

Tuesday 22 January 2013 – Morning

GCSE ADDITIONAL APPLIED SCIENCE

A192/02 Science of Materials and Production (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

Duration: 1 hour

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

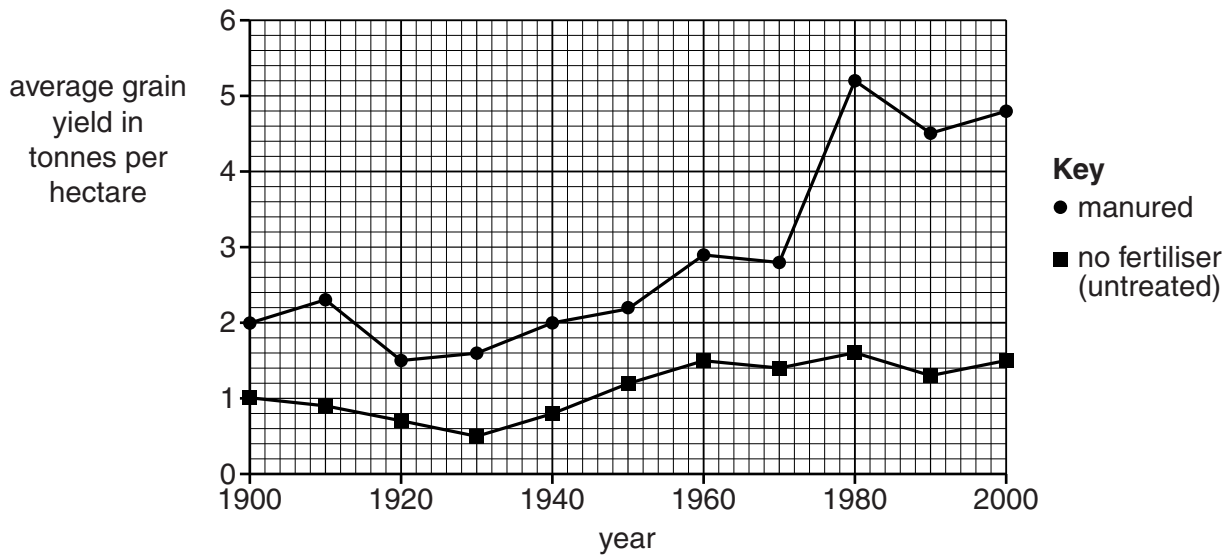
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting 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).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- 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 **50**.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 The graph shows the yield of wheat harvested from two fields since 1900.



One field was treated every year with farmyard manure.

No fertiliser at all was put on the other field.

SuperGro wheat was grown in both fields.

There were some changes introduced during the experiment:

- After 1930, lime was added to both fields.
- After 1960, herbicides were used on both fields.
- After 1970, a different variety of wheat, HyperGro, was grown in both fields.

(a) A scientist claims that all three changes improved the yield in both fields.

Use the graph to show that this claim is **not** correct.

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..... [2]

- (b) The seed supplier claims that using HyperGro wheat instead of SuperGro wheat improves the yield between manured and untreated fields by at least 200%.

By completing the calculations in the table below, discuss the validity of the claim.

You may use the space below the table for your working.

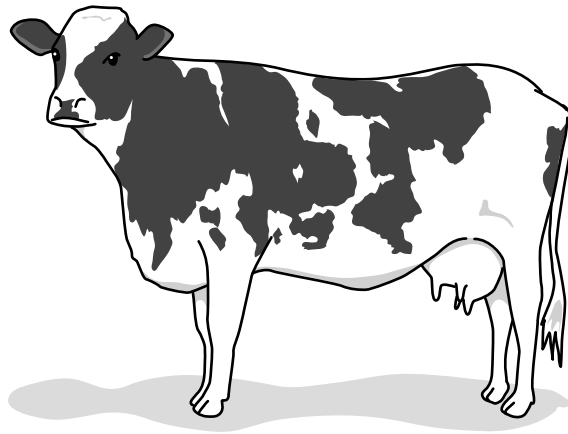
Year	Grain yield in tonnes per hectare		Improvement = $\frac{\text{manured yield} - \text{untreated yield}}{\text{untreated yield}} \times 100$
	Untreated	Manured	
1910	0.9	2.3	156%
1970	1.4	2.8	
2000			

.....

 [3]

[Total: 5]

2 Mary is a farmer. She makes yogurt with milk from her cows.



(a) Mary's herd of cows produces a lot of milk.

This is because the herd is a product of selective breeding.

Here are some stages of selective breeding.

- A Inseminate the best cow.
- B Store the sperm in a freezer.
- C Extract sperm from the best bull.
- D Inject the best cow with hormones.
- E Wait until the best cow comes into oestrus.

Put the stages into the correct order.

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[2]

(b) Mary follows this recipe to make some yogurt:

- 1 Heat the milk to 80°C and then let it cool.
- 2 Stir in a small amount of yogurt from the last batch.
- 3 Cover the bowl with a muslin cloth and leave at 30°C for two days.

Each stage of the recipe has a different effect on the bacteria in the milk.

Explain the effect of each stage on the bacteria in the milk.

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..... [3]

(c) Mary sells her yogurt in the farm shop.

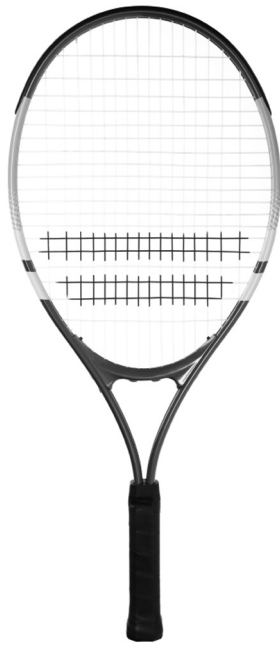
State why Mary's yogurt production is regulated by law.

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..... [1]

[Total: 6]

4 Ann's tennis racquet looks quite different from her grandpa's racquet.



Ann's tennis racquet



Grandpa's tennis racquet

The old racquet and the modern racquet use different materials.

These changes have made the game of tennis more exciting.

This is because modern racquets allow the ball to travel faster.

Describe and explain **another** example where the development of new materials has improved performance in sport.



The quality of written communication will be assessed in your answer.

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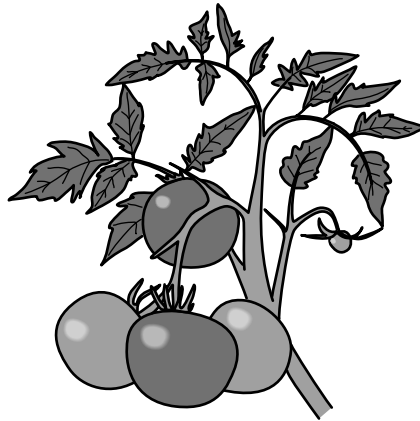
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[6]

[Total: 6]

Turn over

- 5 Tomato fertiliser often contains magnesium nitrate.



- (a) The formula for magnesium nitrate is $\text{Mg}(\text{NO}_3)_2$.

Name the elements in $\text{Mg}(\text{NO}_3)_2$ and give the relative proportion of each element.

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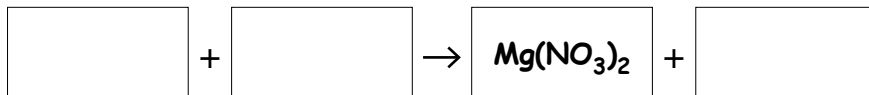
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..... [2]

- (b) Magnesium nitrate is manufactured by reacting magnesium oxide with nitric acid.

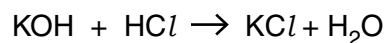
Complete this balanced symbol equation for this process.



[2]

(c) Another substance often found in tomato fertiliser is potash, KCl .

It can be obtained by reacting potassium hydroxide with excess hydrochloric acid.



Use the data in the table below to calculate the theoretical yield of potash when 280 kg of potassium hydroxide reacts with excess hydrochloric acid.

Show your working clearly.

Element	Relative atomic mass
H	1
O	16
Cl	35.5
K	39

mass of potash = kg [2]

[Total: 6]

6 Bill is a theatre lighting technician.

He can only do this job because he has studied theatre lighting.

(a) Bill studied several different topics to earn his qualification in theatre lighting.

Put a **ring** around **three** topics he would have studied.

- connecting amplifiers
- electric circuits
- light sources
- managing microphones
- siting loudspeakers
- using computers

[1]

(b) Bill uses filters to alter the properties of light coming out of sources of white light.

(i) Bill inserts a filter that **absorbs** blue light.

What colour is the light coming out of the filter?

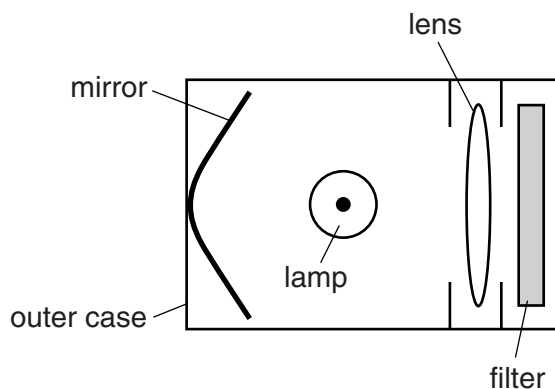
..... [1]

(ii) Bill also inserts a filter that **absorbs** infra-red.

Why does he do this?

.....
 [1]

(c) Here is a simple diagram of a light source which Bill uses in the theatre.



Complete the table by writing down the word that describes the important material property of each part.

Part of the light source	Material property
outer case	opaque
mirror	
filter	
lens	

[3]
 [Total: 6]

7 Debra needs a new pair of football boots.



She looks for boots which have metal studs, rubber soles and leather uppers.

(a) Metals are strong. This makes them a good material for making the studs.

State **another** property of metals which makes them suitable for the studs.

Explain why that property is important for studs.

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..... [2]

(b) One pair of boots has ceramic studs.

Use a material property of ceramics to explain why Debra should **not** buy them.

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..... [2]

(c) The upper part of the football boot is made from a natural composite material called leather. This allows the boot to be tough, flexible and strong.

(i) Name one other composite material you have studied and describe its structure.

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..... [2]

(ii) Describe a use for a composite material, other than leather, in a named sport.

Give the properties of this composite material that makes it suitable for the sport you have named.

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..... [3]

[Total: 9]

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