Question number	Answer	Notes	Marks
1 (a) (i)	idea of rubbing / friction; with another insulator;	 allow **suitable** named insulator e.g. duster, cloth, hair etc.	2
(ii)	C (-0.0052 C); A is incorrect because this is equivalent to -520 mC B is incorrect because this is equivalent to -52 mC D is incorrect because this is equivalent to -0.52 mC		1
(iii)	A (the rod has gained negatively charged electrons); B is incorrect because electrons are not positively charged C is incorrect because this would make the rod positively charged D is incorrect because electrons are not positively charged		1
(iv)	suitable method of demonstrating; correct observation;	e.g. • place rod on electroscope • place rod near stream of water from a tap • place rod near hair • place rod above small pieces of paper • place rod near another (charged) rod e.g. • leaf on electroscope deflects • water moves towards rod • hair moves towards rod • paper moves towards rod • rods move towards/away from each other	2
(b) (i)	photocopiers / inkjet printers / smoke precipitators / (electrostatic) spray painting;	allow any correct use	1
(ii)	risk of a spark; (causing) explosion / fire;		2

Total for Question 1 = 9 marks

Question number	Answer	Notes	Marks
2 (a)	substitution OR rearrangement; evaluation; e.g. $1.25 \times 10^{18} = 1 / T$ OR $T = 1/f$ (T =) 8.00×10^{-19} (s)	 -1 for POT error allow 8×10^{-19} (s)	2
(b)	use of $v = f \times \lambda$;	seen as a formula or implied by working allow v, c, s for speed allow λ for wavelength	3
	substitution OR rearrangement; evaluation; e.g. $v = f \times \lambda$ $3.00 \times 10^{8} = 1.25 \times 10^{18} \times \lambda$ OR $\lambda = v / f$ (λ =) 2.40×10^{-10} (m)	-1 for POT error allow 2.4×10^{-10} (m)	

Total for Question 2 = 5 marks

Question number	Answer	Notes	Marks
5 (a) (i)	C (nuclear); A is incorrect because chemical reactions do not happen in the Sun B is incorrect because the kinetic store of particles increases during nuclear fusion D is incorrect because the thermal store of the Sun remains constant whilst fusion is taking place		1
(ii)	B (by radiation); A is incorrect because transfers by heating cannot happen in a vacuum C is incorrect because there is no electrical circuit or flow of ions D is incorrect because the transfer does not happen due to forces		1
(b) (i)	evaluation of total power / conversion of hours to seconds; evaluation of energy in J; evaluation of energy in MJ; e.g. power = (1000 × 15 =) 15 000 (m^2) OR time = (2 × 60 × 60 =) 7200 (s) energy = (15 000 × 7200 =) 108 000 000 (J) energy = (108 000 000 ÷ 1 000 000 =) 108 (MJ)	allow ×3600 seen anywhere in working	3
(ii)	substitution into $\Delta Q = m \times c \times \Delta T$; rearrangement; evaluation of ΔT; evaluation of final temperature; e.g. 100 000 000 = 1100 × 4200 × ΔT ΔT = 100 000 000 / (1100 × 4200) (ΔT =) 22 (°C) T = (20 + 22 =) 42 (°C)	-1 for POT error allow ECF from incorrect ΔT allow 23.3…, 21.6… allow 41.6-43.8 (°C)	4
(iii)	any sensible suggestion; e.g. • heating process is not 100% efficient • energy also heats up pipes / not all energy is transferred to water • some energy is transferred to the surroundings • power of Sun may change	allow energy transferred to (solar) panel ignore 'heat is lost'	1

Total for Question 5 = 10 marks