PHYSICAL SCIENCES
DISTRICT SE

GRADE 11: FORMAL PRACTICAL 1: INSTRUCTIONS

Time 2 hrs **Marks 57**

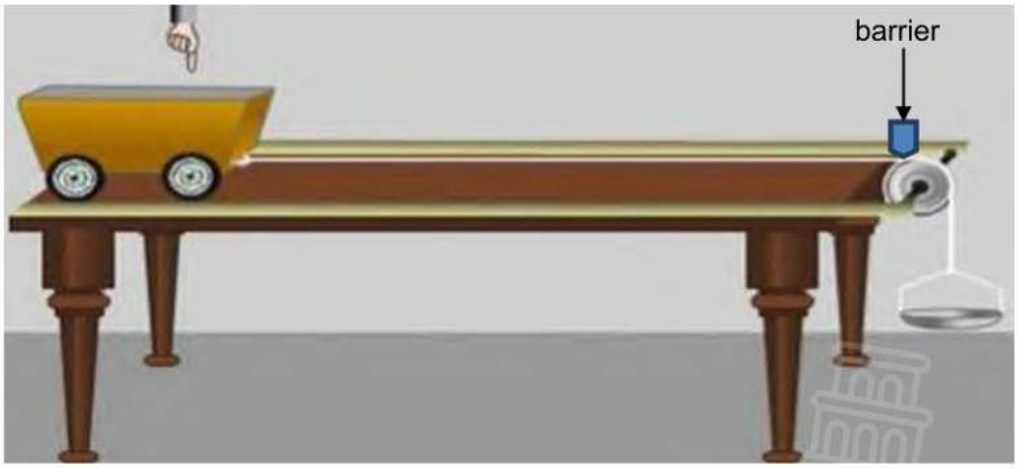
1. To determine the relationship between the resultant/net force acting on an object and acceleration produced on a constant mass

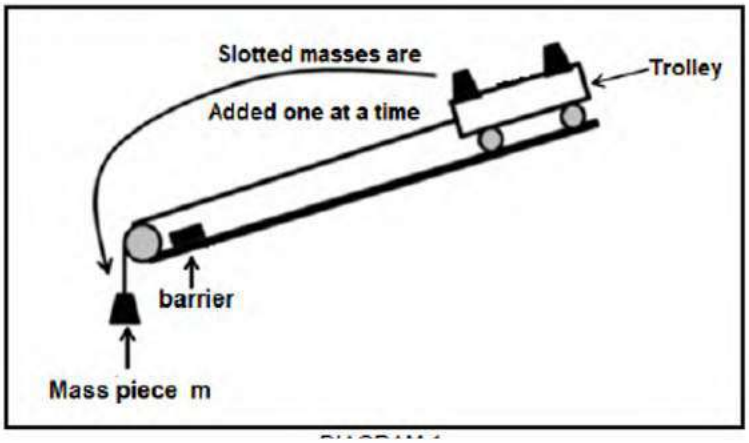
2. APPARATUS/EQUIPMENT

1. Dynamics trolley kit
2. Inextensible string / fishing gut
3. Mass pieces
4. Stopwatch
5. Runway with a pulley
6. Mass hanger
7. Ruler or measuring tape if runway is not calibrated

3. METHOD/PROCEDURE

1. Measure the mass of the trolley and record it.
2. Clean the runway.
3. Set up the runway with a trolley, as shown below. (Without any mass pieces on the trolley)





(Need a slight incline)

4. Raise the one end of the runway so that the trolley moves at a constant velocity down the runway.
5. Measure the length of the runway from the front wheel to the barrier.
6. Place five or more mass pieces on top of the trolley.
7. Take mass piece $\mathbf{m_1}$ from the trolley and put it on the pan/hanger. So that, when the trolley is released, it accelerates.
8. Use a stopwatch and measure the time from the moment the trolley is released up to the time it strikes the barrier. Repeat this action at least three times.
9. Take another mass $\mathbf{m_2}$ piece from the trolley, add it to the pan/hanger and repeat this action at least three times.
10. Take another mass $\mathbf{m_3}$ piece from the trolley and add it to the pan/hanger.
    Record the time for the trolley to accelerate. Repeat this action at least three times.
11. Repeat the procedure with another mass $\mathbf{m_4}$ and $\mathbf{m_5}$

Repeat this until you you get results for five different masses that are on the pan / hanger

4. RESULTS

Exp No.	Distance $\Delta\mathbf{x}$ (m)	Mass **m** (kg)	$\Delta\mathbf{t_1}$ (s)	$\Delta\mathbf{t_2}$ (s)	$\Delta\mathbf{t_3}$ (s)	$\Delta\mathbf{t}$ **avg** (s)
1		m_1				$\Delta\mathbf{t_1}$ **avg**
2		m_2				$\Delta\mathbf{t_2}$ **avg**
3		m_3				$\Delta\mathbf{t_3}$ **avg**
4		m_4				$\Delta\mathbf{t_4}$ **avg**
5		m_5				$\Delta\mathbf{t_5}$ **avg**

(3)

5 Calculate the average times for each for each of the experiments (3)

6 Calculate the acceleration of the trolley for each of the experiments using relevant equations of motion (10)

ANALYSIS /INTERPRETATION

7 Draw a free body diagram for the trolly and the mass and for the masses on the pan/ hanger. Ignore friction.

Use the diagrams to calculate the net force, F_{net}/ resultant force acting on the trolley due to the massess on the pan/hangder (13)

Troley : mass on pan/hanger:

EXP 1	Exp 2
 $F_{Net\ 1}$ = _____	$F_{Net\ 2}$ =_____
EXP 3	**EXP 4**
$F_{Net\ 3}$ =_____	**$F_{Net\ 4}$ = _____**
EXP 5	
$F_{Net\ 5}$ =_____	

8 Complete the table for F_{net} and accelerationon the trolley for ythe different masses

	mass 1	mass 2	mass 3	mass 4	mass 5
F_{Net} (N)					
a in ($m.s^{-2}$)					

9. Draw a graph of acceleration against F_{net} on graph paper provided (5)

10 Draw a conclusion for the experiment. (2)

11 For this experiment, identify the following variables:

11.1 Independent (1)

11.2 Dependent (1)

11.2 Controlled (1)

12 Why was the runway raised? (1)

13 Why was the runway cleaned? (1)

14 Give one reason why the mass pieces were transferred from the trolley to the pan/ hanger (1)

15 How will the acceleration of the trolley be affected when the friction on the wheels increases?
Write down only INCREASE, DECREASE or REMAINS THE SAME. (1)
Motivate the answer. (1)

16.1Calculate the gradient of the graph (4)

16.2 What does the gradient of the graph represent? (1)

16.3 Calculate the mass (1)

PRACTICAL SKILLS

CRITERIA	MARKS
Correct setting up of apparatus	1
Cleaning the runway	1
Raising the runway so that the trolley moves with a constant velocity	1
Measuring: • The length of the runway accurately • The mass of the trolley accurately	 1 1
Stopwatch used correctly	1
Following a sequence of instructions logically	1

(7)

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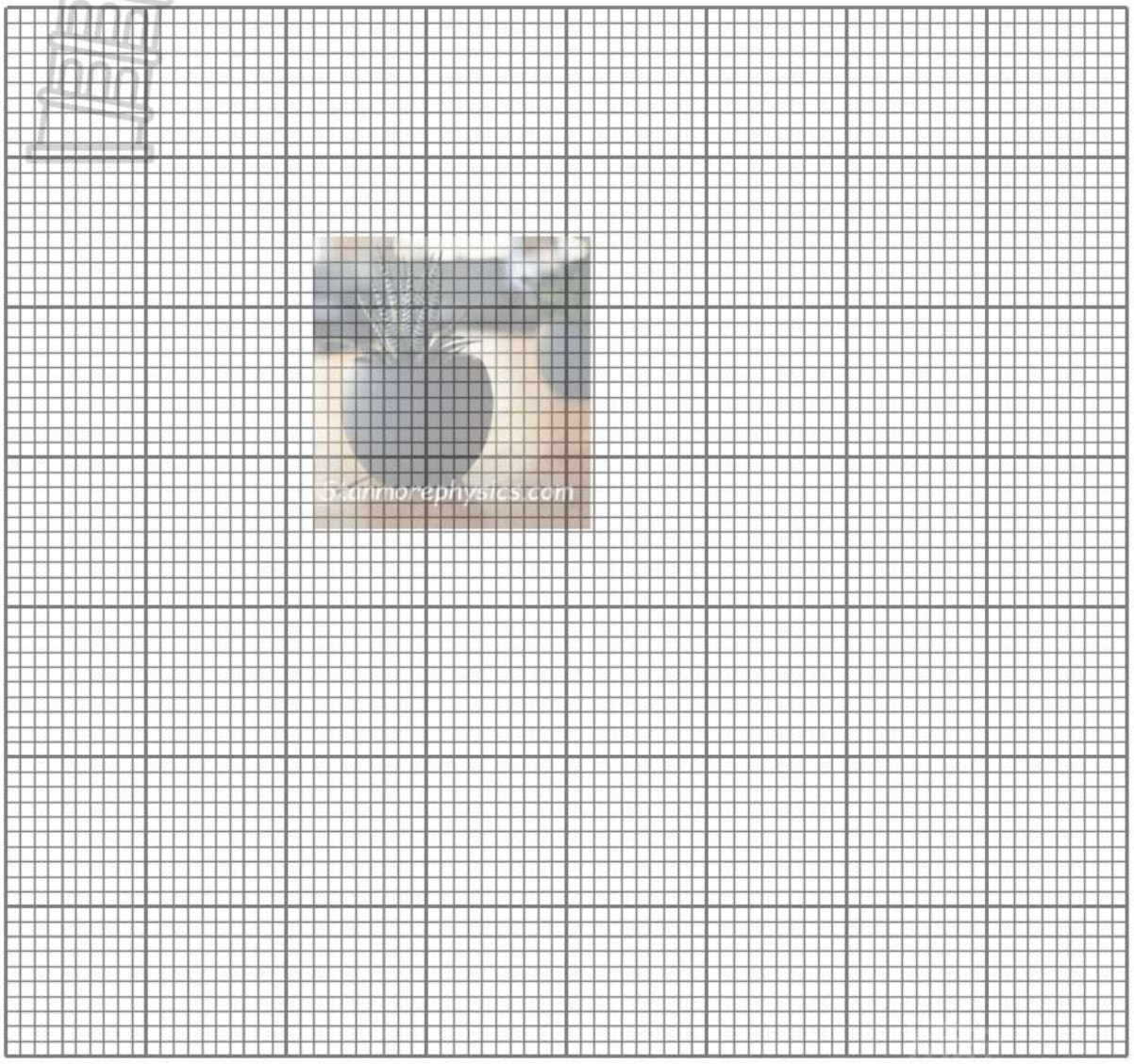
NAME :



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GRADE 11 FORMAL PRACTICAL 1 MEMO Total 57

4. RESULTS

RECORDING OF RESULTS **SET A**

Exp No.	Distance **Δx** (m)	Mass **m** (kg)	Δt_1 (s)	Δt_2 (s)	Δt_3 (s)	Δt **avg** (s)
1	1	m_1 0,02	2,27	2,07	2,22	Δt_1 avg = 2,19
2	1	m_2 0,04	1,52	1,78	1,76	Δt_2 avg = 1.69
3	1	m_3 0,06	1,41	1,39	1,51	Δt_3 avg = 1,44
4	1	m_4 0,07	1,57	1,32	1,41	Δt_4 avg = 1,43
5		m_5				Δt_5 avg
	whole column ✓	whole column ✓	3 column ✓			

(3)

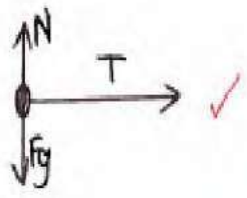
5 average times last column in table (3)

6 acceleration (10)

$$\Delta x = v_i \Delta t + \tfrac{1}{2} a \Delta t^2 \quad ✓✓$$

Exp 1: $1 = 0(2,19) + \frac{1}{2} . a (2,19)^2$ ✓ $a = 0,42\ m.s^{-2}$ ✓	Exp 2: $1 = 0(1,69) + \frac{1}{2} . a (1,69)^2$ ✓ $a = 0,7\ m.s^{-2}$ ✓
Exp 3: $1 = 0(1,44) + \frac{1}{2} . a (1,44)^2$ ✓ $a = 0,96\ m.s^{-2}$ ✓	Exp 4: $1 = 0(1,43) + \frac{1}{2} . a (1,43)^2$ ✓ $a = 0,98\ m.s^{-2}$ ✓
Exp 5:	

7 ANALYSIS /INTERPRETATION (13)

Troley :	masses on pan/hanger:
	

Troley $F_{net} = T$ ✓ masses on pan/hanger $F_{net} = W - T = ma$ ✓

$T = W - ma$

$F_{net} = W - ma$

$= mg - ma = m(g-a) = m(9,8 - a)$ ✓

EXP 1	**Exp 2**
$F_{net} = m(9,8 - a)$ $= 0,02\ (9,8 - 0,42)$ ✓ $F_{Net\ 1} = 0,19$ N ✓	$F_{net} = m(9,8 - a)$ $= 0,04\ (9,8 - 0,7)$ ✓ $F_{Net\ 2} = 0,36$ N ✓
EXP 3	**EXP 4**
$F_{net} = m(9,8 - a)$ $= 0,06\ (9,8 - 0,96)$ ✓ $F_{Net\ 2} = 0,53$ N ✓	$F_{net} = m(9,8 - a)$ $= 0,07\ (9,8 - 0,98)$ ✓ $F_{Net\ 2} = 0,61$ N ✓
EXP 5	
$F_{Net\ 5}$ =_____	

8

	mass 1	mass 2	mass 3	mass 4	mass 5
F_{Net} (N)	0,19 N	0,36	0.53	0,61	
a in ($m.s^{-2}$)	0,42	0,7	0,96	0.98	

9. Draw a graph of acceleration against F_{net} on graph paper provided (set A)

Axes labelled correctly; a on y-axis and Fnet on x-axis with units. *Asse korrek benoem; T op y-as en t op x-as met eenhede.*	✓
Suitable divisions on axes. *Geskikte indelings op asse.*	✓
Any two points plotted correctly. *Enige twee punte korrek geplot.*	✓
Any three other points plotted correctly. *Enige drie ander punte korrek geplot.*	✓
Correct shape for graph *Korrekte vorm vir grafiek*	✓

(5)

10 The acceleration is directly proportional to the Net/ resultant force acting on a body, if the mass is constant ✓✓ (2)

11.1 Independent Net/ resultant force (1)
11.2 Dependent acceleration (1)
11.3 Controlled mass (accept angle of inclination/ surface/ length of runway) (1)

12 To compensate for friction between the track and the wheels of the trolley (1)

13 To ensure it is smooth/ free of dirt. To minimise (the effect of) friction (1)

14 To keep the mass of the system (mass of trolley and mass pieces) constant
To change the net force applied to the trolley (1)

15 DECREASE (1)
The net force decrease causing the acceleration to decrease (1)

16.1 Calculate the gradient of the graph

Gradient $= \Delta a / \Delta F_{net}$ ✓

$= \frac{0,96 - 0}{0,53 - 0}$ ✓ ✓

$= 1,81 \text{ kg}^{-1}$ ✓ (4)

16.2 Reciprocal of mass /1/mass / inverse of mass ✓ (1)

16.3 mass = 1/ gradient
= 1/ 1.81

= 0,55 kg ✓ (1)

[50]

PRACCTICAL SKILLS **(7)**

[57]

MORE RESULTS SECOND SET

.4 RESULTS SET B

RECORDING OF RESULS

Exp No.	Distance **Δx** (m)	Mass **m** (kg)	**Δt₁** (s)	**Δt₂** (s)	**Δt₃** (s)	**Δt avg** (s)
1	1	m_1 0,01	3,41	3,3	3.41	Δt_1 avg = 3,37
2	1	m_2 0,03	2,.18	2,11	2,25	Δt_2 avg = 2,18
3	1	m_3 0,05	1,6	1,67	1,62	Δt_3 avg = 1,62
4	1	m_4 0,07	1,45	1,35	1,52	Δt_4 avg = 1,44
5		m_5				Δt_5 avg
	whole column ✓	whole column ✓	3 column ✓			

(3)

5 Calculate the average times for each for each of the experiments last column in table (3)

6 Calculate the acceleration of the trolley for each of the experiments using relevant equations of motion (10)

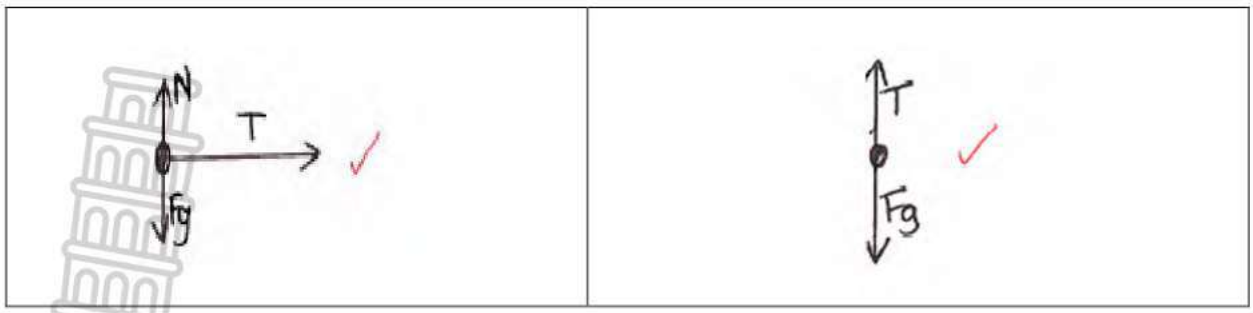
$\Delta x = v_i \Delta t + \frac{1}{2} a \Delta t^2$ ✓✓

Exp 1: $1 = 0(3,37) + \frac{1}{2} a (3,37)^2$ ✓ $a = 0,18\ m.s^{-2}$ ✓	Exp 2: $1 = 0(2,18) + \frac{1}{2}.a.(2,18)^2$ ✓ $a = 0,42\ m.s^{-2}$ ✓
Exp 3: $1 = 0(1,59) + \frac{1}{2} a (1,62)^2$ ✓ $a = 0,76\ m.s^{-2}$ ✓	Exp 4: $1 = 0(1,44) + \frac{1}{2}.a.(1,44)^2$ ✓ $a = 0,96\ m.s^{-2}$ ✓
Exp 5:	

7 Draw a free body diagram for the trolly and the mass and for the masses on the pan/ hanger. Ignore friction.

Use the diagrams to calculate the net force, F_{net}/ resultant force acting on the trolley due to the massess on the pan/hangder (13)

Troley : masses on pan/hanger:



Trolley $F_{net} = T$ ✓ masses on pan/hanger $F_{net} = W - T = ma$ ✓

$T = W - ma$

$F_{net} = W - ma$

$= mg - ma = m(g-a) = m(9,8 - a)$ ✓

Eksp 1	Eksp 2
Trollie: $F_{net} = T$ Massastel: $F_{net} = ma$ $F_g - T = ma$ $0,01(9,8) - T = 0,01(0,18)$ ANTW: $F_{Net\,1} =$ 0,096 – 0,1 N ✓	$F_g - T = ma$ $0,03(9,8) - T = 0,03(0,42)$ ✓ ANTW: $F_{Net\,2} =$ 0,28 N ✓
Eksp 3: $F_g - T = ma$ $0,05(9,8) - T = 0,05(0,76)$ ✓ ANTW: $F_{Net\,3} =$ 0,45 N ✓	**Eksp 4:** $F_g - T = ma$ $0,07(9,8) - T = 0,07(0,96)$ ✓ ANTW: $F_{Net\,4} =$ 0,62 N ✓

8

	massa 1	massa 2	massa 3	massa 4	massa 5
F_{Net} in N	0,1	0,28	0,45	0,62	
versnelling (a) in $m.s^{-2}$	0,18	0,42	0,79	0,96	

9 Graph B (5)

Axes labelled correctly; a on y-axis and F_{net} on x-axis with units. *Asse korrek benoem; T op y-as en t op x-as met eenhede.*	✓	
Suitable divisions on axes. *Geskikte indelings op asse.*	✓	
Any two points plotted correctly. *Enige twee punte korrek geplot.*	✓	
Any three other points plotted correctly. *Enige drie ander punte korrek geplot.*	✓	
Correct shape for graph *Korrekte vorm vir grafiek*	✓	

16.1

Gradient $= \Delta a / \Delta F_{net}$ ✓

$= \frac{0,86 - 0}{0,50 - 0}$ ✓ ✓

$= 1,72\ kg^{-1}$ ✓ (4)

16.2 Reciprocal of mass /1/mass / inverse of mass ✓ (1)

16.3 mass = 1/ gradient

= 1/ 1,72

=0,58 kg ✓ (1)

PHYSICAL SCIENCES
DISTRICT SE

GRADE 11 PHYSICAL SCIENCE
FORMAL ASSESSMENT: TASK 1 **Date:**

Name of Learner: **Grade 11 ___**

PRACTICAL SKILLS

CRITERIA	MARKS	
Correct setting up of apparatus	1	
Cleaning the runway	1	
Raising the runway so that the trolley moves with a constant velocity	1	
Measuring: • The length of the runway accurately • The mass of the trolley accurately	 1 1	
Stopwatch used correctly	1	
Following a sequence of instructions logically	1	

(7)

Name Grade 11 Date

Scale: x axis 2 cm rep y axis 2 cm rep