

Question number	Answer	Notes	Marks
3 (a)	D (2500 J);  D is the only correct answer  A is incorrect because this is the wasted output energy B is incorrect because this is the (useful – wasted) output energy C is incorrect because this is the useful output energy		1
(b)	any two from: MP1. there is a current in the coil / wire;  MP2. coil / wire has resistance; MP3. electrical energy transferred to thermal energy;	allow answer in terms of electron movement e.g. electrons move through coil allow electrons collide (with ions in the coil); condone electrical energy transferred to heat energy	2
(c) (i)	power = current $\times$ voltage;	allow in standard symbols and rearrangements e.g. $P = I \times V$ reject C, A for current reject W for power	1
(ii)	substitution OR rearrangement; evaluation to at least 3 s.f.;  e.g. $2500 = I \times 230$ OR current = power / voltage ( $I =$ ) 10.9 (A)	allow dimensionally correct substitution reject 10.8 (A)  allow 10.86, 10.87, 10.869... (A)	2
(iii)	if current increases above 13A (for a sustained length of time); fuse (wire) melts / eq.; circuit is broken;	allow 'too large a current'  condone 'fuse blows' allow current is cut off / eq.	3

**Total for question 3 = 9 marks**

Question number	Answer	Notes	Marks
10 (a) (i)	any three from: MP1. distance is continuous variable; MP2. meter reading is discrete / discontinuous variable; MP3. graph 1 correct for continuous data; MP4. graph 1 better for identifying anomalies; MP5. idea that graph 1 can be used to predict non-tested values; MP6. graph 2 correct if any data is discrete / discontinuous;	e.g. distance for a certain meter reading can be found	3
(ii)	any sensible suggestion; e.g. <ul style="list-style-type: none"> <li>• read rule at eye level</li> <li>• move rule closer to torch</li> <li>• rule parallel to torch</li> <li>• check for zero error / use a fiducial marker;</li> </ul>	ignore references to repeats and precision  avoid parallax	1
(iii)	any sensible suggestion; e.g. <ul style="list-style-type: none"> <li>• zero error</li> <li>• always a small amount of ultraviolet present</li> <li>• change is too small to measure</li> </ul>	allow because of background light ignore background radiation	1
(b)	any four control variables from: MP1. constant {thickness / amount / mass / volume} of sunscreen cream; MP2. constant distance (from torch to meter); MP3. constant ultraviolet light intensity; MP4. same (transparency / thickness of) sheet used each time; MP5. same detector used each time; MP6. constant temperature; MP7. constant background light level;	allow constant distance from sheet to torch / meter allow same torch, constant power of the torch / eq.	4

**Total for question 10 = 9 marks**

Question number	Answer	Notes	Marks
13 (a)	any three from: MP1. energy is transferred by particle vibration; MP2. copper is the best conductor; MP3. metals are better conductors; MP4. plastic is an insulator; MP5. statement linking number of rings to conduction;	allow electron movement in metals allow metals ranked in order of conductivity for both MP2 and MP3  allow plastic is a poor conductor e.g. <ul style="list-style-type: none"> <li>• most wax rings have melted on copper</li> <li>• more wax rings have melted on metals</li> <li>• wax has not melted on the plastic</li> </ul>	3
(b)	any two from: MP1. energy is not transferred to ice; MP2. (because) little conduction in liquids / glass; MP3. hot water stays at top (of test tube); MP4. (because) it is less dense;	ignore references to metal ring ignore heat for energy  allow no conduction in water  allow hot water rises	2
(c)	paper on the brass does not get as hot; (because the) brass tube conducts thermal energy (away from the flame);	allow metal for brass allow RA allow heat for thermal energy allow RA	2

**Total for question 13 = 7 marks**