Question Number	Answer	Acceptable answers	Mark
1(a)	**D** driving for a long time without taking a break		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(b)(i)	substitution 1200 x 8(.0) (1) evaluation 9600 (J) OR 9.6 x 10^3 (J) (1)	Give full marks for correct answer with no working. 9.6 x any other power of 10 = 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)(ii)	substitution 0.5 x 1400 x 25^2 (1) evaluation of v squared 0.5 x 1400 x 625 (1) evaluation 4.4 x 10^5 (J) (1) OR 440 000	Give full marks for correct answer with no working. accept 625 seen anywhere for this mark e.g. 875 000 gets 1 mark (forgot ½) 437 500 (J) 4.4 x any other power of 10 = 2 marks	**(3)**

Question Number		Indicative Content	Mark
QWC	***1(c)**	An explanation including some of the following points: • Statement of what is meant by stopping distance Factors affecting driver • factors affecting driver's thinking distance/reaction time Factors dependent on the car • factors affecting braking distance e.g. tyre tread, condition of brakes • cars may be carrying different loads • cars may have different masses External factors • road surface • weather • uphill / downhill Use of data • calculation of thinking, braking and or stopping distances for average driver • calculation of thinking, braking and or stopping distances for driver A • calculation of thinking, braking and or stopping distances for driver B	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation of the differences using one fact OR one piece of data from the chart OR factor(s) affecting thinking/braking distance. e.g. A has a longer thinking distance OR B is a longer braking distance OR thinking distance can be affected by a driver using their phone • 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, giving more than one fact using data from the chart about either car OR at least one piece of data about each OR using one piece of data from the chart about one car AND at least one factor affecting thinking/braking distance OR a statement linking data from the chart to the cause for one car but nothing correct about the other car e.g. A has a braking distance of (about) 33 m, its thinking distance is longer than an average car. OR B has a longer stopping distance. B's reaction time is faster than the Highway code. OR B has a very short thinking time. Car B's brakes may be worn out OR Driver A may have drunk alcohol making his reaction time slower. Car B has better brakes (NB 2nd sentence is incorrect) • 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 linking data from the chart to the cause for one car AND at least one statement about the other OR two statements linking data from the chart to the cause for one car e.g. B has a braking distance of (about) 60 m. This means B might be on a wet road. A has a longer thinking distance. OR B has a shorter thinking distance than A. A has a longer thinking distance compared to the average (in highway code). He may be a drink driver. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 5 = 12 marks

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

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	A description to include any two of • Gravitational / potential energy reduces (1) • kinetic energy increases (1) • total energy remains constant (1)	Ignore energy changes resulting from impact with sand GPE reduces KE increases Allow GPE is transferred to KE for 2 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(b)	A explanation linking • (work is done) displacing the sand (1) with EITHER • (as) <u>kinetic</u> energy of the ball(s) has been transferred (1) OR • by the force between the ball and the sand (1)	sand moving/ pushing/ blowing upwards OWTTE or ball sinking into sand	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	transposition mass = momentum / velocity (1) substitution mass = 0.46 / 6.2 (1) evaluation 0.074 (kg) / 74g (1)	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. Give full marks for correct answer with no working. Answers that round to 0.074 (kg) 0.07 (kg)	**(3)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	substitution (impact) force = 0.46 / 0.17 (1) evaluation 2.7 (N) (1)	Give full marks for correct answer with no working. Ignore power of ten error until evaluation Answers which round to 2.7 Allow ECF if candidate has used mass from part (i) in F=m(v-u) / T F= $\frac{6.2 - 0}{0.17}$ X 0.074 (1) = 2.7 (N) (1)	**(2)**

Total for Question 3 = 10 marks

Question Number	Answer	Acceptable answers	Mark
3(a)(i)	force (1)	If than one word given then 0 marks.	**(1)**

Question Number	Answer	Acceptable answers	Mark
3 (a)(ii)	B 0.07kg		**(1)**

Question Number	Answer	Acceptable answers	Mark
3 (a)(iii)	Arrow pointing (vertically) upwards (1) Value of 1.2 (N) (written near to arrow) (1)	 Marks are independent of each other	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	Substitution $\frac{90}{1000}$ x 3.3 (1) evaluation 0.30 (N) (1)	 A value which rounds to 0.30 eg 0.297 Give full marks for correct answer with no working Ignore power of ten error until evaluation Allow 1 mark for 297 even with no working shown	**(2)**

Question Number		Indicative Content	Mark
QWC	***3(b)(ii)**	An explanation demonstrating some of the following: Descriptions of the graph • Accelerates upwards during stage1 • Maximum velocity is reached at the end of stage 1 • Accelerates downwards / decelerates during stage 2 • Accelerates during stage 3 • Comes to rest during stage 4. Interpretations of the shape of the graph • Fuel is burnt creating thrust in stage • Thrust is upwards in stage 1/ • Gravity/weight (is always) a downward force • Fuel runs out at end of stage 1/ has ran out by stage 2 • Still going up during/ max height at end of stage 2 • Starts to fall at start of stage 3 • Negative velocity during stage 3 because it is falling. • Rapid deceleration / collision with the ground during stage 4/end of stage 3 Explanations for changes in velocity • Resultant force upwards/ thrust greater than gravity force during stage 1 • Acceleration non-linear because mass is decreasing / resultant force is increasing • Linear deceleration in stage 2/3 because force of gravity is constant • Resultant downward force/only gravity/ weight is acting during stage 2 and 3 • Large resultant force of impact during stage 4	**(6)**

Level	0	No rewardable content
1	**1 - 2**	• A limited explanation involving descriptions of the graph. • E.g. The rocket gets faster as it goes up during stage 1. The rocket slows down during stage 2 • 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 involving interpretations of the shape of the graph e.g. The rocket's velocity increases during stage 1 because the burning fuel provides a force. The rocket accelerates downwards during stage 3 • 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 which includes descriptions and interpretations for the shape of the graph including an explanation. E.g. The rocket's acceleration during stage 1 is increasing because it is losing mass as the fuel is burnt. It then slows down until it reaches maximum height at the end of stage 2 • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 5 = 12 marks

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	B (50 m)		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	kinetic (1) electrical (1) in this order.	movement electric, electricity poor spellings of electrical electronic Reject 2 forms of energy in one answer	 **(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	140 (J)	200 – 60 140 in words	 **(1)**

Question Number	Answer	Acceptable answers	**Mark**
4(b)(ii)	• substitution (1) $\frac{60}{200} \times 100$ % • evaluation (1) 30 %	$\frac{60}{200}$ 0.3 ignore units Award full marks for correct answer with no working	 **(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)(iii)	explanation linking: • energy supplied and radiated (1) • (at) equal (rate) (1)	allow used for radiated heat gained = heat lost 2 marks input energy = output energy 2 marks input power = output power 2 marks input = output 1 mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)	• substitution (1) $\frac{6000}{250}$ • evaluation (1) 24 (years)	Award full marks for correct answer with no working ignore units	**(2)**

(Total for Question 3 = 10 marks)