Question number			Answer	Notes	Marks
1	(a)		Electrical; Chemical / potential;		2
	(b)	(i)	Charge = current x time;	Accept rearrangements and standard symbols e.g. current = $\frac{\text{charge}}{\text{time}}$ Q = I x t I=Q/t ignore units	1
		(ii)	Substitution; Calculation; Matching correct unit i.e. coulomb/C; e. Q = $\frac{400 \times 3.5 \times 3600}{1000}$ 5000 C	 Allow mC Allow 5040 **MAX 2 if** time not converted into s (1.4, 1400, 60, 60 000,seen) POT error seen	3
	(c)		Longer (charging) time needed; Any **one** of P=IV; Lower current OR charge (supplied at a) lower rate; rate of charging lower/ less energy available;		2

Total 8 marks

Question number	Answer	Notes	Marks
2 (a)	ANY FOUR – Conduction from hot plate to pan; conduction through pan; conduction from pan to water; convection in the water; conduction from water to potato; conduction through potato;		Max 4
(b)	ANY THREE – microwaves are electromagnetic waves; penetrate (a few cm) into the food; cause water molecules to vibrate more / heat water; conduction through the rest of the potato	no marks for whether or not the statement is true needs ref to water, not just particles / molecules needs conduction ref, not just spreads out	Max 3
(c)	Any five from Electromagnetic induction; coil creates magnetic field around it; which cuts through the metal pan; field alternates / changes; inducing a voltage in the pan; causing a current in the pan; current makes the pan get hot; which heats the water by conduction; water convects energy to potato;	Effect named – not just ‘induction’ (given in question) Pan heating must be linked to current, not just ‘the pan gets hot’	Max 5

Question number	Answer	Notes	Marks
3 (a)	two correct comparative statements about temperature:- MP1 Bear('s fur) and snow about the same temperature; MP2 Bear's head/nose/eyes warmer (than fur); MP3 Bear's eyes are warmer than eyes/nose OR bear's eyes are the warmest; MP4 Sky/air is cooler than bear/snow OR sky/air is the coldest;	allow reverse arguments bear's nose is cooler than its eyes bear/snow warmer than air	2
(b) (i)	Any two of - MP1. (hollow) hair / fibres contains an <u>insulator</u>; MP2. air is an insulator/poor conductor (of thermal energy); MP3. air is kept / trapped near the body (by fur); MP4. convection currents cannot form between hairs; MP5. white fur is a poor emitter of thermal energy / I R;	hair is an insulator only small convection currents can form	2
(ii)	Any three of - MP1. Black (skin) is a good emitter/radiator of thermal energy; MP2. White (fur) is a good reflector of thermal energy; MP3. Black (skin) is a good absorber of thermal energy; MP4. the reflected thermal energy is absorbed by the black (skin);	Allow white fur is a poor emitter.	3
(c) (i)	Any two of- MP1. Snow reflects UV OR does not absorb UV; MP2. Sky absorbs UV OR does not reflect UV; MP3. Bear('s fur) absorbs UV OR does not reflect UV; MP4. Bear's eyes reflect UV OR do not absorb UV;	ignore other verbs such as emits radiates	2

(ii)	Any one of- Sky absorbs UV; Sky not emitting UV; Sun not included in image;	allow air or atmosphere for sky ignore 'blocks out' Accept sky doesn't reflect or only reflects UV diffusely	1
(iii)	Any two of - MP1. UV/light travels in air, not in glass or hair (material); MP2. UV is absorbed by hair; MP3. TIR does not happen; MP4. explanation of why TIR can't happen ;	light/UV always travels in the less dense medium ORA for optical fibre Allow reflection in hair is external, not internal there is no critical angle	2

Total 12 marks

Question number	Answer	Notes	Marks
4 (a) (i) (ii)	light; kinetic;		2
(b) (i)	Power = energy ÷ time	power = energy ÷ time energy = power x time time = energy ÷ power ONLY ACCEPT standard letters (P, E, t)	1
(ii)	Substitution into correct equation; Rearrangement; Calculation; e. 78 = energy ÷ 10 78 x 10 780 (J)	Correct final value gets all three marks irrespective of working. Substitution and rearrangement in either order. Rearrangement may be shown in (b)(i)	3
(c)	Useful energy calculated; Correct substitution in formula; e. 200 – 176 OR 24 (J) 24 ÷ 200 (x 100 = 12%) ALTERNATIVE METHOD energy wasted = 176 ÷ 200 OR 88(%); useful energy transfer = 100 – 88 = (12%);	 Second line of working scores 2 (since the use of 24 implies first line has been correctly carried out) Second line of working scores 2 (since the use of 88 implies first line has been correctly carried out)	2

Total 8 Marks

Question number	Answer	Notes	Marks
5 (a)	(nuclear) fission;	DO NOT ALLOW fusion	1
(b)	Nucleus splits; Releasing neutrons; Which (hit / are absorbed by) different (uranium) nuclei;	PENALISE ONCE if 'atom' used for 'nucleus'	3
(c)	Kinetic (energy of particles) Of (fission) products / (daughter) nuclei / neutrons	DO NOT ALLOW 'movement' for kinetic	1 1
(d) (i)	Slow down neutrons;	DO NOT ALLOW 'movement' for kinetic	1
(ii)	Kinetic/heat/thermal; Kinetic; Kinetic/electrical; Electrical;	ALLOW 'electric' for 'electrical'	4
		Total	**11**

Question number	Answer	Notes	Marks
6 (a) (i)	voltage = current x resistance	ACCEPT equivalent rearrangement ACCEPT suitable abbreviations e.g. V = I x R REJECT V = I x REJECT equation 'triangles' alone	1
(ii)	1.2 x 4.0; 4.8 (V);		2
(iii)	12 – 4.8; 7.2 (V);	ECF on (ii)	2
(iv)	E = VIt (NO MARK) time conversion to seconds (5.0 x 60); 7.2 x 1.2 x (5.0 x 60); 2600 (J);	ECF on (iii) Allow 2592 or 2590 ALLOW 2500/2520 (J) for full marks (using 7 V) ALLOW 42 (J) or 43.2 (J) for 2 marks (using 5 mins)	3
(v)	idea of energy losses rate of energy loss = rate of energy supply (at steady temp)	 NB this statement alone scores (2) as it includes idea of energy loss	2

Question number	Answer	Notes	Marks
6 (b) (i)	X – series, Y – parallel	BOTH REQUIRED for the mark	1
(ii)	THREE SUITABLE, e.g.- series advantage – fewer wires; series advantage – lower resistance values; series disadvantage – one fails, circuit fails; series disadvantage – no independent control;	ALLOW REVERSE ARGUMENTS in terms of parallel circuits but do not award the same mark twice IGNORE refs to efficiency ACCEPT correct answers that link to battery voltage / current, etc	Max 3