Specimen Paper

AQA

General Certificate of Secondary Education
Higher Tier
Specimen Paper

Additional Applied Science

Unit 1 Science at Work

Higher Tier

H

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

Time allowed
- 60 minutes

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 space 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 reminded of the need for good English and clear presentation in your answers.
- Question 4(a)(i) 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) A glass manufacturer needs to know the refractive index of a specimen of glass.

He can do this by passing a ray of light through a piece of the glass and measuring the angle of incidence and angle of refraction.
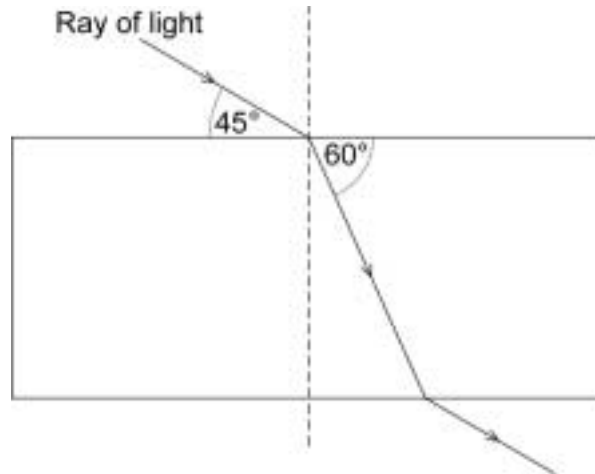
1 (a) (i) What is the name of the dotted line shown on the diagram?

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(1 mark)

1 (a) (ii) The table shows the refractive indices of different types of glass.

Type of glass	Refractive index
Window glass	1.500–1.520
Headlamp glass	1.400–1.430
Spectacle glass	1.520–1.550

Use the information in the diagram and the table to suggest whether this piece of glass is suitable for headlamps.

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(4 marks)

1 (b) A forensic scientist needs to identify a tiny fragment of glass. The fragment is so small that she cannot use the method described in (a).

The forensic scientist put the glass fragment on a microscope slide and covered it with a few drops of liquid. The liquid was heated and then allowed to cool down.

1 (b) (i) As the liquid heats up, the glass fragment seems to disappear and reappear. As the liquid cools, a similar observation is made.

Explain why the glass seems to disappear at one particular temperature.

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(2 marks)

1 (b) (ii) Why is it better to measure the 'disappearance temperature' twice?

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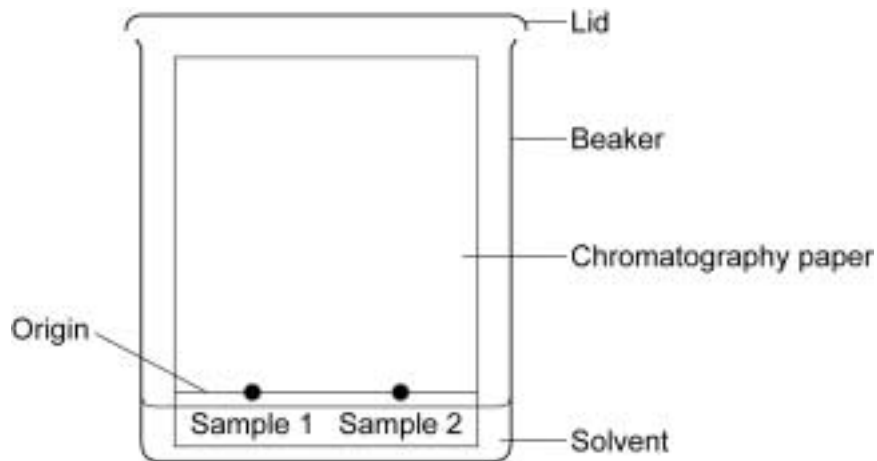
(3 marks)

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Turn over ▶

2 Chromatography is a useful technique for separating mixtures. Analytical scientists often use it to compare mixtures to see if they have the same components.

The diagram shows a paper chromatography experiment that is being used to compare two samples of ink obtained from a crime scene.

2 (a) Explain why the origin line is drawn in pencil and is drawn above the level of the solvent.

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(2 marks)

2 (b) Explain how the components in the sample are separated into two or more spots.

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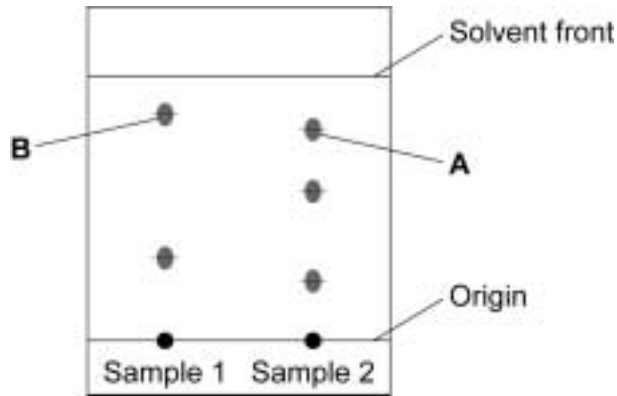
(3 marks)

2 (c) The result of the experiment is shown in the diagram.

2 (c) (i) The R_f value of spot **A** is 0.80.

Calculate the R_f value for spot **B**.

Show clearly how you work out your answer.

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R_f = ...
(2 marks)

2 (c) (ii) Use the R_f value you have just calculated, and information in the diagram, to suggest why Sample 1 and Sample 2 are **not** the same.

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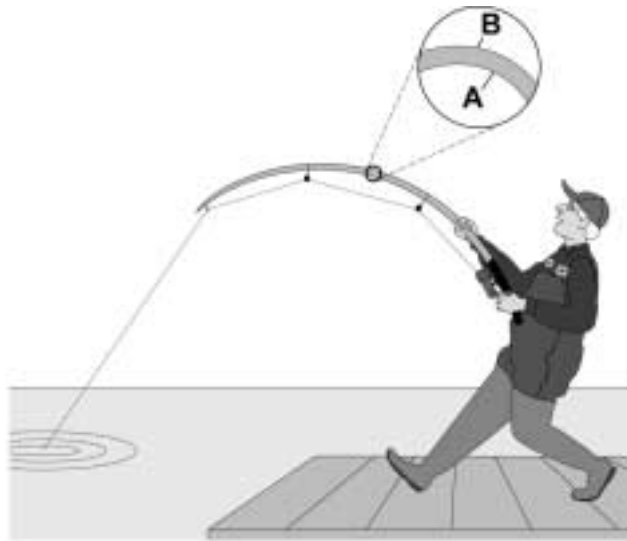*(2 marks)*

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Turn over for the next question

Turn over ▶

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**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

3 The diagram shows a person using a fishing rod.

3 (a) Which row in the table shows the type of stress that is acting at point **A** and at point **B** in the fishing rod?

Tick (✓) the box next to the correct answer.

Stress at point A	Stress at point B	Tick (✓)
Compression	Compression	
Compression	Tension	
Tension	Tension	
Tension	Compression	

(1 mark)

3 (b) The fishing rod is made from a carbon fibre composite, and the fishing line is made from nylon (a polymer).

Which property of **both** carbon fibre composite **and** nylon make them suitable for these uses?

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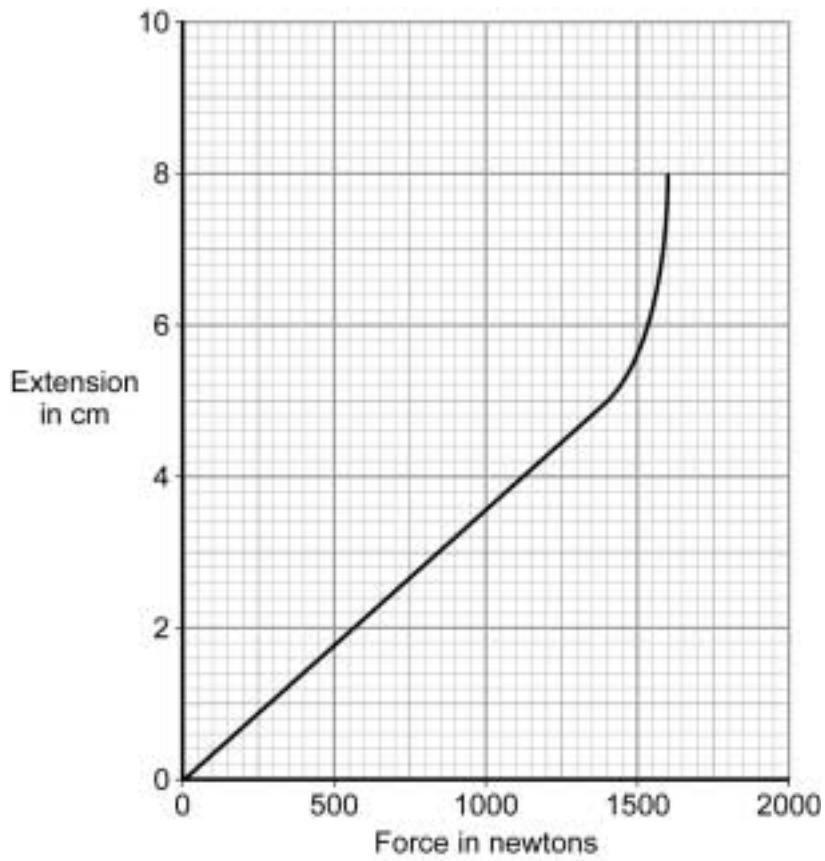
(1 mark)

Question 3 continues on the next page

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3 (c) The graph shows the scientist's results.

3 (c) (i) Over what range of force was the extension directly proportional to the force applied?

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(1 mark)

3 (c) (ii) The line the scientist tested had a cross-sectional area of 2 mm^2.

The breaking force of the line was 1600 N.

What is the stress on the line at this breaking force?

Show clearly how you work out your answer. Give the units in your answer.

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Stress = ...
(2 marks)

3 (c) (iii) A fisherman wants to use the cheapest suitable line for catching fish in a local lake.

He knows that the biggest fish he is likely to catch in the lake is 5 kg.

He also knows that the thinner the line is the less likely a fish is to see it.

The table gives some information about three different fishing lines, **A**, **B** and **C**.

Diameter of line in mm	Line A		Line B		Line C	
	Breaking strain in kg	Cost in £ per 50 m reel	Breaking strain in kg	Cost in £ per 50 m reel	Breaking strain in kg	Cost in £ per 50 m reel
0.10	0.92	8.00	0.31	12.00	1.42	11.50
0.12	1.33	7.00	1.89	10.50	2.06	10.50
0.16	2.37	6.50	3.37	9.00	3.66	6.00
0.20	3.60	5.50	5.28	6.50	5.74	5.75
0.24	5.33	5.00	7.60	5.75	8.26	5.50

Use the information to suggest which fishing line, **A**, **B** or **C**, and which diameter of line, the fisherman should use.

Give reasons for your answer.

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(4 marks)

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Turn over for the next question

Turn over ▶

4 (a) An agricultural scientist investigates two fertilisers, **A** and **B**, to test the hypothesis that **A** is better than **B** in increasing the yield of wheat.

4 (a) (i) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe an experiment that the agricultural scientist could do to find out which fertiliser would be better.

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(6 marks)

4 (a) (ii) How would the agricultural scientist use his results to check his hypothesis?

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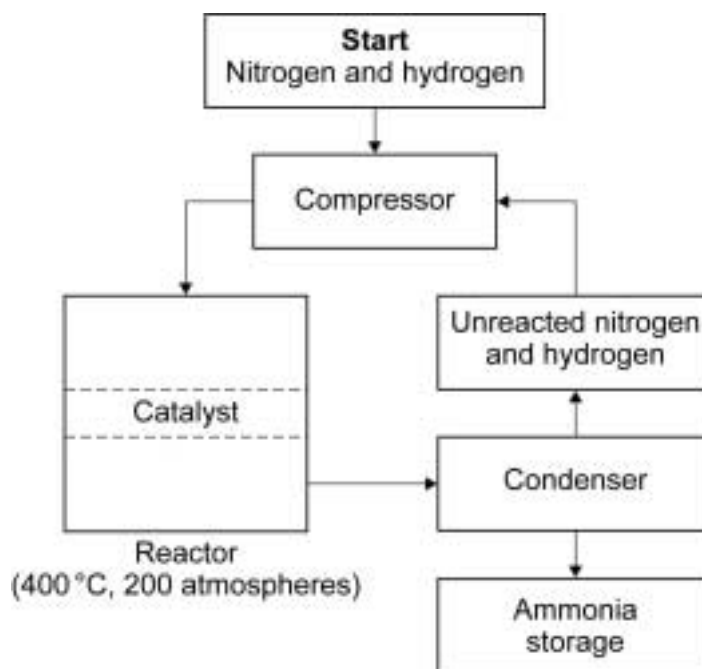
(1 mark)

4 (b) Ammonium nitrate is a soluble compound in artificial fertilisers.

The first stage in making ammonium nitrate is the production of ammonia.

4 (b) (i) Write the balanced chemical equation for the production of ammonia in this process.

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(2 marks)

4 (b) (ii) The production of ammonia is an exothermic reaction.

Give **one** disadvantage of making the process happen at a higher temperature than shown in the diagram.

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(1 mark)

4 (b) (iii) Give **one** advantage of making the process happen at higher pressure than shown in the diagram.

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(1 mark)

Question 4 continues on the next page

Turn over ▶

4 (c) (i) In the production of ammonium nitrate a chemical company expected to make 120 000 kg of ammonium nitrate in a batch.

The actual amount made in the batch was 85 000 kg.

What was the percentage yield?

Show clearly how you work out your answer.

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Percentage yield = ... %

(2 marks)

4 (c) (ii) Suggest **one** reason why the chemical company might not achieve 100% yield.

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(1 mark)

14

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ▶

5　Electrophoresis is an analytical technique that uses an electric field between two electrodes to separate charged particles.

DNA obtained from people can be broken into fragments and these can be separated to produce a DNA profile.

DNA profiling can be used to find out which of two men is the father of a child.

The diagram shows the genetic profiles of two men, a child, and the child's mother.

The numbers refer to the bars on the profiles.
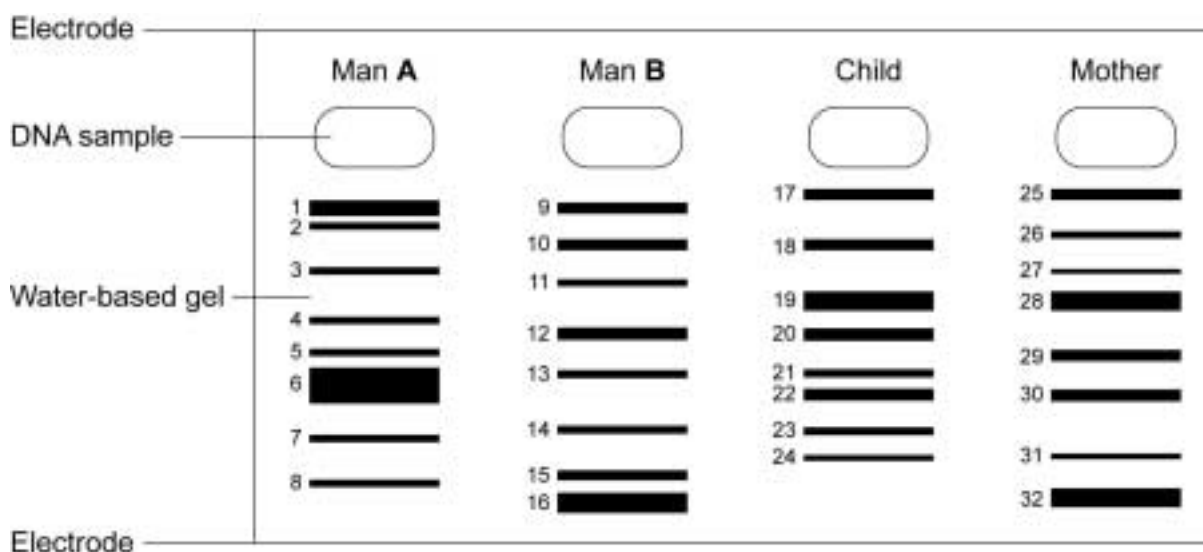
5 (a)　Which man, **A** or **B**, is more likely to be the father of the child?

Use evidence from the diagram to explain why you have chosen this man.

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(4 marks)

5 (b) Explain how the electric field makes the DNA fragments separate.
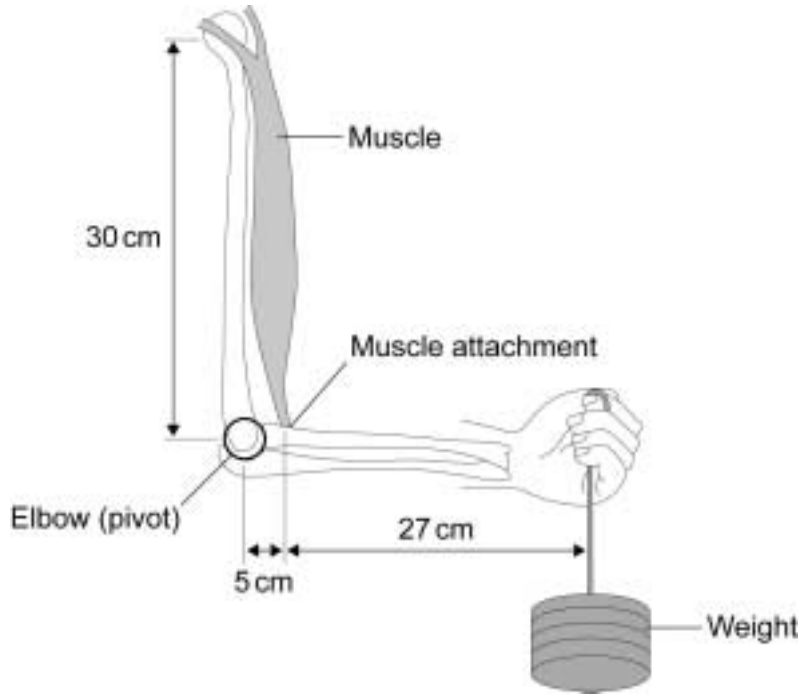
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(4 marks)

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Turn over for the next question

Turn over ▶

6   Physiotherapists need to know about joints so that they can treat skeletal-muscular injuries.

6 (a)   A physiotherapist gives a patient some exercises to do to strengthen her arm muscles.

The diagram shows the bones and one muscle in the patient's arm.

6 (a) (i)   The weight has a turning effect on the patient's lower arm of 2.88 Nm.

Calculate the weight.

Show clearly how you work out your answer and give the correct units

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Weight = ...
(3 marks)

6 (a) (ii)   Name the muscle shown on the diagram.

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(1 mark)

6 (a) (iii) Name the muscle that is the antagonist to the muscle shown on the diagram.

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(1 mark)

6 (a) (iv) Name the structure that attaches muscles to bone.

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(1 mark)

6 (b) The diagram shows the structure of a synovial joint.
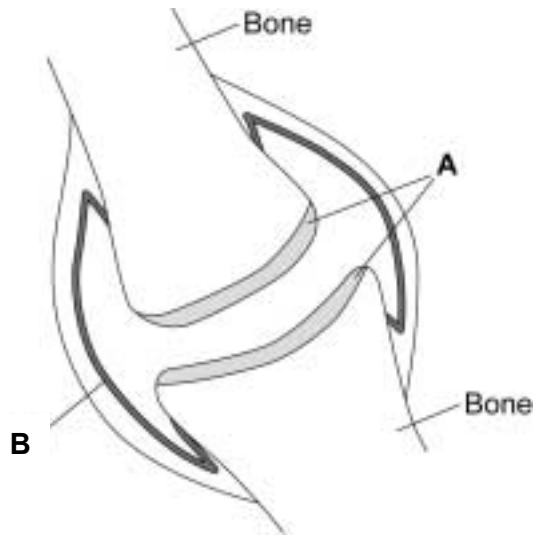
Name the structures labelled **A** and **B** and describe their function.

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(4 marks)

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END OF QUESTIONS

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AQA

GCSE Additional Applied Science Equations sheet

Unit 1

Moment $=$ force $\times$ perpendicular distance to pivot
BMI $=$ $\dfrac{mass}{height^2}$
Density $=$ $\dfrac{mass}{volume}$
Stress $=$ $\dfrac{force}{cross\text{-}sectional\ area}$
Force $=$ constant $\times$ extension
R_f $=$ $\dfrac{distance\ travelled\ by\ substance}{distance\ travelled\ by\ solvent}$
Refractive index $=$ $\dfrac{\sin i}{\sin r}$