LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

SEKHUKHUNE SOUTH

NSC

GRADE 10

PHYSICAL SCIENCES

EXPERIMENT 2

MARKS: 50 **TIME:** 120 min

QUESTION	MARKS	LEARNERS'MARK	MODERATORS MARK	
PART 1	8			
PART 2	18			
PART 3	24			

Name of Learner: .....

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Aim: To determine the position-time, velocity-time and acceleration-time graphs of a trolley.

Apparatus

- A power supply (12 V)
- Ticker timer and tape
- Trolley track
- Trolley
- Graph paper
- Ruler
- Books or wooden blocks to support the trolley track.

Pre-Lab Discussion

When investigating the motion of objects we can use a **ticker timer**. In most cases a ticker timer is connected to an alternating electricity supply. The devise uses the mains electricity frequency of 50 hertz to make 50 ticks per second. A metal strip is made to vibrate up and down 50 times every second according to the frequency of the mains. The vibrating metal strip strikes a paper tape through a carbon paper disc and so prints a dot on the tape 50 time per second. Therefore the time interval Δt between one dot and the next is always 1/50 second or 0,02s.

Practical Skills

Amongst other skills, these are the important skills displayed in this experiment:

- Observations
- Graph plotting
- Data collection and presentation
- Recording of accurate and precise measurements
- Handling of Apparatus

Method

1. **Place** a stopper at the end of the track to stop the trolley from falling off.
2. **Position** the ticker timer unit on or next to the other end of the track. Ensure it is firmly in place.
3. **Connect** the ticker timer unit to the AC power pack with the two connecting leads.
4. **Raise** the end of the track which is near to the ticker timer unit by placing a few books under it.
5. **Measure** a length of ticker tape equal to the length of the track + 10 cm. **Run** the ticker tape through the ticker tape unit and attach the tape to one end of the trolley.

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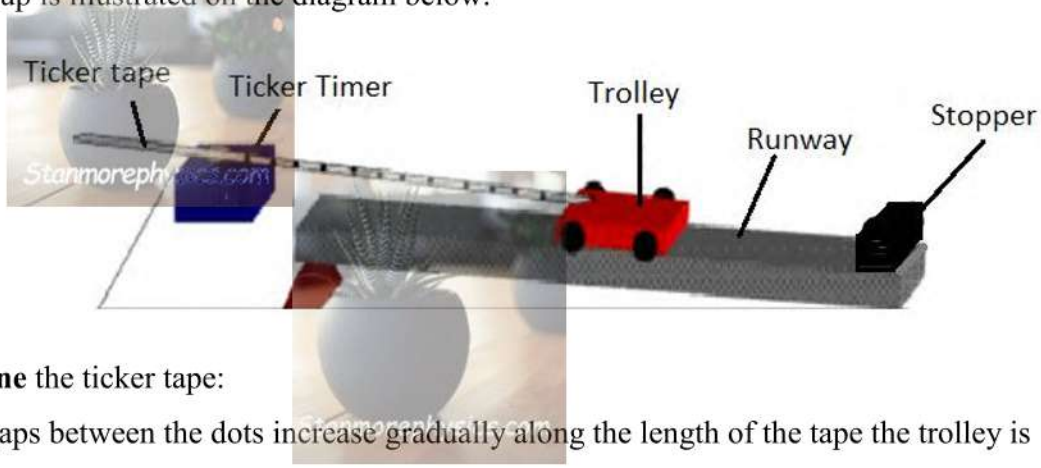
6. **Place** the trolley on the raised end on the track and hold it in a position which will allow it to run down the track to the other end.
7. **Start** the ticker timer and **release** the trolley, allowing it to run freely down the track while it pulls the tape through the timer.
8. **Stop** the timer when the trolley reaches the stopper at the other end.

   The setup is illustrated on the diagram below.



9. **Examine** the ticker tape:
10. If the gaps between the dots increase gradually along the length of the tape the trolley is accelerating. Lower the height of the track a little (by removing a book or two) and repeat the procedure from step 5.
11. If the gaps between the dots on the tape are of equal length, the trolley is running at constant velocity. Move on to the next step.
12. **Repeat** steps 5 to 8 and then label the ticker tape as run 1.
13. **Raise** the trolley track to allow the trolley to accelerate down the track and repeat steps 5 to 8. Label the tape as run 2.

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Observations and recording of results:

Analyse each ticker tape as follows and complete the table below as you work through this section:

1. Choose a section of tape where the gaps between the dots are easy to see and for run 1 are equally spaced and run 2 are gradually increasing.
2. Mark off consecutive segments of five gaps between dots as A,B,C etc.
3. Measure the distance between A & B, B & C, C & D etc.
4. Calculate the period of the ticker timer using the frequency indicated on the timer and hence calculate the time taken to make 5 dots.
5. Copy the table below and record your results.

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Run 1 Distance between the intervals Δx (m)	Run 2 Distance between the intervals Δx (m)	Time taken to form the 5 gaps (s)
AB =	AB =	
BC =	BC =	
CD =	CD =	
DE =	DE =	
EF =	EF =	

6. Keep your results for use in part 2 of the experiment.

PART 1: ASSESSMENT OF LEARNERS' CONDUCT OF THE EXPERIMENT.

NAME: _____ **GRADE:** _____

Skills	0 Marks	1 Mark	2 Marks	Mark obtained
Setting up the apparatus	The apparatus is incorrectly set up and the set up cannot give readings.	An attempt has been made to set up the apparatus correctly but there are one or two mistakes which can compromise the readings.	The apparatus has been set up correctly in all respects, and readings to be taken would be reliable.	
Reading and following instructions	Learners are totally unable to follow instructions and conduct the experiment. They need to be assisted with every step of the experiment.	Learners need to be assisted with some steps (one or two) of the experiment.	Learners follow instructions appropriately and conduct the experiment appropriately without help from the teacher.	
Observations, data collection.	Inaccurate results on the ticker tapes for both run 1 & 2 and the learners were totally unable to analyse the ticker tapes.	Inaccurate results on the ticker tape for one of the runs e.g for run 1 the spacing indicates that the trolley was accelerating. Inaccurate analysis of the ticker tapes	Accurate results on the ticker tapes for both runs and learners were able to analyse the ticker tapes accurately.	
Measurements, calculations and recording of results.	Completely incorrect measurements and calculations.	Either the measurements or calculations inaccurate or incorrect OR Accurate for only one of the runs.	Accurate measurements and calculations for both runs.	
			TOTAL:	

[8]

PART 2

PART 2: ASSESSMENT ACTIVITY

1. What does the spacing of the dots of the ticker tapes tell you about the motion of the trolley during:

    1.1. Run 1 (1)

    1.2. Run 2 (1)

2. On different sets of axes draw position versus time graph for:

    2.1. Run 1 (7)

    2.2. Run 2 (7)

3. Write down a conclusion for your experiment and explain how you reached to your conclusion. (2)

TOTAL: [18]

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Name & Surname: _____ Grade: _____

QUESTION 1.1

Name & Surname: _____ Grade: _____

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QUESTION 1.2

PART 3

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GRADE 10

PHYSICAL SCIENCES

PRACTICAL TEST 2

MARKS: 24 TIME: 30 min

QUESTION	MARKS	LEARNERS'MARK	MODERATORS MARK	
PART 3	24			

Name of Learner: ……

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INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of TWO questions. Answer ALL the questions.
3. You may use a non-programmable calculator.
4. You may use appropriate mathematical instruments.
5. You are advised to use the attached GRAPH SHEETS.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Write neatly and legibly.
8. Start EACH question on a NEW page in the ANSWER BOOK.
9. Leave ONE line between two sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
10. Show ALL formulae and substitutions in ALL calculations.
11. Round off your final numerical answers to a minimum of TWO decimal places, where needed.
12. Give brief motivations, discussions, et cetera, where required.

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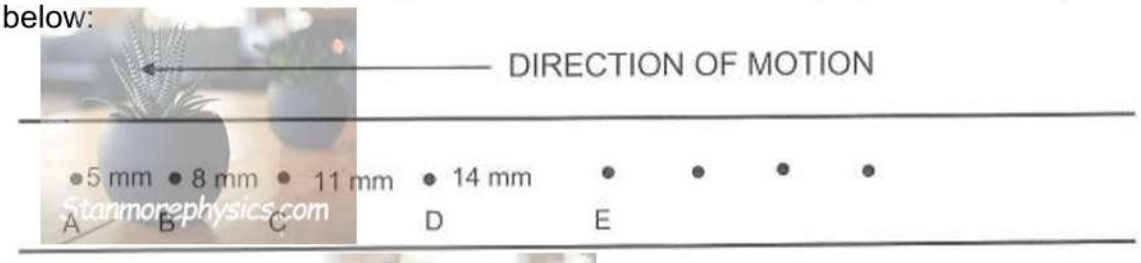
QUESTION 1 (Start on a new page)

A ticker tape is connected to the trolley and is pulled through a ticker timer when the trolley moves. The frequency of the timer is 50 Hz. The tape produced is represented below:



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1.1. Determine the period of the timer. (2)

1.2. Define the term *velocity*. (2)

1.3. Calculate he average velocity of the trolley for the interval A – C. (3)

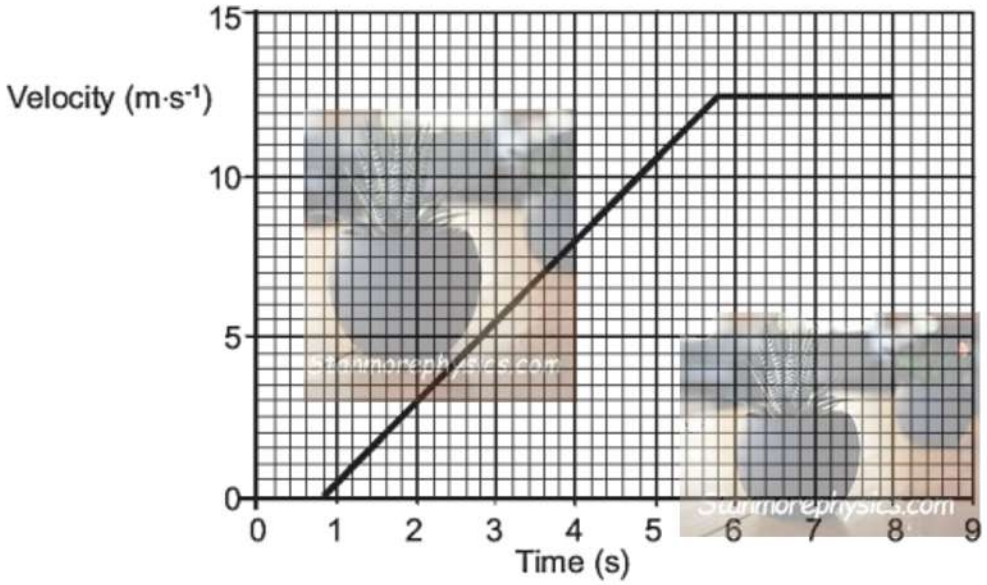
1.4. After how long will the trolley reach point E? (2)

1.5. Describe the motion of the trolley after it passes point E. (2)

[11]

QUESTION 2

2. A driver stops his car at the traffic light when it turns red. The graph of the car's velocity against time shows its motion for $8s$ from the time the traffic light turns green.



2.1. The short time interval between the traffic light turning green (for GO) and the driver responding to the signal, is known as "the driver's reaction time".

2.1.1. How long does the driver take to respond when the traffic light changing to green? (1)

2.1.2. Give TWO factors that can affect the reaction time of a driver. (2)

2.2. Determine the maximum speed of the car. (1)

2.3. Use the graph to calculate the average acceleration of the car. (4)

2.4. What is the acceleration of the car between time interval 6 to 8s? (1)

2.5. Draw acceleration vs time graph to represent the motion of the car from 0s to 8s. (4)

[13]

TOTAL: 24

Name & Surname: _____ Grade: _____

QUESTION 2.5

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GRADE 10

PHYSICAL SCIENCES

EXPERIMENT 2

MARKING GUIDELINE

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MARKS: 50

This marking guideline consists of 6 pages

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NAME: _____ **GRADE:** _____

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			TOTAL:	

[8]

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PART 2
QUESTION 1

1.

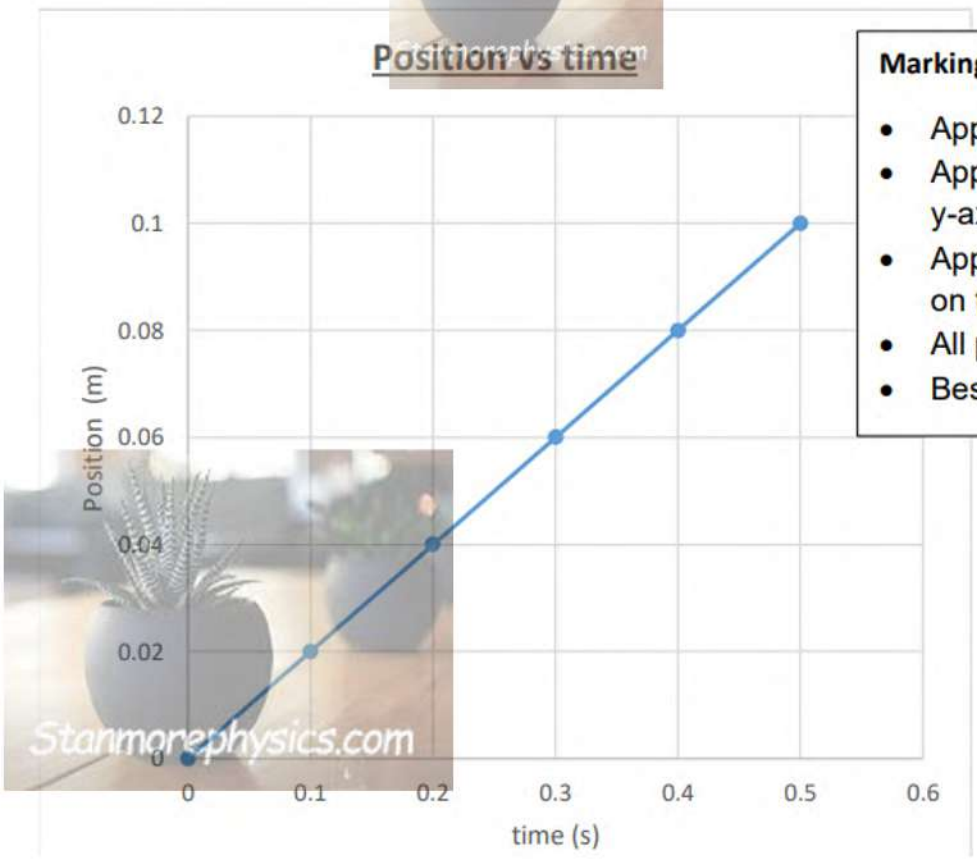
1.1. Constant velocity ✓ (1)

1.2. Velocity is not constant, trolley is accelerating ✓ (1)

NB: All the graphs below are just examples of the kind of graph learners should draw from their results. Arbitrary values have been used, learners' graphs will therefore not be exactly the same as these with regards to the values.

2.

2.1. Run 1

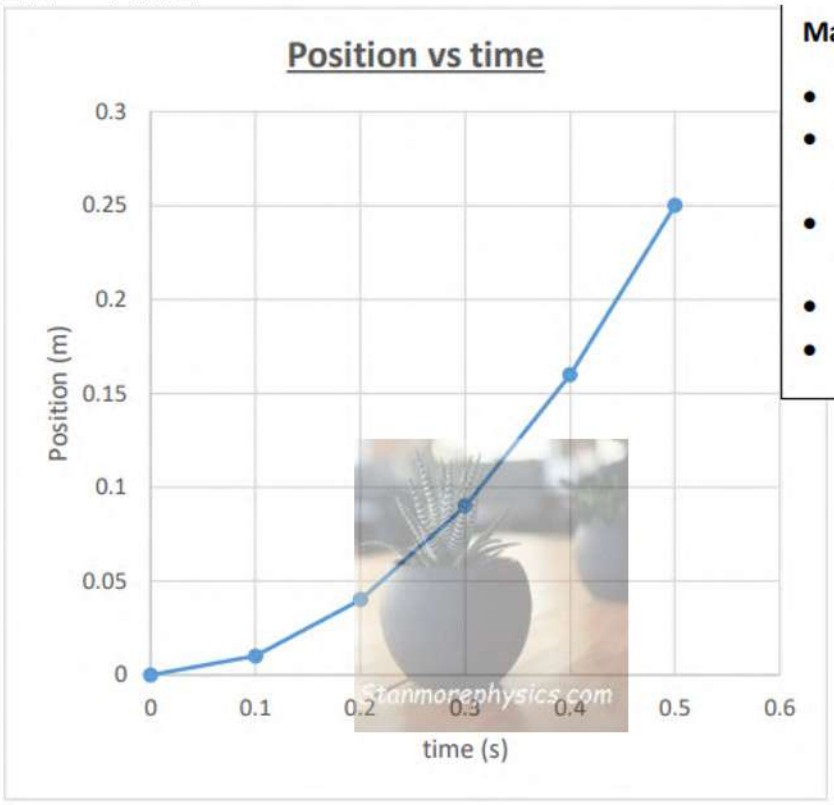


Marking guidelines:

- Appropriate title (heading). ✓
- Appropriate scale on x-axis and y-axis✓
- Appropriate labels and SI units on the x and y axes ✓
- All points plotted correctly. ✓✓
- Best fit straight-line graph ✓✓

(7)

2.2. Run 2



Marking guidelines:

- Appropriate title (heading). ✓
- Appropriate scale on x-axis and y-axis✓
- Appropriate labels and SI units on the x and y axes ✓
- All points plotted correctly. ✓✓
- Accurate best fit line drawn. ✓✓

(7)

3. **CONCLUSION**.

In run 1 the trolley was moving at a constant velocity. ✓
In run 2 the trolley was accelerating. ✓

(2)

PART 3

Question 1

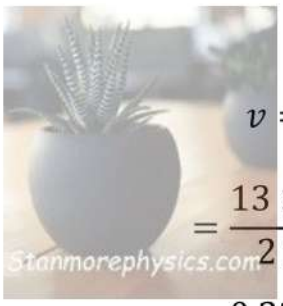
1.1.

$$T = \frac{1}{f} \quad \checkmark$$
$$= \frac{1}{50}$$
$$= 0{,}02s \ \checkmark$$

(2)

1.2. Rate of change of displacement ✓ ✓ (2)

1.3.



$$v = \frac{\Delta X}{t} \quad \checkmark$$
$$= \frac{13 \times 10^{-3}}{2 \times 0{,}02} \quad \checkmark$$
$$= 0{,}325 m.s^{-1} \quad \checkmark$$

(3)

1.4.

$$\Delta t = 4 \times 0{,}02 \ \checkmark$$
$$= 0{,}08s \ \checkmark$$

(2)

1.5. Constant velocity ✓ ✓ OR equal displacements per time interval ✓ ✓ (2)

[11]

Question 2

2.

2.1.

2.1.1. $0{,}8s$ (1)

2.1.2.

- The driver's concentration (due to ill health, older age, being distracted by cell phone message or call, affected by alcohol or medication or taking illegal drugs) ✓
- The driver's reflexes (the time taken for his mind to respond to seeing the traffic light go green) (due to ill health, older age, inexperienced

driver who has recently passes the driver's test, alcohol or medication or taking illegal drugs). ✓

ANY RELEVENT

2.2. $12{,}5\ m \cdot s^{-1}$ ✓

2.3.

$$Average_{acc} = \frac{\Delta v}{\Delta t} \quad ✓$$

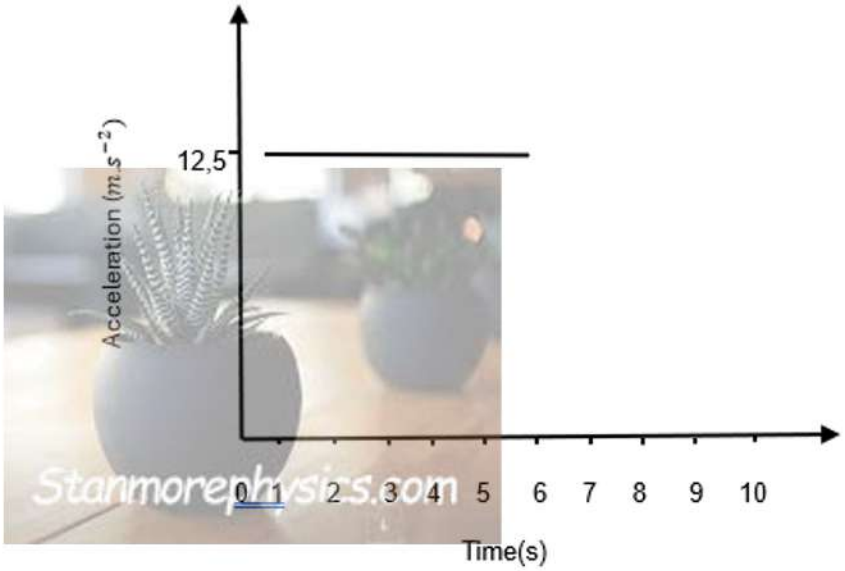
$$= \frac{12{,}5-0}{5{,}8-0{,}8} \quad ✓✓$$

$$= 2{,}5 m.s^{-2} \quad ✓$$

(4)

2.4. $0\ m.s^{-2}$ ✓ (1)

2.5. Acceleration vs Time graph



(4)

[13]