

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced Subsidiary GCE

PHYSICS (B) (ADVANCING PHYSICS)

2860

Physics in Action

Friday **9 JUNE 2006** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Data, Formulae and Relationships Booklet
Electronic calculator
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number										
	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>						<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> </table>					

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces provided on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Show clearly the working in all calculations and give answers to only a justifiable number of significant figures.

INFORMATION FOR CANDIDATES

- You are advised to spend about 20 minutes on Section A, 40 minutes on Section B and 30 minutes on Section C.
- The number of marks is given in brackets [] at the end of each question or part question.
- There are four marks for the quality of written communication in Section C.
- The values of standard physical constants are given in the Data, Formulae and Relationships Booklet. Any additional data required are given in the appropriate question.

FOR EXAMINER'S USE		
Section	Max.	Mark
A	20	
B	40	
C	30	
TOTAL	90	

This question paper consists of 23 printed pages and 1 blank page.

Answer **all** the questions.

Section A

1 Here is a list of units.

kg m^{-3} J m^{-2} Nm Nm^{-2}

Choose the correct unit for

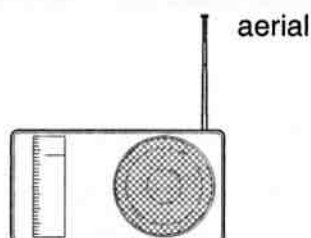
(a) Young modulus

(b) density.

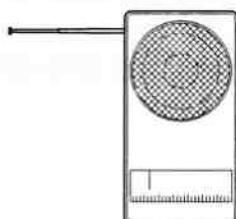
[2]

2 A teacher uses a portable radio to demonstrate some properties of waves.
He tunes in to a VHF station.

(a) He obtains the strongest signal when the aerial is vertical as shown below.



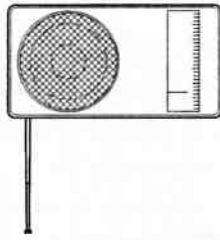
However, the signal fades to a minimum when he rotates the radio through 90° , as shown below.



State the property of transverse waves that this experiment demonstrates.

[1]

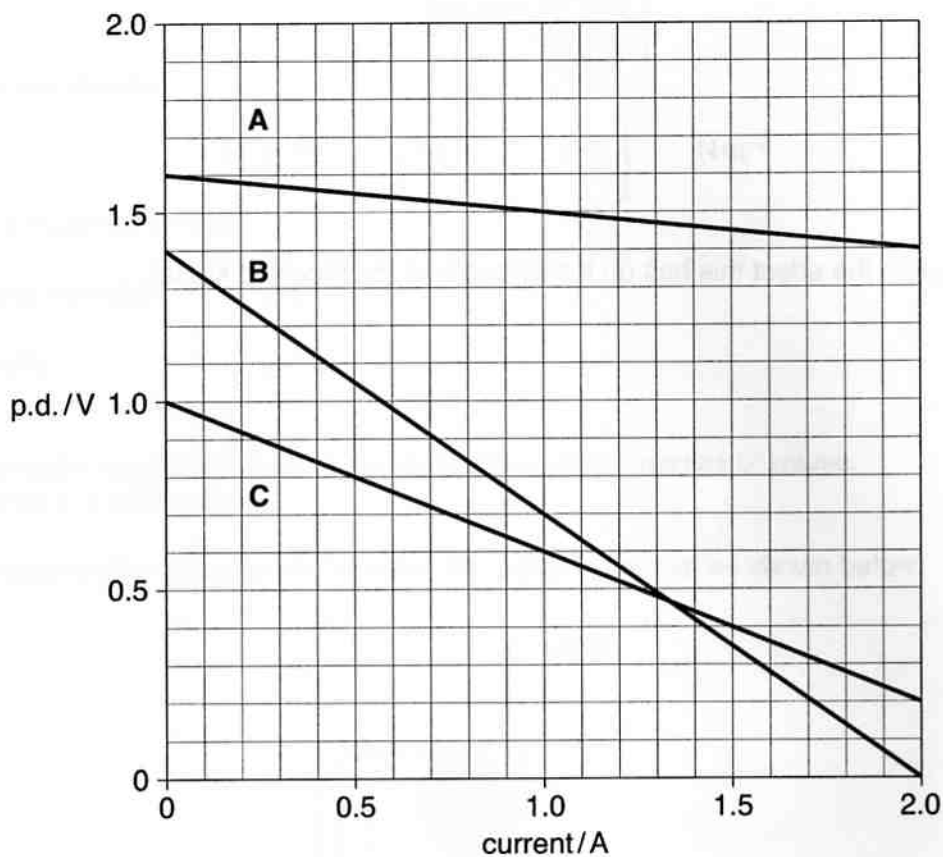
(b) The teacher rotates the radio once more through another 90° , as shown below.



State and explain the effect this has on the strength of the received signal.

[2]

- 3 The graph below shows how the p.d. across three different cells **A**, **B**, and **C** decreases as more current is drawn from each.



State which of the cells **A**, **B** or **C**

(a) has the smallest emf

(b) will deliver the most electrical power at a current of 1.0 A

(c) has the smallest internal resistance.

[3]

- 4 Fig. 4.1 shows part of a scanning tunnelling microscope (STM).
Electrons flow between a fine tip and the surface.

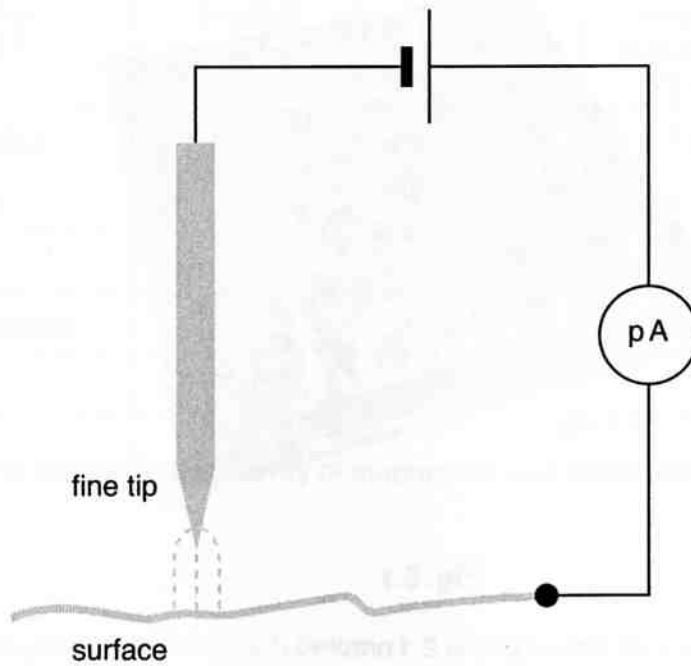


Fig. 4.1

20 million electrons per second flow between the tip and the surface.

Calculate the current in the circuit.

charge on electron, $e = 1.6 \times 10^{-19} \text{C}$

current = A [2]

- 5 Fig. 5.1 shows an STM image of 34 iron atoms arranged in a rectangle on a copper surface.

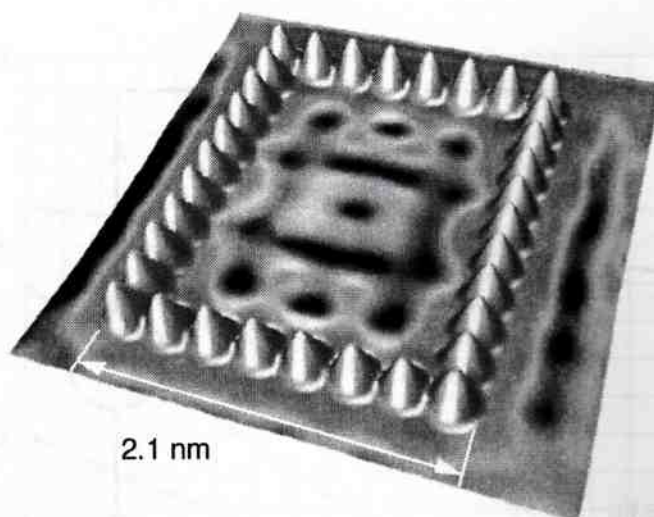


Fig. 5.1

The length of the front row of iron atoms is 2.1 nm.

Calculate the diameter of an iron atom.
Give your answer to 2 significant figures.
Show your working clearly.

diameter of iron atom =m [2]

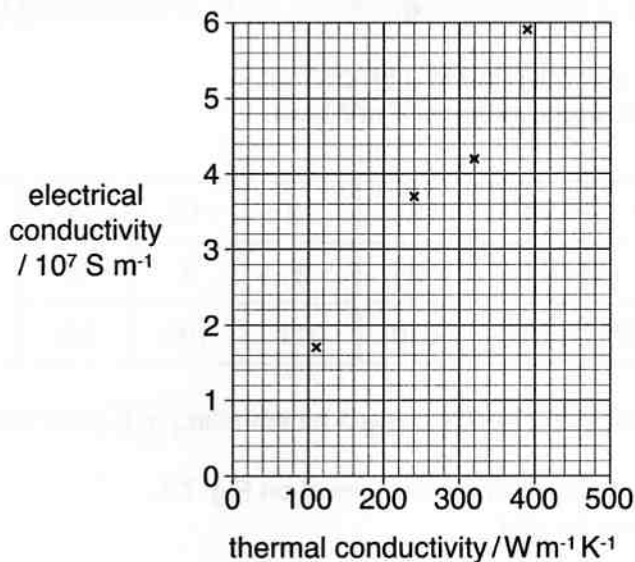
6 The table shows the thermal and electrical conductivities of five pure metals.

	thermal conductivity $/\text{W m}^{-1} \text{K}^{-1}$	electrical resistivity $/\Omega \text{m}$	electrical conductivity $/\text{S m}^{-1}$
aluminium	240	2.7×10^{-8}	3.7×10^7
copper	385	1.7×10^{-8}	5.9×10^7
gold	310	2.4×10^{-8}	4.2×10^7
magnesium	150	4.0×10^{-8}	
zinc	110	5.9×10^{-8}	1.7×10^7

(a) Calculate the electrical conductivity of magnesium and record the value in the table.

[1]

(b) The data are plotted on the graph below.



Plot the point for magnesium on this graph.

[1]

(c) (i) State the trend shown by this graph.

[1]

(ii) What microscopic feature of metals explains this trend?

[1]

