

Wednesday 20 June 2012 – Morning

**GCSE TWENTY FIRST CENTURY SCIENCE
ADDITIONAL APPLIED SCIENCE A**

A336/02 Materials and Performance (Higher Tier)

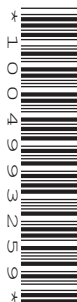
Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 45 minutes



Candidate forename		Candidate surname	
Centre number		Candidate number	

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- 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).
- Do **not** write in the bar codes.

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.

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 Sometimes materials are combined to improve their properties.

(a) A composite is made of more than one material.

Put a tick (✓) in the box next to the best description of a composite material.

a material with improved properties

☐

one material embedded in another material

☐

one material dissolved in another material

☐

different materials used for different parts of a structure

☐

[1]

(b) Write down the name of a composite material.

State what it is used for and what materials it is made from.

.....

.....

.....

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

(c) A pure metal can be improved by adding substances to make an alloy.

(i) What is a metal alloy?

.....

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

(ii) Aluminium 6061 is an alloy, which is used for bicycle frames.

It is made according to a product standard.

Suggest why this alloy is made according to a product standard.

.....

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

(iii) Suggest why aluminium alloy is better than pure aluminium for a bicycle frame.

.....

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

[Total: 6]

Turn over

2 Clothing designers need to know about the properties of the fabrics they use.

(a) (i) When clothes are worn, they stretch as the wearer moves.

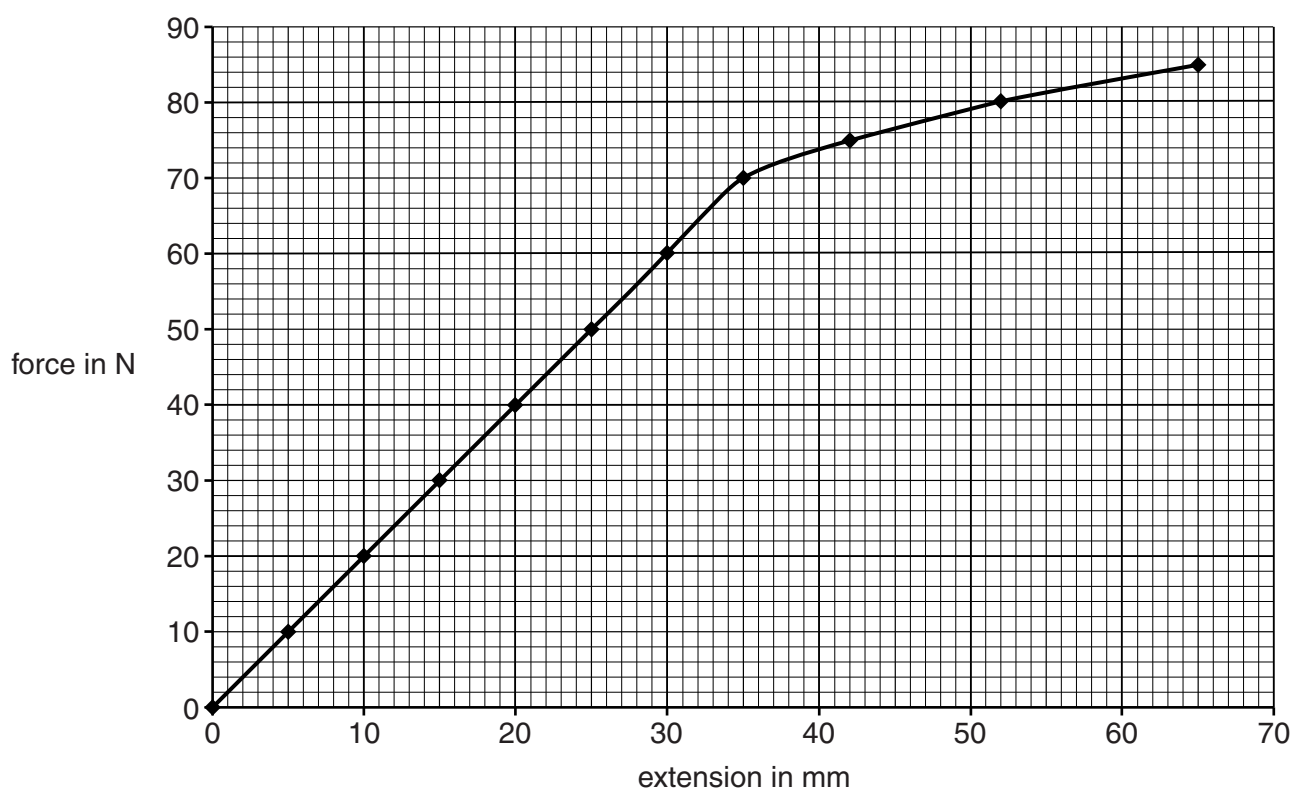
Sometimes, clothes stretch too much and do not go back to their original shape.

We call this behaviour [1]

(ii) Usually they return to their original shape.

We call this behaviour [1]

(b) The graph shows the extension of a fabric thread when a force is applied to it.



(i) The graph suggests that higher values of the force stretch the thread so that it does **not** return to its original length.

State the **smallest** value of the force which has this effect. N [1]

- (ii) The graph shows the effect of a force applied to one single thread.

This formula shows how to calculate the extension when the force is applied to a number of threads.

Calculate the extension due to a force of 60 N applied to a one-centimetre width of fabric.

There are 30 threads in each centimetre width of fabric.

$$\text{extension in mm} = \frac{\text{force in N}}{4.0 \times \text{number of threads}}$$

answer = mm [2]

[Total: 5]

3 Mr Mills runs a company which produces different types of glass.

(a) Mr Mills reads about how a lens makes an image.

He sees this diagram of a lens.



(i) Write down the name of the unit for the **power** of the lens.

..... [1]

(ii) The sentences **A**, **B**, **C**, **D** and **E** describe how a lens forms an image of a distant object.

A The rays meet.

B The lens refracts the rays.

C The rays are parallel to each other.

D The image forms in the focal plane.

E Rays of light come from a point on a distant object.

Arrange the sentences in the correct order.

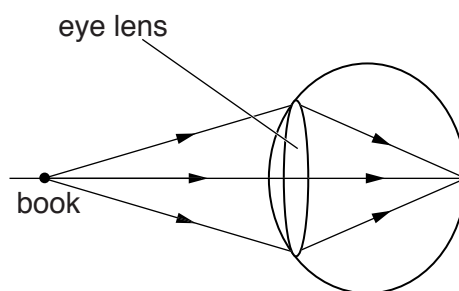
One has been done for you.

				D
--	--	--	--	----------

[2]

(b) Mr Mills reads a book.

a normal eye



(i) The image of the book formed in Mr Mills' eye is smaller than the book itself.

Choose **two** other words from this list to describe the image.

Put a ring around the correct words.

real

virtual

upright

inverted

refractive

transparent

[2]

(ii) Mr Mills brings the book closer to his face.

Describe what happens in his eye as the book moves closer to his face.

Complete the sentences.

His eye lens to keep the image in focus.

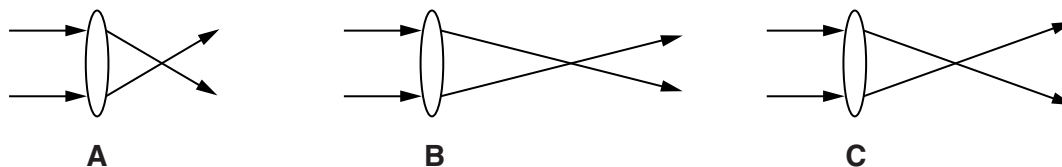
The image

[2]

- (c) Each type of glass has a different value of **refractive index**.

The diagram shows three lenses with identical shapes.

Each lens is made of a **different** type of glass.



Put the lenses **A**, **B** and **C** in order of increasing refractive index.

lowest

.....

highest

[1]

- (d) The glass for optical fibres needs high purity.

Explain why glass for optical fibres needs high purity.

.....

 [2]

- (e) Mr Mills decides to get contact lenses. He considers their properties.

Describe **three** important properties of the materials used for contact lenses.

Explain why each property is important.

property 1

 property 2

 property 3
 [3]

[Total: 13]

4 Safety in cars is important.

- (a) Car manufacturers have improved safety in cars by adding safety features.

A car's crumple zone is a safety feature.

Explain how a crumple zone improves safety.

Use **$Ft = \text{change in momentum}$**

.....

.....

..... [2]

- (b) The material for the crumple zone has a useful combination of properties.

It is both stiff and light.

Give **another** example of a material which is used because it has a useful combination of properties.

Do not use the crumple zone.

use of material

.....

useful properties

..... [2]

(c) Car drivers can improve road safety by travelling at **lower speeds**.

(i) A car has a collision which makes it stop.

The mass of the car is 1000 kg and it travels at 15 m/s before the collision.

The time for the collision is 0.1 seconds.

Calculate the **force** of the collision.

Use **$Ft = m(v-u)$**

force = N [2]

(ii) The force in a collision is reduced if the car travels at a lower speed.

Use the equation above to explain why.

Assume the time for the collision remains the same.

.....

..... [1]

[Total: 7]

5 This question is about thermal expansion.

(a) Belinda wants to compare the thermal expansion of two materials.

(i) Draw a diagram of apparatus she could use.

[1]

(ii) State one factor she would need to keep the same for both materials.

.....

..... [1]

(iii) Describe how she could measure accurately the very small expansion.

.....

..... [1]

- (b) Some radiators have thermostat valves.

When the temperature rises, wax in the valve expands at a **different** rate from the metal of the radiator.

Describe **another** device which uses two materials that expand at different rates when heated.

Your answer should include

- the device and the materials used
- what happens when the system is heated.

You may use a diagram to help your answer.

.....

.....

.....

..... [2]

[Total: 5]

END OF QUESTION PAPER



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