

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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6	
7	
TOTAL	



General Certificate of Secondary Education
Higher Tier
January 2012

Additional Applied Science **AASC/2H**

Unit 2 Science at Work

Written Paper

H

Tuesday 24 January 2012 9.00 am to 10.00 am

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a ruler • a calculator.
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Time allowed

- 1 hour

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Advice

- In all calculations, show clearly how you work out your answer.

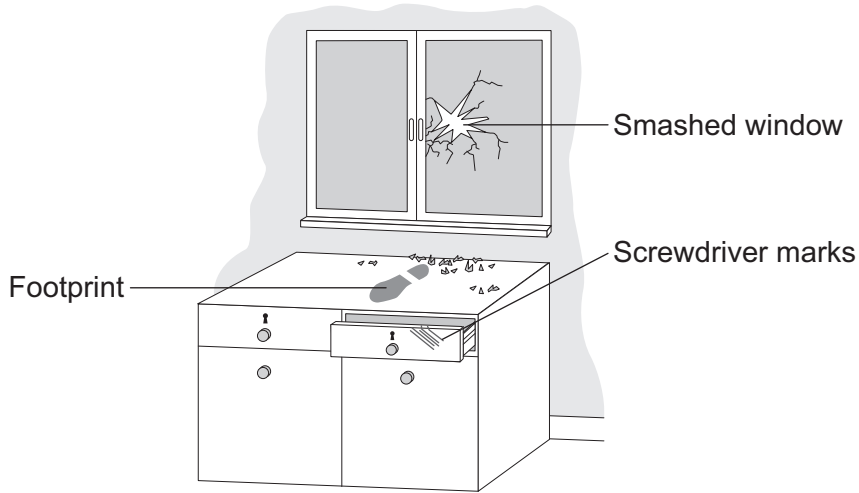


J A N 1 2 A A S C 2 H 0 1

Answer **all** questions in the spaces provided.

1 A Scenes of Crime Officer (SOCO) took a photograph of a crime scene.

The drawer had been forced open using a screwdriver and marks were left in the wood. A shoeprint was left on the top of the cupboard.



1 (a) (i) How would the SOCO collect evidence of the marks left by the screwdriver at the crime scene?

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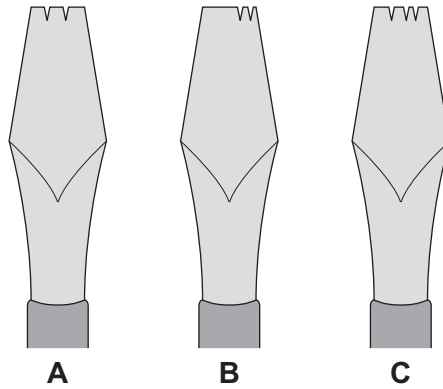
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(2 marks)



1 (a) (ii) The marks made by the screwdriver were analysed by a forensic scientist.
 Three screwdrivers were collected, one from each of three possible suspects.



The diagram below shows the marks on the drawer at the crime scene.



Which screwdriver, **A**, **B** or **C**, caused the marks on the drawer?

Screwdriver

(1 mark)

1 (a) (iii) The shoeprint mark left at the crime scene was found to match one of the shoes from a suspect.

This does **not** mean the suspect committed the crime.

Give **one** reason why not.

.....

(1 mark)

Question 1 continues on the next page

Turn over ►



1 (b) A large piece of glass from the broken window was collected and analysed to find the refractive index of the glass. It was later compared with fragments of glass found on a suspect's clothing.

Other than the oil immersion method, describe how the forensic scientist would find the refractive index of the large piece of glass.

You may draw a diagram to help explain your answer.

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(3 marks)



1 (c) The table shows the refractive index of four different types of glass.

Type of glass	Refractive index
Headlight	1.47–1.49
Television	1.49–1.51
Window	1.51–1.52
Bottle	1.51–1.52

The refractive index of the piece of glass from the window was 1.512.
The refractive index of the fragments of glass found on the suspect was 1.504.

What conclusions can be made from these results?

Use the information in the table to help you.

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(2 marks)

9

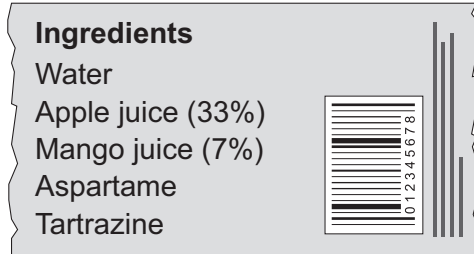
Turn over for the next question

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2 One of the roles of the Food Standards Agency is to study food additives to ensure that they are safe to use in food.

2 (a) The following list of ingredients was found on the label of a bottle of fruit drink.



2 (a) (i) Identify the additives in this fruit drink and explain why they are added.

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(2 marks)

2 (a) (ii) A mother chose not to buy this drink for her child because it contained tartrazine.

Suggest why she made this decision.

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(1 mark)

2 (a) (iii) The acceptable daily allowance of aspartame is 50 milligrams per kilogram of body weight.

If a child weighs 13 kilograms, calculate how many milligrams of aspartame she would be allowed in a day.

.....

.....

..... mg
(1 mark)



2 (b) The following product recall notice appeared in a local newspaper.

Food alert: for information

Ref: 31/2009/Northern Ireland

Allied Quality Associated Bottling Company (AQABC) is withdrawing certain batches of 500 ml bottles of Juicy Juice due to high levels of benzoic acid.

The product listed below is being withdrawn from sale. No other batches of Juicy Juice are known to be affected. The affected batch was distributed only in Northern Ireland and the Republic of Ireland.

Product: Juicy Juice
Pack size: 500 ml
Batch codes: KH42315L91807 to KH42359L91807 with best before dates of end December 2011

2 (b) (i) Why might soft drink manufacturers add small amounts of benzoic acid to their products?

..... (1 mark)

2 (b) (ii) Suggest **two** possible problems that such a recall might cause to the company.

1
.....
2
..... (2 marks)

2 (b) (iii) Suggest **two** possible effects that such a recall might have on the consumer.

1
.....
2
..... (2 marks)



3 A basketball player wanted to increase his fitness level.

He used a step test to measure his fitness level before and after 21 days of training.

To perform the step test, he stepped up and down onto a bench. He then stopped exercising, and recorded his pulse rate every minute for 3 minutes.

He then used the following equation to calculate his fitness level.

$$\text{fitness level} = \frac{30\,000}{(\text{pulse rate after 1 min}) + (\text{pulse rate after 2 mins}) + (\text{pulse rate after 3 mins})}$$

Table 1 shows his results.

Table 1

Day	Pulse rate after 1 minute	Pulse rate after 2 minutes	Pulse rate after 3 minutes	Fitness level
1	148	128	118	76
21	126	104	80	

He then compared his results to the fitness ratings in **Table 2**.

Table 2

	Fitness rating				
	Excellent	Above average	Average	Below average	Poor
Male fitness level	>90	80–90	65–79	55–64	<55
Female fitness level	>86	76–86	61–75	50–60	<50



3 (a) (i) Use his results to calculate his fitness level on day 21.

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.....

.....
(2 marks)

3 (a) (ii) Use **Table 2** to find his fitness rating on day 1.

.....
(1 mark)

3 (a) (iii) What **two** things should the basketball player control to make sure that this was a fair test and that his results were valid?

1

2

(2 marks)

3 (a) (iv) How would the basketball player measure his pulse rate?

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.....

(1 mark)

3 (a) (v) The test is a measure of the improvement of his *recovery rate* after exercise.

What is meant by *recovery rate*?

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.....

(1 mark)

3 (a) (vi) What **two** visible changes would occur to the basketball player's body during exercise?

1

2

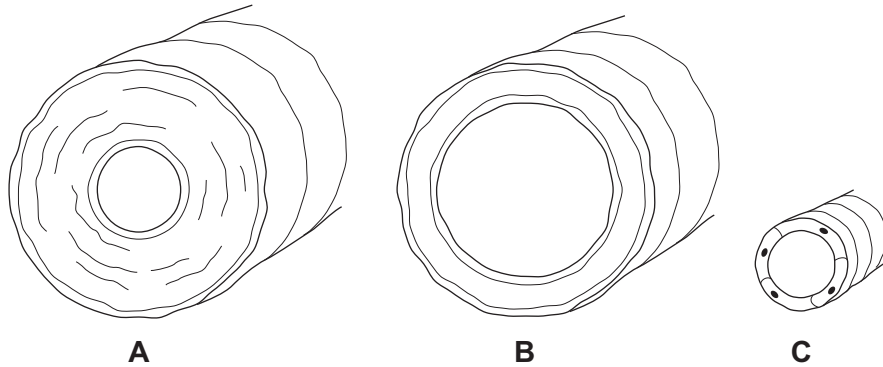
(2 marks)

Question 3 continues on the next page

Turn over ►



3 (b) The basketball player needs plenty of oxygen during a game of basketball.
The diagram shows three blood vessels in his cardiovascular system.



3 (b) (i) Explain why blood vessel **A** has a thicker wall than blood vessel **B**.

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(2 marks)

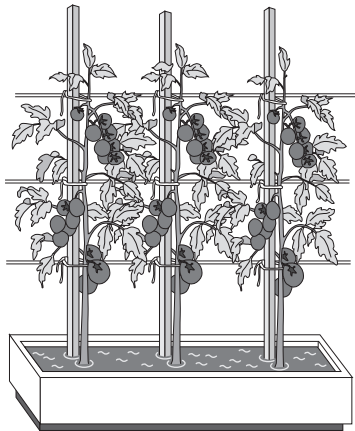
3 (b) (ii) The wall of blood vessel **C** is only one cell thick.
Explain the advantage of the wall being so thin.

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(1 mark)



4 Many commercial farmers grow tomatoes by having the roots in water containing nutrients, rather than in soil. This makes it easier to control the amount of nutrients that each plant receives. This method of growing tomatoes is called hydroponics.



4 (a) Name **three** minerals that should be added to the water to promote healthy growth in the tomatoes.

- 1
- 2
- 3

(3 marks)

4 (b) The tomatoes are grown intensively.

Give **two** other ways, apart from adding fertilisers, that intensive farmers could use to increase crop yields.

- 1
- 2

(2 marks)

5

Turn over for the next question

Turn over ►



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

Turn over ►



6 Databases are very useful in helping the Police with their investigations.

In 2009, the National DNA Database (NDNAD) held profiles of 5 532 847 people in England and Wales.

Some information from these profiles for England and Wales is shown in the tables below.

Table 1 – Gender profile

Gender	Number of people	Percentage (%) of total
Female	1 158 173	20.93
Male	4 335 141	78.36
Unassigned	39 533	0.71

Table 2 – Ethnic profile

Ethnic appearance	Number of people	Percentage (%) of total
Asian	313 819	5.67
Black	433 376	7.83
Chinese, Japanese or other South East Asian	38 415	0.69
Middle Eastern	45 130	0.82
White European	4 405 765	79.63
Unknown	296 342	5.36



Table 3 – Age profile

Current age	Number of people	Percentage (%)
Under 10	0	0
10–20	767 381	13.87
21–30	1 618 594	29.25
31–40	1 450 928	26.22
41–50	947 368	17.13
51–60	489 591	8.85
61+	258 306	4.67
Age unknown	679	0.01

6 (a) Give **three** of the most common characteristics of people who have had their DNA profile taken.

Use the information in each of the tables to help you.

- 1
- 2
- 3

(3 marks)

6 (b) The total number of profiles held on the NDNAD is 5 532 847.

The total number of profiles held on the NDNAD from volunteers is 38 647.

What percentage of the total number of profiles comes from volunteers?

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..... %
(2 marks)

Question 6 continues on the next page

Turn over ►



6 (c) The DNA from a suspect was obtained from a crime scene.

6 (c) (i) Explain why DNA evidence is important in solving a crime.

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(1 mark)

6 (c) (ii) Explain, as fully as you can, how electrophoresis is used to separate fragments of DNA and produce a DNA profile of a person.

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(4 marks)

10

Turn to page 18 for Question 7



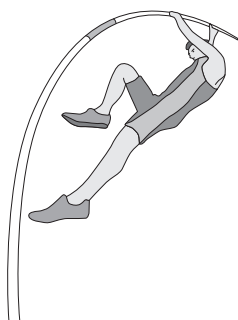
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7 One of the events in the London Olympics is the pole vault.



Some material scientists develop and test new materials to see if they can make a better vaulting pole to improve the performance of the pole vaulter.

Poles have been made from bamboo, aluminium, steel, glass fibre and, more recently, carbon fibre reinforced plastic.

The table shows some of the properties of these materials.

Property	Bamboo	Aluminium	Steel	Glass fibre	Carbon fibre reinforced plastic
Density in g per cm ³	0.86	2.7	7.7	2.5	1.80
Strength in GPa	50	70	200	80	140
Corrodes	No	No	Yes	No	No

7 (a) (i) Suggest why steel poles were tried **and** why they were **not** very successful.

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(2 marks)

7 (a) (ii) What is a composite material?

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(2 marks)



7 (a) (iii) What is the advantage of using a composite material to make the poles?

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(2 marks)

7 (b) A sports physiologist uses a spirometer to assess the pole vaulter's fitness.

The picture shows a spirometer in use.



Name and describe any **two** of the measurements that can be recorded using a spirometer.

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(4 marks)

END OF QUESTIONS

10



There are no questions printed on this page

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Question 6: National DNA Database (NDNAD) Data © National Policing Improvement Agency (NPIA) <http://www.npia.police.uk/en/13338.htm>

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