



**LIMPOPO**  
PROVINCIAL GOVERNMENT  
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF  
**EDUCATION**

CAPRICORN NORTH DISTRICT

**NATIONAL SENIOR CERTIFICATE**

**GRADE 11**

*Stanmorephysics.com*

**PHYSICAL SCIENCES  
FORMAL EXPERIMENT 1**

**19 FEBRUARY 2026**

*Stanmorephysics.com*

**MARKS: 25**

**TIME: 1 HOUR**

This PRACTICAL SHEET consists of 3 pages including cover.

**TITLE: INVESTIGATING NEWTON 'S SECOND LAW OF MOTION**

**Method:**

1. Place a trolley on smooth runway and tilt the runway very slightly so that the slope compensates for the friction between the wheels and the runways.
2. N.B. If pushed gently the trolley should move at a constant velocity down the track
3. Measure the mass of the trolleys
4. Attach the ticker tape to the trolley and thread the tape through the ticker timer
5. Attach a smooth pulley vertically to the bottom of the runway
6. Tie a light thread to the trolley and allow the thread to hang freely over the almost frictionless pulley
7. Tie a small hook to other side of the thread from which a mass piece can hang, test the trolley without a mass piece to see if it will move at a constant velocity
8. Place a mass piece on the hook and place the other three on the trolley
9. Switch the ticker timer on and allow the trolley to be pulled down the slope by the mass piece
10. Repeat the experiment at least three times, each time hanging another 10 g mass piece on the hook

**PART A: Write a scientific report which must include the following**

1. Aim (1)
2. Investigative question (1)
3. Hypothesis (1)
4. Variables
  - 4.1.Independent variable (1)
  - 4.2.Dependent Variable (1)
  - 4.3.Controlled Variable (1)
5. Apparatus/Materials used (2)
6. Method (2)
7. Results (3)

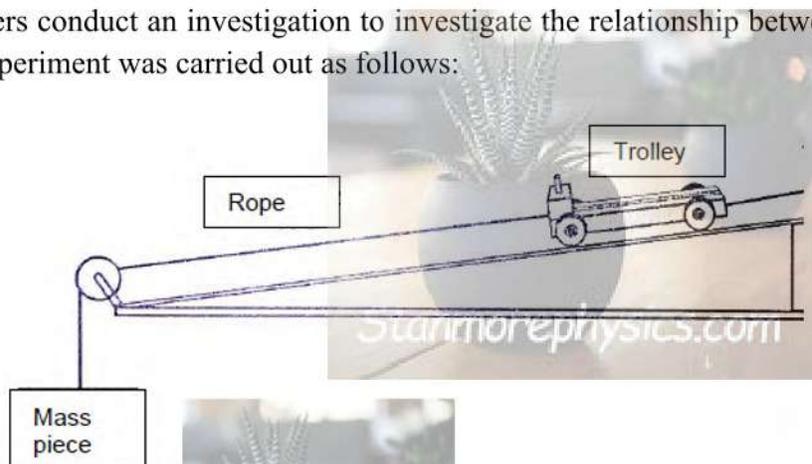
Mass on holder (m) in (kg)	Force of Holder (mg)	Segment 1 (m)	Segment 2 (m)	Segment 3 (m)	Average speed (v1) Segment 1/0.1 (m/s)	Average speed (v3) Segment 3/0.1 (m/s)	Acceleration (a) $\frac{v3-v1}{0.2}$ (m/s <sup>2</sup> )
0.010							
0.020							
0.030							

8. Draw the graph of the net force versus acceleration (3)
9. Conclusion (2)

**[PART A: 18 MARKS]**

**PART B**

A group of learners conduct an investigation to investigate the relationship between acceleration and mass. The experiment was carried out as follows:



The trolley track was slightly raised. The slope was kept constant throughout. The mass piece, which was connected to the front end of the trolley, accelerated the trolley down the slope. The mass was increased after each reading, by stacking another trolley on top of the others.

The following results were obtained:

Force (N)	Mass (number of trolleys)	Acceleration ( $\text{m}\cdot\text{s}^{-2}$ )
2.45	1	4.4
2.45	2	2.8
2.45	3	2.3
2.45	4	1.9

1. State Newton's second law in words. (2)
2. Give a reason why the trolley track was slightly raised during the investigation. (1)
3. From the investigation above, write down the:
  - 3.1 Dependent variable. (1)
  - 3.2 Independent variable. (1)
  - 3.3 Controlled variable. (1)
4. What mathematical relationship between acceleration and mass can you deduce from the table of results above? (1)

**[PART B: 7 MARKS]**

..... **TOTAL = 25 MARKS** .....



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**PHYSICAL SCIENCES**  
**RUBRIC FORMAL EXPERIMENT 1**

**19 FEBRUARY 2026**  
*Stanmorephysics.com*

**MARKS: 25**

This RUBRIC & MEMO consists of 4 pages including cover.

	1	2	3	Weighting	Score
<p><b><u>Aim</u></b> To investigate the relationship between acceleration and net force when mass is kept constant.</p> <p>Must include all variables.</p>	The aim stated is irrelevant and does not or partially show the relationship between acceleration and net force.	Aim clearly stated. Describes the intention investigate the relationship between the acceleration and net force when mass is kept constant.		<b>×0,5</b>	1
<p><b><u>Investigative question</u></b> What is the relationship between acceleration and the net force when mass is kept constant? OR how will and increase in net force affect the acceleration when mass is kept constant.</p>	The question does not include variables or may include one or two variables and does not allow the second person to do the experiment.	The question includes dependent, independent and control variable and allows the second person to do the experiment.		<b>×0,5</b>	1
<p><b><u>Hypothesis</u></b> Acceleration is directly proportional to the net force when mass is kept constant. OR when net force increases, the acceleration will also increase when mass is kept constant.</p>	The hypothesis does not include variables or may include one or two variables and it is not an answer to the investigative question.	The hypothesis includes dependent, independent and control variable and is an answer to the investigative question.		<b>×0,5</b>	1
<p><b><u>Variables</u></b> Dep-acceleration. Indep-net force Control-mass of object.</p>	Only one of the variables is correctly identified	Two variables are correctly identified	Three variables are correctly identified	<b>×1</b>	3
<p><b><u>Apparatus/materials used</u></b> Trolleys, runaway track, ticker tape, ticker timer, frictionless pulley, light thread(rop), mass pieces, hook, and batteries.</p>	4 to 5 apparatus correctly listed.	8 to 10 apparatus correctly listed.		<b>×1</b>	2
	1	2	3	Weighting	Score

<p><b>Method</b></p>	<p>Method is copied as in question paper and/or is not written or is partially in past tense. It can lead to desired results.</p>	<p>Well written in past tense. Method can be followed and provide the desired results between acceleration and net force.</p>		<p>x1</p>	<p>2</p>
<p><b>Table of results</b></p> <ul style="list-style-type: none"> <li>➤ Force of holder correctly calculated.</li> <li>➤ Initial and final velocity correctly calculated.</li> <li>➤ Acceleration correctly calculated.</li> </ul>	<p>The table is correct for one variable either force, velocities or acceleration.</p>	<p>The table is partially correct with two variables correctly completed and calculated either force, velocities or acceleration.</p>	<p>The whole table is correctly completed and calculated for force, velocities and acceleration.</p>	<p>x1</p>	<p>3</p>
<p><b>Graph</b> Net force vs acceleration</p> <ul style="list-style-type: none"> <li>➤ Correct axes.</li> <li>➤ Points plotted.</li> <li>➤ Shape of graph.</li> </ul>	<p>One of either axes with units, or points are correctly plotted or Shape of the graph shows direct relationship.</p>	<p>Two of either axes with units, and/or points are correctly plotted and/or Shape of the graph shows direct relationship.</p>	<p>Axes are correctly labelled with correct units. All points are correctly plotted. Shape of the graph shows direct relationship.</p>	<p>x1</p>	<p>3</p>
<p><b>Conclusion</b></p> <ul style="list-style-type: none"> <li>➤ Related to investigative question/hypothesis.</li> <li>➤ Concise summary of results.</li> </ul>	<p>Conclusion is partially related to either investigative question and/or hypothesis and summarize the results partially.</p>	<p>Conclusion is directly related to investigative question and/or hypothesis. Conclusion is concise summary of results.</p>		<p>x1</p>	<p>2</p>

**PART A: 18 MARKS**

**MEMO**

1. To investigate the relationship between acceleration and mass when the force applied is constant.
2. What is the relationship between acceleration and mass when the force applied is constant.
3.
  - a) When mass increases, acceleration increases, provided force is constant or vice versa
  - b) When mass increases, acceleration decreases, provided force is constant or vice versa
  - c) *Any* relationship between a and m when f is constant.

4.
  - 4.1 Mass
  - 4.2 Acceleration
  - 4.3 Force



5. Apparatus
  - Runaway/Track
  - Trolley
  - Ticker timer
  - Power source, name what was used
  - Pulley
  - Ticker tape
  - Measuring tape
  - 3 mass-pieces of e.g 100g
  - A thread/string
  - Carbon paper

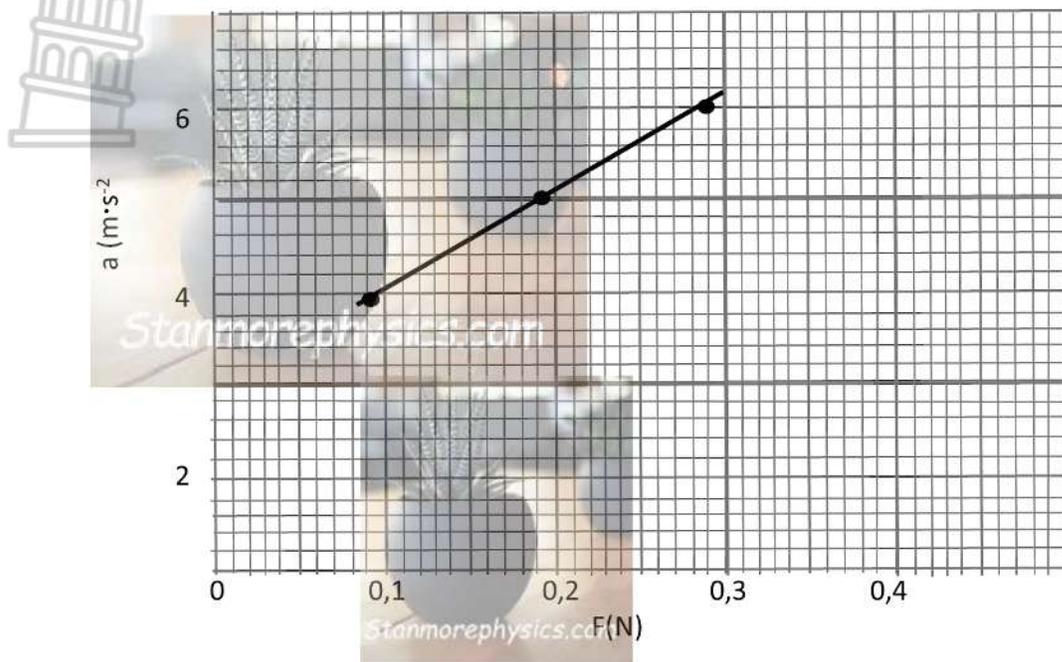
6. In Past tense and reported speech.

7. Hypothetical results

Mass on holder (m) in (kg)	Force of Holder (mg)	Segment 1 (m)	Segment 2 (m)	Segment 3 (m)	Average speed (v1) Segment 1/0.1 (m/s)	Average speed (v3) Segment 3 (m/s)	Acceleration (a) $\frac{v_3-v_1}{\Delta t}$ (m/s <sup>2</sup> )
0.010	0,098	0,05	0.11	0,21	0,25	1,05	4,0
0.020	0,196	0,08	0,17	0,28	0,4	1,4	5,0
0.030	0,294	0,12	0,23	0,36	0,6	1,8	6,0

8.

The graph of acceleration against time for for a mass-piece



9. The results lead to the conclusion that when force increases, acceleration increases for a constant mass. Therefore, Newton's Second law is supported that the relationship between acceleration is inversely proportional to mass and directly proportional to the resultant force.

**PART B**

1. When a net force acts on an object, the object will accelerate in the direction of the force and the acceleration is directly proportional to the force and inversely proportional to the mass of the object. ✓✓ (2)
2. To compensates for the friction between the wheels and the runways. ✓ (1)
3.
  - 3.1 Acceleration. ✓ (1)
  - 3.2 Mass of the trolleys. ✓ (1)
  - 3.3 Force. ✓ (1)
4.  $a \propto \frac{1}{m}$  ✓ (1)

[7 marks]

..... **TOTAL = 25 MARKS** .....