

0 6

Some students investigated the effect of drinking caffeine on reaction time.

They used a drink containing 32.25 mg of caffeine per 100 cm³

This is the method used.

1. Divide the students into four groups, **A**, **B**, **C** and **D**.
2. Measure and record the reaction time of each student using the ruler-drop test.
3. Students in:
 - group **A** drink 200 cm³ of water
 - group **B** drink 200 cm³ of the caffeine drink
 - group **C** drink 400 cm³ of the caffeine drink
 - group **D** drink 600 cm³ of the caffeine drink.
4. Repeat step 2 after 15 minutes.

0 6 . 1

Describe how to do the ruler-drop test.

[3 marks]

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0 6 . 2 Table 3 shows the mass of caffeine taken in by each student.

Table 3

Group	Mass of caffeine in mg
A	0
B	64.5
C	129.0
D	X

Calculate value **X**.

[1 mark]

X = _____ mg

0 6 . 3 Why did group **A** drink water instead of the caffeine drink?

[1 mark]



Table 4 was used to convert the results of the ruler-drop test into reaction times.

Table 4

Distance in cm	Reaction time in s
2	0.064
4	0.090
6	0.111
8	0.128
10	0.143
12	0.156
14	0.169
16	0.181
18	0.192
20	0.202
22	0.212
24	0.221
26	0.230

Distance in cm	Reaction time in s
28	0.239
30	0.247
32	0.256
34	0.263
36	0.271
38	0.278
40	0.286
42	0.293
44	0.300
46	0.306
48	0.313
50	0.319
52	0.326

0 6 . 4 Estimate the reaction time for a student who recorded a distance of 23 cm

[1 mark]

Reaction time = _____ s

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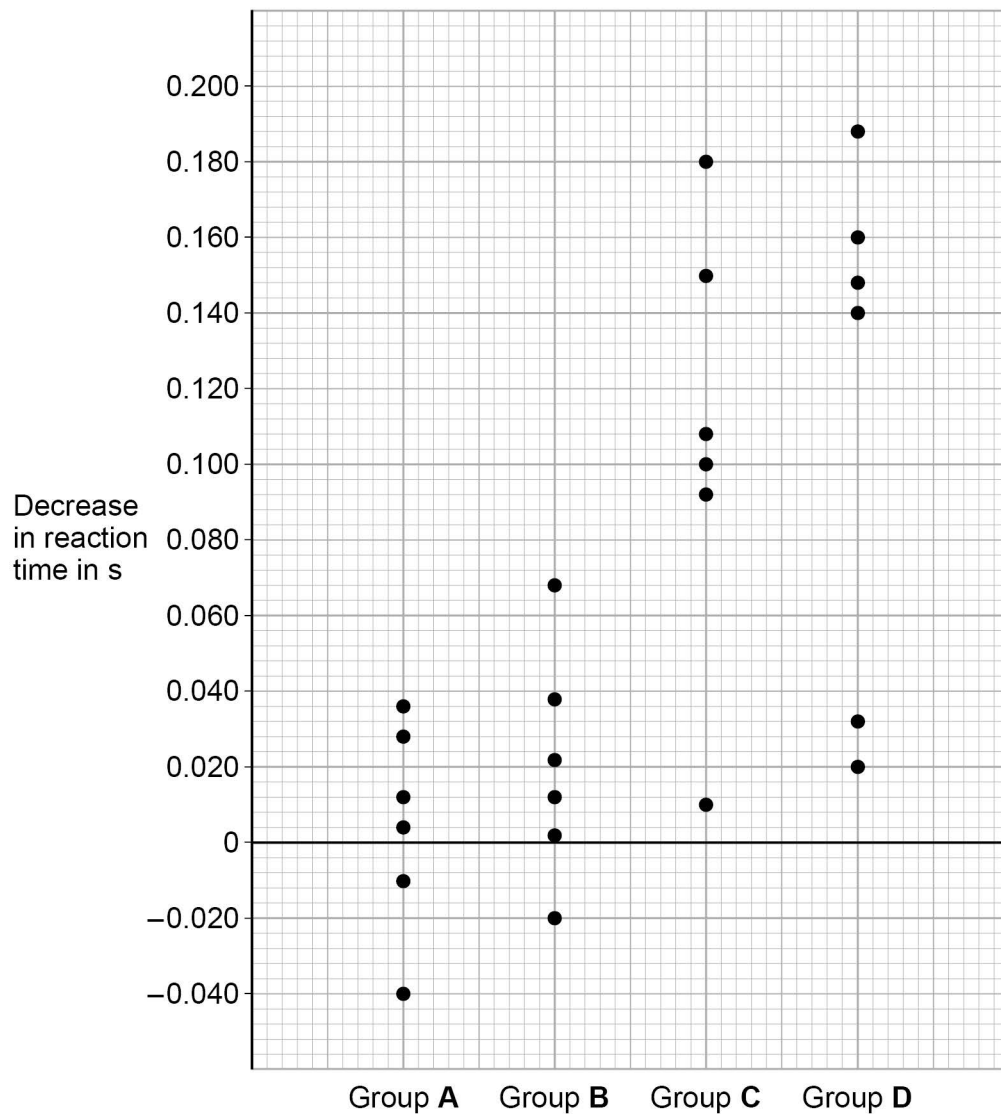
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Students calculated the decrease in their reaction time after the drink compared with before the drink.

Figure 6 shows the results for each student.

Figure 6



0 6 . 5

Describe the effect of the mass of caffeine taken in on the decrease in reaction time.

[1 mark]



0 6 . 6 For three students the decrease in reaction time was negative.

Give the reason why the value was negative.

[1 mark]

0 6 . 7 What is the range of results for group C?

[1 mark]

0 6 . 8 Suggest **two** variables that should have been controlled in this investigation.

[2 marks]

1 _____

2 _____

0 6 . 9 Explain why the ruler-drop test does **not** involve a reflex action.

[2 marks]

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	hold a ruler (just) above the (open) hand of the other student	ignore near the hand	1	AO1 4.5.2
	drop the ruler and other student catches it	do not accept give verbal signal	1	
	record where the ruler is caught	ignore timing	1	
06.2	193.5		1	AO2 4.5.2
06.3	to compare the effect of no caffeine	allow as a control (group) allow to show the effect of caffeine do not accept control variable	1	AO3 4.5.2
06.4	0.217 (s)	allow any value in the range 0.2150 to 0.2180	1	AO2 4.5.2
06.5	as mass of caffeine increases the decrease / change in reaction time increases	allow converse ignore caffeine decreases reaction time do not accept the greater the increase in reaction time the greater the mass of caffeine	1	AO3 4.5.2
06.6	their reaction time was greater (after the drink)	allow converse allow slower / longer for greater do not accept anomalous result	1	AO3 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	0.01(0) to 0.18(0) or 0.18(0) to 0.01(0) or 0.17(0)	allow values in range 0.008 to 0.012 and 0.178 to 0.182 allow correct calculation from values in range if no values are given, allow answers in the range 0.166 to 0.174 allow $0.01 \leq C \leq 0.18$ ignore units	1	AO2 4.5.2
06.8	any two from: • (same range of) age • (same) sex / gender • (same) height / weight / BMI • all had no caffeine / medication / drugs earlier that day • equally tired or (same) amount of sleep • practice of the ruler drop test • starting point of ruler / hand • same point to take measurement above / below the thumb / finger • using the same hand • (same) number of students in each group	allow height ruler dropped from do not accept volume / concentration of caffeine	2	AO3 4.5.2
06.9	not automatic (because) it involves the (conscious part of the) brain	allow it is a voluntary action allow because it involves thinking / decision or conscious action	1 1	AO2 4.5.2
Total			13	