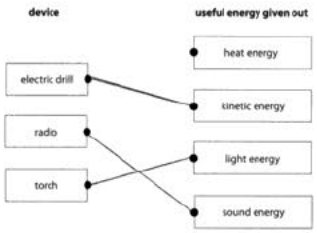
Question Number	Answer	Acceptable answers	Mark
1(a)(i)	 drill → kinetic energy radio → sound torch → light	More than one line to or from a box gets no mark for that box.	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	heat/thermal/internal		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	300 / 2500-2200 (J)	Accept correct working with wrong answer	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	chemical to heat/thermal/internal		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(iii)	An explanation linking any two of the following: • Kettle insulated / beaker is not insulated (1) • kettle loses/wastes less heat or energy **ORA** (1) • element inside kettle / bunsen or flame open (to surroundings) (1)	Kettle is plastic/more closed/has a lid/keeps in heat or energy **ORA** kettle is more efficient **ORA** Kettle keeps in more energy = 2 marks **ORA** IGNORE references to gas/electricity or light/sound energy or speed of boiling	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	A		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	An explanation linking the following: • {energy / heat / radiation} is lost (1) • (heat lost) = heat gained / absorbed (1) • rate (of heat loss) = rate (of heat gained) (1)	given out /output for 'is lost' power lost = power gained =3 description of dynamic equilibrium =3 Ignore references to boiling water	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(b)(i)	D		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)(ii)	substitution (1) 5 000 000 / 21 700 evaluation (1) 230 W	Ignore powers of 10 until evaluation 230.4 W Give full marks for correct answer, no working 2.3 x any other power of 10 = 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)(iii)	substitution (1) 5 x 100 / 25 evaluation (1) 20(%)	0.2, 1/5 Give full marks for correct answer, no working 2 x any other power of 10 = 1 mark e.g. 200, 1/500	**(2)**

Question number	Answer	Mark
3(a)(i)	(Carried by) electromagnetic wave	(1)

Question number	Answer	Mark
3(a)(ii)	As chemical energy in the battery	(1)

Question number	Answer	Additional guidance	Mark
3(a)(iii)	Calculation of area (1) 7 × 11 Substitution (1) 77 × 0.12 Answer (1) 9.2 (J)	77 ecf area award full marks for correct numerical answer without working	(3)

Question number	Answer	Additional guidance	Mark
3(b)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • the heating effect for the oven and the phone depends on their power (1) • and since the power of an oven is much greater than the power of a phone, the oven produces a greater heating effect (1)	allow not the same wavelength/microwaves cover a range in wavelengths	(2)

Question number	Answer	Additional guidance	Mark
4(a)	rearrangement (1) $m = \frac{f}{a}$ substitution and conversion (1) $m = \frac{1870}{1.83}$ answer and rounding to 3 s.f. (1) 1020 (kg)	maximum 2 marks if kN not converted to N award full marks for correct numerical answer without working	**(3)**

Question number	Answer	Additional guidance	Mark
4(b)	rearrangement of $\frac{(v-u)}{t} = a$ (1) $v = u + at$ substitution (1) $v = 0 + 1.83 \times 16$ answer (1) 29.3 (m/s)	award full marks for correct numerical answer without working	**(3)**

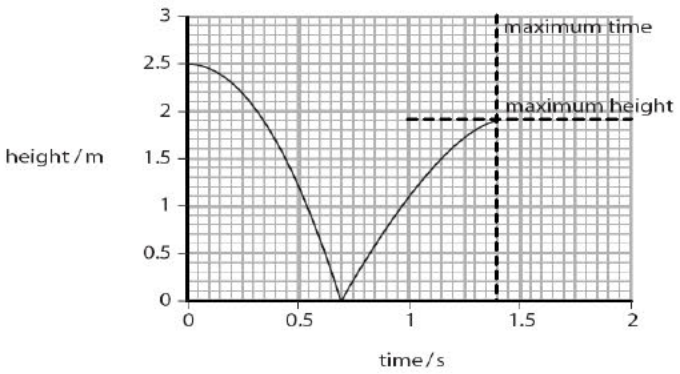
Question number	Indicative content	Mark
*4(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO2** • fuel forms a store of chemical (potential) energy • chemical energy is transferred to kinetic energy and thermal energy when the car moves • kinetic energy transferred to thermal energy as the car slows down **AO3** • during X, kinetic energy increases as the car's speed increases/car accelerates and the increase in kinetic energy is provided by the chemical energy store • during all three sections, work is done against frictional forces in the moving parts of the car and against the drag from the air • during Y, kinetic energy stays constant when the car moves at constant speed but energy is still transferred to thermal energy • during Z, kinetic energy decreases as the car slows down	**(6)**

Level	Mark	Descriptor
	0	No awardable content.
1	1–2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The description attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
2	3–4	• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • The description is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)

3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The description is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Question Number	Answer	Acceptable answers	Mark
5 (a)(i)	2.5 (m)	Allow answers between (and including) 2.45 & 2.55	**(1)**

Question Number	Answer	Acceptable answers	Mark
5 (a)(ii)	0.7 (s)	Allow answers between (and including) 0.68 & 0.72	**(1)**

Question Number	Answer	Acceptable answers	Mark
5 (a)(iii)	 line: same shape as original (1) peak at 1.9 m (1) time taken < 0.7 s (1)	Ignore any part of the graph after the peak	**(3)**

Question Number	Answer	Acceptable answers	Mark
5 (a)(iv)	An explanation linking: <u>energy</u> lost (1) in collision with ground / air resistance (1)	Inelastic collision worth (2) as sound or heat	**(2)**

Question Number	Answer	Acceptable answers	Mark
5 (b)(i)	shown using data Any two from kinetic energy before = 12.5 + 0 (=12.5) (1) kinetic energy after = 4.5 + 8 (=12.5) (1) Kinetic energy is the same before and after the collision (1)	 Kinetic energy is conserved/no energy lost	 **(2)**

Question Number	Answer	Acceptable answers	Mark
5 (b)(ii)	cyclotron (1)	named particle accelerator accept CERN	**(1)**

Total mark for question 4 = 10