GCSE

PHYSICS

8463/2H

Paper 2H

Mark scheme

Specimen (set 2)

Version: 1.0

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Please be aware that not all schools and colleges will be using these tests at the same time.

Help us to maintain the security of these papers by ensuring they are not distributed on social media or other platforms.

Important – please note

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers.

It must be stressed that a mark scheme is a working document. This mark scheme has **not** been through the full standardisation process. 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.

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.

The Information to Examiners is included as a guide to how the mark scheme will function as an operational document.

The layout has been kept consistent so that future operational mark schemes do not appear different from these test materials.

If the printing process in your school alters the scale of a diagram, measure the values on your printed papers and mark the scripts accordingly.

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
- the Assessment Objectives, level of demand 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 ecf 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 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore 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.

3.10 Do <u>not</u> accept

Do **not** accept 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.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- 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 two 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.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise 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.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 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. / Demand
01.1	the magnets are not touching but (each) experiences a force	 allow but there is a force of attraction between them	1 1	AO1 4.7.1.1 4.5.1.2 Standard
01.2	place a (plotting) compass near the (north / south) pole of the magnet and mark the direction that the compass points move the (plotting) compass around the bar magnet (to the other pole) marking at (regular) intervals the direction the compass points join the points up and add an arrow pointing from the north pole to the south pole		1 1 1	AO1 4.7.1.1 Standard
01.3	(closing switch **S**) causes a current in the coil a magnetic field is created a force of attraction acts on the ball bearing so the ball bearing accelerates (towards the iron nail)	allow switches on the electromagnet	1 1 1 1	AO2 4.7.1.2 4.7.2.1 4.5.6.2.2 Standard
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
02.1	(resultant) force = mass × acceleration	allow F = m a symbols must be correct	1	AO1 4.5.6.2.2 Standard
02.2	(2.7 – 1.5) = 0.75 × a $a = \frac{1.2}{0.75}$ a = 1.6 m/s^2	an answer of 1.6 scores **3** marks allow compensation marks for correct use of incorrect resultant force	1 1 1 1	AO2 AO1 4.5.6.2.2 Standard
02.3	transverse the oscillation / vibration is perpendicular to the direction of energy transfer	allow wave travel for energy transfer	1 1	AO3 4.6.1.1 Standard
02.4	use springs with a greater spring constant **or** use a trolley with greater mass	allow use stronger springs allow use a heavier trolley do **not** accept use a larger trolley allow add a mass / weight to the trolley	1	AO3 4.6.1.2 Standard
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
03.1	double		1	AO2 4.5.6.2.2 Standard
03.2	the hypothesis does not say how increasing / decreasing the force increases / decreases the acceleration		1	AO3 4.5.6.2.2 Standard
03.3	appropriate equipment to apply and measure force appropriate equipment to measure change in velocity and time	eg newtonmeter **or** slotted masses + string + pulley eg ticker timer + tape **or** light gates + datalogger	1 1	AO1 4.5.6.2.2 Standard
03.4	to reduce the effect of friction on the trolley		1	AO2 4.5.6.2.2 Standard

03.5	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.5.6.2.2 Standard
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • method by which the trolley is to be accelerated • how the accelerating force is varied to give a suitable range of results • how the accelerating force is measured • the use of suitable apparatus to measure the change in velocity of the trolley over a given distance or time • what data is to be collected in order to calculate acceleration • how the data required is to be measured		

03.6	so that the mass is constant as changing mass would change the acceleration (produced by a given force) **or** so there is only one independent variable	fair test is insufficient	1 1	AO2 4.5.6.2.2 Standard

03.7	the results give a straight line that passes through the origin showing direct proportionality		1 1	AO3 4.5.6.2.2 Standard

Total			**15**

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
04.1	gamma rays		1	AO1 4.6.2.1 Standard
04.2	can travel through the atmosphere		1	AO1 4.6.2.4 Standard
04.3	explosion of a red super giant **or** a supernova		1	AO1 4.8.1.2 Standard
04.4	1.2×10^9 Hz		1	AO1 4.6.2.1 Standard
04.5	$3.0 \times 10^8 = 1.2 \times 10^9 \times \lambda$ $\lambda = \frac{3.0 \times 10^8}{1.2 \times 10^9}$ $\lambda = 0.25$ (m)	an answer of 0.25 (m) scores **3** marks allow ecf from **04.4**	1 1 1	AO2 4.6.1.2 Std./High
04.6	same as the radio wave		1	AO1 4.6.2.3 Std./High
04.7	expansion due to fusion energy in equilibrium with gravitational collapse	forces acting inwards equal forces acting outwards gains **1** mark	1 1	AO1 4.8.1.1 Std./High

04.8	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO3 4.8.1.2 Std./High
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	No relevant content	0	
	Indicative content • Sun goes from main sequence to red giant • then from red giant to white dwarf • when the Sun changes to a red giant the surface temperature will decrease • and the relative luminosity will increase • when changing from a red giant to a white dwarf the surface temperature increases • and the relative luminosity decreases		

Total			**14**

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
05.1	a vector has direction (a scalar does not)		1	AO1 4.5.1.1 Standard
05.2	accept any vector quantities eg • velocity • force • weight • acceleration • displacement		1	AO1 4.5.6.1.3 Standard
05.3	mass × velocity	do **not** accept speed for velocity do **not** accept symbols	1	AO1 4.5.7.1 Standard
05.4	kilogram(s) metre per second	allow kg m/s	1	AO1 4.5.7.1 Standard
05.5	1.8 ms = 0.0018 s $1500 = \frac{0.045 \times v\ (-\ 0.045 \times 0)}{0.0018}$ $v = \frac{1500 \times 0.0018}{0.045}$ v = 60 (m/s)	an answer of 60 (m/s) scores **4** marks an answer of 60 000 scores **3** marks	1 1 1 1	AO2 4.5.7.3 Std./High

05.6	longer the time of contact the greater the change of momentum since the mass of the golf ball is constant the velocity of the golf ball must increase increasing the distance the golf ball travels	allow the converse	1 1 1 1	AO2 4.5.7.3 Std./High

Total			**12**

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
06.1	gravity		1	AO1 4.8.1.3 Standard
06.2	as the wire moves through the Earth's magnetic field a potential difference is induced between the ends of the wire the wire must be part of a complete circuit		1 1 1	AO1 4.7.3.1 4.7.1.2 Std./High
06.3	new trace shows: twice the frequency twice the amplitude		 1 1	AO3 4.7.3.2 Std./High
06.4	dynamo	dc generator is insufficient	1	AO1 4.7.3.2 Std./High
06.5	the alternator pd changes polarity, the 2nd type of generator does not		1	AO3 4.7.3.2 Std./High
06.6	$\frac{230}{V_s} = \frac{690}{57}$ $V_s = \frac{230 \times 57}{690}$ $V_s = 19$ (V)	an answer of 19 (V) scores **3** marks	1 1 1	AO2 4.7.3.4 Std./High
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
07.1	arrow vertically down – same size as lift – labelled weight arrow to the left – same size as drag - labelled thrust	judge by eye judge by eye two correct arrows without labels gains **1** mark	1 1	AO2 4.5.1.4 Standard
07.2	$34^2 - (0^2) = 2 \times 4.0 \times s$ $\frac{34 \times 34}{8} = s$ s = 144.5 s = 140 (2 sig figs)	an answer of 140 scores **4** marks an answer of 144.5 scores **3** marks	1 1 1 1	AO2 4.5.6.1.5 High
07.3	tension force drawn to a suitable scale and in correct direction triangle completed showing correct components scale used to determine both component forces horizontal component = 1900 N vertical component = 680 N	 allow 1850 to 1925 inclusive allow 660 to 700 inclusive	1 1 1 1	AO2 4.5.1.4 4.5.1.1 High
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
08.1	point the first two fingers and thumb of the left hand so they are at right angles		1	AO1 4.7.2.2 Std./High
	point the first / index finger in the direction of the magnetic field from North to South		1	
	point the second / middle finger in the direction of current from positive to negative	allow in the direction of conventional current for positive to negative	1	
	the thumb then points in the direction of the force in this case to the right		1	
08.2	mean of 0.23 calculated		1	AO3 4.7.2.2 Std./High
	0.02		1	
08.3		an answer of 0.059 (m) scores **5** marks		AO2 4.7.2.2 4.5.1.3 High
	$F = 0.40 \times 10^{-3} \times 9.8$		1	
	$F = 3.92 \times 10^{-3}$ (N)		1	
	$3.92 \times 10^{-3} = 0.03 \times 2.2 \times L$	up to **3** marks to be awarded for a correct calculation of L using an incorrect value of F	1	
	$L = \frac{3.92 \times 10^{-3}}{0.03 \times 2.2}$		1	
	L = 0.059 (m)		1	
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref. / Demand
09.1	light (inside the tin can) is reflected many times before incident on the hole at each reflection energy / light is absorbed so (very) little light / energy leaves the hole		1 1	AO1 4.6.3.1 Std./High
09.2	the object absorbs all of the radiation incident on it **or** the object does not reflect or transmit any radiation **or** the object is the best possible emitter of radiation		1	AO1 4.6.3.1 Std./High
09.3	the intensity of every wavelength increases the shorter the wavelength the more rapid the increase in intensity the peak intensity occurs at shorter wavelength		1 1 1	AO3 4.6.3.2 High
09.4	accept any value between 1600 (°C) and 10 000 (°C)		1	AO3 4.6.3.2 High

09.5	the temperature has increased as 200 years ago the energy / radiation from space = energy / radiation emitted (and reflected) into space but now less radiation is emitted so there is a net absorption	 allow energy for radiation	1 1 1	AO3 4.6.3.2 High

Total			**10**