Candidate Forename		Candidate Surname	

Centre Number					Candidate Number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A336/02

TWENTY FIRST CENTURY SCIENCE ADDITIONAL APPLIED SCIENCE A

Unit 6: Materials and Performance (Higher Tier)

TUESDAY 22 JUNE 2010: Morning
DURATION: 45 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the Question Paper

A calculator may be used for this paper

OCR SUPPLIED MATERIALS:
None

OTHER MATERIALS REQUIRED:
Pencil
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.

- Use black ink. Pencil may be used for graphs and diagrams only.

- Read each question carefully and make sure that you know what you have to do before starting your answer.

- Answer <u>ALL</u> the questions.

- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.

- The total number of marks for this paper is <u>36</u>.

BLANK PAGE

Answer <u>ALL</u> the questions.

1 Sean designs cars. He knows how the momentum of a moving car affects safety.

(a) (i) Sean needs the values of <u>TWO</u> quantities to calculate the momentum.

Write down these quantities.

1 _____

2 _____ **[2]**

(ii) Sean knows how each quantity affects the momentum.

Describe how each quantity affects momentum.

Draw straight lines to link the boxes to make the <u>BEST</u> sentence.

… is the division of …

… is inversely proportional to …

The momentum …

… is proportional to …

… the two quantities.

… is the addition of …

[1]

(b) Sean includes a steel frame in the car design. The frame protects people in the car because steel is stiff.

Give <u>ANOTHER</u> example of a device used for improving road safety.

Describe how its <u>MECHANICAL</u> properties are important for safety.

device: _____

how its mechanical properties improve safety:

_____

_____

_____ **[2]**

[Total: 5]

2 Metals used in a kitchen are often alloys.

(a) What do we mean by an alloy?

Draw a straight line to link the boxes to make the **BEST** sentence.

… a composite material.

… a complementary material.

An alloy is …

… a solid solution of elements in a metal.

… the same as a pure metal.

[1]

(b) Knives and forks are often made of stainless steel.

Stainless steel is an alloy of iron. It corrodes less than pure iron.

Suggest __ANOTHER__ property of stainless steel which makes it better than pure iron for knives and forks.

Give a reason why this property is important.

property: _____

reason: _____

_____ **[2]**

(c) Good quality knives and forks are rigid.

Suggest how stainless steel knives and forks can be made more rigid.

_____

_____

_____ **[1]**

(d) (i) The metal shelves in an oven expand when the oven is hot.

Describe an experiment to measure the <u>THERMAL EXPANSION</u> of a metal sample.

You may include a diagram in your answer.

_____

_____

_____

_____ **[3]**

(ii) Other than expansion, describe how a mechanical property of a metal, or other material, changes when the temperature increases.

_____

_____ **[1]**

[Total: 8]

3 Beth is a sound engineer. She knows about how we hear sounds.

(a) Answer these questions about how we hear sounds.

(i) Our ears hear the PITCH of a musical note.

Which physical quantity determines the pitch of the sound?

Put a (ring) around the correct physical quantity.

FREQUENCY   INTENSITY

LOUDNESS   SPEED

[1]

(ii) The sensitivity of our ears varies with frequency.

What is the value of the frequency to which our ears are most sensitive?

frequency = _____ Hz [1]

(iii) Our ears hear the LOUDNESS of the sound. This is different from its intensity.

Which TWO physical quantities determine the loudness?

1 _____

2 _____ [2]

(b) Beth uses the decibel scale to describe __SOUND INTENSITY__.

Graphs A, B and C opposite show how the decibel scale could depend on sound intensity.

Only __ONE__ of the graphs is correct.

Which graph, A, B or C, correctly
shows the decibel scale? _____ [1]

(c) Beth has normal hearing.

She hears a band practising in the room next door.

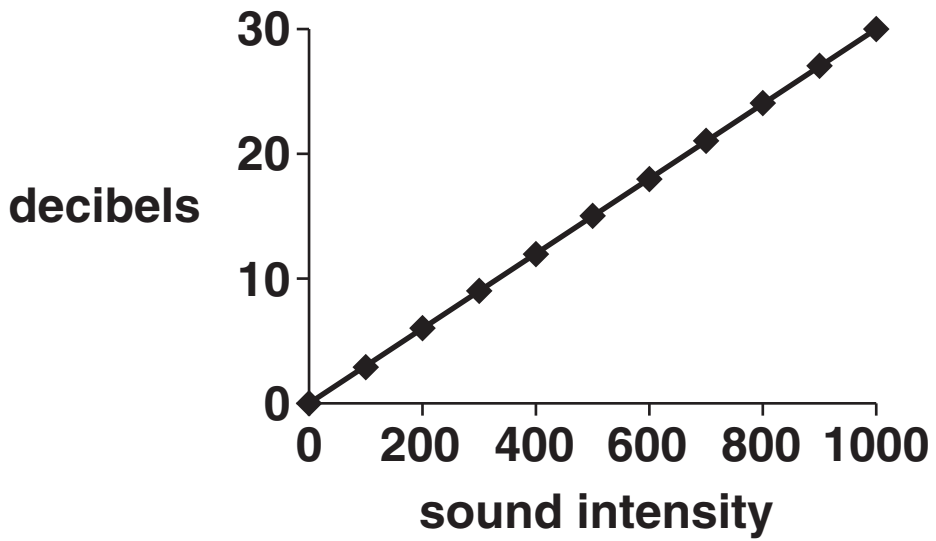She can only hear the low-pitch notes.
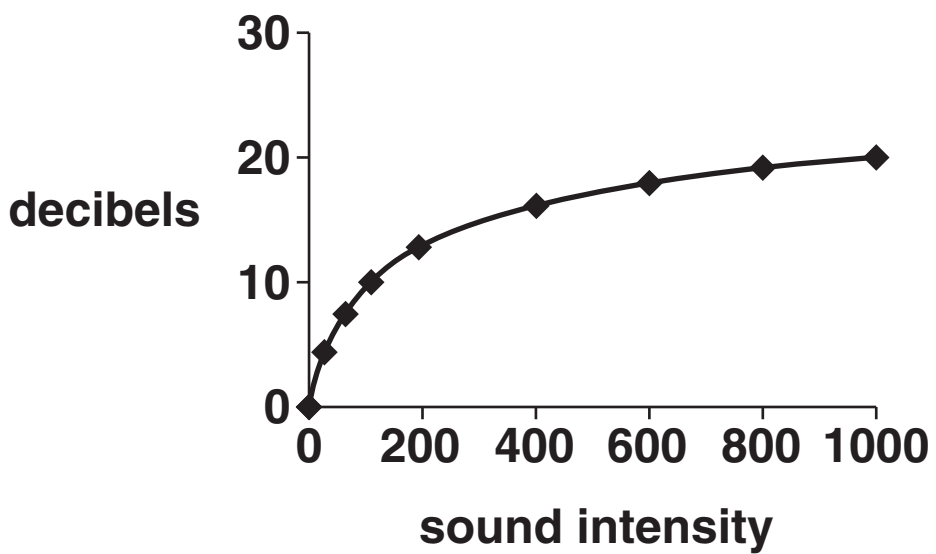
Give a reason for this.

_____

_____ [1]

[Total: 6]

Graph A

decibels / sound intensity

Graph B

decibels / sound intensity

Graph C

decibels / sound intensity

11
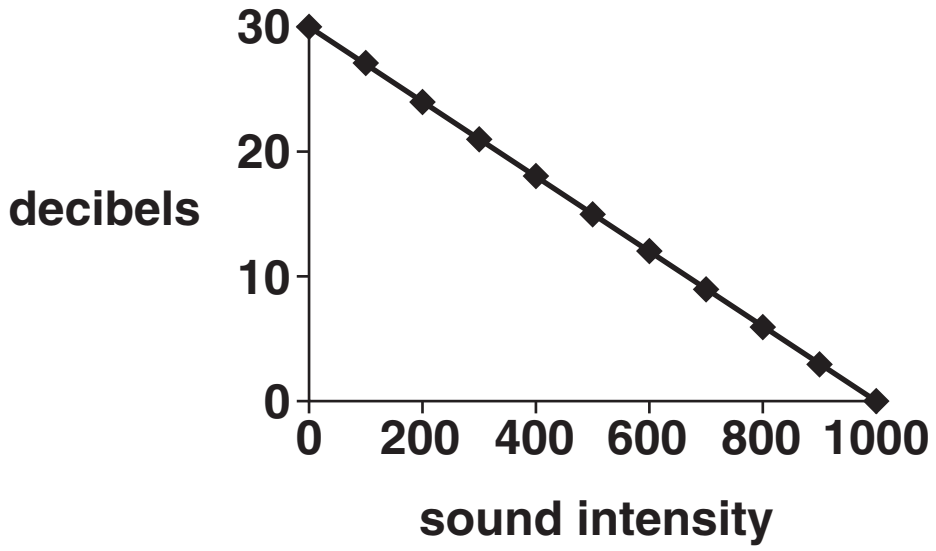
4   Gary is an outdoor pursuits instructor. He wants children to be safe when climbing.

(a) He needs to know how much a safety rope stretches when it holds a child's weight.

The stiffness of this rope is 200 N/m.

Calculate how much this rope stretches for a child of weight 500 N. Show your working.
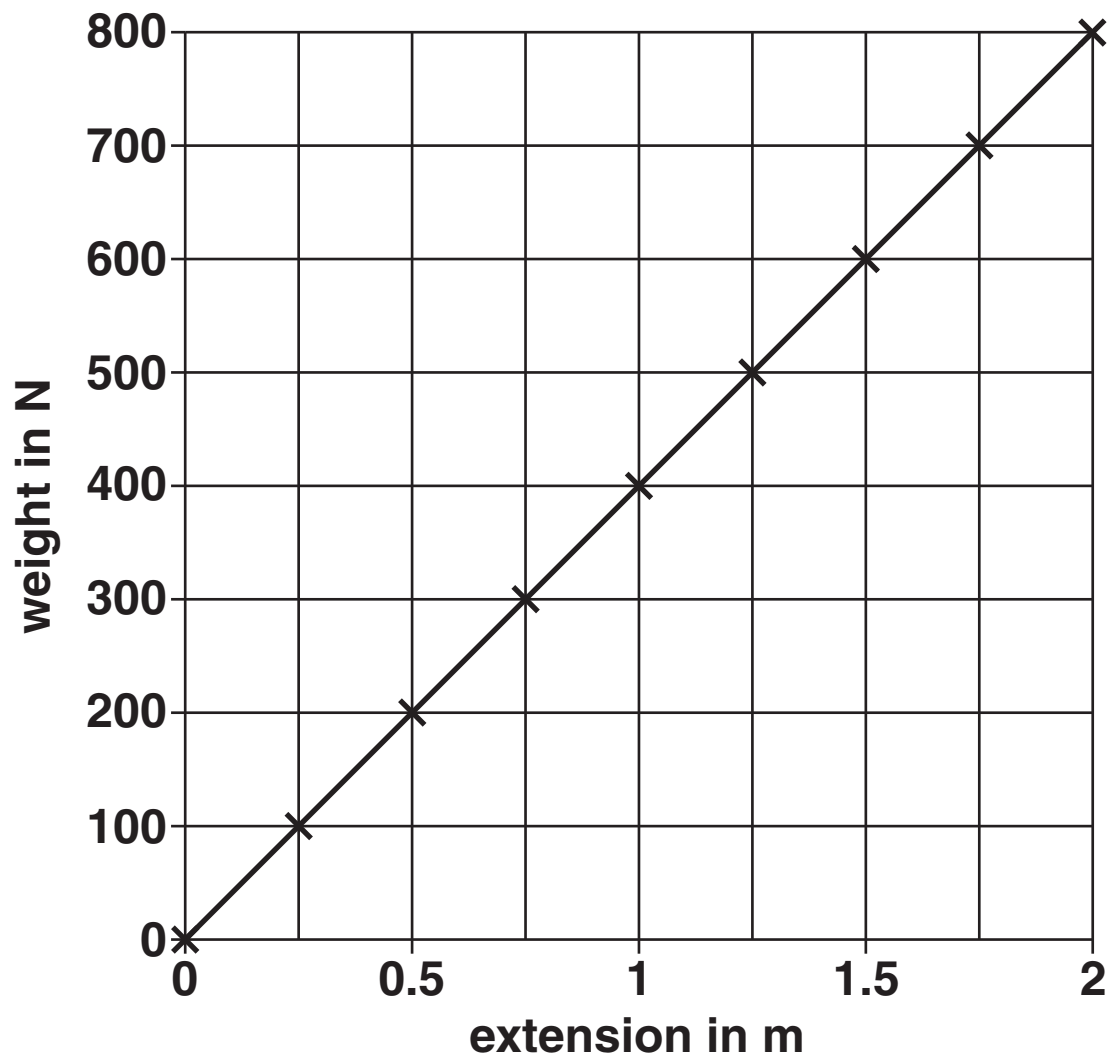
Use the rule **F = kx**

answer = _____ m [2]

(b) The graph opposite shows how another safety rope stretches.

Gary uses the graph to find out how much energy is stored in the rope when it is stretched by 1.5 m.

Do a calculation to show the energy stored in the rope is more than 400 J.

Show your working.

answer = _____ J [2]

12

(c) The rope has fibres on the inside and a protective cover on the outside. The fibres are strong in tension but are easily damaged. The cover is tough but not strong.

Describe <u>ANOTHER</u> example of a device which uses two materials with <u>COMPLEMENTARY MECHANICAL PROPERTIES</u>. Explain why <u>BOTH</u> materials are needed.
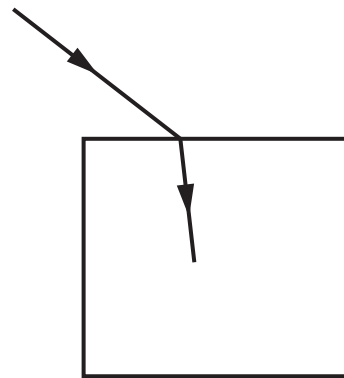
_____

_____

_____

_____

_____ **[3]**

[Total: 7]

5 **(a)** **(i)** **When a ray of light enters a material it changes direction.**
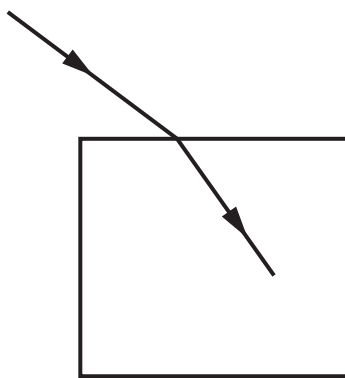
material 1   material 2

This change of direction depends on a property of the <u>MATERIAL</u>.

Write down the name of this material property.

_____ [1]

(ii) Lenses for correcting vision can be made with different <u>POWERS</u>.

Lenses with high power may be very thick, but thin lenses are more comfortable in spectacles.
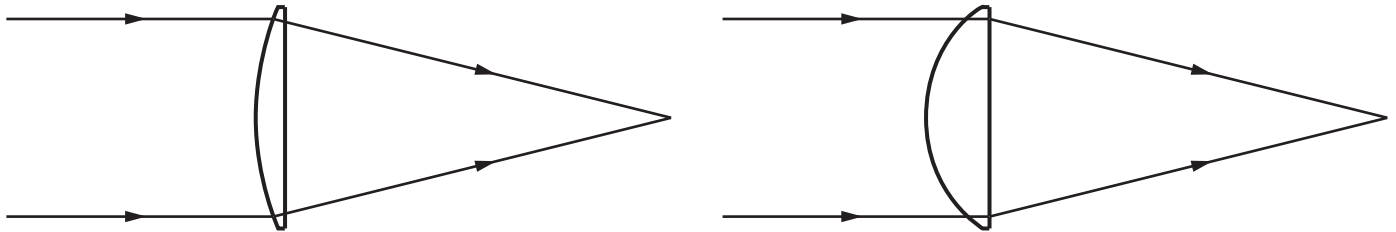
Explain how both the thin and the thick lenses have the same power.

_____

_____

_____ **[2]**

(b) There is a network of optical fibres laid underneath the pavements of many towns.

The optical fibres transmit cable TV to many homes.

The glass used for optical fibres must have high purity.

(i) Explain why high purity is needed for optical fibres.

_____ [1]

(ii) Suggest a mechanical property for the glass used in these optical fibres.

Give a reason why this property is important.

_____ [1]

(c) Contact lenses must be made of a material that is transparent so light can enter the eye.

Describe **THREE** other properties needed for materials used for contact lenses.

Give a reason why each property is needed.

_____

_____

_____

_____

_____ **[3]**

(d) When a distant object moves towards the eye, the eye must alter to keep the object in focus.

(i) Describe the change in the eye which keeps the object in focus.

_____ **[1]**

(ii) Describe one change to the image as the object moves towards the eye.

_____

_____ **[1]**

[Total: 10]

END OF QUESTION PAPER

BLANK PAGE

20