



GCSE

Science B

Unit **B712/01**: Modules B2, C2, P2 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2016

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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1. Annotations used in scoris

Annotation	Meaning
	correct response
	incorrect response
BOD	benefit of the doubt
NBOD	benefit of the doubt not given
ECF	error carried forward
	information omitted
I	ignore
R	reject
CON	contradiction

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

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

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Question	Answer	Marks	Guidance
1 a	<p>any two from</p> <p>ideas about climate change / global warming (1)</p> <p>habitat destruction (1)</p> <p>pollution (1)</p> <p>ideas about competition (1)</p> <p>idea of not enough food / famine (1)</p> <p>disease (1)</p>	2	<p>ignore hunting by humans or other animals</p> <p>ignore environment damage / homes damaged</p> <p>allow examples of pollution e.g. litter / oil spills (1)</p> <p>allow less prey / no food (1)</p> <p>allow idea that there are fewer mates (for breeding) (1) but ignore just 'don't reproduce' / don't breed</p> <p>ignore natural disasters</p>
b	<p>idea that resource can be taken from the environment without it becoming extinct or endangered (1)</p>	1	<p>allow you only take so many (1)</p> <p>allow idea of a quota (1)</p> <p>allow idea of what is taken must be replenished / maintained (1)</p> <p>allow used up at same rate as being produced (1)</p> <p>allow still some left (1)</p> <p>allow can be hunted without it becoming extinct (1)</p> <p>allow does not run out (1)</p> <p>ignore can be used again and again</p>

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Question	Answer	Marks	Guidance
c	<p>Hunting whales helps us to find out how they survive deep in the ocean. <input type="checkbox"/></p> <p>Hunting should be banned because it is cruel. <input checked="" type="checkbox"/></p> <p>Whale hunters can make money. <input type="checkbox"/></p> <p>Whale oil can be used to make lipstick. <input type="checkbox"/></p>	1	more than one tick negates a mark
d	<p>(supports statement because) graph shows there are more dolphins in November or March or winter or any named month from November to March / ora (1)</p> <p>(but) does not show the number of fishing boats (1)</p>	2	<p>assume answer is about November to March unless otherwise stated</p> <p>allow graph shows there are more dolphins in those months (1)</p> <p>allow idea of November or March or February having the most sightings (1)</p> <p>allow comparison of data e.g. in June there were 20 and November there were 100 (1)</p> <p>allow number of dolphins increases in August or September (1)</p> <p>allow does not show why there are more dolphins (in winter)(1)</p> <p>allow only shows one year of data (1)</p> <p>allow only shows data from one source (1)</p> <p>allow idea that December or January is lower than April or September or October (1)</p> <p>allow April or September or October also have high numbers (1)</p>
	Total	6	

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Question	Answer	Marks	Guidance
2 a	<p>any two from</p> <p>herons eat frogs (1)</p> <p>frog population goes down / fewer frogs / no frogs /not many frogs (1)</p> <p>fewer grasshoppers eaten (1)</p>	2	<p>allow fewer grasshopper predators (1)</p> <p>allow fewer grasshoppers hunted by frogs (1)</p> <p>ignore just ' frogs eat grasshoppers '</p>
b	<p>unreactive (1)</p> <p>nitrates (1)</p>	2	
c	<p>idea of decay / decompose / rot / broken down (1)</p> <p>(decay caused by) bacteria / fungi / decomposers (1)</p>	2	<p>allow plants are biodegradable (1)</p> <p>allow (plants turns to) compost (1)</p> <p>ignore digest / degrade</p> <p>ignore detritivores / earthworms /insects / woodlice</p>
Total		6	

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Question	Answer	Marks	Guidance
3	<p>[Level 3] Links increase in population to a detailed description of why there is more household waste AND suggests at least one adaptation in detail. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>[Level 2] Simple link of increase in population to more household waste AND suggests one simple adaptation OR links increase in population to a detailed description of why there is more household waste OR suggests at least one adaptation in detail. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>[Level 1] Simple link of increase in population to more household waste OR suggests one simple adaptation. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0marks)</p>	6	<p>This question is targeted at grades up to C Indicative scientific points for detailed links and adaptations include: detailed link to increase in population</p> <ul style="list-style-type: none"> • exponential growth in population has resulted in more household waste • increased use of packaging means more waste • (more) non - biodegradable plastics packaging means need to use (more) landfill <p>detailed adaptation</p> <ul style="list-style-type: none"> • changed their behaviour for hunting strategy so can get more food • move to landfill because food (resources) is in short supply elsewhere in the desert • increased competition because of food shortage • idea that they are hunting prey or rats that may be found in the landfill site / their prey or rats are easier to find in the landfill sites <p>ignore just ‘spend more time at landfill site’</p> <p>Indicative scientific points for simple links and adaptations include: simple link to increase in population</p> <ul style="list-style-type: none"> • more waste or more rubbish <p>ignore more people more landfill sites</p> <p>simple adaptation</p> <ul style="list-style-type: none"> • idea that they are hunting or feeding or scavenging at landfill • idea that they are eating waste or were attracted by waste at landfill <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
Total		6	

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Question	Answer	Marks	Guidance
4 a	crustacean (1) arachnid (1)	2	ignore spider
b	no (no mark) and any one from idea that C and D (are more closely related because they) are in the same genus (1) idea that A and B are in different genera / different genus name (1)	1	<p>if yes then zero for question if unclear assume answer refers to A and B allow <i>Dytiscus marginalis</i> for C throughout allow <i>Dytiscus latissimus</i> for D throughout allow <i>Gyrinus natador</i> for A throughout allow <i>Orectochilus Villosus</i> for B throughout</p> <p>allow C and D (more closely related) because the first part of their name is the same / both have <i>Dytiscus</i> in the name / have similar binomial names (1) not same binomial name</p> <p>allow A and B have different first part of name (1) allow A and B do not have a similar binomial name (1)</p> <p>ignore different binomial names ignore references to species</p>

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Question	Answer	Marks	Guidance
c i	<p>bars drawn to correct scale +/- half a square and in the correct order (1)</p> <p>bars correctly labelled (1)</p>	2	<div> </div> <p>order of labels secondary consumers (6 mm) primary consumers (12 mm) producers(100 mm)</p> <p>All bars need to be same height as each other – actual height is not important</p>

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Question	Answer	Marks	Guidance
c ii	<p>difference any one from</p> <p>winter (pyramid) is not a pyramid (shape) / in winter there is less (mass of) producers than consumers / ora (1)</p> <p>winter (pyramid) is smaller (than spring pyramid) / ora (1)</p> <p>identifies any level in winter (pyramid) being smaller than spring (pyramid) (1)</p> <p>reason</p> <p>(in winter) less light or less energy for photosynthesis / less light or less energy for growth / ora (1)</p>	2	<p>If unclear assume answer refers to winter pyramid</p> <p>allow less biomass in winter / ora (1)</p> <p>examples include less producers in winter (than spring) / ora (1) less consumers or animals in winter (than spring) / consumers or animals hibernate in winter /ora (1)</p> <p>ignore less Sun for photosynthesis allow (in winter) lower temperature so less photosynthesis / lower temperature so less growth / ora (1)</p> <p>allow idea that more energy is lost as heat (1)</p>
Total		7	

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Question	Answer	Marks	Guidance
5 a	3 (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
b	5 (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
c	ammonium nitrate or NH_4NO_3 (1)	1	allow clear indication of correct answer allow correct answer ticked, circled or underlined in list if answer line is blank
Total		3	

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Question	Answer	Marks	Guidance
6 a	<p>any three from inner core (1) outer core (1) mantle (1) crust (1)</p>	3	<p>allow core for inner core or outer core (1)</p> <p>allow lithosphere (the upper crust and mantle) (1) allow arthenosphere (upper layer of mantle) (1) ignore description ignore tectonic plates</p>
b	<p>(when Wegener made the proposal) there was little or no evidence or no proof (1)</p> <p>now other scientists have tested the theory (1)</p>	2	<p>allow people did not believe him because they could not see it happening (1) allow it was hard to collect evidence (1) allow it was just a theory (1) allow examples of why he had no evidence e.g. cannot go below the surface and see what is happening (1) allow they did not have the technology (1)</p> <p>ignore religion / beliefs</p> <p>allow collect data (1)</p> <p>allow it takes evidence to prove that a theory is correct (2)</p> <p>allow specific examples of evidence available now e.g.</p> <p>allow not accepted until sea floor spreading discovered / not accepted until submarines could investigate constructive plate margins under the ocean (2)</p> <p>allow the technology to observe plate movements was not available in Wegener’s time (2)</p>
Total		5	

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Question	Answer	Marks	Guidance
7 a i	<p>E (1) its melting point is above 2000 (°C) / is 3410 (°C) (1)</p>	2	<p>second marking point is dependent on the first</p> <p>allow it will not melt at 2000 (°C) (1) allow has a higher melting point than the molten metal (1) allow has a higher melting point than metal placed inside (the container) (1) allow the others will all melt (1) ignore it has the highest melting point ignore other irrelevant properties from the table</p>
ii	<p>C (1) good (electrical) conductivity / high (electrical) conductivity (1)</p> <p>low density / lowest density (1)</p>	3	<p>second marking point is dependent on the first</p> <p>allow lightweight (1) but ignore light / lighter ignore good density</p> <p>allow maximum 2 marks for A / A and C (1) good (electrical) conductivity / high (electrical) conductivity (1) ignore just (electrical) conductivity of 64</p> <p>ignore other irrelevant properties from the table</p>

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Question	Answer	Marks	Guidance
b	any two from strong (1) low density (1) does not corrode (1) malleable (1)	2	ignore references to cost ignore 'how strong it is' / is it strong or not allow lightweight (1) ignore light / lighter ignore not heavy allow does not rust / rusts slowly (1) allow does not react with water (1) ignore 'will it last' ignore will it corrode or not allow can be bent into shape (1) ignore references to melting point ignore can be moulded ignore ductile
	Total	7	

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Question	Answer	Marks	Guidance
8 a	<p>Level 3 Gives a complete description of solution mining <u>AND</u> names at least two products of the electrolysis. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>Level 2 Gives a rudimentary description of solution mining <u>AND</u> names one product of the electrolysis</p> <p><u>OR</u> names all three products of electrolysis. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>Level 1 Gives a rudimentary description of solution mining <u>OR</u> names one product of the electrolysis. Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0marks)</p>	6	<p>This question is targeted at grades up to C.</p> <p>Indicative scientific points may include: Solution mining</p> <ul style="list-style-type: none"> • water pumped into mine / add water • sodium chloride dissolves in water • sodium chloride or salt (solution) is pumped out <p>allow idea of evaporation to get the salt</p> <p>Products of electrolysis</p> <ul style="list-style-type: none"> • chlorine • hydrogen • sodium hydroxide <p>check for names of gasses labelled correct electrode not required</p> <p>on diagram ignore location of products</p> <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
		6	

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Question	Answer	Marks	Guidance
9 a	40(%) (1)	1	
b	decreases / AW (1)	1	allow if temp decreases yield increases (1) changes is not sufficient
c	any two from 450°C / temperature gives a fast reaction (1) 450°C / temperature gives a reasonable yield (1) catalyst speeds up reaction (1) low pressure needs less energy to generate (1) low pressure is cheaper (1)	2	ignore just 'higher yield' / just 'speeds up reaction' allow idea that temperature (of 450°C) means you will make enough (1) ignore 450°C / temperature gives a high yield allow vanadium or oxide speeds up the reaction (1) allow idea of cheaper equipment (can be used) with low pressure e.g. you don't need expensive chamber if use low pressure (1) allow idea that these are the compromised conditions (1)
	Total	4	

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Question	Answer	Marks	Guidance
10 a i	C (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank allow electric fire / fire (1)
ii	A (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank allow lamp (1)
b	315 (pence) (2) but if answer incorrect 3 x 7 x 15 (1)	2	allow £3.15 (£ sign essential) (2) allow 3.15 with no £ sign (1) allow 3150 (pence) / £31.50 (£ sign essential) (1) allow 3000 x 7 x 15 (1) allow 315000 (pence) / £3150.00 (£ sign essential) (1)
	Total	4	

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Question	Answer	Marks	Guidance
11 a	<p>reason for max one from less or no carbon dioxide / greenhouse gases (1)</p> <p>does not contribute to global warming (1)</p> <p>no smoke or ash (1)</p> <p>no need to transport fuel to power station (1)</p> <p>it is renewable (1)</p> <p>reduces dependency on fossil fuels (1)</p> <p>reason against max one from large numbers needed / need 1000 wind turbines / do not produce much power or enough power(1)</p> <p>idea that it is not always windy (1)</p> <p>idea of visual pollution (1)</p> <p>noise pollution (1)</p> <p>need space / use land that could be used for farming (1)</p> <p>kills birds (1)</p>	2	<p>ignore produce no pollution ignore references to environmentally friendly / eco-friendly / won't harm the environment</p> <p>allow reduces climate change (1)</p> <p>allow less lorries needed (to transport fuel) (1)</p> <p>allow it will not run out (1) ignore it is sustainable</p> <p>ignore references to cost</p> <p>allow power stations produce more power (1) ignore use less power</p> <p>allow if there is no wind then no electricity is generated (1) ignore not reliable</p> <p>allow spoils the view / spoils the scenery / unattractive (1)</p> <p>allow (noise) will keep people awake (1)</p> <p>allow take up a lot of space (1)</p>

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Question	Answer	Marks	Guidance
b	D (1) idea of highest current (1)	2	second marking point is dependent on the first allow idea of highest (total) amps (1) allow best current / best amps (1) ignore 3 amps unless qualified ignore power /charge / energy
c	larger area (1)	1	allow more solar cells (1) allow larger panel / more panels (1) allow more efficient (conversion) (1) allow (use one that) tracking the Sun / always facing the Sun / facing south (1) allow (use one) in a place with more sunlight (1) ignore larger current
	Total	5	

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Question	Answer	Marks	Guidance
12	<p>[Level 3] Calculates efficiency AND detailed description of the generation and distribution of electricity. Quality of written communication does not impede communication of the science at this level (5 – 6 marks)</p> <p>[Level 2] Attempts to calculate efficiency AND partial description of the generation and distribution of electricity. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks)</p> <p>[Level 1] Attempts to calculate efficiency OR limited description of the generation and distribution of electricity. Quality of written communication impedes communication of the science at this level (1 – 2 marks)</p> <p>[Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>	6	<p>This question is targeted up to C</p> <p>Indicative scientific points may include: stages in generation and distribution of electricity</p> <ul style="list-style-type: none"> • coal is burnt • water is heated • steam produced • turbine turns • generator used for electrical production • transformer changes the voltage / there is a step-up transformer / there is a step-down transformer • (electrical) energy distributed / (electrical) energy goes to consumers or factories or homes <p>allow electricity is distributed / electricity goes to consumers or factories or homes</p> <p>not if stages are reversed e.g. electrical energy goes to the turbine</p> <p>Indicative scientific points may include: calculation of efficiency</p> <ul style="list-style-type: none"> • $\text{efficiency} = \frac{\text{useful energy}}{\text{total energy input}}$ • $\text{efficiency} = \frac{1110}{3700}$ • calculate efficiency = 30 (%) or 0.3 <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p>
	Total	6	

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Question	Answer	Marks	Guidance
13 a i	<p>any one from</p> <p>smoke detectors (1)</p> <p>tracers (1)</p> <p>paper thickness gauges (1)</p> <p>sterilising equipment (1)</p> <p>non-destructive testing (1)</p>	1	<p>ignore to treat cancer / detect cancer</p> <p>allow to look leaks in a pipe (1)</p> <p>ignore paper tracers / medical tracers</p> <p>allow sterilising any type of equipment e.g. sterilise hospital equipment (1)</p> <p>allow preserving food / cleaning equipment (1)</p> <p>ignore X-ray / MRI scan / CAT scan</p> <p>ignore power / power stations</p>
ii	<p>any one from</p> <p>damages (living) cells / organs (1)</p> <p>(causes) cancer (1)</p> <p>(causes) mutation (1)</p> <p>causes ionisation (1)</p>	1	<p>allow kills (living) cells / organs (1)</p> <p>ignore just 'kill you'</p> <p>allow makes cells divide uncontrollably (1)</p> <p>ignore health problems / brain damage / skin damage / hair loss</p> <p>allow radiation poisoning (1) but ignore just poisoning</p> <p>ignore bombs</p>

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Question	Answer	Marks	Guidance
iii	<p>any two from</p> <p>(idea of) distant handling / remote handling (1)</p> <p>short exposure time / monitoring badge / AW (1)</p> <p>idea of shielding / protective clothing / lead apron (1)</p>	2	<p>allow use tongs / keep away from body / don't touch / keep your distance / 'stay away from it' / stand away from it (1)</p> <p>allow film badge (1)</p> <p>allow clothing (thick enough) to stop radiation getting through (to the skin) (1)</p> <p>allow lead gloves / lead lab coat (1)</p> <p>allow protective safety gear e.g. protective gloves(1)</p> <p>allow safety screen (1)</p> <p>ignore just goggles / gloves / lab coat / safety gear / body suits / masks</p> <p>ignore idea about storage in a suitable container</p>

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Question	Answer	Marks	Guidance
b	<p>yes if alpha or beta (1) as it will be stopped (by thick aluminium) (1)</p> <p>or</p> <p>no if gamma (1) as it can penetrate (aluminium) or not stopped (by aluminium) (1)</p>	2	<p>allow alpha will be stopped (by aluminium) (2) allow beta will be stopped (by aluminium) (2)</p> <p>allow gamma will penetrate (aluminium) (2) allow for gamma (thick) lead is needed (2)</p> <p>if no other marks awarded ignore yes or no and allow 1 mark from idea that (some types of) radioactive emissions or radiation can penetrate or be stopped by (aluminium) (1) ignore waste or liquid penetrates aluminium beta and gamma get through (aluminium) (1) need to use lead (1)</p>
	Total	6	

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Question	Answer	Marks	Guidance
14 a	<p>any two from</p> <p>moon(s) (1)</p> <p>asteroid(s) (1)</p> <p>comet(s) (1)</p> <p>meteor(s) (1)</p>	2	<p>ignore stars and planets</p> <p>allow natural satellite (1) but ignore (artificial) satellites</p> <p>allow meteorite(s) (1)</p> <p>ignore black holes / supernova / red giant / white dwarf / other stars / Sun / life / aliens / water / ice / rocks / crystals / dust / red shift / big bang</p>
b	<p>unmanned (no mark)</p> <p>any two from</p> <p>long distance / too far away / spacecraft cannot travel that distance(1)</p> <p>will take a long time / takes too long(1)</p> <p>do not need food / water / oxygen / fuel / resources (1)</p> <p>spacecraft does not need to return (1)</p> <p>too much radiation / too hot / too cold (for life) (1)</p>	2	<p>ignore manned</p> <p>allow humans do not live long enough (1)</p> <p>allow spacecraft do not travel at the speed of light (1)</p> <p>allow it will take more than 4 (light) years to get there (1)</p> <p>allow cannot carry enough or a lot of food / water / oxygen / fuel / resources (1)</p> <p>allow (people will) not survive / risk to life / may get killed (1)</p> <p>ignore just it will be dangerous / may get harmed / going into the unknown</p> <p>ignore cost</p>
	Total	4	

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Question	Answer	Marks	Guidance
15 a i	67.6 (%) (1)	1	allow 68(%) not 67(%)
ii	<p>any two from</p> <p>more carbon dioxide or greenhouse gases (1)</p> <p>increase global warming (1)</p> <p>idea of (fossil fuels) running out (1)</p> <p>(need to) use (more) nuclear (1)</p> <p>(need to) use (more) renewable resource / alternative resource / sustainable resource (1)</p>	2	<p>allow increased acid rain (1)</p> <p>ignore cause air pollution</p> <p>allow causes climate change (1)</p> <p>ignore fossil fuels are non-renewable</p> <p>allow examples of resources e.g. solar power (1)</p> <p>ignore references to cost</p>
b i	<p>China</p> <p>USA</p> <p>UK</p> <p>Japan</p> <p>Rest of Europe</p> <p>Canada</p> <p>all correct (2)</p> <p>any three on the correct lines (1)</p>	2	<p>allow correct numbers i.e.</p> <p>80</p> <p>46</p> <p>30</p> <p>28</p> <p>22</p> <p>14 (all ± 1)</p> <p>all numbers correct (2)</p> <p>any three numbers on the correct lines (1)</p>

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Question	Answer	Marks	Guidance
ii	Canada (1) and one from more hydro-electricity (1) more solar (1) more tidal (1) more wind (turbines) (1) more nuclear (power) (1)	2	second mark is dependent on the first mark allow lots of other reserves or resources available (1) e.g. they have lots of wood (1) allow fossil fuels or coal or oil or gas not (as) available (1) but ignore just uses or produces the least amount of fossil fuels or coal or oil or gas allow smaller population (1) but ignore it is a smaller country allow more concerned about pollution (1) ignore uses geothermal energy
iii	USA (1)	1	more than one country = 0 marks allow America

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Question	Answer	Marks	Guidance
c	<p>any two from</p> <p>total or world electricity production is increasing (1)</p> <p>total or world electricity production decreased in 1997 or 2003 or 2007 or 2008 or 2009 (1)</p> <p>percentage increased and then decreased (1)</p> <p>percentage increased until 1992 / percentage highest in 1992 / percentage decreased from 1992 (1)</p>	2	<p>assume total or electricity or world or TWh refers to bar chart</p> <p>assume percentage refers to line graph</p> <p>not any incorrect year e.g. total decreased in 1997 and 2006 (0)</p> <p>allow percentage decreased after any year in the range of 1992 – 2004 (1)</p> <p>not any incorrect year e.g. percentage increased until 1990 (0)</p> <p>allow percentage increased quicker until 1987 (2)</p> <p>allow total world production must be increasing if total increasing but percentage decreasing (2)</p> <p>allow idea that if percentage of nuclear is decreasing then percentage of other fuels or methods is increasing (1)</p>
	Total	10	

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