Question number	Answer	Notes	Marks
1 (a) (i)	any two from:- MP1. travels at speed of 3 x 10^8 m/s; MP2. travels in a vacuum; MP3. transverse wave; MP4. transfer energy / information; MP5. can be reflected/refracted/diffracted;	travel at the same speed /speed of light	2
(ii)	B gamma rays;		1
(b) (i)	step- up;	allow	1
(ii)	$\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$ $\frac{V_P}{V_S} = \frac{n_P}{n_S}$	equation in any rearrangement	1
(iii)	substitution; rearrangement; evaluation; e.g. $\frac{230}{2000} = \frac{110}{n_s}$ $n_s = \frac{110 \times 2000}{230}$ $n_s = 960$	sub and rearrangement in either order 956.52, 957	3
(iv)	to protect user from high voltage/eq;	allow plastic is an insulator to prevent (electric) shock Total 9 marks	1

Question number	Answer	Notes	Marks
2 (a)	cooking – micro(waves) OR infrared (waves); treating cancer – ultraviolet OR x-rays OR gamma (rays); identifying broken bones - x-rays;	if more than one example given for each use then reject mark if any incorrect	3
(b)	C - the same speed;		1
(c) (i)	drawn ray shows refraction in the correct direction (downwards) at **both** surfaces; drawn ray is above yellow ray and diverges from it (if ray had entered at the original point);	judge by eye ignore arrows and labels dependent on previous allow if ray drawn enters **parallel** to original ray	2
(ii)	A- black;		1

Total 7 marks

Question number	Answer	Notes	Marks
3 (a) (i)	Any one of- MP1 Speed / velocity (in a vacuum); MP2 Transverse (wave); MP3 Electromagnetic (wave); MP4 A general wave property;	 e.g. reflection, refraction, diffraction, transfer energy	1
(ii)	Any two of- Frequency; Wavelength; Energy;	Any wavelength or frequency relationship if stated must be correct	2
(b) (i)	There are more than two values; Reference to shape/slope/ramp(s);	Accept peaks not all same height not just 1 and 0 Accept RA Ignore "analogue"	2
(ii)	MP1 More than one gap measured / averaging seen; MP2 Value of 1.15 or 1.35 (s);	 Allow 2 marks for bald answers of: 1.15 or 1.35 (s) Allow 1 mark (MP1) for bald answers of: 1.2, 1.25, 1.4, 1.55 (s)	2
(iii)	Calculation of frequency (from f= 1/T); Unit to match value; e.g. f = 1/1.15 = 0.87 Hz	Allow e.c.f from time value given in (b)(ii) 1/1.35 = 0.74	2

Total 9 marks