GCSE
PHYSICS

PAPER 2H

Mark scheme

Specimen 2018

Version 1.0

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 and underlining

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 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)

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

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working.

Full marks can however be given for a correct numerical answer, without any working shown.

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 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient are 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 as well, will still mean that the mark is not awarded.

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.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	accept any value between 12 (mm) and 13(mm) inclusive		1	AO2/2 4.5.3
01.2	to reduce the error in measuring the extension of the spring as the ruler at an angle would make the measured extensions shorter	accept length for extension throughout	1 1	AO3/3a 4.5.3
01.3	1 (N) to 6 (N)	accept from 0 (N) to 6 (N)	1	AO2/2 4.5.3
01.4	gives a straight line through the origin		1	AO3/1a 4.5.3
01.5	any practical technique that would improve the accuracy of length measurement eg use a set square to line up the bottom of the spring with the ruler scale **or** attach a horizontal pointer to the bottom of the spring (1) so that the pointer goes across the ruler scale (1)		 1 1	AO3/3b 4.5.3
01.6	the spring has been inelastically deformed because it went past its limit of proportionality	 accept elastic limit for limit of proportionality accept it does not go back to its original length when the weights are removed	1 1	AO3/2a AO2/2 4.5.3
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	red–shift		1	AO1/1 4.8.2
02.2	the further away from the Earth, the faster a galaxy is moving		1	AO3/1a 4.8.2 WS3.5
02.3	**strength** as the balloon expands the dots get further apart, representing the galaxies moving apart **weakness** dots are only on the surface of the balloon, galaxies are throughout the universe **or** there is a limit to how far the balloon can expand		1 1	AO3/1b 4.8.2 WS1.2
02.4	both theories suggest that the Universe is expanding		1	AO1/2 4.8.2
02.5	new evidence / observations that cannot be explained by Theory 1	accept specific example of new evidence ie CMBR	1	AO1/1 4.8.2 WS1.1
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	$\text{magnification} = \frac{\text{image height}}{\text{object height}}$		1	AO3/1b 4.6.2.5
	dividing by an object height of 1 cm gives the same (numerical) value		1	
03.2	accept anything practical that would work eg: use a taller object use a (travelling) microscope attach a scale to the screen and used a magnifying glass		1	AO3/3b 4.6.2.5 WS2.3/7
03.3	both points plotted correctly correct line of best fit drawn	 a curve passing through all points (within ½ square), judge by eye	1 1	AO2/2 4.6.2.5 WS3.1/2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	values of 1.4 and 0.6 extracted from the graph 2.33 times bigger	 accept any number between 2.3 and 2.5 inclusive	1 1	AO2/2 4.6.2.5 WS3.5
03.5	by dividing the distance between the lens and the image by the distance between the lens and the object at least one correct calculation and comparison eg 100÷25 = 4 which is the same as the measured magnification		1 1	AO3/1a AO2/2 4.6.2.5 WS3.5
03.6	any two correct construction lines upright image drawn correctly	construction lines can be dotted or solid the image line can be dotted or solid but must show correct orientation ignore any arrows drawn on construction lines	2 1	AO2/2 4.6.2.5
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	move a (magnetic/plotting) compass around the wire the changing direction of the compass needle shows a magnetic field has been produced **OR** sprinkle iron filings onto the card (1) tapping the card will move the filings to show the magnetic field (pattern) (1)		1 1	AO1/2 4.7.2.1

04.2	**Level 2:** A detailed and coherent explanation is provided. The response makes logical links between clearly identified, relevant points that explain how the ignition circuit works.	3–4	4	AO2/1 4.7.2.1
	Level 1: Simple statements are made. The response may fail to make logical links between the points raised.	1–2		
	No relevant content	0		
	Indicative content • closing the (ignition) switch causes a current to pass through the electromagnet • the iron core (of the electromagnet) becomes magnetised • the electromagnet/iron core attracts the (short side of the) iron arm • the iron arm pushes the contacts (inside the electromagnetic switch) together • the starter motor circuit is complete • a current flows through the starter motor (which then turns)			

Total		**6**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	**Level 3:** A detailed and coherent plan covering all the major steps is provided. The steps in the method are logically ordered. The method would lead to the production of valid results. A source of inaccuracy is provided.	5-6	6	AO1/2 4.6.2.2
	Level 2: The bulk of a method is described with mostly relevant detail. The method may not be in a completely logical sequence and may be missing some detail.	3–4		
	Level 1: Simple statements are made. The response may lack a logical structure and would not lead to the production of valid results.	1–2		
	No relevant content	0		
	Indicative content place a glass block on a piece of paper draw around the glass block and then remove from the paper draw a line at 90^{o} to one side of the block (the normal) use a protractor to measure and then draw a line at an angle of 20^{o} to the normal replace the glass block using a ray box and slit point the ray of light down the drawn line mark the ray of light emerging from the block remove the block and draw in the refracted ray measure the angle of refraction with a protractor repeat the procedure for a range of values of the angle of incidence **possible source of inaccuracy** the width of the light ray which makes it difficult to judge where the centre of the ray is			
05.2	velocity/speed of the light decreases	allow velocity/speed of the light changes	1	AO1/1 4.6.2.2
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	It is easily magnetised.		1	AO1/1 4.7.3.3
06.2	p.d. across the secondary coil is smaller (than p.d across the primary coil)		1	AO3/2a 4.7.3.3 WS3.5
06.3	ratio $\frac{V_p}{V_s} = \frac{6}{12}$ $\frac{6}{12} = \frac{50}{N_p}$ $N_p = 100$	accept any other correct ratio taken from the graph use of the correct turns ratio and substitution or correct transformation and substitution allow 100 with no working shown for **3** marks	1 1 1	AO2/1 4.7.3.3
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	any sensible suggestion eg • theory supported by results from other experiments • could not believe the 'theory' could be wrong • 'theory' is the basis of many other ideas		1	AO2/2 4.5.6 WS1.1
07.2	any **two** from: • to allow peer review of data • to assess the reproducibility of the data • to promote further enquiry / experiments • to encourage other scientists to develop explanations / new theories		2	AO3/2a 4.5.6 WS1.6
07.3	730 000 = 300 007 400 x time $\text{time} = \frac{730\,000}{300\,007\,400}$ 2.43(3273) x 10^{-3} s	 this step without the previous step stated gains 2 marks accept 0.00243(3273) s allow 2.43(3273) x 10^{-3} with no working for **4** marks	1 1 1	AO2/1 AO2/1 AO2/1 4.5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	60×10^{-9} s		1	AO1/1 4.5.6 WS4.4
07.5	systematic error		1	AO3/2a 4.5.6 WS3.7
07.6	add on 60 nanoseconds to each time recorded (then recalculate)		1	AO3/3b 4.5.6 WS3.7
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	distance is a scalar and displacement is a vector **or** distance has magnitude only, displacement has magnitude and direction		1	AO1/1 4.5.6.1.1
08.2	37.5 km 062^{o} or N62^{o}E	accept any value between 37.0 and 38.0 inclusive accept 62^{o} to the right of the vertical accept an angle in the range 60^{o} -64^{o} accept the angle correctly measured and marked on the diagram	1 1	AO2/2 4.5.6.1.1
08.3	train changes direction so velocity changes acceleration is the rate of change of velocity		1 1	AO1/1 4.5.6.1.3/5
08.4	number of squares below line = 17 each square represents 500 m distance = number of squares x value of each square correctly calculated – 8500 m	accept any number between 16 and 18 inclusive	1 1 1	AO2/2 4.5.6.1.5
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	the distance travelled under the braking force		1	AO1/1 4.5.6.3.1
09.2	the reaction time will increase increasing the thinking distance (and so increasing stopping distance)	 increases stopping distance is insufficient	1 1	AO1/1 4.5.6.3.2
09.3	No, because although when the speed increases the thinking distance increases by the same factor the braking distance does not. eg increasing from 10 m/s to 20 m/s increases thinking distance from 6 m to 12 m but the braking distance increases from 6 m to 24 m		 1 1	AO3/1a 4.5.6 WS3.3/5
09.4	If the sled accelerates the value for the constant of friction will be wrong.		1	AO1/2 4.5.6.2.1
09.5	only a (the horizontal) component of the force would be pulling the sled forward the vertical component of the force (effectively) lifts the sled reducing the force of the surface on the sled		1 1	AO1/2 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	$-u^2 = 2 \times -7.2 \times 22$	award this mark even with 0^2 and / or the negative sign missing	1	AO2/2 4.5.6.1.5 WS4.6
	u = 17.7(99)		1	
	18		1	
		allow 18 with no working shown for **3** marks		
		allow 17.7(99) then incorrectly rounded to 17 for **2** marks		
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	air molecules colliding with a surface create pressure		1	AO1/1 4.5.5.2
	at increasing altitude distance between molecules increases **or** at increasing altitude fewer molecules (above a surface)		1	
	so number of collisions with a surface decreases **or** or so always less weight of air than below (the surface)		1	
10.2	atmospheric pressure = 20 kPa from graph **and** conversion of 810 cm^2 to 0.081 m^2	allow ecf for an incorrect value clearly obtained from the graph	1	AO2/1
	$5 \times 10^4 = \frac{F}{0.081}$		1	AO2/1
	$F = 5 \times 10^4 \times 0.081$		1	AO2/1
	4050		1	AO2/1
	4100 (N)	allow 4100 (N) with no working shown for **5** marks allow 4050 with no working shown for **4** marks	1	AO2/1 4.5.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	force from air pressure acting from inside to outside bigger than force acting inwards so keeps the window in position		1 1	AO2/1 4.5.5.1.1
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	in a longitudinal wave the oscillations/vibrations are parallel to the direction of energy transfer.	accept wave travel for energy transfer throughout	1	AO1/1 4.6.1.1
	in a transverse wave the oscillations/vibrations are perpendicular to the direction of energy transfer.		1	AO1/1 4.6.1.1
11.2	accept any sensible suggestion eg. a vibrating drum skin does not move the air away to create a vacuum (around the drum)		1	AO1/2 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.3	**Level 3:** A detailed explanation linking variations in current to the pressure variations of a sound wave, with a logical sequence.	5-6	6	AO1/2 4.6.1.1 4.7.2.4
	Level 2: A number of relevant points made, but not precisely. A link between the loudspeaker and a sound wave is made.	3–4		
	Level 1: Some relevant points but fragmented with no logical structure.	1–2		
	No relevant content	0		
	Indicative content the current in the electrical circuit is varying the current passes through the coil the coil experiences a force (inwards or outwards) reversing the current reverses the force the size of the current affects the size of the force the varying current causes the coil to vibrate the (vibrating) coil causes the cone to vibrate the vibrating cone causes the air molecules to move the movement of the air molecules produces the pressure variations in the air needed for a sound wave the air molecules bunch together forming compressions and spread apart forming rarefactions			
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
12.1	motor effect		1	AO1/1 4.7.2.2
12.2	increase the strength of the magnet **or** increase the current		1	AO2/1 4.7.2.2
12.3	$4.8 \times 10^{-4} = F \times 8 \times 10^{-2}$ $F = 6 \times 10^{-3}$ (N) $6 \times 10^{-3} = B \times 1.5 \times 5 \times 10^{-2}$ $B = \frac{6 \times 10^{-3}}{7.5 \times 10^{-2}}$ $B = 8 \times 10^{-2}$ or 0.08 Tesla	allow 8×10^{-2} **or** 0.08 with no working shown for **5** marks a correct method with correct calculation using an incorrect value of F gains **3** marks accept T do not accept t	1 1 1 1 1 1	AO2/1 4.7.2.2 4.5.4 AO1/1 4.7.2.2
Total			**8**	