AQA

GCSE
Additional Science / Physics
PH2HP
Mark scheme

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

Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8   Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9   Ignore / Insufficient / Do <u>not</u> allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4.   Quality of Communication and levels marking

In Question **2(d)** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	starting / stopping the stopwatch **or** timing over the smaller distances	human error is insufficient reaction time is insufficient accept not timing accurately do not accept references to measuring distance incorrectly	1	AO3 2.1
1(b)(i)	before		1	AO3 2.1
1(b)(ii)	increasing	accept accelerating it is not constant is insufficient it is less than after four seconds is insufficient it reaches a constant speed negates	1	AO3 2.1.2b
1(b)(iii)	calculate the gradient of the straight/steepest/constant section	accept gradient of any section after 5.5 seconds/30 cm	1	AO1 2.1.2b
1(b)(iv)	drag (force) increases (as the ball bearing gets faster) (until) drag (force) = weight **or** (until) resultant force is zero	accept frictional/upward force for drag accept upward force = downward force accept till forces are balanced	1 1	AO1 2.1.4b

1(c)	less than		1	AO3 2.1.4a/b
	ball bearing increases speed at a greater rate **or** ball bearing has a greater acceleration **or** terminal velocity has not been reached	accept it travels the same distance in less time accept the ball bearing is going faster	1	
	so resultant force must be greater **or** as weight is the same (the drag must be less)	accept warmer oil has a lower density/viscosity for 1 mark if neither of the two reason marks score	1	
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	2 protons and 2 neutrons	accept 2p and 2 n accept (the same as a) helium <u>nucleus</u> symbol is insufficient do not accept 2 protons and neutrons	1	AO1 2.5.2c
2(b)(i)	gamma rays		1	AO1 2.5.2e
2(b)(ii)	loses/gains (one or more) <u>electron</u>(s)		1	AO1 2.5.1d
2(c)	any **one** from: • wear protective clothing • work behind lead/concrete/glass shielding • limit time of exposure • use remote handling	accept wear mask/gloves wear goggles is insufficient wear protective equipment/gear is insufficient accept wear a film badge accept handle with (long) tongs accept maintain a safe distance accept avoid direct contact	1	AO2 2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(d)	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 4 and apply a 'best-fit' approach to the marking.		6	AO1 2.5.2e 2.5.2f

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	There is a description of at least one type of radiation in terms of one or more properties.	There is a description of at least two types of radiation in terms of some properties **or** a full description of one type of radiation in terms of all three properties **or** the same property is described for all three radiations	There is a description of all three types of radiation in terms of at least two of their properties **or** a full description of two types of radiation in terms of all three properties.

examples of physics points made in the response	extra information
alpha particles • are least penetrating • are stopped by paper / card • have the shortest range • can travel (about) 5cm in air • are (slightly) deflected by a magnetic field • alpha particles are deflected in the opposite direction to beta particles by a magnetic field **beta particles** • (some are) stopped by (about) 2mm (or more) of aluminium/metal • can travel (about) 1 metre in air • are deflected by a magnetic field • beta particles are deflected in the opposite direction to alpha particles by a magnetic field **gamma rays** • are the most penetrating • are stopped by (about) 10cm of lead • have the longest range • can travel at least 1 km in air • are not deflected by a magnetic field	accept (some are) stopped by aluminium foil

| **Total** | | | **10** |

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	3rd box from the left ticked		1	AO2 2.3.2j
3(b)	correct symbol drawn in series with other components	symbol must have upper case A	1	AO1 2.3.2c
3(c)(i)	9 + 3 = 12V	reason only scores if this mark scored	1	AO2 2.3.2k
	pd of battery is shared between the variable resistor and fixed resistor	accept $V_1 + V_2$ = pd of the battery accept p.d. is shared in a series circuit accept voltage for p.d.	1	AO1 2.3.2k
3(c)(ii)	600	reason only scores if this mark scored	1	AO2 2.3.2k
	p.d. of supply shared equally when resistors have the same value **or** ratio of the p.d. is the same as the ratio of the resistance		1	AO1
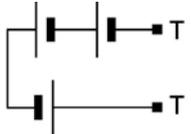
Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(c)(iii)	0.015 **or** their (c)(i) ÷ (their (c)(ii) + 200) correctly calculated	allow **2** marks for correct substitution ie 12 = I × 800 **or** their (c)(i) = I × (their (c)(ii) +200) allow **1** mark for total resistance = 800 (Ω) or their (c)(ii) + 200 **or** allow **1** mark for a substitution of 12 = I × 200 **or** their (c)(i) = I × 200 **or** alternative method using the graph V = 3 V (1) 3 = I × 200 (1)	3	AO2 2.3.2k 2.3.2h
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	pin made from brass because it is (hard and) a (good electrical) conductor outer case plastic/rubber because it is a (good electrical) insulator	accept copper for brass metal is insufficient heat conductor on its own negates heat insulator on its own negates	1 1	AO1 2.4.1f
4(b)(i)	live		1	AO1 2.4.1g
4(b)(ii)	makes it hot/warm	melts is insufficient	1	AO1 2.4.2a
4(b)(iii)	8.7	accept an answer that rounds to 8.7 allow **1** mark for correct substitution ie 2000 = 230 × I an answer of 0.0087**or** 0.009 **or** 3.0(4) **or** 5.65 **or** 5.7 gains **1** mark	2	AO2 2.4.2c
4(c)	a (large) current goes from the live wire to the earth wire (which causes) the fuse to (overheat and) melt	accept metal case for live wire accept a current goes from live to earth do not accept electricity for current accept blow for melt break is insufficient do not accept snap / blow up for melt	1 1	AO1 2.4.1k

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(d)	reduce chance of an electric shock	accept to reduce the risk of an accident accept prevent electric shock accept prevent electrocution accept prevent or reduce the risk of an (electrical) fire accept an electric shock can kill you accept it can kill you accept so you can use it safely	1	AO3 2.4
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	elastic potential		1	AO1 2.1.5b 2.2.1c
5(b)(i)	line is straight	accept line does not curve	1	AO1 2.1.5c
5(b)(ii)	400	allow **1** mark for correct substitution of any pair of numbers correctly taken from the graph e.g.160 = k × 0.40	2	AO2 2.1.5d
	newtons per metre **or** N/m	if symbols are used they must be correct	1	AO1 2.1.5d
5(b)(iii)	300	allow **1** mark for correctly obtaining force on 1 spring = 100N	2	AO3 2.3.2l
5(c)	52	allow **2** marks for calculating change in gpe for 1 chin-up as 260 (J) or for 12 chin-ups as 3120 (J) an answer 4.3 gains **2** marks allow **1** mark for correct substitution into gpe equation ie gpe = 65 × 10 × 0.4 (×12) **or** correct use of power equation with an incorrect value for energy transferred	3	AO2 2.2.1e
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	(enough) dust and gas (from space) is pulled together by: gravitational attraction **or** gravitational forces **or** gravity	accept nebula for dust and gas accept hydrogen for gas accept gas on its own dust on its own is insufficient mention of air negates this mark ignore any (correct) stages beyond this	1 1	AO1 2.6.2c
6(a)(ii)	joining of two (atomic) nuclei (to form a larger one)	do not accept atoms for nuclei	1	AO1 2.6.2a
6(a)(iii)	more sensitive astronomical instruments / telescopes **or** infrared telescopes developed	accept better technology more knowledge is insufficient	1	AO3 2.6
6(b)(i)	(other) planets / solar systems	do not accept galaxy moons is insufficient	1	AO3 2.6
6(b)(ii)	provided evidence to support theory	accept proves the theory	1	AO1 2.6
6(c)	elements heavier than iron are formed only when a (massive) star explodes	accept materials for elements accept supernova for star explodes accept stars can only fuse elements up to (and including) iron	1	AO1 2.6.2f
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	resultant force = zero **or** upward force = downward force	accept forces are balanced accept weight for downward force	1	AO1 2.1.1d
7(b)(i)	84	allow **1** mark for correct substitution ie 840 = m × 10	2	AO2 2.1.4d
7(b)(ii)	12 **or** 1010 ÷ their (b)(i) correctly calculated m/s^2	accept 12.02 for both marks a resultant force of 1010 (N) gains **1** mark an answer 22(.02) gains 1 mark accept m/s/s	2 1	AO2 2.1.2a AO1 2.1.2a
Total			**6**	