



**AQA Level 1/2 Certificate in Physics
PAPER 2**

SPECIMEN MARK SCHEME

MARK SCHEME

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 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

- 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 lines 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.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates 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)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate 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

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column.

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 are 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.

4. **Quality of communication and levels marking**

In Question 4(b)(ii) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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question	answers	extra information	mark											
1(a)(i)	B and C	both required and no other	1											
	same speed and direction		1											
1(a)(ii)	<table border="1"> <thead> <tr> <th>Vector</th> <th>Scalar</th> </tr> </thead> <tbody> <tr> <td>(force)</td> <td>distance</td> </tr> <tr> <td>acceleration</td> <td>kinetic energy</td> </tr> <tr> <td>momentum</td> <td>time</td> </tr> <tr> <td>weight</td> <td></td> </tr> </tbody> </table>		Vector	Scalar	(force)	distance	acceleration	kinetic energy	momentum	time	weight		1 mark for each correct answer	max 6
	Vector	Scalar												
	(force)	distance												
	acceleration	kinetic energy												
	momentum	time												
weight														
1(b)(i)	the front of the trolley is not level with the end of the metre rule		1											
	the stop clock has not been reset to zero		1											
1(b)(ii)	as the force increases so does the average speed	accept reference to positive correlation accept numerical example	1											
	the increase in speed is not linear / not directly proportional		1											
1(c)(i)	a single force that has the same effect as all the forces combined	accept all the forces added or the sum of the forces or overall force	1											
1(c)(ii)	constant velocity or constant speed (in a straight line)		1											
1(d)	$\frac{3600}{3}$		1											
	1200	correct answer with or without working gains 2 marks	1											

Question 1 continues on the next page . . .

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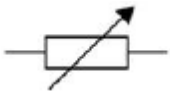
Question 1 continued . . .

question	answers	extra information	mark
1(e)	both cars are travelling at the same initial velocity	accept converse throughout	1
	car B starts decelerating (0.8 seconds) after car A		1
	the thinking time for driver B is longer		1
	both cars decelerate at the same rate		1
	car B stops (0.8 seconds) after car A		1
	and travels (12 metres) further		1
1(f)	Z		1
	it gives a unique value of resistance for each force applied	accept different force values give a different resistance value accept answers in terms of why X and Y would not be best, eg X – same resistance value is obtained for 2 different force values and Y – all force values give the same resistance	1
	there is a linear relationship between resistance and force	do not accept force and resistance are (directly) proportional	1
Total			25

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question	answers	extra information	mark
2(a)	correct symbol identified 		1
2(b)	because both I and n are changing it could be either I or n that affect W or it could be both I and n that affect W	if no other marks awarded allow 1 mark for one needs to be controlled or must only have one independent variable	1 1
2(c)	for all values of n weight supported increases with increasing current but not linearly for a given current the weight supported increases with increase in n weight supported reaches a maximum with $n = 30$ turns	accept for 1 mark, weight supported increases with increasing current	2 1 1 1
2(d)	2.3 (A)	accept any value between 2.3 and 2.4	1

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
2(e)(i)	there is a current in the electromagnet	accept electromagnet is switched on	1
	the electromagnet attracts the iron arm		1
	the arm pivots and pushes the contacts together	accept closes the switch	1
	resulting in a current in the (starter) motor circuit		1
2(e)(ii)	electrical energy is supplied to the motor, and not all of this energy is usefully transferred to kinetic energy		1
	some of the energy is wasted as thermal energy, (and sound energy)		1
	therefore (useful energy out divided by / total energy in) is less than 100%		1
Total			16

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question	answers	extra information	mark
3(a)	J Geiger–Müller tube K ratemeter		1
			1
3(b)	B		1
3(c)(i)	30		1
3(c)(ii)	$54 - 30 = 24$ (counts per minute)	allow ecf from (c)(i)	1
3(d)	any one from: <ul style="list-style-type: none">take more valuesobtain count rate over a long period of time		1
3(e)(i)	correct plotting curved line of best fit		1
			1
3(e)(ii)	2 lines drawn horizontally showing count rate halving, eg 80 and 40 2 lines drawn vertically from intercepts of above lines 6 to 8 minutes found from the difference in times between intercepts of the vertical lines drawn		1
			1
		allow 2 marks for single horizontal and vertical line at 45 counts per minute and half-life given between 6 and 8 minutes	

Question 3 continues on the next page . . .

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Question 3 continued . . .

question	answers	extra information	mark
3(f)	carbon-14 has decayed through 3 half-lives, (16,800/5,600).	allow 3 marks for an answer of 1.6g	1
	therefore, only 1/8 present today		1
	therefore, 1.6g (0.2 X 8) present, 16,800 years ago		1
Total			13

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question	answers	extra information	mark
4(a)	amplitude = 8 (cm)		1
	period = 4(s)		1
*4(b)(i)	same reading error for 10 swings as 1 swing		1
	so reduces (%) error in timings or improves accuracy		1
4(b)(ii)			
Marks awarded for this answer will be determined by the quality of communication as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a best-fit approach to the marking.			
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	There is a basic description of the experimental steps but no correct reference to dps or sfs.	There is a clear description of the experimental steps and correct reference to either dps or sfs	There is a clear and detailed description of the experimental steps and correct reference to both dps and sfs
examples of the physics points made in the response <ul style="list-style-type: none"> • measure the length of the pendulum with a ruler • pull the bob to one side, measure the angle of release and release the pendulum bob • time 10 swings / oscillations • change the length of the pendulum and repeat • divide each recorded time by 10 • number of decimal places for raw data depends on resolution of measuring device • number of sf for Time period (1.80) depends on number of sfs for time for 10 swings (18.0) 			

* The mark scheme for this question has been amended and is awaiting approval.

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question	answers	extra information	mark
4(b)(iii)	as the length of the pendulum increases the time period increases, and this relationship is non-linear	do not accept they are directly proportional	1
	the time period does not depend on the mass of the pendulum bob or the angle of release or there is no relationship between either the mass of the pendulum bob or the angle of release and the time period		1
	a specific statement illustrating that the conclusions are only valid within the limits of experimental uncertainty or a statement that the conclusions are only valid within the ranges measured for each variable	eg there are always random uncertainties within any experiment. For Table 2 data repeating the experiment 5 times for the same mass of pendulum bob, you would expect a small variation in times between 20.0 s and 20.3 s.	1
4(c)	No time period does not change / always 4 seconds because		1
	frequency is constant / frequency is related to period ($T = 1 / f$) and hence if period is constant frequency will be constant		1
Total			15

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question	answers	extra information	mark
5(a)(i)	120, 12.5 ringed		1
	thermometer / stop clock misread	allow parallax error human error is insufficient	1
5(a)(ii)	repeat the experiment twice more to obtain 3 sets of data		1
	and take a mean		1
5(a)(iii)	because the data is recorded more frequently / continuously		1
	and to a greater resolution / accuracy / no reading error		1
5(b)	there are attractive forces between molecules	accept particles for molecules	1
	only the fastest molecules have enough energy to break away from other molecules		1
	these molecules escape from the surface of the liquid		1
	therefore the average speed / energy of the remaining molecules goes down		1
	the lower the average speed / energy of molecules the lower the temperature of the liquid		1

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(c)	it reduces the cooling effect		1
	because the rate of evaporation of sweat / water decreases		1
Total			13

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question	answers	extra information	mark
6(a)	latent heat is evolved / transferred because (the substance is) changing from a liquid to a solid	accept because (the substance is) changing state	1 1
6(b)	that 3.3×10^5 (330 000) joules of energy are needed to change 1 kg of pure ice at 0°C to water at 0°C	accept in terms of energy evolved / transferred in changing from water to ice	1
6(c)(i)	acts as a control allowing the amount of ice melted without the heater to be measured or allowing the amount of ice melted by the air temperature to be measured		1 1
6(c)(ii)	using correct mass and changing to kg, ie 0.039 4.4×10^5 or 440 000	correct answer with or without working gains 2 marks	1 1
6(c)(iii)	accept any sensible suggestion that would lead to less ice being melted by the heater than expected, eg: because heater not totally covered by ice or some energy used to warm heater itself or some energy lost to the surroundings / funnel		1
Total			8