

0	1
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A student planned to investigate the effect of temperature and concentration on the rate of reaction.

The student predicted that the rate of reaction would increase as the temperature was increased.

0	1	.	1
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Give **two** reasons why the student's prediction is correct.

[2 marks]

Tick **two** boxes:

- The particles are more concentrated.
- The particles have a greater mass.
- The particles have a larger surface area.
- The particles have more energy.
- The particles move faster.

From this investigation the student correctly concluded:

'As the concentration of sodium thiosulfate solution doubles, the rate of reaction doubles.'

0	1	.	2
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Explain the student's conclusion in terms of particles.

[3 marks]

- Twice as many particles in the same volume ..... [1]
- Particles will collide twice as often ..... [1]
- Particles more likely to collide with enough energy for a successful collision ..... [1]
- Hydrochloric acid particles will be used up in half the time - double the rate ..... [1]
- .....

**WARNING:**  
Pressure and surface area are not relevant here because both of the reactants are solutions.

0	2
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The student then investigated how the surface area of marble chips affected the rate of reaction.

0	2	.	1
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Which **two** variables should the student keep constant?

[2 marks]

Tick **two** boxes:

- Amount of water in the trough
- Concentration of acid
- Mass of marble chips
- Size of marble chips
- Volume of measuring cylinder

0	2
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2
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Explain, in terms of particles and collisions, the effect that increasing the surface area of the marble chips has on the rate of reaction.

[2 marks]

*increasing the surface area increases rate* [1]

*(because of) more frequent collisions (between particles)* [1]

*accept particles are more likely to collide*

*ignore more collisions*

*ignore more successful collisions*

0	3
0	3

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1
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Calcium carbonate is a catalyst for the industrial production of biodiesel.

Give **one** reason why using a catalyst reduces costs.

[1 mark]

*any one from:*

- increases rate of reaction*
- reduces energy required*
- lower temperature can be used*
- catalyst is not used up.*

(Total 10 marks)

End