

**GENERAL CERTIFICATE OF SECONDARY EDUCATION
TWENTY FIRST CENTURY SCIENCE
ADDITIONAL APPLIED SCIENCE A**

A336/02

Materials and Performance
(Higher Tier)

**Friday 23 January 2009
Morning**

Duration: 45 minutes

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)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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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, however additional paper may be used if necessary.

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 **8** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	8	
2	5	
3	7	
4	5	
5	11	
TOTAL	36	

Answer **all** the questions.

1 Arun has learned how changes in momentum can affect road safety.

(a) He knows that velocity affects momentum.

Link the phrases in the boxes to make the **best** sentence that describes velocity.

Use straight lines to join the boxes.

	how fast the speed changes	when slowing down
Velocity is	how fast something moves	when going round a corner
	how far something goes	in a particular direction

[2]

(b) Arun uses a trolley of mass 0.80 kg in a test crash. It travels at 2.4 m/s just before it crashes.

Show that the change in momentum in the crash is about 2 kg m/s.

Use the formula:

momentum = mass × velocity

answer kg m/s [2]

(c) Crumple zones increase the time taken for a collision. This protects people.

(i) Explain why increasing the impact time can protect people in a collision.

.....

.....

..... [2]

(ii) Crumple zones are made of metal because metal is malleable.

Give **another** use of a material that improves road safety.

Describe how the **mechanical properties** of the material are important.

.....

.....

..... [2]

[Total: 8]

2 Bobbie designs cars. She knows that fibre glass can be used to make a body shell that is strong but light.

(a) Choose **another** job requiring a good knowledge of materials. Describe an important property of a material used in that job.

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

(b) The steering wheel on a new model of car has too much vibration at motorway speeds.

Suggest how Bobbie could stop vibrations getting to the steering wheel.
Your answer should include the name of the material used.

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

(c) Bobbie examines a car body. She finds it is made from carbon fibre composite.

How can she tell it is a **composite**?
A labelled diagram may help your answer.

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

[Total: 5]

Turn over

3 Alice is a science student. She needs to test the thermal expansion of some metals.

- (a) Describe how Alice could measure the thermal expansion of a metal sample in a school laboratory.
Include a labelled diagram of the apparatus.

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

- (b) Alice knows that the mechanical properties of the metal may change when it is heated. Complete the sentences.
Choose the **best** words from the list.

changes contracts decreases increases remains the same

When the metal expands, the volume
When the metal expands, the density [2]

- (c) This question is about matching thermal behaviour of different materials.
Alice selects materials for making a camera. Their thermal expansions match.
Give **another** example where thermal expansion of the materials must match.
Your answer should include:

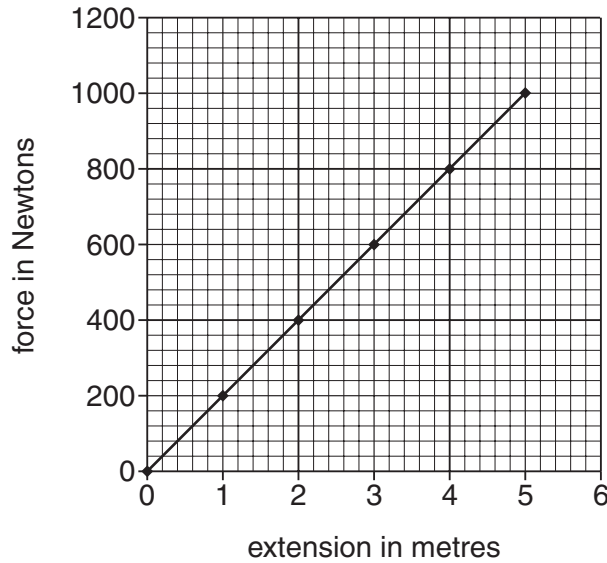
- the materials whose thermal expansion must match.
- the reason why their thermal expansion must match.

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

[Total: 7]

4 Greg is testing climbing ropes. He plots his results on a graph.

This graph shows his results.



- (a) When a climber falls, the rope absorbs energy.
When the force is 800N, the energy stored in the rope is more than 1500J.

Do a calculation to show this, using the graph.

answer = J [2]

- (b) The rope's stiffness can be calculated using the equation:

$$F = kx$$

Where k is the stiffness of the rope.
Use values from the graph to calculate the stiffness of the rope.

Give the unit for your answer.

stiffness = unit = [3]

[Total: 5]

- 5 Kerrie finds it hard to read notices.
She visits the optician.

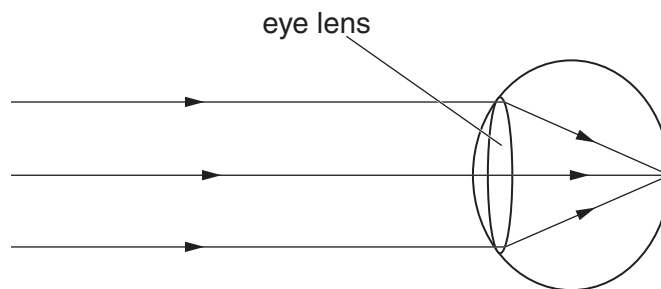
- (a) (i) The optician measures the **power** of the lens in Kerrie's eye.
Put a ring around the correct unit for the power of a lens.

carats decibels dioptres kelvin watts

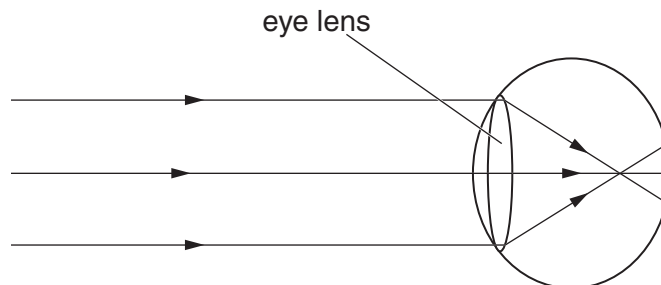
[1]

The diagrams show a normal eye and a shortsighted eye.

a normal eye



a shortsighted eye



- (ii) On the diagram of the shortsighted eye, draw a line to show the position of the **focal plane**. [1]

- (iii) In the shortsighted eye, the image is not focused in the right place.
Complete the sentence.
Choose a word from this list

concave convex great magnified small

In a shortsighted eye, the **power** of the eye lens is too [1]

(b) The optician says Kerrie is shortsighted. She can read notices more easily if she moves towards them. This increases the size of the image in her eye.

(i) Describe **another** effect this has on the image.

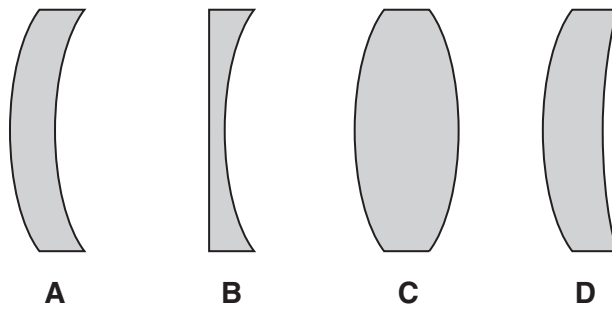
.....
..... [1]

(ii) Describe how Kerrie's eye lens changes as she moves towards the notice.

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

(c) The optician prescribes a **diverging** lens for Kerrie's short sight.

(i) Which shape, **A**, **B**, **C** or **D**, shows a diverging lens? [1]



(ii) The optician suggests a lens coating to transmit more light. Name another device which uses a coated lens.

..... [1]

