OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE UNIT **2860**

PHYSICS B (ADVANCING PHYSICS)

Physics in Action

FRIDAY 12 JANUARY 2007 Afternoon

Time: 1 hour 30 minutes

Additional materials:
Data, Formulae and Relationships Booklet
Electronic calculator
Ruler

Candidate Name

Centre Number

Candidate Number

INSTRUCTIONS TO CANDIDATES

- Write your name, Centre Number and Candidate number in the boxes above.
- Answer **all** the questions.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Do **not** write in the bar code.
- Do **not** write outside the box bordering each page.
- WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. ANSWERS WRITTEN ELSEWHERE WILL NOT BE MARKED.
- Show clearly the working in all calculations, and round answers to only a justifiable number of significant figures.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 90.
- You are advised to spend about 20 minutes on Section A, 40 minutes on Section B and 30 minutes on Section C.
- 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		
Qu.	Max.	Mark
A	20	
B	40	
C	30	
Total	90	

This document consists of **20** printed pages.

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Answer **all** the questions.

Section A

1 Here is a list of electrical units.

$\mathbf{As}$ $\quad$ $\mathbf{Js^{-1}}$ $\quad$ $\mathbf{Sm^{-1}}$ $\quad$ $\mathbf{\Omega m}$ $\quad$ $\mathbf{\Omega}$

Choose a correct unit for

(a) power .....

(b) charge .....

(c) resistivity. .....

[3]

2 A clarinet plays a musical note. The note is recorded, as shown in Fig. 2.1.
It shows the waveform over a time interval of about 40 ms.

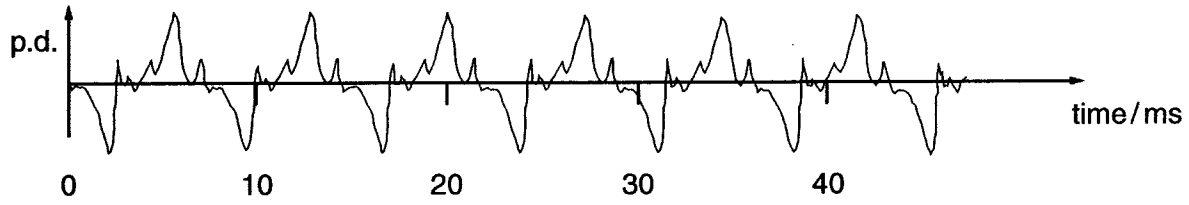

Fig. 2.1

(a) Draw on the waveform of Fig. 2.1 a box enclosing exactly **one** complete oscillation of the lowest frequency component of the note. [1]

(b) Use Fig. 2.1 to estimate the time period of this lowest frequency component of the note.

time period = ...ms [1]

(c) Calculate the frequency of the lowest frequency component of the note using your value for the time period from **(b)**.

frequency = ... Hz [1]

3 An ultrasound scanner produces waves of frequency 2.5 MHz.

(a) Calculate the wavelength of the waves in soft tissue.

speed of ultrasound in soft tissue = $1500\,m\,s^{-1}$

wavelength = ...m [2]

(b) Fig. 3.1 shows the wavefronts of the ultrasound at a boundary between soft tissue and bone.
The waves are travelling at right angles to the boundary.
In the bone, the ultrasound waves travel **faster**.

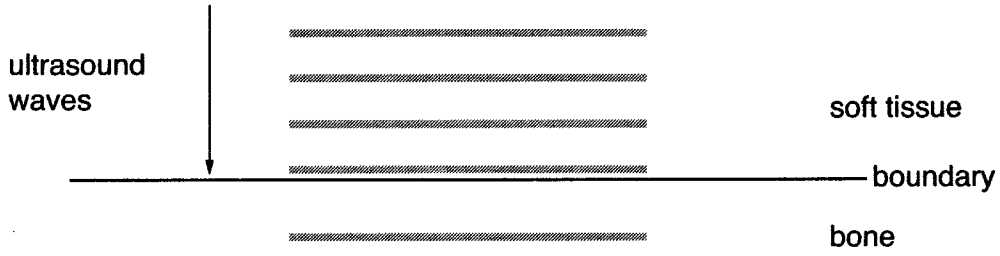

Fig. 3.1

Complete Fig. 3.1 to show the wavefronts being transmitted through the bone.
The first wavefront in the bone has been drawn for you.
Add **three** more wavefronts. [1]

(c) Some of the wave energy is **not** transmitted through the bone.
State what happens to this wave energy.

[1]

4 This question is about some properties of materials.

Fig. 4.1 shows, on a plot of the compressive strength against toughness, ranges of values for different classes of material.

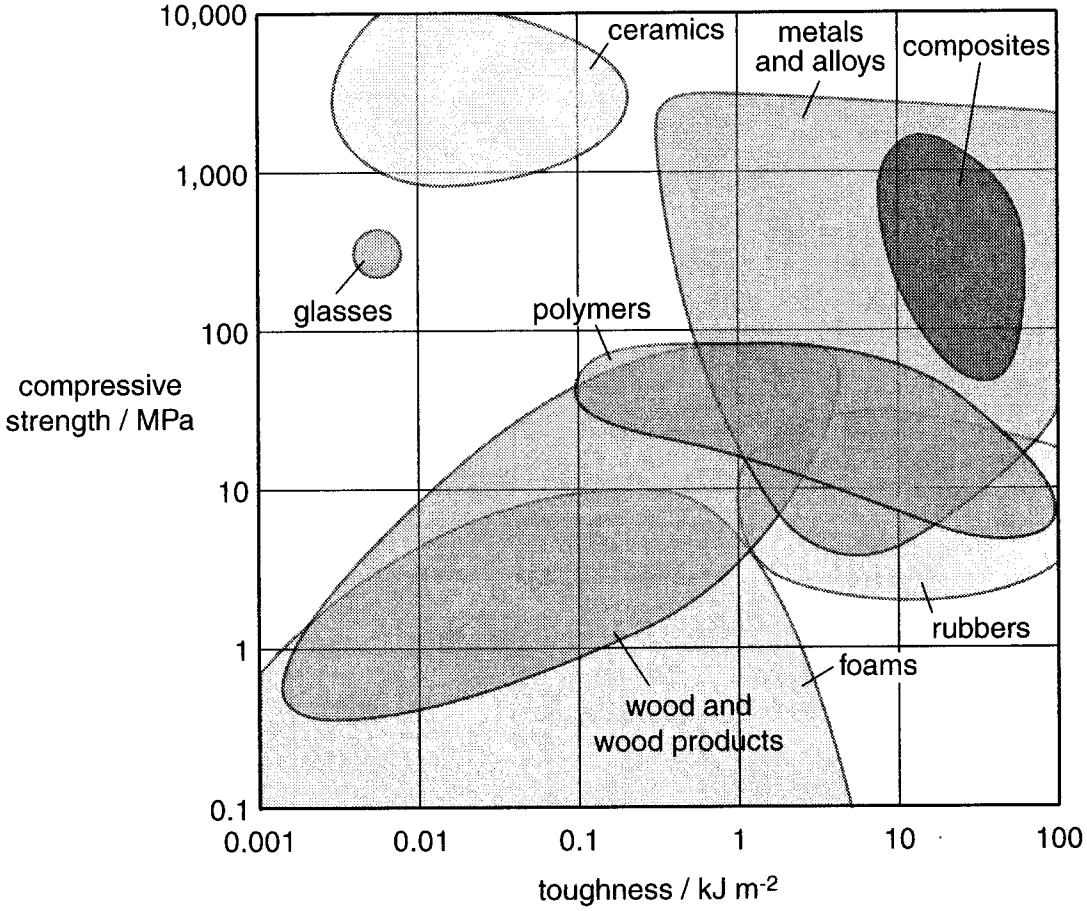

Fig. 4.1

(a) State the class of materials shown in Fig. 4.1 that has the greatest average strength in compression.

[1]

(b) State what is meant by the compressive strength of a material.

[1]

(c) The head of a hammer needs to be strong.

Explain whether the class of material you named in **(a)** might be suitable for constructing the head of a hammer.

[1]

5 Fig. 5.1 shows two conductors connected in parallel.
The conductors have conductances of 1.0 mS and 3.0 mS as shown.

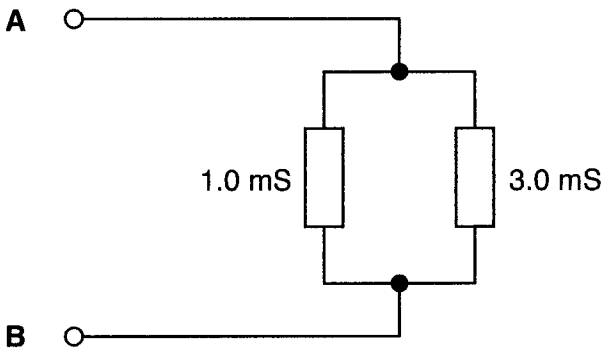

Fig. 5.1

(a) State the total conductance of the parallel conductors.

total conductance = ... mS [1]

(b) A battery of emf 6.0 V and negligible internal resistance is connected between **A** and **B**.

Calculate the current drawn from the battery.

current = ... A [2]

6 A metal surface is divided into a square grid of side 1.0 nm.
A single xenon atom can be placed on any square.
Fig. 6.1 shows an array of xenon atoms written onto the surface.
The presence of a xenon atom represents binary 1 and the absence of a xenon atom represents binary 0.

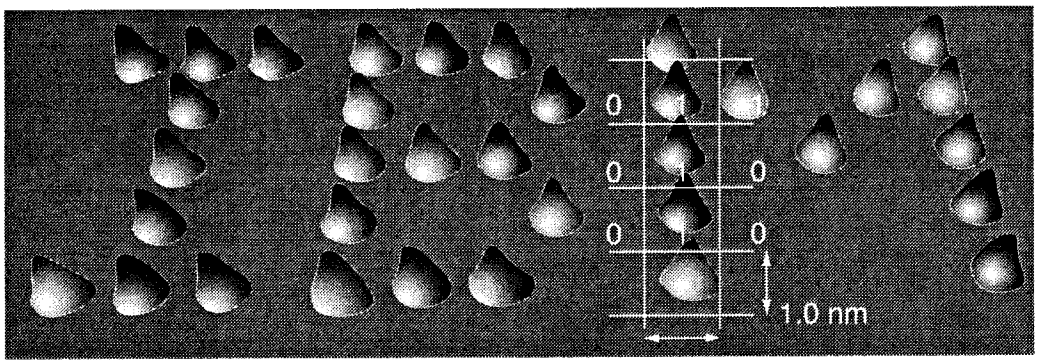

Fig. 6.1

This technique has been suggested as a way of writing the smallest possible encyclopaedia.

Show that the amount of information that could be stored per cm^2 of surface is greater than 10 Tbytes.

1 Tbyte = 10^{12} bytes

[2]