Section B

Answer **two** questions from this section.

7 **(a)** Define

(i) *velocity*,

.....[1]

(ii) *acceleration*.

.....[1]

(b) A car travelling in a straight line has a starting velocity u. It accelerates with a uniform acceleration a for a time t.

Using your definitions in **(a)**, derive an expression for the distance travelled s in terms of u, a and t.

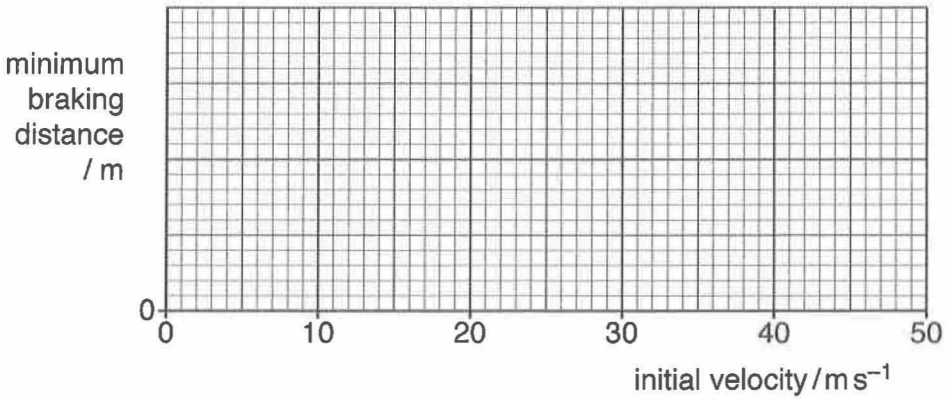
[4]

(c) A car of mass 1200 kg is travelling in a straight line. The maximum braking force that can be applied by the brakes is 1700 N.

(i) Calculate the minimum distance travelled by the car while decelerating to a stop (braking distance) from an initial velocity of $30\,m\,s^{-1}$.

distance = ... m [3]

(ii) Use your answer to **(i)**, together with further calculations for different initial velocities, to plot a graph to show the relationship between braking distance and initial velocity.



[4]

(iii) Suggest an algebraic relationship between the initial velocity u and the minimum braking distance s, provided that the braking force is kept constant.

.....[1]

(d) Explain how the following features of car design help to minimise the severity of the injuries received by the passengers in a car accident.

(i) safety belts

.....

.....[2]

(ii) anti-slip tyres

.....

.....[2]

(iii) easily distortable front bodywork on the front of the car (crumple zones)

.....

.....[2]

[Total: 20]