GCSE

4791/01

S16-4791-01

ADDITIONAL APPLIED SCIENCE

UNIT 1: Science at Work in Applied Contexts
FOUNDATION TIER

P.M. TUESDAY, 17 May 2016

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	9	
2.	7	
3.	9	
4.	5	
5.	6	
6.	10	
7.	14	
Total	60	

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 **7**(b)(ii).

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

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

1. *(a)* Laboratory technicians use the following techniques to analyse samples:

titrations   flame tests   chromatography   genetic profiling   ~~microscopy~~   using dataloggers

(i) Select the correct technique from the box to complete the table below.
One row has been completed for you. [3]

Test	Technique used
comparing fibres	microscopy
identifying dyes in lipstick	....
monitoring oxygen content in a water sample over a few days	....
testing for inherited diseases	....

(ii) A titration is used for quantitative analysis and flame tests are used for qualitative analysis. Give **one** difference between quantitative and qualitative analysis. [1]

....

....

(b) Paper chromatography is used to identify the different colours used in food dyes.

(i) Describe how you would carry out this technique. [3]

....

....

....

....

....

(ii) Complete the following sentence by <u>underlining</u> the correct word in brackets. [2]

In chromatography, colours are separated by the movement of a (solid / solute / solvent) over a (primary / secondary / stationary) phase.

9

2. Scientists have transferred a gene, which controls production of fish oil, from a fish into a rapeseed plant. Genetically modified (GM) rapeseed crops will now produce fish oil.

(a) The following statements are advantages and disadvantages of GM rapeseed crops. Place a **tick (✓)** next to the disadvantages. [3]

Statements about GM crops	Disadvantages
Easier to create large quantities of fish oil	
GM crops could cross breed and contaminate other plants	
GM rapeseed crops may be harmful	
The rapeseed GM crops will be more expensive	
Vegetarians can take fish oil from GM crops	

(b) An estimate of the worldwide production 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

Use the information in the table to answer the following questions.

(i) What area was used for growing **all** maize crops in 2010? [1]

.... millions of hectares

(ii) What area was used for growing GM cotton crops in 2014? [1]

.... millions of hectares

(iii) By how much has the area of land used for growing non-GM soya bean decreased between 2010 and 2014? [1]

.... millions of hectares

(iv) State how the production of GM crops has changed between 2010 and 2014. [1]

....

7

4791
010003

3. Modern cycle helmets contain a Kevlar® composite to protect the head in case of an accident.

(a) The diagram below shows part of a molecule of Kevlar®.
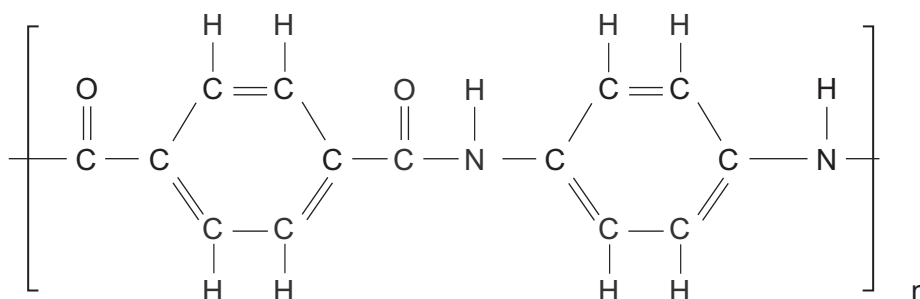
(i) Complete the boxes to show the molecular formula for Kevlar®. [3]

[-CO-C ☐ H ☐ - CO-NH-C$_6$H$_4$- ☐ ☐ -]n
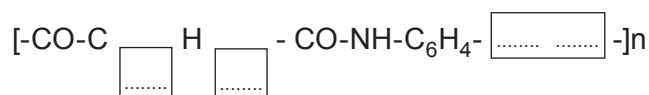
(ii) Calculate the relative formula mass for a molecule of Kevlar® using the information below. [4]

Element	hydrogen	carbon	nitrogen	oxygen
Relative atomic mass	1	12	14	16
Number of atoms	10	14	2	....
Total atomic mass	10	168	....	....

relative formula mass = ...

(b) 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]

mass = density × volume

Mass = ... g

9

4. *(a)* Complete the following table showing examples of different types of material. [3]

Type of material	Example
Ceramic	porcelain
....	silver
....	fibre glass
....	rubber

(b) (i) State **one** property of lead which is unusual for a metal. [1]

....

(ii) State **one** property of mercury which is unusual for a metal. [1]

....

5

Turn over.

5. (*a*) Statements **A-F** below show the main stages of making beer. However the stages are not in the correct order.

| **A** | The drink is pasteurised, then stored in casks or bottles |

| **B** | Fermentation is allowed to continue (the carbon dioxide helps to keep air out) |

| **C** | Sugar is extracted from the plants |

| **D** | The mixture is clarified by settling and filtration |

| **E** | Air and other microorganisms are kept out of the fermentation container using an air lock |

| **F** | Yeast is added to the solution and the mixture is kept warm |

Use the letters **B**, **D**, **E**, **F** to arrange the stages in the correct order in the boxes below.

[3]

| **C** | .... | .... | .... | .... | **A** |

(*b*) (i) Name the microorganism used in this process. .... [1]

(ii) State **one** reason why the fermentation chamber should be sterilised before use.

[1]

....

(iii) State why the beer is pasteurised before it is bottled. [1]

....

6. Four children are competing in a 4 x 100 m relay race in which each child runs 100 m.
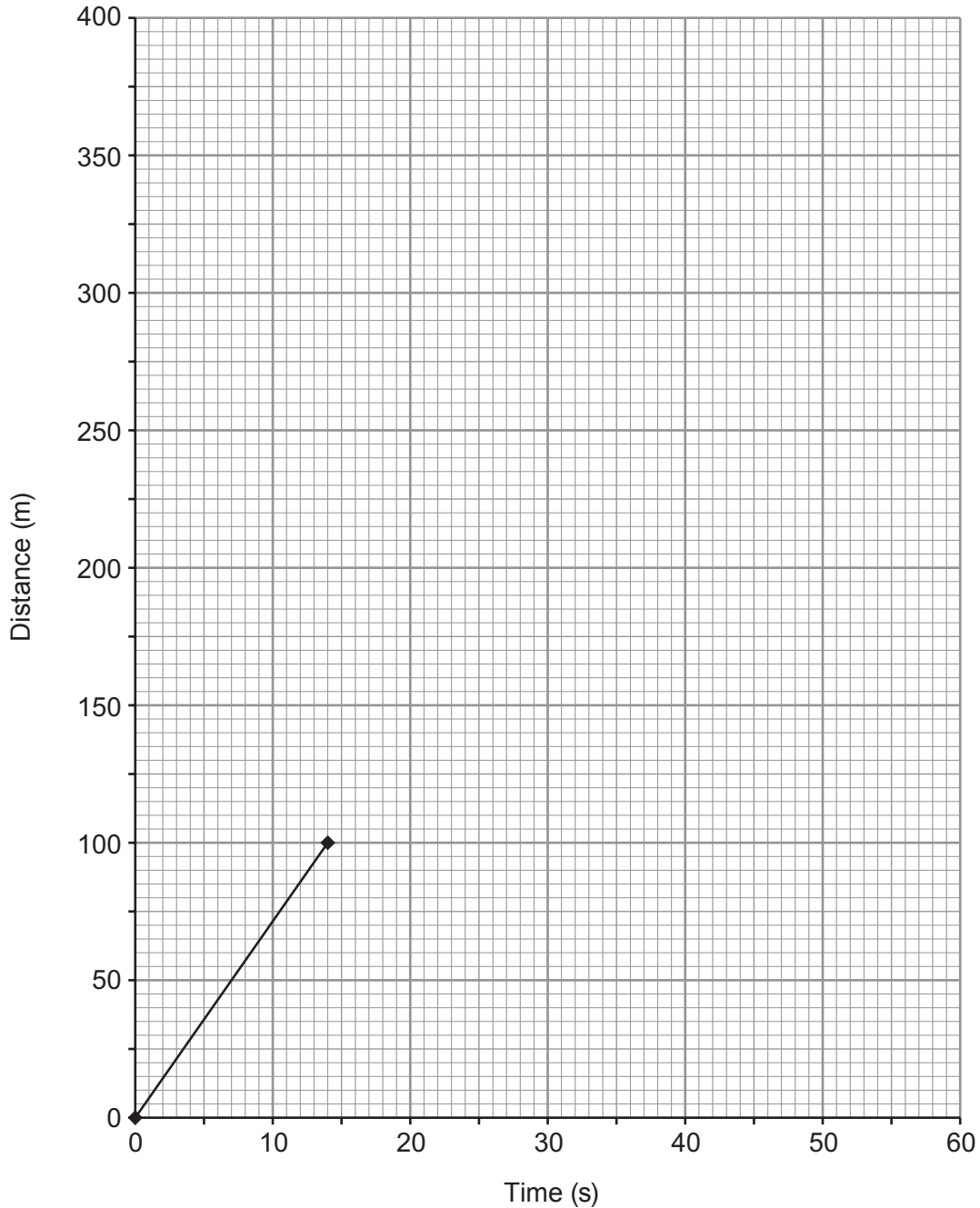
(a) (i) How long did it take the **first child** to run **100 m**? ....[1]

(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: ....

(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]

....

....

....

10

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

....

....

(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

....

....

....

....

....

(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.

high blood pressure

smoking

high cholesterol

obesity

alcohol

medical complications

murder

illicit drug use

transport accidents

non-transport accidents

infections

low fruit and vegetables

physical inactivity

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

....

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

....

....

....

....

....

....

....

....

END OF PAPER

14