

Science B J640

Gateway Science Suite

General Certificate of Secondary Education

Mark Scheme for the Units

January 2010

J640/MS/R/10J

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
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NOTTINGHAM
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Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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Mark Scheme Guidance

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

= underlined words must be present in answer to score a mark

ecf = error carried forward

AW = alternative wording

ora = or reverse argument

B621/01

Question		Expected Answers	Marks	Additional Guidance
1	(a)	large body mass = both (1) pierced ear = environment (1) shaved head = environment (1)	3	if more than one box ticked score 0 for that row
	(b)	idea that genes / eye colour also inherited from mother / idea that not all genes come from father / idea that genes / eye colour inherited from both parents (1)	1	allow green might be recessive / not dominant or another colour is dominant / gets her eye colour from her mother ignore just mother does not have green eyes / has her mother's eyes ignore just has different genes than her father / has not inherited the genes from her father allow reference to a mutation occurring ignore reference to contact lenses
Total			4	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	<p>any two from:</p> <p>fast /quickly / AW (1)</p> <p>protective / AW (1)</p> <p>automatic / does not involve (conscious) thought (1)</p>	2	<p>ignore reference to the brain</p> <p>allow instantly / immediately / suddenly</p> <p>allow happens unconsciously</p>
	(b)	skin (1)	1	<p>ignore hand / fingers</p> <p>allow temperature receptor / thermo receptor</p>
	(c)	nerve cell(s) / neurone(s) / impulse(s) / electrical (signals) (1)	1	<p>allow sensory neurone / nerves / nervous system</p> <p>ignore just signals / messages</p> <p>not in blood</p> <p>ignore CNS</p>
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
3	(a)	thermometer / digital probe (1) mouth / under arm / anus / ear (1)	2	allow sensitive strip (1) on skin (1) thermometer on the skin = 1
	(b)	oxygen (1) glucose / sugar (1)	2	allow fat sugar and fat = 2, but sugar and glucose = 1
	(c)	(i)	37 (°C) (1)	1 allow any answer in range 36 - 38 (°C) allow any answer in range 98-99 °F
		(ii)	to stay healthy / stop him being ill / might die / might be sick (1)	1 allow higher level answer: avoid hypothermia or hyperthermia / avoid heat stroke / avoid dehydration / affect enzymes / damage protein / the body won't work properly
		Total	6	

Question		Expected Answers	Marks	Additional Guidance
4	(a)	<p>more carbohydrate / fat (1)</p> <p>for energy / calories / joules (1)</p> <p>Or</p> <p>more protein (1)</p> <p>for (muscle) growth (1)</p> <p>Or</p> <p>more water (1)</p> <p>to stay hydrated (1)</p>	2	<p>first marking point must be comparative</p> <p>ignore any reference to minerals / fibre / vitamins for first marking point</p> <p>but second marking point must specifically link carbohydrate / fat to energy or link protein to growth / repair</p> <p>e.g. more protein and carbohydrate for energy = 1</p> <p>e.g. more protein and vitamins for growth = 1</p> <p>assume unqualified answer refers to Mary</p> <p>allow reverse arguments for Vicki</p>
	(b)	<p>21(2)</p> <p>but if answer is incorrect</p> <p>$60 \div 1.7 \times 1.7$ (1) or $60 \div 1.7^2$ (1) or $60 \div 2.89$ (1) or $60 \div 2.9$ (1)</p>	2	allow any answer between 20.7 and 21(2)
	(c)	(i)	1	carbon monoxide / CO (1)
		(ii)	1	stimulant (1)
Total			6	

Question		Expected Answers	Marks	Additional Guidance	
5	(a)	any two from microwave / boiling / steaming / grilling / frying / barbeque / poached (1)	2	allow bbq as aw for barbeque allow over a fire as alternative to bbq allow smoked ignore on a spit	
	(b)	(i)	new substance formed / difficult to reverse (1)	1	allow energy change takes place allow colour change ignore texture / appearance / taste / flavour / smell
		(ii)	change in energy / colour / texture / appearance / taste / flavour / smell / become safe to eat / pathogens killed (1)	1	allow microbes / bacteria not germs do not allow answer if credited in (b) (i)
Total			4		

Question		Expected Answers	Marks	Additional Guidance	
6	(a)	(compound containing) carbon and hydrogen only / AW (1)	1	ignore (compound containing) carbon and hydrogen not mixture of carbon and hydrogen only not a (compound containing) carbon and hydrogen molecules only	
	(b)	diesel (1) propane (1)	2	if more than two responses given, each incorrect answer loses 1 mark to a minimum of zero	
	(c)	(i)	26 (1)	1	
		(ii)	C ₈ H ₁₈ (1)	1	not C ₈ H ₁₈ / C ⁸ H ¹⁸ allow H ₁₈ C ₈
Total			5		

Question		Expected Answers	Marks	Additional Guidance	
7	(a)	petroleum spirit (1) largest temperature rise / increase / change AW (1)	2	allow petrol or spirit ignore highest temperature at end allow starts lowest but ends up highest ignore others don't heat up as much allow all temperature differences calculated correctly ie 17 / 10 / 15 / 24 (°C) mark independently	
	(b)	(i)	water (vapour) / carbon dioxide (1)	1	allow correct formulae H ₂ O / CO ₂
		(ii)	incomplete combustion / AW (1)	1	allow not enough oxygen or air / produces carbon / carbon present
		Total		4	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	(food) packaging / (plastic) bags / bottles / containers / AW (1)	1	allow wrapping thing / protection / prevent damage / (electrical) insulation / cups ignore gutters / plastic / clothes / fabrics
	(b)	takes a long time to / does not decay / decompose (by bacterial action) (1)	1	allow rots slowly / breaks down slowly ignore does not disintegrate / deteriorate / destroyed / wear away / dissolve / does not degrade / cannot be recycled

Question	Expected Answers	Marks	Additional Guidance
(c)	<p>any two from non-toxic / does not poison you (1)</p> <p>does not rot / non-biodegradable / not attacked by microbes / will not decompose (1)</p> <p>not degraded by sunlight / not degraded by UV / AW (1)</p> <p>does not react with water / does not rust / does not corrode / does not react with oxygen / does not react with air / does not react with moist air / AW (1)</p> <p>lightweight / low density (1)</p> <p>waterproof / does not dissolve (in water) (1)</p> <p>flexible / it can flex / bendy / not brittle (1)</p> <p>strong / tough (1)</p> <p>solid / high melting point / melting point above 100°C (1)</p>	2	<p>ignore easily moulded (equivalent to easy to shape)</p> <p>allow not attacked by bacteria / not affected by bacteria / not affected by fungi / not affected by mould ignore weathering</p> <p>allow not broken down by sunlight / UV allow not damaged by sunlight / UV allow not damaged by sun's rays / sun's energy</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 light not heavy ignore light</p> <p>allow not permeable to water / insoluble (in water) / resistant to water / does not leak / holds water</p> <p>allow will not break (easily) (1) ignore rigid</p> <p>allow durable / hard wearing / long lasting</p> <p>ignore can be coloured / smooth</p>
	Total	4	

Question		Expected Answers	Marks	Additional Guidance
9	(a)	ester (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank more than one answer scores zero
	(b)	(pleasant) smell / evaporates easily / quickly / does not dissolve in water / non-toxic / does not react / irritate skin (1)	1	ignore evaporates unless qualified allow does not wash off easily ignore does not react with water (stem of question) allow does not stain
	(c)	(to ensure that it was) safe to use / (to make sure it) doesn't harm her / no side effects AW (1)	1	allow all answers from (b) even if repeated
		Total	3	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	<p>any two from (increased) <u>energy</u> / electricity (1)</p> <p>(more) cars / transport / factories / fuel use (1)</p> <p>(more) CO₂ / greenhouse gases produced (1)</p> <p>deforestation / AW (1)</p> <p>increased population (1)</p>	2	<p>allow carbon footprint / carbon emissions</p> <p>allow less carbon dioxide used up / less oxygen produced</p>
	(b)	<p>any two from: dust / debris / ash (ejected) (1)</p> <p>stops (some) heat / radiation reaching Earth / (1)</p> <p>IR / radiation / Sun's rays / (Sun's) energy <u>reflected</u> (1)</p>	2	<p>ignore gases / lava</p> <p>allow smoke / sulfur / sulfate / sulfur dioxide / SO₂</p> <p>allow blocking out the Sun(light)</p> <p>allow heat <u>reflected</u> ignore bounce</p>
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
11	(a)	idea that messages are fast(er) (1)	1	allow idea that light signals can be seen over long(er) distances ora
	(b)	Morse (1)	1	ignore digital
	(c)	(ii) B	1	
		(ii) A (and) D (1)	1	both letters needed
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	electromagnetic (1)	1	allow radio / TV / microwaves / infrared
	(b)	reflected / focussed (1)	1	not refracted / transmitted / diffracted allow bounces off
	(c)	analogue (1)	1	
		Total	3	

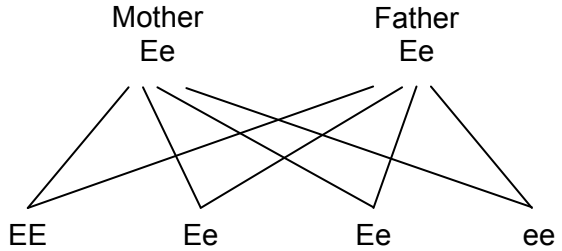
Question		Expected Answers	Marks	Additional Guidance								
13	(a)	0.6 (2) but if answer is incorrect $12000 \div 20000 \times 100$ (1)	2	allow 60% (2) if % sign clearly shown if % answer is incorrect 60 on it's own scores (1) ignore any units other than % on the answer line e.g. 0.6J or 0.6N scores (2), but 0.6% scores (1)								
	(b)	<table border="0"> <thead> <tr> <th>improvement</th> <th>explanation</th> </tr> </thead> <tbody> <tr> <td>shiny foil behind radiators</td> <td>it is a poor conductor</td> </tr> <tr> <td>put fibreglass in the loft space</td> <td>it stops cold air entering</td> </tr> <tr> <td>fit draught-proofing around windows and doors</td> <td>it reflects heat energy (infrared)</td> </tr> </tbody> </table>	improvement	explanation	shiny foil behind radiators	it is a poor conductor	put fibreglass in the loft space	it stops cold air entering	fit draught-proofing around windows and doors	it reflects heat energy (infrared)	2	3 correct scores (2) 1 or 2 correct scores (1)
improvement	explanation											
shiny foil behind radiators	it is a poor conductor											
put fibreglass in the loft space	it stops cold air entering											
fit draught-proofing around windows and doors	it reflects heat energy (infrared)											
	(c)	3 (years) (1)	1									
		Total	5									

Question		Expected Answers	Marks	Additional Guidance
14	(a)	✓s in 3 rd and 4 th boxes (2)	2	if more than two boxes ticked deduct one mark for every wrong box ticked
	(b)	(i) °C (1)	1	if answer line is blank allow correctly circled / underlined / shaded / ticked answer
		(ii) highest temperature (at start) / hotter things cool quicker (1)	1	ora allow more heat (at start) must be comparative
Total			4	

B621/02

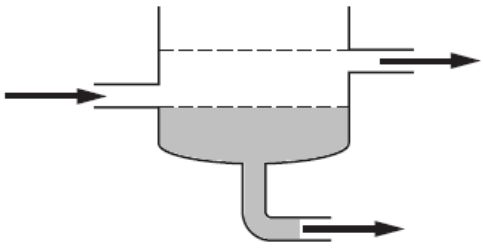
Question		Gd	Expected Answers	Marks	Additional Guidance	
1	(a)	CC	<p>more carbohydrate / fat (1)</p> <p>for energy / calories / joules (1)</p> <p>Or</p> <p>more protein (1)</p> <p>for (muscle) growth (1)</p> <p>Or</p> <p>more water (1)</p> <p>to stay hydrated (1)</p>	2	<p>first marking point must be comparative</p> <p>ignore any reference to minerals / fibre / vitamins for first marking point but second marking point must specifically link carbohydrate / fat to energy or link protein to growth / repair e.g. more protein and carbohydrate for energy = 1 e.g. more protein and vitamins for growth = 1</p> <p>assume unqualified answer refers to Mary allow reverse arguments for Vicki</p>	
	(b)	DD	<p>21(2)</p> <p>but if answer is incorrect $60 \div 1.7 \times 1.7$ (1) or $60 \div 1.7^2$ (1) or $60 \div 2.89$ (1) or $60 \div 2.9$ (1)</p>	2	allow any answer between 20.7 and 21(2)	
	(c)	(i)	C	carbon monoxide / CO (1)	1	
		(ii)	D	stimulant (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
			Total	6		

Question		Gd	Expected Answers	Marks	Additional Guidance
2	(a)	CD	CNS / relay neurone / spinal cord (1) motor neurone / motor nerve (1)	2	not brain allow intermediate neurone / association neurone (1) allow motor neurone followed by synapse for (1)
	(b)	B	slows impulse across synapse (1) slows down / reduces / blocks the neurotransmitter / acetylcholine / ACh release (1) blocks the receptor sites / detection of the neurotransmitter / acetylcholine /ACh (1)	1	ignore makes you drowsy / drunk / AW allow (alcohol) is a depressant (1) ignore alcohol makes you feel 'down' allow less nerve impulses or signals travel to the brain e.g. prevents signals getting from the body to the brain (1) ignore references to slowing down the brain or nervous system e.g. they block the chemical acetylcholine (so less nerve impulses travel to the brain) (1) e.g. reduce the amount of chemical transmitter released (at synapses) (1) ignore blocks the synapse
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance									
3	(a)	(i)	B (both) parents heterozygous / (both) Ee / (both) have one of each allele (1)	1	ignore they are both carriers allow (both) parents have 2 different alleles ignore references to genes									
		(ii)	AA genotypes of parents and offspring correct (1)  or <table border="1"> <tr><td></td><td>E</td><td>e</td></tr> <tr><td>E</td><td>EE</td><td>Ee</td></tr> <tr><td>e</td><td>Ee</td><td>ee</td></tr> </table> but 25% / 0.25 / 1/4 / 1 in 4 / 1:3 (2)		E	e	E	EE	Ee	e	Ee	ee	2	e.g. genotype of both parents Ee and genotypes of offspring EE, Ee, Ee and ee (1) correct Punnett squares or spaghetti diagram without labels scores (1) not 1 in 3 / 3:1 / 1:4
	E	e												
E	EE	Ee												
e	Ee	ee												
	(b)		B tick in 2nd row / people who are homozygous for the E allele have free earlobes (1)	1	two ticks or more scores zero									
			Total	4										

Question		Gd	Expected Answers	Marks	Additional Guidance
4	(a)	A*AA	<p>any three from converts excess glucose (1)</p> <p>to <u>glycogen</u> (1)</p> <p>(stores) in liver / (stores) in muscles (1)</p> <p>(liver or muscle) cells take up more glucose (1)</p> <p>increased rate of respiration (in liver or muscle cells) / increased metabolic rate (in liver or muscle cells) (1)</p>	3	<p>use ticks in this question</p> <p>allow removes excess glucose ignore breakdown of glucose</p> <p>not any incorrect spelling or incorrect name e.g. glucagon</p> <p>ignore references to insulin targets liver cells</p>
	(b)	C	idea of balancing bodily inputs and outputs / maintaining a constant internal environment / control of internal environment (1)	1	<p>allow maintain optimum status in body allow examples of controlling or maintaining e.g. temperature, carbon dioxide, water level, pH allow 'keeping the glucose levels the same' (limit of acceptability) ignore keep everything in balance</p>
	(c)	A*	idea that genes switched off in other cells (1)	1	<p>allow insulin gene is only switched on in pancreas cells ignore genes are dormant or not active in other cells</p>

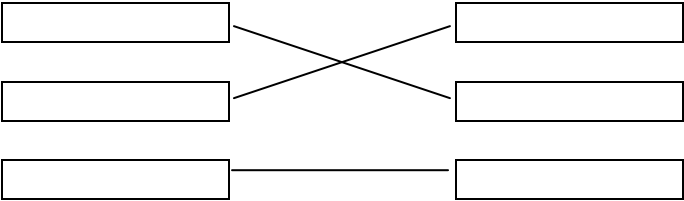
Question		Gd	Expected Answers	Marks	Additional Guidance
	(d)	DD	any two from does not use oxygen / happens when there no oxygen (1) does not produce carbon dioxide (1) does not produce water (1) produces lactic acid (1) produces less energy / less efficient (1) incomplete breakdown of glucose (1)	2	ignore references to oxygen debt / happens when there is not enough or lack of oxygen / uses less oxygen allow cramp / fatigue / ache allow reverse arguments for aerobic respiration if clearly stated if two marking points given in first line, mark them both and just check there are no contradictions on the next line
			Total	7	

Question		Gd	Expected Answers	Marks	Additional Guidance
5	(a)	D	(compound containing) carbon and hydrogen only / AW (1)	1	ignore (compound containing) carbon and hydrogen not mixture of carbon and hydrogen only not a (compound containing) carbon and hydrogen molecules only
	(b) (i)	D	X inside the column, either inside the pipe or anywhere up to the first dotted line (1) i.e. X anywhere in the grey area 	1	not to the right hand side of the bottom arrow (see diagram) look at centre of X
	(ii)	C	boiling points / molecular sizes / relative molecular masses (RMMs) / AW (1)	1	not just different temperatures allow properties such as volatility / viscosity allow chain length allow flammability ignore density
	(c)	BA	$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ correct reactants and products (1) correct balancing (1)	2	allow any correct multiple, including fractions allow = / \rightleftharpoons instead of \rightarrow not and / & / '+ energy' balancing mark is dependent on the correct formulae but allow 1 mark for a balanced equation with a minor error in subscripts / formulae eg $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
	(d)	C	heat / energy given out / AW (1)	1	allow temperature increases allow heat or energy / exits / released / produced allow energy or heat is lost (limit of acceptability) ignore gives more energy not energy is created / made
			Total	6	

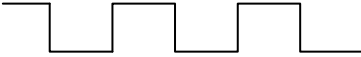
Question		Gd	Expected Answers	Marks	Additional Guidance
6	(a)	DC	petroleum spirit (1) largest temperature rise / increase / change AW (1)	2	allow petroleum or spirit ignore highest temperature at end allow starts lowest but ends up highest ignore others don't heat up as much allow all temperature differences correctly calculated i.e. 17 / 10 / 15 / 24 (°C) mark independently
	(b)	AA*	6300(J) (2) but energy released = $100 \times 4.2 \times 15$ (1)	2	look for correct answer first , 6300(J) on its own scores (2) despite any other working out allow 6.3kJ (2) unit not needed – ignore incorrect units, unless a con , eg 6300kJ
			Total	4	

Question		Gd	Expected Answers	Marks	Additional Guidance
7	(a)	DC	<p>any two from non-toxic / does not poison you (1)</p> <p>does not rot / non-biodegradable / not attacked by microbes / will not decompose (1)</p> <p>not degraded by sunlight / not degraded by UV / AW (1)</p> <p>does not react with water / does not rust / does not corrode / does not react with oxygen / does not react with air / does not react with moist air / AW (1)</p> <p>lightweight / low density (1)</p> <p>waterproof / does not dissolve (in water) (1)</p> <p>flexible / it can flex / bendy / not brittle (1)</p> <p>strong / tough (1)</p> <p>solid / high melting point / melting point above 100°C (1)</p>	2	<p>ignore easily moulded (equivalent to easy to shape)</p> <p>allow not attacked by bacteria / not affected by bacteria / not affected by fungi / not affected by mould ignore weathering</p> <p>allow not broken down by sunlight / UV allow not damaged by sunlight / UV allow not damaged by sun's rays / sun's energy</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 light not heavy ignore light</p> <p>allow not permeable to water / insoluble (in water) / resistant to water / does not leak / holds water</p> <p>allow will not break (easily) (1) ignore rigid</p> <p>allow durable / hard wearing / long lasting</p> <p>ignore can be coloured / smooth</p>

Question	Gd	Expected Answers	Marks	Additional Guidance
(b)	AB	<p>correct formula for poly(chloroethene)</p> $\begin{array}{c} \text{Cl} \\ \diagdown \\ \text{C} = \text{C} \\ \diagup \quad \diagdown \\ \text{H} \quad \quad \text{H} \end{array}$ <p>(1)</p> <p>correct repeat units for PTFE</p> $\left[\begin{array}{cc} \text{F} & \text{F} \\ & \\ -\text{C} & - \text{C}- \\ & \\ \text{F} & \text{F} \end{array} \right]$ <p>(1)</p>	2	<p>allow Cl in any position</p> <p>ignore n after bracket allow round or square brackets, but brackets must be present</p>
(c)	B	<p>it has a (carbon to carbon) double (covalent) bond (1)</p>	1	<p>ignore it does not have the maximum number of hydrogen atoms ignore references to single bonds ignore references to alkane / alkene</p>
Total			5	

Question		Gd	Expected Answers	Marks	Additional Guidance
8	(a)	C	ester (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank more than one answer scores zero
	(b)	DD	insoluble – so that perfume cannot be washed off easily non-irritant – so Sam can put the perfume directly onto her skin non-toxic – so Sam is not poisoned	2	all 3 correct = 2 marks 1 or 2 correct = 1 mark 
	(c)	BA*	any two from idea that forces or attractions between the particles in the liquid overcome or weakened or broken (1) idea that (only) weak attraction between particles in perfume / weak intermolecular forces (1) idea that particles gain energy / particles with lots of energy escape from liquid (1)	2	use ticks in this question allow bonds instead of forces allow molecules instead of particles ignore energy gets stronger ignore references to particles becoming more spread out or separated ignore references to diffusion
			Total	5	

Question			Gd	Expected Answers	Marks	Additional Guidance
9	(a)	(i)	A	idea of rapid increase since 1800 / from any point during last 200 years (1)	1	not just increases allow increase after a long steady period
		(ii)	B	idea of increased global warming / increased greenhouse effect (1)	1	ignore Global warming or the greenhouse effect unless clear reference to an increase allow idea of increase in (average) temperature / reduction of ice caps / ice caps melting / glaciers melting / rising sea level ignore warming the Earth but allow making the Earth warmer / warming up the Earth (limit of acceptability) ignore just climate change / changes in weather ignore effects on living organisms not references to ozone layer / CFC's
		(iii)	B	idea of increased human activity (1)	1	allow specific examples of increased human activity e.g. more production of fuels / more use of fuels / more cars or transport / more factories / increased population / industrial revolution / deforestation ignore farming
	(b)		CD	any two from: dust / debris / ash (ejected) (1) stops (some) heat / radiation reaching Earth / (1) IR / radiation / Sun's rays / (Sun's) energy <u>reflected</u> (1)	2	ignore gases / lava allow smoke / sulfur / sulfate / sulfur dioxide / SO ₂ allow blocking out the Sun(light) allow heat <u>reflected</u> ignore bounce
Total					5	

Question		Gd	Expected Answers	Marks	Additional Guidance
10	(a)	C	Morse (1)	1	ignore digital
	(b)	D	can be on and off / can be 0 or 1 / can be high or low / can only take two (set) values / AW (1)	1	<p>allow can turn on and off not you switch it on and off</p> <p>allow binary code</p> <p>allow correct pulse diagram, e.g.</p>  <p>ignore can only have two results</p> <p>ignore can be multiplexed</p>
	(c)	D	A to D	1	<p>allow distance from point on a wave to same point on next wave e.g. distance from crest to crest or distance from trough to trough</p> <p>allow wavelength correctly indicated on diagram</p> <p>ignore the length of one wave</p>
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance
11		BA*	<p>reflected from ionosphere (1)</p> <p>(re)transmitted from satellites / microwaves pass through ionosphere (1)</p>	2	<p>allow by layer of charged particles or by TIR but not just upper atmosphere</p> <p>ignore references to refraction</p> <p>ignore references to bouncing off the ionosphere</p> <p>not references to reflection (from satellites)</p> <p>allow sent to Earth from a satellite</p>
			Total	2	

Question		Gd	Expected Answers	Marks	Additional Guidance
12	(a)	CD	<p>0.6 (2)</p> <p>but if answer is incorrect $12000 \div 20000 \times 100$ (1)</p>	2	<p>allow 60% (2) if % sign clearly shown</p> <p>if % answer is incorrect 60 on it's own scores (1)</p> <p>ignore any units other than % on the answer line e.g. 0.6J or 0.6N scores (2), but 0.6% scores (1)</p>
	(b)	C	3 (years) (1)	1	
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance
13	(a)	AA*	water / fat / lipid (1) molecules or particles vibrate more / molecules or particles move more quickly / molecules gain (kinetic) energy (1)	2	use ticks in this question ignore reference to heating the brain / temperature of the brain ignore heating of particles e.g. it heats them up ignore 'move around more' allow temperature of the water / fat / lipid rises (2) allow water heats up (2)
	(b)	BB	any two from higher frequency / lower wavelength (1) larger energy / greater amplitude (1) longer exposure / closer to source (1)	2	
			Total	4	

Question		Gd	Expected Answers	Marks	Additional Guidance
14	(a)	C	take in heat / absorb heat / heat is transferred from the surroundings (1)	1	allow surroundings above 0 °C / melting point (of ice) allow surroundings are hotter allow heat moves from hot to cold (limit of acceptability) ignore ice getting hotter allow higher level answers relating to overcoming forces between molecules
	(b)	C	remains constant / remains at 0 (°C) (1)	1	allow temperature is steady
	(c)	D	energy melt (1)	1	both needed for 1 mark
			Total	3	

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Question		Gd	Expected Answers	Marks	Additional Guidance
1	(a)	GFkeep warm (1) keep grip / climb (on the rocky hills) (1)	2	allow for insulation / protect from knocks / protection form the cold / stop heat loss allow dig into ice / (help them) walk up hills / fight off predators / kill predators / defence / attack rivals / dig into ground / so they do not slip not kill or attack prey ignore to be able to walk
	(b)	F	food / water / shelter / mates (1)	1	allow females / space / land / territory / grass / minerals
	(c)	FDD	global warming (1) carbon dioxide (1) increasing (1)	3	allow greenhouse effect ignore climate change allow methane / CFC / water / carbon monoxide / CO ₂ / CO / CH ₄ / H ₂ O allow formula even with minor errors in case, subscript or superscript e.g.CO ² , CH ₄ ,H ₂ O or Co allow growing / getting larger / bigger / causing more pollution not just large
			Total	6	

Question		Gd	Expected Answers	Marks	Additional Guidance
2	(a)	F	an animal and an invertebrate (1)	1	if two or more boxes are ticked do not award a mark
	(b)	EE	habitat (1) community (1)	2	
	(c)	CC	they are a new species (1) only members of the same species can produce fertile offspring / offspring produced were not fertile / offspring produced were hybrids(1)	2	allow they now have different genes / there are two species allow they are a different type (of mosquito) / they are a different variety (of mosquito) / they are a different kind (of mosquito) ignore they are a different breed not different class (of mosquito)
			Total	5	

Question		Gd	Expected Answers	Marks	Additional Guidance
3	(a)	G	It is in danger of becoming extinct (1)	1	allow close to dying out / rare / only a few left / are not many of them not just population is decreasing
	(b)	GF	thyme plants (1) ants (1)	2	allow thyme / plants
	(c)	(i)	G net (1)	1	
		(ii)	DC any two from: less bare ground / more grass (so fewer places for ants to live) (1) there are fewer ants (1) so fewer for the butterflies to eat (1) less butterflies (survive) to mate (1)	2	Annotate this question fully with ticks and crosses etc. in the answer candidate can refer to large blues rather than butterflies less ants due to more grass will be awarded both marks less ants for them to eat will be awarded both marks the them refers to butterflies ignore there are no ants left ignore butterflies have no food
			Total	6	

Question		Gd	Expected Answers	Marks	Additional Guidance
4	(a)	E	chlorophyll (1)	1	answer must sound like chlorophyll e.g. clorofil is as bad as it could be ignore chloroplasts
	(b)	E	sugar / glucose / carbohydrate (1)	1	ignore starch
	(c)	G	there is (more) pollution (1)	1	allow named pollutant eg oxides of nitrogen / sulfur dioxide / carbon monoxide / particulates / poor air quality / air is not 'clean' allow acid rain
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance
5	(a)	G	<p>any two from glass (1)</p> <p>plastics (1)</p> <p>fibres (1)</p>	2	<p>allow rubber (1) cloth (1) leather (1)</p> <p>allow named plastic/ fibre e.g. pvc (1) polycarbonate (1) nylon (1) polyester (1)</p> <p>allow carbon fibres (1)</p> <p>allow named metals e.g. lead (1) copper (1) aluminium (1) chrome / chromium (1)</p> <p>ignore iron / alloy / metal</p>
	(b)	DD	<p>any two from</p> <p>properties steel is harder (1) steel is stronger / steel has a higher tensile strength (1) steel is more malleable (1) steel is less likely to corrode / steel is less likely to rust (1)</p> <p>explanations steel is safer / so less damage in a crash with steel / so crumples less in a crash / steel is not damaged so easily (1) steel car will last longer (1)</p>	2	<p>Full marks can be awarded either by comparing two properties or by comparing one property with an explanation</p> <p>For the property and explanation there must be a comparison e.g. stronger but not just strong / steel rusts more slowly but not steel rusts slowly / steel is safer but not just steel is safe allow ora for iron e.g. iron is weaker (1) so more damaged in a crash (1)</p>
	(c)	GF	<p>to decorate (1)</p> <p>to protect (1)</p>	2	<p>allow to make it look pretty / to give it colour / to look good / aesthetics / looks better / looks nice</p> <p>ignore to make it shiny</p> <p>allow to stop it rusting / stop water getting in / waterproof it / stop air reaching surface / stops oxygen reaching surface</p>
			Total	6	

Question		Gd	Expected Answers	Marks	Additional Guidance
6	(a)	C	(a large volume of) gas (1)	1	allow carbon dioxide / water / sulfur dioxide / heat / energy / sound (1) ignore carbon monoxide / oxygen / nitrogen / hydrogen / smoke
	(b)	CD	(flour or powder) has a larger surface area (1) more collisions (1)	2	Annotate this question fully with ticks and crosses etc. 'it' refers to powder or flour if 'it' not specified. allow more exposed particles (1) allow ora if lump specified flour is broken down is not sufficient / flour has a large surface area is not sufficient allow higher level answers such as collisions more often / more collisions per second / more successful collisions ignore faster collisions
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance	
7	(a)	C	calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water (1)	1	Allow any order of reactants (LHS) and any order of products (RHS) allow correct formulae with no minor errors of subscripts or superscripts e.g. $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ ignore incorrect balancing allow correct multiples allow mix of formulae and names allow = or equilibrium sign for arrow not and for +	
	(b)	(i)	G	3 (minutes) (1)	1	ignore any units
		(ii)	E	has a steeper slope / larger gradient (1)	1	allow steeper line / steeper curve allow experiment 2 is higher than experiment 1 ignore shorter curve allow finishes earlier / shorter reaction time / at a given time expt. 2 makes more gas / goes to 50 cm ³ before expt 1 allow the curve is (always) above expt 1 ignore volume of gas increases quicker
			Total	3		

Question		Gd	Expected Answers	Marks	Additional Guidance
8	(a)	G	hydrogen	1	allow other ways of indicating the correct answer e.g. a tick
	(b)	E	photosynthesis links with increase level of oxygen respiration links with decrease level of carbon dioxide	1	Both needed for one mark
	(c)	E	any one from kills plants / kills aquatic life / erodes stonework / corrodes metals (1)	1	allow kills trees / kills fish / erodes buildings / causes breathing problems / causes asthma / damages plants / damages crops / damages buildings / erodes cliffs / harms fish / rusts quicker / kills living organisms / erodes (stone) statues / corrodes (metals) statues ignore pollution / damages or kills animals / rots buildings / corrodes rocks / erodes metals not global warming / greenhouse effect / ozone depletion
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance
9	(a)	GF	<p>correct answers in order of height of arrow point lava crust magma</p> <p>all three labels correct (2) one or two labels correct (1)</p>	2	
	(b)	E	soil is (very) fertile / crops grow better / AW (1)	1	<p>allow soil has many nutrients present not soil is good unless qualified e.g., can grow bigger crops or soil good for crops would be sufficient to gain a mark</p> <p>allow provided geothermal energy / cheap source of heat / because people may want to study the volcano / want to live in same place as rest of family / housing may be cheap / may want to build a hotel for tourists</p> <p>ignore because there is no where else to go / for warmth</p>
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance
10	(a)	F	electrolysis (1)	1	
	(b)	F	6 (1)	1	
			Total	2	

Question		Gd	Expected Answers	Marks	Additional Guidance	
11	(a)	G	cancer treatment / tracers / sterilising / thickness gauging / Non-Destructive Testing (NDT) / smoke detectors (1)	1	Allow example of sterilisation e.g. cleaning surgical instruments not just cancer not for x-rays ignore nuclear power / nuclear weapons	
	(b)	(i)	G	(causes) cancer / damages living cells / radiation sickness / radiation burns (1)	1	allow hair loss / sterility / reduction in white blood cell count / damage to CNS / kills cells / burns the skin / allow causes genetic abnormality / (genetic) mutations / birth defects / damages genes ignore death
		(ii)	F	protective clothing / tongs / short exposure time / shielding / keep your distance (1)	1	allow monitoring radiation / wear protection (1) allow wear goggles / wear gloves / (safety) PPE (personal protection equipment) / full body suite / respirator
	(c)	G	beta (1)	1	allow correct symbol (β)	
			Total	4		

Question			Gd	Expected Answers	Marks	Additional Guidance
12	(a)	(i)	F	coal and (crude) oil (1)	1	any order both needed for mark
		(ii)	F	manure (1) wood (1)	2	any order
	(b)		DC	heat / thermal (1) plutonium (1)	2	allow hot water ignore radiation
				Total	5	

Question		Gd	Expected Answers	Marks	Additional Guidance	
13	(a)	GF	highest power / largest kW (1) used longest time / AW (1)	2	allow highest kWhr (2) any order allow correct calculation of kWhr for washing machine = 6kWhr (1) not just high but allow higher power not most electricity not just a long time but allow longer time allow used more often / used for more time	
	(b)	(i)	D	0.5 (1)	1	allow half / $\frac{1}{2}$
		(ii)	D	6 (1)	1	allow ecf: incorrect answer from 13bi x 12 (1) If answer incorrect remember to check for ecf by looking at image for (b) (i) underneath image for (b) (ii)
			Total	4		

Question		Gd	Expected Answers	Marks	Additional Guidance
14	(a)	EEE	<p>absorbed – light / sunlight energy (1)</p> <p>produced – electricity / current / DC (1)</p> <p>advantages – remote use / free energy (in use) / non-polluting (when in use) / does make carbon dioxide (when in use) (1)</p>	3	<p>Annotate this question fully with ticks and crosses etc.</p> <p>allow attract light / gather light / collecting light ignore Sun's energy / solar energy / heat not gives out light</p> <p>allow electrical energy / voltage not produces kinetic energy</p> <p>allow higher level answers eg rugged / renewable (source) / longevity / does not contribute to global warming (when in use) / do not need much maintenance / does not have moving parts / does not need a fuel (when in use)</p> <p>it does not cost anything is not sufficient but allow does not cost anything to produce the energy</p> <p>ignore greener / environmentally friendly</p>
	(b)	E	affects (operation of artificial) satellites	1	<p>allow affects (satellite) communication (1)</p> <p>allow interference (of electromagnetic radiation) / interference of (communication) signals / affects electricity distribution (1)</p> <p>allow danger to astronauts (1)</p>
	(c)	G	moon (1)	1	allow a satellite or any named satellite e.g. international space station, Hubble telescope
	(d)	(i)	(planetary) nebula (1)	1	allow correct answer underlined, circled or ticked in list if answer line is blank more than one answer scores zero
		(ii)	supernova (1)	1	allow correct answer underlined, circled or ticked in list if answer line is blank more than one answer scores zero
			Total	7	

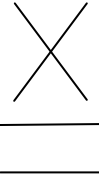
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Question		Gd	Expected Answers	Marks	Additional Guidance
1	(a)	B	can compete more successfully for food / can retain more heat (1) ORA reduces heat loss	1	allow have more food reserves / fat / stored food (1) ignore wool / fur allow lower surface area to volume ratio
	(b)	D	global warming (1) carbon dioxide(1)	2	allow greenhouse effect ignore climate change allow methane / CFC / water / carbon monoxide / CO ₂ / CO / CH ₄ / H ₂ O allow formula even with minor errors in case, subscript or superscript e.g.CO ² , CH ₄ ,H ₂ O or Co
			Total	3	

Question			Gd	Expected Answers	Marks	Additional Guidance
2	(a)	(i)	D	a backbone / vertebral column (1)	1	allow spine / spinal cord / bones / vertebrae (1)
		(ii)	C	Benefits from a (living) organism / host, causing harm to host(1)	1	allow lives off another (living) organism causing harm (1) allow lives off another named animal or plant causing harm(1) allow feeds on and causes harm to another organism (1) allow feeds on the blood of live birds and causes harm (1) but ignore "feeds on blood of live birds" as in stem of question
	(b)		DC	populations (1) habitats (1)	2	
	(c)	(i)	CC	they are a new species (1) only members of the same species can produce fertile offspring / offspring produced were not fertile / offspring produced were hybrids(1)	2	allow they now have different genes / there are two species allow they are a different type (of mosquito) / they are a different variety (of mosquito) / they are a different kind (of mosquito) ignore they are a different breed not different class of mosquito
		(ii)	A*	Paul (1)	1	
				Total	7	

Question		Gd	Expected Answers	Marks	Additional Guidance
3	(a)	DC	<p>any two from:</p> <p>less bare ground / more grass (so fewer places for ants to live) (1)</p> <p>there are fewer ants (1)</p> <p>so fewer for the butterflies to eat (1)</p> <p>less butterflies (survive) to mate (1)</p>	2	<p>in the answer candidate can refer to Large Blues rather than butterflies</p> <p>less ants due to more grass will be awarded both marks allow less ants for them to eat (2) the them refers to butterflies ignore there are no ants left</p> <p>ignore butterflies have no food</p>
	(b)	B	<p>protect food chains /</p> <p>cultural reasons /</p> <p>ethical reasons /</p> <p>future use (1)</p>	1	<p>allow other species feed on Large Blue (1) allow ant population affected (1) allow affect population size of other organisms (1) allow to help pollinate (plants)</p> <p>allow keeps Large Blue for other people to see (1)</p> <p>allow humans want to stop them becoming extinct (1) allow larger ant population may lead to excess use of pesticides (1) allow may have useful genes to treat illnesses etc. / use for idea of future research (1)</p>
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance
4	(a)	B	Cannot photosynthesise / make their own food (1)	1	allow lack chloroplasts / chlorophyll / cell walls made of cellulose (1)
	(b)	AA	H ₂ O and O ₂ (1) correct balancing (1)	2	balancing mark is conditional on correct formulae allow = instead of → allow heat above arrow allow correct multiples + energy = 0 allow 1 mark if correctly balanced but minor errors in subscript and/or symbols example 6H ₂ o ... → 6O ₂
	(c)	(i)	DB can be used to indicate pollution / environmental change(1) more lichens further away from factory (1) ORA less lichen closer to factory (1)	2	allow more lichen further from factory where air is cleaner (2) allow crusty lichen survive in polluted areas as the bushy cannot survive so easily (1) allow named pollutant gases ignore carbon dioxide as not a pollutant for lichens
		(ii)	A bushy lichens more sensitive to pollution / do not grow so close to the factory (1) ORA crusty lichen grow closer to factory (1)	1	allow quantitative answers allow crusty lichen can live in more polluted areas unlike the bushy lichen (1) allow bushy lichen are found only in non-polluted areas (1)
		(iii)	A* more surface area in contact with the air (1)	1	allow bushy has larger surface area so absorbs more pollution (1) just surface area on its own is insufficient
			Total	7	

Question		Gd	Expected Answers	Marks	Additional Guidance
5	(a)	DD	<p>any two from</p> <p>properties steel is harder (1) steel is stronger / steel has a higher tensile strength (1) steel is more malleable (1) steel is less likely to corrode / steel is less likely to rust (1)</p> <p>explanations steel is safer / so less damage in a crash with steel / so crumples less in a crash / steel is not damaged so easily (1) steel car will last longer (1)</p>	2	<p>Full marks can be awarded either by comparing two properties or by comparing one property with an explanation</p> <p>For the property and explanation there must be a comparison</p> <p>e.g. stronger but not just strong / steel rusts more slowly but not steel rusts slowly / steel is safer but not just steel is safe allow ora for iron e.g. iron is weaker (1) so more damaged in a crash (1)</p>
	(b)	DC	<p>amalgam – mercury brass – copper and zinc solder – lead and tin</p> <p>all three correct (2) one or two correct (1)</p>	2	
	(c)	B	returns to original shape	1	not returns to original shape when heated (any reference to heating for change loses mark)
			Total	5	

Question		Gd	Expected Answers	Marks	Additional Guidance
6	(a)	C	(a large volume of) gas (1)	1	allow carbon dioxide / water / heat / energy / sound (1) ignore carbon monoxide / oxygen / nitrogen / hydrogen / smoke
	(b)	CD	(flour or powder) has a larger surface area (1) more collisions (1)	2	'it' refers to powder or flour if 'it' not specified. allow more exposed particles (1) allow ora if lump specified flour is broken down is not sufficient / flour has a large surface area is not sufficient allow higher level answers such as collisions more often / more collisions per second / more successful collisions ignore faster collisions
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance
7	(a)	C	calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water (1)	1	allow any order of reactants(LHS) and any order of products(RHS) allow correct formulae with no minor errors of subscripts or superscripts e.g. $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ ignore incorrect balancing allow correct multiples allow mix of formulae and names allow = or equilibrium sign for arrow not and for +
	(b)	(i)	A*A 15 (cm ³ / minute) (2) But 30/2 (1)	2	
		(ii)	B more frequent collisions / more chance of collision / more likely to collide (1)	1	allow more collisions per second / more successful frequent collisions (1) ignore more collisions ignore more crowded particles not references to particles moving faster / have more energy / more surface area
			Total	4	

Question		Gd	Expected Answers	Marks	Additional Guidance
8	(a)	A*B	$2\text{CuCO}_3 + \text{C} \rightarrow 2\text{Cu} + 3\text{CO}_2$ formulae (1) balancing (1)	2	allow any order of reactants(LHS) and any order of products(RHS) balancing mark is conditional on correct formulae allow = instead of \rightarrow allow heat above arrow allow correct correct multiples + energy = 0 allow 1 mark if correctly balanced but minor errors in subscript and/or symbols example $2\text{CuCO}_3 + \text{C} \rightarrow 2\text{Cu} + 3\text{CO}_2$
	(b)	(i)	ABB solution A is copper sulfate (1) anode is impure copper (1) cathode is pure copper (1)	3	if anode is copper and cathode is copper allow 1 mark allow copper chloride / copper nitrate
			Total	5	

Question		Gd	Expected Answers	Marks	Additional Guidance
9	(a)	D	lithosphere (1)	1	allow answer circled / underlined or indicated correctly in any way in list
	(b)	C	tectonic plates are less dense (1) ORA	1	ignore weight
	(c)	C	cools slowly / rate of cooling is low (1)	1	allow ora allow cools very slowly (1) allow granite cools slowly (1)
			Total	3	

Question		Gd	Expected Answers	Marks	Additional Guidance	
10	(a)	DDD	both needed for each mark no no (1) no no (1) gamma yes (1)	3	each row has to be correct for each mark allow correct symbol for gamma γ (1)	
	(b)	(i)	DC	heat / thermal (1) plutonium (1)	2	allow hot water ignore radiation
		(ii)	AAA	1 800 (3) if answer is incorrect Input = 3 000 (MW) scores 2 if incorrect 1200 / 0.4 or AW score (1)	3	mark correct answer (3) if answer incorrect seek to award marks for correct working and method. eg correct substitution such as 0.4 = 1 200 / input scores (1)
	(c)	BBB	maximum of three marks advantages – any 2 from: independence from fossil fuels / doesn't use fossil fuels(1) (relatively) high fuel stocks (1) doesn't contribute to global warming / no greenhouse gases / no CO ₂ AW (1) no acid rain / less dust (1) disadvantages – any 2 from pollution from fuel processing (1) nuclear accidents or named event (1) cost of maintenance is high / idea of cost of decommissioning being high / cost a lot to run (1) long lived activity from waste / waste difficult to dispose of / has to be stored for a long time (1) can cause cancer / mutation (1) non-renewable (1) terrorists may get hold of it (1) waste is radioactive (1)	3	allow for advantages: small amount of fuel needed (1) less thermal pollution (1) not just pollution needs to be qualified allow for disadvantages: lack of suitable / acceptable sites (1) radioactive leaks / emissions (1) ignore renewable can be used to make nuclear weapons (1)	
			Total	11		

Question		Gd	Expected Answers	Marks	Additional Guidance
11	(a)	D	0.5 (1)	1	allow $\frac{1}{2}$ / half
	(b)	D	6 (1)	1	allow ecf: incorrect answer from 11a x 12 (1) If answer incorrect remember to check for ecf by looking at image for (a) above image for (b)
			Total	2	

Question			Gd	Expected Answers	Marks	Additional Guidance
12	(a)	(i)	C	low maintenance / rugged / renewable energy (source) / no need for power cables / longevity / no polluting (waste) / free energy (source) / AW (1)	1	ignore renewable unless qualified ignore "energy from the sun is used" as in stem of question allow fossil fuels are not used (1) allow lasts a long time (1)
		(ii)	C	no power in poor light / darkness / low power output / AW (1)	1	ignore bad weather unless qualified. allow may not be enough sunlight around (1) allow don't work at night (1)
	(b)		B	power failures / power surges / communication problems / AW (1)	1	ignore heats up Earth / heat surges ignore affects / damages satellites unless qualified as in stem of question but allow damages satellites and stops signals / TV's / GPS / mobile phones from working (1)
	(c)	(i)	C	(planetary) nebula (1)	1	allow correct answer underlined, circled or ticked in list if answer line is blank more than one answer scores zero
			C	supernova (1)	1	allow correct answer underlined, circled or ticked in list if answer line is blank more than one answer scores zero
Total					5	

Question	Gd	Expected Answers	Marks	Additional Guidance
13	A*A*	<p>any two from: correct idea of red-shift (1)</p> <p>BUT correct idea of differential red-shift (2)</p> <p>idea of extrapolation to calculate age and / or starting point (1)</p>	2	<p>allow galaxies or stars moving away show a red-shift / show light with a longer wavelength / shorter frequency (1) not planets or Earth not galaxies turn red or galaxies are red BUT faster moving galaxies or galaxies further away display greater red-shift / show light with an even longer wavelength / shorter frequency (2)</p> <p>idea of using speeds to extrapolate where they have come from (and at what time) (1) example "by measuring how fast they move away from us to go back to the point where they all started" "calculate starting time using $\text{time} = \text{distance}/\text{speed}$"</p>
		Total	2	

Grade Thresholds

General Certificate of Secondary Education
GCSE Science B Gateway (J640)
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B621/01	Raw	60	-	-	-	37	30	24	18	12	0
	UMS	69	-	-	-	60	50	40	30	20	0
B621/02	Raw	60	44	35	26	18	12	9	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B622/01	Raw	60	-	-	-	36	29	23	17	11	0
	UMS	69	-	-	-	60	50	40	30	20	0
B622/02	Raw	60	43	35	26	18	12	9	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J640	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J640	1.3	8.2	26.3	58.8	89.4	95.4	97.9	99.8	100.0	624

For a description of how UMS marks are calculated see:
<http://www.ocr.org.uk/learners/ums/index.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

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