Question	Answer	Marks	Guidance
1	**[Level 3]** **descriptions about <u>all three</u> from:** - **ultrasound v surgery** - **ultrasound v X rays** - **detailed information about the display** Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** **descriptions about <u>any two</u> from:** - **ultrasound v surgery** - **ultrasound v X rays** - **basic information about the display** Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** **descriptions about <u>any one</u> from:** - **ultrasound v surgery** - **ultrasound v X rays** - **basic information about the display** Quality of written communication impedes communication of the science at this level (1 – 2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*.** **ultrasound used rather than surgery may include:** non-invasive / no damage to human / no scars (more) accurate method fat thickness can be measure at different parts of the body quick method **ultrasound used rather than X rays may include:** produces images / readings / results for soft tissue does not damage living cells **allow** reverse arguments e.g. x rays do not show soft tissue **detailed information about the display may include:** peak **A** is at 5 - 7 (mm) peak **A** is at the fat-muscle layer the thickness of fat in the arm is 5 - 7 (mm) peaks **A B** and **C** are at different depths in the body **basic information about the display may include:** each peak is at a tissue boundary waves reflect from tissue **boundary** the first peak shows the body fat thickness (shows) reflections at different depths / distances **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	Total	**6**	

Question	Answer	Marks	Guidance
2 a	(suggestion) idea of exact alignment with receiver [1] (explanation) to maximise signal received / AW [1] (suggestion) idea of making dish larger [1] (explanation) to reduce diffraction / so wave spreads less / to maximise signal received / to produce a parallel beam / AW [1] (suggestion) position dish high up / sensible place [1] (explanation) avoids obstacles / maximise signal received / avoids signal loss [1]	4	**Answers in either order acceptable** Eg. line of sight needed [1] Eg. Point in right direction [1] Eg more waves hit receiver / more chance of receiving the signal / stronger signal (received) [1] **Ignore** focussed **Ignore** more curved **Allow** stronger signal received [1] **Ignore** focussed Eg. Ensures line of sight [1] **Eg.** no obstacles to absorb microwaves [1]
OVERLAP b i	**B** [1] less than 30MHz / low**est** frequency / few**est** MHz / high**est** wavelength [1]	2	**If B not chosen (0)** **Allow** 15m or 20MHz [1] **second mark is conditional on B being chosen** look for a comparison. Eg. 'it's the low frequency one [1]
OVERLAP ii	**C** [1] above 30GHz (waves absorbed or scattered) [1]	2	**If C not chosen (0)** Allow 0.006m or 50GHz [1] **second mark is conditional on C being chosen**
	Total	**8**	

Question	Answer	Marks	Guidance
3 a	idea that more (male) skin exposed(to UV light) (which causes skin cancer) / ORA (1)	1	**allow** (short hair) less(UV) absorbed/blocked greater exposure(to UV)[1] less protection(to UV) eg less protected by hair eg female skin more shaded by hair (1)
b	**any two from** idea of surveying people (1) large sample size(1) example of fair test/ comparison (1) type of exposure(1) eg sunbed and sun	2	 surveying lots of people (2) eg time exposure /comparing outcomes/similar skin types [1] **allow** suitable experiments e.g. expose people or animals / cells to sunbed and compare with people or animals not exposed to sunbed (2)
c i	**darker skins** absorb UV (1) let less UV reach **underlying** tissue AW (1)	2	 **allow** contains (more) pigment / melanin (1) **ignore** filters
ii	A and C (1)	1	**both required either order**
	Total	**6**	

Question	Answer	Marks	Guidance
4 a	infrared heats surface / skin (only) (1) (this causes) water to evaporate from surface (making it crispy)AW (1)	2	**allow** microwaves do not just heat the surface /microwaves penetrate into the food / heat the first cm of potato(1)
b	**Microwaves** any two from: (only) **absorbed** by water or fat (1) do not heat container or oven / pass through plastic or glass plate (1) penetrates food further (so less distance needed for conduction) (1)	2	**ignore** heat the food / water **allow** penetrates specified distance up to 10 cm (1)
c	IR will not penetrate to centre of potato / only crisps / heats the outside (in a short time /8 minutes) (1) so need all the microwave heating / 8 minutes of microwave heating / all the cooking done by the microwaves (1)	2	**allow** IR has very little effect on cooking the potato in the first few minutes (1) **allow** only energy from microwaves reach the centre in 8 minutes (1) **allow** energy is also needed to heat up the oven (to emit IR before it can crisp the potato) (1)
	Total	**6**	

Question	Answer	Marks	Guidance
5 a	**gamma** **X-ray** (1) (ultraviolet) **(visible) light** **infrared** **microwave** (1) (radio)	2	top two rows correct (1) rows 4 to 6 correct (1)
b	number of waves / oscillations / cycles **in a second / unit of time** / AW (1)	1	**allow** number of times a crest / trough / peak / wave passes a point each second (1) **NOT** peaks **AND** troughs
c	**evidence of any correct calculation** 3 X 10^8 / wavelength value (1) 4.05 x 10^{14} (1) 0.01 x 10^{14} (1) **evidence of subtracting** 4.05 x 10^{14} - 0.01 x 10^{14} = 4.04 x 10^{14} (1)	4	**N.B. this is not a calculation so do not merely award 4 marks for correct answer** **Must calculate frequency not wavelength** **look** for candidates who subtract wavelengths first. Then use this value to calculate frequency. This can only score the first mark .
	Total	7	

Question			Answer	Marks	Guidance
6			**Level 3 (5–6 marks)** Answers must include **high level** linked explanations of **two** of the following: • **speed** of cooking • benefit of **stirring** • relevance of **standing time** • **microwaves increase the KE of fat or water particles** Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** **Answers should include a simple reference to four of these ideas** • microwaves cannot get to the centre of the food • microwaves are absorbed by water or fat • Dishes / oven do not absorb microwaves • **Middle** of food continues to heat/cook when left to stand • Stirring or standing ensures even / full heating of the food • KE of particles increase Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** **Answers should include a simple reference to two of these ideas** • microwaves cannot get to the centre of the food • microwaves are absorbed by water or fat • Dishes / oven do not absorb microwaves • **Middle** of food continues to heat/cook when left to stand • Stirring or standing ensures even / full heating of the food • KE of particles increase Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A*** Indicative scientific points may include: High level linked explanations: **Speed** - **all microwaves** are absorbed by food / water / fat (in food) **OR** microwaves not used to heat oven / dishes etc. **OR** outside cm heated (by microwaves) so less food needs to be heated by conduction/convection. **Stirring** – inner particles redistributed towards surface so they can be heated by microwaves/ stirred so that microwaves reach all particles or food. **Standing time** – allows time for further conduction or convection to centre of food **Kinetic energy** – **water/fat** particles increased KE. **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
			Total	**6**	