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

**2**

**Form 4** ***(Track 2)*** ***Physics*** **Time:** ***1hour 30 minutes***

| Question No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Main Paper | Practical Work | Global Mark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. Mark | 8 | 8 | 8 | 8 | 8 | 8 | 15 | 15 | 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 = $\frac{(a + b)\,h}{2}$<br>Area of triangle = 1/2 base x height | s = $\frac{(u+ v)\,t}{2}$ |
| **Momentum** | momentum = mv | |
| **Waves** | v = fλ | |

## Section A

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.The thinking distance is the distance moved by the car while the driver is:
A. braking
B. reacting
C. driving

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.

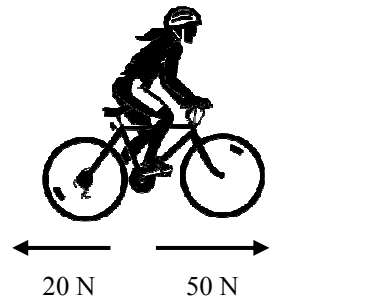
7.Which has a greater momentum?
A. A stationary toy car
B. a toy car of mass 2kg moving at 4 m/s
C. a toy car of mass 1 kg moving at 9 m/s

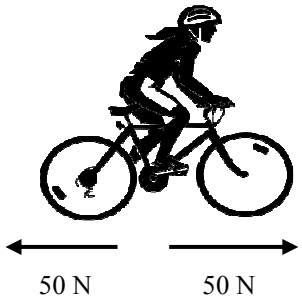
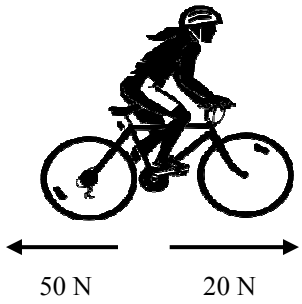
8. The area under a velocity—time graph gives the:
A. Acceleration
B. Deceleration
C. total distance covered

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 [8]

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**

| | **Resultant Force** | **Describe Roberta's Motion** |
|---|---|---|
| Direction of motion  20 N 50 N | | |

| | Resultant Forces | Describe Roberta's Motion |
|---|---|---|
| Direction of motion   | | |
|   | | |

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

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

c) On the above diagram mark the amplitude with an '**a**'. [1]

d) Mark also one **wavelength** by using the symbol 'λ'. [1]

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

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

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

g) 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 of the car.

_____

_____ [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 to explain your answer.

_____

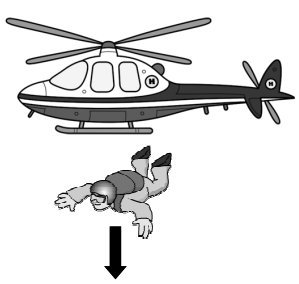
_____

_____ [2]

f) The car can be made safer by including air bags. Explain.

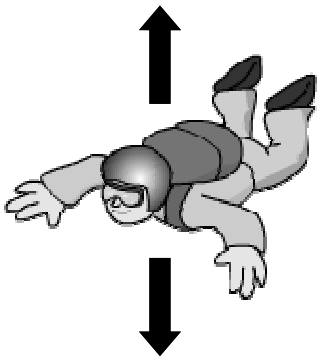
_____

_____ [1]

5a 

Jim has just been dropped from a helicopter. There is only one force acting on him. This is his w_____.

This r_____ force makes him a_____ downwards at _____ $m/s^2$.



b. As he travels faster, the a_____ r_____ increases. Eventually the forces b_____.

(i) Jim's mass is 75kg, calculate his weight.

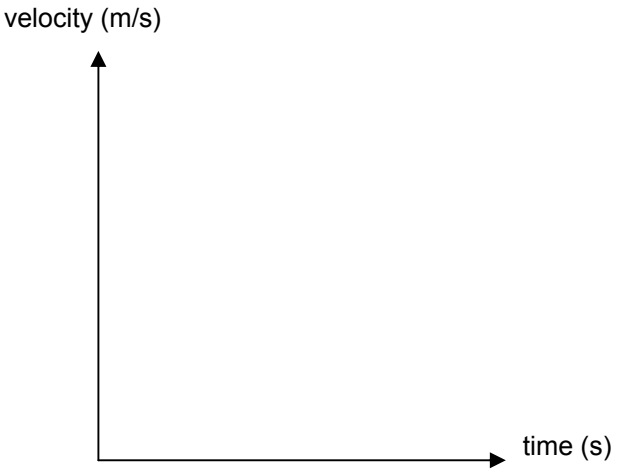
_____

(ii) How much is the upward force when Jim is moving with a constant velocity?

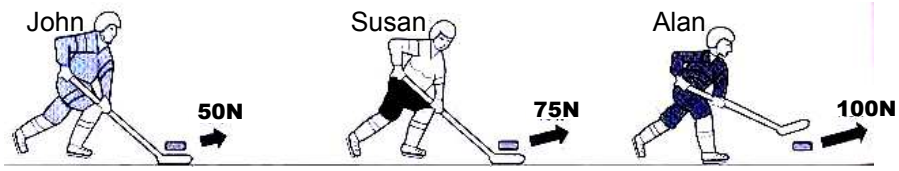
_____

(iii) This constant velocity is called _____ velocity.

c. 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.



6. The diagram below shows three players pushing an ice hockey puck.

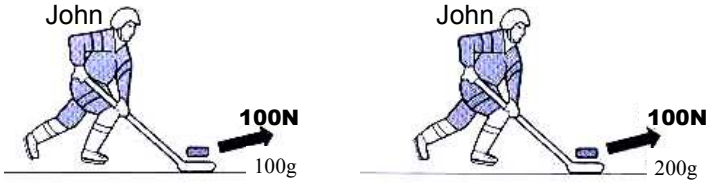



a. Which player gives the puck the greatest acceleration? Explain your answer.

_____

_____

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




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

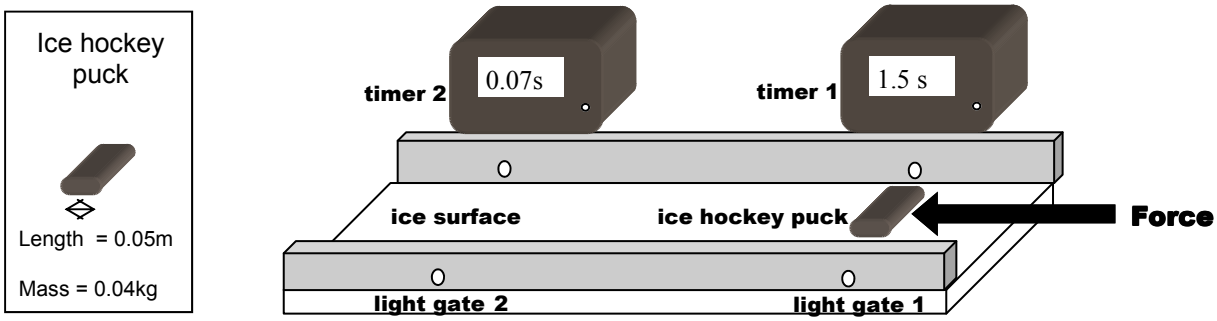
_____

_____

(ii) What must John do to make the pucks move with the same speed?

_____

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 and the time shown on 'timer 2' is 0.07seconds. Find the final velocity reached by the puck at light gate 2.

_____

(ii) Find the acceleration of the puck if 'timer 1' records a time of 1.5 seconds.

_____

(iii) Find the force given to the puck if it has a mass of 0.04kg.

_____

**Section B. This section carries 45 marks.**

7.This question is about Newton's laws

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. Label the given information on the diagram above. Include arrows to indicate the direction of movement.

b (i) Find the total mass of Mario and the horse.

_____

(ii) Find the total momentum of Mario and the horse.

_____

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

AFTER EXPLOSION

c Label the given information on the diagram above. Include arrows to indicate the direction of movement.

d (i) Calculate the momentum of the horse when it stopped.

_____

(ii) State the Principle of Conservation of Momentum, by completing the following:
When two or more bodies collide with each other, their total _____ before the explosion is _____.

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

_____

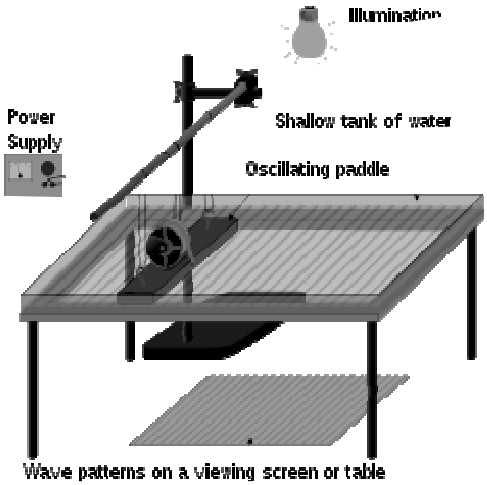
(iv) Calculate the velocity with which Mario fell forward.

_____

_____

_____

8. Jade and Ruby use this special apparatus to observe the water waves.




a) What is this apparatus called?
_____ [1]

b) Fill in the paragraph by choosing from this list:

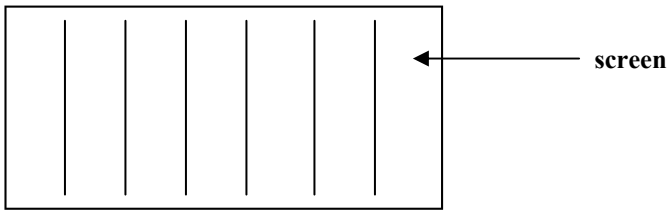
***increases, straight, spherical, wavelength, generator***

To produce straight wavefronts Jade and Ruby use a _____ dipper but to produce circular wavefronts they use a _____ dipper . They increases the frequency from the _____. They notice that when the frequency _____, the _____ decreases. [5]

c) Mention **one** precaution Jade and Ruby should take during this experiment
_____[1]

Every **minute**, Jade counts that 120 waves were passing.
d) How many waves pass every second ?
_____[2]

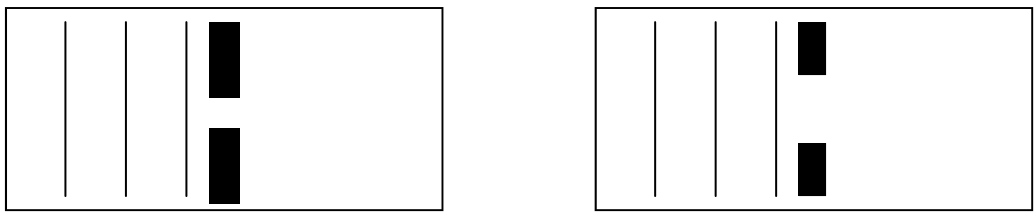
At a particular instance the wave patterns on the screen were as follows.




e) Use your ruler to measure the wavelength in cm and write your answer below.
**Wavelength** = _____ cm [1]

f) Find the **wave velocity** in cm/s using your answers in (d) and (e).
_____ [2]

Jade and Ruby use two barriers in the water during their experiments.
g) Complete the two diagrams below to show how waves pass through gaps. [2]



h) When waves passes through gaps, _____ occurs. [1]

9. The graph shows the motion of a car which accelerates from rest and then moves at a constant speed.

| Velocity (m/s) | 0 | 5 | 10 | 15 | 20 | 20 | 20 |
|---|---|---|---|---|---|---|---|
| Time (s) | 0 | 2 | 4 | 6 | 8 | 10 | 12 |

a. Plot a graph of velocity (m/s) on the y axis against times (s) on the x axis. [5]

b. At 12 seconds a small child runs in front of the car. The driver's reaction time (thinking time) was 0.5second and it took a further 2 seconds to stop the car.

(i) Draw on the graph the line to show the motion of the car while the driver was thinking to stop. [1]

(ii) Draw on the graph the line to show the motion of the car while the driver was applying the brakes. [1]

c. (i) What is meant by thinking distance? [1]
(ii) What is meant by braking distance? [1]

d. Calculate from the graph the stopping distance travelled by the car. [2]

e. The deceleration of the car during braking. [2]

f. (i) Name one factor that could affect the thinking distance. [1]
(ii) Name one factor that affects the car's braking distance when it is travelling at 20m/s. [1]