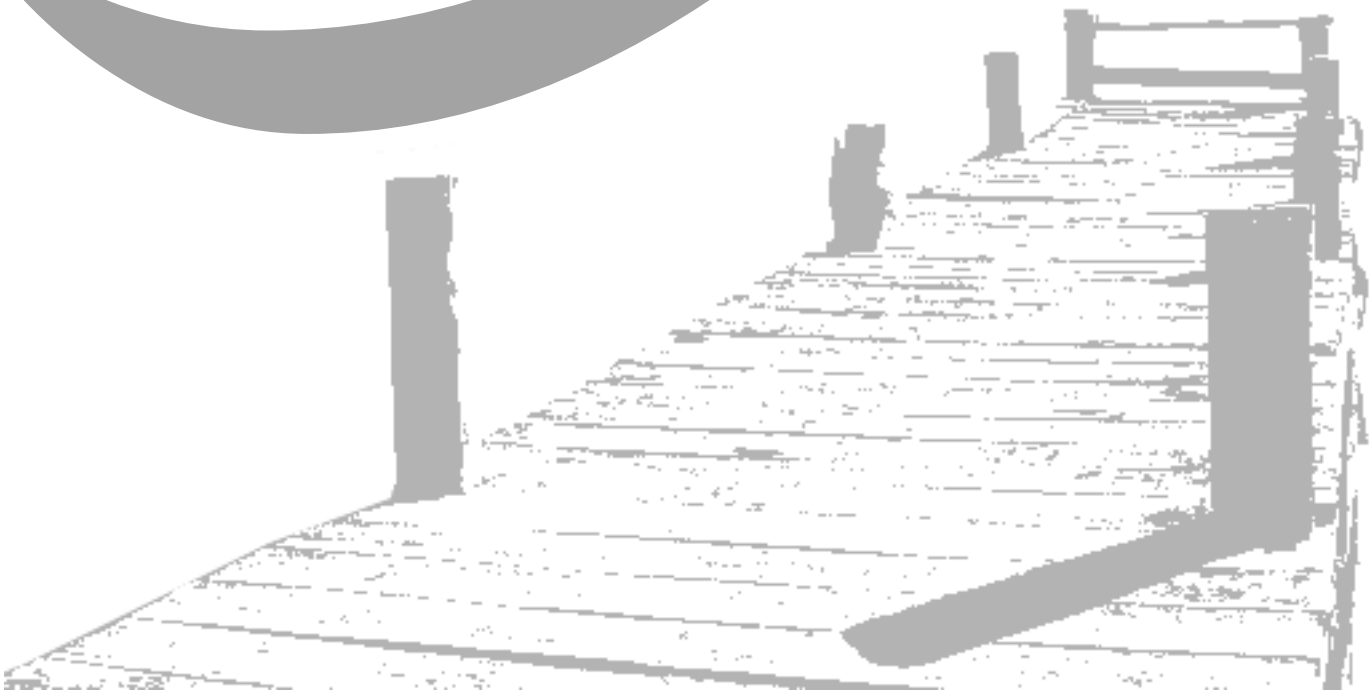
GCE
AS and A Level

Physics A

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 5D: Approved specimen question paper

Version 1.1



Surname		Other Names	
Centre Number						Candidate Number				
Candidate Signature										

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General Certificate of Education
2010
Advanced Examination

version 1.1

PHYSICS A PHA5D
Unit 5D Turning Points in Physics

Section B

SPECIMEN PAPER

Time allowed: 50 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- A *Data and Formula Booklet* is provided as a loose insert.

Information
- The maximum mark for this paper is 35.
- The marks for the questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers. You will be assessed on your quality of written communication where indicated in the question.

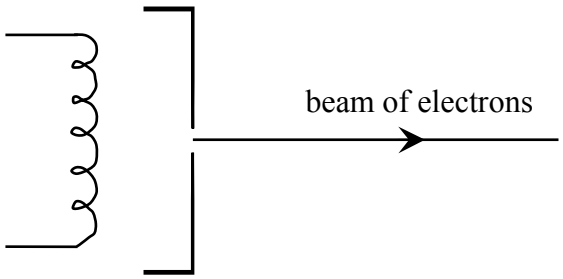
For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
Total (Column 1)			
Total (Column 2)			
TOTAL			
Examiner's Initials			

Section B

The maximum mark for this section is 35 marks. You are advised to spend approximately 50 minutes on this section.

1 (a) **Figure 1** shows a narrow beam of electrons produced by attracting electrons emitted from a filament wire to a metal plate which has a small hole in it.

Figure 1



(i) Why does electric current through the filament wire cause the wire to emit electrons?

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(ii) Why must the filament wire and the metal plate be in an evacuated tube?

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(3 marks)

(b) The voltage between the filament wire and the metal plate is 3900 V. For each electron emerging through the hole in the plate, calculate

(i) the kinetic energy, in J,

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(ii) the speed.

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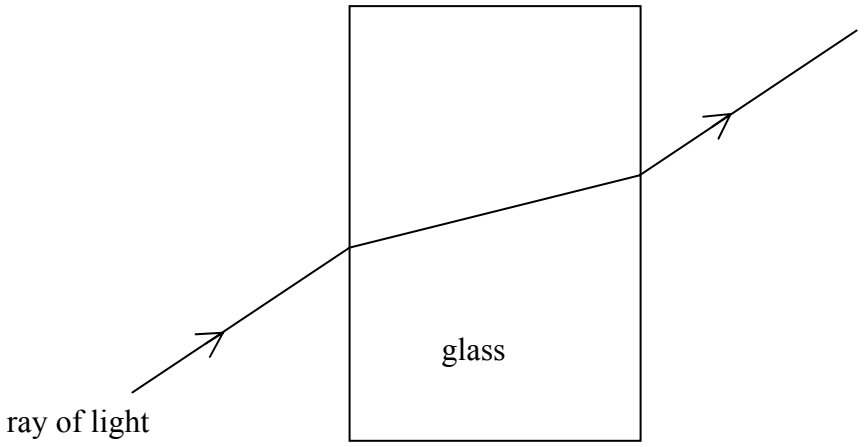
(4 marks)

Total 7 marks

2 **Figure 2** shows the path followed by a ray light which is incident at non-normal incidence on a glass block in air.

Figure 2



(a) Use Newton's theory of light to explain the path of the light ray shown in **Figure 2**.

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(4 marks)

(b) Newton's theory of light was eventually abandoned by the scientific community in favour of Huygen's theory of light. State one piece of evidence that supports Huygen's theory and explain why it supports Huygen's theory.

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(3 marks)

Total 7 marks

3 (a) One of the two postulates of Einstein's theory of special relativity is that the speed of light in free space is invariant.

(i) Explain what is meant by this postulate.

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(ii) State and explain the other postulate.

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(4 marks)

(b) A stationary muon has a rest mass of 1.9×10^{-28} kg.

For a muon travelling at a speed of 0.995 c, where c is the speed of light in a vacuum, calculate

(i) its mass,

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(ii) its total energy, in J.

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(iii) its kinetic energy, in J.

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(6 marks)

Total 10 marks

4 (a) The discovery of photoelectricity and subsequent investigations led to the wave theory of light being replaced by the photon theory. State one feature of photoelectricity that could not be explained using the wave theory of light and describe how it is explained using photon theory.
The quality of your written answer will be assessed in this question.

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(6 marks)

(b) A certain metal has a work function of 2.2 eV.

(i) Explain what is meant by this statement.

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(ii) The surface of the metal is illuminated with light of wavelength 520 nm.
Calculate the maximum kinetic energy of electrons emitted from the surface.

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(5 marks)

Total 11 marks