OXFORD
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PHYSICS

9203/1

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 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.

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 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.

Question 1

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.1	**A** = microwaves **B** = ultraviolet **C** = gamma rays	**2** marks for all three correct **1** mark for one **or** two correct	2	AO1 3.3.2 b 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.2	**Type of electromagnetic wave** / **Use** Gamma rays Infrared Radio waves Bluetooth Medical imaging of unborn babies Night vision devices Security markings Sterilizing surgical instruments if more than one line is drawn from any type of electromagnetic wave then all of those lines are wrong		1 1 1	AO1 3.3.2 h 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.3	gamma waves travel at the same speed as light waves		1	AO1 3.3.2 b 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.4	10^{-15} to 10^{4} m		1	AO1 3.3.2 b 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
01.5	$v = 1.5 \times 10^{-6} \times 1.6 \times 10^{14}$ $v = 240\,000\,000$ $v = 2.4 \times 10^{8}$ (m/s)		1 1 1	AO2 3.3.1 h 4–5

Total Question 1		**10**

Question 2

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.1	a renewable energy resource is one that is being (or can be) replenished as it is used	allow it will not run out do **not** accept can be used again	1	AO1 3.2.3 d 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.2	geothermal solar		1 1	AO1 3.2.3 d 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.3	does not increase overall level of carbon dioxide in the atmosphere so does not contribute to global warming	allow carbon neutral	1 1	AO3 3.2.3 c 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.4	$\frac{80}{10} \times 2$ number = 16 (litres)	allow any correct working	1 1	AO2 3.2.3 c 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.5	distance = 60 × 15 distance = 900 (km)		1 1	AO2 3.2.3 c 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
02.6	any **two** from: • travels at a different speed • mass of contents of van varies • van travelling uphill / downhill • windy weather • condition of tyres • amount of braking during journey • different road surfaces • using air conditioning	allow any sensible alternative	2	AO3 3.1.1 b 3.2.1 b 1–3

Total Question 2		**11**

Question 3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.1	**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 3.1.1 h 4–5
	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 • hang the spring from the retort stand • measure the original length of the spring with a metre rule • attach a pointer to the end of the spring • add 100 g mass to the spring • measure the length of the spring • repeat for different masses • calculate the extension of the spring • length of spring – original length • or use a pointer and start with pointer at zero on the ruler to measure extension directly • calculate the force applied to the spring • use w = mg Some of the indicative content may be gained by a correctly labelled diagram.			

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.2	straight line through the origin	allow a calculation that shows that extension is directly proportional to force	1	AO2 3.1.1 h 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.3	e = 0.12 (m) F = 6 (N) 6 = k × 0.12 $k = \frac{6}{0.12}$ k = 50 (N/m)	 allow any correct pair of readings from the line of best fit allow a correct gradient calculation	 1 1 1	AO2 3.1.1 h 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
03.4	the spring would return to its original length because the spring has not exceeded the limit of proportionality	 allow elastic limit for limit of proportionality	1 1	AO3 3.1.1 h 4–5

Total Question 3		**12**

Question 4

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.1	line has a constant gradient	allow graph is a straight line allow speed is increasing at a steady rate	1	AO1 3.1.3 e 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.2	t = 25 (s)		1	AO2 3.1.3 e 1–3

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.3	$a = \frac{4.4}{9}$ a =0.49 m/s^2	 allow an answer that rounds to 0.49 	1 1 1	1 × AO1 2 × AO2 3.1.3 e 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.4	distance = area under graph distance = 0.5 × 4.4 × 11 = 24.2 (m) **and** distance = 9.0 × 4.4 = 39.6 (m) total distance = 24.2 + 39.6 = 63.8 (m)	 allow distance consistent with their calculated area(s)	1 1 1	AO2 3.1.3 f 6–7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.5	$2.0 = \frac{0.090}{Q}$		1	AO2 3.5.1 f 6–7
	$Q = \frac{0.090}{2.0}$	allow a correct rearrangement using an incorrectly / not converted value of *E*	1	
	Q = 0.045 (C)	allow a correct calculation using an incorrectly / not converted value of *E*	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.6	any **one** from: • LED is small so will fit inside fitness tracker • LED (uses a small current so) battery does not need recharging as often • LED doesn't get as hot • LED more efficient		1	AO3 3.5.1 o 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
04.7	the LED is in the reverse direction	allow the LED has a very high resistance in the reverse direction	1	AO3 3.5.1 o 6–7

Total Question 4		**13**

Question 5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.1	acceptable line of best fit	do **not** accept line through the origin	1	AO3 3.1.1a 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.2	$0.5 = m \times 9.8$ $m = \frac{0.5}{9.8}$ $m = 0.051$ (kg)	allow weight of one slotted mass = 0.5 N allow 0.05	1 1 1	AO2 3.1.1e 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.3	there is a frictional force in the opposite direction **or** because the block has a weight / mass		1	AO4 3.1.1a 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.4	ignore 14.2 N as it is an anomalous result add together 11.4, 11.6 and 11.8, then divide the total by 3	 2 marks may be awarded for working that clearly shows how the correct mean value of 11.6 was obtained, after the anomalous result was discarded	1 1	AO4 3.1.1a 1 × 4–5 1 × 6–7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
05.5	(at constant speed) the resultant force (on the block) is zero so pulling force will be equal to friction force (on the block)	 allow so meter reading does not keep changing	1 1	AO4 3.1.3g 1 × 6–7 1 × 8-9

Total Question 5		**9**

Question 6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.1	used in a thermostat to switch a device on / off (at a specific temperature)	allow an appliance that contains a thermostat	1 1	AO1 3.5.1 k 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.2	total resistance = 24 000 (Ω) 6 = *I* × 24 000 $I = \frac{6}{24\,000}$ *I* = 0.00025 (A)	 allow a correct substitution using an incorrectly / not converted value of *R* allow a correct rearrangement using an incorrectly / not converted value of *R* allow a correct calculation using an incorrectly / not converted value of *R* allow a maximum of **2** marks if R = 9.0 kΩ	1 1 1 1	AO2 3.5.1 h r 6–7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.3	total resistance of the circuit decreases current in the circuit increases resistance of resistor is constant V = IR therefore potential difference across resistor increases **OR**	allow as temperature increases the resistance of the thermistor deceases	1 1 1 1	AO1 3.5.1 k 2 × 6–7 2 × 8–9

	temperature increases the resistance of the thermistor deceases (1) potential difference shared between components (1) potential difference across the thermistor decreases (1) therefore potential difference across the resistor increases (1)			

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.4	potential difference across the thermistor connected in parallel is higher		1	AO1 3.5.1 s 6–7
	resistance of the thermistor is the same in each circuit		1	
	therefore, the current is higher in the thermistor connected in parallel	allow therefore the current in the parallel circuit is greater than the current in the series circuit	1	

Total Question 6		**13**

Question 7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.1	output power = 16 000 (W)		1	AO2 3.2.1 a f 8–9
	$16\,000 = \frac{W}{8}$	allow a correct substitution using an incorrectly calculated value of output power	1	
	$W = 16\,000 \times 8$	allow a correct rearrangement using an incorrectly calculated value of output power	1	
	$W = 128\,000$ (J)	allow a correct calculation using an incorrectly calculated value of output power	1	
	$128\,000 = 3200 \times d$	allow a correct substitution using an incorrectly calculated value of *W*	1	
	$d = 40$ (m)	allow a correct calculation using an incorrectly calculated value of *W*	1	
	OR			
	$64\,000 = \frac{W}{8}$ (1)			
	$W = 64\,000 \times 8$ (1)			
	$W = 512\,000$ (J) (1)			
	output $W = 128\,000$ (J) (1)			
	$128\,000 = 3200 \times d$ (1)			
	$d = 40$ (m) (1)			

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.2	work done by gravity on train **B** increases gravitational potential energy of train **A** **OR** the weight of train **B** acts down the track (1) which provides a force on train **A** up the track (1) **OR** resultant force on **A** = force from motor + force of **B** down track (2)		1 1	AO3 3.2.1 b 6–7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
07.3	the foam compresses		1	AO1 3.1.4 c 6–7
	time taken for train to stop increases (compared to hitting the wall)		1	
	therefore, rate of change of momentum decreases		1	
	therefore, reduces force on passengers	dependent on mp3	1	

Total Question 7		**12**

Question 8

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.1	$\frac{240}{V_s} = \frac{3200}{80}$ $V_s = \frac{240 \times 80}{3200}$ V_s = 6.0 (V)		1 1 1	AO2 3.6.2 e 6–7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.2	$\frac{I_s}{I_p} = \frac{240}{6}$ $I_s = 40\ I_p$	If no other mark awarded allow one mark for, if the power in both coils is the same, and the potential difference decreases the current increases	1 1	1 × AO2 1 × AO3 3.6.2 f 6–7

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.3	lighter / smaller / portable very little power used when no load applied		1 1	AO1 3.6.2 g 4–5

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
08.4	there is an alternating current in the coil in the charging pad causes an alternating magnetic field across the coil in the mobile phone	Dependant on mp 2	1 1 1	AO3 3.6.2 c 8–9

	which induces an alternating potential difference across the coil in the mobile phone (which creates an alternating current)			

Total Question 8		**10**