Surname		Other Names	
Centre Number			Candidate Number	
Candidate Signature			

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General Certificate of Education
January 2004
Advanced Level Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

PHYSICS (SPECIFICATION A) PA04
Unit 4 Waves, Fields and Nuclear Energy

Section B

Monday 26 January 2004 Morning Session

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

In addition to this paper you will require:
- a calculator;
- a pencil and a ruler.

Time allowed: The total time for Section A and Section B of this paper is 1 hour 30 minutes

Instructions
- Use a blue or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for this Section is 30.
- Mark allocations are shown in brackets.
- Section A and Section B of this paper together carry 15% of the total marks for Physics Advanced.
- You are expected to use a calculator where appropriate.
- A *Data Sheet* is provided on pages 3 and 4 of Section A. You may wish to detach this perforated sheet at the start of the examination.
- In questions requiring description and explanation you will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary where appropriate. The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

Answer **all** questions.

You are advised to spend approximately **one hour** on this section.

1 (a) State the conditions that are necessary for the formation of a stationary wave.

You may be awarded marks for the quality of written communication provided in your answer.

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(2 marks)

(b)

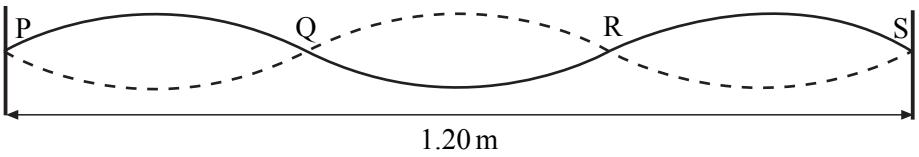

Figure 1

The diagram represents a stationary wave on a stretched string. The continuous line shows the position of the string at a particular instant when the displacement is a maximum. P and S are the fixed ends of the string. Q and R are the positions of the nodes. The speed of waves on the string is 200 m s^{-1}.

(i) State the wavelength of the waves on the string.

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(ii) Calculate the frequency of vibration.

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(iii) Draw on the diagram the position of the string 3.0 ms later than the position shown. Explain below how you arrive at your answer.

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(5 marks)

7

2 (a) Complete the table of quantities related to fields. In the second column, write an SI unit for each quantity. In the third column indicate whether the quantity is a scalar or a vector.

quantity	SI unit	scalar or vector
gravitational potential		
electric field strength		
magnetic flux density		

(3 marks)

(b) (i) A charged particle is held in equilibrium by the force resulting from a vertical electric field. The mass of the particle is 4.3×10^{-9}kg and it carries a charge of magnitude 3.2×10^{-12}C. Calculate the strength of the electric field.

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(ii) If the electric field acts upwards, state the sign of the charge carried by the particle.

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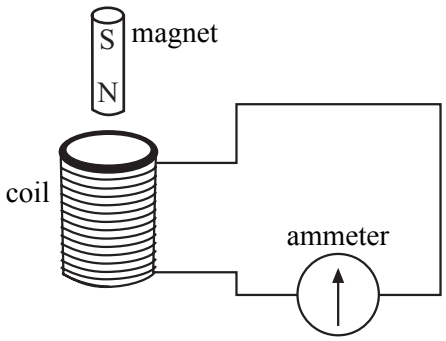
(3 marks)

6

TURN OVER FOR THE NEXT QUESTION

3 A coil is connected to a centre zero ammeter, as shown. A student drops a magnet so that it falls vertically and completely through the coil.



(a) Describe what the student would observe on the ammeter as the magnet falls through the coil.

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(2 marks)

(b) If the coil were not present the magnet would accelerate downwards at the acceleration due to gravity. State and explain how its acceleration in the student's experiment would be affected, if at all,

(i) as it entered the coil,

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(ii) as it left the coil.

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(4 marks)

(c) Suppose the student forgot to connect the ammeter to the coil, therefore leaving the circuit incomplete, before carrying out the experiment. Describe and explain what difference this would make to your conclusions in part (b).

You may be awarded marks for the quality of written communication provided in your answer.

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(3 marks)

9

TURN OVER FOR THE NEXT QUESTION

LEAVE MARGIN BLANK

4 A capacitor of capacitance 330 μF is charged to a potential difference of 9.0 V. It is then discharged through a resistor of resistance 470 kΩ.

Calculate

(a) the energy stored by the capacitor when it is fully charged,

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(2 marks)

(b) the time constant of the discharging circuit,

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(1 mark)

(c) the p.d. across the capacitor 60 s after the discharge has begun.

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(3 marks)

6

QUALITY OF WRITTEN COMMUNICATION *(2 marks)*

2

END OF QUESTIONS