# The Electromagnetic Spectrum
## Mark Scheme 3

| Level | IGCSE(9-1) |
|---|---|
| Subject | Physics |
| Exam Board | Edexcel IGCSE |
| Module | Single Award (Paper 2P) |
| Topic | Waves |
| Sub-Topic | The Electromagnetic Spectrum |
| Booklet | Mark Scheme 3 |

**Time Allowed:**        30 minutes

**Score:**        /25

**Percentage:**        /100

**Grade Boundaries:**

| A* | A | B | C | D | E | U |
|---|---|---|---|---|---|---|
| >85% | 775% | 70% | 60% | 55% | 50% | <50% |

| Question number | | | Answer | Notes | Marks |
|---|---|---|---|---|---|
| 1 | (a) | (i) | any two from:- <br> MP1. travels at speed of $3 \times 10^8$ m/s; <br><br> MP2. travels in a vacuum; <br><br> MP3. transverse wave; <br><br> MP4. transfer energy / information; <br><br> MP5. can be reflected/refracted/diffracted; | travel at the same speed /speed of light | 2 |
| | | (ii) | B gamma rays; | | 1 |

| (b) | (i) | step- up; | | 1 |
|---|---|---|---|---|
| | (ii) | $$\frac{\text{input (primary) voltage}}{\text{output (secondary) voltage}} = \frac{\text{primary turns}}{\text{secondary turns}}$$ $$\frac{V_P}{V_S} = \frac{n_P}{n_S}$$ | allow 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);<br><br><br>treating cancer – ultraviolet OR x-rays OR gamma (rays);<br><br>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;<br><br>drawn ray is above yellow ray and diverges from it (if ray had entered at the original point); | judge by eye<br>ignore arrows and labels<br>dependent on previous<br><br>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-<br>MP1 Speed / velocity (in a vacuum);<br>MP2 Transverse (wave);<br>MP3 Electromagnetic (wave);<br>MP4 A general wave property; | e.g. reflection, refraction, diffraction, transfer energy | 1 |
| (ii) | Any two of-<br><br><br>Frequency;<br>Wavelength;<br>Energy; | Any wavelength or frequency relationship if stated must be correct | 2 |

| (b) | (i) | There are more than two values; | Accept peaks not all same height not just 1 and 0 | 2 |
| | | Reference to shape/slope/ramp(s); | Accept RA Ignore "analogue" | |
| | (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**