Level 3 Certificate/Extended Certificate
APPLIED SCIENCE
ASC1P

Unit 1 Key Concepts in Science

Section C – Physics

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 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

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.

Question	Answers	Additional comments	Mark	AO
01.1	copper is a good thermal / heat conductor (the heat exchanger) has a large surface area	ignore responses which simply state 'it is made from copper'	1 1	AO1 AO1
01.2	it is not always sunny **or** solar energy is unpredictable (so) the water from the solar panels may not heat the water sufficiently	allow correct reference to night time allow 'the water heater provides a backup'	1 1	AO1 AO1
01.3	temperature of water (inside the tank) temperature of the outside (of the insulating jacket)	allow 'the temperature difference between the water in the tank and surface of the insulating jacket' for **2** marks allow 'the temperature of the surroundings' for 'outside of the tank' if no other marks awarded allow 1 mark for the change in temperature	1 1	AO3 AO3
01.4	**A**		1	AO2
01.5 **(view with 1.4)**	it has the lowest temperature drop **or** it has the lowest temperature change	no error carried forward from Question **01.4** allow loses least heat allow 'the final temperature is higher'. allow 'it takes the longest to cool down' **or** 'cools at the slowest rate'.	1	AO1
Total			**8**	

Question	Answers	Additional comments	Mark	AO
02.1	**Advantage:** any **one** from: • no CO_2 / exhaust gases / greenhouse gases / zero emissions produced by electric car • electric cars are more efficient • electricity to charge car can be generated from a renewable source • reduces reliance on (crude) oil / conserves supplies of (crude) oil **Disadvantage:** any **one** from: • fossil fuels are burned to generate the electricity needed to charge electric car • cars cost more • range of car is less than petrol car • not many charging points • takes a long time to charge	ignore pollution or less damaging to the environment unqualified do not accept 'fossil fuels' instead of oil here as fossil fuels still needed to generate electricity	1 1	AO1 AO1
02.2	correct conversion of 72 kW to 72000 W (use of $I = \frac{P}{V} = \frac{72000}{360}$ to give) 200 A **or** amps **or** amperes	 an answer of 200 scores 2 marks an answer of 0.20 or 20 scores 1 mark (failure to convert 72 kW) do **not** allow 'a'	1 1 1	AO2 AO2 AO1

02.3	correct use of $I = \frac{Q}{t}$ $(t = \frac{Q}{I} = \frac{9.1 \times 10^5}{200} =)$ 4550 (s) or 4600 (s)	allow ecf from Question **02.2** an answer of 4550 or 4600 scores 2 marks an answer of 75.8(333) minutes scores 2 marks allow a calculation using a time of 76 minutes for example: $I = \frac{Q}{t} = \frac{9.1 \times 10^5}{4560}$ = 199(.56…) ≈ 200 A for 2 marks **or** Q = It = 200 x 4560 = 912 000 ≈ 9.1 x 10^5 C for 2 marks answer must be consistent with the current value in **02.2** for both marks	1 1	AO2 AO2

02.4	correct use of s = vt (s = 24 × 4600 =) 109 200 **or** 109 000 **or** 110 000	allow ecf from Question **02.3** an answer of 110 000 / 109 000 / 109200 scores 2 marks allow (24 x 76 =) 1824 for 1 mark allow 109 440 (use of 76 minutes = 4560 s) for 2 marks	1 1	AO2 AO2

02.5	(the car has the) same (kinetic) energy / power going downhill as it had on the horizontal track		1	AO1
	some of this (kinetic) energy is provided by (the change in) gravitational potential energy **or** work is done as gravitational potential energy is decreasing	allow correct reference to (force of) gravity	1	AO2
	(so) electrical energy required is less (than the horizontal track) **or** (so) power / energy from the battery is less (than the horizontal track) **or** (so) less work is done by the battery	allow reference to current = power/voltage **or** current = energy/(voltage × time) so the current is less for last mark.	1	AO2

Total			**12**