Kulleġġ Santa Tereża
PARVA PARVORUM PULCHRA

GIRLS' JUNIOR LYCEUM, MRIEHEL

HALF YEARLY EXAMINATIONS 2011/2012

FORM: **4**	**PHYSICS**	Time: **1½ hrs**

Name:_____ Class:_____

Graph paper to be provided, and calculators are allowed

Table of Formulae

Acceleration due to gravity $g = 10\ m/s^2$

$F = ma$ $\quad W = mg$ $\quad$ Average speed $= \frac{\text{total distance}}{\text{total time}}$

$v = u + at$ $\quad a = \frac{(v - u)}{t}$ $\quad s = ut + \frac{1}{2}at^2$ $\quad s = \frac{(u + v)t}{2}$

$v^2 = u^2 + 2as$ $\quad p = mv$ $\quad F = \frac{mv - mu}{t}$

ANSWER ALL QUESTIONS SHOWING ALL YOUR WORKING

Where necessary give your answers correct to 2 decimal places.

SECTION A – This section carries 55 marks

1. This question is about symbols and units

a) Complete the following table. (4)

Quantity	Symbol	S.I. Unit
Mass	m	Kg
Initial speed	u	_____
Acceleration	a	_____
Momentum	p	_____
Distance	s	_____

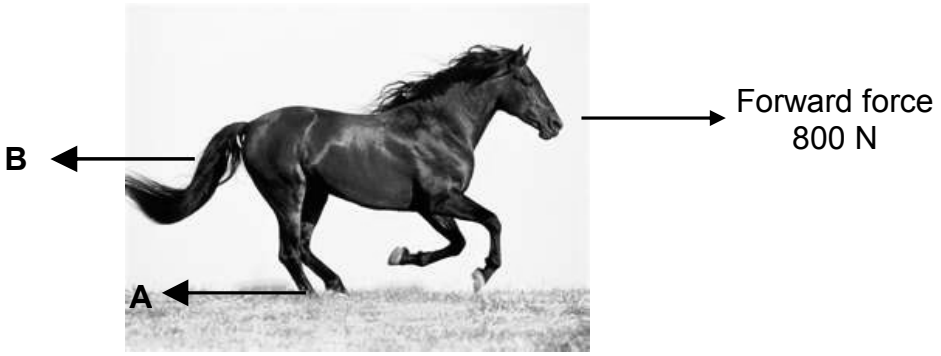
b) Fill in the missing words using ***some*** of the following terms:

volume, greater, constant, rest, mass, accelerating, moving.

Inertia is the tendency of a body to remain at rest if it is at _____ or continues to move if it is already _____. The inertia of an object depends on the _____ of the object and the _____ the mass, the bigger is the inertia. (4)

2. This question is about Newton's laws of motion

The diagram shows a horse of mass 800 kg running on a horizontal road at ***constant speed*** of 7 m/s.



a) Name the forces labelled A and B.

i) A _____ ii) B _____. (2)

b) If force A is 500 N, find the value of force B.

_____ (1)

c) The horse now runs across the same horizontal road increasing its speed to 14 m/s.

i) What happens to force B. Explain.

_____

_____

_____ (2)

Assuming that the forward force provided by the horse is increased to 4000 N, force A remains constant and force B is equal to 1500 N, calculate the

ii) resultant force acting on the horse,

_____ (1)

iii) acceleration of the horse.

_____

_____ (2)

3. This question is about static electricity.

a) Elena rubs a *polythene* strip with a duster. Both the polythene strip and the duster become charged.

i) What kind of charge does the polythene strip acquire? _____ (1)

ii) What is the charge on the duster? _____ (1)

iii) Name the force causing the polythene strip and the duster to become charged.

_____ (1)

b) Elena then holds the charged polythene strip from one of its ends.

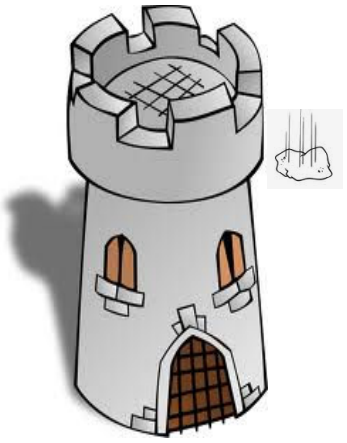
i) Does the charged polythene strip lose its charge? _____ (1)

ii) Explain your answer.

_____

_____ (1)

4. This question is about free fall



A stone dropped from the top of a tower reaches the ground in 4 seconds.
Assume ***no air resistance*** is present as the stone falls down.

a) What is the acceleration of the stone?

_____ (1)

b) Name this acceleration.

_____ (1)

c) Calculate the height of the tower.

_____

_____

_____ (2)

d) Find the final velocity with which the stone hit the ground.

_____

_____

_____ (2)

e) What happens to the acceleration of the stone if there is the *air resistance acting against the stone*?

_____ (1)

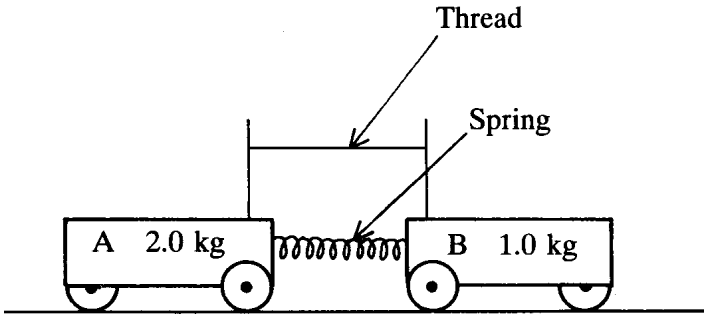
f) Give a reason for your answer to (e).

_____

_____ (2)

5. This question is about momentum

The diagram shows two stationary trolleys A and B of mass 2.0 kg and 1.0 kg respectively held together by a thread and separated by a compressed spring.



a) Use *Newton's third law* of motion to explain what happens when the thread is cut.

_____

_____ (2)

b) What is the total momentum of both trolleys just before the thread is cut.

_____ (1)

c) As the thread is cut, trolley B moves off with a speed of 0.25 m/s.

i) Find the momentum of trolley B just after the thread is cut.

_____ (2)

ii) What is the momentum of trolley A just after the thread is cut?

_____ (1)

iii) Find the velocity with which trolley A moves off.

_____

_____

_____ (2)

6. This question is linear motion

A car moves along a straight level road. The following table shows the velocity of the car.

Velocity (m/s)	0	7.5	15	22.5	30	30	30	30	30	25	20	15	10	5	0
Time (s)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70

a) Plot a graph of velocity in m/s (y-axis) against time in s (x-axis). (5)

b) Describe the motion of the car from the 40th second onwards._____ (1)

c) Fill in the blanks:

i) Gradient of a velocity-time graph = _____ (1)

ii) Area under a velocity-time graph = _____ (1)

7. This question is about collisions

A 1100 kg van moving at 14 m/s collides into a car which was at rest at a pedestrian crossing from behind and they stick to each other. After the collision, the two cars continue moving together at 10 m/s.

a) Calculate the momentum of the 1100 kg van before colliding into the car.

_____

_____ (2)

b) What is the momentum of the car before collision at the pedestrian crossing?

_____ (1)

c) What is the total momentum of both vehicles after collision.

_____ (1)

d) Which principle did you use in (c)?

_____ (1)

e) State this principle.

_____

_____

_____ (2)

f) Calculate the mass of the car.

_____

_____

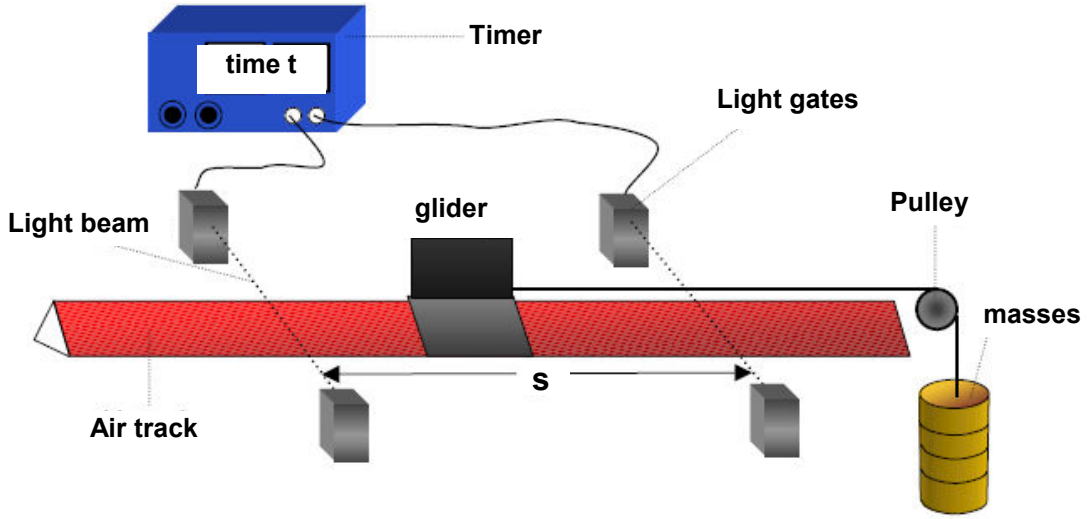
_____

_____ (2)

SECTION B – This section carries 45 marks

8. This question is about Newton's laws of motion

Two students, Maria and Rebecca used the following apparatus to verify Newton's second law of motion.



a) Fill in the blanks:

Newton's second law states that the unbalanced force on an object is directly proportional to the _____ of the object if the _____ of the object is kept constant. (2)

b) The students decided to check this law using a particular method.
Indicate the order of numbers 2 to 6 in which the steps of the experiment have to be performed. (5)

The apparatus was set up as shown.	1
Keeping the distance s constant, the mass was increased gradually.	
The results were tabulated.	
The air track was switched on and the mass was let to fall down.	
The force and acceleration were calculated in each case.	
The air track was perfectly levelled horizontally.	

c) Mention **one** precaution to ensure accurate results.

_____ (1)

d) Which equation is used to find the unbalanced force F? _____ (1)

e) Which quantities must be plotted on the graph?

_____, _____. (2)

f) Draw a sketch of this graph labelling your axes properly. (2)

g) During this experiment, when the glider was pulled by a force of 0.20 N, its acceleration was 0.35 m/s^2. Find the acceleration of the glider when it was pulled by a weight of 0.60 N.

_____

_____

_____ (2)

9. This question is about stopping distances and impact

a) While traveling in his car at a constant speed of 30 m/s, Johann notices an obstruction in the middle of the road 50 metres ahead. If he has a reaction time of 0.61 s and it takes 2.5 seconds for the car to stop from the moment the brakes are applied,

i) calculate the thinking distance,

_____

_____

_____ (2)

ii) calculate the braking distance.

_____

_____

_____ (2)

iii) Hence find the total stopping distance.

_____ (1)

iv) Will the car be able to stop in time?

_____ (1)

v) Johann's car has been designed with crumple zones. In case he could not avoid the obstacle, explain how these crumple zones can provide safety.

_____

_____

_____ (2)

b) A boy catches a cricket ball of mass 0.14 kg which has a velocity of 20 m/s. Calculate

i) the momentum of the ball,

_____

_____ (1)

ii) the average force used by the boy's hands to stop the ball in (i) 0.5s,

_____

_____ (1)

(ii) 0.01s.

_____

_____ (2)

iii) Which force will hurt the boy more? _____ (1)

iv) Give a reason for your choice.

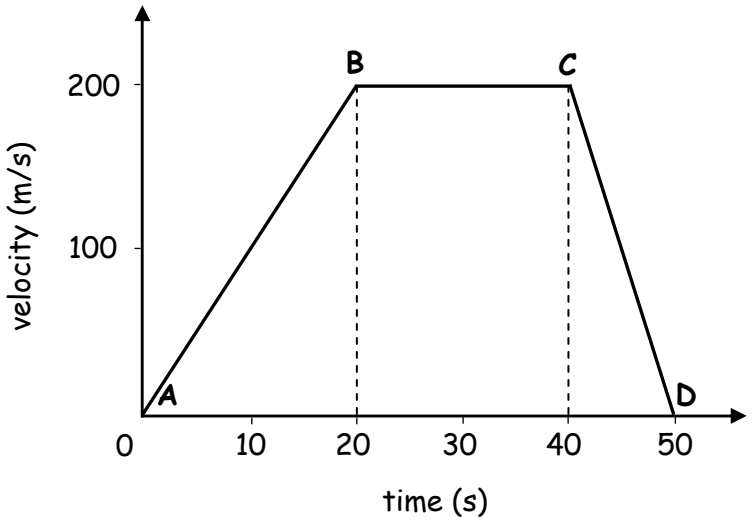
_____

_____

_____ (2)

10. This question is about motion graphs

The figure shows a velocity-time graph of a train starting from rest.



a) Describe the motion of the train along:

AB: _____

CD: _____ (2)

b) Find the acceleration of the train.

_____

_____ (2)

c) How long does the train has zero acceleration? _____ (1)

d) Explain why the acceleration is zero during this time.

_____

_____ (1)

e) Using the graph, or otherwise, find the distance travelled in the first 20 seconds.

_____

_____

_____ (2)

f) Sketch the distance-time graph for the first 20 seconds. Label your graph and show the values of the time and distance on the respective axis. (3)

g) ***From the graph***, find the distance travelled by the train during the whole journey.

_____

_____

_____ (2)

h) In which of the regions AB and CD is the change in velocity per unit time the largest?

_____

_____ (1)

i) Give a reason for your answer to (h).

_____ (1)

END OF PAPER