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H

GENERAL CERTIFICATE OF SECONDARY EDUCATION

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)

Wednesday 26 January 2011
Afternoon

Duration: 45 minutes

A336020

OCE/25589

Candidate forename		Candidate surname	

Centre number						Candidate number				

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.

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Answer **all** the questions.

1 **(a)** It is important to know the tensile strength of materials used for structures.

Describe how you could measure tensile strength of a material sample in a school laboratory.

You may use a diagram to help your answer.

.....

.....

.....

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

(b) Glass-reinforced plastic is made from glass and resin.

Resin is used in glass-reinforced plastic because it is tough but it is weak in tension.

Suggest what property of **glass** makes it useful in glass-reinforced plastic.

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

(c) Glass-reinforced plastic is a **composite** material which is used for boats.

(i) Give **another** example of a composite material and its use.

composite material .....

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

(ii) Draw a diagram to show the structure of the composite material you have chosen**.**

[1]

[Total: 7]

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2 This question is about lenses.

(a) A projector and a magnifying glass produce images which are larger than the object.

The image from the projector is **real** and **inverted**.

Describe the image from the magnifying glass.

.....

.....

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

(b) The lamp in a slide projector gives out heat energy. The lens in the projector is made of a specialised glass which absorbs the heat energy.

Describe **another** example of a specialised glass and its use.

Give a reason why its special property is needed.

.....

.....

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

[Total: 4]

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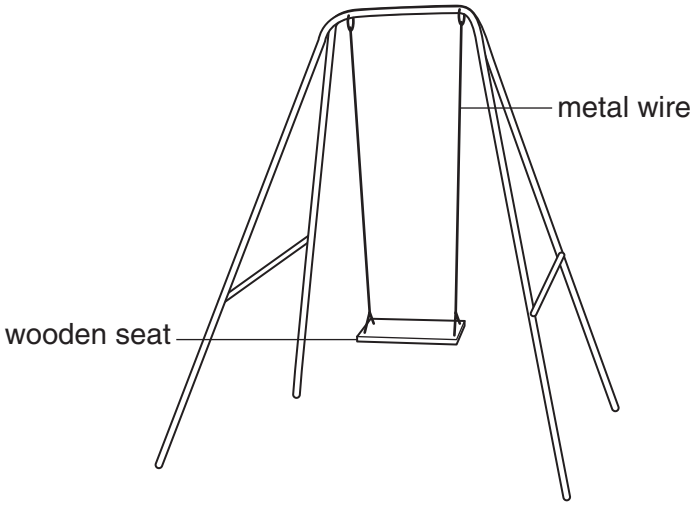
3 Ranjit walks to school. He sees a very old swing.



(a) The wooden seat of the swing hangs from metal wires. The metal wires feel cold.

The wooden seat does not feel cold.

The wires and the seat are at the same temperature.

Explain why the wires feel cold, but the seat does not.

.....

.....

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

(b) Metal wire is used in this swing because it is tough and hard.

Write down another **mechanical** property the metal wire must have.

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

(c) Metal is stretched to make the wire.

The metal does not go back to its original shape after being stretched.

Name this type of behaviour.

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

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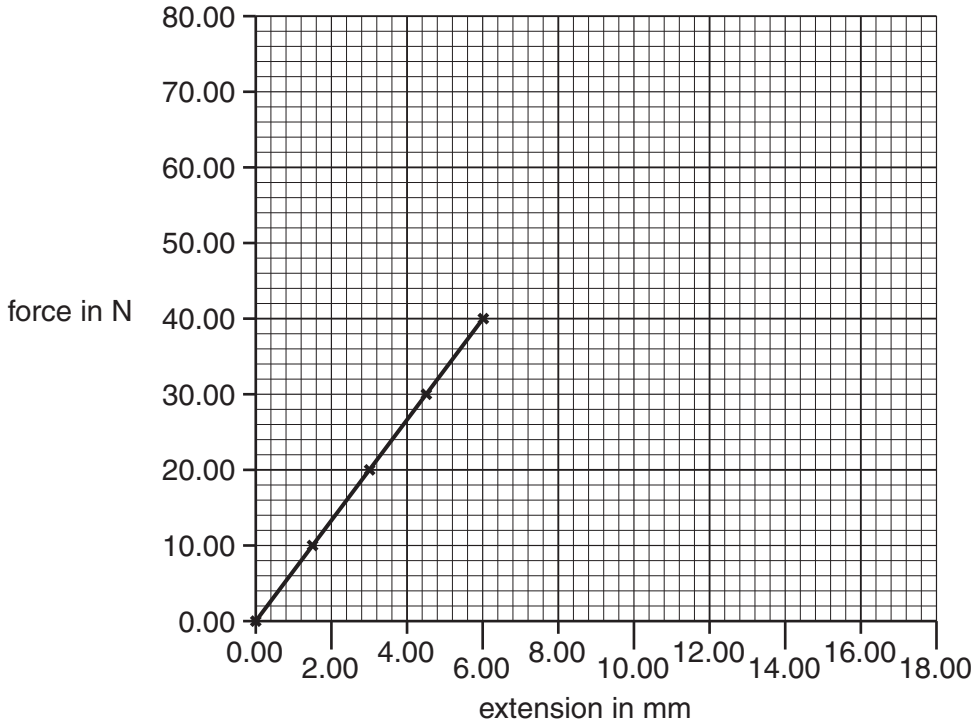
(d) Ranjit goes to a science lesson. He stretches a thin steel wire.

He records the extension for each force.

He plots this graph.



The teacher helps Ranjit to apply larger forces safely.

These are the results for the larger forces.

force in N	extension in mm
50	8.0
60	11.4
70	16.8

(i) Complete the graph by plotting these points and drawing a smooth curve through the points. **[2]**

(ii) The shape of the graph changes for forces above 40 N.

Suggest why the wire behaves differently for forces above 40 N.

.....

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

[Total: 7]

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4 **(a)** Some materials are chosen so their mechanical properties match. For example, the materials used for replacement hips should have a similar density and stiffness to bone.

Give **another** example of using materials with matching mechanical properties.

Your answer should include

- the names of the materials and how they are used
- the mechanical properties which match
- why the properties should match.

.....

.....

.....

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

(b) An alloy is made from a pure metal by adding other elements.

(i) One benefit of using an alloy can be increased strength.

State **one other** benefit of using an alloy rather than a pure metal.

.....

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

(ii) An alloy can be described as a solid solution.

Give a reason why an alloy can be described as a solution.

.....

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

[Total: 5]

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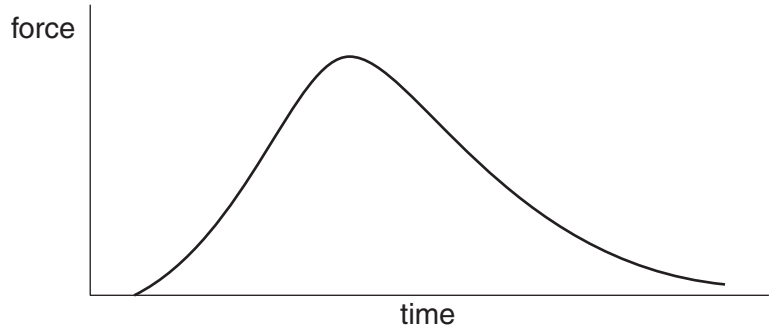
5 Anita investigates forces in collisions. She tests a model car by making it collide with a barrier. The barrier stops the car.

(a) This graph shows how the force acting on the car in the collision varies with time.



What does the area under the graph represent? ..... **[1]**

(b) Anita repeats the same test with another car. This car has a crumple zone.

Both cars have the same mass and travel at the same speed before colliding with the barrier.

Show the effect of the crumple zone by completing the table.

Put a tick (✓) in each correct box. The first one is done for you.

Effects of using crumple zone	decreases	increases	stays the same	may increase or decrease
time for collision		✓		
average force				
area under graph				
height of peak on graph				

[3]

(c) A model car travels at 15 m/s before a collision which makes it stop. The mass of the car is 0.5 kg. The collision time is 0.1 s.

Calculate the average force acting on the car during the collision.

Use **Ft = m (v – u)**

Give the unit in your answer.

force = ... unit ..... **[3]**

[Total: 7]

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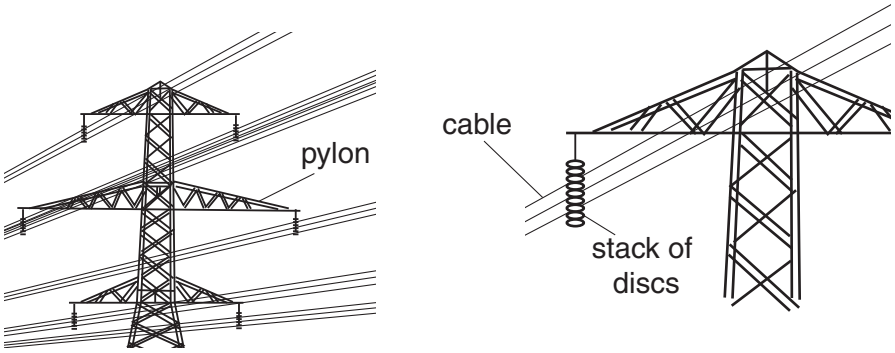
6 Electricity pylons support long electrical cables. These hang from the pylons.

Stacks of discs prevent current passing to the pylons from the cables.



(a) (i) The material used for the discs needs a combination of properties.

Suggest one **mechanical** and one **other** property the material should have.

.....

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

(ii) Suggest which **class** of material would be best for the stack of discs.

class of material ..... **[1]**

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(b) The cables should have a high electrical conductance.

Describe how you would find the electrical conductance of a thin metal sample in a school laboratory.

Draw a diagram of the circuit you would use.

Include an ammeter and a voltmeter.

Label the components and the sample to be tested.

Show how you would calculate the conductance.

Use **G = I/V**.

.....

.....

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

[Total: 6]

END OF QUESTION PAPER

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