



# General Certificate of Secondary Education

## Science 3860

*3860/2H Science for the Needs of Society*

## Mark Scheme

*2006 examination – January series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

question	answers	extra information	marks
1(a)	oxygen (released)	allow unambiguous symbols	1
	carbon dioxide (from the air)		1
	water (from the roots)		1
(b)	chlorophyll	accept phonetic spelling  do <b>not</b> accept chloroplast	1
(c)	glucose / sugar / starch		1
(d)	any <b>four</b> from: <ul style="list-style-type: none"> <li>• at least two plants <b>or</b> use the same plant twice</li> <li>• fair test specified e.g. same size <b>or</b> leave for same amount of time</li> <li>• at least two different lighting conditions</li> <li>• measure or compare</li> <li>• repeat experiment <b>or</b> take an average of results</li> </ul>	ignore experiments for germinating seeds  do <b>not</b> accept leaves if detached from plant (but can score other marks)  accept check differences between them	4
<b>Total</b>			<b>9</b>

question	answers	extra information	marks
2(a)	Fe <sub>2</sub> O <sub>3</sub> / Fe <sub>3</sub> O <sub>4</sub> / FeO	accept OFe do <b>not</b> allow FeO <sub>2</sub> / FeO <sub>3</sub> symbols correct <b>not</b> superscript	1
	carbon		1
	calcium carbonate		1
	compound	do <b>not</b> allow non metal compound	1
(b)(i)	gives out heat / energy <b>or</b>	do <b>not</b> allow gets hotter	1
	creates / produces heat	allow heat is lost	
(b)(ii)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• provides heat / high temperature</li> <li>• speeds up reaction</li> <li>• produces the reducing agent (CO)</li> </ul>	do <b>not</b> allow to separate iron from iron ore	1
(c)(i)	mined / quarried / dug up / extracted from the ground	do <b>not</b> accept from the ground only <b>or</b> extracted only	1
(c)(ii)	CaCO <sub>3</sub>		1
	CaO	formulae must be correct	1
	CO <sub>2</sub>	-1 for incorrect balancing	1

question	answers	extra information	marks
2(d)	<ul style="list-style-type: none"><li>• by reduction / displacement</li><li>• removal of oxygen (from iron oxide)</li><li>• using carbon / carbon monoxide / coke or using reducing agent</li></ul>		1 1 1
	second and third bullet points can be scored from word <b>or</b> symbol equation		
	e.g.		
	$\text{FeO} + \text{CO} \rightarrow \text{Fe} + \text{CO}_2 = 2$ marks		
	$\text{FeO} + \text{CO} \rightarrow \text{Fe} = 1$ mark (reducing agent)		
	$\text{FeO} \rightarrow \text{Fe} + \text{CO}_2 = 1$ mark (removal of oxygen)		
	$\text{FeO} \rightarrow \text{Fe} = 0$ marks		
<b>Total</b>			<b>13</b>

question	answers	extra information	marks
3(a)(i)	<b>A</b> healthier pigs	anything that implies healthy	1
	<b>B</b> eat more food / put on weight <b>or</b> move about less / lose less energy	allow get fat	1
	<b>C</b> less energy used up keeping warm <b>or</b> pig won't lose energy / weight keeping warm		1
(ii)	pigs under controlled conditions / pigs in pens / crowded conditions / small space / indoors	no mark for intensive  do <b>not</b> accept organic but give error carried forward for (b)	1
(b)(i)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• low labour cost / cheaper</li> <li>• space saved / mass production</li> <li>• more meat produced / higher yield</li> <li>• pigs easier to monitor / control</li> <li>• safe from predators</li> </ul>	if organic as answer (a)(ii) healthier / happier animals / more humane (1)  better quality meat / no chemicals (in meat) / tastes better (1)	2
(ii)	unnatural / cruel / cannot move	if organic as answer (a)(ii) cost more	1
	unhealthy / prone to disease	more space labour intensive lower yield / less meat harder to monitor / control	1

question	answers	extra information	marks
3(c)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• outdoors / free range / humane / better conditions</li> <li>• no artificial additives in feed / organic feed</li> </ul>		1
(d)(i)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• longer body / more meat / heavier</li> <li>• <b>no</b> tusks</li> <li>• tamer / less aggressive</li> <li>• not so much hair / fur</li> <li>• smaller snout</li> <li>• smaller tail</li> </ul>	do <b>not</b> allow fatter	2
(ii)	select parents with desired characteristics e.g. size <b>or</b> quality of meat  cross them / let them breed  select from offspring  repeat over several generations	<b>not</b> just best	1 1 1 1
<b>Total</b>			<b>15</b>

question	answers	extra information	marks
4(a)(i)	any <b>one</b> from: <ul style="list-style-type: none"> <li>larger surface area (for heat transfer)</li> <li>small tubes heat up quicker / easier to heat</li> </ul>		1
(ii)	absorbs heat / light / energy / takes in heat <b>or</b> gets hotter than white  by radiation	<b>do not</b> accept attracts heat	1 1
(b)	<u>conduction</u> word must be used in context e.g. (conduction) from: tubes / solar water heat  to: water supply / heat exchanger  convection <ul style="list-style-type: none"> <li>in water in the cylinder</li> <li>hot water rises / circulation in water</li> </ul>		1 1 1 1
(c)	lower heat capacity than water  less heat transferred / less heat absorbed	<b>not</b> speed up heating  <b>not</b> just less efficient	1 1
(d)(i)	$3 \times 4$ = 12 (kWh) (12 000 Wh = 2 marks)	<b>two</b> marks for correct answer only  answer of 12 000 from $3000 \times 4 = 1$ mark	1 1
(ii)	$12 \times 7$ = 84 (p)	allow ecf	1 1

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>marks</b>
(iii)	$365 \times 84$		1
	$= 30\,660 \text{ p} = \text{£}307$		1
(iv)	$3000 / 307$		1
	$= 9.8$ (years) allow 10 years		1
<b>Total</b>			<b>17</b>



question	answers	extra information	marks
5(a)	readings from graph (6.1 and 10.1)		1
	4 (or consequential on own values)		1
(b)(i)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• cannot produce hormone / need to take hormone</li> <li>• cannot control sugar levels</li> <li>• <b>sugar levels</b> stay high</li> </ul>		2
(ii)	insulin phonetic spelling		1
(c)	any <b>three</b> from: (if glucose level is too high) <ul style="list-style-type: none"> <li>• insulin released</li> <li>• from pancreas</li> <li>• glucose converted to glycogen</li> <li>• stored</li> <li>• in liver / muscles</li> </ul>	<b>not glucagon</b>	3
	any <b>one</b> from: (if glucose level is too low) <ul style="list-style-type: none"> <li>• glucagon released</li> <li>• glycogen turned back into glucose</li> </ul>		1
<b>Total</b>			<b>9</b>

question	answers	extra information	marks
6(a)	any <b>three</b> from: <ul style="list-style-type: none"> <li>• ionic bonding / formation of ions</li> <li>• transfer of electrons (bonding diagram)</li> <li>• from magnesium to oxygen</li> </ul> or <ul style="list-style-type: none"> <li>• force of attraction</li> <li>• between ions</li> <li>• of opposite charge</li> </ul>	can mix and match  <b>not</b> strong bonds	3
(b)(i)	any <b>three</b> from: <ul style="list-style-type: none"> <li>• covalent bonds</li> <li>• between atoms</li> <li>• sharing of electrons</li> <li>• giant</li> <li>• molecule</li> </ul>	covalent must be spelled correctly  <b>not</b> sharing of atoms	3
(c)	lining furnaces / bricks / plates / tiles /  pottery / hair straightener		1
<b>Total</b>			<b>7</b>

question	answers	extra information	marks
7(a)	power = voltage $\times$ current		1
	= $12 \times 1.5$	can subsume first marking point for 2 marks	1
	= 18 (watts)	3 marks for correct answer alone	1
(b)	power = 0.018	first 2 marks one independent mark	1
	time = 0.5		
	energy = 0.009 (kWh)	allow ecf from (a)	1
			1
(c)	efficiency = energy transferred / energy supplied		1
	= $0.0042 / 0.009$	ecf from (b)	1
	= 0.47 (47%)	answer alone scores 3 marks	1
(d)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• use a lid</li> <li>• heater nearer bottom / heater with larger surface area</li> <li>• insulate the sides of the beaker / reduce heat loss</li> <li>• use a more powerful heater / reduce the heating time / higher voltage</li> </ul>		2
<b>Total</b>			<b>11</b>

question	answers	extra information	marks
8(a)(i)	23 in egg		1
	23 in sperm		1
	46 in zygote		1
(a)(ii)	meiosis	spelling must be correct	1
	meiosis		1
	mitosis		1
(b)	<p>any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>• chromosomes are copied</li> <li>• chromosomes pair up</li> <li>• parts are exchanged</li> <li>• first cell division</li> <li>• second cell division</li> <li>• four gametes formed / (daughter) cells</li> <li>• half the number of chromosomes in each cell</li> </ul>		3
<b>Total</b>			<b>9</b>
<b>Overall marks = 90</b>			