# OCR
**Oxford Cambridge and RSA**

**F**

## Monday 19 June 2017 – Morning

### GCSE ADDITIONAL APPLIED SCIENCE

**A192/01** Science of Materials and Production (Foundation Tier)

**Duration:** 1 hour

| 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. 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 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.

**Turn over**

**2**

Answer **all** the questions.

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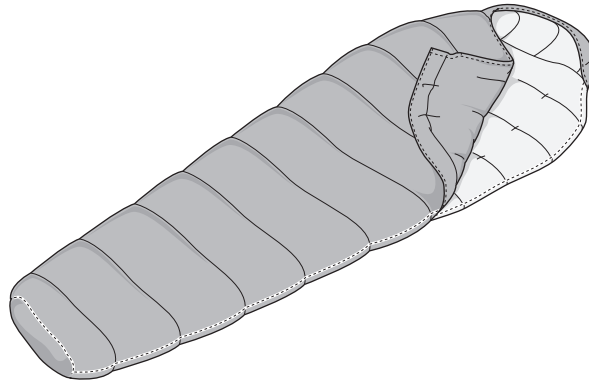


On a cold night, the temperature drop between the inside and the outside of the sleeping bag is 50 °C.

**(a)** The inside is kept at 35 °C by the person sleeping in the bag.

What is the temperature on the **outside** of the bag on a cold night?
Put a (ring) around the correct value.

        **−25 °C**        **−15 °C**        **−5 °C**        **+15 °C**

<div align="right">

**[1]**

</div>

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

| Material | Thermal conductivity | Thickness in mm | Energy loss in 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.

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



200 W/m$^2$ is a really low value for the energy loss, so I'm going to use MaxWarm.

Has Hilary made the right decision?

Do calculations to complete the table.

Use the table to justify your answer.

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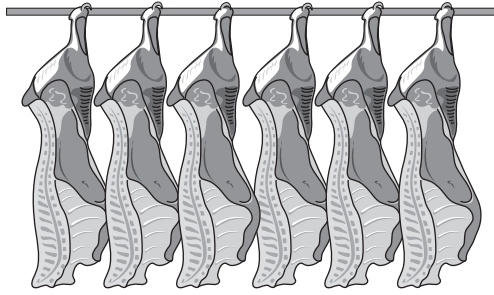
**(c)** Hilary's design uses a rectangle of MaxWarm to make the sleeping bag.
The rectangle measures 1.4 m by 0.8 m.
The energy loss from MaxWarm on a cold night is 200 W/m$^2$.

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 her to do this.

What does Julie's job involve and why is it necessary?

*The quality of written communication will be assessed in your answer.*
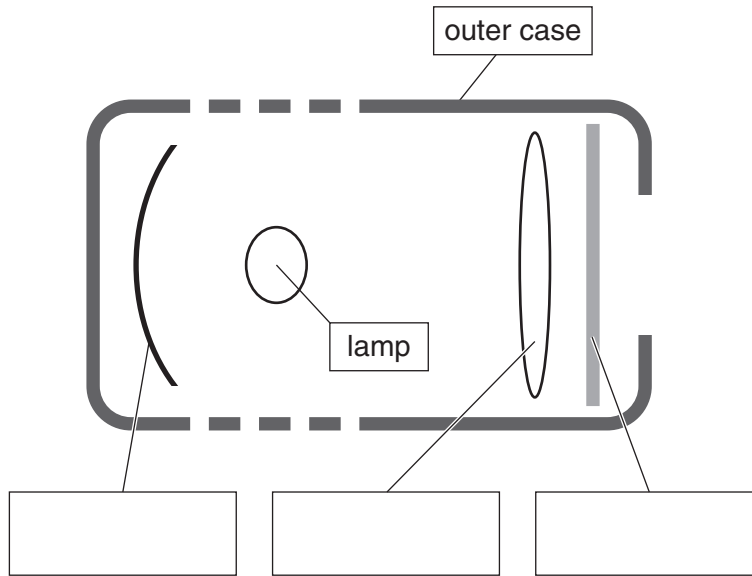
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**[Total: 6]**

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

outer case

lamp

**(a)** Complete the labels. Choose words from the list.

**filter          lens          mirror          shutter**

**[3]**

**(b)** The outer case has a large hole at one end to let the light out.
There are also small holes above and below the lamp.

Explain why these small holes are necessary.

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**(c)** Here are some properties of materials.

Put ticks (✓) in the boxes next to the **two** properties that are most important for the outer case.

brittle

strong

flexible

opaque

transparent

**[2]**

**[Total: 7]**

**Turn over**

**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 solid magnesium carbonate with sulfuric acid.

Describe how you would prepare some crystals of pure magnesium sulfate.

🖉 *The quality of written communication will be assessed in your answer.*
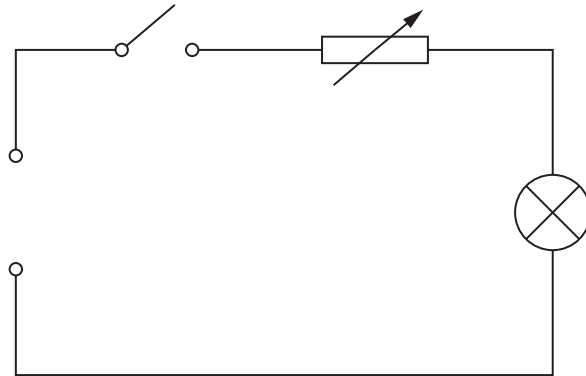
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**[Total: 6]**

**5** Freda is a lighting technician in a theatre.
She controls the lights with circuits like the one below.



**(a)** The circuit diagram contains a switch.

Draw a (ring) around the switch. **[1]**

(b) The four components of the circuit are listed below.

Draw straight lines to link each **component** of the circuit to its **function**.

| Component | | Function |
|---|---|---|
| lamp | | adjusts amount of current |
| switch | | mains electricity input |
| dimmer | | turns current on or off |
| power supply | | source of light |

**[3]**

**(c)** Every two years Freda has to attend a one-day course on electrical lighting.

Explain why she has to do this.

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**[Total: 6]**

**Turn over**

**6** Sam is a pole-vault champion.



He has to choose between two different poles.

Sam wants a pole which is not too stiff.

Describe a test that Sam could do in a laboratory to compare the stiffness of the two poles.

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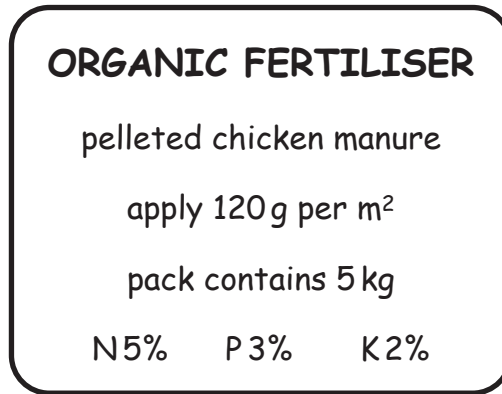
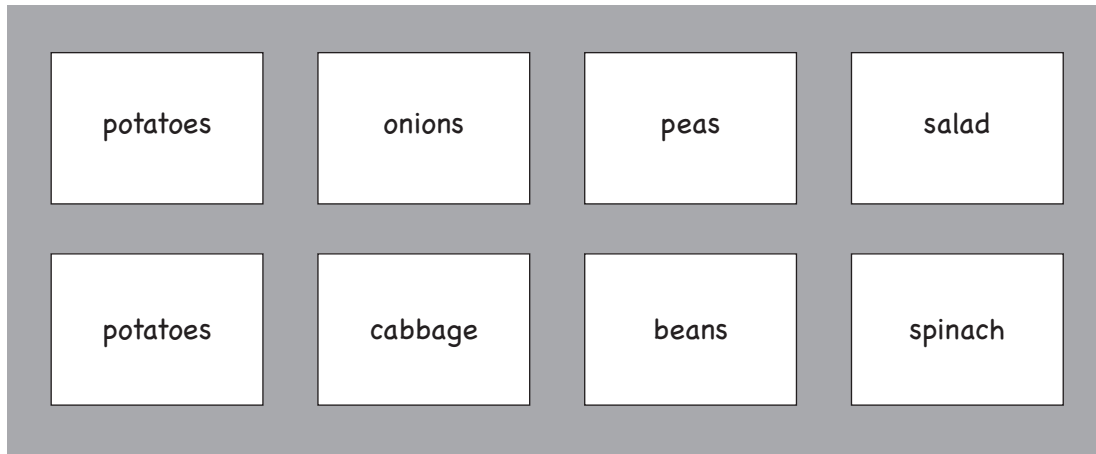...................................................................................................................................................

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**[Total: 6]**

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

> **ORGANIC FERTILISER**
>
> pelleted chicken manure
>
> apply 120 g per m²
>
> pack contains 5 kg
>
> N 5%    P 3%    K 2%

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

| potatoes | onions | peas | salad |
| potatoes | cabbage | beans | spinach |

The allotment has eight beds for growing vegetables.
Each bed has an area of 5 m².

Has she bought enough fertiliser for all of the beds?

Justify your answer using calculations.

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

**(b)** Here are some reasons why Kate applies fertiliser to her allotment.

Put ticks (✓) in the boxes next to the **two** best reasons for applying fertiliser.

She keeps chickens in her garden. ☐

To increase the yield of her vegetables. ☐

It supplies elements missing from the soil. ☐

To keep pests away from her growing plants. ☐

It stops the soil getting waterlogged when it rains. ☐

**[2]**

**(c)** Kate's friends talk about reasons for using manure as an **organic** fertiliser.



**Alan**
There is no other way of disposing of manure.

**Bess**
The manure improves the soil structure.

**Carl**
Organic fertiliser is more expensive.

**Debra**
It smells better than inorganic fertiliser.

Suggest who gives the **best** reason. .......................................................... **[1]**

**[Total: 6]**

**8** Copper carbonate is a blue-green pigment.
It is an insoluble salt which can be made by reacting solutions of sodium carbonate and copper sulfate.

**(a)** Complete the word equation for the reaction.
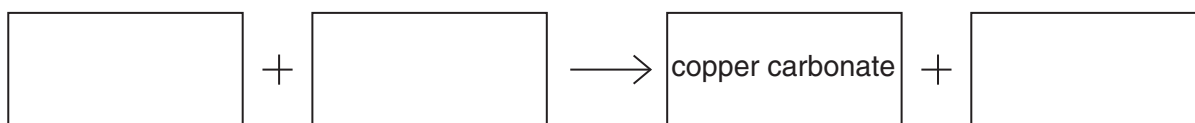
[　　　　] + [　　　　] ⟶ [copper carbonate] + [　　　　]

**[2]**

**(b)** Here are the steps required to prepare a dry sample of copper carbonate.
They are in the **wrong** order.

**A** Dry the filter paper.

**B** Scrape off the crystals.

**C** Add the sodium carbonate solution.

**D** Pour the mixture through filter paper.

**E** Pour distilled water through filter paper.

**F** Place copper sulfate solution in a beaker.

Fill in the grid below to show the correct order.
The first and last ones have been done for you.

| F | | | | | B |
|---|---|---|---|---|---|

**[2]**

**(c)** Draw straight lines to link each **chemical** involved in the production of copper carbonate to its correct **description**.

| **Chemical** | **Description** |
|---|---|
| distilled water | solute |
| copper sulfate | solvent |
| copper carbonate | precipitate |

**[1]**

**Turn over**

**(d)** Jill makes a batch of copper carbonate.

The theoretical yield for this batch is 124 g of copper carbonate.
She uses a watch glass to weigh her copper carbonate crystals.
Here are her results.

mass of empty watch glass = 20 g
mass of watch glass and crystals = 82 g

Complete this calculation of the yield for this batch.

mass of copper carbonate = ................. − ................. = ................. g

$$\text{yield} = \frac{\text{.................}}{124} \times 100 = \text{.................} \%$$

**[2]**

**[Total: 7]**

**END OF QUESTION PAPER**