Name: _____

Stopping distances

Mark Scheme

**Date:**

**Time:**

**Total marks available:**

**Total marks achieved: _____**

## Mark Scheme

Q1.

| | | Indicative Content | |
|---|---|---|---|
| **QWC** | * | an explanation linking some of the following points:<br><br>compared to a car with just the driver, a fully loaded c<br><br>• have a greater mass / be heavier<br>• greater kinetic energy / momentum<br>• experience the same braking force (when brak applied)<br>• require a greater braking force (than available the same distance)<br>• have a smaller acceleration / deceleration<br>• take a longer time to come to rest (from given<br>• travel greater distance in this time<br>• needs to do more work with same amount of f<br>• use of relevant equations such as F = ma, wor d<br>• consequence of driver distractions | |
| **Level** | **0** | No rewardable content | |
| **1** | **1 - 2** | • a limited explanation using one idea from the indicative content eg fully loaded car is heavier.<br>• in answer communicates ideas using simple language and uses limited scientific terminology<br>• spelling, punctuation and grammar are used with limited accuracy | |
| **2** | **3 - 4** | • a simple explanation which links ideas from the indicative content eg it is heavier and so it takes a longer distance to stop<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately<br>• spelling, punctuation and grammar are used with some accuracy | |
| **3** | **5 - 6** | • a detailed explanation which links several ideas from the indicative content e.g. It has more momentum and so it will take a longer time to stop. This means that it will travel a further distance. The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately<br>• spelling, punctuation and grammar are used with few errors | |

Q2.

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

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

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

Q3.

| Question Number | | Indicative Content | Mark |
|---|---|---|---|
| **QWC** | * | An explanation including some of the following points:<br><br>• Statement of what is meant by stopping distance<br><br>Factors affecting driver<br>• factors affecting driver's thinking distance/reaction time<br><br>Factors dependent on the car<br>• factors affecting braking distance e.g. tyre tread, condition of brakes<br>• cars may be carrying different loads<br>• cars may have different masses<br>External factors<br>• road surface<br>• weather<br>• uphill / downhill<br>Use of data<br>• calculation of thinking, braking and or stopping distances for average driver<br>• calculation of thinking, braking and or stopping distances for driver A<br>• 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.<br>e.g. A has a longer thinking distance OR B is a longer braking distance<br>OR thinking distance can be affected by a driver using their phone<br>• the answer communicates ideas using simple language and uses limited scientific terminology<br>• 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<br>OR a statement linking data from the chart to the cause for one car but nothing correct about the other car<br>e.g. A has a braking distance of (about) 33 m, its thinking distance is longer than an average car.<br>OR B has a longer stopping distance. B's reaction time is faster than the Highway code.<br>OR B has a very short thinking time. Car B's brakes may be worn out<br>OR Driver A may have drunk alcohol making his reaction time slower. Car B has better brakes (NB 2nd sentence is incorrect)<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately<br>• 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<br>OR two statements linking data from the chart to the cause for one car<br>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.<br>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.<br>• the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately<br>• spelling, punctuation and grammar are used with few errors |

Q4.

| | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **(a)(i)** | 8 – 0 (m/s) | 8 | **(1)** |
| **(a)(ii)** | substitution<br>8 / 5 (1)<br><br>evaluation (1)<br>1.6 ($m/s^2$) | ecf from (i)<br><br>full marks for correct answer (or ecf) with no working shown. | **(2)** |
| **(a)(iii)** | 0 | Nil / nothing / zero / none<br>(no mark for no response) | **(1)** |
| **(b)** | substitution | full marks for correct answer with | **(2)** |

| | | | |
|---|---|---|---|
| | F = 1200 × 0.8 (1)<br><br>evaluation (1)<br>960 (N) | no working shown. | |

| | | Indicative Content | |
|---|---|---|---|
| **QWC** | ***(c)** | an explanation linking some of the following points:<br><br>compared to a car with just the driver, a fully loaded c<br><br>• have a greater mass / be heavier<br>• greater kinetic energy / momentum<br>• experience the same braking force (when brak applied)<br>• require a greater braking force (than available the same distance)<br>• have a smaller acceleration / deceleration<br>• take a longer time to come to rest (from given<br>• travel greater distance in this time<br>• needs to do more work with same amount of f<br>• use of relevant equations such as F = ma, wor d<br>• consequence of driver distractions | |
| **Level** | **0** | No rewardable content | |
| **1** | **1 - 2** | • a limited explanation using one idea from the indicative content eg fully loaded car is heavier.<br>• in answer communicates ideas using simple language and uses limited scientific terminology<br>• spelling, punctuation and grammar are used with limited accuracy | |
| **2** | **3 - 4** | • a simple explanation which links ideas from the indicative content eg it is heavier and so it takes a longer distance to stop<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately<br>• spelling, punctuation and grammar are used with some accuracy | |
| **3** | **5 - 6** | • a detailed explanation which links several ideas from the indicative content e.g. It has more momentum and so it will take a longer time to stop. This means that it will travel a further distance. The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately<br>• spelling, punctuation and grammar are used with few errors | |