Version 1.0



General Certificate of Secondary Education
June 2013

Physics PH3FP

(Specification 4403)

Unit: Physics 3

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner 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 examiners 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 examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

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

Copyright © 2013 AQA and its licensors. All rights reserved.

Copyright
AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX.

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 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.

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 <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.

Quality of Written Communication and levels marking

In Question 8(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

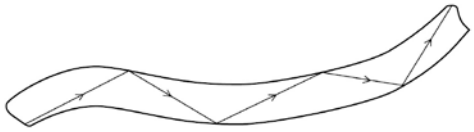
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some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

PH3FP

Question 1

question	answers	extra information	mark
1(a)	middle box ticked 		1
1(b)	reflection	do **not** accept refraction	1
1(c)	endoscope		1
1(d)	eye surgery		1
Total			**4**

PH3FP

Question 2

question	answers	extra information	mark
2(a)	iron primary secondary	correct positions only	1 1 1
2(b)	(it) decreases the p.d.	accept it would increase current accept voltage for p.d. the voltage goes from 230(V) to 20(V) is insufficient do **not** accept decreases current / energy / power do **not** accept decreases p.d. / voltage and current	1
2(c)	any **one** from: • lighter • smaller • use (very) little power / current / energy when switched on and no load / phone not connected • more efficient	 accept it is easier to carry around accept no power / current / energy is drawn do **not** accept electricity for power / current / energy accept does not get as hot **or** less heat produced	1
2(d)	an environmental		1
Total			**6**

PH3FP

Question 3

question	answers	extra information	mark
3(a)	centre of X drawn at centre of pendulum bob	judged by eye accept dot drawn at centre of circle	1
3(b)(i)	2	allow **1** mark for correct substitution, ie $\frac{1}{0.5}$ provided no subsequent step shown	2
3(b)(ii)	30 **or** 60 ÷ their (b)(i) correctly calculated	allow **1** mark for $\frac{60}{2}$ **or** $\frac{60}{\text{their (b)(i)}}$ **or** 0.5 × 60 provided no subsequent step shown	2
3(c)	51.2	allow **1** mark for correct substitution, ie 64 × 0.8 provided no subsequent step shown	2
3(d)	it increases (the moment)	must be comparative accept **1** mark for calculation of the moment = 64 (Nm)	1
Total			**8**

PH3FP

Question 4

question	answers	extra information	mark
4(a)(i)	The width of the base of the raft The position of the centre of mass of the raft		1 1
4(a)(ii)	Design B		1
4(b)(i)	inverted real		1 1
4(b)(ii)	0.4	allow **1** mark for correct substitution, eg $\frac{8}{20}$ (in mm) **or** $\frac{0.8}{2}$ (in cm) **or** $\frac{0.008}{0.02}$ (in m) **or** $\frac{4}{10}$ (number of squares) ignore any units ignore negative sign	2
4(c)	this shape ticked: 		1
Total			**8**

PH3FP

Question 5

question	answers	extra information	mark
5(a)	A		1
5(b)(i)	9000	an answer of 9 k(N) gains **1** mark	1
5(b)(ii)	increase	accept other comparative terms, eg give a bigger affect / change is insufficient	1
5(b)(iii)	smaller	accept other comparative terms, eg less	1
5(c)	Q N M	all three in correct boxes one statement in correct box gains **1** mark	2
5(d)	any **two** from: • increase the current / p.d. (supplied to the coil) • increase number of turns (on the coil) • increase the area (of the coil) • increase the (strength of the permanent) magnetic field	accept reduce the resistance of the coil **or** increase cross sectional area of wire accept more cells / batteries **or** turn up the power supply increase power is insufficient accept increase the width of the coil increase width / size is insufficient accept move the magnets closer to the coil accept use stronger magnets do **not** accept use larger magnets	2
5(e)	an economic		1
Total			**9**

PH3FP

Question 6

question	answers	extra information	mark
6(a)(i)	are incompressible		1
6(a)(ii)	in all directions		1
6(b)	1.6	allow **1** mark for correct substitution, ie $\frac{80}{50}$ provided no subsequent step shown an answer 0.032 gains **0** marks	2
6(c)	Pa		1
6(d)	increases		1
Total			**6**

PH3FP

Question 7

question	answers	extra information	mark
7(a)	cornea (LHS gap)	must be in correct space	1
	retina (RHS gap)		1
7(b)	iris **or** pupil		1
	to change the shape / curvature (of the surface) of the lens	accept to make the lens thinner / fatter to contract and relax is insufficient	1
	to focus the light (from the object, onto the retina)	accept to refract / change direction of light accept rays for light accept to form / focus an image (on the retina) to focus is insufficient	1
7(c)	the older (a human), the longer the near point (or vice versa) **or** young people have the shortest near point (or vice versa)	answer must be in terms of near point (or a description of), eg become increasingly long sighted as you get older allow near point increases with age do **not** accept eye sight deteriorates as you get older answers must be comparative	1
	the (rate of) change of the near point increases as you get older (or vice versa)	accept near point increases most rapidly after 40 this statement alone gains **2** marks: the (rate of) increase of the near point gets greater as you get older	1

Question 7 continues on the next page . . .

PH3FP

Question 7 continued . . .

question	answers	extra information	mark
7(d)	test / measure / use more people (to increase the range of ages) **or** test / measure / use more people with ages in between (those already measured)	accept test older / younger people accept increase sample size repeat the measurements (of the same people) is insufficient	1
7(e)	2.5	allow **1** mark for correct substitution and conversion to metres, ie $\frac{1}{0.4}$ provided no subsequent step shown an answer of 0.025 gains **1** mark	2
Total			**10**

PH3FP

Question 8

question	answers	extra information	mark
8(a)	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

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 either wave **OR** What happens to either wave when they enter the body. However there is little other detail.	There is either: A clear description of BOTH waves **OR** A clear description as to what happens to BOTH waves inside the body **OR** A clear description of ONE of the waves with clear detail as to what happens to either wave inside the body.	There is a detailed description of BOTH of the waves **AND** A detailed description as to what happens to EITHER wave inside the body.

Question 8 continues on the next page . . .

PH3FP

Question 8 continued . . .

Examples of the points made in the response: **Description of an X-ray** • X-rays are electromagnetic waves / part of the electromagnetic spectrum • X-rays are (very) high frequency (waves) • X-rays are (very) high energy (waves) • X-rays have a (very) short wavelength • Wavelength (of X-rays) is of a similar size to (the diameter of) an atom • X-rays are a transverse wave • X-rays are ionising radiation **Description of ultrasound** • ultrasound has a frequency above 20 000 (hertz) **OR** ultra sound is above 20 000 hertz • ultrasound is above / beyond the human (upper) limit (of hearing) • ultrasound is a longitudinal wave **Statement(s) as to what happens to X-rays inside the human body:** • X-rays are absorbed by bone • X-rays travel through / are transmitted by tissue / skin **Statement as to what happens to ultrasound inside body:** • ultrasound is (partially) reflected at / when it meets a boundary between two different media • travel at different speeds through different media	do **not** allow a description of a property – eg X-rays travel through a vacuum / at the speed of light correct description acceptable – oscillations / vibrations are perpendicular (at 90°) to direction of energy transfer accept ultrasound cannot be heard by humans correct description acceptable – oscillations / vibrations (of particles) are parallel (in same direction) to direction of energy transfer	

Question 8 continues on the next page . . .

PH3FP

Question 8 continued . . .

question	answers	extra information	mark
8(b)	(because the X-rays) are ionising	accept a description of what ionising is	1
	(they will) damage cells **or** mutate cells / cause mutations / increase chances of mutations **or** turn cells cancerous / produce abnormal growths / produce rapidly growing cells **or** kill cells	instead of cell, any of these words can be used: DNA / genes / chromosomes / nucleus do **not** accept they can be dangerous (to human health) do **not** accept damage to soft tissue	1
8(c)	any **one** from: • removal / destruction of kidney / gall stones		1
	• repair of damaged tissue / muscle	accept examples of repair, eg alleviating bruising, repair scar damage, ligament / tendon damage, joint inflammation accept physiotherapy accept curing prostate cancer **or** killing prostate cancer cells	
	• removing plaque from teeth	cleaning teeth is insufficient	
Total			**9**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion