



**General Certificate of Secondary Education  
January 2013**

**Additional Science**

**AS2FP**

**(Specification 4409)**

**Unit 6: Additional Science 2**

**Final**

***Mark Scheme***

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Principal Examiners have prepared these mark schemes for examination. However, as there were no entries for this paper, these mark schemes have not been through the normal process of standardising that would take place for other live papers.

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](http://aqa.org.uk)

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## Quality of Written Communication and levels marking

In Question 11 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 1**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>1(a)(i)</b>	carbon dioxide	answers may be in either order	1
	water	allow only correct chemical formulae	1
<b>1(a)(ii)</b>	releases energy		1
<b>1(b)</b>	mitochondria		1
<b>1(c)(i)</b>	run for the same time		1
	run at the same speed		1
	be the same sex		1
<b>1(c)(ii)</b>	less prone to (human) error / more accurate	accept any relevant error described	1
<b>Total</b>			<b>8</b>

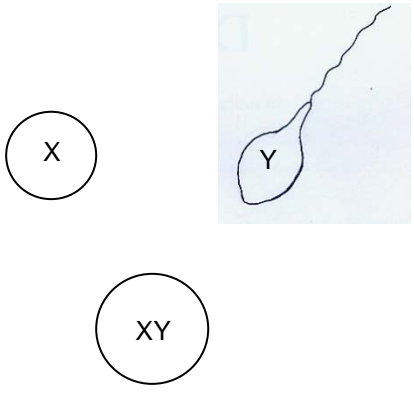
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**Question 2**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>2(a)(i)</b>	takes less time / quicker	answers must be comparative takes 15 minutes, <u>not</u> 24 hours (answer must be comparative)	1
	less risk of poisons / toxins produced	allow less poisons / toxins produced	1
<b>2(a)(ii)</b>	any <b>one</b> from: <ul style="list-style-type: none"> <li>more (long) protein / fibres broken down</li> <li>less (physical) effort</li> </ul>	answers must be comparative	1
<b>2(b)</b>	protease		1
<b>2(c)</b>	any <b>one</b> from: <ul style="list-style-type: none"> <li>enzymes (more) active / work (faster)</li> <li>protein / fibres broken down quicker</li> </ul>	accept converse if clear reference to cold place	1
<b>2(d)</b>	(enzyme would be) denatured / destroyed / damaged	accept description, eg active site (shape) changed do <b>not</b> accept 'killed'	1
<b>Total</b>			<b>6</b>

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**Question 3**

question	answers	extra information	mark
3(a)	male with PKU	both descriptors needed, either order	1
3(b)	recessive		1
3(c)(i)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• ovary / ovaries</li> <li>• testis / testes</li> </ul>	accept only correct (biological) term	1
3(c)(ii)	23	do <b>not</b> accept 23 pairs	1
3(d)	 <p>The diagram illustrates the fusion of gametes. On the left, a circle contains the letter 'X'. To its right is a sperm cell, depicted as a head with a tail, containing the letter 'Y'. Below these, a larger circle contains the letters 'XY', representing the fertilized cell.</p>	ignore upper/lower case letters  1 mark for X in correct gamete 1 mark for Y in correct gamete 1 mark for XY or YX in fertilised cell	3
<b>Total</b>			<b>7</b>

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**Question 4**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>4(a)(i)</b>	sulfuric (acid)	accept sulphuric (acid)	1
<b>4(a)(ii)</b>	CuO	accept copper oxide	1
<b>4(a)(iii)</b>	crystallising		1
<b>4(b)(i)</b>	blue		1
<b>4(b)(ii)</b>	reversible	allow description eg reaction can go either way / both ways	1
<b>Total</b>			<b>5</b>

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**Question 5**

question	answers	extra information	mark
5(a)	exothermic		1
5(b)	(calcium oxide +) water (→) calcium hydroxide	accept correct formulae	1
5(c)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• insulating material</li> <li>• different factories used to fill can</li> <li>• internal wall (separates reactants from the drink)</li> </ul>		2
5(d)(i)	mass	allow amount/weight allow same starting temperature allow volume of drink / water	1
5(d)(ii)	small lumps any <b>one</b> from: <ul style="list-style-type: none"> <li>• large lumps don't heat the drink up enough</li> <li>• powdered drink too hot to drink or other safety idea</li> <li>• heats to safe drinkable temperature</li> </ul>	accept safety idea  allow for <b>2</b> marks powdered as use less of it so save money / space	1 1
5(e)(i)	powdered		1
5(e)(ii)	has the largest surface area		1
<b>Total</b>			<b>9</b>



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**Question 6**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>6(a)(i)</b>	sodium chloride solution		1
<b>6(a)(ii)</b>	ions		1
<b>6(b)(i)</b>	(gases – either order)		
	chlorine		1
	hydrogen		1
	(solution)		
	sodium hydroxide		1
<b>6(b)(ii)</b>	bleach		1
	soap		1
<b>Total</b>			<b>7</b>

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**Question 7**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>7(a)(i)</b>	brown	in this order only	1
	blue		1
<b>7(a)(ii)</b>	conducts electric current	allow conducts electricity do <b>not</b> allow just conductor unqualified or conductor of heat	1
<b>7(b)(i)</b>	current		1
<b>7(b)(ii)</b>	frequency		1
<b>7(c)(i)</b>	5A		1
<b>7 (c)(ii)</b>	(fuse) melts/breaks	accept blow	1
<b>7(c)(iii)</b>	920	1 mark for 4 x 230	2
	W		1
<b>Total</b>			<b>10</b>

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**Question 8**

question	answers	extra information	mark
<b>8(a)(i)</b>	any suitable source  eg cosmic rays nuclear weapons testing nuclear accidents	not just nuclear or nuclear power	1
<b>8(a)(ii)</b>	protons  neutrons		1  1
<b>8(a)(iii)</b>	84  134	accept answers on the diagram	1  1
<b>8(b)(i)</b>	highest radon levels  <b>or</b> highest concentration of uranium rocks	allow most/more uranium rocks	1
<b>8(b)(ii)</b>	bedroom <b>and</b> living room  these rooms are where people spend most of the time  so have longer exposure to radon gas	either order  these marks are still given even if the rooms they suggest are incorrect.	1  1  1
<b>8(b)(iii)</b>	the agency offers unbiased advice		1
<b>Total</b>			<b>10</b>

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**Question 9**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>9(a)(i)</b>	'remains' of organisms	allow examples eg bones / shells / rootlet traces / burrows / tracks	1
	any <b>one</b> from: <ul style="list-style-type: none"> <li>• from many years ago</li> <li>• in rocks</li> </ul>	allow eg 'hundreds of years'	1
<b>9(a)(ii)</b>	any <b>two</b> ideas from: <ul style="list-style-type: none"> <li>• not yet found</li> <li>• were never formed</li> <li>• destroyed (by geological activity)</li> </ul>		2
<b>9(b)</b>	D		1
	idea of deeper rocks being formed earlier	do <b>not</b> allow just 'deeper/ lower'	1
<b>9(c)</b>	any <b>three</b> from: <ul style="list-style-type: none"> <li>• changes to the environment over long periods of/ geological time</li> <li>• <u>new</u> predators</li> <li>• <u>new</u> diseases</li> <li>• <u>new</u> (more successful) competitors</li> <li>• catastrophic event/ example</li> <li>• cyclical nature of speciation</li> </ul>	do <b>not</b> allow just 'changes to the environment' an idea of long time scale is required do <b>not</b> allow predators, alone do <b>not</b> allow disease, alone do <b>not</b> allow competitors, alone	3
<b>Total</b>			<b>9</b>

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**Question 10**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>10(a)(i)</b>	alkaline / alkali		1
<b>10(a)(ii)</b>	OH <sup>-</sup>		1
<b>10(b)</b>	can be developed (for writing to be seen)	allow is colourless (in neutral / acidic solution) so can't be seen but is pink (in alkaline solution)	1
<b>Total</b>			<b>3</b>

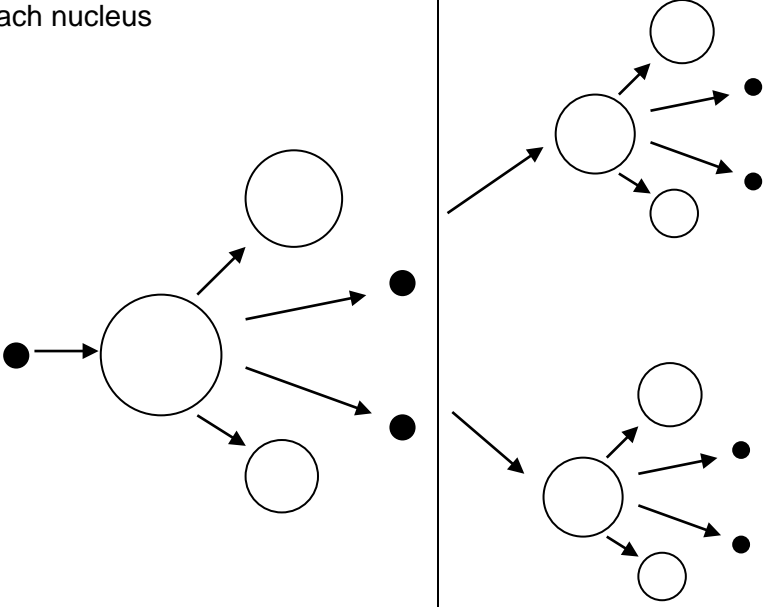
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**Question 11**

question	answers	extra information	mark
11			6
<p>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 3 and apply a best fit approach to the marking.</p>			
0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	There is a brief description of why catalysts are used in industry <b>or</b> a reason why platinum is used as a catalyst. There is little specialist terminology used.	There is a clear description of why catalysts are used in industry and a reason why platinum is used as a catalyst. There is some specialist terminology used.	There is a clear and detailed description of why catalysts are used in industry linked to the use of platinum as a catalyst. Specialist terminology is used accurately.
<p><b>examples of chemistry points made in the response</b></p> <p>Used in industry because:</p> <ul style="list-style-type: none"> <li>• (lowering activation energy) decreases energy particles need for successful collisions</li> <li>• more particles will have the necessary activation energy</li> <li>• so more successful collisions</li> <li>• and rate of reaction increases</li> <li>• reactions take place at lower temperatures / require less energy</li> <li>• so saves fuel / energy</li> <li>• (and) reduces costs</li> </ul> <p>Platinum used:</p> <ul style="list-style-type: none"> <li>• catalysts are specific for a particular reaction (different reactions need different catalysts)</li> <li>• not used up</li> <li>• only small amounts used / structures designed to have large surface area eg gauze, honeycomb structure which is thinly covered by catalyst</li> </ul>			<p><b>extra information</b></p>
<b>Total</b>			<b>6</b>

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Question 12

question	answers	extra information	mark
12(a)(i)	any <b>one</b> from <ul style="list-style-type: none"> <li>• uranium</li> <li>• plutonium</li> </ul>	ignore any number	1
12(a)(ii)	a (uranium/plutonium) nucleus absorbs a neutron	do <b>not</b> accept neutron fired/hits into uranium/plutonium	1
	the nucleus splits		1
	energy is released		1
	2 further neutrons are released		1
12(a)(iii)	2 more nuclei splitting into 2		1
	2 further neutrons released from each nucleus		1
12(b)(i)	joining two atomic nuclei to form a larger one	allow named fusion reaction	1

Question 12 continues on the next page . . .

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**Question 12 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>12(b)(ii)</b>	any <b>one</b> from <ul style="list-style-type: none"><li>• mass of star is very large</li><li>• small fraction (of the total mass) is being converted each second</li></ul>		<b>1</b>
<b>12(b)(iii)</b>	any <b>one</b> from: <ul style="list-style-type: none"><li>• can't reach/maintain high enough temperatures</li><li>• no materials can withstand the extreme temperature needed</li><li>• technology not developed yet</li></ul>		<b>1</b>
<b>Total</b>			<b>10</b>