats or sinks.
- Quantitative data refers to data that is measurable (has a value). E.g. how many bubbles are released, using a ruler to measure how much foam is formed, recording how long it took for something to happen.

Drawing tables

- Always use a sharp pencil and ruler.
- Table heading is written above the table.
- The heading must refer to the dependent and independent variable.
- If applicable, each column of the table must have a heading, with units.
- The independent variable must be written in the first column of the table.

Drawing graphs

- Heading must be written above the graph.
- Heading must refer to both the dependent and independent variable.
- The independent variable must be shown on the x-axis of the graph.
- The dependent variable must be shown on the y-axis.
- A scale must be used on each axis.
- Axes must be labelled, and units provided (if applicable)

Bar graphs

- Bar graphs depict discontinuous/ discrete information.
- There must be spaces between the bars. The spaces must be the same width.
- A key must be drawn when necessary.

Method.

Writing a method is usually done for 8 marks, however far more than 8 points are considered for all 8 marks to be awarded.

- Do not give a list of materials, it is not required.
- Layout: method must be numbered or bulleted (as per instructions)
- Aims: within your method you must state two aims of the experiment.

Aim 1: What is being observed or measured.

Aim 2: What does this observation/ measurement mean

- Original: your method must be original, do not simply copy the method of the first part of the experiment.
- Equipment: you must mention what was used in the experiment, e.g. test tube, scale, water, beaker, iodine, dropper.
- Measurements: Always state how much, eg. Size of test tube, volume of water used, size of beaker, how many drops of iodine.
- Validity: Does your experiment actually make sense, and does it relate to the aim that you were given. Remember to include a control.
- Results: you must state what is being observed/ measured/ recorded and you must say what this means to the experiment.

Accuracy and Reliability.

When a scientist repeats an experiment with a different group of people or a different batch of the same chemicals and gets very similar results under the same conditions then those results are said to be reliable. Reliability is measured by a percentage – if you get exactly the same results every time then they are 100% reliable.

Validity in an experiment is about the accuracy of measurement of the dependent variable. How do reliability and validity relate to each other?

A reliable measurement is not always valid; the results might be reproducible, but they are not necessarily correct.

A valid measurement is generally reliable; if a test produces accurate results, they should be reproducible.