OCR
Oxford Cambridge and RSA

GCSE Physics A (Gateway)

J249/04 Physics A P5-P8 and P9 (Higher Tier)

Question Set 5

1 A scientist uses different drivers to test the stopping distances of the same car.

Look at the results.

Driver	Speed (m/s)	Thinking distance (m)	Braking distance (m)
A	8	6	6
B	16	13	24
C	32	24	96
D	16	12	24
E	8	5	6
F	32	30	120

(a) Most of the drivers tested the car on a dry day, on a level road.

Which driver tested the car on an **icy** road?

Driver ..... F ..... tested the car on an **icy** road.

[1]

(b) Which driver has the **quickest** reaction time?

Driver ..... E ..... has the **quickest** reaction time.

$\frac{d}{s} = t$

Calculate their reaction time.

$\frac{5}{8} = 0.625$

Answer = ... 0.625 ..... s

[3]

(c) Give **two** drivers that have the **same** reaction time.

Drivers ..... A , C ..... have the **same** reaction time.

Explain your answer.

[2]

A $\Rightarrow \frac{6}{8} = 0.75$ seconds

C $\Rightarrow \frac{24}{32} = 0.75$ seconds

$\therefore$ same reaction time

$\frac{\text{Thinking distance}}{\text{velocity of car}} = \text{reaction time}$

(d) Driver **C** travels at 32 m/s on the road and then stops. The car has a mass of 1200 kg.

(i) Show that the **kinetic energy** stored by the car at 32 m/s is approximately 614000 J.

$KE = \frac{1}{2}mv^2$ **[2]**

$\frac{1}{2} \times 1200 \times 32^2 = 614400 \text{ J}$

$\simeq 614000 \text{ J}$

(ii) Describe what happens to the kinetic energy of the car as it brakes and stops.

Kinetic energy is transferred into thermal energy from friction between the tires and road surface, and the brake pad and mechanism. This, therefore, slows down the vehicle to a stop as all kinetic energy is transferred from the system. **[2]**

(iii) The braking distance of the car is 96 m.

Calculate the **braking force** on the car. Give your answer to **4** significant figures.

$W = \frac{F}{s}$

$Ws = F$

Answer 589800000 W [3] **[3]**

$614400 \times 96 = 58982400 \text{ N}$

589800000 N

(e) Driver **B** travels at 16 m / s on the road. The thinking distance is 13 m and the braking distance is 24 m.

Driver **B** now drives the car **uphill** at the same speed on the same road.

How will driving the car **uphill** affect thinking, braking and stopping distances?

The reaction time will stay the same.

Complete the sentences.

The **thinking** distance will stay the same

The **braking** distance will decrease

The **stopping** distance will decrease

[2]

Total Marks for Question Set 5: 15

Thinking distance = speed x time

↑ the same ↑ the same