

Subtopic: Stopping distance and reaction times

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Q1.(2019)

a)

- reaction time

explained in terms of longer reaction times increase thinking distance (from a given speed)

- taking drugs
- drinking alcohol
- tiredness
- age
- distractions

explained in terms of effect on driver's reaction time

- speed

explained in terms of the faster the vehicle the greater the distance travelled in the driver's reaction time (or converse)

OR

explained in terms of increased speed increases KE so increases work done to stop the vehicle

- condition of the tyres
- condition of road surface
- wet/icy roads

explained in terms of condition of tyres and road surface (including weather considerations) affecting friction (between tyres and road)

- condition of brakes

explained in terms of effect on braking force (applied to the wheels) or reduced friction

- mass / weight of vehicle

explained in terms of deceleration force or kinetic energy or change in momentum

answers do not need to reference thinking / braking distance
a Level 1 answer would list factors only **or** one factor with one linked explanation

a Level 2 answer lists at least three factors with one linked explanation **or** two factors with two linked but different explanations
a Level 3 answer lists at least three factors with at least two linked but different explanations

b)

work (done) = force × distance

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c)

$$900\,000 = 60\,000 \times \text{distance}$$

$$\text{distance} = \frac{900\,000}{60\,000}$$

$$\text{distance} = 15 \text{ (m)}$$

d)

brakes overheating

or

brakes locking

(causing) loss of control

or

(causing) a skid

Q2.(2021)

a)

Factors

- poor condition of tyres
- poor road surface
- wet or icy road
- poor/worn brakes

Explanation

- because of decreased friction

Factors

- increased mass of car/passengers

Explanation

- increases kinetic energy of car
- more work needs to be done to stop car
- increases momentum of the car

Factor

- road slopes downhill

Explanation

- (a component of) gravity opposes the braking force
- resultant (braking) force is reduced

allow answers in terms of reducing braking distance throughout

A single factor with no related explanation is insufficient to score a mark

b)

resultant force = mass ×
acceleration

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c)

$$7200 = 1600 \times a$$

$$a = \frac{7200}{1600}$$

$$a = 4.5 \text{ (m/s}^2\text{)}$$

d)

$$15 \text{ (m)} \quad 38 \text{ (m)}$$

$$= 53 \text{ (m)}$$

e)

$$p = \frac{F}{A}$$

f)

$$120\,000 = \frac{60}{A}$$

$$A = \frac{60}{120\,000}$$

$$A = 0.0005$$

$$A = 5 \text{ (.0)} \times 10^{-4}$$

$$\text{m}^2$$

Q3.(2023)

a)

kinetic

thermal

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b)

(minimum braking) distance
increases with increasing speed

c)

increases

d)

$$12.5 - 5.0 = 7.5 \text{ (m/s)}$$

$$t = \frac{7.5}{0.25}$$

$$t = 30 \text{ (s)}$$

e)

$$F = 1600 \times 0.25$$

$$F = 400 \text{ (N)}$$

f)

initial height of the ruler above
the person's hand

g)

there will be more variation in
distances

h)

carry out the experiment
listening to music

then not listening to music (and
compare the results)