Name _____( ) Class _____

PRELIMINARY EXAMINATION
GENERAL CERTIFICATE OF EDUCATION ORDINARY LEVEL

PHYSICS 5058/02
Paper 2 **Thursday 15 September 2011**
1 hour 45 minutes

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams or graphs.
Do not use highlighters, correction fluid or correction tape.

Section A [50 marks]
Answer **ALL** questions.

Section B [30 marks]
Answer **ALL** questions. **Question 11** has a choice of parts to answer.

Information for students:

Students are reminded that all quantitative answers should include appropriate units and should be given to a sensible number of significant figures. Errors in units and numbers of significant figures will be penalised.
If working is needed for any question, it must be shown in the space provided. Omission of essential working will result in loss of marks.

Take the value of acceleration due to gravity on Earth, $g = 10\ ms^{-2}$ or **10 N/kg**.

For Examiner's Use	
Section A	
Section B	
Total	

This document consists of **16** printed pages including this cover page.

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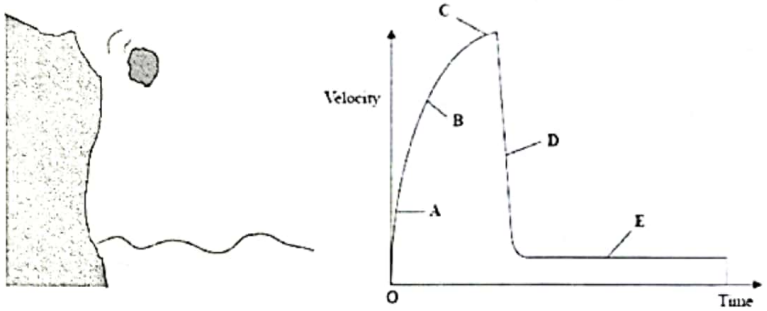
CHIJ ST NICHOLAS GIRLS' SCHOOL
A Leader in Every Student

[Turn Over

Section A [50 Marks]
Answer all the questions in this section.

1. During a storm, a large rock falls from a high cliff into the sea.



The graph shows the velocity of the rock as it falls from the cliff until it reaches the bottom of the sea. **A**, **B** and **C** are stages in its fall in air before it hits the sea. **D** and **E** represent stages in its fall in the sea water.

(a) At which of these stages does the rock have

(i) greatest acceleration, ... [1]

(ii) greatest deceleration, ... [1]

(iii) the greatest force acting on it due to air resistance? ..... [1]

(b) Describe and explain the motion of the rock when it is in the sea at stage **E**. Use the concepts of water resistance, weight, acceleration and velocity in your answer. [3]

Motion of rock: .....

Explanation :

(c) Explain why there is a steep decrease in velocity for part **D**. [1]

(d) Is the height of the cliff greater, the same or less than the depth of the sea? [1]

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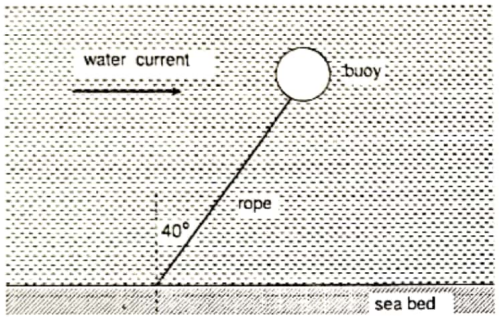
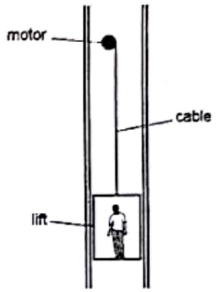
2. The diagram below shows a light weight buoy being held submerged in sea water by a rope anchored to the sea bed. Water current causes the buoy to be displaced so that the rope makes an angle of 40° to the vertical. The buoy is acted on by the tension in the rope, **T** of 780 N, the vertical upthrust of the water, **U** and the horizontal force of the water current of 500 N.



In the space below, draw to scale a vector diagram of these forces to determine the magnitude of the vertical upthrust, **U**. State the scale of your diagram. [4]

3. The diagram shows a motor used to raise a lift which is carrying a man inside. The motor is supplied with an electrical power of 6400 W. The man and the lift has a total mass of 600 kg. The lift accelerates upward at 0.100 m/s^2, moving a vertical distance of 11.3 m from rest in 15 s.

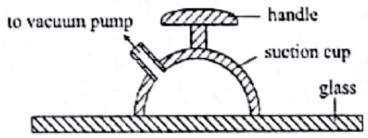


(a) Calculate the tension in the cable when the lift is accelerating at 0.100 m/s^2. [2]

(b) Calculate the work done by the motor in 15 s. [2]

(c) Calculate the power loss of the motor. [2]

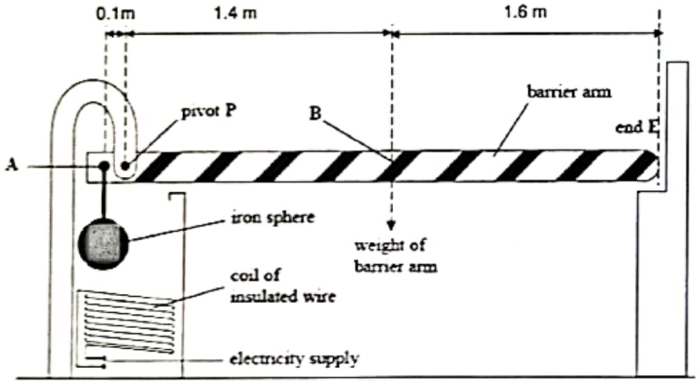
4. The diagram below shows a piece of glass being lifted up by a suction cup. Some air inside the suction cup is removed by a vacuum pump till it is 60 kPa. The atmospheric pressure of 100 kPa outside the cup prevents the glass from dropping. The area of the glass covered by the cup is 0.0025 m^2.



(a) Calculate the maximum weight of a piece of glass that can be lifted with this cup when the air inside the cup is 60 kPa. [3]

(b) Suggest two changes that would allow the suction cup to lift a heavier piece of glass. [2]

5. The diagram shows a barrier at a car park. The barrier arm is usually in the position shown. An iron sphere is attached to the barrier arm at **A**. The weight of the barrier arm acts at **B**. When there is a current in the coil, the barrier arm at end **E** moves upwards.

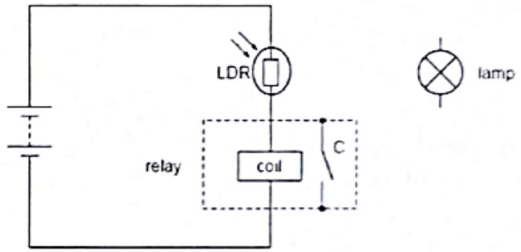


(a) The coil of insulated wire is connected to a d.c. supply. Explain why the barrier arm moves upward at end **E** when a current flows in the coil of insulated wire. [3]

(b) State what happens if the electricity supply is replaced by an a.c. source. Explain your answer. [2]

(c) When the electricity is switched on, the total force which acts at **A** is 900 N.
This force can just start to pull the iron sphere down. Use the distances shown on the diagram to calculate the weight of the barrier arm.
Show your working. [2]

6(a) The diagram below shows a circuit that uses a relay system. When light falls on the light-dependent resistor (LDR), the relay contacts **C** close.



(i) State what happens to the resistance of the LDR when light falls on it. [1]

(ii) The circuit for the lamp is not complete. Connect the lamp, the relay contacts **C** and the battery so that the lamp will light up when light falls on the LDR. [1]

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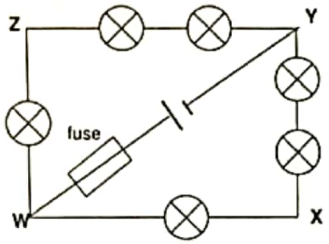
(b) Six identical lamps, each with a resistance of 2.5 Ω, are connected to a 12.0 V cell as shown in the diagram below.



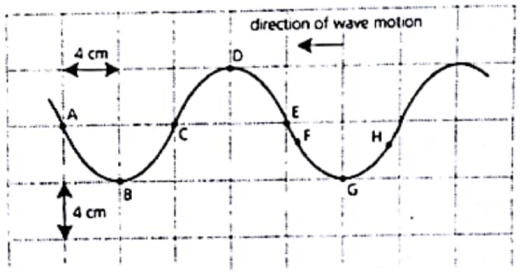
(i) Calculate the current that flows through point **X** . [2]

(ii) What is an appropriate fuse rating for the fuse shown in the circuit diagram? Show relevant working. [2]

(iii) What is the purpose of the fuse in this circuit? [1]

(iv) The lamps are switched on for 4 hours every day. If one unit of electricity cost 25 cents, what is the cost of using the lamps for one month? [2]

7. A transverse wave is traveling from right to left through a series of particles. At a certain instant the waveform is as shown in the diagram below. Each of the vibrating particles is observed to perform two complete oscillations in 20 seconds.



(a) Find the following quantities: [4]

(i) Wavelength :

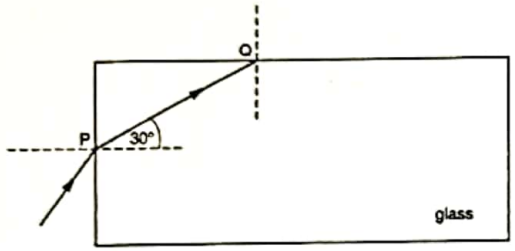
(ii) Frequency :

(iii) Speed :

(iv) Amplitude:

(b) Mark the position of the particle **C** one-quarter of a period later. Label it **C'** on the diagram above. [1]

8 The diagram (not drawn to scale) shows a ray of light passing from air into a rectangular glass block of refractive index 1.54.



(a) Calculate the angle of incidence in the air at point **P**. [2]

(b) Sketch the path of the ray when it leaves **Q** till it emerges out of the glass. Show relevant working and label on the diagram all the relevant angles. [3]

(c) Give one practical application of the phenomenon of light as seen in **Q**. [1]

Section B [30 MARKS]

Answer all the questions. Q11 has a choice of section to answer.

9. Firewalking is defined as the act of walking barefoot over a bed of hot embers or charcoal. Firewalking has been practiced by many people and cultures in different parts of the world. It is often used as a rite of passage, as a test of an individual's strength and courage, or in religion as a test of one's faith. Scientists have tried to debunk the myth behind firewalking by using data and their understanding of thermal energy. The following table shows the data gathered for a man attempting to walk over a bed of burning charcoal:

Temperature of burning charcoal	450°C
Length of charcoal pit	5.0 m
Speed of man	0.38 m/s
Contact area between one foot and the charcoal.	$7.0 \times 10^{-3}\ m^2$
The heating power of charcoal	$15\ kW/m^2$
Total time of contact between one foot and the charcoal	6.8 s
Average specific heat capacity of a foot	$3500J\ kg^{-1}\ °C^{-1}$

(a) Calculate the total energy supplied to one foot of the man by the burning charcoal during his walk. [2]

(b) Assuming the heating effect is concentrated on the bottom most layer of the feet which has a mass of 40 g for one foot, calculate the temperature change of the foot after passing over the bed of burning charcoal. [2]

(c) According to the answer in (b), does firewalking burn the man's feet? Suggest a reason to explain the phenomenon. [2]

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(d) The heat from the burning charcoal makes the man perspire. The sweat will evaporate and cools down his body.

(i) State two atmospheric conditions that would cause the sweat to evaporate quickly. [2]

(ii) Explain in terms of kinetic theory why the temperature of the sweat on the body drops during evaporation. [2]

10.(a) Parts of the electromagnetic spectrum have various uses.

Which part is used for

(i) heaters and night vision equipment, ... [1]

(ii) sterilising food and medical equipment? ..... [1]

(b) All the parts of the electromagnetic spectrum are transverse waves.

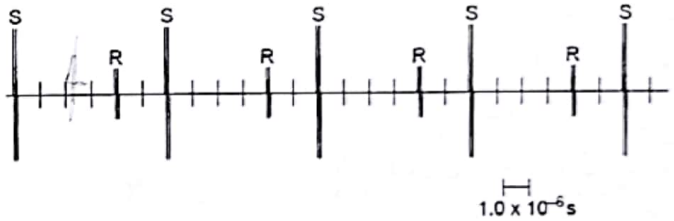
(i) State **one** other property which all electromagnetic waves have in common. [1]

(ii) Give one example of a transverse wave which is **not** part of the electromagnetic spectrum. [1]

10(c) Ultrasound is used in quality control to detect cracks in metal. Pulses of ultrasound are sent into the metal from a transmitter. A detector is placed next to the transmitter on the front surface of the metal.

The diagram below shows the oscilloscope trace of the ultrasound pulses produced if the metal contains no cracks. One division along the *x*-axis represents 1.0×10^{-6} s.

Pulses labelled **S** are the pulses initially sent out from the transmitter. Each pulse labelled **R** is the reflection from the back surface of the metal of the previous pulse **S**.



(i) State what is meant by *ultrasound*. [1]

(ii) Calculate the number of pulses sent out by the source in one second. [2]

(iii) Suggest one reason why the amplitude of **R** is less than the amplitude of **S**. [1]

(iv) Some time later, the piece of metal is tested again. It now has a small crack half-way between the front surface and the back surface.
On the diagram, draw the position and size of the pulses produced by this crack. Label each of these pulses **C**. [2]

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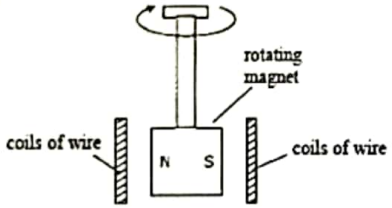
11 EITHER

(a) The diagram below shows a bicycle dynamo. When the front wheel of the bicycle turns, the magnet rotates within coils of wire and the lamp on the bicycle lights up.



(i) Explain how the dynamo produces a current and why the current alternates. [3]

(ii) Suggest one way in which the brightness of the lamp could be increased. [1]

(iii) Give one advantage of using a dynamo for the bicycle lamp instead of a battery. [1]

(iv) Give one disadvantage of using a dynamo for the bicycle lamp instead of a battery.[1]

11 EITHER

(b) A phone charger requires 6.0 V of direct current. Draw a labelled circuit diagram to show how this can be made possible from a 240 V a.c mains. [2]

Circuit Diagram:

State the purposes of the main electrical components you have included in the circuit [2]

Purposes Of the Main Electrical Components:

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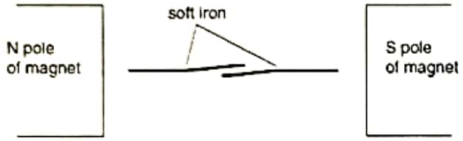
11 **OR**

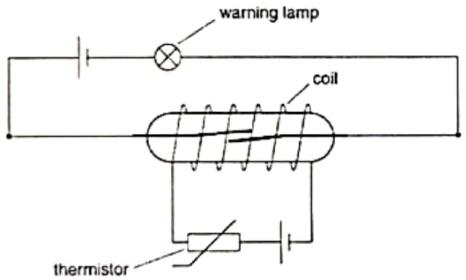
The effect of electromagnetism is applied in many electrical devices such as the reed switch and in the d.c. motor.

(a) (i) The diagram shows two pieces of soft iron in the magnetic field of a strong permanent magnet. The two pieces become magnetised.



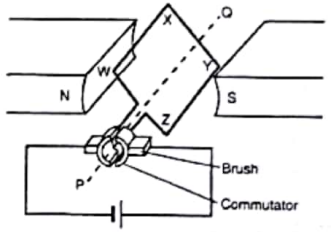
Mark the magnetic poles produced at each end of both pieces of soft iron. [1]

(ii) The two soft irons are used in the reed switch. The diagram below shows two separate electrical circuits. One circuit consists of a reed switch connected in series with a cell and a warning lamp. The other circuit consists of a thermistor, a cell and a coil wound round the reed switch.



Explain how this arrangement can be used to warn the farmers when the temperature in a greenhouse is too high. [3]

(b) The diagram below shows a simple electric motor with a coil **WXYZ** slanted at an angle at an instant of time. The coil is free to spin about the axis **PQ**.



(i) Mark on the diagram, the direction of the force **F** on **WX** of the coil and the direction of rotation **R** of the coil. [2]

(ii) Explain how the electric motor works and how it is able to rotate continuously in one direction. [3]

(iii) Why would it be better to include a rheostat in the circuit? [1]

End of Paper

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