

Example Key Stage 4 Student Work – Chemistry

The following gives some examples of the level of work covered in Chemistry at Key Stage 4, including details of how we expect students to set out their work and engage with feedback received. There is a strong correlation between the excellent diligence illustrated and student progress.

All work has a clear title and date

clw catylists 08/10/2024

· catylists are substances that speed up a reaction but aren't used in the process
· adding a catylist gives reaction alternate pathway with lower activation energy

energy reactant product normal activation energy enzyme reactant product activation energy lowered by enzyme

X · do not say "the enzyme lowers activation energy"
✓ · say they "provide an alternative path of reaction which has lower activation energy"

Key term definitions and other important key phrases are emphasised so that students know how to best articulate key ideas.

Practical results are presented neatly in a table that includes units. Follow up questions to the practical are completed in detail.

time (s)	Volume of gas cm ³			
	apple	liver	copper oxide	manganese oxide
10	0	0	0	1
20	0	0	0	7
30	0	0	0	12
40	0	1	0	14
50	0	2	0	18
60	0	2.5	0	22
70	0	3	0	25
80	0	3.5	0	28
90	0	4	0	31
100	0	5	0	34
110	0	5.5	0	38
120	0	6	0	41

① manganese oxide provided the greatest increase in rate of reaction. We know this because the reaction was fastest and most O₂ was produced in 2 mins. The energy profile was much lower, as we can see many more particles reacted, meaning the activation energy must have been lower. Their E_a must have been lowest (because in alternate pathway).

② The mass of the catalyst stays the same, so we know it has not been used up. weigh before and after, needs to be dried, taken out via filter/tweezers ✓ (3 mark question)

③ If the catalyst was lumpy, there would have been less SA, so the catalyst would be less effective. If the liver/potato was boiled (and then cooled), the biological enzymes would denature. This process would not have affected the chemical catalyst, since their ~~the~~ chemical compound would still be the same.
active site of enzyme

④ a biological catalyst is commonly known as an enzyme changes, substrate-enzyme substrate not formed

less particles exposed, so less frequency of successful collisions ✓

Student answers are checked in green pen with a clear break down of where marks are allocated. Even if a student gets the correct answer, they still look for ways that answers could be improved even further.

Students engage with teacher marking, writing detailed corrections in green pen using hints from the teacher marking.

- 2- a) 17cm^3 ✓
b) 29cm^3 ✓
c) 47cm^3 ✓

3- At 0 s: rate of reaction = $\frac{20}{10} = 2\text{cm}^3/\text{s}$ SA of marble chips

4- At 30s: rate of reaction = $\frac{25}{35} = 0.71\text{cm}^3/\text{s}$ higher lower concentration

5- At 30 seconds there are much less particles of the reactant (calcium carbonate) in the boiling tube, meaning there is a lower frequency of successful collisions happening between the acid and the CaCO_3 , so less product (CO_2) will be made. what factor does this affect specifically? of acid

6- At 70 seconds, the reaction stops as ~~all~~ of the reactant has reacted or been used up, meaning there is no product being made due to there being no more successful collisions between reactant particles. marble chips do not get used up as they are excess

7- Average rate of reaction = $\frac{\text{amount of } \text{CO}_2 \text{ produced}}{\text{time}}$ all of the acid has been used up as there is excess CaCO_3 so reaction stops.
 $= \frac{33}{30}$
 $= 1.1\text{cm}^3/\text{s}$ ✓

Calculations are laid out with clear working

It differs because it is an average for a period of time rather than the actual value at 1 point in time, for which a tangent would need to be drawn.

Always remember concentration is of liquids e.g. acid + surface area is of solids e.g. CaCO_3 .

Students reflect, consider misconceptions and routinely record advice or feedback on how they can improve for next time.