Nil Mediocriter

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KULLEĠĠ SAN ĠORĠ PRECA

HALF YEARLY EXAMINATIONS 2012

FORM 4	**PHYSICS**	**Time: 1h 30mins**

NAME: _____ **CLASS:**_____

For the Examiner's use only:

Total Mark	**Written paper (85 marks)**	**Experiments (15 marks)**	**Total Mark (100 marks)**
Actual Mark			

Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Max Mark	**8**	**8**	**8**	**8**	**8**	**15**	**15**	**15**
Actual Mark								

Answer all questions. All working must be shown. The use of a calculator is allowed.

Where necessary, take acceleration due to gravity, g, to be 10m/s^2.

You might find the following list of formulae useful:

$\text{Average Speed} = \frac{\text{Total distance}}{\text{Total time}}$	W = m g
v = u + at	$s = ut + \frac{1}{2}at^2$
$s = \frac{(u+v)}{2}t$	$v^2=u^2+2as$
m a = unbalanced force	Momentum = m v

Section A: Answer ALL Questions. This section carries 40 marks.

1. Put a **X** in the box to show which of the following quantities are scalars and which are vectors and write down the SI unit in each case. (8)

Quantity	**Scalar**	**Vector**	**SI Unit**
mass			
force			
acceleration			
velocity			

2. a) i) A coin and a feather were dropped together from the same height in a vacuum tube. What difference, if any, will there be on their separate time of fall? Give a reason for your answer. (2)

ii) If this time, the coin and the feather are dropped together from the same height through a window in the 3rd floor, what difference, if any, will there be on their separate time of fall? Give a reason for your answer. (2)

b) A boy standing on a bridge 20m high drops a tennis ball.

i) What is the initial velocity of the ball? (1)

ii) Calculate the time it takes to reach the ground, neglecting air resistance. (3)

3. A cyclist was travelling along a horizontal road at a constant velocity of 5m/s. He had to brake as quickly as possible to avoid a child who ran into the road 15m in front of him. His reaction time was 0.6s and the bicycle took 3s to stop after the brakes were applied.

a) Calculate the thinking distance. (2)

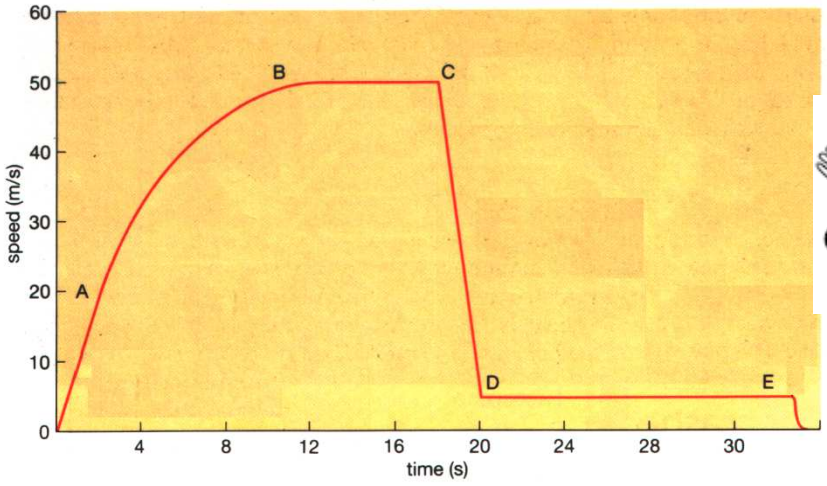
b) Calculate the braking distance. (2)

c) Calculate the overall stopping distance. (1)

d) Will the cyclist manage to brake in time? (1)

e) State two factors which affect the cyclist's reaction time (2)

4. A parachutist jumps from an aircraft and falls through the air. After some time the parachute ens.



a) State the name of the downward force acting on the parachutist. (1)

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b) The graph shows how the speed of the parachutist varies with time.

i) State the initial value of the acceleration of the parachutist as soon as he starts to fall. (1)

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ii) Explain why the acceleration of the parachutist decreases between A and B. (1)

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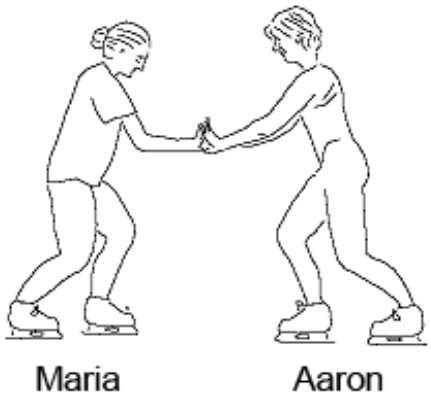
iii) The parachutist reached _____ _____ after 12 seconds. This shows that at that point in time his resultant force was _____ because the acceleration was _____. (3)

iv) From the graph, state the value of the velocity before and after the parachute opens.
Before parachute opens, velocity was _____ (1)
After parachute opens, velocity was _____ (1)

5. Two ice skaters are at rest in the middle of an ice skating rink.



a) Write down the total momentum of Maria and Aaron. (1)

b) Is momentum a scalar or a vector quantity? Why? (2)

c) Maria and Aaron now push each other and move apart in opposite directions.

i) Aaron has a mass of 40kg and moves to the right with a velocity of 3.2m/s. Calculate his momentum. (1)

ii) Write down the momentum of Maria. (1)

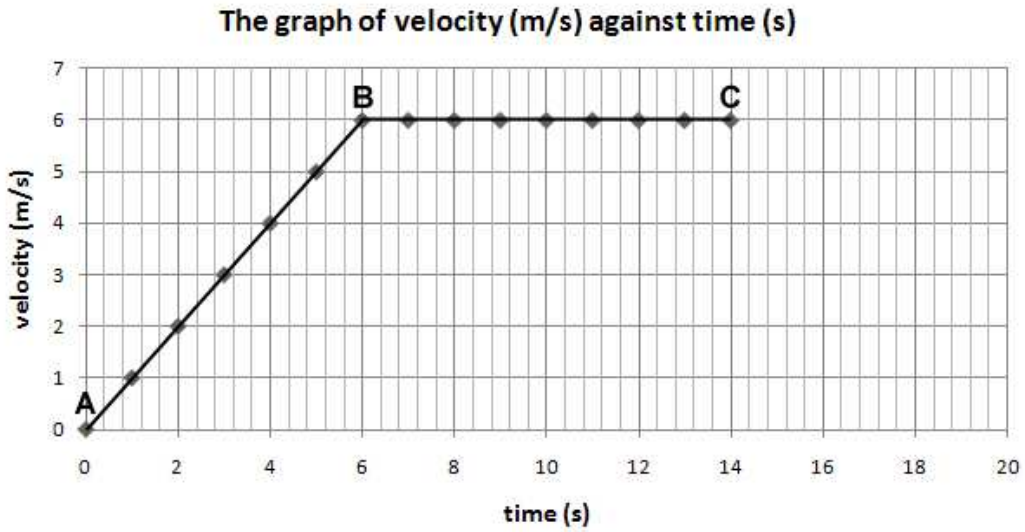
iii) Calculate the velocity with which Maria moves given that her mass is 32kg. (1)

iv) Write down the Principle of Conservation of Momentum (2)

Section B: Answer ALL Questions. This section carries 45 marks.

6. *This question is about velocity time graphs.*

A cyclist is travelling from home to a nearby sports ground. The following is a velocity-time graph for his journey.



a) Fill in the blanks:

At A, the cyclist is at _____. Between A and B, the cyclist travels at a constant _____. After _____ seconds, he reaches a maximum velocity of _____ m/s. (4)

b) Using the graph or otherwise, calculate the acceleration of the cyclist. (2)

c) Complete the graph above, given that the cyclist decelerates at a constant deceleration in the last 4s of his journey (between 14s and 18s) until he comes to rest. (1)

d) Using the graph or otherwise, calculate the deceleration of the cyclist. (2)

e) Calculate the total distance travelled by the cyclist in the **whole** journey. (3)

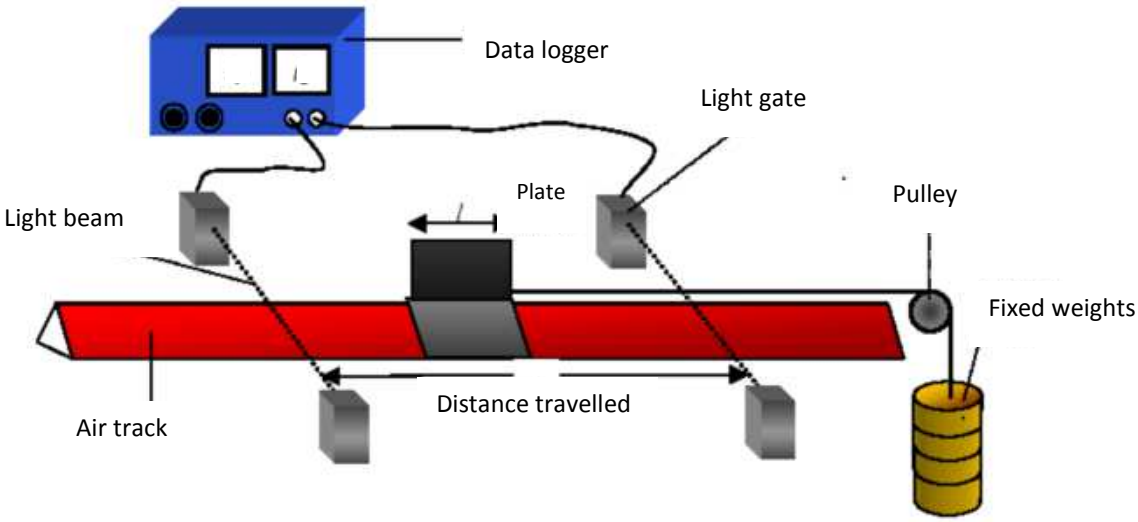
f) Calculate the average speed of the cyclist throughout his journey. (2)

g) On the same velocity-time graph above, draw a line showing how the graph would have been if the cyclist would have travelled the whole journey at the average speed calculated in part (f) above. (1)

7. *This question is about Newton's Laws of Motion.*

a) Nowadays, car manufacturers are aware that each car which they design has to go under several safety tests.

The diagram below simulates how the acceleration of the car varies with different number of passengers inside, keeping the force constant. The glider was loaded with different weights to replicate the mass of the passengers, keeping the weights attached to the string passing over the pulley the same throughout the whole experiment. Each time the acceleration was recorded using a data logger.



The readings obtained were tabulated in the table below.

Acceleration (m/s^2)	0	30	22.5	15	10	5
Mass (kg)	0	1.25	1.66	2.50	3.70	7.5
$\frac{1}{\text{Mass}}$ (kg^{-1})	0	$\frac{1}{1.25} = 0.8$				

a i) Fill in the missing values in the table above. The first one has been done for you. (2)

a ii) Plot a graph of acceleration (m/s^2) on the y-axis and $\frac{1}{mass}$ (kg^{-1}) on the x-axis. Draw the best straight line. (5)

a iii) From the graph, what can you say about the relationship between acceleration and mass? Give a reason for your answer. (2)

_____

_____

a iv) From the graph or otherwise, find the constant force applied during the whole experiment.(1)

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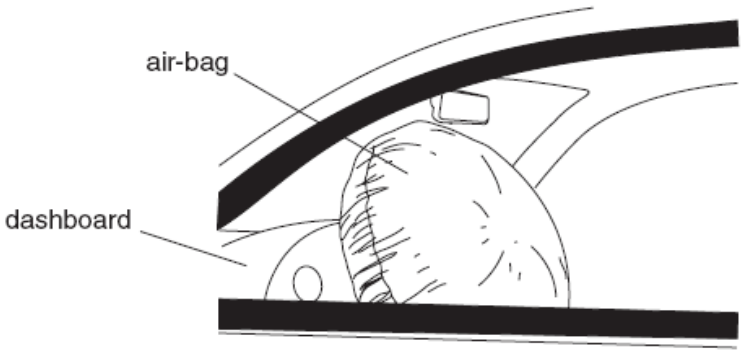
b) Another safety feature that car manufacturers have to consider is the air bag. Many cars are fitted with an air-bag as shown below. In a collision the airbag inflates.



i) In a test of the air-bag, a dummy of mass 60kg is used instead of the passenger. If the average deceleration of the dummy is $5m/s^2$, calculate the average force exerted on the dummy. (1)

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ii) What would be the force exerted by the dummy on the air-bag? Give a reason for your answer. (2)

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iii) Explain why the dummy continues to move forward after the impact. (1)

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iv) Fill in:

The airbag is a safety feature because it _____ the time of impact and decreases the force on the dummy. (1)

8. *This question is about electrostatics.*

a) Fill in: (7)

i) There are two types of charges: _____ and _____.

ii) An atom is made up of three basic particles called _____, _____ and _____.

iii) Materials which do not allow electric charge to move through them are called _____.

iv) Materials which allow electric charge to flow through them are called _____.

b) i) How can a polythene strip be charged? (1)

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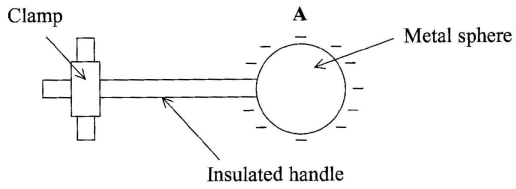
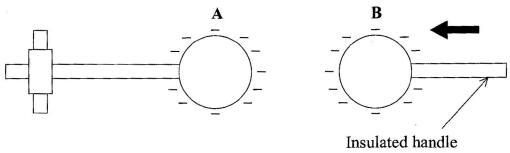
ii) Explain the answer to b (i) in terms of the movement of electrons. (1)

iii) What is the final charge on the polythene strip? (1)

c) The diagram shows a negatively charged metal sphere A with a clamped insulated handle.



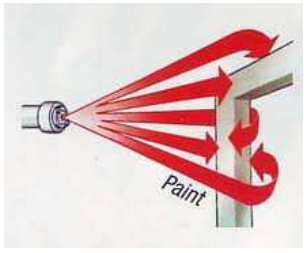
A similarly negatively charged sphere B is brought close to but not touching sphere A as shown below.



i) What type of force is present when they are brought close to each other? (1)

ii) As sphere B is brought closer to sphere A, what change, if any, will there be in the size of the force between them? (1)

d) John wants to paint the iron gate of his front garden. He uses an electrostatic spray gun as shown. Powdered paint is blown out of the gun at high speed towards the gate. The powdered paint rubs against the sides of the spray gun's nozzle and charges the spray droplets positively.



i) Give one reason why the powdered paint spreads out as it comes out of the spraying gun. (1)

ii) If the gate is earthed, what charge is produced on the gate while he is spraying? (1)

iii) Why is this electrostatic spray gun more effective than a jet spray? (1)