OCR
Oxford Cambridge and RSA

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Monday 20 June 2016 – Morning

GCSE ADDITIONAL APPLIED SCIENCE

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

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)
- Calculator

Duration: 1 hour

A192/02

5961150067

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. 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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- 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 Imran is designing a new tennis racket.

(a) The material used to make a good tennis racket frame should be durable and tough. This is so that it doesn't wear out too quickly.

Give **two** other properties that the frame's material should have, and explain why they are important.

1 .....

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2 .....

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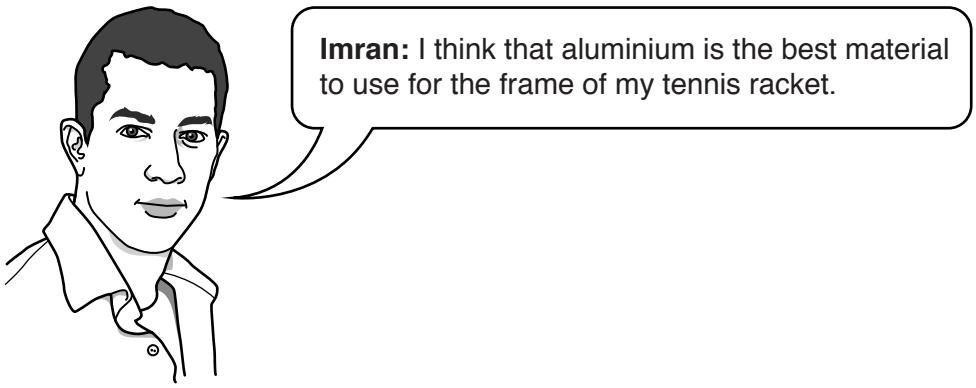
[2]

(b) Imran finds this data for four different materials that he could use for the frame.

Material	Stiffness in GPa	Strength in MPa	Density in kg/m^3
Aluminium	69	110	2700
Carbon fibre	150	1500	1800
Polycarbonate	3	60	600
Wood	9	40	800



Has Imran made the best choice of material?

Justify your answer with data from the table.

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

(c) Imran uses a material with a low thermal conductivity for the handle of his tennis racket.

Explain how this will make the racket more comfortable to use on a cold day.

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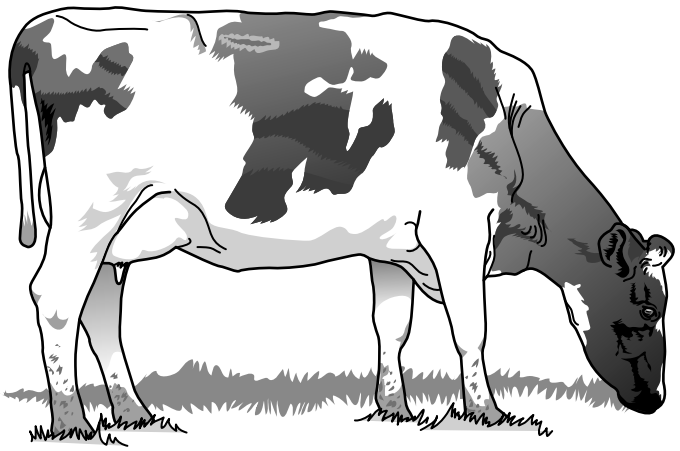
..... **[2]**

[Total: 7]

2 Fresh cows' milk has a short shelf-life.



Milk can be fermented to make other foods with a much longer shelf-life.

Explain how fermentation is used to convert milk into other foods.

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

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..... **[6]**

[Total: 6]

3 Some chemicals are made in bulk.
Examples include ammonia, sulfuric acid and sodium hydroxide.

(a) Explain why some chemicals are made in bulk.

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

(b) Complete the table to show the raw materials used for making ammonia, sulfuric acid and sodium hydroxide. Choose words from this list.

You can use each word once, more than once or not at all.

air **coal** **sodium chloride** **sulfur** **water**

Chemical	**Raw materials**
Ammonia	..... and ..... and methane
Sulfuric acid	..... and ..... and .....
Sodium hydroxide	..... and .....

[3]

(c) Ammonium hydroxide and sulfuric acid can be reacted to make a useful fertiliser, ammonium sulfate.

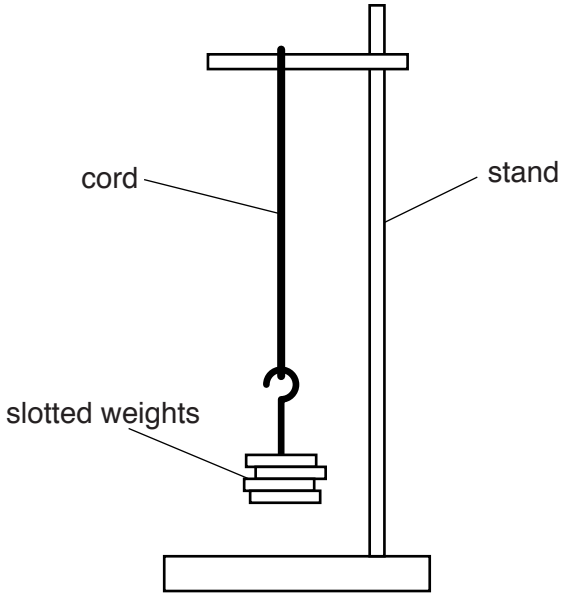
Complete and balance this equation for the reaction.

$$NH_4OH + H_2SO_4 \rightarrow \text{.....} + \text{.....}$$

[2]

[Total: 7]

4 Julie uses this apparatus to investigate the stiffness of a sample of bungee-jump cord.



Julie measures the total length of the cord, from one end to the other, for different amounts of weight hung from its end.

(a) Here are some of her results.

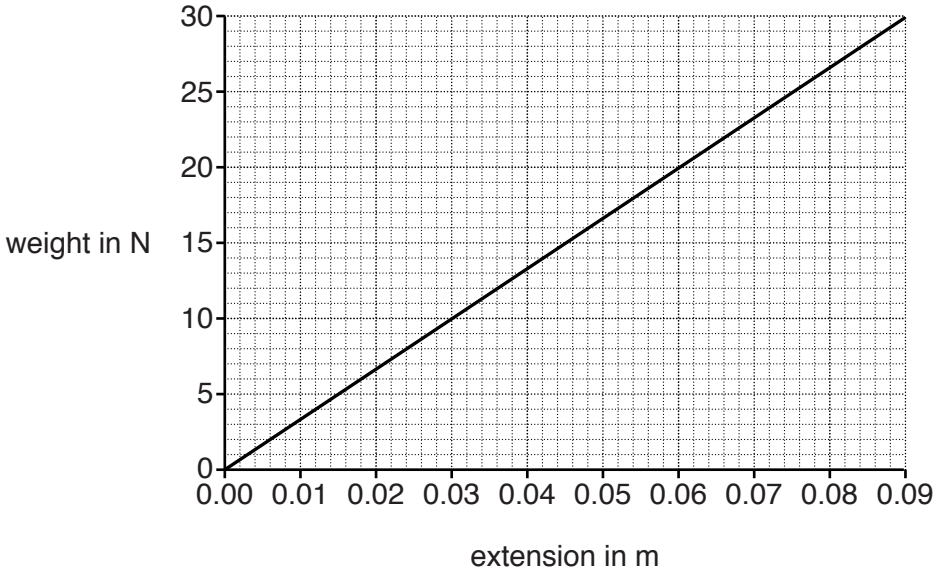
Weight in N	Total length in mm
10	240
15	255

Calculate the expected total length of the cord when she hangs 25 N from its end.

Show clearly how you work out your answer.

length = ... mm **[2]**

(b) Here is a graph of her results.



Calculate the energy stored in the cord when it supports a weight of 25 N.

Show your method clearly.

stored energy = ... J **[2]**

(c) Julie's investigation shows the cord has either elastic or plastic behaviour.

State the behaviour of the cord.
Give a reason for your answer.

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

[Total: 5]

5 Giles decides to grow wheat on his farm.

Describe all the stages required for the production of wheat on the farm.

Explain the need for each stage.

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

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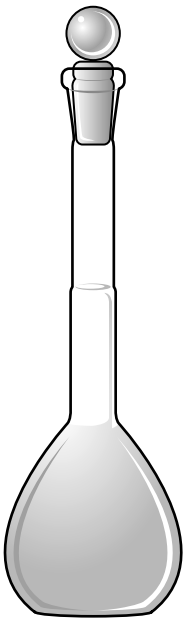
..... **[6]**

[Total: 6]

6 Ravi has been asked to prepare 1.5 litres of a solution of cooking salt. The solution must have a concentration of 117 grams per litre. The largest volumetric flask in his lab has a volume of 250 ml.

Write out a set of detailed instructions for him to follow, including explanations of calculations.



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

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..... **[6]**

[Total: 6]

7 Jake uses this camera to take photos of people at weddings.

(a) The viewfinder contains a mirror. All mirrors are reflective.

Complete the table to show the required **optical property** of each **camera part**.

Camera part	Optical property
viewfinder mirror	reflective
body	
lens	

[2]

(b) Sometimes Jake uses incandescent lamps to light the people that he photographs. Incandescent lamps can be a health hazard.

State and explain a precaution Jake should take to keep people safe when he uses these lamps.

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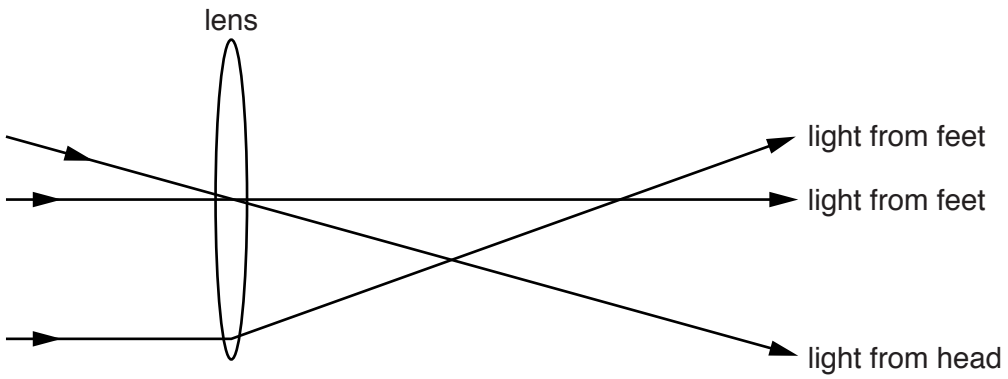
..... **[2]**

(c) Jake takes a photo of Nina.
The diagram shows three rays of light from Nina entering the camera lens.



Nina is a long way from the camera.
Two rays come from her feet. One ray comes from her head.

(i) Draw a vertical line on the diagram to show the focal plane. **[1]**

(ii) Draw another ray from Nina's head which passes through the top half of the lens and the focal plane. **[1]**

(iii) Nina now walks towards the camera.

How does Jake adjust the camera to keep the image in focus?

Give a reason for your answer.

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

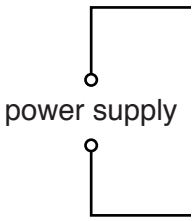
[Total: 7]

8 Zoe is a technician in a theatre.

(a) She uses electrical circuits to control the lights.
Each circuit has:

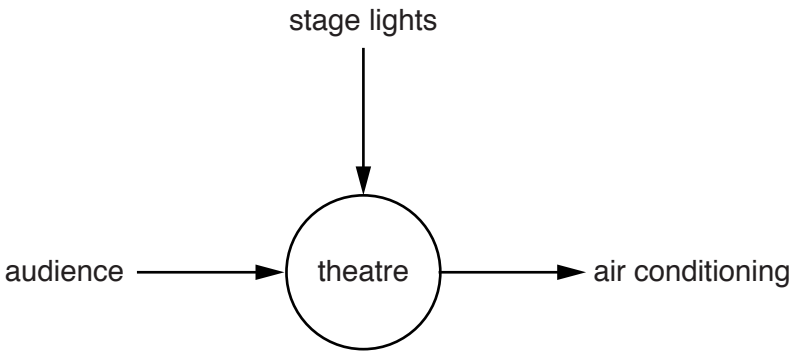
- a switch
- a variable resistor
- a lamp.

Complete this circuit diagram to show how the components are connected to the power supply.



[2]

(b) The lamps put light and heat into the theatre.
The diagram below shows the flows of heat into and out of the theatre.



(i) Explain why Zoe needs to be aware of the diagram during a performance.

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

(ii) The table gives data for the heating power of lamps and people seated in the theatre during one performance.

Heat source	Average power in W	Number
footlights	500	30
spotlights	750	4
seated adult	100	800

Calculate the optimum setting for the air conditioning power during the performance.

Show your working clearly.

air conditioning power = ... W **[2]**

[Total: 6]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).