GCSE

Physics

PH3HP

Final 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

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 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.

4. Quality of Communication and levels marking

In Question **2(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)	any **two** from: • The number of turns on the coil • The strength of the magnet • The (stiffness of the) elastic bands	do not accept number of coils allow how tightly the turns are wrapped allow distance between the magnet and coil / cone allow strength/elasticity/tension for stiffness ignore references to size of paper cone change direction of current or magnet is insufficient	2	AO3 3.3.1c
1(b)(i)	1.3 (cm)	two values (1.4 and 2.7) correctly taken from the graph scores **1** mark	2	AO2 3.3.1b
1(b)(ii)	any **two** from: • (Below 1A) as the current increases the distance increases • Above 1A the distance does not change (with current) • Between 0.3A and 0.7A the relationship is linear	accept the maximum distance (that the cone can move) is 2.8 cm accept between 0.6 cm and 2.2 cm the relationship is linear ignore references to positive correlation and direct proportionality a description of the shape of the graph is insufficient eg the line levels off after 1A	2	AO3 3.3.1c
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	any **one** from: • They don't need replacing if your eyesight changes • They don't need an optician/specialist to prescribe them	accept they can be adjusted to see near or far objects allow only need one pair of glasses can be re-used by other people is insufficient ignore they are cheaper than traditional glasses they focus on objects at different distances is insufficient	1	AO3 3.1.4b

2(b)			6	AO1 AO3 3.1.4b 3.1.4a

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.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant comments	Describes how an image is formed by the eye **or** Identifies that the lens changes shape to focus light **or** Gives the reason why long **or** short sight gives a blurred image	Explains how an image is formed by the eye **and** **either** Identifies that the lens changes shape to focus light from objects at different distances **or** Gives the reason why long **or** short sight gives a blurred image	Clearly explains how an image is formed by the eye **and** **either** Explains how the lens changes shape to focus light from objects at different distances **or** Correctly identifies that in long sight the image is focused behind the retina **and** for short sight it is focused in front of the retina

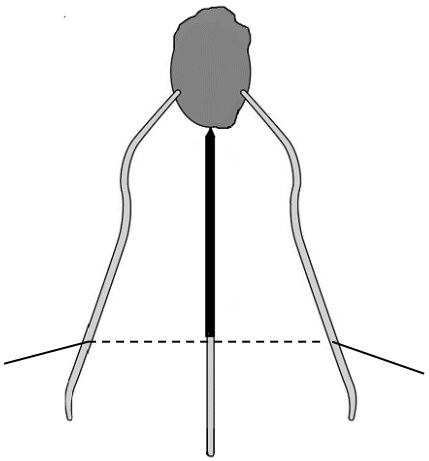
Examples of the points made in the response Explain how a normal eye forms an image:- • Light enters the eye through the pupil • Light is refracted at the cornea • Light is focused by the lens and the cornea • The image should be focused on the retina • The image is inverted, real and diminished Explain how light from objects at different distances forms an image:- • For objects at different distances the lens changes shape • The ciliary muscles pull the suspensory ligaments changing the shape of the lens • For distant objects the lens becomes less powerful • For nearby objects the lens becomes more powerful Explain why long and short sight cause blurred images:- • In long and short sight the (focused) image does not form on the retina • In long sight, the image forms behind the retina • In short sight, the image forms in front of the retina	**extra information** For distant objects the lens becomes thinner For nearby objects the lens becomes fatter In long sight the eyeball is too short In short sight the eyeball is too long	

Total			**7**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	CT scans cause ionisation because they use X-rays	 references to mutations/damage to cells are insufficient	1 1	AO1 3.1.1a
3(a)(ii)	Because the (potential) benefits outweigh the risks	ignore references to the risk being small	1	AO2 3.1
3(b)	Wear a lead vest	accept stand behind a safety screen accept check if mother is pregnant	1	AO1 3.1.1c
3(c)	(CT scans give) a higher quality image	accept can differentiate between tissues accept higher resolution or more detail accept a clearer image accept (CT scans give) a view of a larger portion of the body accept (CT scans give) a useful image more quickly the CT scan is quicker is insufficient accuracy/precision are insufficient	1	AO1 3.1
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	CCD (charge coupled device)	accept CMOS	1	AO1 3.1.4d
4(b)	Converging – both real and virtual images Diverging – virtual image only		1 1	AO1 3.1.3g
4(c)	The refractive index of the converging lens is greater (for all frequencies) The refractive index of the converging lens increases more than that of the diverging lens The refractive index of the converging lens reaches a maximum at a lower frequency than that of the diverging lens	use of data without comparison is insufficient	1 1 1	AO2 3.1.3c
4(d)	An answer that rounds to 12	allow **2** marks for $r = \sin^{-1}(0.21)$ allow **1** mark for correct substitution ie $1.6 = \sin(20)/\sin(r)$ allow **1** mark for $r = \sin^{-1}(\sin(20)/1.6)$ allow **1** mark for 0.21	3	AO2 3.1.3c
4(e)	− 2.5 dioptres / D	allow **1** mark for − 0.025 allow **1** mark for (+) 2.5	2 1	AO2 AO1 3.1.4e
4(f)	curvature refractive index	allow shape allow material it is made from ignore references to density	1 1	AO1 3.1.3g
Total			**14**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	(hydraulic fluid is) incompressible	accept virtually incompressible	1	AO1 3.2.3a
5(b)	2.1×10^5	accept 210 000 for **3** marks allow **1** mark for correct substitution ie $5.2 \times 10^8 = F / 4.1 \times 10^{-4}$ allow **2** marks for an answer of 213200 **or** one that rounds to 2.1×10^5	3	AO2 3.2.3c
5(c)	The force (at the tips) is less because the tips are further away (from the pivot than the piston)	 reason only scores if correct answer given	1 1	AO3 3.2.2e
5(d)	The moments are equal (in size) The moments are opposite (in direction)	 accept clockwise moment = anti-clockwise moment for **2** marks if no other mark gained allow **1** mark for the moments are balanced **or** there is no resultant moment	1 1	AO1 3.2.2c
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	A cross marked on the knife between the tip of the knife and a line drawn between the two fork labels as shown by the darker shading below 		1	AO1 3.2.1b
6(a)(ii)	The point where the mass is (thought to be) concentrated		1	AO1 3.2.1a
6(b)	1.25 Hz	allow **1** mark for correct substitution and re-arrangement ie 1/0.8 an answer of 2.5 scores **1** mark	2	AO2 3.2.1d
Total			**4**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	20 001 hertz / Hz	accept 20 000 hertz	1	AO1 3.1.2a
7(b)(i)	The time (taken for the pulse to travel to the crack and back)	accept how long it takes (for the pulse to travel to the crack and back)	1	AO1 3.1.2c
7(b)(ii)	The speed (of ultrasound in the wing)		1	AO1 3.1.2c
7(b)(iii)	Partially reflected and partially transmitted	accept it is reflected and transmitted for **2** marks	1 1	AO2 3.1.2b
7(c)	If a fault is missed on an inspection it will still be safe (until the next inspection)	accept there is a far lower risk of the fault being missed and becoming dangerous	1	AO3 3.1.2
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)(i)	The direction is changing Because direction is changing the velocity is changing Because velocity is changing the train is accelerating	 accept velocity is speed in a certain direction accept acceleration is rate of change of velocity	1 1 1	AO1 3.2.4a 3.2.4b
8(a)(ii)	Track B has a larger radius allowing a greater speed for the same centripetal force	 accept requiring a lower centripetal force for the same speed	1 1	AO3 AO1 3.2.4c
8(b)(i)	The train can go faster round bends	accept it is less likely to topple ignore references to it will not topple over	1	AO3 3.2.4c
8(b)(ii)	There is no (resultant) moment		1	AO1 3.2.2f
8(c)(i)	**either** When the angle doubles the radius halves. An explanation using numbers quoted from the graph to support this eg at 2 degrees the minimum radius is 3000 m but at 4 degrees it is 1500 m. **or** The product of angle and radius is constant (the product is) 6000		 1 1	 AO2 3.2

8(c)(ii)	A computer simulation allows for more variables to be tested	accept computer models can control variables more easily accept can generate lots of results in a short time accept does not get damaged in test runs ignore references to accuracy ignore references to cost reduces the likelihood of human error is insufficient	1	AO3 3.2
Total			**10**	