AQA

LEVEL 3 CERTIFICATE AND EXTENDED CERTIFICATE

APPLIED SCIENCE

ASC3

Science In The Modern World

Mark scheme
January 2018

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1 8 1 A A S C 3 / M S

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

Marking methods

In fairness to candidates, all examiners must use the same marking methods. The following advice may seem obvious, but all examiners must follow it as closely as possible.

1. If you have any doubt about how to allocate marks to an answer, consult your Team Leader.

2. Refer constantly to the mark scheme and standardising scripts throughout the marking period.

3. Use the full range of marks. Don't hesitate to give full marks when the answer merits them.

4. The key to good and fair marking is consistency.

Introduction

The information provided for each question is intended to be a guide to the kind of answers anticipated and is neither exhaustive nor prescriptive. All appropriate responses should be given credit.

Where literary or linguistic terms appear in the Mark Scheme, they do so generally for the sake of brevity. Knowledge of such terms, other than those given in the specification, is not required. However, when determining the level of response for a particular answer, examiners should take into account any instances where the candidate uses these terms effectively to aid the clarity and precision of the argument.

Descriptions of levels of response

The following procedure must be adopted in marking by levels of response:

- read the answer as a whole

- work up through the descriptors to find the one which best fits

- where there is more than one mark available in a level, determine the mark from the mark range judging whether the answer is nearer to the level above or to the one below.

Since answers will rarely match a descriptor in all respects, examiners must allow good performance in some aspects to compensate for shortcomings in other respects. Consequently, the level is determined by the 'best fit' rather than requiring every element of the descriptor to be matched. Examiners should aim to use the full range of levels and marks, taking into account the standard that can reasonably be expected of candidates.

Question	Answers	Additional Comments/Guidelines	Mark
01.1	Any **two** from: • Abrasive sandblasting • Break up of large plastic ***OR*** large plastics eroded by water • Microfibres ***OR*** synthetic clothing ***OR*** synthetic fibres • Tyres	allow example of large plastic wastes in oceans ignore clothing unqualified	2
01.2	Any **two** from: • (significant) public concern ***OR*** awareness about environmental impacts • most is known about them • we can avoid using them • there are alternatives		2

01.3	Any **four** from: Small size: • they pass through water filtration systems • eaten by wildlife/marine life • large surface area • can form nanobeads that can pass through the gut wall Plastic material: • plastic is durable / strong / hard wearing / stable / slow to degrade • contain additives / chemicals / plasticisers / flame retardants / antimicrobials • can adsorb other chemicals/PBT's **or** transfer other chemicals/PBTs		4

01.4	Plastics can travel great distances (once they are in the oceans) They affect other countries ***OR*** they don't just affect the country that generated the pollution		1 1

Total			**10**

Question	Answers	Additional Comments/Guidelines	Mark
02.1	(microplastics) found in shellfish sold for human consumption	allow found in sea salt sold for human consumption allow some people may eat up to 11 000 microplastic particles per year	1
02.2	(Chinese people) might eat more shellfish in their diet ***OR*** Chinese waters might contain more microplastics	allow might eat more fish in their diet allow more plastic pollution in Chinese waters	1
02.3	(Nanoplastics are small enough to) pass through the gut wall ***OR*** (Nanoplastics can be) absorbed into the body	allow small enough to pass *'across the gut'*	1
Total			**3**

Question	Answers	Additional Comments/Guidelines	Mark
03	0.31% to 0.85% 80000 to 219000 tonnes of microplastics from Europe entering oceans per year 680 tonnes of microbeads used in UK each year $\frac{680}{80000} \times 100 = 0.85\%$ $\frac{680}{219000} \times 100 = 0.31\%$	Correct answer with or without calculation gets four marks in either order	 1 1 1 1
Total			**4**

Question	Answers	Additional Comments/Guidelines	Mark
04.1	Consumers can make (an informed) choice	allow consumers are fully informed of the contents of the product	1
04.2	Might affect sales of their products containing microbeads		1
Total			**2**

Question	Answers	Additional Comments/Guidelines	Mark
05.1	Microbeads make up only between 0.01 and 4.1% ***OR*** Microbeds make up a maximum of 4.1%		1
05.2	Any **four** from: • Put less plastic into landfill • Develop better separation processes for plastic • Recycle more plastic • Develop plastics that are more biodegradable • Raise awareness ***OR*** better education of plastic issue among the public • Better techniques to capture microplastics • More effective water treatment processes ***OR*** washing machine filtration systems	allow **one** mark for manage plastic waste better if none of these bullet points given allow idea of using alternatives to plastics	4
Total			**5**

Question	Answers	Additional Comments/Guidelines	Mark
06	Dr Ugelstad made / invented <u>microbeads</u> microbeads were initially used for (important) medical treatments (but) later turned out to cause major environmental / health problems		1 1 1
Total			**3**

Question	Answers	Additional Comments/Guidelines	Mark
07.1	Might slow down the development / use of other useful (microbead type) products (because) public perception is that microbeads are bad		1 1
07.2	The editorial had not been checked by other experts before being published This means that it may be less reliable / incorrect / inaccurate		1 1
07.3	Improve the technology of microbeads ***OR*** alter the surface of the microbeads So that the microbeads stick together and can be filtered		1 1
Total			**6**

Question	Additional Comments/Guidelines	Mark
08	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

0 marks	**Level 1 (1–3 marks)**	**Level 2 (4–6 marks)**	**Level 3 (7–9 marks)**
• Incorrect no answer.	• Uses **1** source and discusses validity and effectiveness **or** uses more than 1 source but does not comment on both validity and effectiveness. • Discussion shows little attempt at structure. • Little use of scientific vocabulary.	• Uses **at least 2** sources and discusses validity and effectiveness. ***OR*** • Uses **3 or 4** sources and discusses the validity or effectiveness of each. • Discussion shows some attempt at structure. • Some use of scientific vocabulary.	• Uses **3 or 4** sources and discusses validity and effectiveness of each. • Discussion is well-structured with minimal repetition or irrelevant points. • Use of specialist vocabulary for science.

Source	**Validity**	**Effectiveness**
A	• Royal Society of Chemistry is an internationally recognised organisation. • Valid source as it has taken its information from several other sources which are referenced. • Most facts/figures relate to UK and Europe so relevant.	• Scientific paper from a journal called Education in Chemistry published by Royal Society of Chemistry. • To be read primarily by teachers/lecturers in this area of science or other interested individuals. • Contains scientific terminology eg infrared spectroscopy, particulates. • High level language in general as aimed at educators/intelligent people eg synonymous, ubiquitous. • Lots of facts and figures which give detailed information to those who want it eg 275 million tonnes of plastic generated, 15 – 51 trillion particles.

Source	Validity	Effectiveness
B	• Independent report prepared for government so should be able to trust its findings. • Written after consultation with several other agencies, eg Environment Agency, so information should be accurate and up to date. • Figures relate to the UK so relevant to its audience.	• Government paper aimed at politicians (intelligent individuals but not necessarily scientists or those with any specialist knowledge). • High level language (not necessarily scientific terminology) eg terms such as 'legislative', 'transitional' and 'transparency'. • Contains lots of figures and statistics to illustrate points made eg 100000 plastic particles per shower, 680 tonnes of microbeads used in UK per year.
C	• Newspapers are commercial products – eg can its information be trusted, is the information cherry picked, does the newspaper have an agenda? • Quotes from a study on 'North America's great Lakes in 2012' so some validity but don't know how valid this actual source is. • Unlikely that anyone reading this article will check the authenticity of information. • Mentions the report detailed in source B so this information should be accurate.	• Major daily newspaper read by large numbers of the general public. • Article is story-like (eg story of Dr John Ugelstad, and of the double-crested cormorant) and so is easy reading for the general public. • Use of sensationalised language appeals to readers who may not usually be interested in scientific topics, eg heading 'Microbeads – tiny objects, massive problem?', plus in text 'useless droopy plastic soufflés', 'snacks for microscopic plankton' and 'sandpaper excess dermis off your face'. • Some use of scientific language as this is not a tabloid newspaper, considered to be read by reasonably intelligent individuals, but still sensationalised eg 'gnarled exoskeleton'. • Several well-known multinational organisations mentioned to increase the public's interest (organisations they will have heard of) eg L'Oreal/ Unilever/Procter and Gamble.
D	• Written about the personal opinions of scientists in this field. • Not validated with other sources. • Comment at bottom - 'reported as having no relevant disclosures' at the end – means they have no connections with any companies or individuals that would make their views biased.	• Specialised scientific paper (dermatology news). • Likely to be read only by others / subscribers in this specialised field. • Doesn't need to have sensationalised headlines and language as not read by the general public. • High level language - both scientific (eg aquatic ecosystems, nanotechnology) and non- scientific language (eg bipartisan consensus amongst law makers).

		• Scientists reading this will have knowledge of this field so can take these opinions and make up their own minds.

Question	Answers	Additional Comments/Guidelines	Mark
09.1	Money spent on household waste management increases Money spent on waste water management increases up until 2006 and then decreases again. More money spent on household waste management than water waste management. Correct data quoted from the table		1 1 1 1
09.2	$(\frac{12083}{15416} \times 100 =)$ 78.4%	allow answer in range of 78.38 to 78.40	1
09.3	Use of 12083 from the table (£)422.48	correct answer = 2 marks	1 1
Total			**7**

Question	Answers	Additional Comments/Guidelines	Mark
10.1	**Best:** Paper and cardboard **Worst:** Wood		1 1
10.2	Any **four** from: • The only metals used in packaging materials are aluminium and steel ***OR*** no other metal used • Most of the metal recycled comes from steel ***OR*** more steel is recycled than aluminium • More metal is recycled than the EU target • There are no EU targets for individual metals • Less metal waste from packaging		4
10.3	Wood Paper/cardboard		1 1
Total			**8**

Question	Answers	Additional Comments/Guidelines	Mark
11	(Ecologist) studies the effects (of the waste) on the environment / ecosystems / organisms (Analytical chemist) identify the chemicals in the waste ***OR*** Measures how much chemical is present (in the environment) (Laboratory technician) prepare the samples / machinery / equipment (needed by the analytical chemist and the ecologist)		1 1 1
Total			**3**