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PHYSICS

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Paper 1

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 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 oxfordaqaexams.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.

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 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

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 mark 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

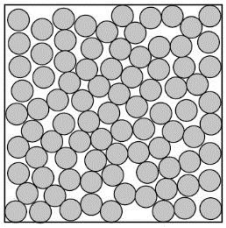
Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

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.

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
01.1	3.0 V		1	AO1 3.5.1 r	A
01.2	$I = \frac{0.40}{8.0}$ 0.050 (A)		1 1	AO2 3.5.1 c	E
01.3	the same as		1	AO1 3.5.1 r	G
01.4	60 (Ω)		1	AO2 3.5.1 r	E
01.5	6.0 V		1	AO1 3.5.1 s	E
01.6	$6.0 = I \times 30$ $I = \frac{6.0}{30}$ 0.2 (A)	 allow ecf from question **01.5**	1 1 1	AO2 3.5.1 s	E
01.7	0.4 (A)	allow 2 × their answer to question **01.6**	1	AO2 3.5.1 s	E
01.8	less than		1	AO1 3.5.1 s	G
Total			**11**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
02.1	ultrasound has a frequency above 20 000 Hz range of human hearing is 20–20 000 Hz	 allow humans cannot hear above 20 000 Hz allow frequency of ultrasound is above the range of human hearing for **2** marks	1 1	AO1 3.3.3 d	E
02.2	distance = 330 × 0.012 3.96 (m)		1 1	AO2 3.3.3 g	E
02.3	1.98 (m)	allow their answer to question **02.2** ÷ 2	1	AO2 3.3.3 f	E
02.4	$330 = f \times 0.75$ $f = \frac{330}{0.75}$ $f = 440$ (Hz)		1 1 1	AO2 3.3.1 h	E
Total			**8**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
03.1			1	AO1 3.4.1 a	A
03.2	**Level 3:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 3.4.1 e	E
	Level 2: The design/plan 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 design/plan 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 • Put stearic acid into a test tube. • Boil the water in the kettle. • Pour the boiling water into a beaker. • Place the test tube of stearic acid into the beaker. • Leave until the stearic acid melts. • Take the test tube out of the hot water. • Place the thermometer in the stearic acid. • Record the temperature every 30 seconds for 20 minutes (or suitable time). • Stir the stearic acid during experiment.				
03.3	900 – 160 740	allow 900-150 or 900-100 allow 750 or 800 if consistent with acceptable values read from graph	1 1	AO2 3.4.1 e	E

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
03.4	m = 0.015 kg		1	AO2 3.4.1 b	E
	$\Delta\theta = 6.0$ (°C)	allow tolerance of 5.8 – 6.2	1		
	$E = 0.015 \times 560 \times 6.0$		1		
	$E = 50$ (J)	allow 50.4 (J)	1		

Total			**13**

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
04.1	Dependent		1	AO4 3.2.3	A
04.2	(a result that) does not fit the pattern		1	AO3 3.2.3	E
04.3	the distance between the lamp and the solar panel is too small	allow the lamp is too low allow the distance between the lamp and the solar panel was measured incorrectly allow mis-reading of the meter ruler	1	AO4 3.2.3	E
04.4	as the distance between the lamp and the solar panel increases the power output of the solar panel decreases greater change in power output per cm when closer to the lamp	 allow non-linear	1 1	AO3 3.2.3	E
04.5	connect an ammeter in series and a voltmeter in parallel use an ammeter to measure current **and** a voltmeter to measure potential difference P = I V	 allow voltage for potential difference	1 1 1	AO4 3.2.3	E

Question	Answers	Mark	AO/ Spec. Ref	ID
04.6	**Level 2**: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	3.2.3 AO3	E
	Level 1: Points identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2		
	No relevant content	0		
	Indicative content • Reducing the cost allows more solar panels to be used. • Using more solar panels increases power output. • As there are plenty of roads, so enough surface area for solar panels to cover. • Power output of road and roof solar panels are similar. • Much larger difference in price. • Same lifespan. • Can buy six roof panels for price of one road panel.			

Total			**12**

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
05.1	$160 = 50 \times v$ $v = \frac{160}{50}$ $v = 3.2$ m/s		1 1 1 1	1 × AO1 3 × AO2 3.1.4 a	E
05.2	$F = \frac{160}{0.80}$ $= 200$ (N)		1 1	AO2 3.1.4 c	E
05.3	the crash mat compresses the time taken to stop increases (compared to landing on a hard floor) decreases the rate of change of momentum reduces the force on the child		1 1 1 1	AO1 3.1.4 c	E
Total			**10**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
06.1	(in the core of) stars		1	AO1 3.7.4 d	E
06.2	the two nuclei are positively charged therefore there is a strong force of repulsion nuclei need to get very close to fuse particles move faster at high temperatures so are more likely to get close together		1 1 1 1	AO1 3.7.4 a c	E
06.3	produces more energy for same amount of fuel bigger difference between energy needed to produce fuel and energy released from fuel therefore space rocket can either travel further	allow carry less fuel	1 1 1	3.7.4 2.7.3 AO3	E
06.4	large nucleus splits into two smaller nuclei releases (two/three) neutrons and energy		1 1 1	3.7.3 c AO1	E
Total			**11**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
07.1	a satellite		1	AO1 3.8.2 c	A
07.2	arrow drawn towards the centre of the Earth		1	AO1 3.8.2 e	E
07.3	acceleration is the rate of change of velocity velocity is a vector direction changes but the magnitude stays the same		1 1 1	AO1 3.1.1 d 3.1.3 d	E
07.4	$1.2 \times 10^{13} = 0.5 \times 4.2 \times 10^5 \times v^2$ $v = \sqrt{\left(\frac{1.2 \times 10^{13}}{(0.5 \times 4.2 \times 10^5)}\right)}$ v = 7559 (m/s) v = 7600 (m/s)	 allow correct answer given to two or more significant figures	1 1 1 1	AO2 3.2.1 e	E
07.5	increase in kinetic energy increase in velocity increase in orbital radius/height	 dependent on 1st and 2nd marking points allow converse throughout	1 1 1	AO3 3.8.2 f g	E
Total			**12**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
08.1	the chemical energy of the battery decreases the kinetic energy of the drill increases thermal energy is dissipated to the surroundings		1 1 1	AO1 3.2.2 a c	E
08.2	$E = 18 \times 30$ $E = 540$ J $21.6 = \frac{540}{t}$ $t = \frac{540}{21.6}$ $t = 25$ (s)	 allow correctly substituted incorrect value of E allow correct rearrangement using incorrect value of E allow correct calculation using incorrect value of E	1 1 1 1 1	AO2 3.6.5 b d	E
08.3	battery uses direct current which flows in one direction mains uses alternating current which continually changes direction		1 1	AO1 3.6.3 a b	E
08.4	$E = 1.5 \times 0.5$ $E = 0.75$ (kWh) cost per kW h = 0.2 $	allow $\frac{0.15}{0.75}$	1 1 1	AO2 3.6.5 f	E
Total			**13**		