Surname

Other Names

Candidate Signature

AQA

General Certificate of Secondary Education
Higher Tier
June 2013

Additional Applied Science   AAS1HP

Unit 1   Science at Work

H

Written Paper

Tuesday 14 May 2013   9.00 am to 10.00 am

For this paper you must have:
- a ruler
- a calculator
- the Equations Sheet (enclosed).

Time allowed
- 1 hour

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 3 should be answered in continuous prose.
  In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

Answer **all** questions in the spaces provided.

1 A technician tested the stiffness of a material.

The diagram shows the equipment the technician used.

Clamp

Material being tested

Amount of bending in cm

1 N weights

Load
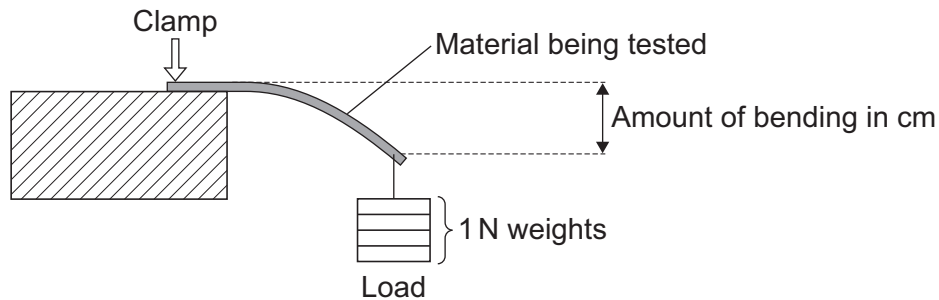
1 (a) Part of the material being tested is in compression. On the diagram, label the part in compression with the letter **C**. *(1 mark)*

1 (b) Suggest how the technician would use the weights to test the stiffness of the material.

....

....

....

....

....

(2 marks)

1 (c) The technician tested the stiffness of two materials, **J** and **K**.

The results for material **J** are shown in the table.

Load in N	Amount of bending in cm
0	0·0
1	0·5
2	1·0
3	1·6
4	2·0
5	2·5

1 (c) (i) The results for material **K** have been plotted on the graph.

On the same axes plot the results for material **J**.

Draw a line of best fit.
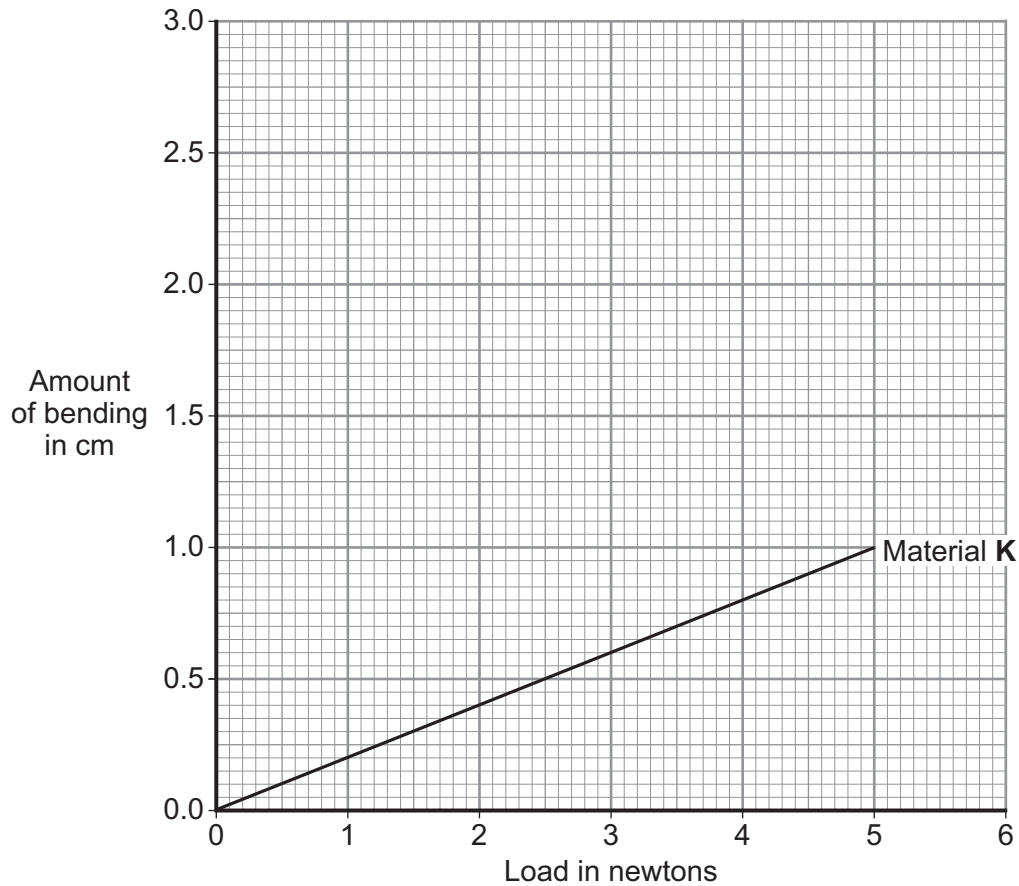
(2 marks)

1 (c) (ii) Look at your graph.

Which material is stiffer, **J** or **K**?

Give a reason for your answer.

....

....

(1 mark)

6

Turn over for the next question

2 Athletes need to drink more fluids when they are training.

2 (a) (i) Which drink in the table, **W**, **X**, **Y** or **Z**, shows the correct list of ingredients for an isotonic sports drink?

Tick (✓) **one** answer.

Drink	Ingredients	Tick (✓)
W	Glucose, water, sugar	
X	Glucose, water, electrolytes	
Y	Sucrose, water, electrolytes	
Z	Sucrose, water, sugar	

(1 mark)

2 (a) (ii) What does 'isotonic' mean?

....

....

....

....

(2 marks)

2 (a) (iii) Athletes drink isotonic drinks when exercising.

Suggest **one** reason why.

....

....

(1 mark)

2 (b) A nutritionist measured a man's height and mass.

2 (b) (i) The man's height was 1.6 m and his mass 74 kg. Calculate the man's BMI.

Use the Equations Sheet to help you answer the question.

....

....

....

BMI ....

(2 marks)

2 (b) (ii) The table below shows what the BMI values mean.

BMI	What it means
<18.5	Underweight
18.5–24.9	Ideal weight
25.0–29.9	Overweight
>30.0	Obese

What advice would you give to the man?

Use the information from your calculation and the table to help you.

....

....

....

....

(2 marks)

8

Turn over ▶

3 *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The information in the table shows how tennis racquets have changed since 1950.

Wooden racquet, 1950	Aluminium racquet, 1980	Composite racquet, 2010
Mass 400 g Head size 420 cm^2	Mass 280 g Head size 700 cm^2	Mass 330 g Head size 645 cm^2 Composite may contain: • carbon fibre • glass fibre • titanium • ceramics

Use the information to suggest the advantages to tennis players of the changes to the materials used in tennis racquets since 1950.

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

(6 marks)

6

Turn over ▶

4 (a) Describe how a forensic scientist would use the oil immersion method to measure the refractive index of a piece of glass.

....

....

....

....

....

....

....

....

(4 marks)

4 (b) To explain refraction, a teacher sets up the equipment shown in the diagram.

Glass rod

Beaker

Clear oil
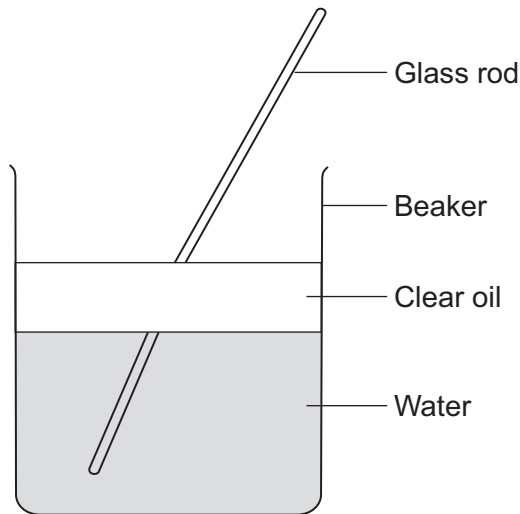
Water

Why does the glass rod seem to disappear in the oil?

....

....

....

(2 marks)

6

5 Ammonium sulfate is a fertiliser.

5 (a) Ammonium sulfate dissolves in water.

Suggest why it is important for a fertiliser to be soluble in water.

....

....

(1 mark)

5 (b) A student made some ammonium sulfate.

He mixed ammonia solution with dilute sulfuric acid.

Ammonia reacts with sulfuric acid to make ammonium sulfate.

5 (b) (i) Balance the symbol equation for this reaction.

$$NH_3 \quad + \quad H_2SO_4 \quad \longrightarrow \quad (NH_4)_2SO_4$$

(1 mark)

5 (b) (ii) The student predicted he would make 8.0 g of ammonium sulfate.

He actually made 7.0 g.

Calculate his percentage yield.

....

....

....

....

Percentage yield .... %

(2 marks)

5 (b) (iii) Give **two** possible reasons why the student's actual yield was less than the theoretical yield.

1 ....

....

2 ....

....

(2 marks)

Turn over ▶

5 (c)   Plants need nitrates, phosphates and potassium for healthy growth.

The table shows the effect of adding some substances to the soil on the yield of a crop.

Substances added (kg per hectare)			Crop yield (tonnes per hectare)
Nitrates	**Phosphates**	**Potassium**	
0	0	0	1.70
96	0	0	3.70
0	77	107	2.00
96	77	107	6.60

5 (c) (i)   Which substance is most important for the growth of the crop?

Use the data in the table to explain your answer.

Substance ....

Explanation ....

....

....

(2 marks)

5 (c) (ii)   Describe how an organic farmer would add these substances to his soil.

....

....

(1 mark)

5 (c) (iii)   Each of the substances in the table helps the growth of one part of a plant.

Which part(s) of the plant is helped by each substance?

....

....

....

(3 marks)

12

6 Ammonia is made from nitrogen and hydrogen.

The flow chart shows how ammonia is made using the Haber process.
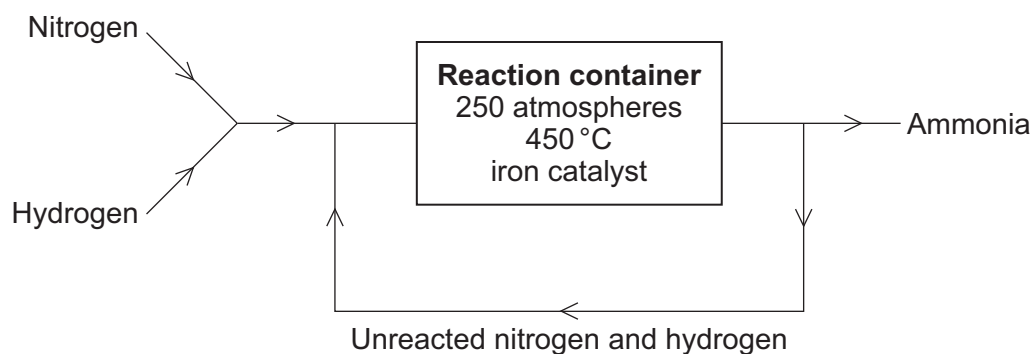
The equation for the reaction is

$$N_2 \ + \ 3H_2 \ \rightleftharpoons \ 2NH_3$$
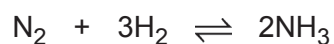
6 (a) What does the $\rightleftharpoons$ sign mean?

....

(1 mark)

6 (b) Some of the nitrogen and hydrogen do not react.

What happens to the unreacted nitrogen and hydrogen?

....

....

(1 mark)

6 (c) Why is a catalyst used in the Haber process?

....

....

(1 mark)

Turn over ▶

6 (d) The graph shows the percentage of ammonia made in the Haber process at different temperatures and pressures.
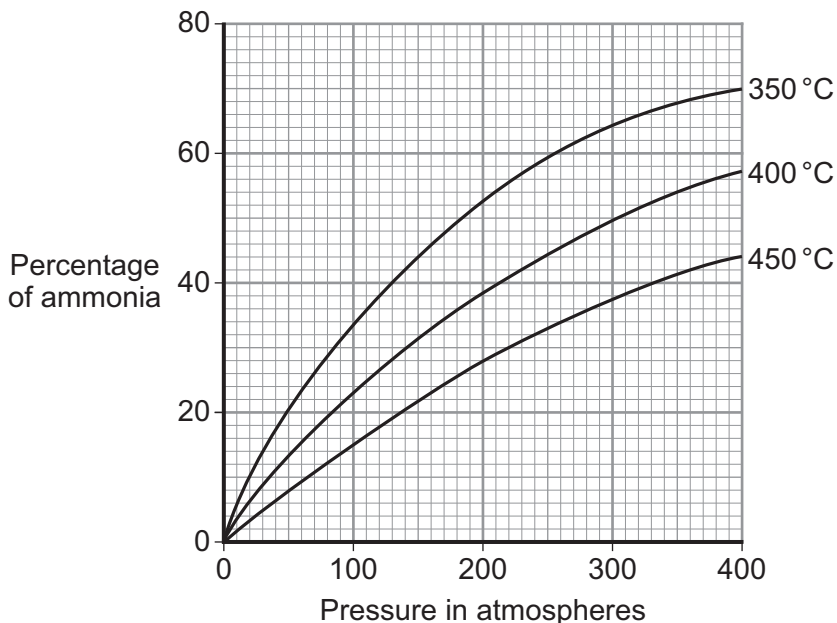
Use the graph to answer the questions.

6 (d) (i) Write down a temperature and pressure which makes 20 % of ammonia. Give the units in your answer.

Temperature ....

Pressure ....

(1 mark)

6 (d) (ii) What conclusions can you make about the effect of temperature and pressure on the percentage of ammonia produced?

....

....

....

....

(2 marks)

6

7 Genetically modified (GM) corn is grown in the USA.

Some bacteria produce a toxin that kills insects.

Corn can be genetically modified by inserting the gene that produces this toxin into the DNA of the corn.

No GM corn is currently grown in the UK.

Use the information, and your own knowledge, to evaluate the use of GM crops in the UK in the future.

....

....

....

....

....

....

....

....

....

....

....

....

(5 marks)

5

Turn over ▶

8 Mountain bikes have frames made out of tubes of metal.

The metal used is usually steel, a steel alloy or an aluminium alloy.

The table shows some of the properties of materials used in making bikes.

	Steel	Steel alloy	Aluminium alloy
Density in g/cm^3	7.85	7.10	2.70
Tensile strength in MN/m^2	430	760	100
Relative cost	Low	Medium	High

8 (a) What is the advantage of using aluminium alloy to make the frame?

....

....
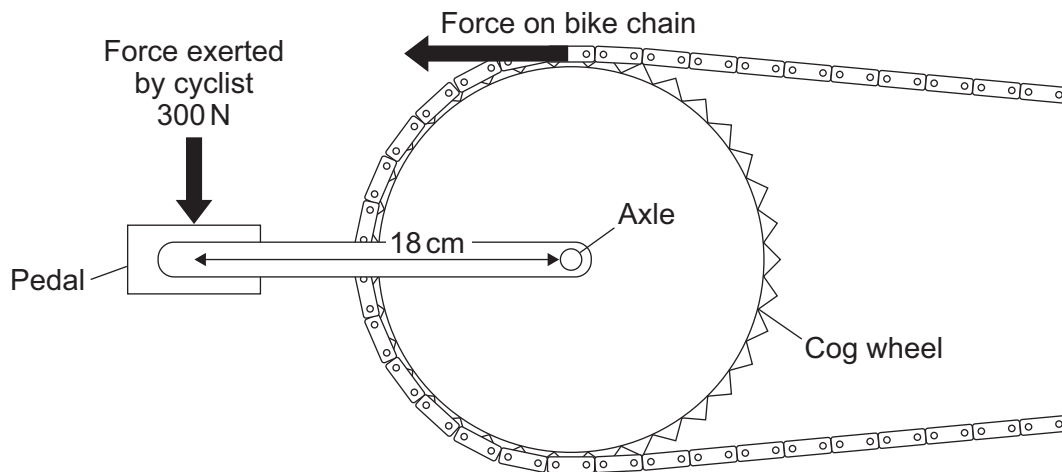
(1 mark)

8 (b)   A mountain bike manufacturer uses 500 cm³ of aluminium alloy to make his bike frame.

Calculate the mass of the frame. Use the Equations Sheet to help you work out your answer.

....

....

....

....

....

Mass .... kg

(3 marks)

8 (c)   The diagram shows the cog wheel, pedal and chain of a mountain bike.

A cyclist pushes down on the pedal with a force of 300 N.

Calculate the moment of the 300 N force around the axle. Use the Equations sheet to help you answer the question.

....

....

....

Answer .... Nm

(2 marks)

6

Turn over ▶

Do not write outside the box

9 The breathalyser test detects alcohol (ethanol).

Ethanol has the formula C_2H_5OH.

9 (a) Name the type of chemical bonding in ethanol.

....

(1 mark)

9 (b) Describe how an analytical chemist would test for an alcohol in the laboratory.

....

....

....

....

....

....

....

....

(4 marks)

5

END OF QUESTIONS