OCR

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Monday 16 June 2014 – 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.

OCR supplied materials:
None

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

Duration: 1 hour

A192/02

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 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 Fred grows wheat in one of his fields.

(a) Fred usually plants winter wheat instead of spring wheat.

Suggest reasons why winter wheat could have a different yield than spring wheat.

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

(b) This year Fred decides to plant spring wheat.

He ploughs the land **and** applies fertiliser **before** putting in the seed.

Explain why he does this.

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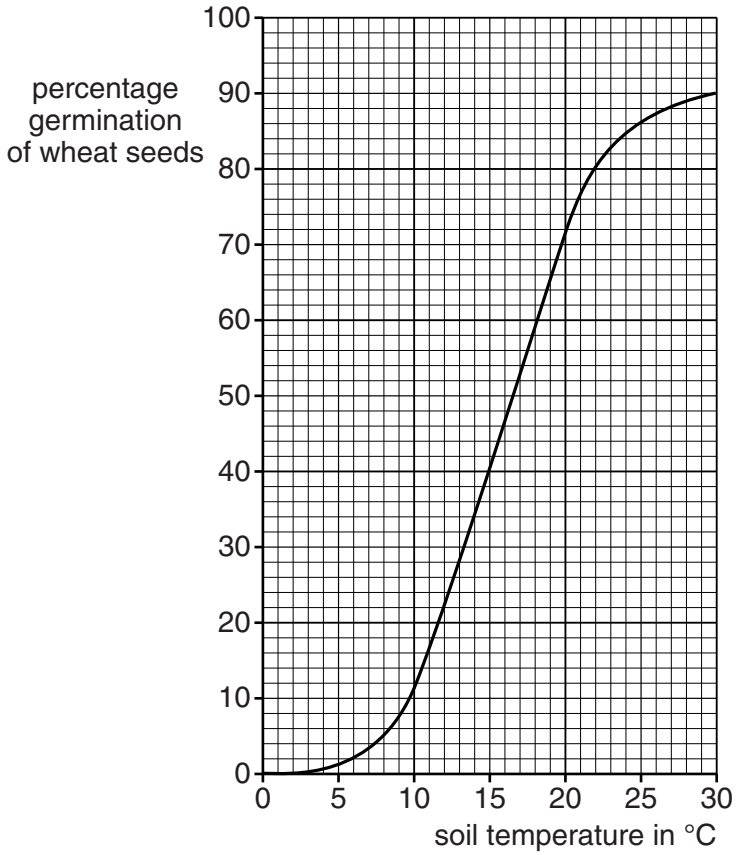
..... **[2]**

(c) Fred waits until the soil temperature is 15 °C before sowing the seed.

He uses the information below to calculate how much seed to plant.

Area of field	8.0 hectares
Soil temperature	15 °C
Ideal planting density	2.5 million plants per hectare



Fred chooses to plant 60 million wheat seeds on his field.

Has he made the best choice from the above information?

Justify your answer with calculations.

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

[Total: 7]

2 Philippa keeps a herd of cows for milking.

Each cow produces a calf every year.

Philippa keeps the male calves on the farm for six months.

She then sells the calves to be fattened up for beef.

Philippa gets more money for big calves than small ones.

State and explain how Philippa should care for the calves so that they grow big.

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

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

[Total: 6]

3 Some people do not have enough iron in their blood.

This makes them feel tired and weak.

Tablets containing iron sulfate may be prescribed to make them better.

(a) Iron sulfate is a soluble salt which is made by reacting iron (Fe) with sulfuric acid (H_2SO_4).

Complete this symbol equation for the production of iron sulfate.

..... + ... → $FeSO_4$ + ... **[2]**

(b) Describe how a batch of pure iron sulfate crystals could be made.

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

(c) Each iron sulfate tablet has this formulation:

- 0.10 g of iron sulfate
- 0.35 g of starch filler
- 0.05 g of sugar coating

How much iron sulfate is needed to make 100 g of tablets?

Show **all** your working.

mass of iron sulfate = ... g **[2]**

[Total: 6]

4 Ken has one full day to make a video.

He thinks about light sources for the video.

All of the scenes in the video show the actors outdoors in the garden of a house.

Even though Ken videos outdoors, he needs to use several different artificial light sources.

Explain why.

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

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[Total: 6]

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5 It is proposed to build a new shopping centre next to a railway station.

The designers worry about noise from the trains getting into the shopping centre.

(a) The trains rolling along their rails make low frequency noise.

Explain why this low frequency noise will be a problem for the shopping centre.

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

(b) The designers decide to put acoustic tiles on all of the ceilings.

This should reduce the **sound level** in the centre by 20 dB.

By how much should this reduce the **loudness** of the sound?

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

(c) They select acoustic tiles which are particularly good at absorbing easily heard sound.

What is the frequency of sound that the ear is most sensitive to?

Put a ring around the correct value.

2.0×10^4 Hz **2.0×10^3 Hz** **2.0×10^2 Hz** **2.0×10^1 Hz**

[1]

(d) The shopping centre will have a public address (PA) system.

It needs to be installed carefully to avoid howling.

Explain what causes howling and how the designers of the PA system stop it happening.

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

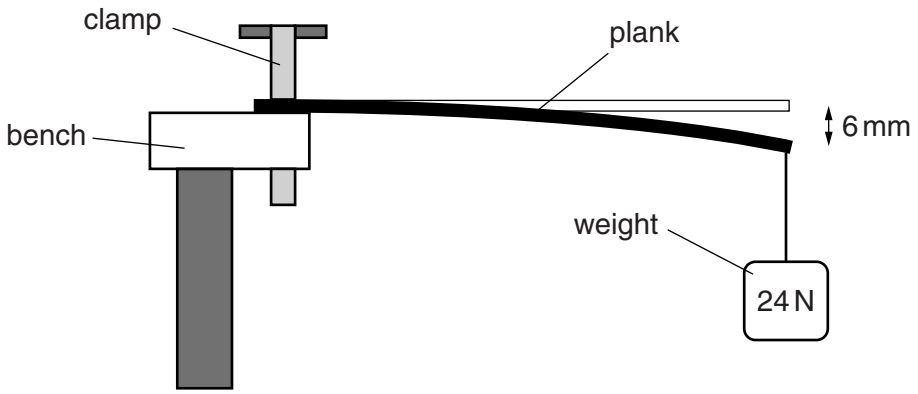
[Total: 6]

6 Jake is making a gym floor out of planks of wood.

The planks need to be stiff enough for the forces on the floor.

Jake decides that each plank needs to have a stiffness of at least 5 N/mm.

(a) Jake uses the apparatus below to check the stiffness of one plank.



He suspends a 24 N weight from the free end of the plank.

The displacement of the free end is 6 mm.

Is it stiff enough for the gym floor?

Justify your answer with a calculation.

$$\text{stiffness (N/mm)} = \frac{\text{suspended weight (N)}}{\text{displacement (mm)}}$$

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

(b) State **two** ways in which the manufacturers could increase the stiffness of the planks.

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

(c) Jake gets planks of wood from various different suppliers.

He finds that one set of planks has this mark on it.

This means that they have been tested by a product standards laboratory.

Explain the work of the product standards laboratory.

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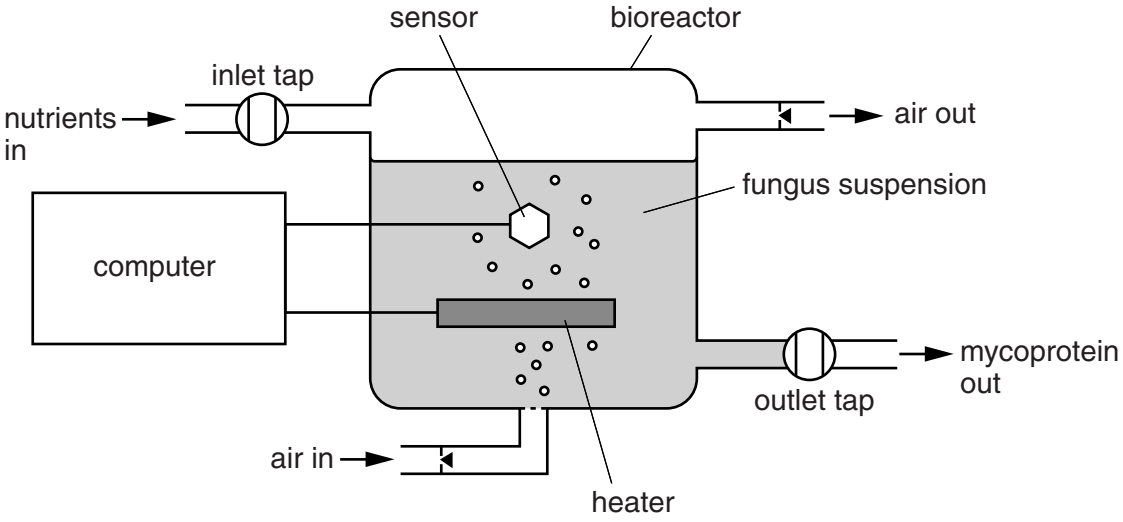
[Total: 7]

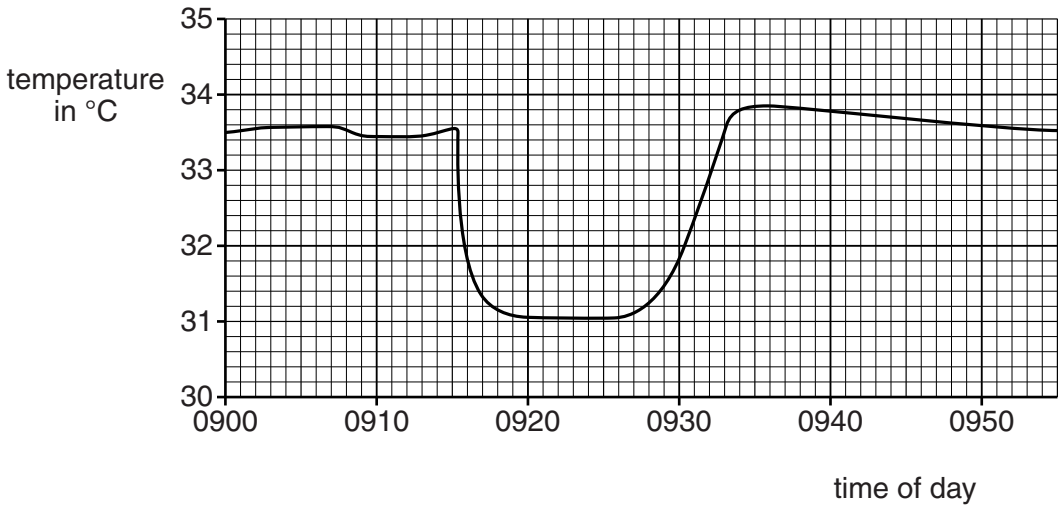
7 Bioreactors are used to make a food called mycoprotein from a fungus.

The fungus needs to be kept at the right temperature.

A computer uses a sensor in the bioreactor to control the temperature.



(a) The computer prints out this temperature-time graph.



At 0915 cold nutrients were added to the bioreactor.

Use the graph to explain the actions taken by the computer **after** 0915.

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

(b) The fungus in the bioreactor needs a steady supply of glucose for aerobic fermentation.

Complete this balanced symbol equation for **aerobic** fermentation.

$$C_6H_{12}O_6 + \text{.....} \rightarrow \text{.....} H_2O + \text{.....} CO_2$$

[2]

(c) The bioreactor contains a genetically modified fungus.

Explain how a genetically modified fungus can make materials that a natural fungus cannot.

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

[Total: 6]

8 A company called ColdGone decides to develop a drug for treating the common cold.

ColdGone knows that it will cost a lot to research, develop and test the new drug.

Explain why it is so expensive to research, develop and test a new drug.

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

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

[Total: 6]

END OF QUESTION PAPER

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