AQA

General Certificate of Education
Advanced Subsidiary Examination
June 2012

Use of Mathematics **UOM4/1**

Applying Mathematics Paper 1

Thursday 24 May 2012   9.00 am to 10.00 am

For this paper you must have:
• a clean copy of the Data Sheet (enclosed)
• a graphics calculator
• a ruler.

Time allowed
• 1 hour

Instructions
• Use black ink or black ball-point pen. Pencil should only be used for drawing.
• Fill in the boxes at the top of this page.
• Answer **all** questions.
• Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
• You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
• Do not write outside the box around each page.
• Show all necessary working; otherwise marks for method may be lost.
• Do all rough work in this book. Cross through any work that you do not want to be marked.
• The **final** answer to questions requiring the use of tables or calculators should normally be given to three significant figures.
• You may **not** refer to the copy of the Data Sheet that was available prior to this examination. A clean copy is enclosed for your use.
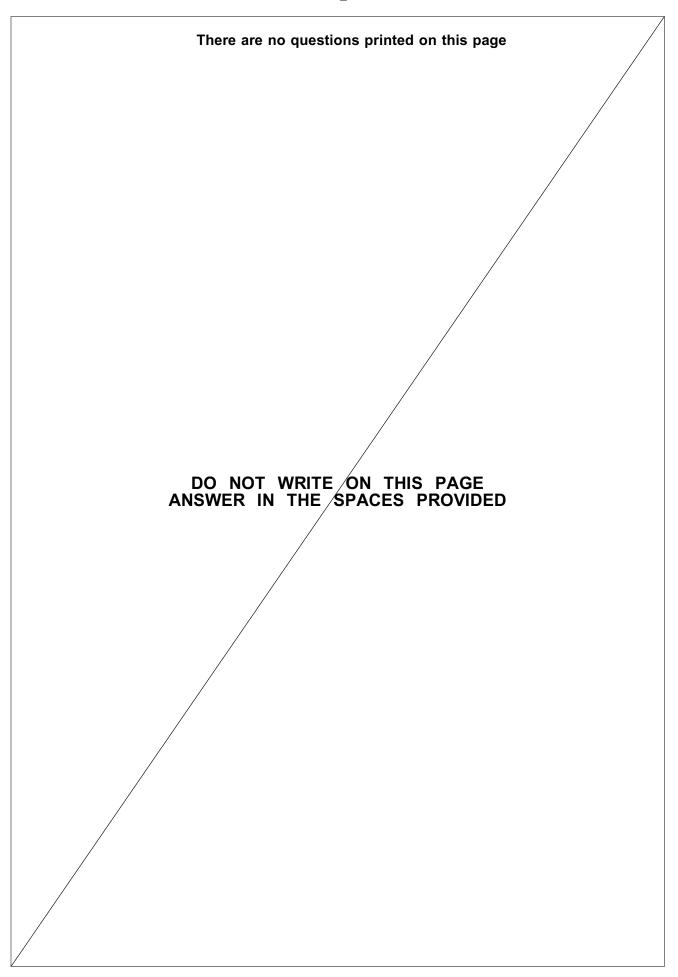
Information
• The marks for questions are shown in brackets.
• The maximum mark for this paper is 30.

Advice
• You do not necessarily need to use all the space provided.

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Making a noise** *on the Data Sheet.*

1 (a) Use the graph in **Figure 2** in the article on the Data Sheet to find:

(i) the sound level if the pressure ratio, $\dfrac{p}{p_{\text{ref}}}$, is 9; *(1 mark)*

(ii) the pressure ratio, $\dfrac{p}{p_{\text{ref}}}$, if the sound level is $-5\,\text{dB}$. *(1 mark)*

(b) Explain what a negative sound level in dB means in terms of pressure. *(1 mark)*

QUESTION
PART
REFERENCE | **Answer space for question 1**

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2   A sound gives rise to a pressure that is sixteen times the reference pressure.

What is the sound level in decibels?   *(2 marks)*

QUESTION PART REFERENCE	**Answer space for question 2**

3   Calculate the pressure ratio, $\dfrac{p}{p_{\text{ref}}}$, for a sound level of 40 dB.   *(2 marks)*

QUESTION PART REFERENCE	Answer space for question 3

Turn over ▶

4 If you stand 10 metres away from a busy road, the sound pressure due to traffic lies between 0.2 Pa and 0.6 Pa.

Find the limits in dB between which the sound level can lie.

Take $p_{\text{ref}} = 20 \times 10^{-6}\,\text{Pa}$. *(4 marks)*

QUESTION PART REFERENCE

Answer space for question 4

5 The sound level of a washing machine is 50 dB at 1 metre.

What would be the sound pressure in this case?

Give your answer in pascals. *(4 marks)*

QUESTION PART REFERENCE	**Answer space for question 5**

6 The article on the Data Sheet states that if you are 10 metres away from a noise source and move so that you are 20 metres away, the pressure will reduce to half of its previous value. This will result in a fall of 6 dB in the sound level.

(a) Use the equation $L = 20 \log_{10}\left(\dfrac{p}{p_{\text{ref}}}\right)$ to verify this result. *(4 marks)*

(b) If instead you had moved so that you were only 2.5 metres from the noise source rather than 10 metres away, what would have been the increase in sound level?

(2 marks)

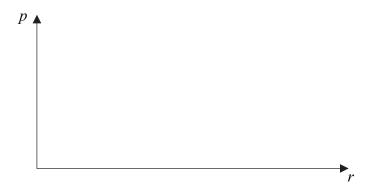QUESTION PART REFERENCE | **Answer space for question 6**

QUESTION PART REFERENCE	Answer space for question 6

Turn over ▶

7 The article on the Data Sheet states: 'The pressure and distance follow an inverse relationship $p \propto \dfrac{1}{r}$ or $p = \dfrac{k}{r}$, where p is the pressure at distance r.'

(a) Sketch a graph of p against r on the axes below.

p

r

(2 marks)

(b) Describe the gradient of this graph as r increases. *(2 marks)*

QUESTION PART REFERENCE | **Answer space for question 7**

8 (a) In the experiment in the article on the Data Sheet, suppose that one sound appears to be one-eighth as loud as another.

What is the difference in sound levels in decibels? *(3 marks)*

(b) In the experiment in the article on the Data Sheet, suppose that one sound is 100 dB louder than another.

How many times louder would this sound appear to be? *(2 marks)*

QUESTION
PART
REFERENCE

Answer space for question 8

Turn over ▶

Do not write outside the box

QUESTION PART REFERENCE	Answer space for question 8

END OF QUESTIONS