St. Ignatius College
Boys Secondary School, Ħandaq
Half-Yearly Examination 2012

3

Form 4 ***(Track 3)*** ***Physics*** **Time:** ***1hour 30 minutes***

Name:_____ **Class:** _____

Question No.	1	2	3	4	5	6	7	8	9	Main Paper	Practical Work	Global Mark
Max. Mark	5	6	8	8	8	9	15	14	15	85	15	100
Mark												

Answer all questions.

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

All working must be shown. The use of the calculator is allowed.

Forces	W = mg	F = ma
Motion	Average velocity = $\frac{\text{distance travelled}}{\text{Time taken}}$	v = u + at
	s = ut + 1/2 at^2	v^2 = u^2 + 2as
	Area of trapezium = $\frac{(a + b)\,h}{2}$ Area of triangle = 1/2 base x height	s = $\frac{(u+ v)\,t}{2}$
Momentum	momentum = mv	
Waves	v = fλ	

Section A: *This section carries 40 marks.*

1. Underline the correct answer.

1. When an object increases its speed at the same rate, it makes:
A. a uniform deceleration
B. a uniform acceleration
C. a non-uniform deceleration

2. When an object is neither accelerating or decelerating, it can be either:
A. at rest or moving at a constant speed
B. at rest or increasing the speed
C. moving at constant speed or decreasing the speed.

3. The resultant force is the product of mass and acceleration. F = ma is known as Newton's
A. First law
B. Second law
C. Third law

4.This factor effects both the thinking distance and the braking distance:
A. the mass of the car
B. the speed of the car
C. the reaction time of the driver

5. The braking distance is the distance moved by the car from the moment the driver:
A. sees the child till he starts to brake
B. sees a child crossing till he stops
C. starts braking till he stops the car

6. Newton's 3rd law of motion states that for every action there is:
A. an equal and opposite reaction
B. an equal and opposite velocity
C. always another action.

7. Which has a greater momentum?
A. a stationary toy car
B. a toy car of mass 2kg moving at 4m/s
C. a toy car of mass 1 kg moving at 9 m/s

8. The area under a velocity—time graph gives the:
A. acceleration
B. deceleration
C. total distance covered

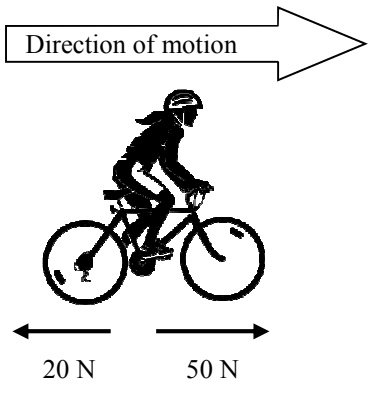
9. When an object falls freely, its acceleration is:
A. O m/s^2
B. 10 m/s^2
C. 20 m/s^2

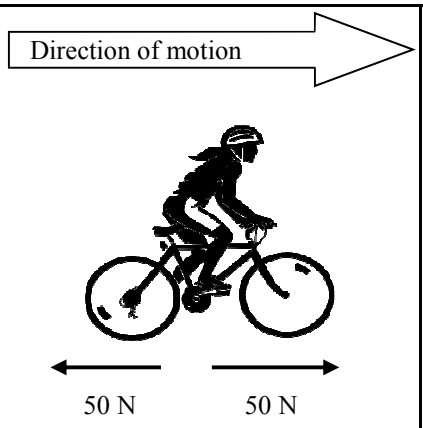
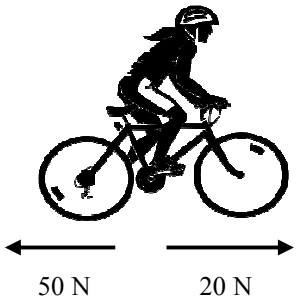
10. If an object starts from rest, then its velocity is:
A. 0N
B. 10m/s
C. 0m/s [5]

2. Roberta rides her bicycle on a straight line in a level road. [6]
The diagrams below show three different stages of her journey.

Find the **resultant force** and **fill in** the table using one of the following:
Deceleration at rest acceleration moving at constant speed

a.

	Resultant Force	Describe Roberta's Motion
		

		Resultant Forces	Describe Roberta's Motion
b.			
c.			

3.a. In the space below, **draw** a transverse wave. [1]

b.i. Mark the crest with a '**C**' and the trough with a '**T**' on the diagram drawn [1]

ii. On the above diagram mark the amplitude with an '**a**'. [1/2]

iii. Mark also one **wavelength** by using the symbol 'λ'. [1/2]

c. In the space below, draw a **longitudinal** wave. [1]

d.i. Mark a rarefaction with an '**R**' and a compression with a '**C**' on the diagram. [1]

ii. Give one example of a **longitudinal** wave. _____ [1]

iii. Mark one **wavelength** by using the symbol 'λ'. [1]

4. A car manufacturer wants to test a new car model for safety before it goes for sale. In one of the tests, the car of mass 1000 kg travels at 9m/s. It collides with a wall and takes 0.10 s to stop.

a. Find the **momentum** of the car **before** hitting the wall.

_____

_____ [1]

b. Find the **final momentum** when the car stops..

_____

_____ [1]

c. What is the **change** in momentum?

_____ [1]

d. Calculate the **force** that the car exerts on the wall.

_____

_____ [2]

e. What is the size of the force that the wall exerts on the car?
Use a **Newton's law of motion** to explain your answer.

_____

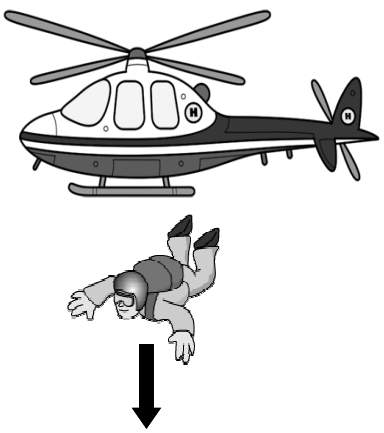
_____

_____ [2]

f. Explain how air bags in cars can increase passenger's safety.

_____

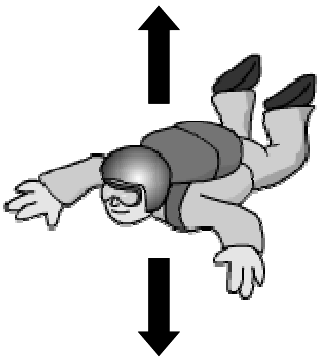
_____ [1]

5. 

a. **Complete the sentences below.**

i. Jim has just been dropped from a helicopter. There is only one force acting on him. This is his **w**_____. [1/2]

ii. This **r**_____ or u_____ force makes him **a**_____ downwards. [1 1/2]



iii. As he travels faster, the a_____ r_____ increases. Eventually the forces b_____ . [1]

c. Jim's mass is 75kg, calculate his **weight**.

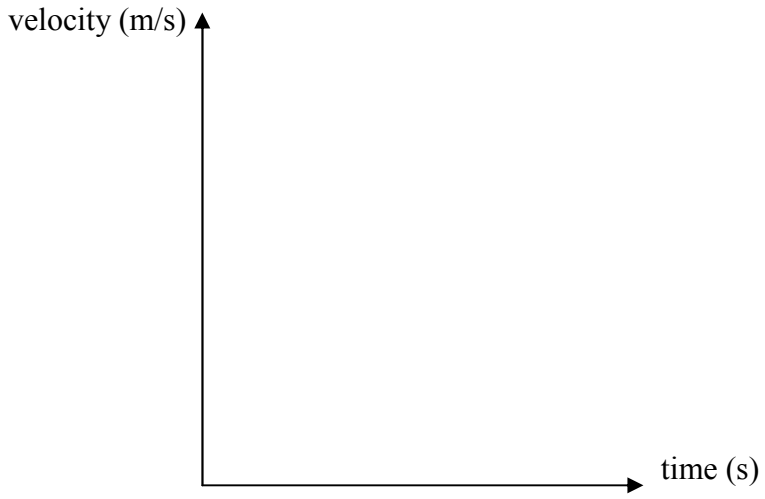
_____ [1]

d. How much is the **upward force** when Jim is moving with a constant velocity?

_____[1/2]

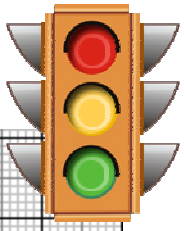
e. This constant velocity is called _____ velocity. [1]

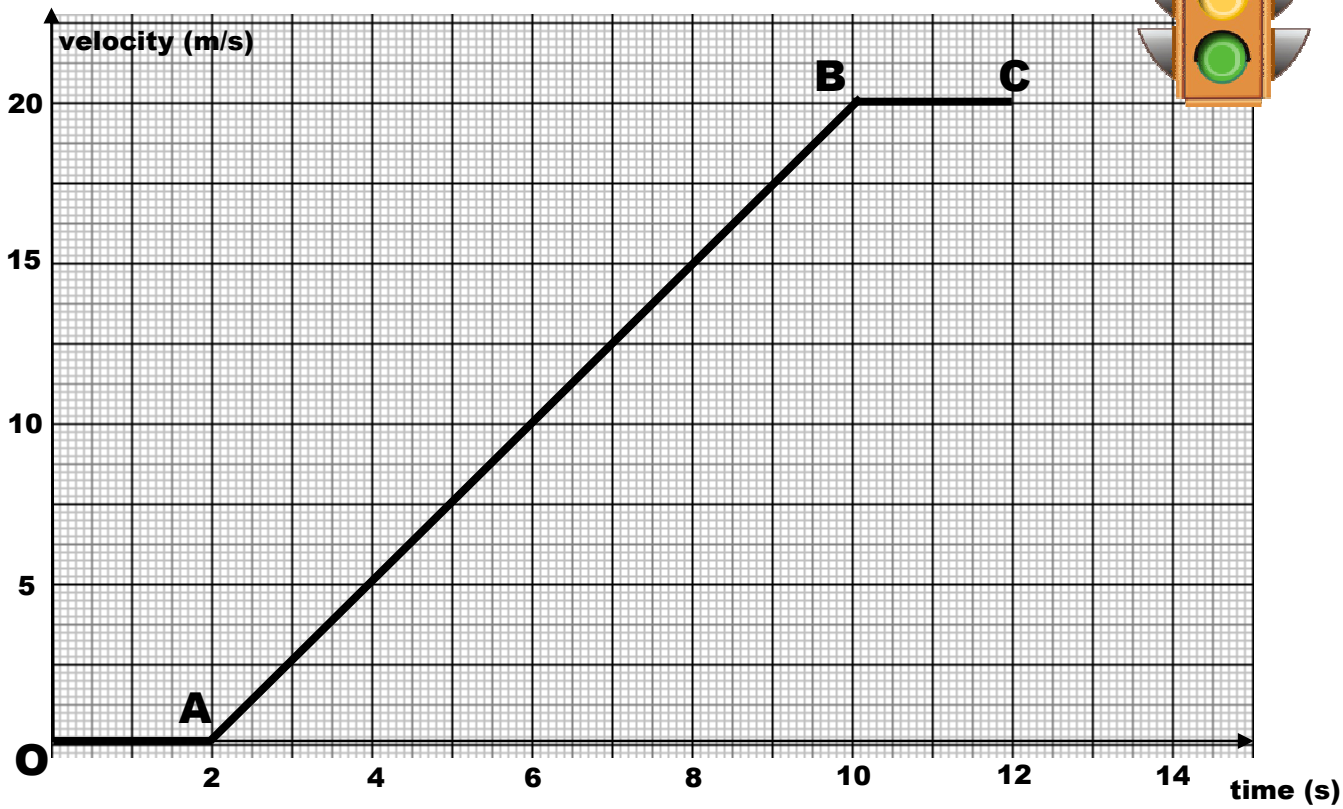
f. Sketch a **velocity** (m/s) against **time** (s) graph to show Jim's motion from the time Jim jumps off the helicopter to the time he reaches constant velocity.



[2]

6. Martha is in her car at the traffic lights. The graph below shows the motion of her car. At point **O** the lights are red at **A** the lights turn green.





a. **Match** the following phrases to describe correctly the motion of Martha's car.

Between O and A	**Martha's car is accelerating**
Between A and B	**Martha's car is travelling at a constant speed**
Between B and C	**Martha's car at rest** [1 1/2]

b. From the graph, calculate the **distance travelled** between A and B.

_____

_____[2]

c. At 12 seconds a small child runs in front of the car. Martha's reaction time (thinking time) was 0.5 second and it took a further 1.5 seconds to stop the car.

i. Draw on the graph above the line to show the motion of the car while Martha was **thinking to stop**. [1/2]

ii. Draw on the graph the line to show the motion of the car while Martha was **applying the brakes**. [1/2]

d. From the graph, calculate the **deceleration** of the car during braking.

_____

_____[2]

Section B. *This section carries 45 marks.*

7. Mario was riding his horse in the countryside at a velocity of 15m/s. Mario's mass is 70kg and the mass of the horse is 430kg.

BEFORE EXPLOSION

a. Mention **two** factors which affect the momentum of an object.

_____[2]

b. i. Find the **total mass** of Mario and the horse.

_____[1]

ii. Find the **total momentum** of Mario and the horse.

_____[2]

Mario and his horse were going to jump over a fence when the horse stopped suddenly and Mario fell forward.

AFTER EXPLOSION

c. Explain in terms of **Newton's First Law** why Mario fell forward.

_____

_____

_____ [2]

d.i. Calculate the **momentum** of the horse when it **stopped**.

_____ [1]

ii. State the **Principle of Conservation of Momentum**, by completing the following correctly:
When two or more bodies split apart, their total _____ before the explosion is _____ [2]

iii. Write down the **total momentum** after the horse stopped and Mario fell forward.

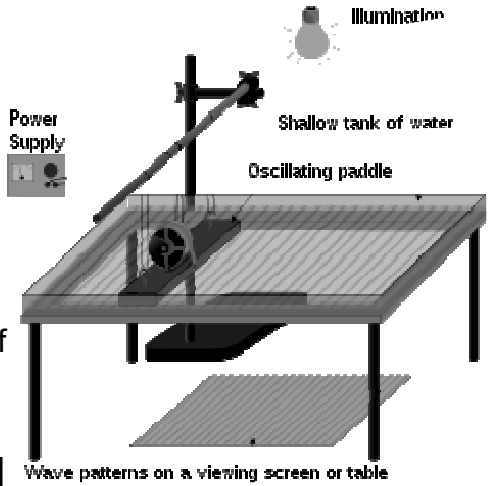
_____ [2]

iv. Calculate the **velocity** with which Mario fell forward.

_____

_____ [3]

8. Jade and Ruby are doing an experiment using a simple ripple tank as shown.



a. Are waver waves transverse or longitudinal ?

_____ [1]

b. Explain how Jade can produce water waves in the ripple tank.

_____ [1]

c. Explain how Jade can **increase** the frequency of the waves in the ripple tank.

_____ [1]

d. Every minute, Jade counts 120 waves passing a certain point in the ripple tank. What is the **frequency** of the waves in **Hz**?

_____

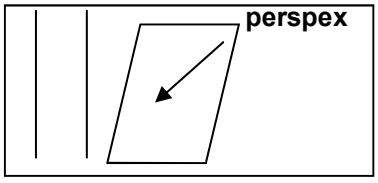
_____[2]

e. Calculate the **speed** of these waves if their wavelength is 0.015m.

_____

_____[2]

f. Jade and Ruby put a flat perspex plate at the bottom of the ripple tank as shown:



i. **Complete** the diagram to show how the water waves travel. [1]

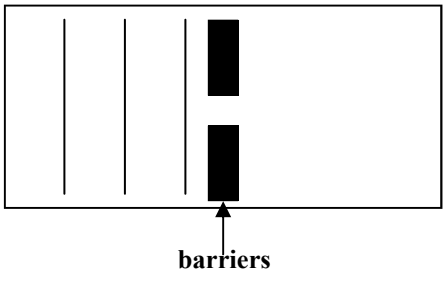
ii. Give the name for this property of waves. _____ [1]

iii. Does the **speed** of the water waves increase, decrease or remain the same on passing over the Perspex?

_____ [1]

g. Ruby places two barriers leaving a gap in between as shown:

i. Complete the diagram to show what happens to the water waves after they pass through the narrow gap. [2]



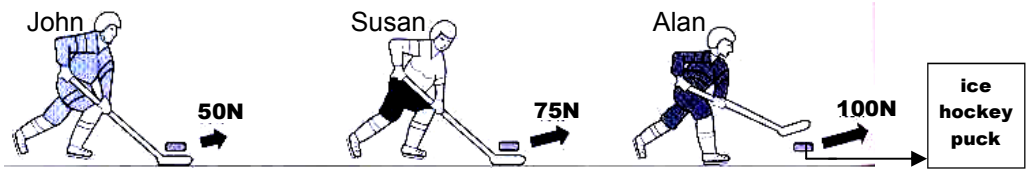
ii. Give a name for this property of waves.

_____ [1]

h. Mention **one precaution** to be taken during this experiment.

_____[1]

9. The diagram below shows three players pushing the same ice hockey puck.

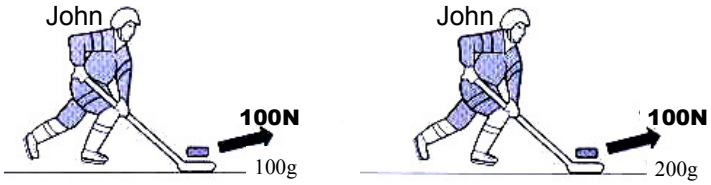


a. Which player gives the puck the **greatest acceleration**? Explain your answer.

_____

_____[2]

b. John hits two different pucks with the same force, as shown below.



i. Which puck **moves fastest**? Give a reason for your answer.

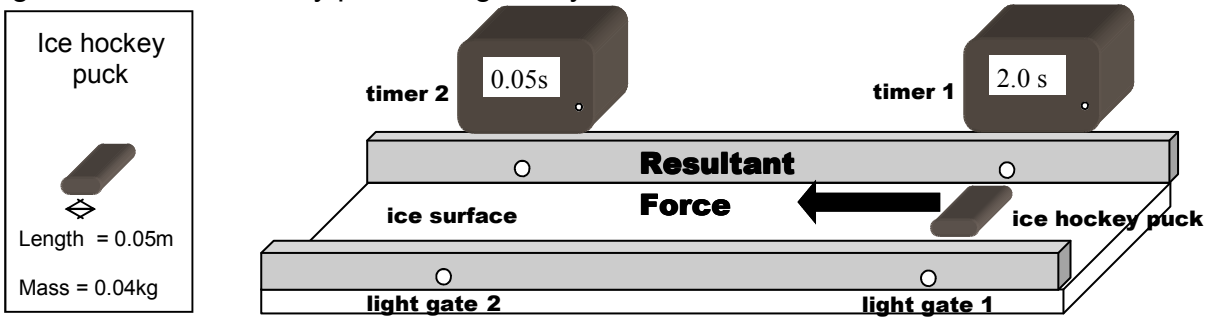
_____

_____[2]

ii. What must John do to make the pucks move with the **same speed**?

_____[1]

c. The apparatus below is used to investigate how acceleration varies with force given to an ice hockey puck along an icy surface.



Timer 1 measures the time the puck takes to travel between light gate 1 and light gate 2.
Timer 2 measures the time the puck takes to pass through light gate 2.

i. The puck is given a force and accelerates uniformly from rest. The length of the puck is 0.05m and the time shown on timer 2 is 0.05seconds.
Calculate the **final velocity** of the puck just as it passed through light gate 2.

_____[1]

ii. Calculate the **acceleration** of the puck if timer 1 records a time of 2.0 seconds.

_____[2]

iii. Calculate the **resultant force** on the puck if it has a mass of 0.04kg.

_____[2]

Using the apparatus shown on the previous page, different forces were applied to the ice hockey puck. Readings for acceleration and resultant force were recorded in the table below.

Resultant Force/N	0	0.02	0.04	0.06	0.08	0.1	0.12	0.14	0.16
Acceleration	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0

d. Plot a graph of **resultant force** on the **(y axis)** against **acceleration** on the **(x axis).** [5]