Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4791/02

S16-4791-02

ADDITIONAL APPLIED SCIENCE

UNIT 1: Science at Work in Applied Contexts
HIGHER TIER

P.M. TUESDAY, 17 May 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**10**	
2.	**14**	
3.	**8**	
4.	**7**	
5.	**7**	
6.	**14**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

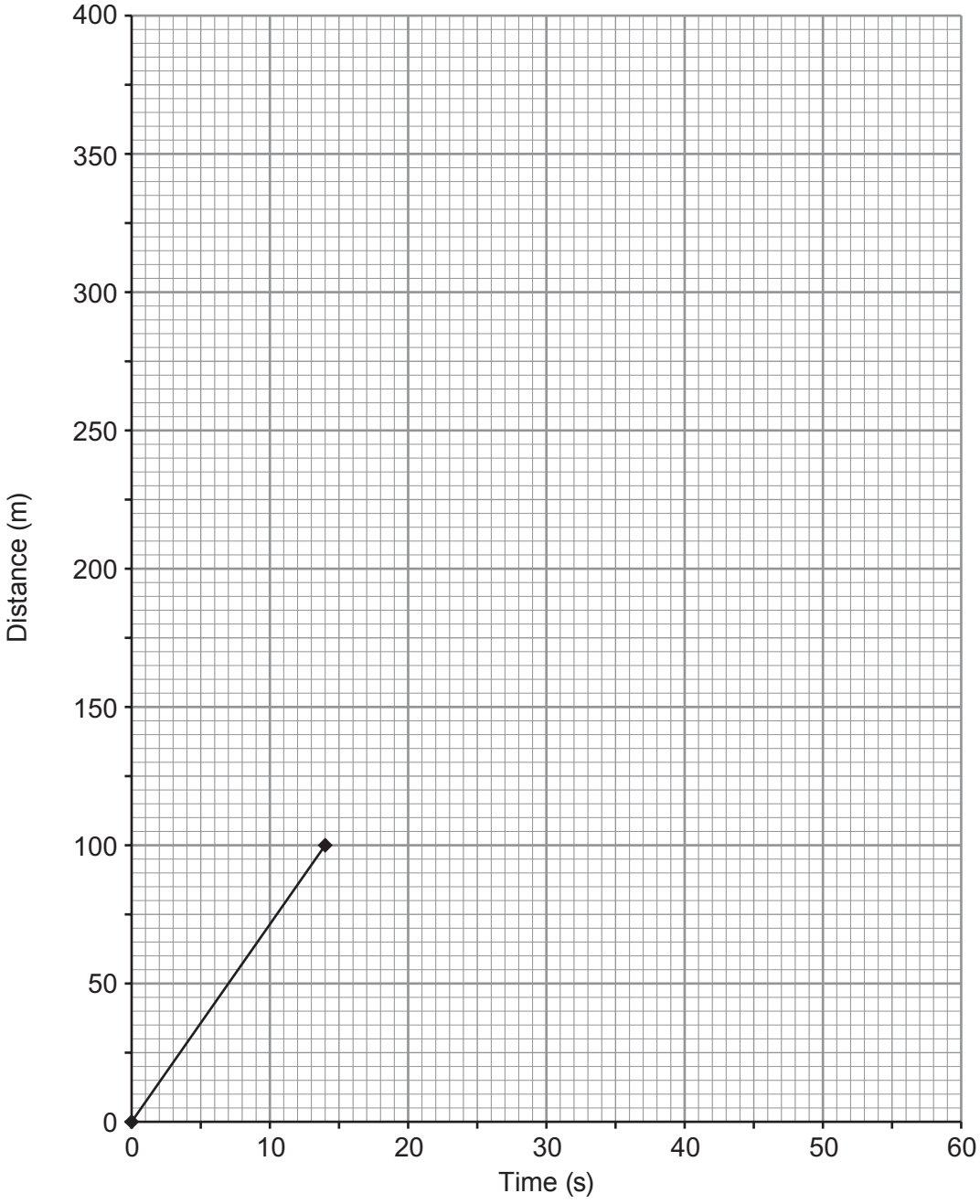
You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **2***(b)*(ii) and **6***(b)*.

You are reminded to show all your workings. Credit is given for correct workings even when the final answer given is incorrect.

Examiner only

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

1. Four children are competing in a 4 x 100 m relay race in which each child runs 100 m.



(a) (i) How long did it take the **first child** to run **100 m**? ..... [1]

(ii) The second child ran their 100 m in 16 s. The third child ran their 100 m in 13 s. The total time to complete the 400 m race was 55 s. Use this information to complete the graph. [3]

(iii) State which child, **first, second, third** or **fourth**, ran their 100 m at the fastest speed. Give **one** reason for your answer. [2]

Child: .....

Reason: .....

Examiner only

(b) Calculate the mean speed for the relay race using the equation. [2]

$$\text{mean speed} = \frac{\text{distance}}{\text{time}}$$

Mean speed = ... m/s

(c) After a period of training, the children are all able to run faster.

Explain how this will affect the graph. [2]

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2. *(a)* (i) Describe how to measure pulse rate. [2]

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(ii) Brian's resting pulse rate was measured five times. The results were 65, 72, 74, 68 and 66 beats per minute. Calculate his mean resting pulse rate. [2]

Mean resting pulse rate = ... beats per minute

(iii) Use the data in the table below to describe the long-term effects of exercise on the body. [3]

Body measurement	Before exercise programme	After exercise programme
pulse rate (beats/minute)	82	65
breathing rate (breaths/minute)	17	14
volume of blood pumped out of the heart at each beat (cm^3)	55	65

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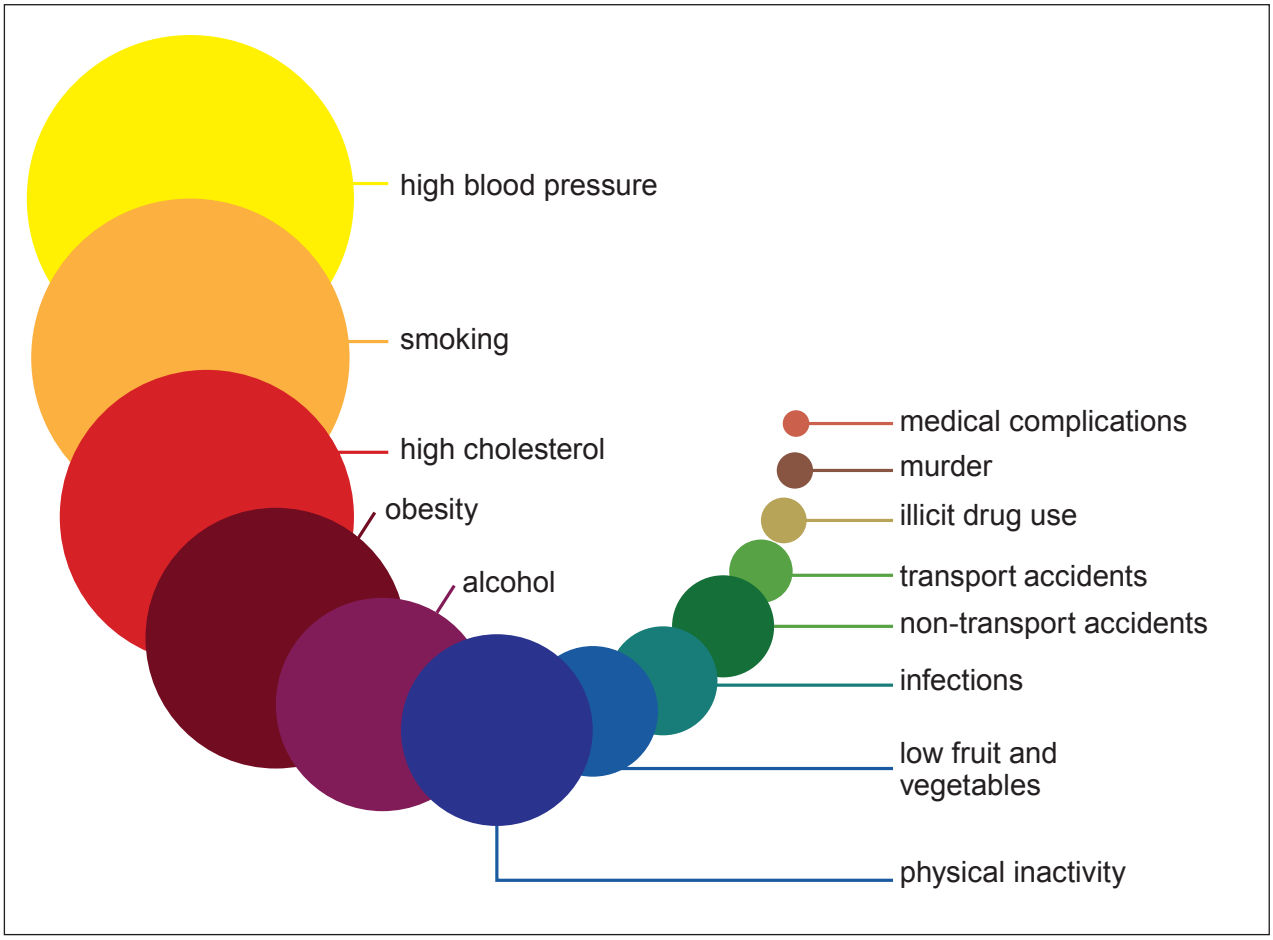
Examiner only

(b) The diagram shows the risks of an early death due to different factors. The bigger the circle the bigger the risk of early death.



(i) State which lifestyle choice presents the lowest risk. [1]

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(ii) Explain how changes in lifestyle could reduce the **five** biggest risk factors. [6 QWC]

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Examiner only

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14

Examiner only

3. *(a)* (i) Describe how paper chromatography is carried out. [2]

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(ii) Explain why molecules are separated in paper chromatography. [3]

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(b) (i) Describe **one** application of gas chromatography. [2]

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(ii) Gas chromatography can be used to carry out qualitative or quantitative analysis.

State **one** difference between these types of analysis. [1]

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8

Turn over.

Examiner only

4. Genes can be transferred artificially from one organism to another. Scientists transferred a gene, which controls production of cod liver oil, from a fish into a rapeseed plant. This genetically modified (GM) rapeseed crop will now produce cod liver oil.

(a) (i) Cod liver oil is said to be good for the heart and nervous system. The world market for cod liver oil has grown rapidly over the last 25 years.
Describe the advantages of growing GM rapeseed crops for the production of cod liver oil. [2]

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(ii) Describe why some people are concerned about the transfer of genes from one species to another, especially between animals and plants. [2]

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(b) An estimate of the worldwide cultivation of three other non-GM and GM crops in 2010 and 2014 is shown in the table below.

	Area (millions of hectares)			
	2010		2014	
crop	non-GM	GM	non-GM	GM
soya bean	72	21	50	45
cotton	34	5	29	13
maize	140	12	116	46

Describe the trends shown by the data. [3]

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7

Examiner only

5. *(a)* (i) Name **one** type of bacteria that causes food poisoning. [1]

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(ii) Explain how bacteria can cause food poisoning. [2]

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(b) (i) Describe how the process of smoking extends the storage time of food. [3]

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(ii) Name **one** other method of preserving food. ..... [1]

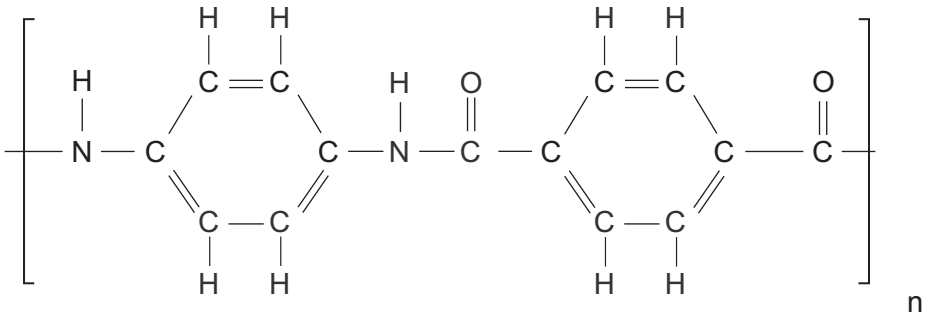
7

Turn over.

Examiner only

6. Kevlar® is a rigid polymer. Modern cycle helmets contain a Kevlar® composite to protect the head in case of an accident. This is a replacement for expanded polystyrene filling which is a flexible polymer.

(*a*) The diagram below shows a section of a molecule of Kevlar®. It is repeated throughout the chain.



(i) Write down the molecular formula for Kevlar®. [2]

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(ii) Calculate the relative formula mass for a molecule of Kevlar® using the information below. [4]

Relative atomic mass	1	12	14	16
element	hydrogen	carbon	nitrogen	oxygen

relative formula mass = ...

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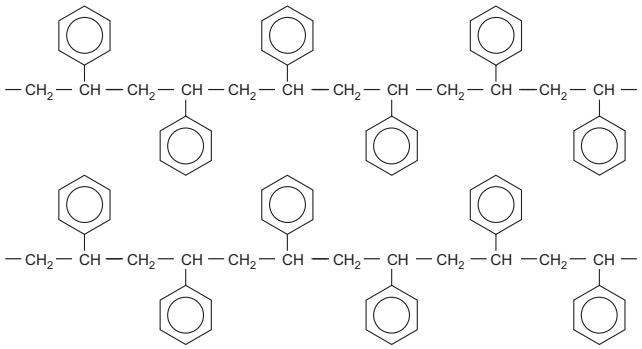
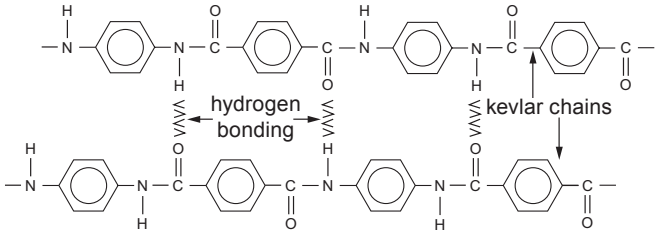
(b) Use your knowledge and the information below to compare the use of Kevlar® in cycle helmets with expanded polystyrene. [6 QWC]

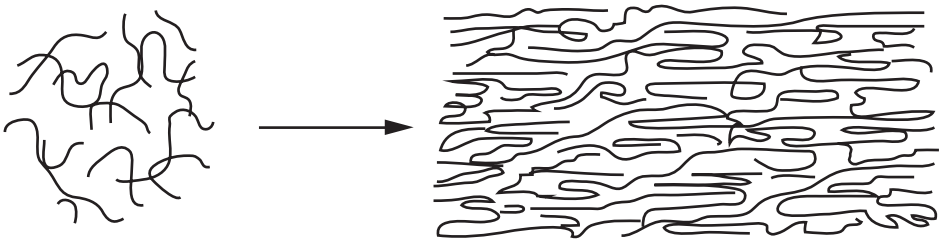
expanded Polystyrene (two chains shown)



Kevlar



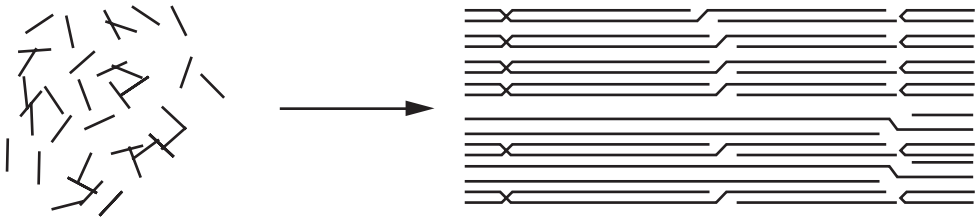
Polystyrene



Dilute solution

Partially extended chains

Kevlar



Dilute solution

Fully extended chains

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Turn over.

Examiner only

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(c) The density of Kevlar® is 1.44 g/cm^3. The volume of Kevlar® used in a cycle helmet is 300 cm^3. Calculate the mass of Kevlar® using the equation. [2]

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Mass = ... g

14

END OF PAPER