
GCSE PHYSICS

PH3HP
Mark scheme

4403
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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

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 / ; e.g. allow smooth / free movement.

3. **Marking points**

3.1 **Marking of lists**

This applies to questions requiring a set number of responses, but for which candidates 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 error / 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)

Candidate	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)

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

3.2 Use of chemical symbols / formulae

If a candidate 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 are 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 Ignore / Insufficient / Do **not** allow

Ignore or 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.

Quality of Written Communication and levels marking

In Question 3(a) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates 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)	(sound waves) which have a frequency higher than the upper limit of hearing for humans or a (sound) wave (of frequency) above 20 000 Hz	sound waves that cannot be heard is insufficient a wave of frequency 20 000 Hz is insufficient	1	AO1 3.1.2a
1(b)	640	an answer of 1280 gains 2 marks allow 2 marks for the correct substitution ie 1600×0.40 provided no subsequent step allow 2 marks for the substitution $\frac{1600 \times 0.80}{2}$ provided no subsequent step allow 1 mark for the substitution 1600×0.80 provided no subsequent step allow 1 mark for the identification that time (boat to bed) is 0.4	3	AO2 3.1.2c
1(c)	any one from: <ul style="list-style-type: none"> pre-natal scanning / imaging imaging of a named organ (that is not surrounded by bone), eg stomach, bladder, testicles Doppler scanning blood flow 	accept heart do not allow brain or lungs (either of these negates a correct answer)	1	AO1 3.1.2d

Question 1 continues on the next page . . .

Question 1 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
1(d)	advantage any one from: <ul style="list-style-type: none"> • (images are) high quality or detailed or high resolution • (scan) produces a slice through the body • image can be viewed from any direction • an image can be made of <u>any</u> part (inside the body) • easier to diagnose or see a problem (on the image) 	clearer / better image is sufficient allow images are (always) 3D / 360° allow whole body can be scanned	1	AO1 3.1
	disadvantage any one from: <ul style="list-style-type: none"> • (the X-rays used or scans) are ionising • mutate cells or cause mutations or increase chances of mutations • turn cells cancerous or produce abnormal growths or produce rapidly growing cells • kill cells • metal/lead/glass/concrete shielding is needed 	allow a description of what ionising is allow for cells: DNA / genes / chromosomes / nucleus / tissue damage cells is insufficient can be dangerous (to human health) unqualified, is insufficient	1	
Total			7	

Question	Answers	Extra information	Mark	AO spec ref
2(a)	gravitational attraction (between the satellite and the Earth)	allow gravity allow weight of the satellite	1	AO1 3.2.4b
2(b)	any two from: <ul style="list-style-type: none"> • mass of satellite • speed / velocity (of satellite) • radius of orbit / circle 	allow height above the Earth radius / height alone is insufficient	2	AO1 3.2.4c
2(c)(i)	increasing the height (above the Earth's surface) increases the time (for one orbit)	allow a positive correlation allow as one gets bigger, the other gets bigger, or vice versa ignore they are directly proportional	1	AO3 4.5.3
2(c)(ii)	there is no relationship / correlation		1	AO3 4.5.3
2(d)	Isaac Newton was a respected scientist who had made new discoveries before		1	AO3 3.2.4, SALoSE
Total			6	

Question	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.			Mark	AO spec ref
3(a)				6	
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	AO1 3.3.2	
No relevant / correct content.	<p>Either there is an attempt at a description of the construction of a transformer</p> <p>or a correct statement of the effect of one type of transformer on the input p.d.</p>	There is a description of the construction of a transformer and a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer and there is a correct description of how transformers affect the input p.d.		
<p>details of construction:</p> <p>a (laminated) core core is made from a magnetic material / iron 2 coils the coils are made from an electrical conductor / copper the coils are covered in plastic / insulation the coils are (usually) on opposite sides step-up transformer has more turns on secondary coil than (its) primary (or vice versa) step-down transformer has less turns on secondary coil than (its) primary (or vice versa)</p> <p>effect on input p.d. :</p> <p>step-up transformer, the output p.d. is greater (than the input p.d.) step-down transformer, the output p.d. is lower (than the input p.d.)</p>			<p>extra information</p> <p>accept voltage for p.d.</p>		

Question 3 continues on the next page . . .

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(b)	switch mode (transformer)		1	AO1 3.3.2j
Total			7	

Question	Answers	Extra information	Mark	AO spec ref
4(a)	3800	allow 1 mark for 2000 allow 1 mark for 1800 if neither of above scored, allow correct substitution for 1 mark (800 × 2.5) + (600 × 3) if moments have been calculated incorrectly, allow 1 mark for adding their two moment values correctly	3	AO1 AO2 3.2.2b
	newton metres or Nm	do not allow nm or NM	1	
4(b)	as the girl increases her distance (from the pivot) the clockwise moment increases		1	AO3 3.2.2b, c
	(F must increase) as the anticlockwise moment must increase		1	
	so (the anticlockwise moment) is equalled / balanced by the clockwise moment or so resultant / overall moment (on the board) is zero	accept to balance / equal the moments to balance the board is insufficient	1	
Total			7	

Question	Answers	Extra information	Mark	AO spec ref
5(a)	CCD / charged coupled device	ignore sensor do not allow film	1	AO1
	pupil	do not allow iris	1	3.1.4d
5(b)	the eye(ball) being too short		1	AO1
	the (eye) lens being unable to focus (an image at the retina) or the (ciliary) muscles being unable to change the shape of the lens sufficiently	accept cornea / lens is not curved enough accept lens is not powerful enough or too weak accept lens being unable to accommodate	1	3.1.4b
5(c)	0.31(25)	allow 1 mark for correct substitution, ie $\frac{1}{3.2}$	2	AO2 3.1.4c
5(d)(i)	1.4	allow 2 marks for $\frac{0.5}{0.358}$ allow 2 marks for 1.39 an answer of 0.72 gains 2 marks allow 1 mark for correct substitution, ie $\frac{\sin 30^\circ}{\sin 21^\circ}$ allow 1 mark for both sine values correctly calculated ie 0.5 and 0.358 ignore any units	3	AO2 3.1.3c

Question 5 continues on the next page . . .

Question 5 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
5(d)(ii)	the lenses can be made thinner	allow the lenses / spectacles/ glasses are lighter allow uses less glass	1	
Total			10	

Question	Answers	Extra information	Mark	AO spec ref
6(a)	suspend shape from a point / pivot / pin	can be shown on labelled diagram	1	AO1 3.2.1a
	attach pendulum (bob) / plumb line to point of suspension		1	
	draw (vertical) line on card where string rests		1	
	suspend card from another point and draw (a second vertical) line on card where string rests		1	
	where two lines cross = centre of mass		1	
		alternative method max 3 marks: balance card on a point (1) find point where card rests horizontally (1) this point is the centre of mass (1)		
6(b)(i)	(the line of action of) the weight acts/lies outside the base	reference to centre of mass unqualified is insufficient	1	AO1 3.2.2f
	there will be a resultant moment	references to stability insufficient	1	

Question 6 continues on the next page . . .

Question 6 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
<p>6(b)(ii)</p>	<p>move the wheels further apart</p>	<p>answers must be comparative to diagram</p> <p>accept any method that would give a <u>wider</u> base</p> <p>accept tilt the wheels</p> <p>accept on own, make a wider base but not wider seat</p>	<p>1</p>	<p>AO2</p> <p>3.2</p>
	<p>lower the seating position</p>	<p>accept any method that would lower the centre of mass, eg place heavy mass under the chair</p> <p>accept on own make it have a <u>lower</u> centre of mass</p> <p>make wheelchair heavier on its own is insufficient</p>	<p>1</p>	
<p>Total</p>			<p>9</p>	

Question	Answers	Extra information	Mark	AO spec ref
7(a)	because the angle of incidence is greater than critical angle	accept the light is totally internally reflected	1	AO1 3.1.5a
7(b)	41.8	allow 1 mark for correct substitution, eg $1.5 = \frac{1}{\sin c}$ or $\sin c = \frac{1}{1.5}$ or $c = \sin^{-1} \frac{1}{1.5}$	2	AO2 3.1.5a
7(c)	(for both fibres) increasing the <u>wavelength</u> of light decreases and then increases the percentage / amount of light transmitted (for both fibres) the minimum transmission happens at 5×10^{-7} metres) or maximum transmission occurs at 6.5×10^{-7} metres) the shorter fibre transmits a greater percentage of light (at the same wavelength)	accept for 1 mark: (for both fibres) increasing the <u>wavelength</u> (of light) to 5×10^{-7} metres), decreases the (percentage) transmission accept for a further 1 mark: (for both fibres) increasing the <u>wavelength</u> of the light from 5×10^{-7} metres) increases the amount of light transmitted increasing <u>wavelength</u> (of light), decreases the percentage transmitted is insufficient on its own accept for 1 mark: Any statement that correctly processes data to compare the fibres	1 1 1	AO3 4.5.3
Total			6	

Question 8 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
8(d)	<p>(the current flowing through the coil) creates a magnetic field (around the coil)</p> <p>(this magnetic field) interacts with the permanent magnetic field or current carrying conductor is in a (permanent) magnetic field</p> <p>this produces a (resultant) force (and coil / cone moves)</p> <p>when the direction of the current changes, the direction of the force changes to the opposite direction</p>	<p>it must be clear which magnetic field is which</p> <p>accept for 2 marks the magnetic field of the coil interacts with the permanent magnetic field</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>AO2 AO3</p> <p>3.3.1a, b</p>
Total			8	