Question number	Answer	Notes	Marks
8 (a)	take repeats and find the mean;	allow 'average' for 'mean'	1
(b)	any two from: MP1. mass (being lifted); MP2. height (lifted) / distance; MP3. power supply / circuit being used; MP4. temperature (of motor);	ignore 'same motor' condone weight	2
(c)	conversion of cm to m; substitution into GPE = mass × g × height; e.g. 50 cm = 0.5 m GPE = 1 × 10 × 0.5 (= 5 J)	 allow 0.5 seen anywhere allow use of g = 9.8(1) (m/s^2)	2
(d) (i)	efficiency formula seen; substitution; evaluation; e.g. efficiency = useful energy output / total energy input efficiency = 5 / 12.7 (×100%) efficiency = 39.4 (%)	 ignore s.f. allow 39, 39.37… reject unsupported incorrect answer	3
(ii)	suitable linear scale chosen (>50% of grid used); axes labelled with quantities and unit; all plotting correct to nearest half square;	ignore orientation ignore plotting at 10V	3
(iii)	acceptable curve of best fit drawn up to a voltage of 6V; straight horizontal line of best fit drawn from 6V onwards;	i.e. curved line with even distribution of points either side by eye	2
(iv)	correctly read voltage from graph consistent with candidate's curve of best fit;	allow range 5.4V – 6.6V allow ecf from (iii)	1

Total for Question 8 = 14 marks

Question number	Answer	Notes	Marks
11 (a)	value of braking distance correctly read from graph; substitution into $v^2 = u^2 + 2as$; rearrangement; evaluation; e.g. braking distance = 78 m $0 = 35^2 + (2 \times a \times 78)$ $(a =) (-) 35^2 / (2 \times 78)$ $(a =) (-) 7.9$ (m/s^2)	allow 77-79 m allow ecf incorrect distance allow 7.75... - 7.95...(m/s^2)	4
(b)	any five from: MP1. thinking distance OR braking distance increases as (initial) speed increases; MP2. braking distance increases by a greater amount than thinking distance for the same increase in (initial) speed; MP3. thinking distance is (directly) proportional to (initial) speed; MP4. braking distance has a non-linear relationship with (initial) speed; MP5. idea that braking distance is proportional to (initial) speed squared; MP6. suitable use of data to justify thinking distance relationship; MP7. suitable use of data to justify braking distance relationship;	 e.g. gradient of braking distance graph larger than gradient for thinking distance e.g. when initial speed doubles, the braking distance is four times greater / eq. e.g. reading off thinking distance for two values of initial speed and showing they increase by the same factor e.g. reading off braking distance for two values of initial speed and showing they do not increase by the same factor	5

Total for Question 11 = 9 marks

Question number	Answer	Notes	Marks
13 (a) (i)	358 (K);		1
(ii)	idea that speed / KE increases; **mean** speed / **mean** KE increases;	allow average for mean	2
(iii)	number of molecules decreases;	however expressed	1
(b)	any four from: MP1. air in flask cools; MP2. molecules in flask slow down/<u>kinetic</u> energy of molecules reduces; MP3. pressure inside flask decreases (as temperature decreases); MP4. pressure outside flask greater than inside/eq; MP5. resultant force (from air) pushes egg down the neck of the flask; MP6. volume of air in flask decreases as the egg moves down; MP7. (so) pressure inside flask increases (as volume decreases); MP8. (eventually) pressure inside and outside balance; MP9. (so) resultant force is now zero (so egg stops moving down);	allow 'stretches egg' allow higher level arguments including weight of egg, friction with neck, etc	4

Total for Question 13 = 8 marks