LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

MOPANI EAST DISTRICT

PRESCRIBED EXPERIMENT 01

TERM 1

PHYSICAL SCIENCES

GRADE 12

TITLE: **CONSERVATION OF LINEAR MOMENTUM**

SURNAME	
FIRST NAME	
SCHOOL	
DATE	

Learner's Marks:

_____

25

INTRODUCTION

Momentum is mass in motion. The amount of momentum of an object is determined by two variables, **mass** and **velocity**.

Linear momentum (momentum in a straight line) can be defined as the product of mass and velocity.

SECTION A

The verification of the conservation of momentum can be determined experimentally during an **explosion** and a **collision**.

AIM

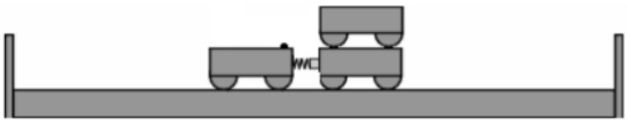
To verify the conservation of linear momentum during an explosion.

APPARATUS

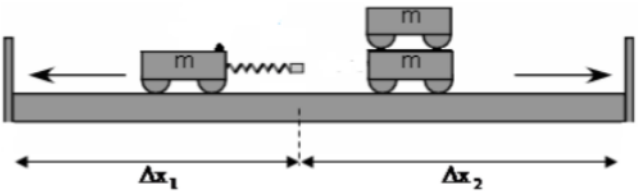
Trolley track.
Trolleys.
Meter ruler.
2 Buffers (wooden plank or brick).

METHOD

1 Place two trolleys, one of which contains a compressed spring, against each other on a smooth, horizontal floor.
2 Place another trolley on top of one of the other trolleys in Step 1. These two trolleys now represent a mass of 2m, while the single trolley represents a mass of 1m.
3 Place two sturdy wooden planks on both sides of the set-up (not further than 1–1,5 m from the set-up) as indicated in the diagram below.



4 Release the spring of the one trolley so that the two trolley systems move apart. Listen to the collisions against the wooden planks. The trolley systems hit the wooden planks at different times, because the one trolley system moves more slowly than the other one – different velocities.



5 By means of trial and error, find a position from which the trolley systems move so that both trolleys will hit the wooden planks on both sides at the same time. Only a single collision should be heard.

6 Measure the distances Δx_1 and Δx_2 that each trolley moved from the starting point to the wooden plank. These distances represent the velocities of the two trolley systems respectively.

7 Repeat the above mentioned procedure to obtain accurate results

8. Repeat the above procedure for different numbers of trolleys.

9 Record all your observations and results as in the table below

10 Hand in *your own* complete scientific report containing

- aim;
- sketch of apparatus;
- a clear method;
- safety precautions;
- results (tabular & graphic if appropriate);
- interpretation;
- conclusion.

[Rubric = 6]

Scientific report

Aim:

Sketch of apparatus:

Method:

Safety precaution:

Results:

Interpretation:

Conclusion:

SECTION B

Table of results.

Trolley system 1					**Trolley system 2**					**Total momentum after explosion ("unit")**
Mass (Trolley unit)	[Velocity v_1] Distance Δx_1 (cm)			Momentum ("unit")	Mass (trolley unit)	[Velocity v_2] Distance Δx_2 (cm)			Momentum ("unit")	
	Trial 1	Trial 2	Average			Trial 1	Trial 2	Average		

(5)

Marking criteria for table of results

√ for average velocity V_1 /distance Δx_1 for trolley system 1
√ for momentum (units) for Trolley system 1
√ for average velocity V_1 /distance Δx_1 for trolley system 2
√ for momentum (units) for Trolley system 2
√ Total momentum after explosion

INTERPRETATION AND DISCUSSION OF RESULTS

1. Explain why it is acceptable to consider the distances travelled by the trolleys as a measurement of their **velocities**. (1)

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_____

2. Give a **reason** why this experiment must be performed more than once. (1)

_____

3. What **recommendation** can you make to improve the results of your experiment? (1)

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_____

SECTION C: APPLICATION

7 A boy with a mass of 50 kg and a girl with a mass of 40 kg are standing on skateboards. They press their hands together and push each other apart as indicated in the sketch. The girl moves to the right at 1 $m.s^{-1}$.



7.1 What is the total momentum of the boy and girl before they move apart. (2)

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7.2 Determine the velocity of the boy directly after they have moved apart. (4)

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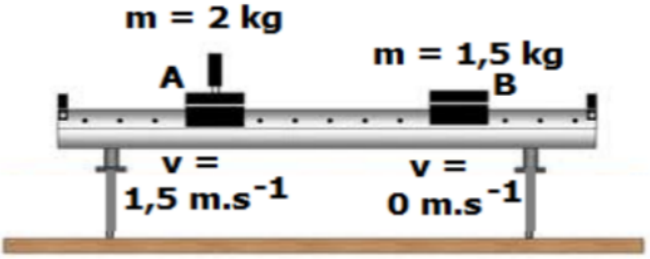
LINEAR AIR TRACK

8. A collision instead of an explosion can be used to investigate conservation of momentum.

The diagram below illustrates the collision of trolleys on an air track.

Trolley A with mass of 2 kg and velocity of 1,5 $m.s^{-1}$ to the right collides with a stationary trolley B with a mass of 1,5 kg.

After the collision trolley A moves at 0,75 $m.s^{-1}$ to the left and trolley B moves at 3 $m.s^{-1}$ to the right.



Prove with a calculation that the momentum was **conserved** during this collision. (4)

9 In the verification of the conservation of momentum, why is it **better** to make use an air track rather than a trolley system? (1)

Section A = 6
Sections B + C =19
TOTAL: 25