

How fast do reactions go?

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test answers (mark scheme)

Award the marks as shown. Explanations need to name the particle idea, not only the factor, to gain full credit. Accept correct alternative wording, and give credit for a correct method when an earlier number was wrong.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-5

Question 1 Concentration and collisions (3 marks)

- a. In the stronger acid there are more acid particles in each cm^3 . The zinc is hit more often, so there are more successful collisions each second. (2 marks)
- b. It stays the same, because the same amount of zinc reacts. (1 mark)

Marking: (a) 1 mark for more particles per volume, 1 for more frequent collisions; (b) 1 mark.

Question 2 Two experiments (3 marks)

- a. A, because its line is steeper. (1 mark)
- b. The same amount of the limiting reactant is used, so the same amount of gas forms. (1 mark)
- c. B used a lower temperature, a lower concentration or larger lumps instead of powder. (1 mark)

Marking: 1 mark each; accept any valid factor in (c).

Question 3 Mean rate (2 marks)

Rate = $54 \div 45 = 1.2 \text{ cm}^3/\text{s}$.

Marking: 1 mark for the formula, 1 for the value with unit.

Question 4 Surface area (3 marks)

- a. Before: $6 \times 16 = 96 \text{ cm}^2$. After: each small cube $6 \times 4 = 24 \text{ cm}^2$, and $8 \times 24 = 192 \text{ cm}^2$. (2 marks)
- b. The rate increases because more surface is exposed to the acid. (1 mark)

Marking: 1 mark for each area; 1 mark for the effect.

Question 5 Temperature (3 marks)

- a. The particles move faster and collide more often; more particles have at least the activation energy. (2 marks)
- b. The increase in the fraction of particles with enough energy. (1 mark)

Marking: 1 mark for each reason; 1 mark for the larger effect.

Question 6 Catalysts (2 marks)

A catalyst provides an alternative pathway with a lower activation energy, so more collisions are successful. It takes part in the reaction but is regenerated at the end, so it is not used up. **Lower activation energy.**

Marking: 1 mark for alternative pathway or lower activation energy, 1 mark for not used up.

Question 7 Doubling rule (2 marks)

Two rises of 10 °C make the rate $2 \times 2 = 4$ times faster, so the time is $120 \div 4 = \mathbf{30\ s}$.

Marking: 1 mark for the factor of 4, 1 mark for the time.

Question 8 Flour dust (2 marks)

Dust has a very large surface area exposed to oxygen, so there are many more collisions per second. The energy released heats the neighbouring dust and the reaction spreads almost instantly. **Large surface area gives a very high rate.**

Marking: 1 mark for large surface area, 1 mark for more frequent collisions or rapid spread.