OCR
RECOGNISING ACHIEVEMENT

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GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE ADDITIONAL APPLIED SCIENCE A

A336/02

Unit 6: Materials and Performance (Higher Tier)

OCE/29196

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)

Tuesday 22 June 2010
Morning

Duration: 45 minutes

A336 02

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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 **all** the questions.
- Do **not** write in the bar codes.
- 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 **36**.
- This document consists of **12** pages. Any blank pages are indicated.

Answer **all** the questions.

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

(a) (i) Sean needs the values of **two** 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 **best** sentence.

	… is the division of …	
The momentum …	… is inversely proportional to …	… the two quantities.
	… is proportional to …	
	… 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 **another** example of a device used for improving road safety.

Describe how its **mechanical** properties are important for safety.

device: .....

how its mechanical properties improve safety:

.....

.....

..... **[2]**

[Total: 5]

2 Metals used in a kitchen are often alloys.

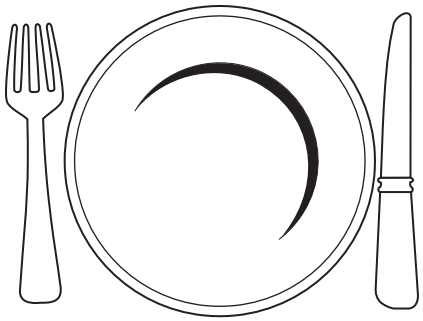
(a) What do we mean by an alloy?

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

An alloy is …	… a composite material.
	… a complementary material.
	… 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 **thermal expansion** of a metal sample.

Include a labelled 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 .....

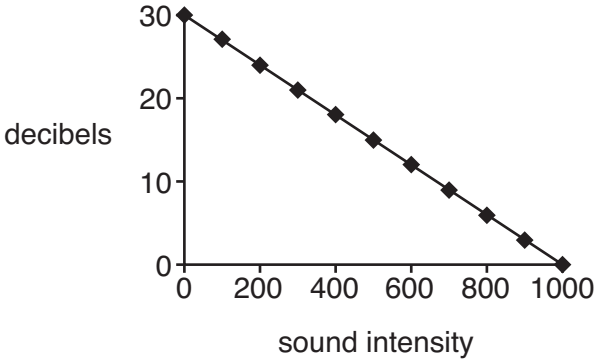
2 ..... **[2]**

(b) Beth uses the decibel scale to describe **sound intensity**.

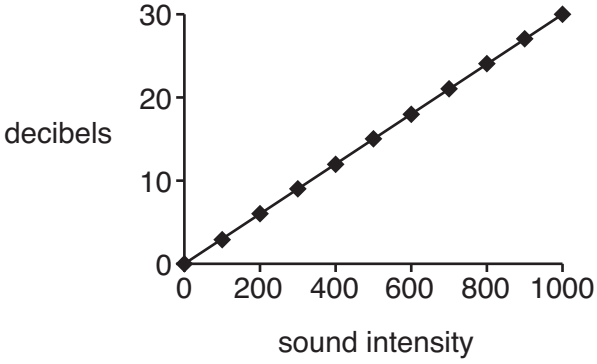
Graphs **A**, **B** and **C** show how the decibel scale could depend on sound intensity.

Only **one** of the graphs is correct.

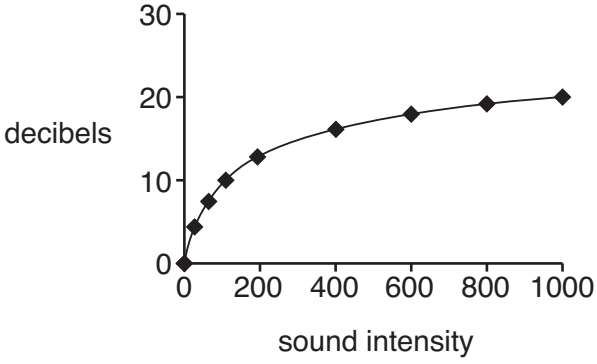
Graph **A**



Graph **B**



Graph **C**



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]

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.

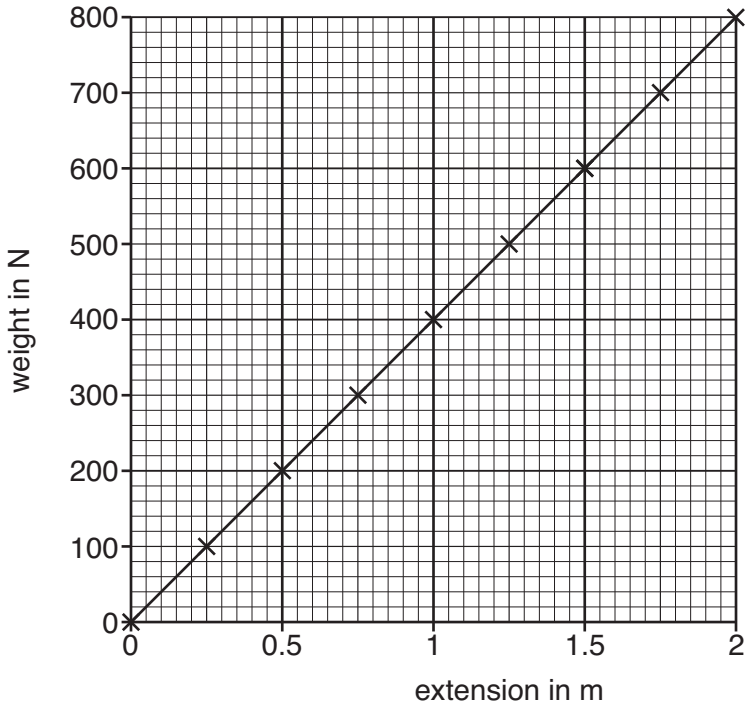
The stiffness of this rope is 200 N/m.

Calculate how much this rope stretches for a child of weight 500 N. Show your working.

Use the formula **F = kx**

answer = ... m **[2]**

(b) This graph 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]**

(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 **another** example of a device which uses two materials with **complementary mechanical properties**. Explain why **both** materials are needed.

.....

.....

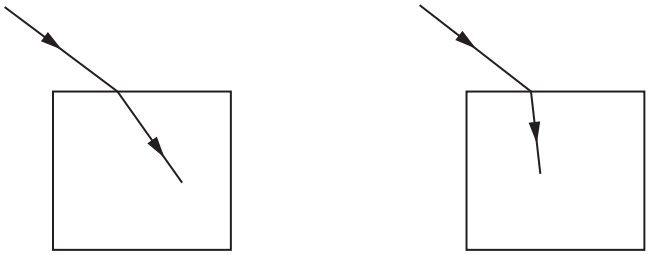
.....

.....

..... **[3]**

[Total: 7]

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



material 1 material 2

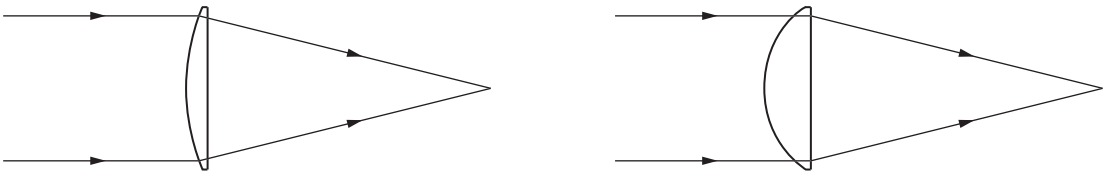
This change of direction depends on a property of the **material**.

Write down the name of this material property.

..... **[1]**

(ii) Lenses for correcting vision can be made with different **powers**.

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

PLEASE DO NOT WRITE ON THIS PAGE