General Writing Considerations

Content

A formal laboratory report consists of the following elements:

- Title
- Abstract
- Introduction
- Materials
- Procedures
- Results
- Conclusions
- Literature cited

Style, Format and Mechanics

- Laboratory reports are typed or written in ink.
- Each section is clearly indicated with a heading centered in the middle of the page. Capitalize the first letter of all words in the heading except articles (a, the), short prepositions (3 or fewer letters), and conjunctions (and, or). These headings may be bolded if you like.
- Check for spelling and grammatical errors. There should not be any cross-outs in the text.
- The laboratory report reflects the objective qualities of the scientific process. Avoid using the more personal first person singular ("I") or plural ("we"). The past perfect tense is preferred. The following is an example for writing sentences in the preferred past perfect tense without the use of the first person.

EXAMPLE

***Preferred* form written in past perfect tense:**
"The results indicated that solution A had a higher concentration than solution B."

***Avoid* this form using the first person:**
"From this experiment I learned that solution A was more concentrated than Solution B."

Introduction

Content

The introduction to the laboratory report includes a background discussion of the major concepts addressed in the laboratory. This section provides a brief, focused historical overview of the problem, definitions of terms related to the experiment and a statement of the purpose.

1. Clearly identifying the research topic being studied. Examples of sentences introducing the research topic include the following:

EXAMPLE

State the topic and identify major concept(s)   _____ [*state topic*] is the focus of this investigation. _____, the key concept underlying this major concept, is defined as   _____.

2. Orient the person reading your report to the subject using a concise review of relevant literature. Research the available scientific information regarding the selected experimental topic.
   - The literature cited may be from a variety of sources, i.e. your class text book, other text books, research articles, articles from the internet, etc.
   - Information must be unmistakably relevant to the specific content of the laboratory.
   - Be selective. When extracting information from other sources, identify 3 or 4 main points. Summarize each point in 1 sentence.
   - Provide a brief, focused historical overview. Introduce the relevant theory or scientific law related to these concepts. Include

     - *who* first discovered the law or formulated the theory
     - *when* the law was discovered
     - briefly *how* it was discovered

     Give an example of 1 or 2 other scientists who investigated the same topic more recently (within the last 5 years). State how each piece of historical information relates to the research topic.
   - When including definitions, state in your own words using the process taught in class.
   - Remember to begin with the more general definitions first and then include the more specific definitions.

EXAMPLE

Identify and define related, more specific concepts   _____ [1^{st} *concept*], _____ [2^{nd} *concept*], and _____[3^{rd} *concept*] are related concepts. _____ [*concept name*] is defined as   _____[*state definition in your words for each concept*].

3. The last sentence(s) of the introduction is the purpose statement. A clear way to start this sentence is to say, "The purpose of this experiment is to…"

Style, Format and Mechanics

- Write introduction using the present tense except when describing research completed in the past.
- Double-space the entire section.
- Key terms and definitions may be bolded.
- If ideas or terms are referenced, state the source of the information. Each citation should have the author(s) and year of publication. Sometimes the page number is required (see below).
  - **Author(s):** If there are **two** authors use an "&" between the last names. If there are **several** authors, state the primary author (the one that comes first) and then the abbreviation *et al*., meaning that all of the authors are included.
  - **Year:** The publication year can be found on one of first few pages of your text book. Look on the back of the book's title page for the copyright sign, "©." Use the most recent publication year. Journal articles are dated on the journal cover and within the journal as well.
  - **Page:** The page number is used only for a direct quote or citing specific facts. If there are multiple pages use the abbreviation pp. (pp. 390-396)
  - If you quote or paraphrase a specific fact or idea from a source, cite the author's last name, the year of publication, and the page number.
  - If you cite a general idea from the literature, the author(s) and year(s) of publication need to be referenced.
  - If you have a series of sentences relating to the same citation, cite that reference only once at the end of the first or last sentence referring to the citation.

EXAMPLE

Citing general ideas

Towle (1989) discusses the process of osmosis in terms of water molecules moving across a semi-permeable membrane.

or

Osmosis is a process that describes the movement of molecules across a semi-permeable membrane (Towle, 1989).

Citing specific ideas

According to Towle (1989), osmosis allows for an increase in turgor pressure which in turn forces guard cells to open and gas exchange to occur in plants (p. 396).

or

Osmosis allows for an increase in turgor pressure which in turn forces guard cells to open and gas exchange to occur in plants (Towle, 1989, p. 396).

Experiment (1): Measure of viscosity

Introduction

In this experiment, you will measure the terminal velocity of a ball bearing as it falls through a viscous liquid with the possibility of using this value to determine the viscosity as an extension task.

Equipment Provided:

- Measuring cylinder
- Beaker containing viscous liquid
- Access to a balance and micrometre screw gauge
- Tube filled with viscous liquid
- Elastic bands or other method of marking distances along tube
- Steel ball bearings
- Magnet
- Metre rule
- Stopwatch
- Paper towels

procedure

1. Measure the mass of an empty measuring cylinder. Pour some of the viscous liquid into the measuring cylinder. Record the volume of liquid and the new mass of the measuring cylinder.

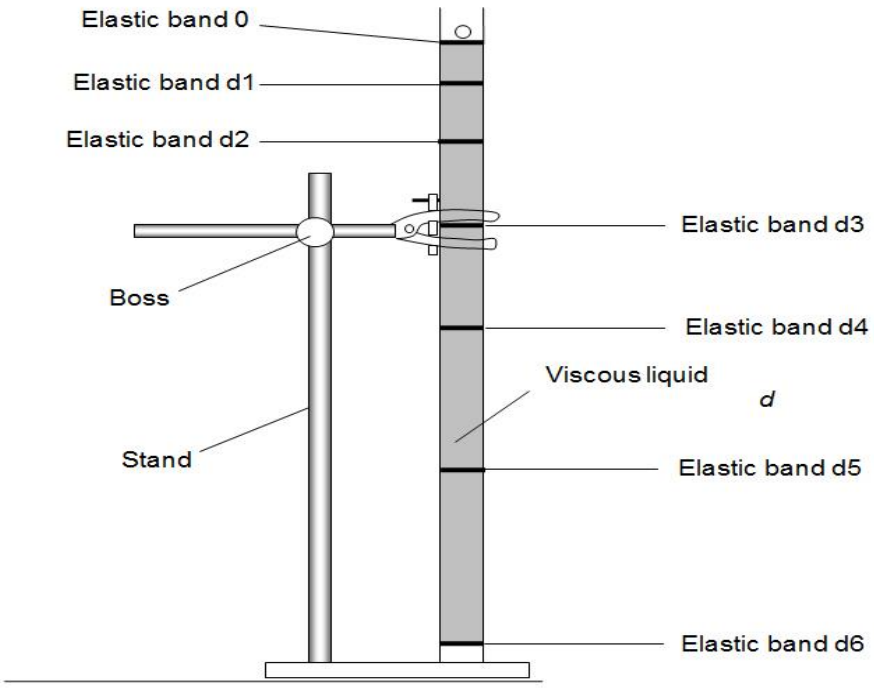

Fig. 1

Mass of measuring cylinder = kg
Volume of liquid = m3
Mass of measuring cylinder with liquid = kg

2. Determine the density of the liquid.
3. Measure and record the mass (m) and diameter (d) of the ball bearings.
4. Carefully drop a ball bearing into the center of the liquid and watch it fall as shown in Fig. 1.

5- Think about where the elastic bands should be placed to identify the distance travelled in equal time periods as the ball falls through the liquid.

6- As the ball drops, mark the positions of the ball at fixed time intervals using elastic bands. The magnet can be used to take a ball bearing out of the tube to repeat your measurements and refine the position of the bands.

7- For each time period measure the distance travelled between consecutive elastic bands, record the time period and use this time to calculate the average velocity of the ball.

8- Plot a graph of velocity v on the y-axis and cumulative time from the release of the ball, t on the x-axis and draw a smooth curve.

9- Identify the time at which the ball reached its terminal velocity.

10- Use your graph to determine the best value of terminal velocity.

11- Identify the range of values for terminal velocity and calculate the maximum percentage variation from your best value.

12- a) Draw a sequence of diagrams to represent the forces acting on the ball bearing at three different positions showing how they change.

b) Discuss what you would expect to happen with smaller or larger ball bearings, giving scientific explanations to support your reasoning.