Question Number	Answer	Acceptable answers	Mark
1(a)	Any **one** from the following points • (overheating) in a computer (1) • (waste heat) in a light bulb (1) • (sparks/heat) in an electric motor (1)	**Note:** any applicable example where dissipation of thermal energy is a clear disadvantage (charge flowing) in a resistor	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)	substitution (1) 500 = I x 230 transposition (1) 500/230 evaluation (1) 2.2 (A)	substitution and transposition in either order 2.17 (A) / 2 (A) give full marks for correct answer, no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(c)	joules per coulomb		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	An explanation linking **two** of the following points • electron collision (1) • (in the/and the) lattice (1)	allow hit, bump into for collide atoms/electrons/molecules/ions not between atoms	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(e)	(Resistance =) 20 000 Ω (from graph) (1) substitution (1) 0.0006 x 20 000 evaluation (1) 12 (V)	ecf if clear misread of R from graph ignore powers of ten until evaluation Give full marks for correct answer, no working	**(3)**

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

Question Number	Answer	Acceptable answers	Mark
2 (a) (ii)	acceleration	Recognisable mis-spellings More than one word written scores zero EXCEPT for the phrase Acceleration due to gravity which scores 1 mark	**(1)**

Question Number	Answer	Acceptable answers	Mark
2 (b)	Substitution weight = 0.00008 x 10 (1) evaluation 0.0008 (N) (1)	8×10^{-4} 1/1250	**(2)**

Question Number	Answer	Acceptable answers	Mark
2 (c)	Substitution speed = 13 / 1.7 (1) evaluation 7.6 (m/s) (1)	An answer which rounds to 7.6 eg 7.647 7.65 7.7	**(2)**

Question Number		Indicativ	Mark
QWC	***2(d)**	A explanation including some of the following points • drops near the top are accelerating • due to force of gravity • travel a greater distance in given time • there is air resistance on the drops as they fall • this increases with velocity • resultant force is downward • this reduces resultant force • eventually resultant force is zero • drops have reached terminal/ maximum velocity • drops near bottom are all travelling at terminal velocity • so travel same distance in given time	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited explanation such as one which correctly addresses either why the drops at the bottom are evenly spaced or why the drops at the top are not e.g. drops at bottom are all going at the same speed OR drops at top are speeding up • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple explanation such as a correct comparison of the motion of the drops at top and bottom e.g. drops at bottom are travelling at terminal velocity whereas drops at top are still accelerating. **Or** a complete explanation of motion at either top or bottom e.g.at the bottom, air resistance and gravity forces are balanced so they travel at constant speed • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed explanation such as one which explains why the motion of the drops at top and bottom are different e.g. The drops were initially accelerating due to a resultant force downwards. The acceleration decreased as they fell and eventually reached zero. With no acceleration their velocity was constant and so equal distance travelled in given time at the bottom. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question number	Answer	Mark
3(a)(i)	B	(1)

Question number	Answer	Mark
3(a)(ii)	vertical arrow, acting downward through the suitcase	(1)

Question number	Answer	Additional guidance	Mark
3(b)(i)	substitution (1) $(KE =) \frac{1}{2} \times 85 \times 1.5^2$ answer (1) 96 (J)	award full marks for correct numerical answer without working allow 95.625 (J)	(2)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	rearrange (1) force = work done ÷ distance answer (1) (force) = 15 (N)	accept rearrangement with values subst., i.e. (force) = 1200 ÷ 80 award full marks for correct numerical answer without working	(2)

Question number	Answer	Additional guidance	Mark
3(c)	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • the work done is the same for walking and running (1) • because work done depends on force and distance only, not time (1)	allow energy for work done because work done ÷ time is power	(2)

Question number	Answer	Additional guidance	Mark
3(d)	rearrangement (1) (height) = change in GPE ÷ (mass × g) answer (1) 2.2 (m)	accept rearrangement with values, i.e. (h) = 264 ÷ (12 × 10) or = 264 ÷ 120 award full marks for correct numerical answer without working	**(2)**