# Saint Margaret College
## Girls' Secondary School, Żejtun

**Half Yearly Exams – Scholastic Year 2011/2012**

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

Name: _____ Index: _____

Class: _____ Teacher: _____

## INSTRUCTIONS

- Answer **ALL** questions on this examination paper. No extra foolscaps are needed.
- This paper carries 85 marks. Laboratory coursework carries 15 marks.
- The use of the calculator is allowed, however **ALL** necessary working must be shown.
- Where necessary assume $g = 10\ m/s^2$.

## FORMULAE

$$W = mg \qquad F = ma$$

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

$$v = u + at \qquad s = \frac{(u+v)t}{2}$$

$$s = ut + \tfrac{1}{2}at^2 \qquad v^2 = u^2 + 2as$$

$$\text{momentum} = mv \qquad c = f\lambda$$

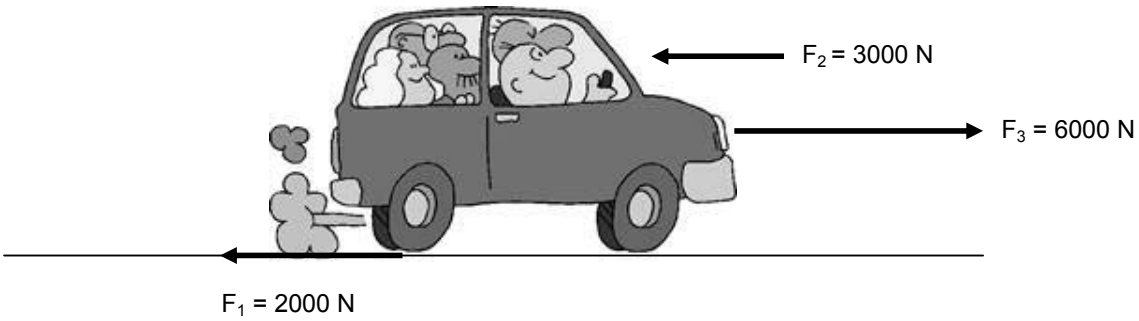
| Question: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Theory | Practical | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. mark: | 8 | 8 | 8 | 8 | 8 | 15 | 15 | 15 | 85 | 15 | 100 |
| Score: | | | | | | | | | | | |

# SECTION A

(This section carries 40 marks of the total mark)

## 1. This question is about forces and motion.

The diagram below shows the forces acting on a car travelling along a level road.




a) Name the three forces acting on the car: [3]

- $F_1$: _____
- $F_2$: _____
- $F_3$: _____

b) Calculate the resultant force acting on the car, stating its direction. [2]

_____

_____

_____

c) If the mass of the car is 1150 kg, calculate its acceleration. [2]

_____

_____

_____

_____

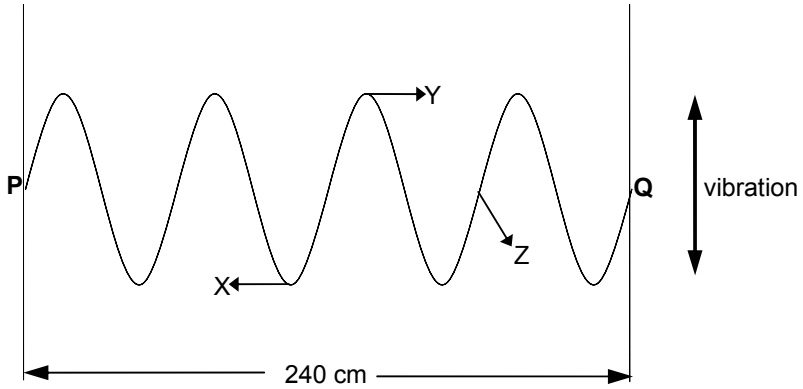
d) Explain what happens to the forces shown in the diagram when the car brakes. [1]

_____

_____

## 2. This question is about waves.

The figure shown represents a transverse wave travelling along a rope held firmly at end P and moved up and down at end Q.




a) On the above diagram mark:

i) The amplitude of the wave and label it **A**. [1]

ii) The wavelength of the wave and label it **L**. [1]

b) Draw a circle around one of the letters **X**, **Y** and **Z** which shows the point that represents the crest of the wave. [1]

c) Use the information given in the diagram to determine:

i) The number of complete waves. [1]

_____

ii) The wavelength of the wave. [1]

_____

_____

d) Calculate the velocity of the wave in m/s, given that the frequency of the vibration is 2 Hz. [2]

_____

_____

e) Calculate the periodic time of the wave. [1]

_____

_____

## 3. This question is about motion.

A stone is dropped from rest from a height of 5 m above the ground.

a) What is the acceleration of the stone as it falls? [1]

_____

b) Find:

i) The final velocity of the stone. [2]

_____

_____

_____

_____

_____

ii) The time taken for the stone to reach the ground. [2]

_____

_____

_____

_____

_____

_____

_____

c) Underline the correct answer: [1]

Another stone of twice the mass (having the same shape) is dropped from the same height to the ground. Provided there are no resistive forces acting, this object will take **the same time / twice the time / half the time** to reach the ground.

d) Give a reason for your last answer in (c). [2]

_____

_____

## 4. This question is about forces, motion and momentum.

Rachel and Ryan are on board a bumping car travelling at 5 m/s. Each child has a mass of 45 kg. Rachel is wearing a seatbelt but Ryan is not. The bumping car comes to a sudden stop as it bumps into a rubber wall.

a) Rachel comes to rest in 2·4 s. Calculate:

i) Her initial momentum. [1]

_____

_____

ii) Her final momentum. [1]

_____

_____

iii) The impact force exerted on her. [2]

_____

_____

b) Ryan comes to rest in 1·5 s. Calculate the impact force exerted on him. [2]

_____

_____

c) Complete the following: [1]

It can be concluded that the seatbelt serves to increase the stopping time. As a result, the impact force on the passenger is _____.

d) Provide another explanation in terms of Newton's laws of motion to describe how a seatbelt works to decrease injury in case of sudden braking. [1]

_____

_____

## 5. This question is about momentum.

A bullet of mass 650 g was fired at a speed of 7 m/s from a gun of mass 1·1 kg.

a) What is the mass of the bullet in kg? [1]

_____

b) What is the momentum of the bullet and the gun before the explosion? [1]

_____

c) Find the momentum of the bullet after it is fired. [2]

_____

_____

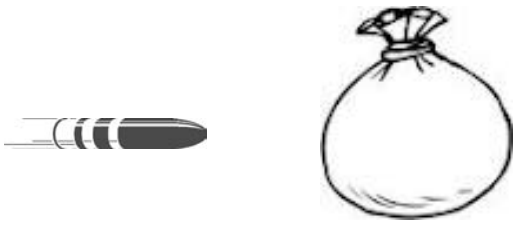
d) Find the recoil velocity of the gun after it is fired. [2]

_____

_____

_____

The bullet then hits a stationary sack of potatoes of mass 3 kg and becomes embedded in it.



e) With what velocity do the bullet and the sack move together? [2]

_____

_____

_____

## 6. This question is about forces and motion.

A coin of mass 20 g was dropped from a given height. The velocity of the coin changes with time according to the table shown below:

| Time (s) | 0 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·6 | 0·7 | 0·8 |
|---|---|---|---|---|---|---|---|---|---|
| Velocity (m/s) | 0 | 2·75 | 4·25 | 5·00 | 5·30 | 5·40 | 5·50 | 5·50 | 5·50 |

a) Plot a graph of time (s) on the x-axis against velocity (m/s) on the y-axis on the graph paper provided on page 12. [4]

b) What is the initial velocity of the coin? [1]

_____

c) A force acts on the coin as soon as it is released. What is this force called? [1]

_____

d) Find the value of the force named in your last question (c). [2]

_____

_____

e) After some time another force starts acting on the coin. What is this force called? [1]

_____

f) Describe the motion of the coin during the first 0·1 s. [1]

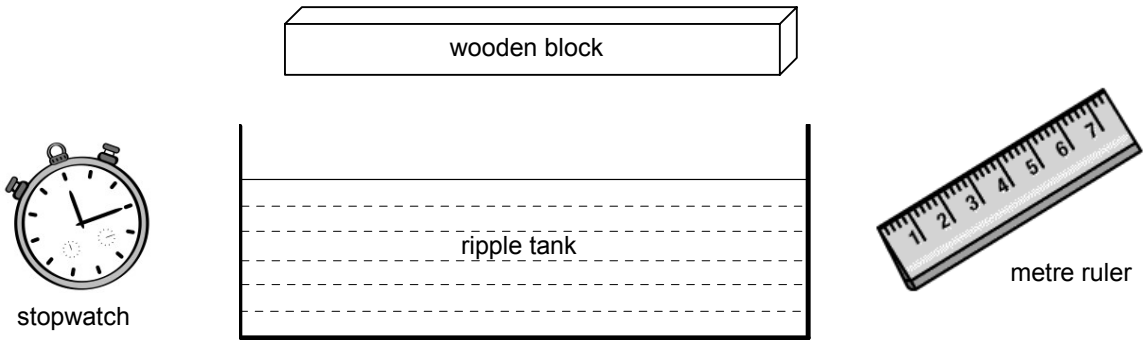
_____

g) Complete the following: [5]

The maximum velocity reached by the coin has a value of _____ and is called the _____. When this velocity is reached the forces are _____ in size and have _____ direction. At this stage, the resultant force acting on the object is _____ and the acceleration has a value of _____.

## 7. This question is about waves.

a) In a physics laboratory, Donna wants to find the average speed of a water wave in a ripple tank. She is provided with the following apparatus as illustrated in the diagram.




i) What type of waves are the water waves in the ripple tank? [1]

_____

ii) Explain how Donna can use the above apparatus to estimate an average speed of the waves in the tank. [3]

_____

_____

_____

_____

_____

_____

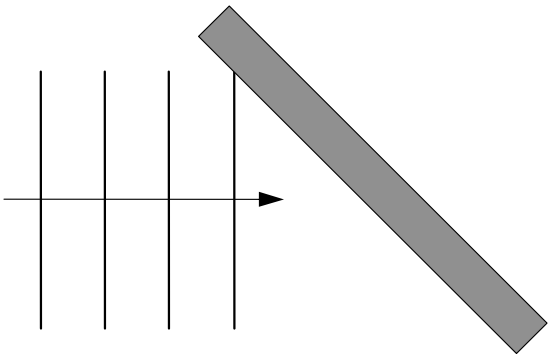
b) Donna observes a small floating piece of cork going up and down in the ripple tank with a frequency of 3 Hz. Define the term frequency. [1]

_____

c) Donna places a slanting perspex plate in the ripple tank so that it is totally submerged in the water. She observes changes in the wave pattern as the waves pass over the perspex plate. Mention one of these changes. [1]

_____

d) Donna places a barrier in the ripple tank and sends wavefronts at an angle towards the barrier as shown in the following diagram.



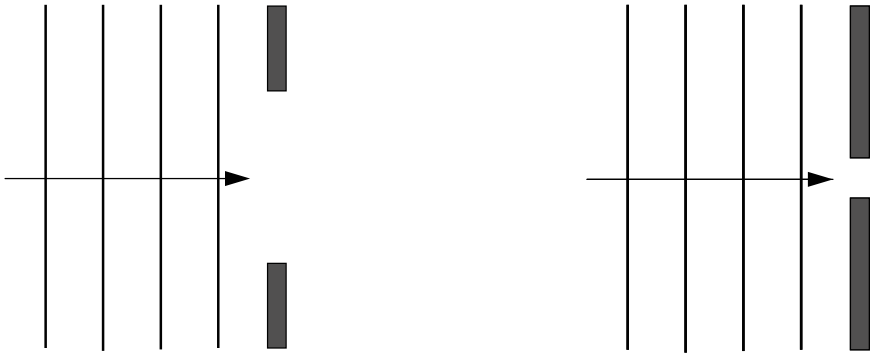
i) Mark the wavelength of the water waves on the diagram above. [1]

ii) Measure the wavelength of these waves. [1]

_____

iii) Complete the diagram to show how the water waves are being reflected after hitting the barrier. [2]

e) Donna now places a barrier with a gap in the middle as shown in the following two diagrams.



i) On **each** of the above diagrams, draw the shape of the wavefronts after passing through the gap. [4]

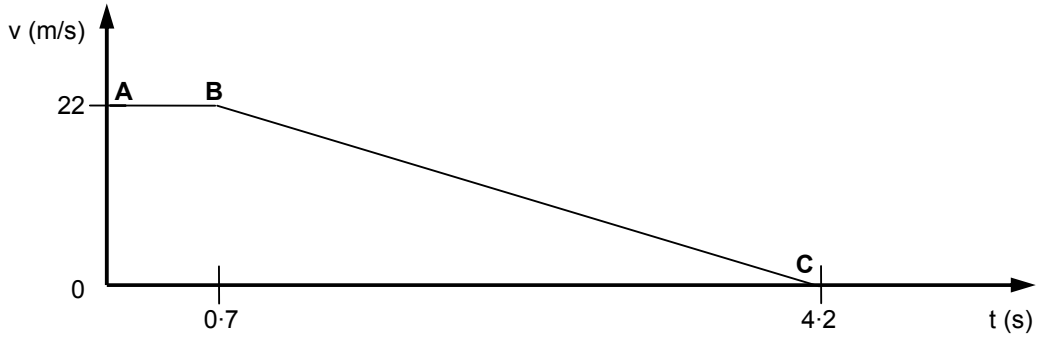
ii) What is this phenomenon called? [1]

_____

## 8. This question is about motion.

Elaine makes an emergency brake as a dog crosses the road.

The graph below shows the changes in motion of Elaine's car.




a) Explain the meaning of the terms:

i) Thinking time. [1]

_____

_____

ii) Braking time. [1]

_____

_____

b) Using the graph, find a value for:

i) The thinking time. _____ [1]

ii) The braking time. _____ [1]

c) Describe the motion of the car in the part labelled:

i) AB. [1]

_____

ii) BC. [1]

_____

d) Using the graph, calculate:

i) The thinking distance. [2]

_____

_____

_____

ii) The braking distance. [2]

_____

_____

_____

iii) The total stopping distance of the car. [1]

_____

_____

iv) The deceleration of the car. [2]

_____

_____

_____

_____

e) Underline the correct answer: [2]

- Dangerous driving practices can lead to fatal traffic accidents. High speed is the number one road killer. Driving at a higher speed increases **the thinking time / the braking time / both the thinking and braking time**.

- Answering or texting on a mobile while driving is also very dangerous. It increases **the thinking time / the braking time / both the thinking and braking time**.

## END OF EXAMINATION PAPER

*Please turn over for graph paper*