LEVEL 3 CERTIFICATE/EXTENDED CERTIFICATE

Applied Science

ASC3 – Unit 3 Science in the Modern World

Mark scheme

June 2018

Version/Stage: 1.0 Final

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	Mark	AO
01.1	any **two** from: • (flawed) reactor design • inadequately trained staff • automatic shutdown was turned off	allow idea of not enough trained staff if no other mark awarded allow **1** mark for high pressure caused by the steam	2	AO1
01.2	any **two** from: • published by a scientific organisation **or** published in a science journal • written for / by scientists • contains quantitative / statistical data • will have been peer reviewed	ignore reasons why newspapers are not as valid ignore has citations / references	2	AO3
Total			**4**	

Question	Answers	Additional comments	Mark	AO
02.1	53.57	Allow 53.6 and 54	1	AO2
02.2	(to ensure people received a) lower / safe dose of radiation **or** less risk of exposure to radiation	ignore reduction in death unqualified ignore saving people unqualified	1	AO3
02.3	radiation (in the area) had dropped **or** radiation was only slightly above normal (background levels) **or** radiation was very low		1	AO3
Total			**3**	

Question	Answers	Additional comments	Mark	AO
03.1	any **one** from: • monitoring the effects of the radiation / toxins on living organisms • monitor the level of radiation / toxins in living organisms	allow monitoring the effects on the environment allow human body **or** named examples of living organisms	1	AO2
03.2	no (reliable public health) data before 1986		1	AO3
03.3	they compared (the exposed group of people) to a control group **or** they compared (the exposed group of people) to a group who had not been exposed		1	AO3
Total			**3**	

Question	Answers	Additional comments	Mark	AO
04.1	any **one** from: • newspapers often exaggerate the truth or • newspapers are not always reliable • Greenpeace might be biased		1	AO3
04.2	(some) radioactive isotopes have a long half-life (so) stay in the environment / food chain (for a long time) (because) they take a long time to decay (to half) **or** (because) they take 30 years to decay (to half)	allow caesium (137) has a half-life of 30 years allow description of how the radiation enters the food chain	1 1 1	AO3
04.3	any **one** from: • increase funding for continuing testing and protection • (provide people with ways to) avoid eating contaminated food (eg by compensating them financially) • resettle / rehome people (in unaffected areas) • avoid using wood from the contaminated area(s)	 allow any examples of this, such as importing food	1	AO3
Total			**5**	

Question	Answers	Additional comments	Mark	AO
05.1	people who want to read about strange / unbelievable / shocking facts **or** children / young people		1	
05.2	any **two** from: • language is very sensationalised / exaggerated • use of colloquialism **or** limited scientific language use • example of sensationalised language, such as 'deadly elephant's foot' / 'it can kill you in 5 minutes' / 'ate through concrete' / 'you're a goner' / 'something strange is happening'	allow specific examples of how the ease of reading is established such short paragraphs	2	
05.3	not peer reviewed **or** not referenced		1	
Total			**4**	

Question	Answers	Additional comments	Mark	AO
06.1	no humans / people (to influence wildlife)	allow reference to behavioural adaptations to environmental changes	1	AO3
06.2	any **two** from: • monitoring / studying how the environment affects the animals • monitor / study animal behaviour • monitor / study the effect of animals on each other **or** monitor the food web / chain	allow monitoring the number of animals	2	AO2
Total			**3**	

Question	Answers	Additional comments	Mark	AO
07.1	develop new / improved materials (with improved properties) test materials (to find out how materials behave under different conditions)		1 1	AO2
07.2	any **two** improvements from: • more watertight • more airtight / sealed • no need for access points **or** no need for people to go inside • stronger **or** more stable **two** corresponding reasons from: • (more watertight) so that radioactive liquids cannot escape • (more airtight) so no radioactive particles can escape • (no need for access points or no need for people to go inside) because internal cranes can be operated from outside • (stronger or more stable so) less likely to collapse	ignore ref to durability and lasting longer allow larger so covers more (contaminated) ground for **2** marks	2 2	AO1 AO3
Total			**6**	

Question	Answers	Additional comments	Mark	AO
08	any **three** from: • scientist / researcher submits article • article sent to (anonymous) reviewers (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		3	AO1

Total			**3**

Question	Answers	Additional comments	Mark	AO

09	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	• discusses **1** group of people, and the exposure **or** consequence • discussion shows little attempt at structure • little use of scientific vocabulary	• discusses **2** or **3** different groups of people and the exposures **and/or** consequences • discussion shows some attempt at structure • some use of scientific vocabulary	• discusses **at least 3** different groups of people and the exposures **and** consequences • discussion is well-structured with minimal repetition or irrelevant points • use of specialist scientific vocabulary	

Examples of the points made in the response

People involved	Exposure	Consequences
Reactor crew / operators / on-site personnel	Direct inhalation / breathing in of (dust) particles released during the explosions	2 died on day of accident and 28 more died within a few weeks
	External radiation caused by (the radioactivity released by) the fires	
Firemen / emergency workers	Direct inhalation / breathing in from the cloud of contaminated air around the reactor immediately after the accident	Of the 28 people who died within a few weeks, 6 were firemen
	External radiation from (extinguishing) the fires	
Liquidators / clean-up workers	Direct inhalation / breathing in from the cloud of contaminated air	Increased risk of cancer in the long term
	Inhalation of re-suspended activity / settled dust when moving around the site	
Local residents (of Pripyat)	Direct inhalation / breathing in from the cloud of contaminated air in days following accident	Most who were evacuated received only low doses of radiation.
	Inhalation of re-suspended activity / ingestions of contaminated food and drink (such as grain and milk)	
Residents in areas of Belarus, Russia and Ukraine	Deposition into the soil leading to radiation present in food and drink Radiation present in the wood used for construction	Increase in cases of thyroid cancer in exposed children – leading to 9 deaths (not necessarily proved to be caused by radiation exposure). No scientific evidence of increases in overall cancer incidence
Workers who built the concrete sarcophagus	Inhalation of re-suspended activity / settled dust when moving around the site	Increased risk of cancer in the long term
Researchers accessing the concrete sarcophagus	Direct radiation from the Elephant's foot / corium	Would die quickly if exposed
Workers who built the new steel shelter	Minimal inhalation of re-suspended activity / settled dust when moving around the site because the shelter was built off-site and assembled several hundred meters away and slid into place.	Should be no long term effects
Tourists	Minimal inhalation of re-suspended activity due to new airtight shelter.	Should be no long term effects.

Total			**9**

Question	Answers	Additional comments	Mark	AO
10.1	any **two** from: • running out of (other) non-renewable sources / fossil fuels • nuclear power has low CO_2 emissions • nuclear power is reliable • increasing demand for power • nuclear power is more energy dense • provides energy security	ignore ref to cost allow nuclear power produces no CO_2 allow nuclear power produces less greenhouse gases	2	AO3
10.2	(1 nuclear reactor) 11 ÷ 449 = 0.024(%) (Total number of reactors) 449 + 60 = 509 (509 reactors) 0.024 x 509 = 12.2(%)	an answer of 12.2 / 12.22 / 12.216 / 12.47 / 12.5 scores **3** marks allow if correctly given to more than three dp allow correct calculated answer from value in step 1	1 1 1	AO2
Total			**5**	

Question	Answers	Additional comments	Mark	AO
11.1	can compare different forms of energy (within same year) can compare use of each form of energy over time	 if no other marks awarded allow 1 mark for idea of clear representation of data **or** data can be compared **or** data is categoric	1 1	AO2
11.2	any **three** from: • solar (panels) • wind (turbines) • wave • tidal • hydroelectric (power) • geothermal • biomass		3	AO1
11.3	any **three** from: • less wind • less sunshine • increase use of nuclear power • increase use of gas • increase use of other fuels • increase imported electricity (from France)		3	AO3
Total			**8**	

Question	Answers	Additional comments	Mark	AO
12.1	France		1	AO3
12.2	any **one** from: • highest percentage of total energy produced by nuclear power • large number of reactors compared to the size of the country	allow **1** mark for the most reactors / most energy from nuclear power if USA given in **Question 12.1**	1	AO3
12.3	USA produces almost 4 times as much energy (from nuclear power) as China **or** USA produces 594.8 billion kwh more energy (from nuclear power) than China USA has almost 3 times as many reactors as China **or** USA has 63 more reactors than China USA produces more than 5 times as much (nuclear) power as a percentage of the total energy produced as China **or** USA produces 16.1% more of their total energy from nuclear power than China	answers must be comparative allow correct use of numbers in comparative statements	1 1 1	AO3

12.4	21.2 (%) = 65.1 (billion kWh) **or** $\frac{65.1}{21.2}$ $(\times 100)$ 307	an answer of 307 scores 2 marks	1 1	AO2

Total			**7**