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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

Friday 25 January 2019 **Afternoon**

Time allowed: 1 hour 30 minutes

For this paper you must have:
- **a clean copy of pre-release SOURCES A, B, C and D**
- **a calculator.**

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

[Turn over]

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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.
- 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.

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 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

0 4 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 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

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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]

_____

_____

_____

[Turn over]

3

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 _____

_____

_____

[Turn over]

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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

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

1 0 **SOURCES A, B, C and D were written by authors with different opinions about the use of gene editing.**

Evaluate how effectively each author presents their opinions about the use of gene editing to the general public.

Your answer should be supported by evidence of the language used by the authors. [9 marks]

9

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.

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1 1 . 1 Suggest why some diseases are called inherited diseases. [2 marks]

1 1 . 2 Use the data in FIGURE 1, on page 26, to estimate the total number of births in the UK each year. [2 marks]

Estimated total number of births in the UK each year =

11.3 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, on page 27, which is a rare disease and ONE disease that is NOT a rare disease. [2 marks]

Rare disease _____

Not a rare disease _____

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, on page 27. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

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, on pages 26 and 27. [4 marks]

_____

_____

_____

_____

11.8 **Suggest how a doctor could diagnose an individual with Fragile X syndrome. [1 mark]**

16

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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For Examiner's Use	
Question	Mark
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