GCSE

Physics

PH3HP

Mark scheme

4403

June 2016

Version/Stage: 1.0 Final 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 not 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 **1(b)** 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)	an electromagnet can be switched off **or** an electromagnet is stronger	accept a permanent magnet cannot be switched off accept control the strength	1	AO1 P3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(b)	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 5 and apply a 'best-fit' approach to the marking.		6	AO1 AO2 P3.3.1a P3.3.1c

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant / correct content	there is a basic description of how to make an electromagnet **or** there is a basic description of how the strength of the electromagnet can be varied **or** there is a basic description of how the electromagnet can be tested	there is a description of how the electromagnet is made **and either** there is a description of how the strength of the electromagnet can be varied **or** there is a description of how the electromagnet can be tested	there is a description of how the electromagnet is made **and** there is a description of how the strength of the electromagnet can be varied **and** there is a description of how the strength of the electromagnet can be tested

Question 1b continues on the next page . . .

examples of the points made in the response	extra information	
Details of how to make an electromagnet • wrap the wire around the nail • connect the wire to the power supply (with connecting leads and croc clips) • switch on the power supply	 accept a current should be sent along the wire	
Details of how to vary the strength of the electromagnet • change the number of turns (on the coil) • change the current (through the coil) • change the separation of the turns	 allow change the potential difference (across the coil) accept wrap the coil more tightly	
Details of how to test the electromagnet • suspend paperclips from the electromagnet • the more paperclips suspended, the stronger the electromagnet is • clamp the electromagnet at different distances from the paperclip(s) • the further the distance from which paperclips can be attracted the stronger the electromagnet is • test before and after making alterations to change the strength • compare the results from before and after making alterations • use de-magnetised paper clips	 accept count the number of paperclips with different current **or** p.d. **or** no. of turns **or** core and see if the number changes/increases	

Total			7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	a magnetic field that is alternating / changing	accept electromagnetic field heat is insufficient	1 1	AO1 3.3.2d
2(b)	20	allow **1** mark for correct substitution, ie $\frac{230}{11.5}$ provided no subsequent step	2	AO2 3.3.2g
2(c)	(most) transformers are not 100% efficient	allow energy / power is lost to the surroundings allow energy / power is lost as heat / sound power is lost is insufficient	1	AO1 3.3.2h
2(d)(i)	0.01 (V) because there is a change in p.d. each time (the number of turns changes)	 allow because all the results (to 2 decimal places) are different accept if results were to 1 decimal place, there might not be a difference	1 1	AO3 3.3.2a 3.3.2b
2(d)(ii)	student 2 moved the coil more slowly (than student 1)	accept student 2 moved the coil at a different speed to student 1 do not accept student 2 moved the coil faster (than student 1)	1	AO3 3.3.2a 3.3.2b
2(d)(iii)	both sets of results show the same pattern	accept trend for pattern results are similar is insufficient results follow a pattern is insufficient	1	AO3 3.3.2a 3.3.2b

Question 2 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(d)(iv)	(electromagnetic) induction	accept it is induced do not accept electric / magnetic induction	1	AO1 3.3.2a
2(e)	any **one** from: • more economical / cheaper for the consumer • easier/cheaper to replace if broken/lost • since fewer transformers need to be made less resources are used	allow more convenient allow in case one gets lost allow fewer plug sockets are needed allow fewer transformers are needed environmentally friendly is insufficient	1	AO3 3.3.2
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	ultrasound is not ionising	allow ultrasound does not harm the (unborn) baby	1	AO1 3.1
	but X-rays are ionising		1	
	so X-rays increase the health risk to the (unborn) baby	accept specific examples of health risks, eg cancer, stunted growth, impaired brain function etc X-rays are dangerous is insufficient	1	
3(b)	ultrasound/waves are partially <u>reflected</u> (when they meet a boundary) (between two different media / substances / tissues)	must be clear that not all of the wave is reflected	1	AO1 3.1.2b
	the time taken is measured (and is used to determine distances)		1	
3(c)	1600 (m/s)	800 (m/s) gains **2** marks 160 000 (m/s) gains **2** marks 0.0016 (m/s) gains **2** marks allow **2** marks for $\frac{0.04}{25 \times 10^{-6}}$ or $\frac{0.08}{50 \times 10^{-6}}$ 80 000 (m/s) gains **1** mark 0.0008 (m/s) gains **1** mark allow **1** mark for $\frac{0.04}{25}$ or $\frac{0.08}{50}$ allow **1** mark for evidence of doubling the distance or halving the time	3	AO2 3.1.2c

Question 3 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(d)(i)	they are absorbed by bone	allow stopped for absorbed X-rays are reflected negates this mark	1	AO1 3.1.1a
	they are transmitted by soft tissue	allow pass through for transmitted allow flesh / muscle / fat accept less (optically) dense material for soft tissue	1	
	(the transmitted) X-rays are detected		1	
3(d)(ii)	short	accept small	1	AO1 3.1.1a
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	angle of incidence: A angle of refraction: D		1	AO1 3.1.3a 3.1.3c
4(b)	42 (degrees)	an answer of 41.8° gains **2** marks an answer that rounds to 42° gains **2** marks an answer of 37 gains **2** marks allow **1** mark for correct substitution i.e. $\sin(c) = \frac{1}{1.5}$ **or** sin(c) = 0.67 provided no subsequent steps	3	AO2 3.1.5a
4(c)	• ray B took longer than ray A (to travel through the optical fibre) • so the pulse spreads out	allow ray B travels further than ray A allow the rays emerge at different times	1 1	AO3 3.1.5b
Total			6	

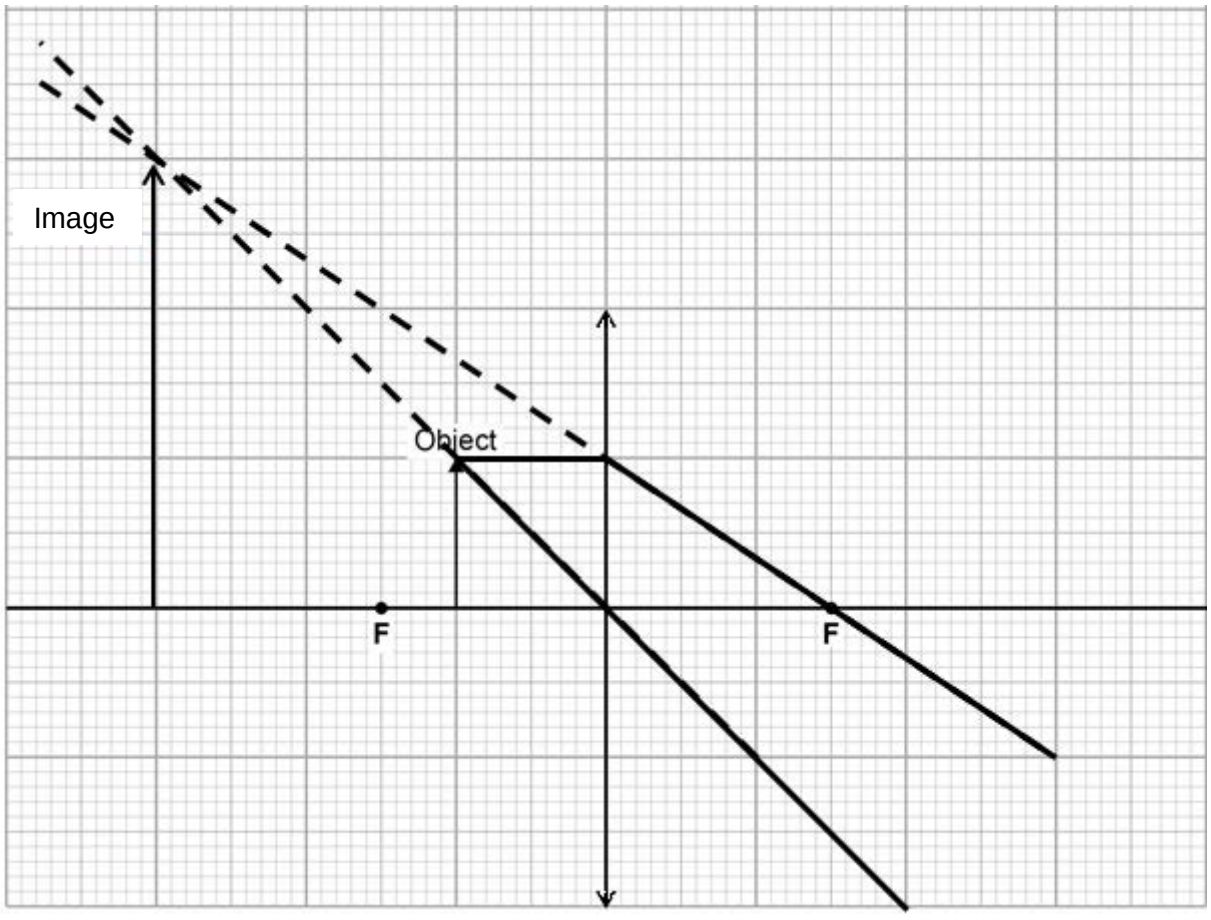
Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	turning effect	accept force multiplied by perpendicular distance from the line of action of the force to the pivot	1	AO1 3.2.2a
5(a)(ii)	moments are equal (in size) and opposite (in direction)	both parts are required allow clockwise moment = anticlockwise moment	1	AO1 3.2.2c
5(a)(iii)	0.9 (N)	allow **2** marks for $F=0.18 \div 0.2$ provided no subsequent steps allow **1** mark for (anticlockwise moment) = 0.18 (Nm) allow **1** mark for correct substitution i.e. 1.5 × 0.12 = F × 0.20	3	AO2 3.2.2e
5(b)	a longer drumstick lever gives a quieter sound a longer drumstick lever allows a greater range of volumes	a greater force gives a louder sound is insufficient	1 1	AO3 3.2.2e
Total			7	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	the point where the mass is (thought to be) concentrated		1	AO1 3.2.1a
6(a)(ii)	the centre of mass is higher the base (area) is smaller / narrower		1 1	AO2 3.2
6(b)	(the blocks at A and B) create equal and opposite moments the resultant moment is zero **or** the block at A creates an anti-clockwise moment (1) so this must be balanced by an equal clockwise moment from the block at B (1)	 accept (moments are in) equilibrium / balanced	1 1	AO1 3.2.2c
Total			5	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)(i)	the eyeball is too short **or** the lens is too weak/thin	accept the light is focussed behind the retina accept the lens is unable to focus accept the cornea is not curved enough old age / inherited is insufficient	1	AO1 3.1.4b
7(a)(ii)	a laser		1	AO1 3.1.5c
7(b)	the image would decrease in size the image would change (from virtual) to real the image would change (from non-inverted) to inverted	 accept that the image (of bulb M) can be projected on to a screen 	1 1 1	AO1 3.1.3d

Question 7 continues on the next page . . .

7(c)	a ray through the centre of the lens	rays should be drawn with a ruler ignore arrows	1	AO2 3.1.3h
	a ray parallel to the principal axis and passing through the principal focus to the right of lens	accept solid or dashed lines accept a ray drawn as if from the principal focus to the left of the lens, emerging parallel to the principal axis	1	
	image drawn where rays cross	image should be to left of the lens	1	



Question 7 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(d)(i)	(because the glass in) lens A has a greater refractive index	accept lens A is more powerful accept lens A has a shorter focal length	1	AO3 3.1.3f
7(d)(ii)	when the magnification increases by 1, the image distance increases by 10 cm	accept for **1** mark it is a linear pattern or as the image distance increases, the magnification increases do **not** accept directly proportional	2	AO3 3.1.3i
7(d)(iii)	diagram showing the surfaces of a convex lens C having greater curvature than lens B	the size of the lens drawn is not important	1	AO1 3.1.4f
Total			12	