basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

TECHNICAL SCIENCES

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 12

2025

These guidelines consist of 23 pages.

TABLE OF CONTENTS

1. INTRODUCTION

The 18 Curriculum and Assessment Policy Statement subjects which contain a practical component all include a practical assessment task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- SCIENCES: Computer Applications Technology, Information Technology, Technical Sciences, Technical Mathematics
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Civil Technology, Electrical Technology, Mechanical Technology, Engineering Graphics and Design

A practical assessment task (PAT) mark is a compulsory component of the final promotion mark for all candidates offering subjects that have a practical component and counts 25% (100 marks) of the examination mark at the end of the year. The practical assessment task for Technical Sciences Grade 12 consists of THREE experiments. The experiments are COMPULSORY for all candidates offering Technical Sciences in Grade 12. The practical component counts 25% of the final promotion mark.

The PAT is implemented during the first three terms of the school year. The formal experiments allow learners to be assessed regularly during the school year and it also allows for the assessment of skills that cannot be assessed in a written format, such as tests or examinations. It is therefore important that schools ensure that all learners complete the practical assessment tasks within the stipulated period to ensure that learners are promoted at the end of the school year. The planning and execution of the PAT differs from subject to subject.

2. TEACHER GUIDELINES

The practical assessment task for Technical Sciences Grade 12 consists of three experiments. The experiments are COMPULSORY for all candidates offering **Technical Sciences in Grade 12**. The practical component counts 25% of the final promotion mark.

2.1 Moderation of the PATs

The experiments should be administered under supervised conditions. Moderation of the experiments may take place on site and can include learners redoing the experiments in the presence of the moderator.

For moderation, the following are required either in a separate class or in a laboratory:

- List of names of learners who are sampled for district moderation
- Equipment/Apparatus/Chemicals placed ready at workstations
- Instruction sheets and worksheets (empty) for sampled learners to answer questions

For moderation, the following documents are required in the teacher's file:

- Index stating all tasks with raw and weighted marks
- All instruction sheets for all experiments
- Marking guidelines for all experiments
- Composite working mark sheet for all learners, showing raw and weighted marks
- Evidence of internal moderation

For moderation, the following documents are required in the learner's file:

- Index stating all tasks with raw and weighted marks
- Answer sheets for all experiments
- Declaration of authenticity

2.2 Procedure for administering the formal experiments

- All formal experiments have the following documents:
  - Instructions sheets explaining the procedure to be followed for the experiments
  - The worksheet consisting of questions to be answered under supervision
  - The teacher's guide with instruction sheets, worksheets and marking guidelines (The teacher's guide should NOT be released to the learners.)

  NOTE: Teachers should compile marking guidelines for the actual results of the experiments conducted. (The teacher should perform the experiment prior to the learners performing the experiment.)
- The teacher should hand out ONLY the instruction sheet for the conduct of the experiment.
- The experiments should be done individually or in pairs.
- In the case where there is insufficient apparatus, the experiments can be performed in groups of not more than FIVE learners. Each learner must submit individual work. NO group work will be allowed.

- Each learner should record his/her OWN data or observations.
- **Each learner should be provided with the worksheet to answer the questions under supervision conditions.**
- Teachers should only hand out the worksheets to each learner once learners have conducted the experiment and are ready to answer the questions under supervision conditions.
- If it is not possible to perform the experiment and complete the worksheet on the same day, the teacher should keep the data collected by the learners at the school after part of the experiment has been done. The data should only be handed back to the learners when they have to complete the worksheet.

3. LEARNER GUIDELINES

3.1 This practical component for Grade 12 consists of THREE experiments.

3.2 Compilation of the PAT should start in Term 1, monitored through Terms 2 and 3 and completed in Term 3.

3.3 The practical components count 25% of the final promotion mark for Grade 12.

3.4 All the work in the practical components must be the learner's own work. Group work will NOT be allowed.

3.5 Show ALL calculations clearly and include units. Round off answers to a minimum of TWO decimal places. Use correct SI units.

4. EVIDENCE OF MODERATION

LEARNER'S NAME: ______________________________

SCHOOL: ______________________________

	SIGNATURE OF TEACHER	DATE	SIGNATURE OF HOD	DATE
MODERATION: SCHOOL-BASED				

PRACTICAL COMPONENT	MAX. MARK	WEIGHTING	LEARNER'S MARK (TEACHER)	MODERATED MARK (SCHOOL)	MODERATED MARK (DISTRICT)	MODERATED MARK (PROVINCE)
EXPERIMENT 1	**40**	**40**				
EXPERIMENT 2	**30**	**30**				
EXPERIMENT 3	**30**	**30**				
TOTAL	**100**	**100**				

SCHOOL STAMP

5. EXEMPLAR OF PAT MARK SHEET

TECHNICAL SCIENCES GRADE 12 PAT WORKING MARK SHEET 2025										
SCHOOL:										
			TERM 1		TERM 2		TERM 3		
			Experiment 1: PAT		Experiment 2: PAT		Experiment 3: PAT		TOTAL PAT
			Raw	Weighted	Raw	Weighted	Raw	Weighted	
No.	SURNAME	NAME	40	40	30	30	30	30	100
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									
21.									
22.									
23.									
24.									
Average									

6. DECLARATION OF AUTHENTICITY

NAME OF THE SCHOOL: ………………………………………………………………..

NAME OF LEARNER: ……………………………………..………………...
(FULL NAME(S) AND SURNAME)

CLASS: ……….……………………………………………………………….

NAME OF TEACHER: ……………………………………………………….

I hereby declare that the tasks submitted for assessment is my own original work and have not been submitted for assessment or moderation previously.

___________________________________ ______________
SIGNATURE OF CANDIDATE **DATE**

As far as I know, the above declaration by the candidate is true and I accept that the work offered is his/her own.

___________________________________ ______________
SIGNATURE OF TEACHER **DATE**

SCHOOL STAMP

7. CONCLUSION

On completion of the practical assessment task, learners should be able to demonstrate their understanding of the industry, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real-world challenges. The PAT furthermore develops learners' life skills and provides opportunities for learners to engage in their own learning.

8. EXPERIMENT INSTRUCTIONS AND WORKSHEETS

EXPERIMENT 1

VERIFICATION OF THE PRINCIPLE OF CONSERVATION OF LINEAR MOMENTUM

1. AIM: To verify the principle of conservation of linear momentum when two trolleys are separated from each other

2. APPARATUS/EQUIPMENT

- Two mechanics trolleys of equal mass, with compressed spring system and frictionless wheels
- Frictionless trolley runway
- Two clamps
- Two buffers/barriers
- Mass pieces
- Two stopwatches
- Measuring tape/Metre ruler
- Measuring scale/Mass meter

3. PRECAUTIONS

- The wheels of the trolleys must be lubricated with oil to reduce the effects of friction.
- Ensure that the TWO trolleys hit the buffers/barriers at the same time.
- The readings on the stopwatches must be taken as soon as the sound of the collision of the trolleys with the buffers/barriers is heard.

4. PROCEDURE

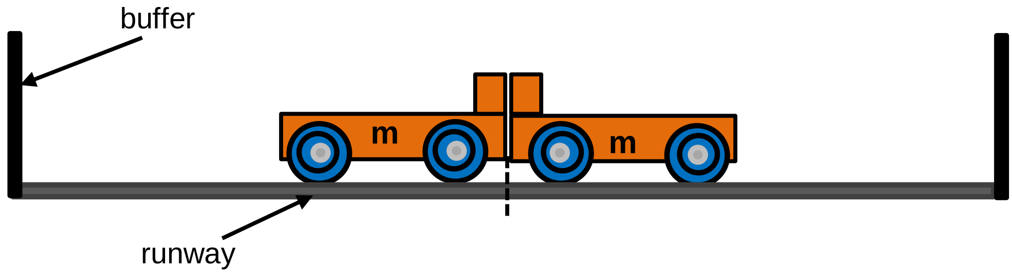
PART 1

Step 1: Clamp two wooden buffers at the end of each side of the horizontal runway.

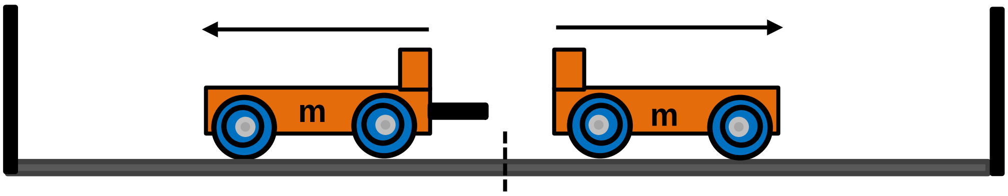
Step 2: Measure the mass of each trolley and record the data in **Table 1**.

Step 3: Measure the distance of the runway and mark off the exact starting point from which the trolleys hit the buffers/barriers simultaneously when released.
Label each section stretching from the buffer to the starting point of the runway $\mathbf{x_1}$ and $\mathbf{x_2}$ respectively.
Record the length of each section in **Table 1**.

Step 4: Place two trolleys head-on, one of a compressed spring, on the marked starting point of the runway.



Step 5: Perform the trial run.
Release the compressed spring, start the stopwatch at the same time and measure the time taken for the trolleys to collide with the buffers.
Record the time at which each trolley reaches the end of the runway.



Step 6: After the trial run, repeat steps **4** and **5** THREE times; record the data in **Table 1**.

Step 7: Use the information obtained to calculate the average momentum for each trolley in **Table 2**.

PART 2

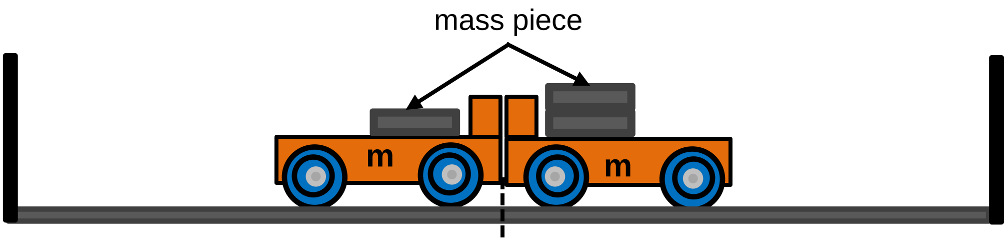
Step 8: Place ONE mass piece on one trolley and TWO or more mass pieces on the other trolley. The load on the trolleys must be different.

Step 9: Measure the mass of each trolley with its load and record the data in **Table 3**.

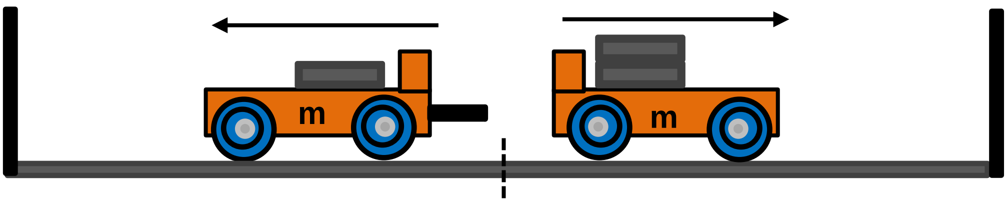
Step 10: Determine the starting point on the runway, where the trolleys should be placed so that they can hit the buffers/barriers at the same time.

Step 11: Measure the distance of the runway and mark off the exact starting point from which the trolleys hit the buffers/barriers simultaneously when released.
Label each section stretching from the buffer/barrier to the starting point of the runway $\mathbf{x_1}$ and $\mathbf{x_2}$ respectively.
Record the length of each section in **Table 3**.

Step 12: Place the two trolleys with their loads head-on once again on the position marked as the starting point on the horizontal runway.



Step 13: Perform a trial run.
Release the compressed spring. Start the stopwatch at the same time to measure the time taken for each trolley to collide with the buffers. Record the time taken for each trolley to reach the end of the runway.



Step 14: After the trial run, repeat steps **12** and **13** THREE times; record the data in **Table 3**.

Step 15: Use the information obtained to calculate the average momentum for each trolley in **Table 4**.

TABLE OF RESULTS

PART 1

TABLE 1

	Trolley 1 Mass (kg) = …………			**Trolley 2** Mass (kg) = …………		
Attempt	**Δx_1** distance (m)	**Δt** time (s)	**$V_{trolley\ 1}$** velocity ($m \cdot s^{-1}$)	**Δx_2** distance (m)	**Δt** time (s)	**$V_{trolley\ 2}$** velocity ($m \cdot s^{-1}$)
1						
2						
3						
Average						

TABLE 2

	Trolley 1	**Trolley 2**
Calculation of average momentum		

PART 2

TABLE 3

	Trolley 1 Mass (kg) = …………			**Trolley 2** Mass (kg) = …………		
Attempt	**Δx_1** distance (m)	**Δt** time (s)	**$V_{trolley\ 1}$** velocity ($m \cdot s^{-1}$)	**Δx_2** distance (m)	**Δt** time (s)	**$V_{trolley\ 2}$** velocity ($m \cdot s^{-1}$)
1						
2						
3						
Average						

TABLE 4

	Trolley 1	**Trolley 2**
Calculation of average momentum		

WORKSHEET FOR EXPERIMENT 1

VERIFICATION OF THE PRINCIPLE OF CONSERVATION OF LINEAR MOMENTUM

PRACTICAL SKILLS

CRITERIA	MARKS
Correct setting of the apparatus	2
Distances $\mathbf{x_1}$ and $\mathbf{x_2}$ are accurately measured between each trolley and the buffer	1
The readings on the stopwatch are taken as soon as the trolleys depart from each other and when the collision is heard of the trolleys hitting the buffers	2

(5)

TABLE OF RESULTS

PART 1

TABLE 1

	Trolley 1 **Mass (kg) = …………**			**Trolley 2** **Mass (kg) = …………**		
Attempt	**Δx_1** distance (m)	**Δt** time (s)	**$V_{trolley\ 1}$** velocity ($m\cdot s^{-1}$)	**Δx_2** distance (m)	**Δt** time (s)	**$V_{trolley\ 2}$** velocity ($m\cdot s^{-1}$)
1						
2						
3						
Average						

(7)

TABLE 2

	Trolley 1	**Trolley 2**
Calculation of average momentum		

(5)

PART 2

TABLE 3

	Trolley 1 **Mass (kg) = …………**			**Trolley 2** **Mass (kg) = …………**		
Attempt	**Δx_1** distance (m)	**Δt** time (s)	**$V_{trolley\ 1}$** velocity ($m \cdot s^{-1}$)	**Δx_2** distance (m)	**Δt** time (s)	**$V_{trolley\ 2}$** velocity ($m \cdot s^{-1}$)
1						
2						
3						
Average						

(7)

TABLE 4

	Trolley 1	**Trolley 2**
Calculation of average momentum		

(4)

DATA ANALYSIS AND INTERPRETATION

1. Formulate a hypothesis for this investigation. (2)

2. Why is it expected that the trolleys should collide with the buffers/barriers at the same time during Part **1**? (2)

3. What is the value for the sum of the momentum of the trolley system before separating from one another in Part **1**? (1)

4. Calculate the sum of the momentum of the trolley system (i.e. Trolley 1 and 2) after separating from one another in:

   4.1 Part **1** (2)

   4.2 Part **2** (2)

5. What can be deduced from the total linear momentum of the trolleys before and after separation? (2)

6. Write down a mathematical equation which explains the relationship between the momentum of the trolleys before and after separation in this experiment. (1)

[40]

EXPERIMENT 2

DETERMINING THE BOILING POINTS OF ORGANIC COMPOUNDS

1. AIM: To determine the boiling points of methanol, ethanol and propanol

2. APPARATUS/EQUIPMENT

- Bunsen burner/Gas burner
- Stand and wire gauze
- Three sealed end capillary tubes
- Rubber band/String/Thread
- 250 cm^3 glass beaker
- Three test tubes
- Three calibrated pipettes/measuring cylinders
- Three thermometers
- Retort stand and clamp

REAGENTS/CHEMICALS

- Water
- 50 mℓ methanol
- 50 mℓ ethanol
- 50 mℓ propanol

3. PRECAUTIONS

- Wear protective clothing (hand gloves, goggles, nose mask and a laboratory coat).
- Work in a fume cabinet/a well-ventilated room.
- Do not expose the organic compounds to a naked flame.

4. PROCEDURE

Experimental setup:

Assemble the apparatus as shown in the diagram below.

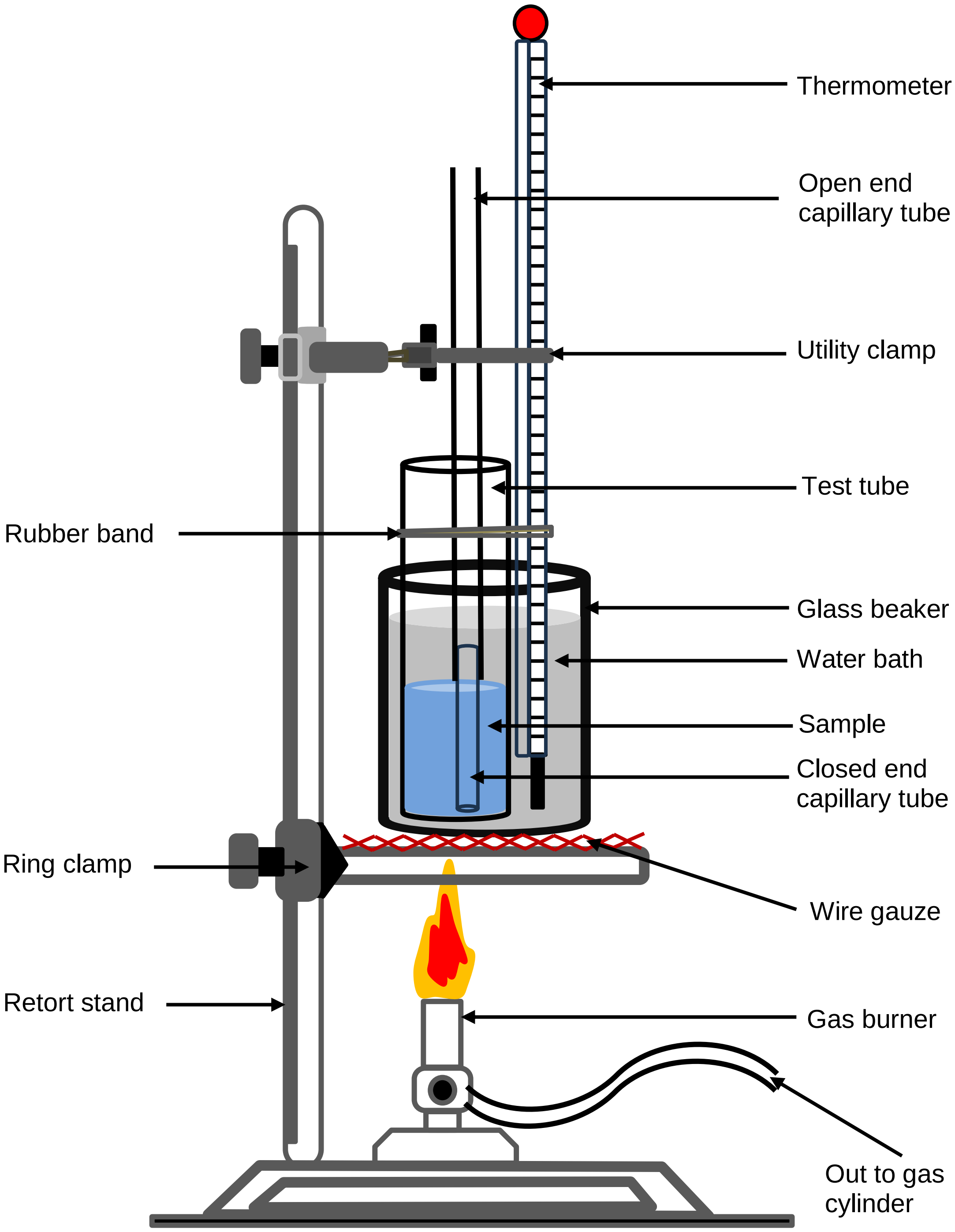


FIGURE 1

Assemble the apparatus as shown in the diagram below.

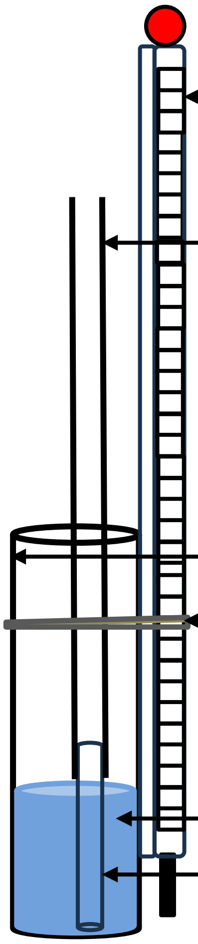


FIGURE 2

Step 1: Attach the thermometer firmly to the test tube with a rubber band/string/thread.

Step 2: Use the pipette to measure 10 mℓ of methanol and place it into the test tube.

Step 3: Fit a closed end capillary tube onto a long open end one and then place it open end down into the sample.

Step 4: Clamp the entire assembly to a retort stand.

Step 5: Immerse the assembly into a water bath and place it on wire gauze on top of a burner.

Step 6: Heat the water bath and carefully observe the changes that take place in the assembly.
As the temperature is increased slowly, gas bubbles evolve from the end of the capillary tube.

Step 7: Continue heating for 5–10 seconds until ALL air has been expelled from the capillary tube and ONLY vapours of the sample remain inside it.

Step 8: Remove the heat while the assembly remains in the water bath and carefully observe any changes that occur inside the capillary tube.
Bubbles will continue to be seen in the capillary tube until the pressure exerted by the vapour of the sample becomes equal to atmospheric pressure. As the temperature decreases, the bubbles will slow down and come to a stop. At this point, the boiling point of the sample is reached.

Step 9: Use the table to record the reading on the thermometer as soon as the bubbles stop. The temperature observed at this point is the boiling point of the sample.

Step 10: Compare the experimental result to the literature value provided in the table of boiling points of organic compounds below.

Step 11: Discard the contents of the test tube and clean up the apparatus thoroughly.

Step 12: Allow the water bath to cool to at least 25 °C below the literature value of the boiling point of the substance.

Step 13: Repeat steps **2** to 1**2** TWO times for the same organic compound using a new closed end capillary tube each time.

Step 14: Follow steps **2** to 1**3** for ethanol and propanol respectively.

LITERATURE VALUES OF BOILING POINTS	
SUBSTANCE	**BOILING POINT (°C)**
Methanol	65
Ethanol	78–79
Propanol	97–98

DATA REPRESENTATION

TABLE 1

EXPERIMENTAL VALUES OF THE BOILING POINTS OF METHANOL, ETHANOL AND PROPANOL

EXPERIMENT NUMBER	**EXPERIMENTAL VALUES OF BOILING POINTS (°C)**		
	Methanol	**Ethanol**	**Propanol**
1			
2			
3			
Average			

WORKSHEET FOR EXPERIMENT 2

DETERMINING THE BOILING POINTS OF ORGANIC COMPOUNDS

PRACTICAL SKILLS

CRITERIA	MARKS
Collecting and setting up all the apparatus/tools as per the instruction/ procedure	2
Measuring skills: • Measuring 10 mℓ sample of the liquid organic compound • Accurate reading of the temperatures on the thermometer	2
Safety precautions: • Safe handling of all apparatus and chemicals • Cleaning of the apparatus before each procedure	2

(6)

TABLE OF RESULTS

EXPERIMENT NUMBER	EXPERIMENTAL VALUES OF BOILING POINTS (°C)		
	Methanol	**Ethanol**	**Propanol**
1			
2			
3			
Average			

(6)

QUESTIONS

1. Explain why it is important to clean the apparatus before each procedure. (1)

2. Why is it important that the procedure be repeated THREE times for each organic compound? (1)

3. Why are these organic compounds heated in a water bath? (2)

4. Define the term *vapour pressure.* (2)

5. For the organic compounds used in this experiment, write down the:

   5.1 Name of their functional group (1)

   5.2 General formula of the homologous series to which they belong (1)

6. Write down THREE types of intermolecular forces that exist in the organic compounds used in this experiment. (3)

7. Arrange these organic compounds in order of increasing boiling points. (2)

8. Explain the reason(s) for the observed differences in the boiling points of these three compounds. (3)

9. What conclusion can be drawn from the results of this experiment? (2)

[30]

EXPERIMENT 3

DETERMINING THE EFFECT OF THE CHANGE IN MAGNETIC FLUX IN A SOLENOID/COIL

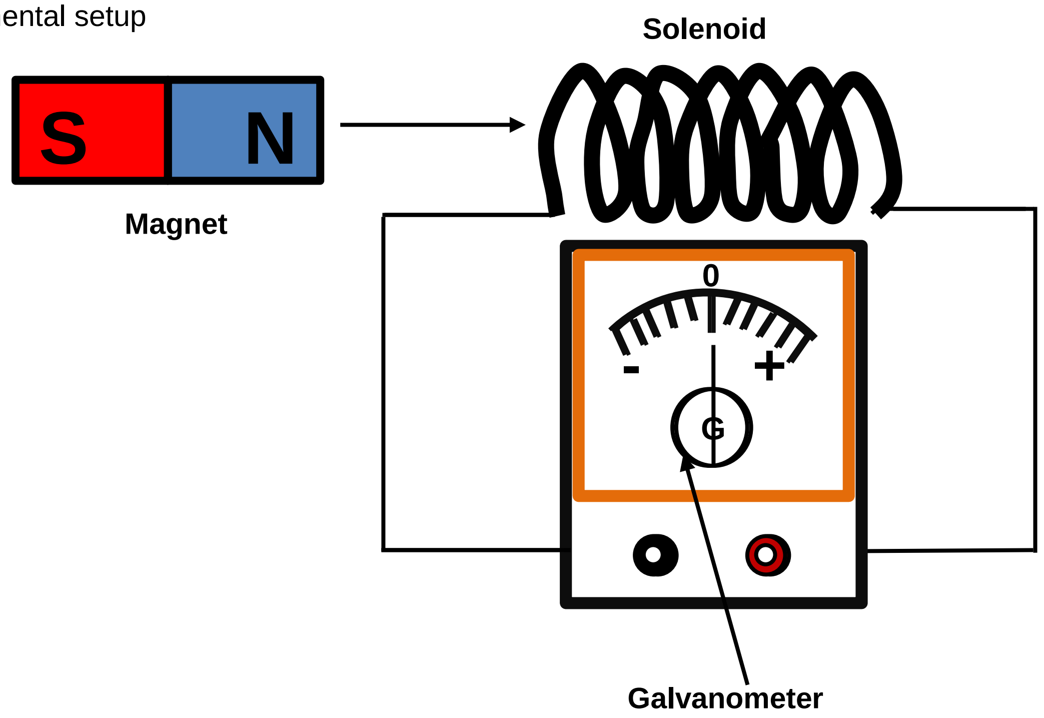
1. AIM: To determine the effect of the changing magnetic flux in a solenoid or coil

2. APPARATUS/EQUIPMENT

- TWO solenoids with different number of turns
- TWO bar magnets of different strengths
- Conducting wires
- Galvanometer

3. PROCEDURE

Experimental setup



PART 1: USING THE SAME BAR MAGNET AND TWO SOLENOIDS/COILS WITH DIFFERENT NUMBER OF TURNS

Step 1: Connect the solenoid/coil with fewer number of turns to the galvanometer.

Step 2: Insert the north pole of the bar magnet into the solenoid/coil and observe what happens to the needle of the galvanometer and record in the table provided.

Step 3: Keep the bar magnet still inside the solenoid/coil and observe and record what happens to the needle on the galvanometer.

Step 4: Pull the bar magnet out of the solenoid/coil and observe and record what happens to the needle on the galvanometer.

Step 5: Repeat steps **1** to **4** with the same magnet inserted into the solenoid/coil with more turns.

DATA REPRESENTATION/OBSERVATIONS

PART 1: USING THE SAME BAR MAGNET AND TWO SOLENOIDS/COILS WITH DIFFERENT NUMBER OF TURNS

ACTION	OBSERVATION	MARKS
The north pole of the bar magnet is inserted into the solenoid/coil with fewer number of turns.		1
The bar magnet is kept still inside the solenoid/coil.		1
The bar magnet is pulled out of the solenoid/coil.		1
The north pole of the bar magnet is inserted into the solenoid/coil with higher number of turns.		1
The bar magnet is pulled out of the solenoid/coil with higher number of turns.		1

PART 2: USING THE SAME SOLENOID/COIL AND BAR MAGNETS WITH DIFFERENT MAGNETIC FIELD STRENGTHS

Step 6: Connect the solenoid/coil with higher number of turns to the galvanometer.

Step 7: Insert the north pole of the bar magnet with a lower magnetic field strength slowly into the solenoid/coil with higher number of turns and observe what happens to the needle of the galvanometer.

Step 8: Keep the bar magnet still inside the solenoid/coil and observe the needle on the galvanometer.

Step 9: Pull the bar magnet out of the solenoid/coil and observe what happens to the needle on the galvanometer.

Step 10: Repeat steps **6** to **9** with the same solenoid, but with a magnet that has a higher magnetic field strength.

4. DATA REPRESENTATION/OBSERVATIONS

PART 2: USING THE SAME SOLENOID/COIL AND BAR MAGNETS WITH DIFFERENT MAGNETIC FIELD STRENGTHS

ACTION	OBSERVATION	MARKS
The north pole of the bar magnet with a weaker magnetic field strength is inserted into the solenoid/coil with a higher number of turns.		1
The north pole of the bar magnet with a stronger magnetic field strength is inserted into the solenoid/coil with a higher number of turns.		1

WORKSHEET FOR EXPERIMENT 3

DETERMINING THE EFFECT OF THE CHANGE IN MAGNETIC FLUX IN A SOLENOID/COIL

PRACTICAL SKILLS

CRITERIA	MARKS
Correct setting up of the apparatus	1
Galvanometer set to the most appropriate scale	1
Correct use of apparatus	1
Following a sequence of instructions logically	1

(4)

TABLE OF RESULTS

PART 1: USING THE SAME BAR MAGNET AND TWO SOLENOIDS/COILS WITH DIFFERENT NUMBER OF TURNS

ACTION	OBSERVATION	MARKS
The north pole of the bar magnet is inserted into the solenoid/coil with fewer number of turns.		1
The bar magnet is kept still inside the solenoid/coil.		1
The bar magnet is pulled out of the solenoid/coil.		1
The north pole of the bar magnet is inserted into the solenoid/coil with higher number of turns.		1
The bar magnet is pulled out of the solenoid/coil with higher number of turns.		1

(5)

PART 2: USING THE SAME SOLENOID/COIL AND BAR MAGNETS WITH DIFFERENT MAGNETIC FIELD STRENGTHS

ACTION	OBSERVATION	MARKS
The north pole of the bar magnet with a weaker magnetic field strength is inserted into the solenoid/coil with a higher number of turns.		1
The north pole of the bar magnet with a stronger magnetic field strength is inserted into the solenoid/coil with a higher number of turns.		1

(2)

QUESTIONS

1. Define the term *magnetic flux*. (2)

2. What happens to the needle on the galvanometer when the N-pole of the bar magnet is moved into the solenoid/coil? (1)

3. Is current induced in the solenoid/coil when the bar magnet does not move relative to the solenoid/coil? Give a reason. (2)

4. What happens to the needle on the galvanometer when the N-pole is pulled out of the solenoid/coil? (1)

5. The S-pole of the bar magnet is moved into the solenoid/coil. What happens to the needle on the galvanometer? (1)

6. State THREE ways in which the magnitude of the induced current in the solenoid/coil can be increased. (3)

7. NAME and STATE the law used to explain the observation in this experiment. (3)

8. Write down a conclusion for this experiment. (2)

9. The magnetic flux linking the solenoid/coil of 150 turns changes from 0,02 Wb to 0,036 Wb in 3 milliseconds.

   Calculate the induced emf in the solenoid/coil. (4)
   [30]

TOTAL: 100