OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

ADDITIONAL APPLIED SCIENCE **A192/01**

Unit A192: Science of Material and Production (Foundation 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

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The number of marks for each question is given in brackets **[ ]** at the end of the 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 Maria designs golf clubs.

©iStockphoto.com

(a) She is preparing samples of materials.

Draw a straight line from each **sample** to the **type of material**.

sample	**type of material**
glass-reinforced plastic	ceramic
steel	composite
plastic	metal
	polymer

[3]

(b) Modern golf clubs are made from many different materials.

The three cards, **A**, **B** and **C**, describe the properties of the materials from which modern golf clubs are made.

card A	**card B**	**card C**
stiff and brittle insulator of heat and electricity	shiny and malleable good conductor of heat and electricity	often flexible insulator of electricity

Write A, B or C in each box to show the types of material described on the cards.

a metal ☐

a polymer ☐

a ceramic ☐

[2]

(c) She wants the hand-grip to feel warm.

Look at the data on thermal conductance.

material	**thermal conductivity in W/m K**
cork	0.05
titanium alloy	5.8
rubber	0.16
wood	0.14

Which material does the data suggest would be best for the hand-grip?

Give a reason for your answer.

.....

.....

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

(d) The main part (the shaft) of the golf club is made of a composite material.

Explain what is meant by a **composite** material.

.....

.....

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

[Total: 9]

2 Wayne tests two different plastics to see which would be best for making corner posts for football pitches.

He wants to compare the stiffness of the two different plastics.

Describe, with the help of a labelled diagram of the apparatus, how this could be done.

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

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

[Total: 6]

3 Martin is an architect. He is designing a theatre.

He is thinking about what glass he needs for the theatre.

Suggest some of the ways he can use different types of glass in the theatre.

Explain the optical properties that make the glass suitable for these uses.

Give reasons for your choice.

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

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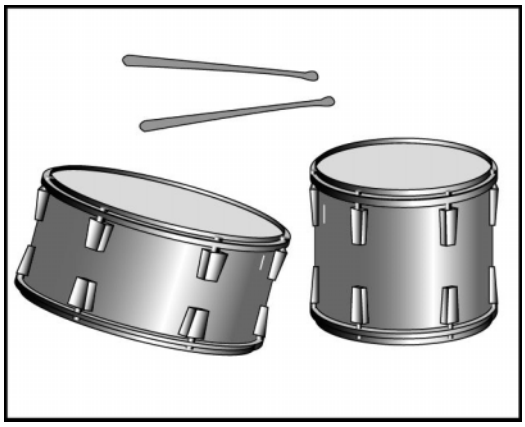
..... **[6]**

[Total: 6]

4 Sasha is the owner of a music venue.



She wants to avoid annoying the neighbours.

(a) Complete these sentences about sound levels.

Choose from this list.

30 60 90 140

The sound level of a normal conversation is ..... decibels.

The sound level which causes temporary hearing loss is ..... decibels.

[2]

(b) Describe one way that Sasha could modify the venue to sound proof it.

Use the information from part (a) to explain how Sasha could check if the insulation was sufficient.

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.....

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

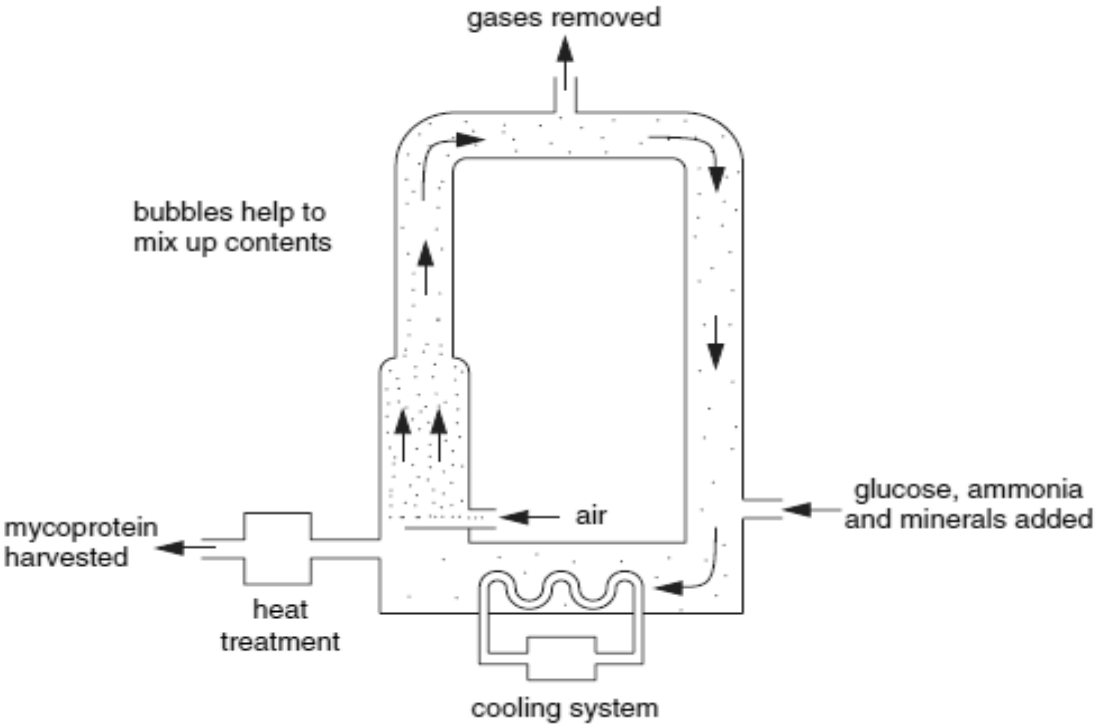
[Total: 4]

5 Protein is an important part of our diet.

A fungus called *Fuscarium* is grown in large fermenters.

The fungus produces large amounts of protein called mycoprotein.

Look at the diagram showing the production of mycoprotein.



(a) Complete the sentences about the production of mycoprotein.

Put a tick (✓) in the box next to each **correct** answer.

Use information in the diagram to help you.

(i) *Fuscarium* uses

carbohydrate	
glucose	
fat	

as food.

[1]

(ii) *Fuscarium* uses

carbon dioxide	
carbon monoxide	
oxygen	

from the air.

[1]

(iii) *Fuscarium* produces

carbon dioxide	
carbon monoxide	
oxygen	

gas.

[1]

(b) The mycoprotien from the fermenter is tested prior to being sold. It is found to be unfit for people to eat.

Suggest reasons why this might happen and how it could be avoided in the future.

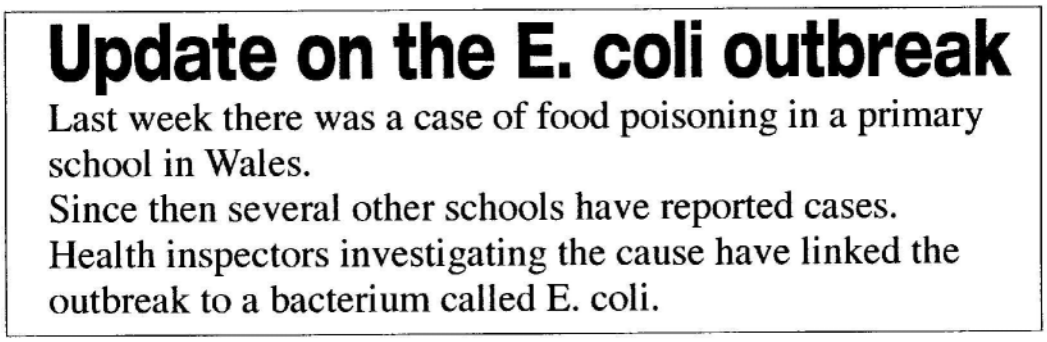
.....

.....

..... **[4]**

[Total: 7]

6 Read the newspaper story about *E. coli*.



Update on the E. coli outbreak

Last week there was a case of food poisoning in a primary school in Wales.
Since then several other schools have reported cases.
Health inspectors investigating the cause have linked the outbreak to a bacterium called E. coli.

(a) *E. coli* is a bacterium.

In ideal conditions, a single bacterium reproduces itself every twenty minutes.

It takes about 200 bacteria to cause illness.

How long, to the nearest 20 minutes, will it take **a single bacterium** to reach a point where it will cause illness?

You must show how you worked out your answer.

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

(b) The ideal temperature for *E. coli* to multiply is 37^{o}C and they can tolerate acidic conditions.

It can take up to twenty four hours for food to leave your digestive system.

Use this information to help you explain why humans become ill when they ingest *E. coli.*

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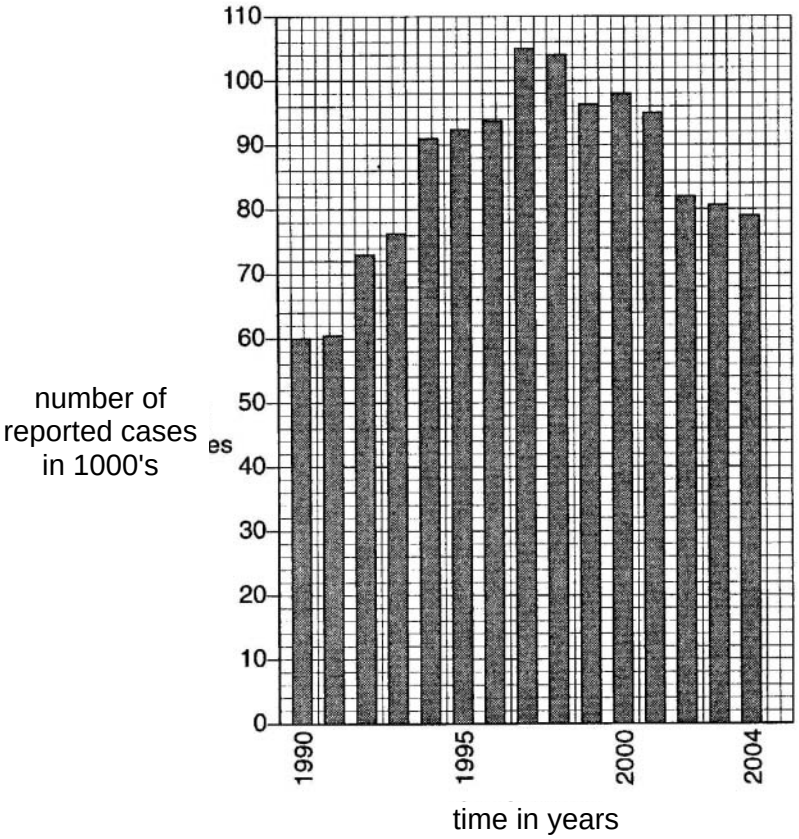
..... **[3]**

(c) The bar chart shows the number of reported cases of food poisoning in the UK between 1990 and 2004.



The Food Standards Agency was created in 2000 to educate the public about food safety.

Use data from the graph to discuss the possible effectiveness of the agency.

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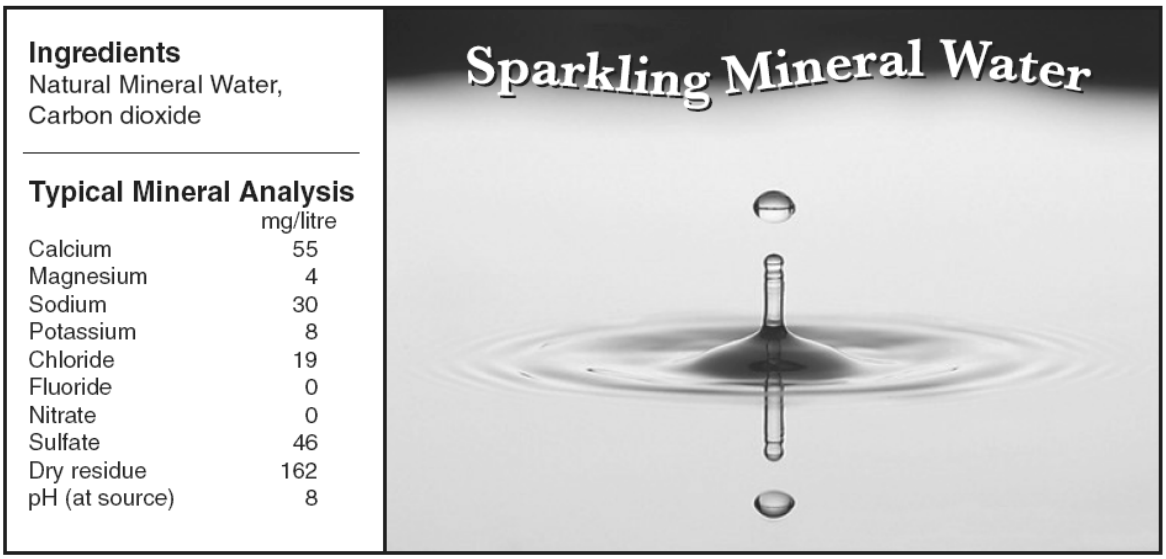
..... **[3]**

[Total: 8]

7 Natural mineral water is formed when water filters through rocks and dissolves minerals.

The label below shows the minerals present in one type of sparkling mineral water.



Ingredients
Natural Mineral Water,
Carbon dioxide

Typical Mineral Analysis

	mg/litre
Calcium	55
Magnesium	4
Sodium	30
Potassium	8
Chloride	19
Fluoride	0
Nitrate	0
Sulfate	46
Dry residue	162
pH (at source)	8

(a) Carbon dioxide is added to natural mineral water to make it sparkling.

Some dissolves in the water to produce the weak acid, carbonic acid.

What effect does this have on the pH?

Put a tick (✓) in the box next to the correct answer.

pH increases ☐

pH stays the same ☐

pH decreases ☐

[1]

(b) (i) Shabeen buys a 250ml bottle of the sparkling mineral water.

Use the information on the label to calculate how much sodium the water in this bottle contains.

Show how you work out your answer.

amount of sodium = ... mg **[1]**

(ii) The recommended nutritional intake (RNI) for sodium is 1600mg per day.

Does drinking this water with the amount of sodium you have calculated pose a risk to Shabeen's health?

Explain your answer.

.....

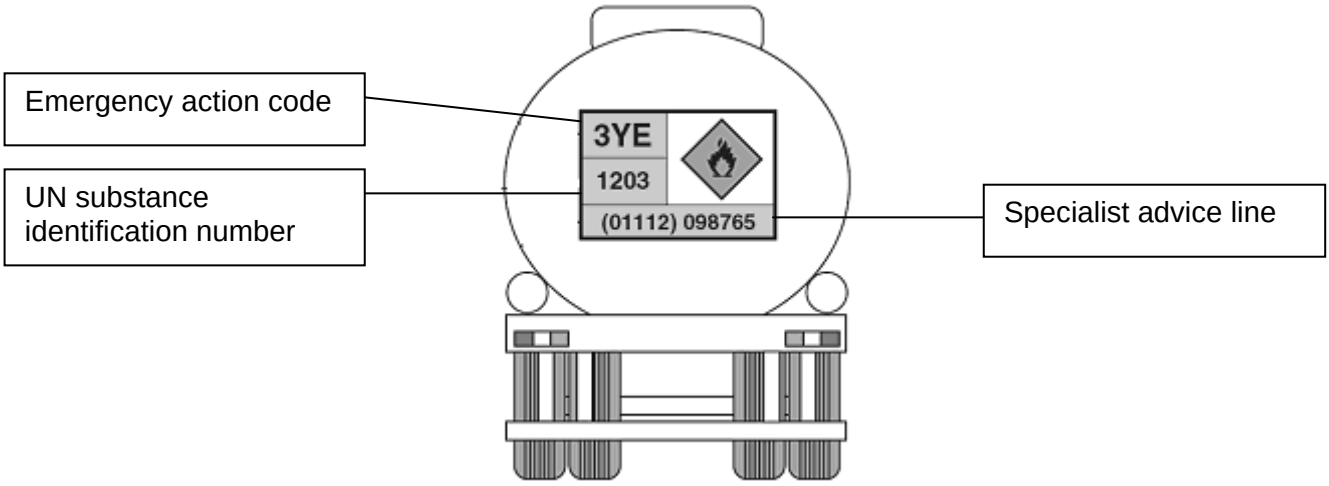
.....

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

[Total: 4]

8 There are lots of different hazchem symbols.

Here is one on the back of a road tanker used by a chemical company to transport their products.



Suggest a product that may be in this tanker and give reasons for your choice.

The hazchem symbol is displayed on the back of the lorry with other letters and numbers.

Explain why.

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

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

[Total: 6]

[Paper Total: 50]

END OF QUESTION PAPER

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SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

ADDITIONAL APPLIED SCIENCE **A192/01**

Unit A192: Science of Material and Production (Foundation Tier)

MARK SCHEME

Duration: 1 hour

MAXIMUM MARK 50

This document consists of 12 pages

Guidance for Examiners

Additional guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, eg mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/	=	alternative and acceptable answers for the same marking point
(1)	=	separates marking points
not/reject	=	answers which are not worthy of credit
ignore	=	statements which are irrelevant - applies to neutral answers
allow/accept	=	answers that can be accepted
(words)	=	words which are not essential to gain credit
words	=	underlined words must be present in answer to score a mark
ecf	=	error carried forward
AW/owtte	=	alternative wording
ORA	=	or reverse argument

Eg mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
work done = 0 marks
work done lifting = 1 mark
change in potential energy = 0 marks
gravitational potential energy = 1 mark

5. Annotations:
The following annotations are available on SCORIS.

✓	=	correct response
×	=	incorrect response
bod	=	benefit of the doubt
nbod	=	benefit of the doubt **not** given
ECF	=	error carried forward
^	=	information omitted
I	=	ignore
R	=	reject

6. If a candidate alters his/her response, examiners should accept the alteration.

7. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

   Eg
   For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.	Put ticks (✓) in the two correct boxes.
☐	☐	✓
☐	☐	✓
✓	✓	✓
✓	✓	✓
☐	☐	☐
This would be worth 0 marks.	This would be worth one mark.	This would be worth one mark.

8. The list principle:
   If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, eg one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

9. Marking method for tick boxes:

   Always check the additional guidance.

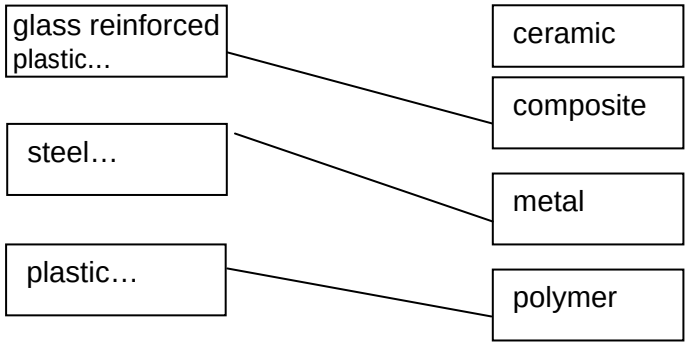
   If there is a set of boxes, some of which should be ticked and others left empty, then judge the entire set of boxes.
   If there is at least one tick, ignore crosses. If there are no ticks, accept clear, unambiguous indications, eg shading or crosses.
   Credit should be given for each box correctly ticked. If more boxes are ticked than there are correct answers, then deduct one mark for each additional tick. Candidates cannot score less than zero marks.

   Eg If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third should be blank (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question			Expected answers	Marks	Additional guidance
1	(a)			[3]	1 mark for each correct line
	(b)		a metal.....card B a polymer.....card C a ceramic.....card A	[2]	3 correct = 2 1 or 2 correct = 1
	(c)		the chosen material needs to have a low thermal conductivity because the hand-grip needs to feel warm therefore cork would be the best choice as it has the lowest thermal conductivity	[2]	
	(d)		two or more materials embedded in each other any of the following: materials not chemically combined composite combines useful characteristics of each material to make a material with required properties	[2]	
			Total	[9]	

Question				Expected answers	Marks	Additional guidance
2	✎			**[Level 3]** Fully labelled diagram. Account includes **all** relevant points, including those in bold. All information in answer is relevant, clear, organised and presented in a structured and coherent format suitable for purpose. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Diagram may have some labels missing. Account will omit some relevant points, possibly those in bold. For the most part the information is relevant and presented in a structured and coherent format suitable for purpose. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Diagram may have no labels. Account may omit several relevant points, possibly only dealing with the first sample in detail. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**Relevant points in order:** • labelled diagram of sample, suspension, load, ruler • measure sample position • add the load • measure new sample position to obtain deflection • **repeat to check answer to increase reliability** • insert a second sample of the **same length, shape and thickness as the first sample** • then repeat measurements • **sample with lower deflection is stiffer** • therefore put the samples in order of stiffness
				Total	**[6]**	

Question				Expected answers	Marks	Additional guidance
3	✎			**[Level 3]** Completely describes at least two applications, with reference to a third. All information in answer is relevant, clear, organised and presented in a structured and coherent format suitable for purpose. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** Incompletely describes at least two applications, with references to others. Names at least one property of glass. For the most part the information is relevant and presented in a structured and coherent format suitable for purpose. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Incompletely describes at least two applications. May not name the property of glass being used. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**Relevant points:** **Description of applications**: • description of where the glass is used in the theatre • name of important property which makes it suitable for this use • reason why that property is important for this use in the theatre **Optical properties of glass:** • reflective • e.g. mirrors in dressing rooms of the actor to view their appearance • translucent • e.g. filters on lights for the stage to create colour effects • transparent • e.g. windows in the entrance to let natural light in • refractive • e.g. lenses in lights to focus/spread the beam **ignore** mechanical properties
				Total	**[6]**	

Question			Expected answers	Marks	Additional guidance
4	(a)		60 90	[2]	
	(b)		method of modification and how it would work to check the insulation measure the dB after installation and then compare it to the figures given in part (a)	[2]	**Relevant Points:** • addition of (named) sound insulation material to absorb the sound • use of (named) sound reflecting material to prevent sound escaping • accept double glazing / cavity walls / breaks in pipes / thicker doors
			Total	[4]	

Question			Expected answers	Marks	Additional guidance
5	(a)	(i)	carbohydrate: glucose: ✔ fat:	[1]	more than one tick = 0
		(ii)	carbon dioxide: carbon monoxide: oxygen: ✔	[1]	more than one tick = 0
		(iii)	carbon dioxide: ✔ carbon monoxide: oxygen:	[1]	more than one tick = 0
	(b)		fermenter has not been sterilised properly so contamination occurred and unwanted microorganisms have grown these produce toxins or different products so spoiling the mycoprotein so make sure fermenter is properly cleaned and sterilised before the next batch of mycoprotein is produced	[4]	
			Total	[7]	

Question			Expected answers	Marks	Additional guidance
6	(a)		2 hours 40 minutes or 160 minutes	[2]	correct answer with working gets 2 marks if incorrect answer given, then evidence of trying to double at equal time intervals gets 1 mark
	(b)		bacteria not killed by stomach acid and the temperature is ideal for growth only small amounts of bacteria are needed to cause illness and from 6(b) they will have enough time to replicate so there will be enough bacteria to produce enough toxin to cause illness	[3]	
	(c)		• *E. coli* cases going down after 2000, the year the Food Standards Agency (FSA) was created • but only fall to about 80,00 cases • so the FSA has been partially effective but still more steps need to be taken OR • cases peaked at 1997 • so are already falling by 2000 when the FSA was created • therefore there is little evidence that the FSA has been successful as the numbers could have fallen anyway	[3]	look for evidence quoted from graph - either years or cases quantified
			Total	[8]	

Question			Expected answers	Marks	Additional guidance
7	(a)		pH increase ☐ pH stays the same ☐ pH decreases ✔	[1]	more than one tick = 0
	(b)	(i)	30 mg in 1000 ml 30/4 = 7.5 mg in 250 ml	[1]	**ecf** on incorrect data from label
	(b)	(ii)	daily intake will depend on how much she drinks per day but if she drunk 8 glasses/ 2 litres (recommended amount) she would only intake 60 mg of sodium which is well below the RNI so this would not pose a risk to her health	[2]	**ecf** accept calculation of amount of water required to give a sodium intake of 1600 mg (53 litres), so would not pose a risk to her health
			Total	[4]	

Question				Expected answers	Marks	Additional guidance
8	✎			**[Level 3]** All information in answer is relevant, clear, organised and presented in a structured and coherent format suitable for purpose. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5 – 6 marks) **[Level 2]** For the most part the information is relevant and presented in a structured and coherent format suitable for purpose. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3 – 4 marks) **[Level 1]** Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	**[6]**	**Relevant points:** • any liquid that is flammable • because the hazchem stands for flammable • information is displayed to show the risk the contents pose **Other letters and numbers** • tells emergency services how to deal with spillage • advice on dangers and clean up • identifies the chemical in the lorry
				Total	**[6]**	
				Paper total	**[50]**	

Assessment Objectives (AO) Grid

(includes quality of written communication✎)

Question	AO1	AO2	AO3	Total
1(a)	3			**3**
1(b)	1	1		**2**
1(c)		2		**2**
1(d)	2			**2**
2✎	6			**6**
3✎	3	3		**6**
4(a)	2			**2**
4(b)	1	1		**2**
5(a)(i)		1		**1**
5(a)(ii)		1		**1**
5(a)(iii)		1		**1**
5(b)		4		**4**
6(a)		2		**2**
6(b)	1	2		**3**
6(c)			3	**3**
7(a)		1		**1**
7(b)(i)		1		**1**
7(b)(ii)		2		**2**
8✎	4	2		**6**
Totals	**23**	**24**	**3**	**50**

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