DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management and eLearning
Educational Assessment Unit
Annual Examinations for Secondary Schools 2011

Track

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

Name: _____ **Class:** _____

Answer ALL questions in the spaces provided on the Exam Paper.
All working must be shown. The use of a calculator is allowed.
Where necessary take the acceleration due to gravity, g = 10 m/s^2.

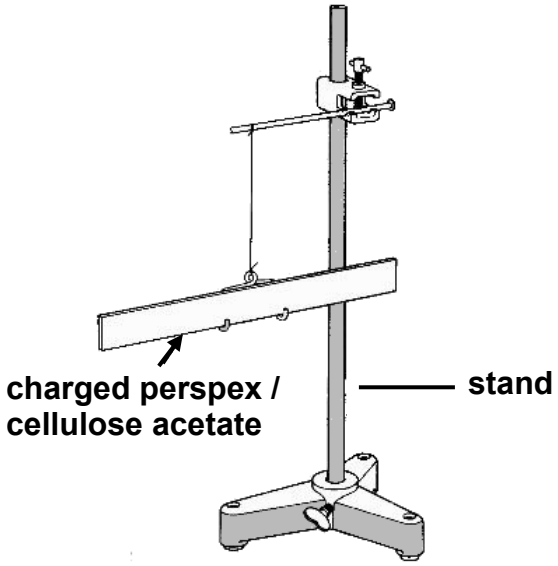
Forces & Motion	$W = mg$	Average Speed = $\frac{\text{Total Distance}}{\text{Total Time}}$
	$v = u + at$	$s = ut + \frac{1}{2} a t^2$
	$s = \frac{(u+v)}{2} t$	$v^2 = u^2 + 2as$
	$F = ma$	Momentum (p) = mv
Electricity	$Q = I t$	$E = Q V$
	$V = I R$	$R = R_1 + R_2 + R_3$
	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$	$R \propto \frac{1}{A}$ $R \propto L$
Waves	$v = f \lambda$	$f = \frac{1}{T}$
	$m = \frac{v}{u}$	$m = \frac{\text{height of image}}{\text{height of object}}$
	$\eta = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$	$\eta = \frac{\text{real depth}}{\text{apparent depth}}$

Number	1	2	3	4	5	6	7	8	Total
Maximum mark	8	8	8	8	8	15	15	15	85
Actual mark									

	Total Theory	Total Practical	Final Mark
Actual Mark			
Maximum Mark	**85**	**15**	**100**

SECTION A **This section carries 40 marks**

1.(a) A **charged perspex (cellulose acetate) strip** is suspended as shown in the diagram.



State what you would observe when:

	Attraction / Repulsion
another charged perspex strip is brought next to it,	
a charged polythene strip is brought next to it,	
an uncharged perspex strip is brought next to it.	

[3]

(b) A light metal sphere is **repelled** by a **positively** charged object. What charge is present on the sphere?

_____

[1]

(c) (i) How can a perspex strip be charged?

_____

[2]

(ii) Explain your answer for c (i) in terms of the movement of electrons.

_____

_____

[2]

2. Kyle and Nicole stand on roller skates as shown below. Initially they are at rest.

(a) What is their total momentum **before** they start to push each other?

_____

[1]

(b) The two skaters push each other and move in **opposite** directions. Calculate the momentum of Nicole, if she has a mass of 45 kg and moves to the right at a velocity of 2 m/s.

_____

[2]

(c) Kyle has a mass of 50 kg. Calculate the velocity at which he moves to the left.

_____

_____

[2]

(d) Complete the following:

The Principle of Conservation of Momentum states that _____

_____

[1]

(e) Why does Kyle move at a lower speed?

_____

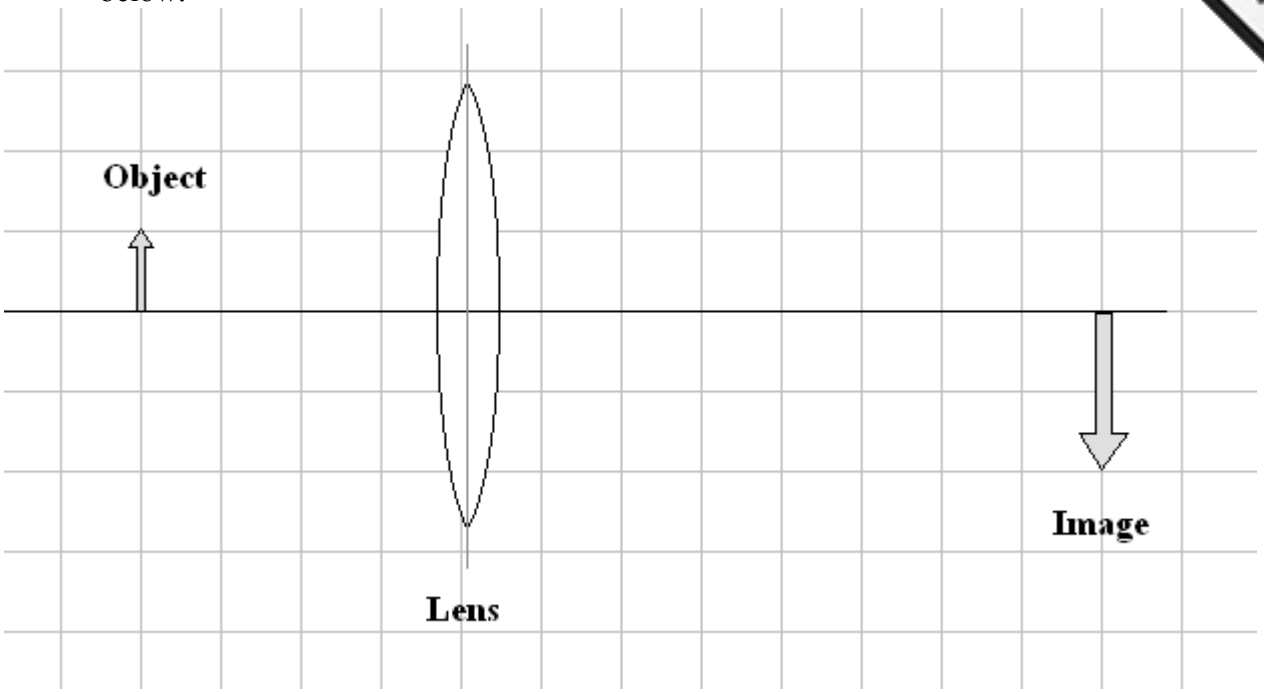
[1]

(f) Kyle and Nicole exert an equal and opposite force on each other. Is this statement correct?

_____

[1]

3. An illuminated object is placed in front of a convex lens producing an image a
below.



(a) Complete the above diagram by adding the missing rays. [2]

(b) On the above diagram, mark with an '**F**' the principal focus of the lens. [1]

(c) Give **one** example when the above lens arrangement is used.

_____

[1]

(d) Use the above diagram to calculate the magnification of the lens.

_____

[1]

(e) Name **one** other property of the inverted image produced.

_____

[1]

(f) The image is produced on a screen. What happens to the image if the screen is moved away from the lens, assuming everything else is unchanged?

_____

[1]

(g) What would happen if the object is moved closer to the lens so that it is placed between the focal point and the lens?

_____

[1]

4. The first known work with ultrasound was carried out by Lazzaro Spallanzani, an Italian scientist who wondered how bats can fly in complete darkness. He blindfolded them and noticed that they still could fly well. He then plugged their ears and found that they bumped into obstacles.

He concluded that bats must emit sound waves which we cannot hear and then listen to the echoes to determine the distance and direction of objects.

(a) What is the normal **range** of hearing for human beings?

_____

[1]

(b) Explain how sound travels through air.

_____

[1]

(c) Is ultrasound made up of transverse or longitudinal waves?

_____

[1]

(d) A bat emits a sound with a frequency of 34 kHz.

(i) What does the term **frequency** mean?

_____

[1]

(ii) Complete: 34 kHz = _____ Hz [1]

(iii) The speed of sound in air is 340 m/s. Calculate the wavelength in metres of the sound waves produced by the bat.

_____

[1]

(e) A bat is flying close to a wall and receives the reflected sound after 0.16s.

(i) What is the reflected sound called?

_____

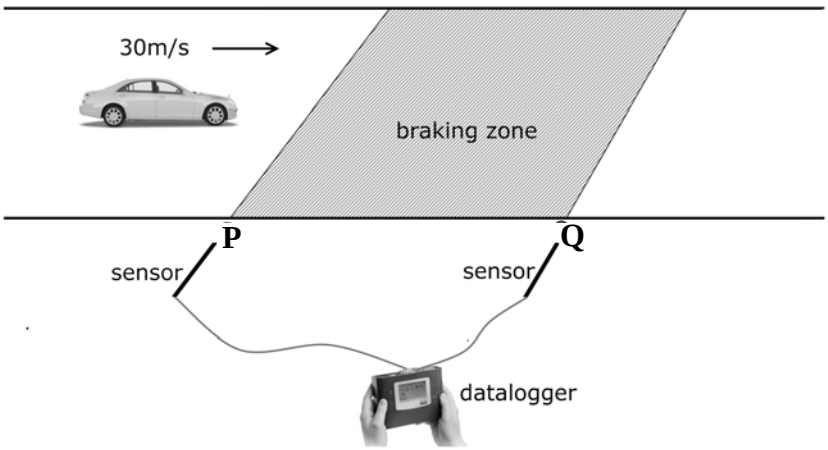
[1]

(ii) Calculate the distance between the bat and the wall. (Speed of sound in air is 340m/s).

_____

[1]

5. A test track is set up to test the braking system of cars. Sensors are connected to a data logger which records the speed of a car at points P and Q as shown in diagram below. In one test, the data logger records the speed at P as 30 m/s and the speed at Q as 12 m/s. The time to move from P to Q is 2 seconds.



(a) Calculate the deceleration of the car.

_____

_____

[2]

(b) The mass of the car is 1000 kg. Calculate the braking force acting on the car.

_____

[1]

(c) Calculate the length of the braking zone.

_____

_____

[2]

(d) The test is repeated with the same car but now with passengers inside. The speed at P is again 30 m/s. The same braking force is applied to the car as in part (b).

(i) Will the **momentum** of the car at P increase, decrease or remain the same?

_____

[1]

(ii) Will the **deceleration** of the car between P and Q be smaller than, equal to or greater than the one calculated in (a) above? Explain.

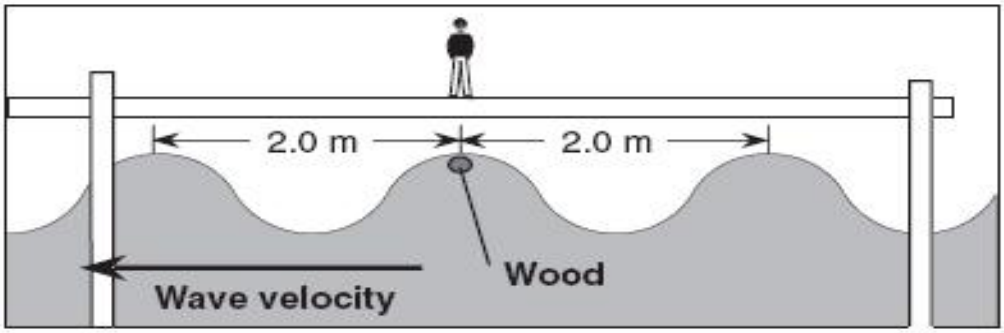
_____

_____

[2]

SECTION B **THIS SECTION CARRIES 45 MARKS.**

6. (a) A student observes a piece of wood floating on the water as shown below.



(Not drawn to scale)

(i) Mark on the above diagram one wavelength with the symbol λ [1]

(ii) From the above diagram what is the value of **one** wavelength? _____ [1]

(iii) The wood moves up and down and returns to its original position in 0.5 s. Calculate the frequency of the water waves.

_____

[1]

(iv) Use the answers to (ii) and (iii) above to calculate the speed of the waves.

_____

_____

[2]

(b) **Diagram 1** shows water wavefronts approaching a wall.

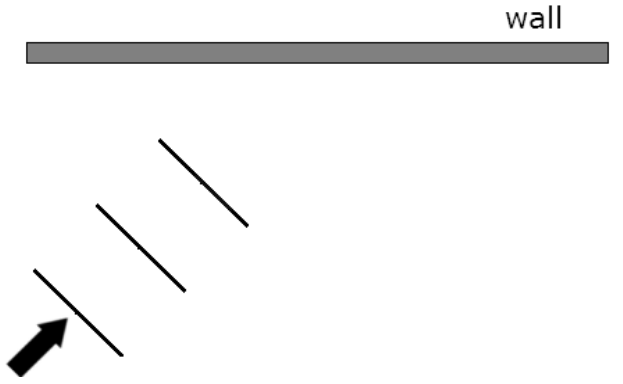


Diagram 1

(i) Complete **Diagram 1** to show the path of the reflected wavefronts. [2]

(ii) On **Diagram 1** above, draw the normal and label it 'N' [1]

(c) **Diagram 2** shows water wavefronts approaching a gap.

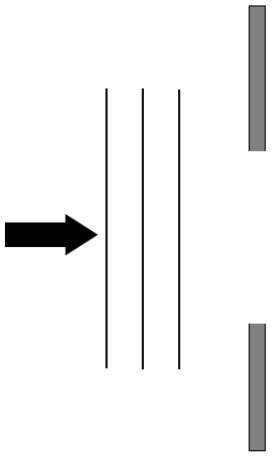


Diagram 2

(i) Draw the shape of the wavefronts after they travel through the gap. [2]

(ii) This effect is more visible as the gap is narrowed. Name this effect.

_____

[1]

(d) A ray of light changes direction when it travels from air to glass.

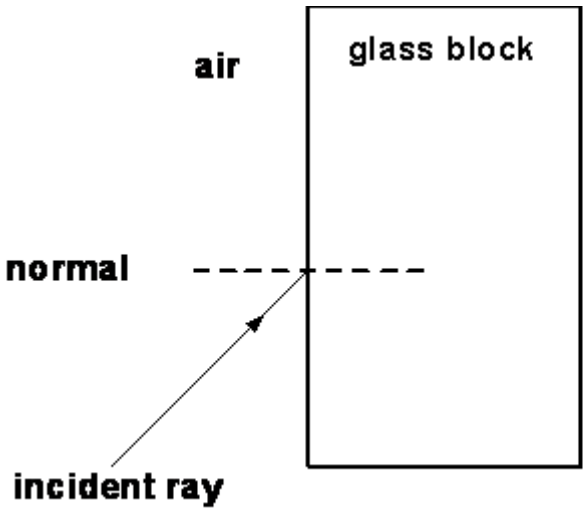


Diagram 3

(i) Draw on **Diagram 3** above the path of the ray of light as it passes through and out of the glass block. [3]

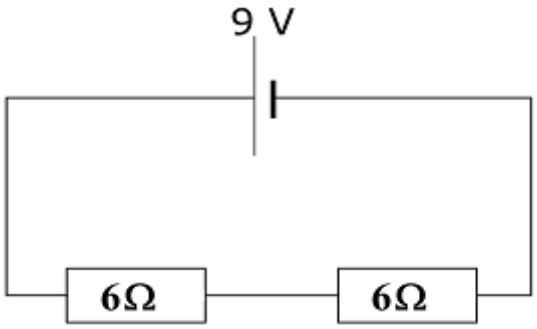
(ii) Name the effect observed.

_____

[1]

7. (a) Two 6 Ω resistors are connected **in series** as shown in **Diagram 4**.

Diagram 4



Calculate the:

(i) total resistance in the circuit,

_____

[1]

(ii) total current flowing through the circuit,

_____

[1]

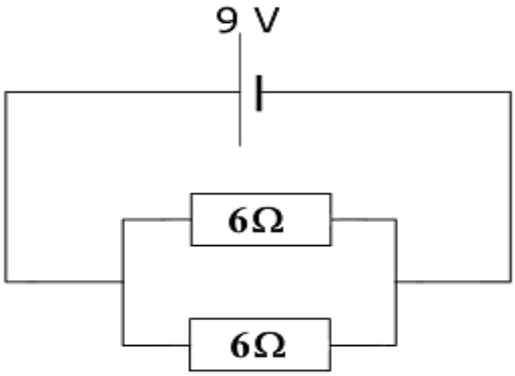
(iii) voltage across one of the 6 Ω resistors.

_____

[1]

(b) The two resistors are now connected **in parallel** as shown in **Diagram 5**.

Diagram 5



Calculate the:

(i) total resistance of the circuit,

_____

[1]

(ii) current flowing through the circuit,

_____

[1]

(iii) current flowing through one of the 6 Ω resistors.

_____

[1]

(c) A student sets up the following circuit to investigate the resistance of resistor R (D **6**). The component A is used to change the voltage and current in the circuit. The rea on B and C are recorded in a table.

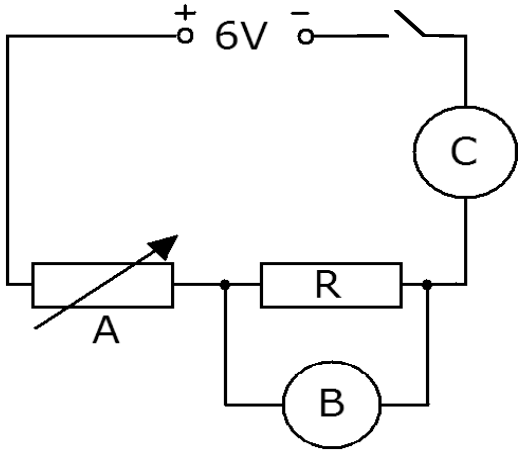


Diagram 6

(i) Name the components A, B and C.

A. _____ B. _____ C. _____

[3]

The student takes a set of readings as shown below.

Current (A)	0	1.8	3.9	5.4	7.2	9.0
Voltage (V)	0	1	2	3	4	5

(ii) Plot a graph of current (y axis) against voltage (x axis). Draw the best straight line through the points. [4]

(iii) Use the graph to find the value of the current when the voltmeter reads 4.2V.

_____

[1]

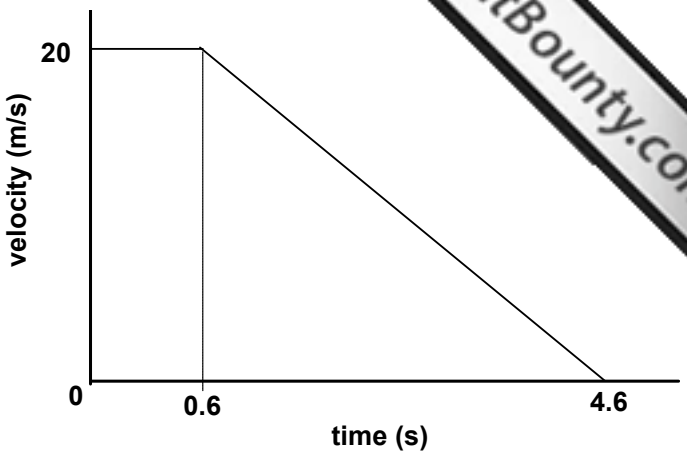
(iv) Using the formula R = V / I calculate the value of the resistor R when the reading on the voltmeter is 4.2 V.

_____

_____

[1]

8. A small child is playing in the middle of the road. The velocity-time graph shows the motion of a car from the moment the driver sees the child till when he stops the car completely.



(a) Describe the type of motion present in the:

(i) first 0.6 s _____ [1]

(ii) last 4 s _____ [1]

(b) What is the value of the acceleration in the first 0.6 s? _____ m/s^2 [1]

(c) On the above graph, mark:

(i) with the letter 'T' the area which represents the thinking distance, [1]

(ii) with the letter 'B' the area which represents the braking distance of the car. [1]

(d) (i) Use the above graph to calculate the area representing the thinking distance.

_____

[2]

(ii) The braking distance is 40m. What is the total stopping distance of the car?

_____

[1]

(iii) Calculate the deceleration of the car in the last 4 seconds.

_____

[2]

(e) Underline the correct answer in each of the following:

(i) A car's mass affects the (thinking / braking / thinking and braking) distance. [1]

(ii) Sleepiness affects the (thinking / braking / thinking and braking) distance. [1]

(iii) A car's speed affects the (thinking / braking / thinking and braking) distance. [1]

(iv) Wet roads affect the (thinking / braking / thinking and braking) distance. [1]

(v) Using a mobile phone whilst driving affects the (thinking / braking / thinking and braking) distance. [1]