A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

Level 3 Certificate/Extended Certificate

APPLIED SCIENCE

Unit 3 Science in the Modern World

ASC3

Thursday 13 June 2019 Morning

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

For this paper you must have:

- **a clean copy of pre-release SOURCES A, B, C and D**
- **a calculator.**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions.**
- **You must answer the questions in the spaces provided. Do NOT write on blank pages.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**

INFORMATION

- **You will be provided with copies of pre-release SOURCES A, B, C and D.**
- **There are two sections in this paper – SECTION A and SECTION B.**
- **You should answer all questions in each section.**
- **You should spend approximately 1 hour on SECTION A and 30 minutes on SECTION B.**
- **The marks for questions are shown in brackets.**
- **The maximum mark for this paper is 60.**

ADVICE

Read each question carefully.

DO NOT TURN OVER UNTIL TOLD TO DO SO

SECTION A

This section is based on SOURCES A, B, C and D.

Answer ALL questions in this section.

0 1

SOURCE A describes the historical landmarks in the development of electric cars.

Use information from SOURCE A to answer Question 01.

0 1 . 1

Electric cars first became popular in the late 1800s.

Why did electric cars first become popular with people living in cities?

Tick (✓) ONE box. [1 mark]

- ☐ **Distance travelled was not an important factor**
- ☐ **Electric cars could travel faster**
- ☐ **Electric cars were cheap to make**
- ☐ **Electric cars were more environmentally friendly**

[Turn over]

0 1 . 2

Give THREE reasons why the popularity of electric cars decreased in the early 1900s. [3 marks]

1

2

3

0 1 . 3

Give TWO reasons why car manufacturers began to make more electric cars in the 1990s. [2 marks]

1 _____

_____

2 _____

_____

_____

6

0 2

SOURCE B suggests that electric vehicles will replace petrol and diesel vehicles.

SOURCE B states 'it is no longer a question of whether this will happen – but how quickly'.

0 2 . 1

Give ONE piece of evidence from SOURCE B that shows the automotive industry is taking electric vehicles more seriously.

Do NOT refer to making more electric vehicles in your answer. [1 mark]

BLANK PAGE

[Turn over]

0 2 . 2

There were some problems with early electric vehicles which have recently been solved.

Give TWO problems with early electric vehicles.

Describe how each problem has recently been solved.

Use information from SOURCE B.
[4 marks]

1 _____

_____

2 _____

_____

_____

_____

_____

_____

[Turn over]

0 2 . 3

There has been an increase in electric vehicle sales in China.

Suggest TWO reasons why this increase has encouraged the automotive industry in Europe to make more electric vehicles.

Use information from SOURCE B.
[2 marks]

1 _____

_____

_____

_____

2 _____

_____

_____

_____

_____

[Turn over]

7

0 3

SOURCE B refers to the Paris climate talks that took place in 2016. During the talks, 195 countries discussed and agreed action plans to reduce global warming.

Explain how the Paris climate talks might have encouraged the automotive industry to increase production of electric cars. [3 marks]

3

0 4

SOURCE B suggests that the increased use of electric cars might have environmental and social benefits.

Give ONE example of an environmental benefit and ONE example of a social benefit in the increased use of electric cars. [2 marks]

Environmental benefit _____

_____

_____

_____

_____

Social benefit _____

_____

_____

_____

_____

_____

[Turn over]

2

0 5

Electric vehicles made by the car manufacturer 'Tesla' are mentioned in SOURCES A, B and C.

Use information from SOURCES A, B or C to answer Question 05.

0 5 . 1

Electric vehicles are becoming more popular with the public.

Give ONE piece of information about the sales of 'Tesla' electric vehicles that shows this popularity. [1 mark]

0 5 . 2

Suggest why the 'Tesla 3' sold well in the US in 2017. [1 mark]

0 5 . 3

Give ONE reason why it was surprising that the 'Tesla 3' sold well in 2017. [1 mark]

3

0 6

SOURCE C was written in 2017. The author believes that there are still potential problems with the safety of electric vehicles.

0 6 . 1

Explain ONE problem with the safety of electric vehicles, according to SOURCE C. [2 marks]

0 6 . 2

Explain how SOURCE C suggests that the safety problem you described in Question 06.1 could be solved. [2 marks]

4

0	7

SOURCE D refers to the Committee on Climate Change.

The committee advises the UK government on ways to reduce carbon dioxide emissions.

One suggestion is to ban the sale of new petrol and diesel vehicles by either 2030 or 2040.

Use information from SOURCE D to answer Question 07.

0 7 . 1

Calculate the percentage of total carbon dioxide emissions in the UK that came from tailpipe emissions from petrol and diesel cars in 2017. [2 marks]

Percentage of total carbon dioxide emissions = _____ %

[Turn over]

0 7 . 2

Calculate the percentage decrease in tailpipe emissions from petrol and diesel cars if the proposed ban on the sale of new petrol and diesel cars began in 2040. [2 marks]

Percentage decrease in tailpipe emissions = _____ %

0 7 . 3

Suggest TWO reasons why a ban introduced in 2040 might be better than an earlier ban in 2030. [2 marks]

1 _____

_____

2 _____

_____

_____

0 7 . 4

Describe what is meant by 'full lifecycle emissions'. [1 mark]

0 7 . 5

Why is 'full lifecycle emissions' a useful measure when discussing electric vehicles? [1 mark]

8

0 8

You are considering whether to buy an electric car or a diesel car.

You read SOURCES A, B, C and D to see if they provide you with information to help you make your decision.

For each source:

- **evaluate its validity**
- **describe its effectiveness at providing useful information.**

[9 marks]

[Turn over]

[Turn over]

9

SECTION B

Answer ALL questions in this section.

0 9

Greenhouse gas (GHG) emissions contribute to climate change.

Greenhouse gases include:

- **carbon dioxide (CO_2)**
- **methane (CH_4)**
- **nitrous oxide (NO_2)**
- **hydrofluorocarbons (HFCs).**

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[Turn over]

TABLE 1 shows greenhouse gas emissions from different industry sectors in the UK.

TABLE 1

Industry sector	Greenhouse gas emissions / million tonnes of carbon dioxide equivalent ($MtCO_2e$)					
	1990	1995	2000	2005	2010	2015
Agriculture	60.2	59.7	56.3	52.6	50.7	51.5
Mining and quarrying	42.5	39.9	34.8	28.4	24.6	20.5
Manufacturing	181.1	168.9	139.6	125.9	96.9	88.5

Household services	285.5	250.3	237.6	242.5	207.7	149.5
Transport	64.8	70.7	83.7	100.4	85.0	85.7
Other industries	198.0	201.8	216.8	219.4	222.5	199.5
Total	832.1	791.3	768.8	769.2	687.4	595.2

[Turn over]

The largest source of GHG emissions is the combustion of fossil fuels.

Reducing the use of fossil fuels is the main reason why GHG emissions have decreased since 1990.

0 9 . 1

Suggest how the UK has reduced the use of fossil fuels across most industry sectors since 1990. [1 mark]

0 9 . 2

Suggest when the UK began to sell more electric cars.

Give a reason for your answer.

Use data from TABLE 1, on pages 32 and 33. [1 mark]

[Turn over]

Household services include:

- **the supply and use of electricity and gas**
- **the management of waste.**

The demand for these services has increased significantly since 1990. However, the GHG emissions from this sector have decreased.

0 9 . 3

Calculate the mean annual decrease in GHG emissions from the household services sector between 1990 and 2015.

Use data in TABLE 1, on pages 32 and 33. [2 marks]

Mean annual decrease = _____ $MtCO_2e$

[Turn over]

0 9 . 4

Suggest TWO reasons which may have contributed to a decrease in GHG emissions in the UK from the household services sector.

Do NOT refer to the reduction in the use of fossil fuels in your answer. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

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[Turn over]

0 9 . 5

Suggest ONE reason that may have contributed to a decrease in GHG emissions in the UK since 1990 in EACH of the following industry sectors:

- **agriculture**
- **mining and quarrying**
- **manufacturing.**

Do NOT refer to the reduction in the use of fossil fuels in your answer. [3 marks]

Agriculture

Mining and quarrying

Manufacturing

[Turn over]

1	0

Carbon dioxide emissions are the largest contributor to global warming.
Reduction of carbon dioxide emissions is the focus of most climate change initiatives.

TABLE 2, on the opposite page, shows data for total GHG and carbon dioxide emissions in 1990 and 2015.

TABLE 2

Year	Emissions / million tonnes of carbon dioxide equivalent ($MtCO_2e$)		Carbon dioxide emissions as percentage of total GHG emissions
	Total GHGs	Carbon dioxide	
1990	832.1	630.7	75.8
2015	595.2	504.3	84.7

[Turn over]

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Evaluate the success of climate change initiatives between 1990 and 2015.

Use data from TABLE 2, on page 43. [3 marks]

3

1	1

Many scientists in different industry sectors are working to reduce climate change.

1	1	.	1

Explain how an ENVIRONMENTAL SCIENTIST could contribute to reducing climate change. [2 marks]

1 1 . 2

Explain how a RESEARCH SCIENTIST could contribute to reducing climate change. [2 marks]

11.3

Explain how a PRODUCT DEVELOPER could contribute to reducing climate change. [2 marks]

END OF QUESTIONS

6

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
1	
2	
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TOTAL	