Question Number	Answer		Mark
20(a)	Use of $A = 4\pi r^2$ Use of $I = P/A$ to calculate I $I = 1.3$ W m^{-2} < 4.5 W m^{-2} so not dangerous **OR** Use of $A = 4\pi r^2$ Use of $I = P/A$ to calculate A $r = 0.13$ m < 0.25 m so not dangerous (For MP2 via second method, look for area of 0.22 m^2) Example of calculation $A = 4\pi$ (0.25 m) $^2 = 0.79$ m^2 $A = P/I$ so 0.79 m^2 = 1.00 W / I , so $I = 1.27$ W m^{-2}	(1) (1) (1) (1) (1) (1)	**3**
20(b)	Use of $E = hf$ Conversion from J to eV Energy per photon = 3.7×10^{-6} (eV) Example of calculation $E = hf = (6.63 \times 10^{-34}$ Js) × (902×10^{6} Hz) = 5.98×10^{-25} J Energy per photon (in eV) = (5.98×10^{-25} J) / (1.60×10^{-19} J eV^{-1}) = 3.74×10^{-6} eV.	(1) (1) (1)	**3**
20(c)	Use of $P = E/t$ for kettle Converts kWh to J for electricity usage **Or** converts J to kWh for kettle usage Percentage = 0.61% so student is correct **Or** states that 150,000 J is less than 1% of 2.47×10^7 J so student is correct (Kettle energy in kW h is 0.042) Example of calculation $E = P \times t$ (for kettle) = 1200 W × 125 s = 150,000 J Electricity usage = 6.85 kWh = 6.85 ×1000 W x 3600 s = 2.47×10^7 J Kettle's percentage of daily usage = [(150,000J) / (2.47×10^7 J)] × 100 Percentage = 0.61%	(1) (1) (1)	**3**
	Total for Question 20		**9**