GCSE

SCIENCE A / PHYSICS

PH1HP

Mark scheme

4405/4403

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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 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

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 / ; e.g. 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 or by each stage of a longer calculation.

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.

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

Ignore or insufficient 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.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 2 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.

Question	Answers	Extra information	Mark	AO spec ref
1(a)	advantage any **one** from: • produce no / little greenhouse gases / carbon dioxide	allow produces no / little polluting gases allow doesn't contribute to global warming / climate change allow produce no acid rain / sulphur dioxide reference to atmospheric pollution is insufficient produce no harmful gases is insufficient	1	AO1 1.4.1a
	• high(er) energy density in fuel	accept one nuclear power station produces as much power as several gas power stations nuclear power stations can supply a lot of or more energy is insufficient		
	• long(er) operating life	allow saves using reserves of fossil fuels or gas		
	disadvantage any **one** from: • produce (long term) radioactive waste	accept waste is toxic accept nuclear for radioactive	1	
	• accidents at nuclear power stations may have far reaching or long term consequences			
	• high(er) decommissioning costs	accept high(er) building costs		
	• long(er) start up time			

Question 1 continues on the next page . . .

Question 1 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
1(b)(i)	12 000 (kWh)	allow **1** mark for correct substitution eg 2000 × 6 **or** 2 000 000 × 6 **or** $\frac{12\,000\,000}{1000}$ an answer of 12 000 000 scores **1** mark	2	AO2 1.3.1c
1(b)(ii)	any idea of unreliability, eg • wind is unreliable • shut down if wind too strong/weak • wind is variable	reference to weather alone is insufficient	1	AO1 1.4
1(c)	any **one** from: • cannot be seen • no hazard to (low flying) aircraft / helicopters • unlikely to be or not damaged / affected by (severe) weather • (normally) no / reduced shock hazard	unlikely to be damaged is insufficient safer is insufficient less maintenance is insufficient installed in urban areas is insufficient	1	AO1 1.4
Total			**6**	

Question	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.	Mark	AO spec ref
2		6	AO1 1.1.2a

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content.	Considers either solid or gas and describes at least one aspect of the particles. **or** Considers both solids and gases and describes an aspect of each.	Considers both solids and gases and describes aspects of the particles. **or** Considers one state and describes aspects of the particles and explains at least one of the properties. **or** Considers both states and describes an aspect of the particles for both and explains a property for solids or gases.	Considers both states of matter and describes the spacing and movement / forces between the particles. Explains a property of both solids and gases.

examples of the points made in the response

Solids
- (particles) close together
- (so) no room for particles to move closer (so hard to compress)
- vibrate about fixed point
- strong forces of attraction (at a distance)
- the forces become repulsive if the particles get closer
- particles strongly held together/not free to move around (shape is fixed)

Gases
- (particles) far apart
- space between particles (so easy to compress)
- move randomly
- negligible/no forces of attraction
- spread out in all directions (to fill the container)

extra information

any explanation of a property must match with the given aspect(s) of the particles.

Total		6

Question	Answers	Extra information	Mark	AO spec ref
3(a)	infrared / IR	correct answer only	1	AO1 1.1.1a
3(b)	any **two** from: • increase the power / watts • decrease the speed • put biscuits through again	 allow increase the temperature of the oven or make the oven hotter allow leave the biscuits in for longer increase radiation is insufficient ignore changes to the design of the oven	2	AO2 1.3.1c
3(c)	(inside) surface is a (good) reflector or poor absorber (of IR) (and) <u>outside</u> surface is poor emitter (of IR) (so) increases the energy reaching the biscuits	ignore bounce for reflect surface is a (good) reflector of light does not score surface is a (good) reflector of light and infrared / heat does score allow reduces energy loss or makes oven more efficient do **not** accept no energy losses keeps oven hotter is insufficient	1 1 1	AO1 1.1.1c, d
Total			**6**	

Question	Answers	Extra information	Mark	AO spec ref
4(a)(i)	440 (sound) waves produced in one second	accept vibrations / oscillations for waves	1	AO1 1.5.1i
4(a)(ii)	0.773 (metres)	allow **2** marks for an answer that rounds to 0.773 allow **2** marks for an answer of 0.77̇2̇ allow **2** marks for an answer of 0.772 allow **1** mark for correct substitution ie 340 = 440 × λ	3	AO2 1.5.1j
4(b)	(sound is) louder	do **not** accept the converse	1	AO1 AO3 1.5.3b
	as amplitude is larger	waves are taller is insufficient	1	
	higher pitch/frequency		1	
	as more waves are seen	reference to wavelengths alone is insufficient waves are closer together is insufficient	1	
Total			**8**	

Question	Answers	Extra information	Mark	AO spec ref
5(a)	water moves (from a higher level to a lower level) transferring GPE to KE rotating a turbine to turn a generator transferring KE to electrical energy	 accept driving or turning or spinning for rotating moving is insufficient transferring GPE to electrical energy gains **1** mark of the **2** marks available for energy transfers	1 1 1 1	AO1 1.4.1b
5(b)	(TVs in stand-by) use electricity generating electricity (from fossil fuels) produces CO_2 (CO_2) contributes to global warming	accept power / energy accept greenhouse gas accept sulfur dioxide accept climate change for global warming accept greenhouse effect if CO_2 given accept acid rain if linked to sulfur dioxide	1 1 1	AO1 AO2 1.4.1f
5(c)	a factor other than scientific is given, eg economic, political or legal	personal choice is insufficient	1	AO3 1.2
Total			**8**	

Question	Answers	Extra information	Mark	AO spec ref
6(a)	air near freezer compartment is cooled or loses energy	accept air at the top is cold	1	AO1 1.1.3a
	cool air is (more) dense or particles close(r) together (than warmer air)	do **not** allow the particles get smaller / condense	1	
	so (cooler) air falls		1	
	air (at bottom) is displaced / moves upwards / rises	do **not** allow heat rises accept warm air (at the bottom) rises	1	
6(b)	if volume is doubled, energy use is not doubled **or** volume ÷ energy not a constant ratio		1	AO3 1.1.3
	correct reference to data, eg 500 is 2×250 but 630 not 2×300		1	
6(c)	accept suitable examples, eg			AO3 1.2
	advantage: • reduces emissions into atmosphere • lower input power or uses less energy or wastes less energy • costs less to run	cost of buying or installing new fridge is insufficient ignore reference to size of fridge	1	
	disadvantage: • land fill • energy waste in production • cost or difficulty of disposal • transport costs		1	
Total			**8**	

Question	Answers	Extra information	Mark	AO spec ref
7(a)	conduction		1	AO1 1.1.3
7(b)	35 000		1	AO2 1.1.4a
7(c)	500 J/kg°C	their 7(b) = 2 x c x 35 correctly calculated scores **2** marks allow **1** mark for correct substitution, ie 35000 = 2 x c x 35 **or** their 7(b) = 2 x c x 35	2 1	AO1 AO2
7(d)	energy lost to surroundings **or** energy needed to warm heater	accept there is no insulation (on the copper block) do **not** accept answers in terms of human error or poor results or defective equipment	1	AO3 1.1.3d
Total			**6**	

Question	Answers	Extra information	Mark	AO spec ref
8(a)(i)	5.88 (watts)	an answer of 5.9 scores **2** marks allow **1** mark for correct substitution ie $0.42 = \frac{\text{power out}}{14}$ allow **1** mark for an answer of 0.0588 or 0.059	2	AO2 1.2.1d
8(a)(ii)	8.12	allow 14 – their 8(a)(i) correctly calculated	1	AO2 1.2.1a
8(b)(i)	input power/energy would be (much) less (reducing cost of running)	accept the converse electricity is insufficient	1	AO1 AO2 1.2
	(also) produce less waste energy / power	accept 'heat' for waste energy	1	
	(as the waste energy / power) increases temperature of the cabinet		1	
	so cooler on for less time		1	
8(b)(ii)	line graph both variables are continuous	need to get both parts correct accept scattergram or scatter graph allow the data is continuous	1	AO3 1.2c

Question 8 continues on the next page . . .

Question 8 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
8(c)	number of bulbs used-halogen=24 (LED=1)		1	AO2 AO3 1.2
	total cost of LED = £30 + £67.20 = £97.20	accept a comparison of buying costs of halogen £36 and LED £30	1	
	total cost of halogen= 24 x £1.50 + 24 x £16.00 = £420 **or** buying cost of halogen is £36 **and** operating cost is £384	accept a comparison of operating costs of halogen £384 and LED £67.20 allow for **3** marks the difference in total cost is £322.80 if the number 24 has not been credited	1	
	statement based on correct calculations that overall LED is cheaper	must be **both** buying **and** operating costs	1	
	an alternative way of answering is in terms of cost per hour:			
	buying cost per hour for LED = $\left(\frac{£30.00}{48000}\right)$ = 0.0625p/£0.000625 buying cost per hour for halogen = $\left(\frac{£1.50}{2000}\right)$ = 0.075p/£0.00075	a calculation of both buying costs scores **1** mark		
	operating cost per hour for LED = $\left(\frac{£67.20}{48000}\right)$ = 0.14p/£0.0014 operating cost per hour for halogen = $\left(\frac{£16.00}{2000}\right)$ = 0.8p/£0.008	a calculation of both operating costs scores **1** mark		
	all calculations show a correct unit	**all** units correct scores **1** mark		
	statement based on correct calculations of **both** buying **and** operating costs, that overall LED is cheaper	correct statement scores **1** mark		
Total			**12**	