Kulleġġ Santa Tereża
PARVA PARVORUM PULCHRA

GIRLS' JUNIOR LYCEUM, MRIEHEL

HALF YEARLY EXAMINATIONS 2010/2011

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 $= \frac{\text{total distance}}{\text{total time}}$

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

$p = mv$ $\quad F = \frac{mv - mu}{t}$

ANSWER ALL QUESTIONS

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. ***(5 marks)***

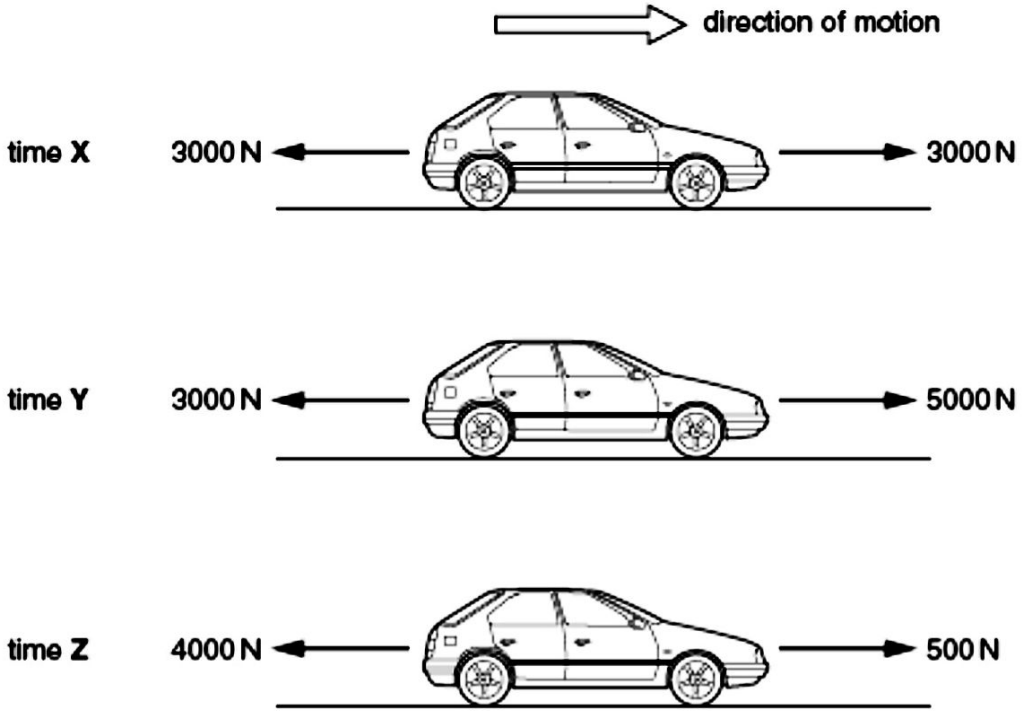
Quantity	Symbol	S.I. Unit
Mass	m	Kg
Final speed	_____	m/s
Acceleration	a	_____
Unbalanced Force	_____	N
Momentum	p	_____
Distance	_____	m

b) Fill in the missing words:

According to Newton's third law of motion, if the burning exhaust gas of a rocket exerts a downward force of 150,000 N, a force of _____ is exerted upwards on the rocket. This is because for every _____, there is an _____ but opposite _____. ***(4 marks)***

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

The diagrams show the ***total forces*** acting forwards and backwards on a car at different times X, Y and Z during a journey.



In each case, the car, of mass 1,000 Kg is moving forward as shown.

a) State the names of the ***two forces*** that act in the ***opposite direction*** to the motion of the car.

_____ ***(2 marks)***

b) i) State and explain whether the speed of the car is changing at ***time X***. ***(2 marks)***

The car at **X** is _____

because _____.

ii) State and explain whether the speed of the car is changing at ***time Z.*** ***(2 marks)***

The car at **Z** is _____

because _____.

c) At ***time Y***, find the value of:

i) the resultant force acting on the car,

_____ ***(1 mark)***

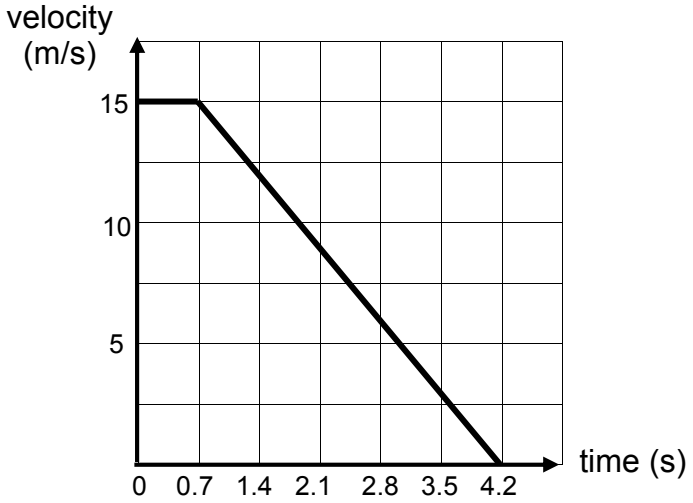
ii) the acceleration of the car.

_____

_____ ***(2 marks)***

3. This question is about stopping distance

The diagram below represents the velocity-time graph of Annabelle's car, who had to stop her car suddenly to avoid a child who ran into the road. Annabelle was driving her car at a constant velocity of 15 m/s. After some time she pressed the brake pedal and the car decelerated uniformly until it stopped.



(a) Using the above graph, what is Annabelle's reaction time.

_____ ***(1 mark)***

(b) Find the distance travelled by the car during this time. What is this ***distance*** called?

_____

_____

_____ ***(3 marks)***

(c) Find the distance travelled by Annabelle's car after she pressed the brake pedal. What is this ***distance*** called?

_____

_____

_____ ***(3 marks)***

(d) Calculate the total distance travelled by the car from the moment Annabelle ***sees the child crossing the road until the car comes to a stop.***

_____

_____

_____ ***(2 marks)***

(e) Name one factor which affects the distance found in (d).

_____ ***(1 mark)***

4. This question is about static electricity

(a) Give the meaning of each of the following and mention one example of each:

(i) conductor: _____

_____ ***(2 marks)***

(ii) insulator: _____

_____ ***(2 marks)***

(b) Matthew rubs a ruler on his sleeve. The ruler becomes positively charged.

(i) Explain, in terms of charges, how the ruler becomes positively charged.

_____

_____

_____ ***(2 marks)***

(ii) What is the charge on the sleeve?

_____ ***(1 mark)***

(iii) The positively charged ruler is brought towards some small pieces of paper. What happens to the small pieces of paper?

_____ ***(1 mark)***

(iv) Draw a diagram showing the ***charges*** on the ruler and on a small piece of paper. ***(2 marks)***

5. This question is about motion

a) i) Mike starts running from rest and reaches a velocity of 3.75 m/s in 2.5 s. Find his acceleration.

_____

_____ ***(2 marks)***

b) After moving at a constant speed of 3.75 m/s for some time, he then starts slowing down until he reaches a velocity of 1.25 m/s. He succeeds to do so in 5 s.

i) Find his new acceleration.

_____

_____ ***(2 marks)***

ii) What does the minus sign mean?

_____ ***(1 mark)***

iii) Calculate the distance travelled when slowing down.

_____

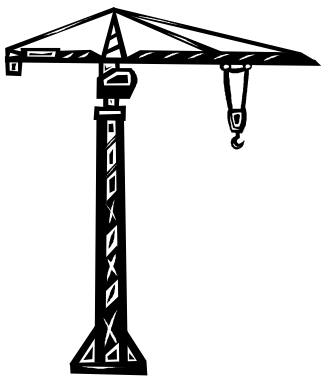
_____ ***(2 marks)***

iv) Calculate the ***decelerating force*** produced by Mike if his mass is 60 Kg.

_____

_____ ***(2 marks)***

6. This question is about free-fall



A tower crane used on a building site was lifting a pile of bricks. When the bricks were at a height of 120 m above the ground, the cable holding the bricks broke up and the bricks fell to the ground.

a) What was the initial velocity of the pile of bricks?

_____ ***(1 mark)***

b) What is the value of the acceleration assuming there was no air resistance during the fall?

_____ ***(1 mark)***

c) What is the force causing this acceleration called?

_____ ***(1 mark)***

d) Calculate the velocity with which the pile of bricks hit the ground.

_____

_____

_____ ***(2 marks)***

e) Calculate the time taken for the pile of bricks to fall.

_____

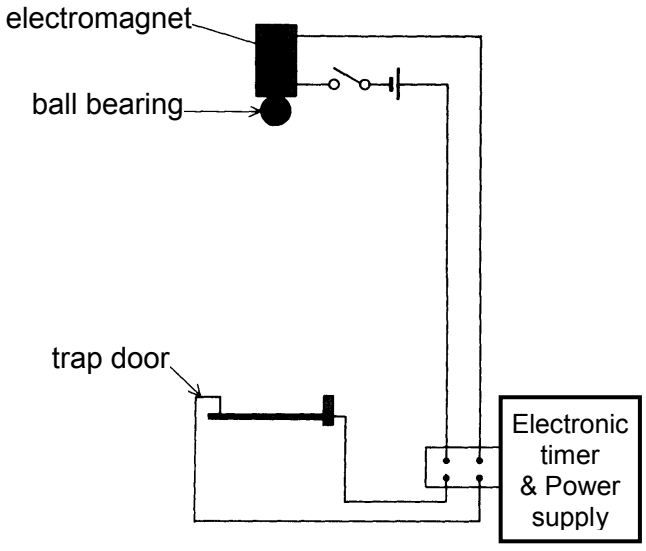
_____

_____ ***(3 marks)***

SECTION B – This section carries 45 marks

7. This question is about measuring 'g' in the laboratory

Maria and Jana use the following apparatus in order to find a value for the acceleration of free fall 'g' of a falling object.



a) Describe how Maria and Jana can use the given arrangement in order to find the time taken by the iron ball to fall over a measured distance.

_____

_____

_____

_____

_____

_____ ***(3 marks)***

b) What distance do the two students need to measure and ***name*** the instrument they would use to measure this distance.

_____

_____

_____ ***(2 marks)***

After some time doing the experiment, the two students tabulated their results in a table as shown.

Height fallen s/(m)	**2s/(m)**	**Time taken t/(s)**	**Time^2 $t^2/(s^2)$**
0	0	0	0
0.20	0.40	0.20	0.04
0.30	0.60	0.25	0.06
0.45	_____	0.30	0.09
0.50	1.00	0.32	_____
0.60	_____	0.35	0.12
0.75	1.50	0.39	0.15
0.90	1.80	0.42	0.18

c) Fill in the missing values (to 2 decimal places) shown in the table above (use this space for your calculations).

_____

_____ ***(3 marks)***

d) Plot a graph of **2s (y-axis)** against **t^2 (x-axis)** and draw the ***best straight line*** through the points. ***(5 marks)***

e) ***Using your graph***, work out a value for the acceleration due to gravity g.

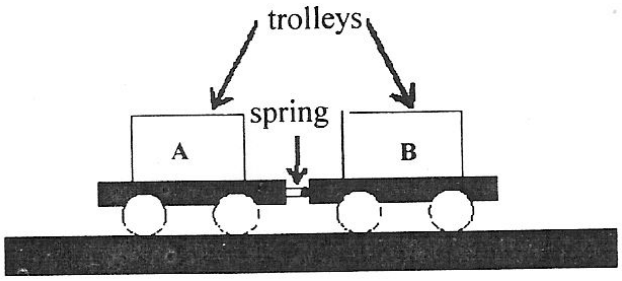
_____

_____

_____ ***(2 marks)***

8. This question is about Momentum

Two trolleys A and B, of mass 1.5 kg and 2.5 kg respectively, are held together by a compressed spring.
The two trolleys are ***initially stationary.***



a) What is the ***total initial momentum*** of the *two trolleys*? Explain.

_____

_____ ***(2 marks)***

b) When the spring is released, the two trolleys move in opposite directions.

(i) Calculate the momentum of *trolley A* if it initially moves at 6 m/s.

_____

_____ ***(1 mark)***

(ii) The ***principle of conservation of momentum*** states that …

_____

_____

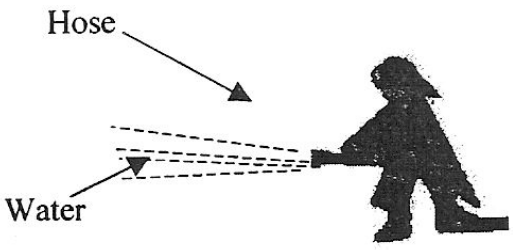
_____ ***(2 marks)***

(iii) Using this principle, calculate the speed of *trolley B*.

_____

_____

_____ ***(2 marks)***



c) A fireman holds a hose which ejects large amounts of high-speed water.

(i) What does the fireman experience when water is ejected from the hose pipe? Explain your answer in terms of Newton's laws.

_____

_____

_____

_____ ***(3 marks)***

(ii) If 5 kg of water are ejected at a speed of 30 m/s, calculate the momentum of this amount of water.

_____

_____ ***(1 mark)***

(iii) The fireman directs this amount of water onto a glass window pane. If the collision between the water and the glass lasts for 0.01 s, calculate the impact force on the glass.

_____

_____

_____ ***(3 marks)***

(iv) State whether the glass window pane will break, if glass can withstand an impact force of 10,000 N.

_____

_____ ***(1 mark)***

9. This question is about motion graphs

(a) What is meant by:

(i) a *uniform velocity of 20 m/s*,

_____

_____ ***(1 mark)***

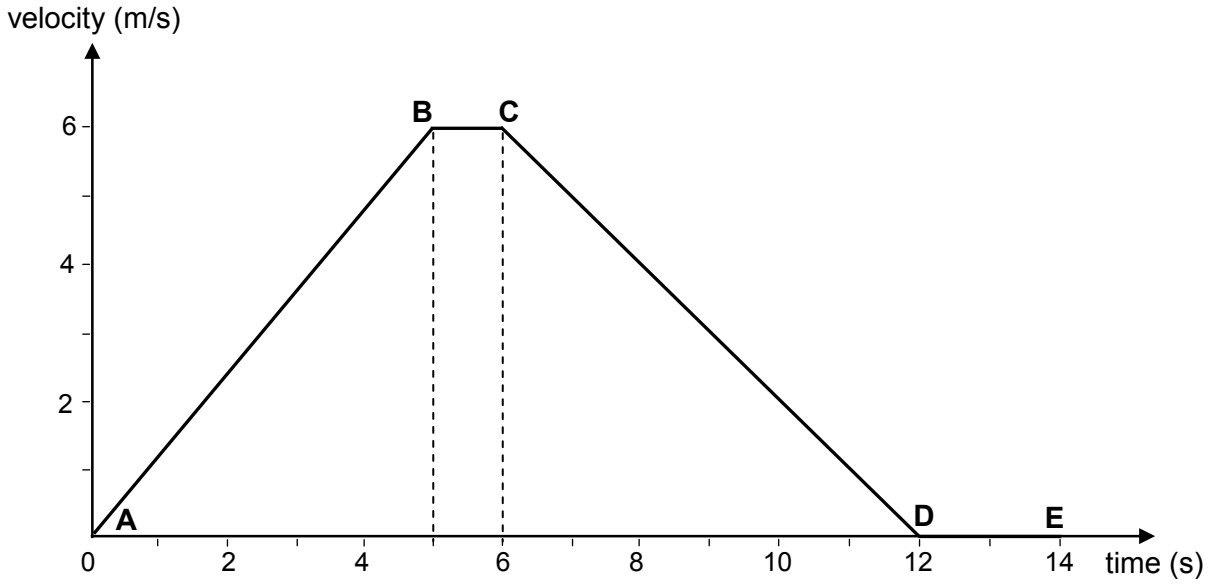
(ii) a *uniform acceleration of 2 m/s*^{2}?

_____

_____ ***(1 mark)***

(b) Sketch a ***distance-time*** graph for a body moving with a ***uniform velocity***. ***(2 marks)***

(c) The following diagram represents the velocity-time graph for a lift in a department store.



(i) Describe the motion of the lift in regions ***AB*** and ***DE***.

AB: _____

DE: _____ ***(2 marks)***

(ii) For how many seconds is the lift actually moving?

_____ ***(1 mark)***

(iii) **Use the graph** to calculate the acceleration of the lift.

_____

_____

_____ ***(2 marks)***

(iv) Find the deceleration of the lift.

_____

_____

_____ ***(2 marks)***

(v) Find the distance travelled by the lift over the region **BCD**.

_____

_____

_____ ***(2 marks)***

(vi) Find the average velocity over the region **BCD**.

_____

_____

_____ ***(2 marks)***

END OF PAPER