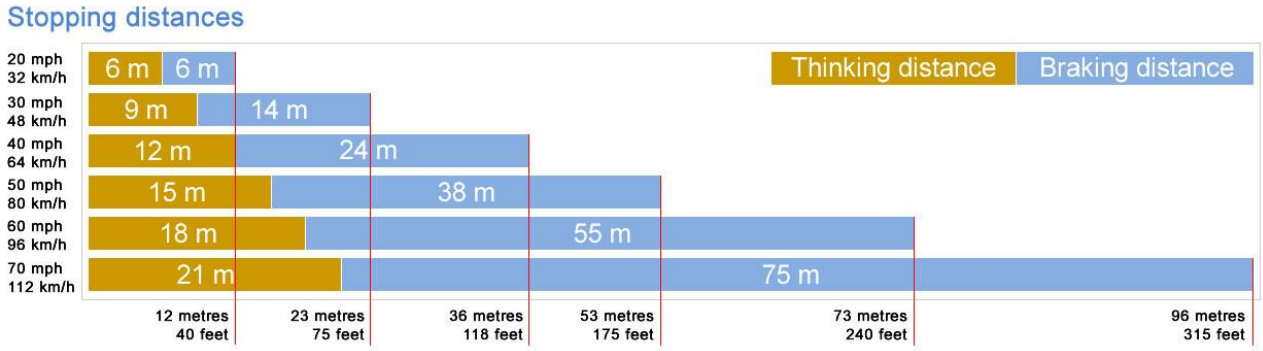
BACCALAURÉAT-Session 2015

Epreuve de Discipline Non Linguistique

Mathématiques/Anglais

Stopping distances for cars

Stopping distances for cars when driving is a calculation based on the drivers reaction distance**;** the distance the car has travelled before the driver reacts to a hazard and the braking distance**,** which is how long the car takes to stop once the brakes have been applied.
The stopping distance graph below gives a visual representation of the increase in braking distance the faster a vehicle travels. Yet it should be pointed out that both the reacting distance and braking distance can be affected depending on various circumstances. For example, if the driver is using a phone, his reaction time increases by 50%.



According to: Bad driving : what are we thinking ?, The Guardian, August 2013
http://www.drivingtesttips.biz/stopping-distances.html

To calculate these distances, the following facts are used:
Based on the results of many studies, 2.5 seconds has been chosen for a reaction time.
The braking distance d is calculated by :

$$d = \frac{0.039v^2}{6.8}$$ (using the Metric system) or $$d = \frac{1.075v^2}{22.4}$$ (using the US Customary)

where : v is the travelling speed of the car (km/h or mph depending on the Unit System)
d is the braking distance (m or ft)

Source: Stopping sight distance, Wikipedia

Questions

1) Make a short presentation of the documents.
2) A car is travelling at $100\ km.h^{-1}$ when the driver sees something that requires rapid braking.
   a. Convert $100\ km.h^{-1}$ in mph.
   b. Find the total distance (in metres) travelled by the car from the moment the driver first sees the problem until the car stops.
3) We consider a driver travelling at 30 mph. Compare the reaction distances of this driver while he is using a phone and while he is not.
4) a. Show that a 10% increase in the speed causes a 21% increase in the braking distance.
   b. Show that a $t\%$ increase in the speed causes a $\left(2t + \frac{t^2}{100}\right)$ % increase in the braking distance.
5) What phenomena can affect overall stopping distances? Do you have any suggestions to improve road safety?