

Science B (Gateway)

General Certificate of Secondary Education **GCSE J640**

Mark Schemes for the Units

January 2007

J640/MS/R/07J

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annersley
NOTTINGHAM
NG15 0DL

Telephone: 0870 870 6622
Facsimile: 0870 870 6621
E-mail: publications@ocr.org.uk

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General Certificate of Secondary Education

GCSE Science B (Gateway) J640

MARK SCHEMES FOR THE UNITS

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Mark Scheme B621/01

January 2007

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	= alternative and acceptable answers for the same marking point
(1)	= separates marking points
not	= answers which are not worthy of credit
reject	= answers which are not worthy of credit
ignore	= statements which are irrelevant
allow	= answers that can be accepted
()	= words which are not essential to gain credit
<u> </u>	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW	= alternative wording
ora	= or reverse argument

Question		Expected Answers	Mks	Rationale
1	(a)	sound (1) ear (1) muscles (1)	3	correct answers only chosen from list more than one response on each line scores zero
	(b)	any two from: she does it without thinking /aw (1) it happens quickly (1) always the same response/aw (1)	2	allow automatic reaction/does not know she is doing it/uncontrollable/brain not involved allow jumps up/leaps up/a sudden movement “ <i>always jumps up</i> ” = 2 marks (for ‘same response’ and ‘rapid response’) “ <i>jumped up without planning it</i> ” = 2 marks (for ‘does it without thinking’ and ‘it happens quickly’)
	(c)	nerves/(sensory)neurones/electrical signals/electrical impulses (1)	1	not motor neurones/connector neurones not reference to the brain ignore messages
		Total	6	

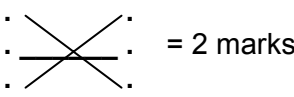
2	(a)		provides energy (1)	1	more than one response scores zero allow if the candidate circles, underlines, ticks or crosses the correct response in the list
	(b)		Liz, Liz total = 142 (1) John total = 91 (1)	2	no mark for Liz on its own allow one mark for 142 and 91 if Liz not identified allow one mark for Liz's (total) is higher than John's/Liz's energy intake is higher/both of Liz's foods are higher than both of John's if no other mark has been awarded allow Liz's foods are higher energy/GI than John's
	(c)		insulin (1) pancreas (1)	2	correct answers only chosen from list answers must be on line correct order only
	(d)		absorption/diffusion (into the bloodstream) (1) occurs in the (small) intestine/ileum/duodenum (1)	2	allow absorption through wall/moves from high concentration to low concentration not absorption through cell walls (cell walls are only found in plant cells) ignore osmosis not large intestine ignore stomach/gut allow villi the marking points are independent so that absorption through large intestines scores 1 mark for absorption
			Total	7	

3	(a)	(i)	gender/eye colour (1)	1	allow female/blue (eyes) any incorrect response scores zero
		(ii)	spoken language/scar (1)	1	correct answer only from list any incorrect response scores zero
	(b)		DNA (1) nucleus (1) genes (1)	3	correct answers only, in correct order, chosen from list
		(i)	some of Grace's genes/DNA/ chromosomes pass to the baby (1) some of Grace's alleles are dominant (some are recessive) (1)	1	allow some of Grace's DNA passes to the baby allow some of Grace's chromosomes pass to the baby allow has genes from both parents/has DNA from both parents/has chromosomes from both parents/has alleles from both parents allow mention of egg instead of Grace the limit of acceptability is because of Grace's alleles/because of Grace's DNA/because of Grace's chromosomes/because of Grace's genes ignore has some of Grace's characteristics
	(ii)	some of the baby's genes/DNA/ chromosomes come from Rick (1) some of Rick's alleles are dominant to Grace's (1) some of Grace's characteristics are influenced by the environment (1)	1	allow some of Rick's DNA passes to the baby allow some of Rick's chromosomes pass to the baby allow has genes from both parents/has DNA from both parents/has chromosomes from both parents/has alleles from both parents the limit of acceptability is because of Rick 's alleles/because of Rick's DNA/because of Rick's chromosomes/because of Rick's genes ignore has some of Rick's characteristics allow mention of sperm instead of Rick allow specific examples of environment, limited to drugs/smoking/alcohol/food/disease	
Total			7		

4

4	(a)		E104 (1)	1	allow 104 not food colour more than one response scores zero
	(b)		(food) colour (1)	1	more than one response scores zero
	(c)		sodium hydrogencarbonate → sodium carbonate + water + carbon dioxide (1)	1	allow any order for the products allow $\text{NaHCO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Na}_2\text{CO}_3$ ie unbalanced allow mix of formulae and names not sodium hydrocarbonate/ hydrogencarbonate if name and formula given mark the name eg sodium hydrocarbonate NaHCO_3 would score 0
			Total	3	

5	(a)		D (1)	1	allow correct formula, ie $\text{CH}_3\text{OH}/\text{CH}_4\text{O}$ (elements may be in any order)
	(b)		carbon (1) hydrogen (1)	2	not C and H - names only allow any order
			Total	3	

6	(a)		insoluble – does not dissolve soluble – does dissolve solvent – liquid that does the dissolving all three correct (2) one or two correct (1)	2	
	(b)		(pleasant) smell (1) evaporates easily (1) does not dissolve in water (1) does not react with water (1) non-toxic (1)	1	ignore does not irritate skin (stem of question) ignore evaporates/evaporates quickly allow does not stain allow does not wash off easily
			Total	3	

7	(a)	<p>any two from: non-biodegradable/do not rot/do not decay/not attacked by bacteria/do not break down/do not decompose/aw (1) cause litter (1) waste of a resource/aw (1) eyesore (1) takes up space in landfill sites (1) burning produces toxic fumes/greenhouse gases/carbon dioxide/carbon monoxide (1) hard to recycle (1)</p>	2	<p>ignore does not deteriorate/does not disintegrate allow takes a long time to rot/does not break down easily</p> <p>allow idea of makes a mess (limit of acceptability)</p> <p>ignore harmful fumes/dangerous fumes ignore pollution ignore references to harming animals</p>
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	(b)	<p>any two from:</p> <p>does not shatter easily/does not break (when hit)/aw (1)</p> <p>does not corrode/does not react with water/does not react with oxygen/does not react with air/does not react with moist air/aw (1)</p> <p>not degraded by sunlight/not degraded by UV/aw (1)</p> <p>does not dissolve in water/aw (1)</p> <p>non-biodegradable/will not rot/not attacked by microbes/will not decompose (1)</p> <p>low density/panes are lightweight (1)</p> <p>(thermal) insulator/does not let heat out/keeps heat in/traps heat (1)</p> <p>flexible/it can flex/bendy/will give in the wind (1)</p> <p>durable/long lasting (1)</p> <p>solid/high melting point/melting point above 100°C</p>	2	<p>allow can't be smashed/tough ignore strong</p> <p>allow unreactive towards air/unreactive towards oxygen/unreactive towards water/acid rain does not affect it/atmosphere does not affect it/not affected by water</p> <p>allow not broken down by sunlight/not broken down by UV/not damaged by sunlight/not damaged by UV/not damaged by Sun's rays/not damaged by Sun's energy (1)</p> <p>allow waterproof/not permeable by water/water runs off it/insoluble/keeps the rain out</p> <p>allow not attacked by bacteria/not affected by bacteria/not affected by fungi/not affected by mould ignore will not deteriorate/does not disintegrate</p> <p>allow light so easy to carry/light not heavy ignore light/heavy</p> <p>allow keeps heat in/traps heat ignore greenhouse effect unless qualified</p> <p>allow it is bendy/gives in the wind</p> <p>ignore it is safer/will not cut you/transport/clear/colourless/see through/lets light through/cost</p> <p>if two marking points given in first line mark them both and just check that there are no contradictions on the next line eg does not react (1) and dissolve (1) in water</p>
		Total	4	

8	(a)	exothermic (1)	1	more than one response scores zero allow if the candidate circles, underlines, ticks or crosses the correct response in the list
∞	(b)	<p>any two from: availability (1)</p> <p>toxicity (1)</p> <p>state/is it a solid, liquid or gas (1)</p> <p>ease of use (1)</p> <p>storage space (1)</p> <p>energy value/amount of energy released/rate at which energy is released/how energy efficient it is (1)</p> <p>viscosity (1)</p> <p>will it burn in the engine/ease of ignition/ignition temperature/ease of burning/flash point (1)</p>	2	<p>allow how easily is it to get/is it renewable/is it non-renewable/can it run out/is it nearby/global stocks/how much in reserves/how easy to transport</p> <p>allow is it poisonous/must be non-poisonous/no harmful effects if in contact with workers/will it irritate skin/do workers need to wear gloves</p> <p>allow melting point/boiling point/will it freeze/will it boil/is it volatile</p> <p>allow is it easy to use/is it difficult to use/is it safe to use (1)</p> <p>allow can it be stored/how much space to store it</p> <p>allow km per litre</p> <p>allow is it runny/ is it thick "it is a runny liquid" scores 2 marks (viscosity and state)</p> <p>allow is it suitable for engine</p> <p>ignore smelly ignore cost/pollution</p>
		Total	3	

9	(a)		thermometer (1)	1	correct answer only
	(b)		yellow/orange flame (1)	1	not red
	(c)	(i)	19 (1)	1	not -19 unit not needed
		(ii)	C (1)	1	carry error forward from (b) only other possible answer is B if (c)(i) is less than 10
			Total	4	

10			<p>objects that warm up lemonade with ice cubes</p> <p>objects that cool down cup of coffee hot bath</p> <p>any two correct (1) but all correct (2)</p>	2	<p>maximum 2 marks</p> <p>any object in both columns is wrong eg all 3 in both columns scores zero</p>
			Total	2	

11	(a)		floor/windows/chimney/door (1)	1	ignore description of doors/windows eg open doors/open windows not roof (equivalent to loft in stem of question)
	(b)		carpet/curtains/double glazing/ cap chimney/draught excluder (1)	1	allow (reflective) foil behind radiators allow build porch allow cling film/plastic film over windows (equivalent to double glazing)
	(c)		$\text{payback time} = \frac{\text{cost}}{\text{saving}} = \frac{150}{75} (1)$ $= 2 \text{ (years)} (1)$	2	allow full marks for correct answer with no working out, ie 2 = 2 marks allow 24 months (2) "24" on own = 1 mark
			Total	4	

12	(a)		D (1)	1	look for label on diagram if no written answer written answer to be marked first
	(b)		3.6 (1)	1	unit not needed no tolerance
			Total	2	

13	(a)	(i)	infrared (1)	1	allow IR more than one response scores zero answer must be on line as list applies to (a)(i) & (a)(ii)
		(ii)	ultraviolet (1)	1	allow UV more than one response scores zero answer must be on line as list applies to (a)(i) & (a)(ii)
	(b)		any two from: use sun block (1) cover up/aw wear a t-shirt etc (1) sit in shade/ not go out in full sun aw (1) spend less time in full sun (1) idea of more frequent application of suntan cream (1)	2	allow use suntan cream/higher SPF both marks can be scored on one line
			Total	4	

14		<p>any two from:</p> <p>human activity (1) burning fuel (1) increased greenhouse effect (1) carbon dioxide/methane/carbon emissions (1) deforestation/aw (1) idea of increasing transport (1) idea of increased productivity/domestic energy use (1) ice caps melting (1) idea of climate change (1) sea levels rising (1)</p>	2	<p>any reference to ozone depletion scores zero</p> <p>eg people are driving more cars/more factories</p> <p>allow Arctic melting, but not Antarctic melting not temperature increase/getting hotter (stem of question)</p> <p>ignore references to animals/habitats</p>
		Total	2	

15	(a)	(i)	analogue (1)	1	correct answer only more than one response scores zero
		(ii)	idea that it is one that can only take set values 0 or 1/on or off/high or low/aw (1)	1	allow pulse diagram with bottom of pulse on same level
	(b)	(i)	radio (1)	1	more than one response scores zero
		(ii)	idea of no need for permanent connection/portable/no wiring required/available 24 hours each day (1)	1	allow expressions such as "can be used anywhere" "can go where you want" "available 24 hours each day" "can be used from further away" ignore just "convenient"
	(c)		any two from: diagram showing every reflection at the surface (1) diagram showing all angle of incidence approx = angle of reflection and $>45^\circ$ (1)	2	to mark this question start by checking that there are between 2 to 5 reflections within the fibre- this should mean that the angles are roughly correct-6 reflections or above means there is likely to be at least one error in the angles look for rays that reflect towards the left or bunched reflections which would not score the second mark maximum of one mark if the ray does not leave the optical fibre at the end arrows not required allow lines not drawn with a ruler if obviously meant to be straight between 2 and 5 reflections required (if more than 5 reflections, angle will be wrong and only reflection mark) maximum 1 if ray does not emerge from fibre maximum 1 if ray does not continue from ray given on diagram
			Total	6	
			Overall Total	60	

Mark Scheme B621/02

January 2007

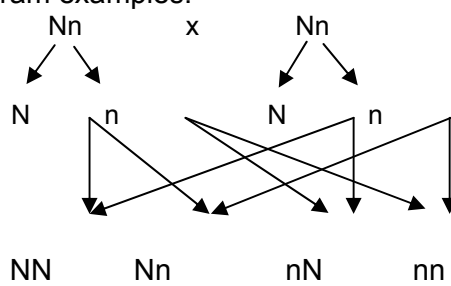
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AW	= alternative wording
ora	= or reverse argument

Question			Expected Answers	Mks	Rationale
1	(a)	(i)	glucose (1)	1	allow other simple sugars eg sucrose, lactose, fructose, maltose, galactose allow C ₆ H ₁₂ O ₆ /C ₁₂ H ₂₄ O ₁₂ ignore monosaccharide/disaccharide/saccharides
		(ii)	carbohydrates (1)	1	ignore carbs/complex
	(b)		Liz, Liz total = 142 (1) John total = 91 (1)	2	no mark for Liz on its own allow one mark for 142 and 91 if Liz not identified allow one mark for Liz's (total) is higher than John's/Liz's energy intake is higher/both of Liz's foods are higher than both of John's if no other mark has been awarded
	(c)		occurs in the (small) intestine/duodenum/ileum (1) by absorption/diffusion (into the bloodstream) (1)	2	allow villi not large intestine ignore stomach/gut allow absorption through wall/moves from high concentration to low concentration ignore osmosis not absorption through cell walls (cell walls are only found in plant cells) the marking points are independent so that absorption through large intestine scores 1 mark for absorption

	(d)		<p>any two marks from: reduces <u>blood</u> sugar level (2)</p> <p>(stimulates the) conversion of glucose to glycogen (2)</p> <p>insulin acts in the liver/insulin acts in muscles (1)</p> <p>increases rate of respiration (1)</p>	2	<p>allow regulates <u>blood</u> sugar level/controls <u>blood</u> sugar level (1) if no other mark given about <u>blood</u> sugar levels</p> <p>allow increases <u>blood</u> sugar level (1)</p> <p>allow stimulates conversion of glucose/changes glucose into something else eg glucose changes into fat (1) if no other marks given about conversion of glucose</p> <p>not breakdown of glucose</p> <p>ignore breathing</p>
			Total	8	

2	(a)	(i)	<p>some of Grace's genes pass to the baby/some of Grace's alleles pass to the baby (1)</p>	1	<p>allow some of Grace's DNA passes to the baby</p> <p>allow some of Grace's chromosomes pass to the baby</p> <p>allow has genes from both parents/has DNA from both parents/has chromosomes from both parents/has alleles from both parents</p> <p>allow egg for Grace</p> <p>the limit of acceptability is because of Grace 's alleles/because of Grace's DNA/because of Grace's chromosomes/because of Grace's genes</p> <p>ignore has some of Grace's characteristics</p>
		(ii)	<p>any one from: some of the baby's genes come from Rick (1) some of Rick's alleles pass to the baby (1)</p> <p>some of the characteristics are influenced by the environment (1)</p> <p>some characteristics influenced by food/influenced by alcohol/influenced by drugs/influenced by disease/influenced by smoking (1)</p>	1	<p>allow some of Rick's DNA passes to the baby</p> <p>allow some of Rick's chromosomes pass to the baby</p> <p>allow has genes from both parents/has DNA from both parents/has chromosomes from both parents/has alleles from both parents</p> <p>allow sperm for Rick</p> <p>the limit of acceptability is because of Rick's alleles/because of Rick's DNA/because of Rick's chromosomes/because of Rick's genes</p> <p>ignore has some of Rick's characteristics</p>

	(b)	<p>XX = female, XY = male/recognition that having a Y results in being male (1)</p> <p>states that there are equal proportions of XX and XY/ two XY and two XX/out of four two have Y in them (1)</p>	2	<p>not YY is male</p> <p>if no other marks awarded the following can be credited for one mark</p> <p>-understanding that there are 2 boys and 2 girls/2 boys out of 4/2 girls out of 4</p> <p>not 50% girls and 50% boys given in question</p>									
	(c)	<p>genotypes of parents ie Nn and Nn / correct gametes ie N and n and N and n (1)</p> <p>genotypes of offspring ie NN, Nn, nN and nn (1)</p> <p>correct probability ie 1 in 4/ ¼/25%/ 1:3/0.25 (1)</p>	3	<p>ignore order of alleles (nN or Nn)</p> <p>allow other symbols other than Nn eg Xx, Yy, Aa etc providing it has an obvious upper case and a lower case letter</p> <p>all four genotypes must be correct but there can be a slip up in the order that may not appear to be consistent with their diagram</p> <p>diagram examples:</p>  <p style="text-align: right;">first marking point</p> <p style="text-align: right;">second marking point</p> <p>or:</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>N</td> <td>n</td> </tr> <tr> <td>N</td> <td>NN</td> <td>Nn</td> </tr> <tr> <td>n</td> <td>Nn</td> <td>nn</td> </tr> </table> <p>there is no ecf in this question</p>		N	n	N	NN	Nn	n	Nn	nn
	N	n											
N	NN	Nn											
n	Nn	nn											

2	(d)	<p>any two from: a good chance of having a baby with the disorder/have a 0.25 chance of having a baby with the disorder/can have a baby that may be a carrier for disorder/aw (1) may think that it is unfair on the child/eg may have a premature death/aw (1) unfair on siblings/aw (1) may consider an abortion/aw (1) have to balance trauma of abortion with benefit/ethical consideration of abortion/aw (1) financial implications/cost of extra hospital treatment/cost of insurance/aw (1) what happens when parents die/aw (1) stress on parents/strain on parents/aw (1)</p>	2	
		Total	9	

3	(a)		C (1)	1	if two or more letters given (0)
	(b)		any one from: sleep under nets/aw (1) use insect repellent/aw (1) take preventative drugs before going/aw (1) use spray to kill insects/use insecticide/aw (1) avoid going out when mosquitoes are present/aw (1) cover the skin/wear long trousers/wear long sleeves/aw (1)	1	allow drink tonic water/use quinine/named drugs eg larium ignore vaccinations ignore immunisation
	(c)		any one from: malaria is caused by Plasmodium/a protozoan (1) antibiotics do not kill protozoa (1) malaria not caused by bacteria (1) antibiotics only destroy bacteria (1) antibiotics only destroy fungi (1)	1	not reference to antibodies not malaria caused by virus
			Total	3	

4	(a)		yes because it contains E104/yes because it contains E153/yes because it contains E104 and E153 (1)	1	allow two E numbers within the food colour range not 1 or some E numbers within the food colour range no marks for yes on its own no marks if other E numbers are referred to as colours eg yes because it contains E471
	(b)		sodiumhydrogen carbonate → sodium carbonate + water + carbon dioxide (1)	1	allow any order for the products allow $\text{NaHCO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Na}_2\text{CO}_3$ ie unbalanced allow mix of formulae and names not sodium hydro carbonate/ hydrogenc arbonate if name and formula given mark the name eg sodium hydrocarbonate NaHCO_3 would score 0
	(c)		any two from: water (molecules) attracted to hydrophilic end/water(molecules) surround the hydrophilic end/aw (1) oil (molecules) attracted to hydrophobic end/hydrophobic end surround oil /aw (1)	2	allow marking points from a labelled diagram but check it does not contradict text allow water (molecules) surround the head (1) allow oil (molecules) surround the tail/oil (molecules) surround the hydrophobic end allow use of particle instead of molecule
			Total	4	

5	(a)		B (1)	1	if two or more letters given (0) allow any identification of the letter eg letter has been ringed
	(b)		A (1)	1	if two or more letters given (0) allow any identification of the letter eg letter has been ringed
	(c)		E (1)	1	if two or more letters given (0) allow any identification of the letter eg letter has been ringed
	(d)		C (1)	1	if two or more letters given (0) allow any identification of the letter eg letter has been ringed
			Total	4	

6	(a)	<p>any two from: does not shatter easily/does not break when hit/aw (1)</p> <p>does not corrode/does not react with water/does not react with oxygen/does not react with air/does not react with moist air/aw (1)</p> <p>not degraded by sunlight/not degraded by UV/aw (1)</p> <p>does not dissolve (in water)/aw (1)</p> <p>non-biodegradable/will not rot/not attacked by microbes/will not decompose (1)</p> <p>low density/panes are lightweight (1)</p> <p>(thermal) insulator/does not let heat out (1)</p> <p>flexible/it can flex</p> <p>durable/longlasting/hardwearing (1)</p> <p>solid/high melting point/melting point above 100 °C (1)</p>	2	<p>allow can't be smashed/tough ignore strong/hard</p> <p>allow unreactive towards air/unreactive towards oxygen/unreactive towards water/acid rain does not effect it/atmosphere does not effect it/not effected by water</p> <p>allow not broken down by sunlight/not broken down by UV/not damaged by sunlight/not damaged by UV/not damaged by sun rays/not damaged by sun's energy (1)</p> <p>allow waterproof/not permeable by water/water runs off it/insoluble/keeps the rain out</p> <p>allow not attacked by bacteria/not affected by bacteria/not affected by fungi/not affected by mould ignore will not deteriorate/does not disintegrate</p> <p>allow light so easy to carry/light not heavy ignore light/heavy</p> <p>allow keeps heat in/traps heat ignore greenhouse effect unless qualified</p> <p>allow it is bendy/gives in the wind</p> <p>ignore it is safer/will not cut you/transport/clear/colourless/see through/lets light through/cost</p> <p>if two marking points given in first line mark them both and just check that there are no contradictions on the next line eg does not react (1) and dissolve (1) in water</p>
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	(b)	Gore-Tex® is made from nylon and PTFE (1) Gore-Tex® contains PTFE which has small holes that lets out water vapour but does not let liquid water in (1)	2	if three ticks 2 correct 1 wrong (1) if three ticks 1 correct 2 wrong (0) if four or five ticks given (0)
		Total	4	

7	(a)	exothermic (1)	1	allow exothermic ticked, crossed, written or underlined if more than one answer (0)
	(b)	any two from: availability (1) toxicity (1) state/is it a solid, liquid or gas (1) ease of use (1) storage space (1) energy value/amount of energy released/rate at which energy is released/how energy efficient it is (1) will it burn in the engine/ease of ignition/ignition temperature/ease of burning/flash point (1) viscosity (1)	2	allow how easily is it to get/is it renewable/is it non-renewable/can it run out/is it nearby/global stocks/how much in reserves/how easy to transport allow is it poisonous/must be non-poisonous/no harmful effects if in contact with workers/will it irritate skin/do workers need to wear gloves allow melting point/boiling point/will it freeze/will it boil/is it volatile allow is it easy to use/is it difficult to use/is it safe to use allow can it be stored/how much space to store it allow fuel consumption/km per litre allow is it suitable for the engine/will it work (in the engine) allow is it runny/is it thick ignore spills/does it smell

	(c)	greater population/energy requirements increasing/objections to renewable energy resources eg wind farms/renewable energy is more expensive/aw (1)	1	allow more transport/more people move from place to place/more car (ownership)/use more electrical appliances/more aeroplanes/more industrialisation must be an implication of more of a use of a fossil fuel ignore more demand unless qualified with a use/more technology
		Total	4	

8	(a)	idea that temp change is double (1) so energy released is 8400 J (1) or energy released = mass of water x temp change x 4.2/E = $ms\Delta T/mc\theta$ / energy released = $100 \times 4.2 \times 20$ (1) so energy released is 8400 J (1)	2	allow maximum marks for correct answer on its own (look for this to start with) despite any other working out allow one mark for temperature change = 10 and temperature change = 20 if no other marks have been awarded. allow one mark for $100 \times 4.2 \times 10$ if not contradicted by written equation not $100 \times 4.2 \times 38$ (0)
	(b)	$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ correct reactants and products (1) correct balancing (1)	2	allow any correct multiple including fractions balancing mark is dependent on the correct formula allow reversible symbol or arrow not and/&/+ energy
		Total	4	

9	(a)		wavelength = 3.6 (1)	1	unit not needed
	(b)		computer/mobile telephone/portable telephone/ remote control for television etc (1)	1	allow to open a car/to open a garage/remote controllers etc/mouse/keyboard/any other suitable answer ignore internet/broadband
	(c)	(i)	can take only set values/can be off or on/can be high or low/can be 0 or 1/aw (1)	1	allow can turn on and off not you switch it on and off allow correct pulse diagram
		(ii)	more information can be carried/multiplexed/less interference/clearer signal/more secure (1)	1	allow more channels/more radio channels/more signals/interleaving allow marks from a suitable diagram showing more than one signal allow information can be compressed allow easier to remove interference/easier to recognise noise/easier to remove noise allow can encrypt signal ignore quicker to transmit
	(d)		(signal sent up from Earth to) satellite (1) signal from satellite to Earth/retransmitted back to Earth (1) or (signal sent up to) ionosphere (1) reflected back to Earth/signal from ionosphere to Earth (1)	2	allow marking points from a labelled diagram allow transmitter or receiver in space not reflected or refracted from a satellite this negates the second marking point allow signal bounced back to Earth ignore diffracted not refracted this negates the second marking point

	(e)	<p>diagram showing every reflection at the surface (1)</p> <p>diagram showing all angle of incidence approx = angle of reflection and $>45^{\circ}$ (1)</p>	2	<p>to mark this question start by checking that there are between 2 to 5 reflections within the fibre - this should mean that the angles are roughly correct- 6 reflections or above means there is likely to be at least one error in the angles</p> <p>look for rays that reflect towards the left or bunched reflections which would not score the second mark</p> <p>allow lines not drawn with a ruler if obviously meant to be straight</p> <p>maximum of one mark if the ray does not leave the optical fibre at the end arrows not required</p> <p>maximum of one mark if ray does not continue from ray given on diagram</p>
		Total	8	
10	(a)	<p>conduction (1) not convection/radiation</p> <p>convection (1) not conduction/radiation</p> <p>less dense (1)</p>	3	<p>must be in correct order</p> <p>not lighter</p>
	(b)	<p>payback time = $\frac{\text{cost}}{\text{saving}} / \frac{150}{75}$ (1)</p> <p>= 2 (years) (1)</p>	2	<p>allow full marks for correct answer with no working out</p> <p>allow 24 months (2)</p> <p>allow 24 (1)</p>
		Total	5	

11	(a)		B (1)	1	if two letters given (0)
	(b)	(i)	W (1)	1	if two letters given (0)
		(ii)	<p>Y</p> <p>any two from:</p> <p>it has the high(est) specific heat capacity/aw (1)</p> <p>it can hold the great(est) amount of energy/aw (1)</p> <p>will take the long(est) time to cool down/aw (1)</p> <p>can transfer the most energy (from the boiler to the room)/aw (1)</p> <p>will still be hottest at the end of the system/aw (1)</p>	2	<p>any other letter given scores 0</p> <p>no marks for Y on its own</p> <p>answer must have one superlative or comparative statement</p> <p>eg high specific heat capacity (1) so holds a lot of energy (0) total 1 mark</p> <p>but high specific heat capacity (1) so holds the greatest amount of energy (1) total 2 marks</p>

	(c)	<p>any three from: the water is boiling/the water is at boiling point/water is changing from a liquid to a gas (1)</p> <p>(energy is) breaking the forces between the molecules/intermolecular forces are breaking/intermolecular forces are weakened/intermolecular forces are overcome (1)</p> <p>molecules are escaping from the liquid (1)</p> <p>only the fast(er) moving molecules escape/only the molecules have a (sufficiently) high (kinetic) energy escape/aw (1)</p> <p>slow(er) molecules then gain (kinetic) energy /aw (1)</p>	3	<p>allow water changing into steam/water changing into a gas ignore changing into water vapour/evaporates</p> <p>ignore bonds are breaking allow hydrogen bonds are breaking but not covalent bonds breaking not bonds within water molecules are breaking allow the word force to mean intermolecular force allow breaking bonds between water molecules</p> <p>ignore molecules evaporating</p> <p>so molecules with high (kinetic) energy escape liquid scores 2 marks but only the fast molecules evaporate will score one mark.</p>
		Total	7	
		Overall Total	60	

Mark Scheme B622/01

January 2007

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	= alternative and acceptable answers for the same marking point
(1)	= separates marking points
not	= answers which are not worthy of credit
reject	= answers which are not worthy of credit
ignore	= statements which are irrelevant
allow	= answers that can be accepted
()	= words which are not essential to gain credit
<u> </u>	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW	= alternative wording
ora	= or reverse argument

Question		Expected Answers	Mks	Rationale
1	(a)	minerals (1) water (1)	2	either order allow correct answers circled or otherwise indicated in list
	(b)	grow faster (1)	1	allow correct answers circled or otherwise indicated in list
	(c)	carbon dioxide (1) water (1) chlorophyll (1)	3	any order allow correct answers circled or otherwise indicated in list
Total			6	

2	(a)	(i)	arachnid (1)	1	not spider
		(ii)	nematode (1)	1	not worm
	(b)		invertebrates (1)	1	more than one answer scores 0
Total			3		

3	(a)		1999 (1)	1	reject 1999 circled in table (could apply to either questions a or b) reject 26337
	(b)		2000 (1) because amount of waste decreased/aw (1)	2	reject 2000 circled in table (could apply to either questions a or b) must have 2000 as answer to first part in order to get second mark
Total			3		

4			<p>any three from:</p> <p><u>feature</u> fat in <u>hump</u> (1)</p> <p>can withstand high body temps (1)</p> <p>bushy/ long eye -lashes (1)</p> <p>hair-lined nostrils (1)</p> <p>large feet (1)</p>	<p><u>how it's useful</u> so whole body is not insulated/so they can go for a long time without feeding/ref to food being scarce (1)</p> <p>so it does not need to sweat/so it can store heat for the night (1)</p> <p>to stop sand getting in eyes (1)</p> <p>to stop sand getting in(1)</p> <p>to spread out the load/ stop camel sinking in sand (1)</p>	<p>allow three descriptions allow one description (1) and an associated explanation (1) not explanation marks</p> <p>ignore – water in hump</p> <p>allow idea that fat store can release water</p> <p>allow hair on top rather than underneath/most hair on top (1) to insulate from Sun's heat (1)</p>
Total			3		

5	(a)		any two from: loss of habitat (1) hunted (by farmers) (1) competition (1) disease (1)	2	allow lack of food/no food/ no prey (1) eg less prey because killed by disease = 2 marks
	(b)	(i)	red squirrel (1)	1	
		(ii)	endangered (1)	1	allow incorrect spelling as long as it is phonetically correct
		(iii)	protecting habitat/legal protection/less hunting/stop hunting/don't kill/don't kill its prey/education programs/captive breeding programs/creating artificial ecosystems /conservation programs(1)	1	eg replant forests ignore – tagging unless qualified ignore zoos unless ref to breeding
			Total	5	

6	(a)		15 (1)	1	
	(b)		acid used up/magnesium used up (1) reactant used up (1)	1	allow acid runs out/magnesium runs out/no more acid/no more magnesium allow no more chemicals <u>to react</u> allow not enough acid/Mg not runs out of chemicals
	(c)		line steeper than original (1) levels off at 25cm ³ (1)	2	line must go through origin for first mark line must not go above 25 for second mark (1 square tolerance)
	(d)		magnesium/hydrochloric acid (1)	1	allow Mg/HCl if used, symbols must be correct not just 'acid'
			Total	5	

7	(a)		solvent (1)	1	allow correct answers circled or otherwise indicated in list
	(b)		give colour (to the paint)/ AW (1)	1	
	(c)		decoration/protection (1)	1	eg attractive/looks nice = decoration eg stops rust/waterproofs/stops damage = protection
	(d)		any two from: (solid) particles (1) dispersed/spread throughout (1) but are not dissolved (1)	2	allow suspension (1) eg tiny particles dissolved in water = 2 marks eg particles suspended = 2 marks
			Total	5	

8	(a)	(i)	calcium oxide/CaO (1) carbon dioxide/CO ₂ (1)	2	allow either order if symbols used they must be correct ignore attempts to balance
		(ii)	(thermal) decomposition (1)	1	allow decompose/decomposes
	(b)		any one from: habitats destroyed (1) landscape destroyed (1) so has to be reconstructed (1) takes up land space (1) (increased) noise or traffic or dust (1)	1	allow 'homes' for habitats
	(c)		3 (1)	1	allow correct list of 3 named elements but reject list of symbols
			Total	5	

9	(a)		brass (1)	1	allow correct answers circled or otherwise indicated in list
	(b)		electrical joints/plumbing (1)	1	allow joining/AW metals/pipes/ cables/ wires (1) eg putting pipes together = lowest acceptable answer not welding
	(c)		lead and tin/Pb and Sn (1)	1	both required symbols must be correct
	(d)		differences – iron is magnetic/ aluminium is not magnetic / iron corrodes easily/ aluminium doesn't corrode easily / iron rusts/aluminium does not rust / iron has higher mp/aluminium has lower mp(1) similarities – both are malleable/ductile/good electrical conductors/strong/good conductors of heat (1)	2	allow Al higher in reactivity series/Fe lower (1) allow Fe <u>more reactive to dilute acids</u> allow Al is amphoteric Fe is not (1) not just high/low for mp (must be higher/lower) ignore ref to colour/weight/cost /any uses
			Total	5	

10	(a)	(i)	coal (1)	1	allow correct answers circled or otherwise indicated in list
		(ii)	wood (1)	1	allow correct answers circled or otherwise indicated in list
	(b)		P = 1 200 000 (W) scores (2) but P = voltage x current/20 000 x 60 scores (1)	2	allow watts = volts x amps (1) allow 1.2MW (2)
			Total	4	

11	(a)		alpha/α (1)	1	
	(b)	(i)	damages (living) cells /damages DNA /causes cancer/radiation sickness/aw/infertility (1)	1	not merely causes damage/causes illness/kills people
		(ii)	any two from: protective clothing (1) tongs (1) keep distance from pupils(1) keep at arms length (1) short exposure time (1) shielded sources (1) labelled sources (1)	2	allow ref to safe storage or disposal (1) not just 'wear goggles'
			Total	4	

12	(a)	(i)	any 1 from: low maintenance (1) no cables needed/can be used in remote places (1) no fuel needed/doesn't use fossil fuels(1) long life (1) renewable source (1) little/no pollution (1)	1	allow low <u>running</u> cost (1) not free energy ignore environmentally friendly unless qualified allow ref to global warming/greenhouse effect (1)
		(ii)	(no power) at night or dull conditions ora/unreliable/low power output/lower efficiency/aw (1)	1	eg you need a lot of them/large surface area to get electricity ignore ref to cost
	(b)		wire in sensible circuit with meter (1) and any 2 from: coil near to or around magnet (1) movement of wire or magnet (1) <u>current</u> output/meter reading/aw (1)	3	allow marking points on diagram and/or in writing must have correct circuit for 3 rd mark not electricity generated (in stem)
			Total	5	

13	(a)		a collision (1) with Earth (1)	2	
	(b)		any 2 from: spying (1) mobile phone signals (1) SAT-navigation/ GPS/ aw (1) photographing Earth (1) telescopes (1) study of space (1) telecommunications/TV/radio/aw (1)	2	if more than one distinct answer per line, mark 1 st use given on each line
			Total	4	

14	(a)		between Mars and Jupiter (1)	1	if more than one tick no marks
	(b)		the formation of the Solar System (1)	1	if more than one tick no marks
	(c)		any one from: crater/ hot rocks ejected/fires/sunlight blocked by dust/climate change/species extinction/killed animals/killed plants/changed Earth's movement slightly/formed the moon/tsunamis (1)	1	
			Total	3	
			Overall Total	60	

Mark Scheme B622/02

January 2007

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/	= alternative and acceptable answers for the same marking point
(1)	= separates marking points
not	= answers which are not worthy of credit
reject	= answers which are not worthy of credit
ignore	= statements which are irrelevant
allow	= answers that can be accepted
()	= words which are not essential to gain credit
<u> </u>	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW	= alternative wording
ora	= or reverse argument

Question		Expected Answers	Mks	Rationale
1	(a)	<p>any three from: fat in hump (1) so whole body is not insulated/for food store (1) can withstand high body temps (1) so it does not need to sweat/so body stores heat for night (1) bushy/long eyelashes (1) to stop sand getting in eyes (1) hair-lined nostrils (1) to stop sand getting in (1) large feet (1) to spread out the load/stop camel sinking in sand (1) hair on top of body rather than underneath (1) to insulate from the Sun's heat (1)</p>	3	<p>allow three descriptions allow one description (1) and an associated explanation (1) not explanation marks allow idea that fat store can release water ignore water in the hump unless qualified</p>
	(b)	(reduced surface area to volume ratio) to reduce water loss (1)	1	allow spines to protect from animals (1)
Total			4	

2	(a)	(i)	mammals (1)	1	ignore odd spellings
		(ii)	fur/have a placenta/give birth to live young/external ears (1)	1	ignore suckle their young
	(b)		can reproduce/breed (1) form fertile offspring (1)	2	allow mate/mating
Total				4	

3	(a)		any two from: loss of habitat (1) hunted (by farmers) (1) competition (1) disease (1) lack of food (1)	2	allow no prey (1) eg less prey because killed by disease scores (2)
	(b)		any two from: protecting habitat (1) legal protection/stop hunting/less hunting (1) education programs (1) captive breeding programs (1) creating artificial ecosystems (1) control of predators (1) culling of competition (1) conservation programmes (1)	2	ignore tagging unless qualified allow restoring habitat eg replanting forests allow don't kill them allow stop/less hunting of the species prey (1) ignore zoos unless reference to captive breeding
			Total	4	

4	(a)		caddis fly (larva)/dragonfly (nymph) (1)	1	
	(b)	(i)	B (1)	1	
		(ii)	polluted water (1)	1	allow lack of oxygen
	(c)		A (1) less animals/lower biodiversity/no caddis fly larva/no dragonfly nymphs/water was polluted/contained blood worms/contained rat-tailed maggots (1)	2	can only score explanation mark if stream A is selected
			Total	5	

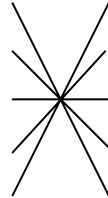
5	(a)		$6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (1)	1	
	(b)		use carbon dioxide produced in respiration (1) so can still photosynthesise (1)	2	allow can use oxygen produced in photosynthesis (1) so can still respire(1) ignore references to breathing
			Total	3	

6	(a)		11.5 (minutes) (1)	1	allow 11 to 12 minutes
	(b)		line steeper than original (1) levels off at <u>25cm³</u> (1)	2	line must go through or be close to origin for first mark line must not go above 25cm ³ for second mark
	(c)		more crowded particles/more particles in the same volume/aw (1) more frequent collisions (1)	2	allow particles closer together/more particles in the same space/more particles per cm ³ /more particles in the same area ignore more particles ignore faster particles allow collisions more often/more chance of a collision/greater rate of collisions reject faster collisions allow 'more (effective) collisions' if no other marking points met
			Total	5	

7	(a)		water (1)	1	allow correct formula, H ₂ O
	(b)		solvent evaporates/aw (1)	1	allow water evaporates allow oil reacts with oxygen or air
	(c)	(i)	any two from: (solid) particles (1) dispersed (1) but are not dissolved (1)	2	allow spread throughout (1) allow suspension (1) eg particles suspended scores 2 marks
		(ii)	(solid) particles are (very) small or light (1) so will not settle to the bottom or remain suspended (1)	2	allow they are too small
			Total	6	

8	(a)	(i)	(thermal) decomposition (1)	1	allow decompose(s)
		(ii)	CaCO ₃ → CaO + CO ₂ formula LHS (1) formula RHS (1)	2	CaCO ₃ → CaO + CO ₂ scores 2 marks allow correct multiples correct chemical formula on either side scores 1 eg CaCO ₃ → 2CaO + CO ₂ scores 1 eg Ca ₂ CO ₃ → 2CaO + CO ₂ scores 1
	(b)		limestone is a sedimentary rock (1) marble is a metamorphic rock (1)	2	allow particles in metamorphic rock are closer together (1) allow correct description of rock type linked to correct rock eg marble is little bits of rock pressured underground
			Total	5	

9	(a)		lead and tin/Pb and Sn (1)	1	both required either way around not PB or SN
	(b)		car body will have a longer lifetime/aw (1)	1	allow so less time spent patching up bodywork/aw ignore car rusts less not more weatherproof
	(c)		aluminium is less dense (1) so better fuel economy achieved/aw (1)	2	allow aluminium is lighter or lightweight (1) lighter car (1) allow car will go faster/aw (1) allow car doesn't need painting (1) due to protective layer of (aluminium oxide) (1)
			Total	4	

10	(a)		furnace → coal burns boiler → water heated turbine → steam makes it spin generator → electricity produced cooling towers → warm water cooled all 5 correct (4) 3 or 4 correct (3) 2 correct (2) 1 correct (1)	4	marking pattern  look at what happens for each part and mark accordingly eg furnace to coal burns and boiler to coal burns = 1 mark for furnace
	(b)		$P = 1\,200\,000$ (W) scores (2) but $P = \text{voltage} \times \text{current} / 20\,000 \times 60$ (1)	2	allow watts = volts x amps (1) allow 1.2MW (2)
	(c)		current is reduced (1) temperature/heat is reduced (1) energy wastage is reduced (1)	3	allow thinner/cheaper cables can be used (1) ignore references to power allow at high currents heat is lost (2) ora
			Total	9	

11	(a)	(i)	low maintenance / no cables needed / no fuel needed / long life / renewable source / no or little pollution (1)	1	allow low running cost (1) ignore references to the energy is free allow eg doesn't use up fossil fuels ignore not harmful to the environment allow reference to lack of greenhouse gases/global warming
		(ii)	no power at night/dull conditions/unreliable/low power output or efficiency/aw (1)	1	ora allow only works during the day allow lots needed/large area required to get enough energy (1) ignore references to cost
	(b)		photocell/or electrons absorb energy or light/aw (1) electrons free to move (1) from silicon or atoms (in crystal) (1) current produced (1)	2	allow electrons knocked loose (1)
			Total	4	
12	(a)		between Mars and Jupiter (1)	1	more than one box ticked score zero
	(b)		the formation of the Solar System (1)	1	more than one box ticked score zero
			Total	2	

13	(a)		rocks/soil/living things/air/space/nuclear industry (1)	1	allow cosmic rays (1) allow named rock ignore power stations ignore food
	(b)		beta stopped by (a few mm) of aluminium (1) gamma goes through aluminium/stopped by (a few cm) of lead (1)	2	allow gamma stopped by thick concrete (1) allow beta stopped by thin sheet of metal (1)
	(c)		electrons/negative charge (1) removed/lost (1)	2	allow 'electrons or negative charges gained' (1)
			Total	5	
			Overall Total	60	

**General Certificate of Secondary Education
Gateway Science(Specification Code J640)
January 2007 Assessment Series**

Unit Threshold Marks

<i>Unit</i>		Maximum Mark	a*	a	b	c	d	e	f	g	u
B621/01	Raw	60				39	32	25	19	13	0
	UMS	69				60	50	40	30	20	0
B621/02	Raw	60	49	40	31	23	16	12			0
	UMS	100	90	80	70	60	50	40			0
B622/01	Raw	60				36	30	24	18	12	0
	UMS	69				60	50	40	30	20	0
B622/02	Raw	60	46	39	32	25	17	13			0
	UMS	100	90	80	70	60	50	40			0

For a description of how UMS marks are calculated see;
http://www.ocr.org.uk/exam_system/understand_ums.html

Statistics are correct at the time of publication

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

(General Qualifications)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: helpdesk@ocr.org.uk

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Facsimile: 01223 552553