OXFORD

INTERNATIONAL
AQA EXAMINATIONS

OXFORD AQA INTERNATIONAL AS Physics PH02

Unit 2

Mark scheme
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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

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Marking guidance	Mark	Comments
01.1	The material has no resistance/resistivity At or below the critical temperature	1 1	 2nd mark dependent on first
01.2	Any sensible application (eg transmission cables, powerful magnets, Maglev trains)	1	Accept particle accelerator Electromagnet is insufficient

Question	Marking guidance	Mark	Comments
02.1	X-rays can produce more detail OR clearer image OR better resolution.	1	Ignore comments about contrast
02.2	Ultrasound is non-ionising Link to risk of cancer or mutations	1 1	Accept real-time or moving image for 1 mark Accept damage to tissue / cell / cell nuclei

Question	Marking guidance	Mark	Comments
03.1	States diameter = $1.89\ (\text{mm})$ or radius = $0.945\ (\text{mm})$ Area = $\pi \times (0.945 \times 10^{-3})^2 = 2.81 \times 10^{-6}\ \text{m}^2$ (must see at least 3 sig. fig.)	1 1	Convincing treatment of powers of 10 necessary for 2nd mark
03.2	$R = \frac{1.7 \times 10^{-8} \times 0.85}{2.81 \times 10^{-6}}$ $= 5.1 - 5.2 \times 10^{-3}\ \Omega$ 2 sig. fig.	1 1 1	1st mark is for a correct substitution or rearrangement Correct answer gets first 2 marks 3rd mark is stand alone

Question	Marking guidance	Mark	Comments
04.1	$I_1 = 0.80\ \text{A}$	1	Accept 1 sig. fig. in this case
04.2	$R = 1.9\ \Omega$	1	
04.3	effect : Reading of A_1 decreases	1	Max 3
	reason: because the total circuit resistance has increased	1	(reason marks are dependent on effect marks)
	effect: Reading of A_2 remains constant	1	
	reason: The p.d. and resistance for this branch are constant.	1	Accept lower part of circuit is unaffected by the switch
	Alternative:		
	$A_1 = A_2$	1	Max 3
	Total circuit resistance = $2R$	1	
	Current = $0.40\ \text{A}$	1	
	So A_1 decreases (A_2 stays the same)	1	

Question	Marking guidance	Mark	Comments
05.1	E = 13.60 – 1.51 = 12.09 eV Multiplies by 1.6×10^{-19} OR divides by 6.63×10^{-34} $f = 2.9 \times 10^{15}$ Hz	1 1 1	
05.2	13.6 eV	1	Do not accept -13.6 eV
05.3	(All of the) photon's energy is absorbed or photon disappears Atom is ionised 4.8 eV surplus energy Plausible destination of surplus energy (eg K.E. of emitted e^-, recoil of nucleus).	1 1 1 1	Max 3

Question	Marking guidance	Mark	Comments
06.1	Varying OR periodic electric and magnetic fields That are perpendicular to each other That are in phase with each other That are both perpendicular to the direction of propagation OR it is a transverse wave Note: a fully labelled diagram that shows all features clearly can gain 3 marks.	1 1 1 1	Max 3 Accept all travel at the same speed in a vacuum for 1 mark
06.2	The reading falls to zero (when A is rotated) One grille polarises and the other is at 90 degrees (so absorbs remaining waves)	1 1	
06.3	The microwaves reflect from the metal plate The outward and reflected wave superpose OR intefere Constructive interference occurs OR antinodes form <u>where the waves are in phase</u> Destructive interference occurs OR nodes form <u>where the waves are π radians or 180 degrees out of phase OR in antiphase</u>	1 1 1 1	Max 3
06.4	Three approximately similar sized loops or half loops	1	
06.5	(The voltmeter reading will) vary from zero to a maximum and back to zero several times (along the length) Correct location of a node or antinode	1 1	For example the voltmeter reading will be zero at 30 cm OR 60 cm (from X)

Question	Marking guidance	Mark	Comments
07.1	The work done OR energy transferred per unit charge to the entire circuit including the internal resistance	1 1	Note the following is worth 1 mark: The p.d. across the battery terminals when there is no current through it OR on open circuit
07.2	Use of V=IR (with V = 9 or 3) R = 4.5 Ω	1 1	
07.3	$\epsilon = I(R + r)$ $12 = I\,(0 + 1.5)$ Maximum current = 8.0 A cao	 1 1	
07.4	Straight line with negative gradient Passing through any two correct data points	1 1	 Look for (0,12), (8,0) OR (2,9)
07.5	Current is 7.5 A (which is less than the maximum possible current) Attempt at calculating lifetime $t = \frac{1.15\times10^4}{7.5}$ OR attempts to calculate charge delivered in 30 minutes Q = $7.5 \times 30 \times 60$ Correct calculation leading to 25.6 min or 1536 s OR 1.35×10^4 C PLUS a statement that the battery is unsuitable	1 1 1	

07.6	Identifies P = 24 W when I = 4.0 A Use of $P = I^2 R$ R = 1.5 Ω OR I = 4.0 A $R_{tot} = \frac{V}{I} = \frac{12}{4.0} = 3.0\ \Omega$ $R_{variable} = 3.0 - 1.5 = 1.5\ \Omega$	1 1 1 1 1 1	

07.7	(To obtain maximum current) the variable resistor has zero resistance hence all power is dissipated in the internal resistance of the battery OR R = 0 so $P = I^2R = 0$	1 1	

Question	Marking guidance	Mark	Comments
08.1	$\pm$ 0.05 for all values of V_s	1	
08.2	0.8 ($\times 10^{-20}$) error bars added to every point Best fit straight line drawn with a ruler and going through every error bar	1 1	1.6 to 3.2; 7.8 to 9.4; 12.0 to 13.6; 19.2 to 20.8 ($\times 10^{-20}$) Candidates who do not draw error bars can gain the final mark for a good best fit line drawn with the existing points
08.3	Correct data from their graph 6.2×10^{-34} to 7.1×10^{-34} (J s) ecf from best fit line	1 1 1	Maximum of 1 mark if no working visible on graph
08.4	Their intercept on the *f* axis correct	1	
08.5	Draws 2 extreme lines within all error bars gives the uncertainty as half the range of intercepts	1 1	
08.6	More sets of values OR Repeats and averages OR Greater precision in V OR Greater range of *f*	1	

Question	Marking guidance	Mark	Comments
09.1	Down arrow labelled Weight OR W OR mg between the driver and the point of contact of the tyre and ground	1	
	Up arrow labelled Reaction OR Normal Reaction OR R OR F_r from the point of contact of the tyre and ground	1	Accept Up arrow labeled Support OR S
09.2	(Taking moments about rear wheel) $760 \times 9.81 \times d = 550 \times 3.7$✓	1	
	$d = 0.27$ m	1	Correct answer only gains full marks
09.3	110 sin 40 seen	1	
	Adds or subtracts 550 OR subtracts from 550	1	
	R = 620 N OR 621 N	1	

Question	Key
10	D
11	B
12	D
13	B
14	C
15	C
16	C
17	B
18	D
19	A
20	C
21	B
22	A
23	B