

Monday 19 June 2017 – 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



Candidate forename		Candidate surname	
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Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

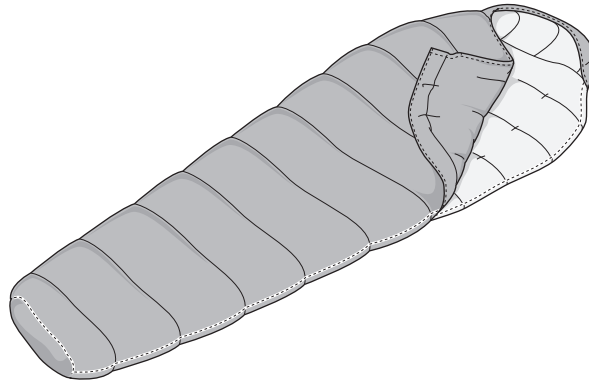
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. 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 barcodes.

INFORMATION FOR CANDIDATES

- The 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 **12** pages. Any blank pages are indicated.

Answer **all** the questions.

- 1 Hilary designs a new sleeping bag for mountain climbers.



On a cold night, the temperature drop between the inside and the outside of the sleeping bag is 50°C .

- (a) The inside of the bag is held at 35°C by the person sleeping in the bag.

What is the outside temperature on this cold night?

outside temperature = $^{\circ}\text{C}$ [1]

- (b) Hilary has three different materials to choose from.
Each has a different thickness and thermal conductivity.

Material	Thermal conductivity	Thickness (mm)	Energy loss (W/m ²)
MaxWarm	60	15	200
LessCold	50	10	
HotStuff	80	25	

Hilary uses this equation to calculate the energy loss through MaxWarm when the temperature drop is 50 °C.

$$\text{energy loss (W/m}^2\text{)} = \frac{\text{thermal conductivity} \times \text{temperature drop (}^\circ\text{C)}}{\text{thickness (mm)}}$$



200 W/m² is a really low value for the energy loss, so I'm going to use MaxWarm.

Has Hilary made the right decision?
Complete the table and use it to justify your answer.

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..... [3]

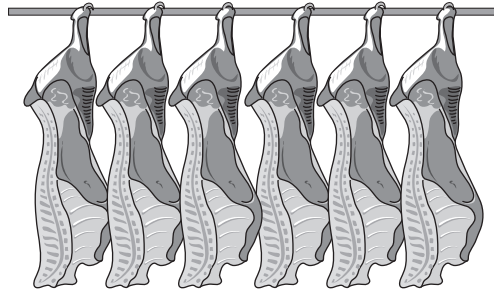
- (c) Hilary's design uses a rectangle of MaxWarm to make the sleeping bag.
The rectangle measures 1.4 m by 0.8 m.
The energy loss from MaxWarm on a cold night is 200 W/m².

Calculate the total energy loss, in W, from the sleeping bag.

total energy loss = W [2]

[Total: 6]

2 Julie is a factory inspector.



Julie's job is to inspect factories which process meat for sale in supermarkets. The government pays for her to do this.

Discuss why the government pays people to inspect food factories.



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

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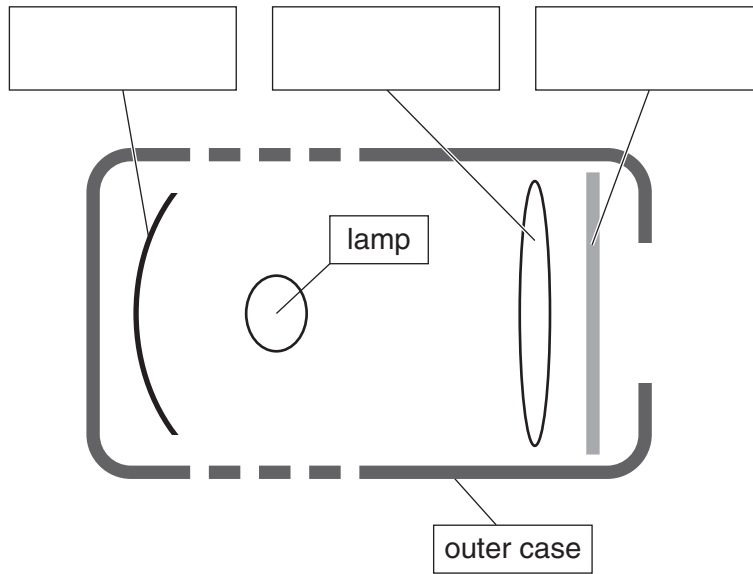
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..... [6]

[Total: 6]

3 Here is a cross-section through a light source used in a theatre.



- (a) Complete the labels. [2]
- (b) The outer case gets very hot when the lamp has been switched on for a long time. The case needs to have a high thermal conductivity to help the heat escape.

State and explain **four** other important properties for the outer case.

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..... [4]

[Total: 6]

4 Many people add crystals called bath salts to their bath water.

The main ingredient of bath salts is magnesium sulfate.

Magnesium sulfate is a soluble salt which can be manufactured by reacting magnesium hydroxide solution with sulfuric acid.

Describe how pure crystals of magnesium sulfate can be prepared by this method.



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

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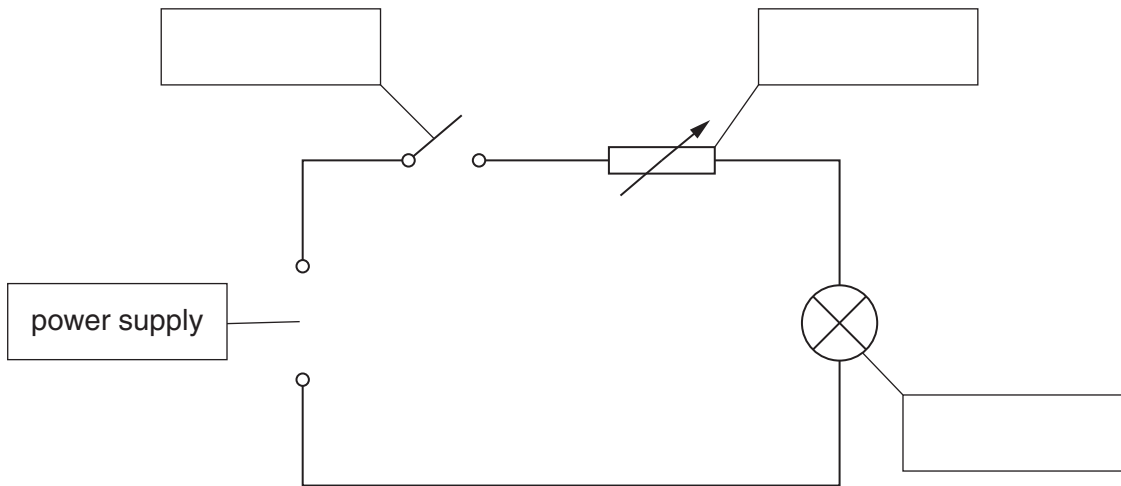
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[Total: 6]

5 Freda is a lighting engineer in a theatre. She controls the lights with circuits like this one.



(a) Complete the labels for the components in the circuit. [2]

(b) The power supply provides electricity for the lights. What do the other components of the circuit allow Freda to do? Refer to the components in your answer.

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..... [2]

(c) Freda also deals with sound systems like this one.



Draw a straight line from each **component** of the system to its **function**.

Component	Function
amplifier	converts sound into vibrations
microphone	increases the loudness of sound
loudspeaker	converts electrical signals into sound
	converts sound into electrical signals
	increases the strength of electrical signals

[3]

[Total: 7]
Turn over

6 Sam is a pole-vault champion.



His pole is made from a composite material.
This allows it to be both light and strong, so Sam can run faster and store more energy in the pole as he jumps.

Describe **another** use of a composite material in sport and explain how it combines the useful properties of its components yet avoids their drawbacks.



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

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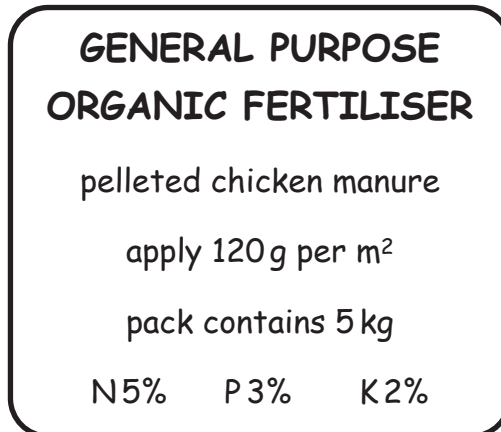
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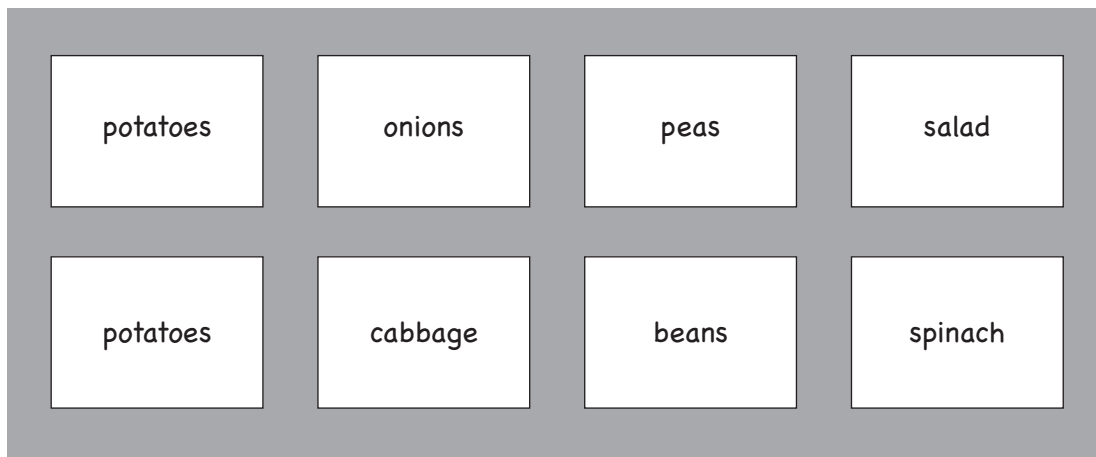
..... [6]

[Total: 6]

- 7 Kate buys one pack of fertiliser for her allotment. She finds this information on the label.



- (a) Here is a plan of Kate's allotment.



Each rectangular plot is 2.0 m by 2.5 m.
She spreads the whole packet evenly over all the plots.

Has she correctly followed the instructions on the label?

Justify your answer with calculations.

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..... [3]

(b) Kate applies fertiliser to her allotment to help the vegetables grow big.

State and explain **two** other chemicals, other than fertilisers, that she could apply to her allotment.

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(c) Bill has the allotment next to Kate's.
Bill uses organic methods to grow his vegetables.
He uses crop rotation on his allotment.

Suggest what this means and why Bill does it.

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..... [2]

[Total: 7]

- 8 Copper carbonate (CuCO_3) is a blue-green pigment. It is an insoluble salt which can be made by reacting solutions of sodium carbonate (Na_2CO_3) and copper sulfate.
- (a) Jill uses 40 litres of sodium carbonate solution with a concentration of 5.3 g/l to make a batch of copper carbonate.

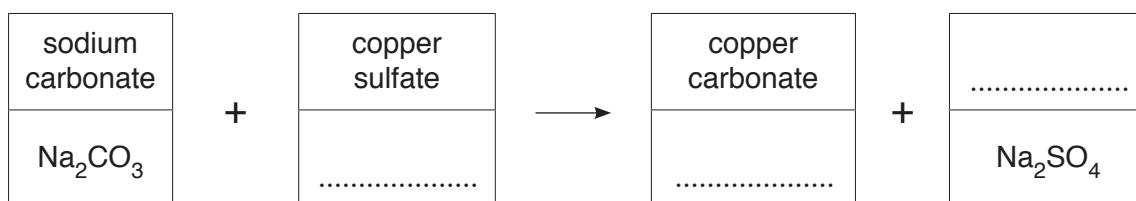
Complete the table of relative formula masses.

Relative atomic masses: C = 12, O = 16, Na = 23, Cu = 63.5

Compound	Relative formula mass
sodium carbonate	106
copper carbonate	

[1]

- (b) Complete the equation for the reaction.



[2]

- (c) Show that the theoretical yield of copper carbonate should be about 250g.

[2]

- (d) Jill's final mass of dry copper carbonate was 200g.

Calculate the actual percentage yield for the batch.

yield = % [1]

[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).

A large rectangular area with a solid vertical line on the left side and horizontal dotted lines across the rest of the page, providing space for writing answers.



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