



Please write clearly in block capitals.

Centre number

Candidate number

Surname _____

Forename(s) _____

Candidate signature _____

Level 3 Certificate/Extended Certificate

APPLIED SCIENCE

Unit 3 Science in the Modern World

Friday 25 January 2019

Afternoon

Time allowed: 1 hour 30 minutes

Materials

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 outside the box around each page or 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 in brackets.
- The total marks for this paper is 60.

For Examiner's Use	
Question	Mark
1	
2	
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9	
10	
11	
12	
TOTAL	

Advice

Read each question carefully.



J A N 1 9 A S C 3 0 1

Section A

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

Answer **all** questions in this section.

0 1

Source A suggests that the development of a system called CRISPR-Cas9 has ‘sparked a lot of concern about the creation of designer babies’.

0 1 . 1

Source A describes the CRISPR-Cas9 system as a ‘copy and paste’ tool for DNA.

Explain why the CRISPR-Cas9 system is described as a ‘copy and paste’ tool for DNA.

[2 marks]

0 1 . 2

One concern is that the human embryos used in the research could be implanted into a woman.

Source A reassures people that this will not be allowed to happen.

Which of the statements below does **Source A** use to reassure people that these embryos will not be implanted into a woman?

Tick (✓) **one** box.

[1 mark]

Embryos from IVF treatments will be used.

Embryos must be destroyed within 14 days.

Only one group of scientists has permission for this research.

Research ethics approval is required.

3



0 2

Source A suggests that the development of healthy human embryos is still an area that is poorly understood by scientists.

Calculate the percentage of **implanted eggs** that continue to develop in the womb beyond 3 months.

Use information from **Source A**.

[2 marks]

Percentage = _____

2

0 3

Source B describes a procedure called germline genetic engineering used by a US scientist called Shoukhrat Mitalipov.

0 3 . 1

How is germline genetic engineering described in **Source B**?

[2 marks]

0 3 . 2

How might germline genetic engineering benefit families?

[1 mark]

3

Turn over for the next question

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0	4
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According to **Source B**, Mitalipov's study was similar to other studies by scientists such as Kathy Niakan. However, in many ways Mitalipov's study was 'a more meaningful use of this technology'.

0	4	.	1
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Mitalipov and Niakan are both scientists who study genes.

Give the name for the type of scientist who studies genes.

[1 mark]

0	4	.	2
---	---	---	---

Give **two** ways that Mitalipov's study was similar to Niakan's study.

Use information from **Source B**.

[2 marks]

1 _____

2 _____

0	4	.	3
---	---	---	---

Describe **one** way that Mitalipov's study was different from Niakan's study.

Use information from **Source B**.

[1 mark]

4



0 5

Suggest why the author of **Source B** made reference to cosmetic surgery in their argument.

[3 marks]

3

0 6

Source B describes 'mosaicism' as a problem when you use germline genetic engineering.

Use **Source B** to answer the following questions.

0 6

. 1

What is mosaicism?

[1 mark]

0 6

. 2

When does mosaicism occur?

[1 mark]

0 6

. 3

How did Mitalipov reduce mosaicism in his study?

[1 mark]

3

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0 7

Source C is an article from *National Geographic* magazine. **Source C** has **not** been peer reviewed.

0 7 . 1

Describe the process of peer review.

[3 marks]

0 7 . 2

Suggest **one** reason why **Source C** would **not** be required to undergo the process of peer review.

[1 mark]

0 7 . 3

Suggest **one** reason why *National Geographic* magazine might want to include the opinions of two different authors.

[1 mark]

5



0 8

Source C discusses the future of gene editing.

0 8 . 1

Source C includes data on children born each year with genetic defects.Calculate the **total** number of children born worldwide per year to the **nearest million**.Use data from **Source C**.**[2 marks]**

Total number of children born worldwide = _____ million

0 8 . 2

Gene editing is one method that parents could use to avoid transmitting an inherited disease. One of the authors in **Source C** discussed **two** other methods.Give the **two** other methods that could be used.**[2 marks]**

1

2

0 8 . 3

According to **Source C**, there are social and political questions to answer before allowing gene editing in human embryos.

An example of a political question is 'How will legislation distinguish between gene editing for medical reasons or for enhancement?'

Give **one** example of a social question, according to **Source C**.**[1 mark]**

0 8 . 4

Suggest an ethical issue that could result from gene editing in human embryos.

[1 mark]

6

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0 9

The author of **Source D** states that gene editing is 'about hope for people like me'.

Explain what the author means by this.

[3 marks]

3



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0 9

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Extra space

9

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Section B

Answer **all** questions in this section.

1	1
---	---

Figure 1 shows information about inherited diseases.

Figure 1

- Inherited diseases are caused by mutations in the DNA in our chromosomes.
- Our sex is determined by one pair of chromosomes called the sex chromosomes. Individuals having two X chromosomes (XX) are female and individuals having one X chromosome and one Y chromosome (XY) are male.
- Some inherited diseases are apparent at birth while others are diagnosed at different stages throughout childhood, and sometimes in adulthood.
- It is estimated that 1 in 25 children born is affected by an inherited disease.
- Approximately 30 000 children are diagnosed with an inherited disease in the UK each year.
- Fragile X syndrome is a genetic disorder, with few distinguishing features, that affects a person's mental development such as their ability to learn.
- Fragile X syndrome is caused by a mutation on the X chromosome; females must have a mutation on both X chromosomes to have Fragile X syndrome.

Table 1 shows data about inherited diseases in the UK.

Table 1

Name of inherited disease	Proportion of births	Estimated number of people	Average life expectancy/years
Down's syndrome	1 in 1000	60 000	60
Cystic fibrosis	1 in 2500	10 800	41
Sickle cell anaemia	1 in 2000	15 000	50
Duchenne muscular dystrophy	1 in 3500	2500	27
Fragile X syndrome	1 in 4000 males 1 in 8000 females	Unknown	Not affected

Use information from **Figure 1** and **Table 1** to answer Question 11.



1 1 . 1 Suggest why some diseases are called inherited diseases.

[2 marks]

1 1 . 2 Use the data in **Figure 1** to estimate the total number of births in the UK each year.

[2 marks]

Estimated total number of births in the UK each year = _____

1 1 . 3 The actual recorded number of births in the UK will be lower than your estimated value in Question **11.2**.

Suggest **one** reason why.

[1 mark]

1 1 . 4 A disease is classified as 'rare' if there are fewer than 5 in 10 000 of the population with the disease.

Identify **one** disease from **Table 1** which is a rare disease and **one** disease that is **not** a rare disease.

[2 marks]

Rare disease _____

Not a rare disease _____

Question 11 continues on the next page

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1 1 . 5 Give **two** reasons why the estimated number of individuals in the UK with Down's syndrome and Duchenne muscular dystrophy are different.

Use information from **Table 1**.

[2 marks]

1 _____

2 _____

1 1 . 6 Suggest **two** reasons why the total number of people affected by Fragile X syndrome might be unknown.

[2 marks]

1 _____

2 _____

1 1 . 7 Explain the difference in the inheritance of Fragile X syndrome in males and females.

Use information from **Figure 1** and **Table 1**.

[4 marks]



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1 1 . 8

Suggest how a doctor could diagnose an individual with Fragile X syndrome.

[1 mark]

16

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1 2

Many different scientists study inherited diseases.

Suggest **one** role for each of the following scientists when they study inherited diseases.

[3 marks]

Research scientist _____

Biomedical scientist _____

Pharmacologist _____

3

END OF QUESTIONS



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