AQA

Level 3 Certificate/Extended Certificate

APPLIED SCIENCE

ASC3

UNIT 3 Science in the Modern World

Mark scheme

January 2019

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Answers	Additional comments	Mark	AO
01.1	cuts / copies DNA / gene(s) so that damaged genes / DNA can be removed **or** so that new / modified genes / DNA can be inserted	 allow DNA / genes can be modified	1 1	AO3
01.2	embryos must be destroyed within 14 days		1	AO3
Total			**3**	

Question	Answers	Additional comments	Mark	AO
02	 $\dfrac{13}{25} \times 100$ 52 (%)	an answer of 52% scores 2 marks allow 1 mark for correct calculation using incorrect data from the source	 1 1	AO2
Total			**2**	

Question	Answers	Additional comments	Mark	AO
03.1	altering the genes of a one day old embryo **or** of a single cell zygote	 allow a momentous operation / development allow opening the door to designer babies allow can be used to enhance desirable genes	1 1	AO3

03.2	eliminating inherited diseases **or** editing out a harmful disease mutation		1	AO3

Total			**3**

Question	Answers	Additional comments	Mark	AO
04.1	geneticist	allow genetic engineer	1	AO1
04.2	any **two** from: • uses CRISPR-Cas9 • carried out on (IVF) embryos • no intention to implant embryos **or** embryos destroyed after 14 days		2	AO3
04.3	any **one** from: • Mitalipov inserted CRISPR-Cas9 into the unfertilised egg at same time as sperm • Mitalipov inserted CRISPR-Cas9 earlier/before fertilisation • Mitalipov's aim is to alter defective genes (not just to understand embryo development)	allow any of these answers written in converse ie 'Niakan did not…'	1	AO3
Total			**4**	

Question	Answers	Additional comments	Mark	AO
05	(the author believes that) germline genetic engineering can be compared to cosmetic surgery	allow reference to similarity between the two for first bullet points.	1	AO3
	(because) cosmetic surgery was first used to repair damaged tissue	if neither mark awarded, allow 1 marks for use expanded into different areas not intended initially	1	
	but then began to be used to enhance the body		1	
Total			**3**	

Question	Answers	Additional comments	Mark	AO
06.1	not all the cells carry the edited gene **or** not all cells are genetically repaired	ignore 'cells are different'.	1	AO3
06.2	when gene editing takes place after cell division has occurred		1	AO3
06.3	he inserted the CRISPR-Cas9 before fertilisation **or** he inserted the CRISPR-Cas9 before cell division **or** he inserted the CRISPR-Cas9 at same time as sperm	allow 'gene editing took place' instead of 'he inserted the CRISPR-Cas9' throughout	1	AO3
Total			**3**	

Question	Answers	Additional comments	Mark	AO
07.1	any **three** from: • scientist / researcher submits article • article sent to (anonymous) reviewers / experts (in the same field) • reviewer comments / checks the paper • researcher amends paper (in light of comments) **or** paper is approved (without changes) • cycle is repeated if necessary	if no other marks awarded allow 1 mark for the process occurring before publication	3	AO1

Question	Answers	Additional comments	Mark	AO
07.2	any **one** from: • only academic research is peer reviewed • (National Geographic) is written for the public / a wider audience • (National Geographic) commission / pay people to write the articles	allow it is not a research paper	1	AO2

Question	Answers	Additional comments	Mark	AO
07.3	any **one** from: • give both sides of the argument • (National Geographic) don't hold an opinion • (National Geographic) are not biased **or** to avoid bias	allow to get a balanced view	1	AO3

Question	Answers	Additional comments	Mark	AO
Total			**5**	

Question	Answers	Additional comments	Mark	AO
08.1	$7.9 \times \dfrac{100}{6}$ 132 (million)	an answer of 132 (million) scores 2 marks allow 1 mark for: • 13.2 (million) • 130 / 131 (million) • 131.666667 (million) • 131 666 667	1 1	AO2

Question	Answers	Additional comments	Mark	AO
08.2	using donated eggs or sperm pre-implantation genetic diagnosis / embryo screening (and IVF)	 allow use PGD	1 1	AO3

Question	Answers	Additional comments	Mark	AO
08.3	any **one** from: • is it justifiable to allow it for parents with inherited diseases? • could we limit its use to cases of serious disease risk?	 allow other correct questions related to the effects on society	1	AO3

Question	Answers	Additional comments	Mark	AO
08.4	any **one** from: • can it cause off-target mutations? • what are the effects of persistent editing? • what are the longer-term health and safety consequences? • does not take into account consent of offspring	allow what are the possible side effects to the child?	1	AO3

Total			**6**	

Question	Answers	Additional comments	Mark	AO
09	he has a genetic / inherited disease / Leber's hereditary optic neuropathy		1	AO3
	gene editing might stop babies being born with this condition in the future		1	
	(therefore) gene editing might save lives / improve the quality of life		1	

| **Total** | | | **3** | |

10	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 3 and apply a 'best-fit' approach to the marking.	9	AO3
0 marks	**Level 1 (1–3 marks)**	**Level 2 (4–6 marks)**	**Level 3 (7–9 marks)**
incorrect no answer	• uses **1** source and states an advantage or disadvantage • discussion shows little attempt at structure • little use of scientific vocabulary	• uses **at least 2** sources and states advantages and / or disadvantages • discussion shows structure • use of scientific vocabulary	• uses **3 or 4** sources and states advantages **and** disadvantages • discussion is well-structured with minimal repetition or irrelevant points • detailed use of scientific vocabulary

Examples of the points made in the response

Source	Effective	Less effective
A	• Very informative – explains what the new legislation actually means. • Plenty of science but broken down into sections / structured / headings. • Tackles the concerns and reassures – examples of language - 'only one group of scientists', 'for the sole purpose', 'they don't just automatically have permission to do whatever they like'. • Quotes from several experts.	• Aimed at young people - example 'share them with your concerned parents and co-workers'.
B	• Gets public's attention with title 'One giant step for designer babies'. • Very informative and explains current research. • Structured article with sub-headings makes it more readable. • Doesn't really have an opinion – just reporting the facts in a neutral way. Asking some questions about what will happen in the future.	• Lot of detailed information, names of scientists and institutions – may put people off reading it. • Language is quite scientific – eg 'intra-cytoplasmic injection' (could be used as positive or negative argument).

C	• Good article as it gives both views for and against gene editing. • Good argument in favour of gene editing by referring to other things that humans already do to save lives that don't count as 'natural'. • Data for numbers of children. Effective language – 'denial costs human lives'. • Against gene-editing and referring to Time magazine – discrediting the scientist 'mouse biologist' implying that it shouldn't apply to humans. Reference to Gattaca movie to make people think this is fictional and scary.	• Lot of text to read with no sub-headings – may prevent some people from reading it all.
D	• Written by someone with an inherited disease. • Emotive language – refers to 'your baby' making it personal to the reader 'mitochondrial disease kills' 'incurable' 'diseases like mine'. • Refers to a high-profile case of Charlie Gard to increase sympathy.	• May not be a scientist. • Doesn't include much actual scientific information.

Question	Answers	Additional comments	Mark	AO
11.1	disease is passed from parents to children		1	AO1
	through (faulty) genes / DNA		1	
11.2		an answer of 750 000 scores 2 marks		AO2
	30 000 × 25		1	
	750 000		1	
11.3	some of the children diagnosed are not newborns		1	AO3
11.4	(rare disease) any **one** from: • cystic fibrosis • Duchenne muscular dystrophy • fragile X syndrome		1	AO3
	(not a rare disease) any **one** from: • Down's syndrome • sickle cell anaemia		1	
11.5	less babies born with Duchenne muscular dystrophy. **or** more babies born with Down syndrome.		1	AO3
	Duchenne muscular dystrophy individuals don't live as long. **or** Down syndrome individuals live longer.		1	

11.6	any **two** from: • may not have noticeable symptoms **or** may not know they have it • might not have been diagnosed **or** might have been diagnosed as something else • don't die from it		2	AO3

11.7	more males have Fragile X syndrome than females		1	AO1
	caused by a mutation on the X chromosome **or** caused by faulty X chromosomes		1	AO1
	males have only one X chromosome **or** females have two X chromosomes		1	AO3
	so males don't have another 'normal' X chromosome **or** so females have another 'normal' chromosome **or** females only have Fragile X if both X chromosomes are faulty		1	AO3

11.8	genetic / DNA test	allow testing chromosomes	1	AO3

Total			**16**	

Question	Answers	Additional comments	Mark	AO
12	(research scientist) conducting / writing about experiments (on inherited diseases) (biomedical scientist) carrying out tests on tissue samples (from patients to diagnose inherited diseases) (pharmacologist) studying the action of drugs (used for inherited diseases) on the human body		1 1 1	AO2

| **Total** | | | **3** | |