

Question		Answer	Marks	Guidance
1	(a)	<p>Maximum of 2 from:</p> <p>Reduction in ozone (concentration / variable data year on year (1) BUT 30% reduction scores (2)</p> <p>10% stays (relatively) level (1) BUT 90% falls more quickly than the 10% (2)</p> <p>narrowing of range between maximum and minimum levels / both trends move closer to the average / narrowing trends between the two (1)</p>	2	<p>allow two related coordinates that illustrate a marking point. Eg. 'average from 0.10 to 0.07 (1)</p> <p>ignore 'negative correlations' ignore identification of a point. Eg all peak at 1988</p>
	(b)	<p>CFC's reduced / AW (1)</p> <p>people more careful in the sun AW(1)</p> <p>more scientific measurements taken from that time (1)</p>	2	<p>allow fridges / aerosols / deodorants / propellants changed (1) ignore references to global warming / greenhouse gases</p> <p>allow (more) sun block used (1)</p>
	(c) (i)	<p>more visiting to hot countries / more sun bed use/ more people using sunbeds (1)</p>	1	<p>allow people spending more time in the sun (1)</p> <p>allow not using enough sun-block / AW (1)</p>
	(ii)	<p>Radiation identified as UV (1)</p> <p>(radiation) absorbed (by upper layers) (1)</p> <p>less radiation reaches underlying skin (1)</p>	2	<p>allow Sun's rays absorbed (by upper layers) (1)</p> <p>BUT UV absorbed (by upper layers) scores (2)</p> <p>ignore melanin</p>
Total			7	

Question			Answer	Marks	Guidance
2	(a)	(i)	DAB uses multiplexing (1) so signals are separated / signals don't interfere (1)	2	allow less or no interference (1)
		(ii)	signals pick up noise (1) and one from: (noise) amplified for analogue (1) (noise) filtered out / not recognised for digital (1)	2	ignore 'signals pick up interference'
	(b)		idea that each button sends out a different signal / code (1) or each function on the TV needs a different digital signal / code to activate it (1)	1	ignore different frequency Eg different wave patterns do different things (1)
			Total	5	

Question	answer	Marks	Guidance
3	<p>(Level 3) Answers show the idea of sensible government action and idea of increased risk for people and ozone hole linked to CFC's Quality of written communication does not impede communication of the science at this level. (5–6 marks)</p> <p>(Level 2) Answers show the idea of sensible government action and either idea of increased risk for people or ozone hole linked to CFC's Quality of written communication partly impedes communication of the science at this level. (3–4 marks)</p> <p>(Level 1) Answers show a simple idea of (increased) risk for people or sensible government action OR ozone hole created 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 at grades up to A*</p> <p>Relevant points include:</p> <p>ozone</p> <ul style="list-style-type: none"> • CFCs have depleted ozone layer • ozone absorbs UV <p>this causes increased risk due to</p> <ul style="list-style-type: none"> • more chance of skin cancer • more likely to develop cataracts • premature skin aging • more damage to human skin cells / tissue / DNA (eg sunburn) <p>action by governments</p> <ul style="list-style-type: none"> • banned use of CFC's • set targets for implementing the ban / Montreal Protocol • looked for alternatives to CFCs • set about having measures for safe disposal of CFC's currently used • advice on sun protection <p>ignore references to fossil fuels, global warming and CO₂</p> <p>eg UV causes cancer (LOWER mark scored within the level) but UV causes skin cancer (HIGHER mark scored within the level)</p>
	Total	6	

Question			Answer	Marks	Guidance
4	(a)	(<p>in support of danger max. two from possible health risks from radiation / m.w. [1]</p> <p>concentrated microwaves / lots of signals emitted / greater power near the mast [1]</p> <p>lots of time spent in house so high dose / continuous exposure [1]</p> <p>in support of little danger max. two from mast is well above house [1]</p> <p>idea of fabric of the house absorbing some microwaves [1]</p> <p>microwave power output is low / AW [1]</p> <p>reference to long wavelength or lower frequency not harming (human) cells [1]</p>	2	<p>allow reference to heating effects / health risks or examples eg brain tumours / cancer / heating brain / damage to human or body cells / tissue / m.w. could be absorbed by human cells or tissue</p> <p>ignore danger from mast falling</p> <p>ignore can be struck by lightning / cause electric shocks</p> <p>ignore illness on its own / affects mind / harm people</p> <p>ignore interference with house circuits</p> <p>ignore idea of interfering with other signals</p> <p>ignore heat fat or water molecules only eg absorbed by water molecules [0] but absorbed by / heats water in the brain [1]</p> <p>ignore gives a better phone signal</p> <p>allow not ionising (like X-rays / gamma rays etc)</p> <p>allow little evidence for the harmful effect of m.w.</p>

Question		Answer	Marks	Guidance
	(b)	<p>any two from:</p> <p>idea of explanations being provisional [1]</p> <p>lack of (enough) data / quality of data [1]</p> <p>not enough evidence or proof that m.w. cause cancer / not certain of the risks of using phones [1]</p> <p>idea of conflicting evidence [1]</p> <p>idea of low power of mobile phones / different phones emit different levels / use of headset / texting (at arms length) [1]</p> <p>long time for symptoms to occur [1]</p> <p>idea of difficulty of control group / elimination of other factors [1]</p>	2	<p>but idea of not enough data to make a firm conclusion yet [2]</p> <p>allow examples of conflicting evidence</p> <p>allow no correlation between m.w. and effects on humans</p> <p>allow examples eg phones only widespread for last few /15 years / mobile phones not in use long enough [1]</p> <p>allow examples eg examples people affected differently frequency / amount of use different levels of exposure can't test everyone that has a mobile phone</p>
		Total	4	

Question	Answer	Marks	Guidance
5	<p>three marks from any of:</p> <p>microwaves:</p> <ul style="list-style-type: none"> • idea of directly heating water / fat in food / AW [1] • idea of (partial) penetration or penetrates more than IR / AW [1] • and so less potato to be heated to centre / by conduction / ORA for IR or convection oven [1] • do not (directly) heat oven / containers / AW [1] • idea of cooks in less time or uses or wastes less energy / ORA for IR or convection oven [1] <p>infrared:</p> <ul style="list-style-type: none"> • (only) reaches / heats surface / cooks from the outer part of potato [1] • heats oven or oven parts, container / surroundings / air [1] 	3	<p>use ✓'s in this question throughout answer</p> <p>ignore liquids</p> <p>ignore efficiency</p> <p>ignore reflection</p> <p>ignore convection (in potato)</p> <p>ignore m.w. cook from the inside or m.w. penetrate to the centre</p> <p>allow moisture or liquid as AW for water</p> <p>allow idea of less food heated by passing on energy or heat or movement on to other particles</p>
	Total	3	

Question	Answer	Marks	Guidance
6 a i	<p>Idea that electrons are involved / collide with ions or atoms (in aluminium) [1]</p> <p>But idea that electrons pass on energy [2]</p> <p>idea that particles vibrate more / get faster / gain KE [1]</p> <p>idea that (kinetic) energy / movement is passed from particle to particle [1]</p>	3	<p>allow electrons vibrate [1]</p> <p>ignore 'particles start to vibrate'</p> <p>allow vibrate faster [1]</p> <p>allow 'particles move more' [1]</p>
ii	<p>The water is heated and it expands. [1]</p> <p>This makes the water less dense so it rises. [1]</p>	2	<p>one mark for each correct sentence</p> <p>allow equivalent answers worded differently. e.g. occupies a larger volume / takes up more space / particles spread out [1]</p> <p>ignore particles expand</p> <p>allow equivalent answers worded differently. eg. denser water sinks [1]</p> <p>ignore particles become more dense</p>
b i	<p>idea that microwaves heat water (and fat) only / microwaves penetrate food [1]</p> <p>but</p> <p>microwaves increase KE / movement / vibration of water (or fat) particles [2]</p>	2	<p>allow IR heats all particles on surface / IR heats surface only [1]</p> <p>ignore microwaves cook from the centre</p> <p>allow IR increases KE of all food particles / particles on the surface [2]</p>

<p>ii</p>	<p>(Both are) electromagnetic waves / reflected by shiny surfaces or metal walls / conduction or convection (heat) to centre of food [1]</p> <p>both transfer KE to particles / [1]</p>	<p>2</p>	<p>maximum two marks ignore references to heat eg (both) conduct to the rest of the food [1]</p> <p>allow both cause particles to vibrate more / vibrate faster [1]</p> <p>eg 'KE passed on to other particles in the rest of the food scores' [2]</p>
	<p>Total</p>	<p>9</p>	

Question	Answer	Marks	Guidance
7 a i	<p>ideas of:</p> <p>(for test group) inaccurate or unreliable measurement(s) [1]</p> <p>(for test group) small(er) sample in group / [1]</p> <p>(for test group) group not representative / research more representative [1]</p>	3	<p>Eg. Equipment may be faulty [1] Eg. method may be flawed [1]</p> <p>Eg. large(r) sample in research [1]</p> <p>allow example of how the group is not representative eg. Test group, some have a hearing impairment [1] eg. All aged 16 in test group / AW [1] eg. (test group) result(s) look anomalous [1]</p>
ii	<p>19 000 [2]</p> <p>but if answer is incorrect or incomplete then:</p> <p>evidence of multiplying average by 5 [1]</p> <p>or</p> <p>$\frac{80\,000 + \text{Dionne}}{5}$ [1]</p>	2	<p>If no answer on answer line check table</p>

Question	Answer	Marks	Guidance
b i	<p>any 2 from:</p> <p>greater hearing loss with ageing [1]</p> <p>greater hearing loss with greater frequency [1]</p> <p>rate of hearing loss increases with ageing [1]</p> <p>rate of hearing loss increases with increasing frequency [1]</p>	2	<p>Eg. as you get older your ability to hear reduces [1]</p> <p>BUT allow as you get older your ability to hear higher frequencies reduces [2]</p>
ii	<p>hearing aid lowers (6000Hz) sounds to 3000(Hz) [1]</p> <p>(with hearing aid) less hearing loss at 3000(Hz) / lower frequency sounds heard more easily [1]</p> <p>(at age 60) hearing aid reduces hearing loss by 10 - 15(dB) / AW [1]</p>	3	<p>Look for use of data in answers.</p> <p>Allow other value of frequency correctly halved [1] ignore just frequency halved</p> <p>Eg better hearing (range) at 3000(Hz)</p> <p>Eg. (at 60) aid reduces hearing loss from 27 to 13 (dB) Allows halves hearing loss [1]</p>
	Total	10	

Question		Answer	Marks	Guidance
8	(a)	<p>Level 3 Answers should include the mechanisms of IR AND microwave cooking causing the relevant particles to gain KE. Also the answer should give a clear explanation of how IR cooking needs more energy or takes a longer time. Quality of written communication does not impede communication of the science at this level. (5–6 marks)</p> <p>Level 2 Answers should include the simple mechanisms of IR AND microwave cooking causing the relevant particles to heat up. Also the answer should give some explanation of how IR cooking needs more energy or takes a longer time. Quality of written communication partly impedes communication of the science at this level. (3–4 marks)</p> <p>Level 1 Answers should include a simple mechanism of IR OR microwave cooking causing the relevant particles to heat up. 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 A* Indicative scientific points may include:</p> <p>Level 3:</p> <ul style="list-style-type: none"> • (microwaves) penetrate the food and are absorbed by water / fat particles which gain KE / vibrate or move faster • (microwave) less energy / cooking time needed as energy only used to heat food • (IR) only heat surface particles which gain KE / vibrate or move faster • (IR) idea that more energy / cooking time needed as oven / dishes need heating first • conduction to centre (for either type of wave) involving transfer of KE or movement between particles / AW • less food heated by conduction or convection with microwaves so less energy / cooking time needed <p>Level 2:</p> <ul style="list-style-type: none"> • (microwaves) penetrate the food and heat water / fat particles • (microwave) less energy / cooking time needed as energy only used to heat food • (IR) only heat surface particles • (IR) idea that more energy / cooking time needed as oven needs heating first <p>Level 1:</p> <ul style="list-style-type: none"> • (microwaves) heat the water / fat particles • (microwave) reflect from oven walls • (IR) only heat surface particles • (IR) idea that IR waves heat the oven / dishes • (microwaves) more efficient • microwaves penetrate further than IR <p>ignore characteristics not on mark scheme</p>

Question		Answer	Marks	Guidance
	(b)	<p>comment on the data in terms of any one from:</p> <ul style="list-style-type: none"> • less people studied / less evidence in A compared with C • shorter time study in A compared with C • more research for mobile phones than against study about old people / not about young people (eg C) • idea that study about human / rat cells may not be representative or reproduced in humans (B) (1) • conflict in conclusions (eg A&B or B&C) <p>then consideration of the risk against the possible benefits (1)</p>	2	eg idea of safety / social interaction for children / young people / teenagers versus risk of use (1)
		Total	8	

Question		Answer	Marks	Guidance	
9	(a)	<p>a compression is a region of high(er) pressure / region where (air) particles are close(r) together / AW (1)</p> <p>a rarefaction is a region of low(er) pressure / region where (air) particles are far / further apart / AW (1)</p>	2	<p>ignore reference to waves / wavelengths / frequency</p> <p>allow where lines are close(r) together / more concentrated (1)</p> <p>allow area of high(er) density (1)</p> <p>allow layers or molecules for particles (1)</p> <p>ignore particles more dense</p> <p>allow where lines are far / further apart / less concentrated (1)</p> <p>allow area of low(er) density (1)</p> <p>allow layers or molecules for particles (1)</p> <p>ignore particles less dense</p> <p>if no marks scored allow [1] mark for correct labelling of both the compression and rarefaction on the diagram.</p>	
	(b)	(i)	(idea that) ultrasound causes vibrations / oscillations (in the stone) (1)	1	<p>allow resonate (1)</p> <p>NOT gamma rays</p>
		(ii)	able to produce images / scans of soft tissue / does not damage living cells / tissue (1)	1	<p>allow non-ionising radiation (1)</p> <p>allow reverse arguments for X-rays.</p> <p>Eg X-rays cannot show soft tissue (1)</p> <p>Eg X-rays only show bones / hard tissues(1)</p> <p>But X-rays show bones (0)</p> <p>Ignore unqualified references to dangers.</p> <p>Eg. ultrasound safer / X-rays more damaging</p>
			Total	4	