

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**TWENTY FIRST CENTURY SCIENCE**

**A336/02**

**ADDITIONAL APPLIED SCIENCE A**

Materials and Performance (Higher Tier)

**Wednesday 22 June 2011**

**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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**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. Pencil may be used for graphs and diagrams only.
- 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).
- Answer **all** the questions.
- Do **not** write in the bar codes.

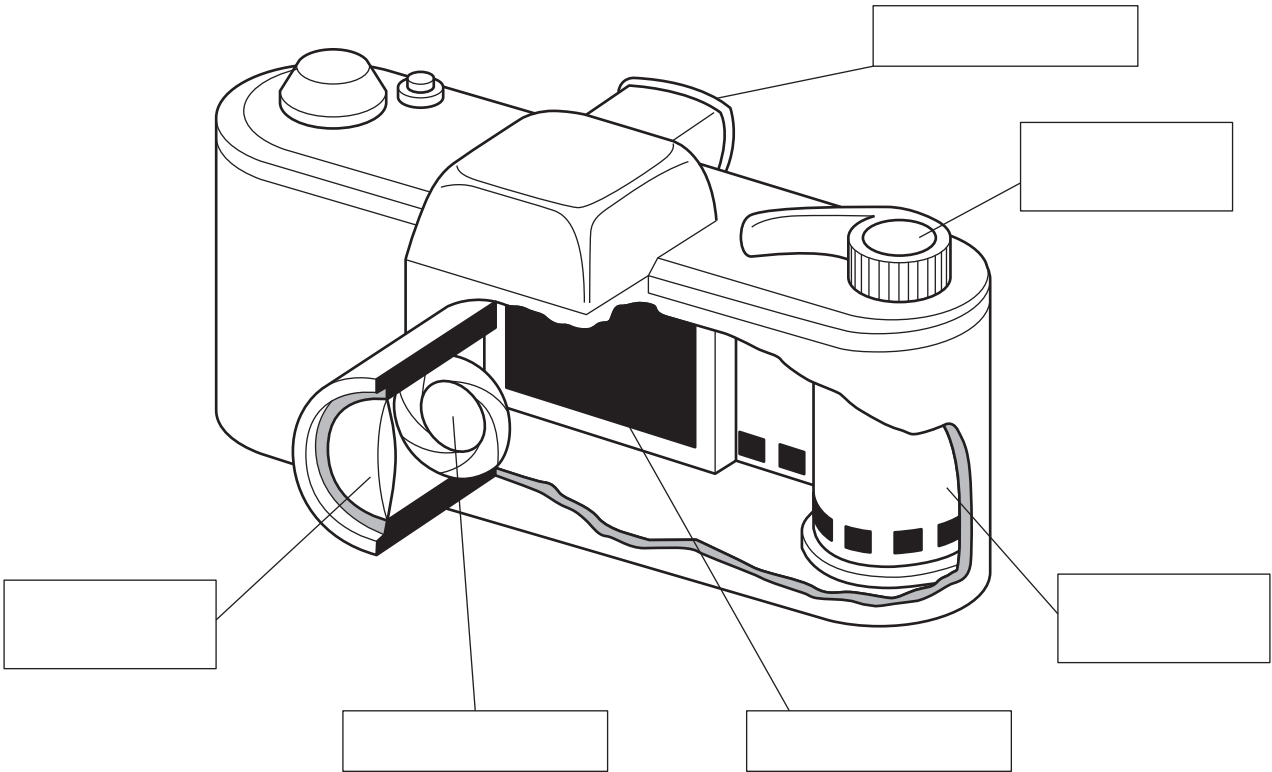
**INFORMATION FOR CANDIDATES**

- 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.

Answer **all** the questions.

1 Cara finds out how her camera works.

(a) (i) Write the words **aperture** and **shutter** in the correct boxes.



[2]

(ii) Cara learns that the camera lens has a special coating.

State the purpose of this coating.

..... [1]

(b) Parallel rays from a distant object arrive at the lens. They change direction as they pass through the lens.

(i) Name the **process** which makes the rays change direction.

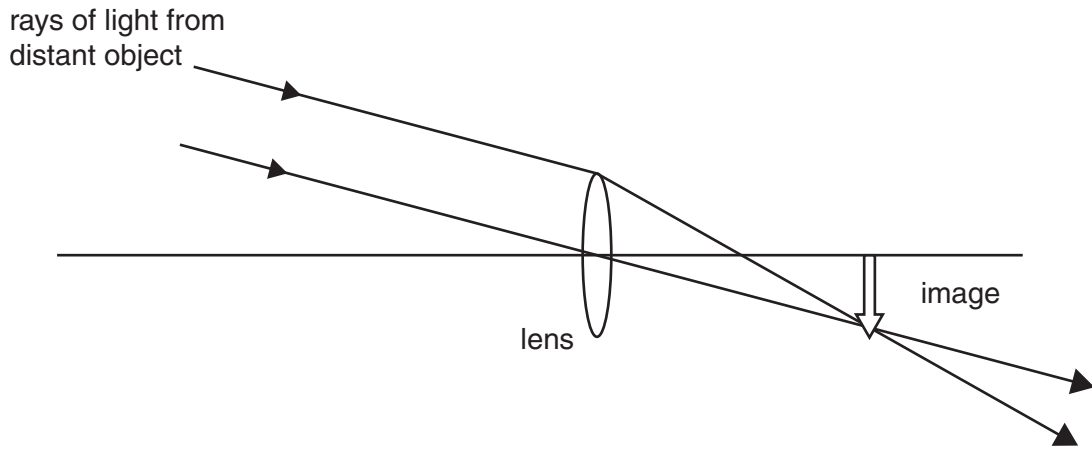
..... [1]

(ii) The change in direction depends on the **power** of the lens.

Write down the unit used for the power of the lens.

..... [1]

(c) The diagram shows how the camera lens focuses parallel rays to make an image.



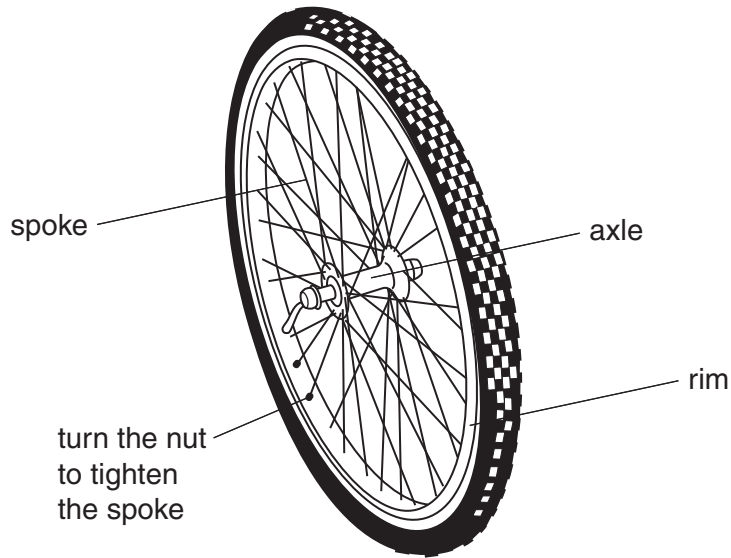
Describe what these words mean. You may draw on the diagram to help your answer.

focal length .....

focal plane ..... [2]

[Total: 7]

2 (a) Ravi tests how tightening the spokes affects the stiffness of a bicycle wheel.



He clamps the axle firmly and uses a force to make the rim bend (deflect) sideways.

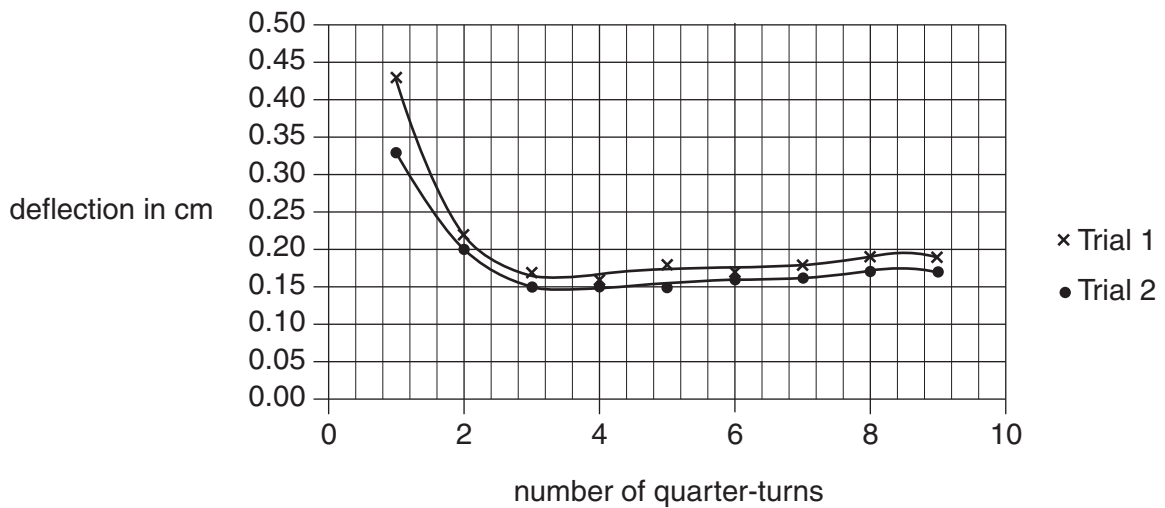
He measures the deflection of the rim.

He then tightens all the spokes by one quarter of a turn and measures the deflection.

He repeats this procedure nine times.

He then repeats the whole of the test to check for reliability.

These are his results.



The graph shows that the wheel is flexible if the spokes are loose and stiff if the spokes are tight.

(i) What is the **smallest** number of quarter-turns needed to make the wheel stiff?

answer ..... quarter-turns [1]

(ii) Are the results reliable?

Explain your answer.

.....

.....

.....

..... [2]

(b) Describe how you would compare the stiffness of samples in a school laboratory.

You may use a diagram to help your answer.

.....

.....

..... [3]

[Total: 6]

3 Sonia checks sound levels in a factory. She measures the sound intensity.

(a) (i) Write down the **name** of the scale used to measure sound intensity.

..... [1]

These are some of Sonia's results.

area of factory	sound intensity in dB
reception	60
canteen	70
workshop	120

(ii) Compare the **loudness** in the canteen with the loudness in the reception area.

Put a **ring** around the correct answer.

The sound in the canteen is

- the same**      **slightly louder**      **10% louder**      **twice as loud**

[1]

(b) Sonia finds that the sound intensity in the workshop is too high, because of its machinery.

The sound intensity in the room needs to be controlled.

Describe a method of reducing sound intensity in a room by using a suitable material.

State the material used and how it helps to reduce sound intensity.

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

- (c) The workshop uses sensitive equipment which must be protected from mechanical vibrations produced by the other machinery.

Describe how equipment can be **isolated** from mechanical vibrations.

You may use a diagram to help your answer.

.....

.....

..... [2]

[Total: 6]

4 This question is about thermal behaviour.

- (a) All parts of a camera should expand at the same rate when the temperature rises. For example, the shutter should expand at the same rate as the camera body, so that the shutter opens and closes properly.

Describe **another** example of an object with parts which should expand at the **same** rate.

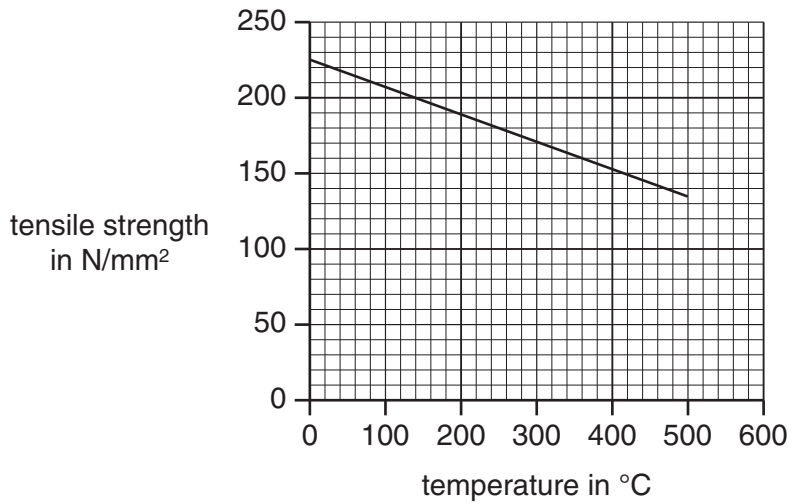
You should name the parts and explain why they should expand at the same rate.

.....

.....

..... [2]

- (b) This graph shows how the tensile strength of copper varies with temperature.



- (i) Calculate the average change in tensile strength when the temperature rises by 1 °C.

Use this formula.

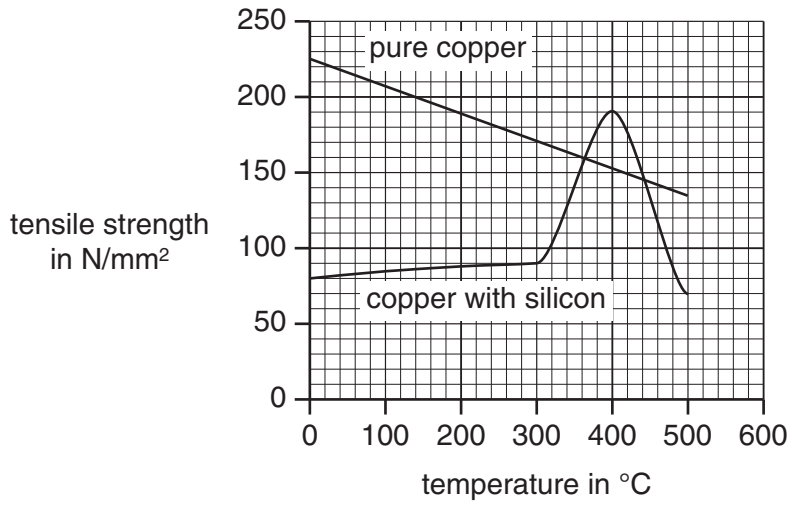
$$\text{gradient of line} = \frac{\text{change of tensile strength}}{\text{change in temperature}}$$

answer = ..... N/mm<sup>2</sup>/°C [2]



(ii) Silicon is sometimes added to copper.

The graph shows how adding silicon alters the tensile strength over a wide range of temperatures.



Describe the effects on tensile strength of adding silicon to copper.

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

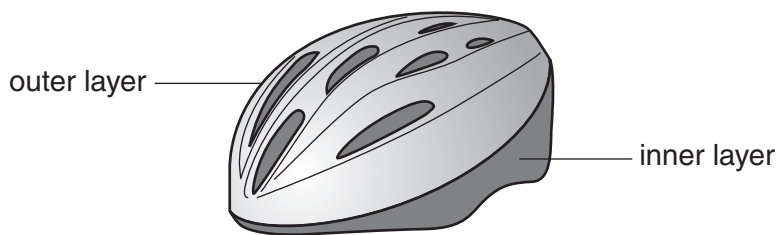
(iii) When silicon is added to copper it changes other properties as well as tensile strength.

Suggest **two** other properties that it may change.

1 .....  
 2 ..... [1]

[Total: 6]

5 Thelme learns about materials for a cycle helmet. She learns that cycle helmets need several properties in order to protect her head.



(a) This part of the question is about a material that needs **more than one** property.

Read Thelme’s notes about the material for the outer layer of a cycle helmet.

A cycle helmet has an outer layer.  
 The material for the outer layer needs to be **hard** in order to spread the force of a collision **and tough** so it does not shatter.

Describe a different material, not used for cycle helmets, that needs **more than one** property.

Your example should include

- what the material is and what it is used for
- the two properties it needs
- why each property is needed.

You may include properties which are not mechanical.

.....

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**[3]**

(b) Read Thelme’s notes about the reason why **two** materials are used for a cycle helmet.

A cycle helmet has an inner layer as well as an outer layer.  
 They are made of different materials because the helmet needs different properties from each material.  
 Polycarbonate is used for the outer layer because it is hard and spreads the force of a collision.  
 Polystyrene foam is used for the inner layer because it is soft and absorbs the energy of the collision.

Describe **another** example of an object that is made from two or more **different materials**, because it needs the mechanical property of each material.

Your example should include

- what the object is and two materials it is made from
- the important mechanical property of each material
- why each mechanical property is required.

.....

.....

.....

.....

..... [3]

(c) Thelme learns that the soft inner layer of the helmet affects how **momentum** changes during a collision. This helps to protect the head.

Use ideas about momentum to explain how the inner layer improves safety.

.....

.....

.....

..... [3]

(d) Thelme cycles home. She stops outside her house.

Her speed before stopping is 5 m/s and she takes 3 s to slow down and stop.

Calculate the force acting on Thelme which makes her stop. Her mass is 60 Kg.

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

Show your working.

force = ..... N [2]

[Total: 11]

**END OF QUESTION PAPER**

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