

GCSE Combined Science: Trilogy

Worksheet: Reaction profiles

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Reaction profiles

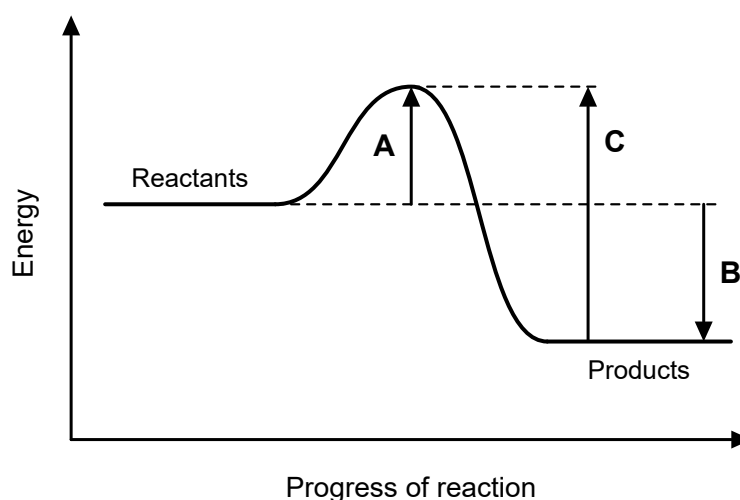
NAME _____ **CLASS** _____ **DATE** _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Figure 1 shows the reaction profile for a reaction.

Figure 1



0 1 . 1

Is the reaction exothermic or endothermic?

Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 1 . 2

Which arrow shows the activation energy?

Tick (✓) **one** box.

A

☐

B

☐

C

☐

[1 mark]

0 1 . 3

Which arrow shows the overall energy change for the reaction?

Tick (✓) **one** box.

A

☐

B

☐

C

☐

[1 mark]

0 1 . 4

What is meant by the activation energy of a reaction?

[1 mark]

0 2

A student adds a catalyst to a reaction mixture.

0 2 . 1

Which statement describes how adding the catalyst changes the reaction profile for the reaction?

Tick (✓) **one** box.

The reactant level moves up

☐

The product level moves down

☐

The peak becomes lower

☐

The curve becomes a straight line

☐

[1 mark]

0 2 . 2

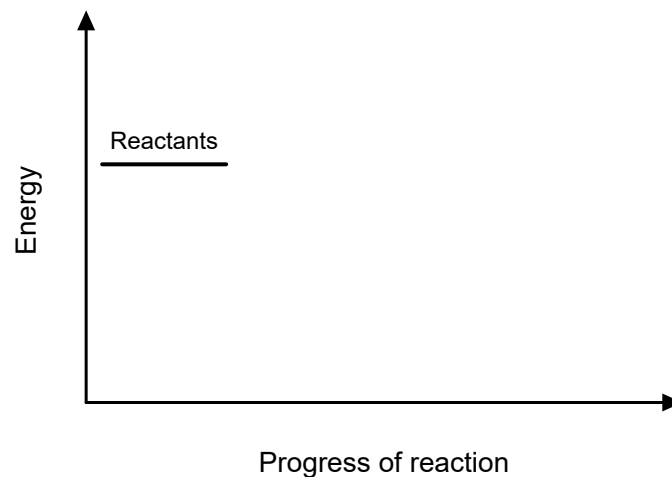
What happens to the overall energy change of the reaction when the catalyst is added?

[1 mark]

0 3

Methane burns in oxygen. The reaction is exothermic. Figure 2 shows axes with the energy level of the reactants marked.

Figure 2



0 3 . 1

Complete the reaction profile on Figure 2 for this reaction. Label the products, the activation energy and the overall energy change.

[4 marks]

0 4

0 4 . 1

Which statement correctly describes the activation energy of a reaction?

Tick (✓) **one** box.

The overall energy change of the reaction

☐

The minimum energy that particles must have to react when they collide

☐

The energy released when new bonds form

☐

The energy of the products

☐

[1 mark]

0 4 . 2

On the reaction profile for a different reaction, the reactants are at an energy of 240 kJ/mol and the products are at an energy of 165 kJ/mol.

Is this reaction exothermic or endothermic?

Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 4 . 3

Calculate the overall energy change for this reaction.

.....

.....

.....

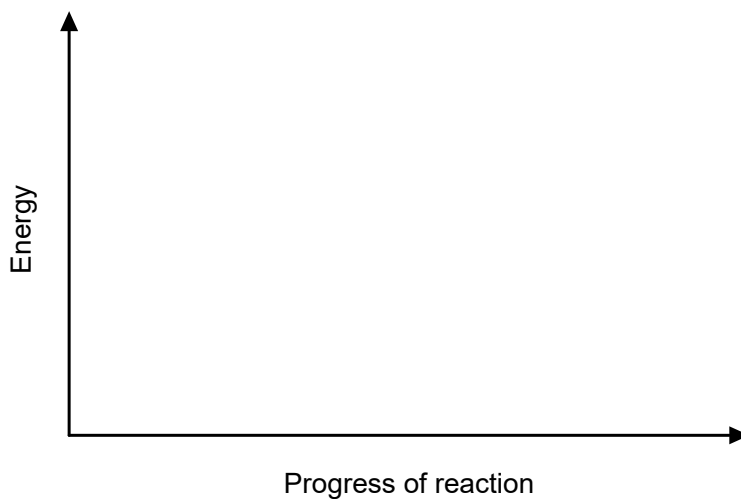
Overall energy change = kJ/mol

[1 mark]

0 5

When citric acid solution reacts with sodium hydrogencarbonate powder, the reaction is endothermic.

Figure 3



0 5 . 1

Sketch a fully labelled reaction profile for this reaction on Figure 3. Your diagram should show the relative energies of the reactants and products, and label the activation energy and the overall energy change.

[4 marks]

0 5 . 2

Give **one** everyday use of an endothermic reaction like this one.

.....

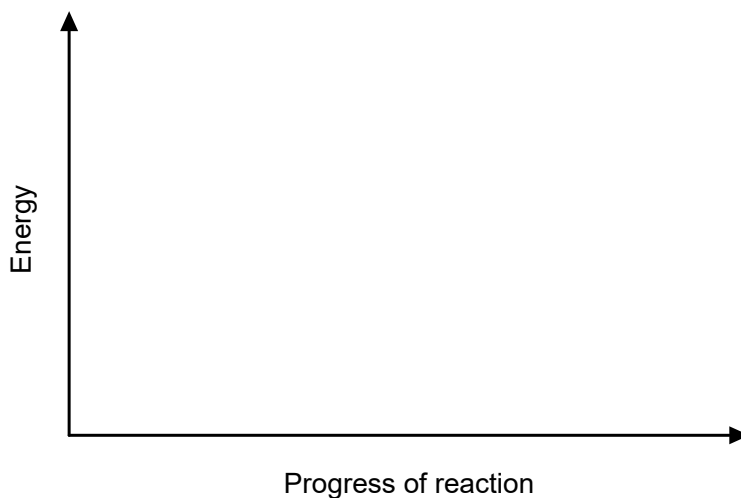
.....

[1 mark]

0 6

The reaction between magnesium and dilute hydrochloric acid is exothermic.

Figure 4



0 6 . 1

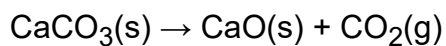
Sketch a fully labelled reaction profile for this reaction on Figure 4.

Your diagram should show the relative energies of the reactants and products, and label the activation energy and the overall energy change.

[4 marks]

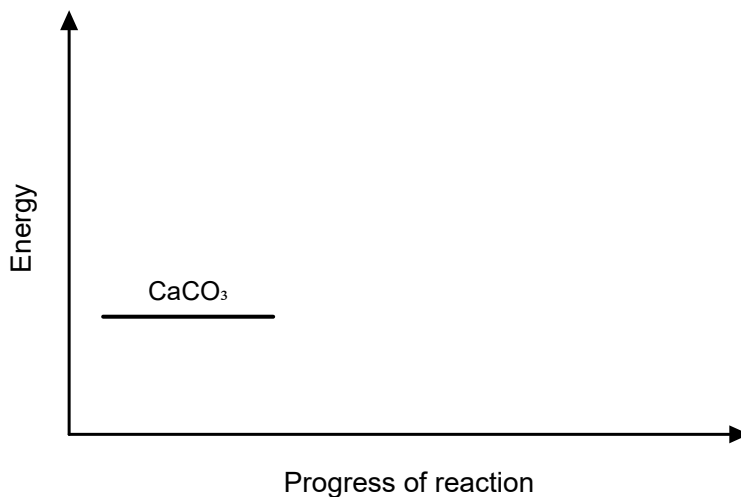
0 7

Calcium carbonate decomposes when it is heated strongly.



The reaction is endothermic.

Figure 5



0 7 . 1

Complete the reaction profile in Figure 5 for this reaction.
Label the products, the activation energy and the overall energy change.

[4 marks]

0 7 . 2

Calcium carbonate must be heated all the time for the reaction to keep going.
Explain why.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Reaction profiles · 30 marks

Question 1 (5 marks)

01.1 [2 marks]

Answer: Exothermic: the products have less energy than the reactants.

- exothermic (1)
- the products have less energy than the reactants / energy is released to the surroundings (1)

Notes: The reason can score only if exothermic is given.

01.2 [1 mark]

Correct: A

01.3 [1 mark]

Correct: B

01.4 [1 mark]

Answer: The minimum energy that particles must have to react.

- the (minimum amount of) energy needed for a reaction to occur / that particles must have to react (1)
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: The peak becomes lower

02.2 [1 mark]

Answer: It stays the same.

- it stays the same / does not change (1)
-

Question 3 (4 marks)

03.1 [4 marks]

Answer: Products level drawn below the reactants, joined by a curve that rises to a peak; activation energy from the reactants' level to the peak; overall energy change from the reactants' level down to the products' level.

- products level drawn (and labelled) below the reactants' level (1)
- a curve from the reactants that rises to a peak and then falls to the products (1)
- activation energy shown from the reactants' level up to the top of the peak (1)
- overall energy change shown from the reactants' level down to the products' level (1)

Notes: Ignore the exact heights. Arrows or lines may be used; an arrowhead is not required.

Question 4 (4 marks)

04.1 [1 mark]

Correct: The minimum energy that particles must have to react when they collide

04.2 [2 marks]

Answer: Exothermic: the products have less energy than the reactants.

- exothermic (1)
 - the products are at a lower energy than the reactants / energy is transferred to the surroundings (1)
-

04.3 [1 mark]

Answer: -75 kJ/mol

- $(165 - 240 =) -75 \text{ (kJ/mol)}$ (1)

Notes: The negative sign is needed for the mark: 75 or +75 scores 0.

Question 5 (5 marks)

05.1 [4 marks]

Answer: Reactant line lower than the product line, joined by a curve that rises to a peak above both; activation energy labelled from the reactant level to the peak; overall energy change labelled from the reactant level up to the product level.

- reactants and products both labelled, with the products at a higher energy than the reactants (1)
- a curve from the reactants that rises to a peak above both levels and then falls to the products (1)
- activation energy shown by an arrow or line from the reactant level up to the top of the peak (1)
- overall energy change shown by an arrow or line from the reactant level up to the product level (1)

Notes: Ignore the exact heights, provided the products are clearly above the reactants.

05.2 [1 mark]

Answer: A sports injury (cold) pack.

- a sports injury pack / an instant cold pack (1)

Notes: Allow a cooling pack for injuries. Do not accept a hand warmer or a self-heating can.

Question 6 (4 marks)

06.1 [4 marks]

Answer: Reactant line higher than the product line, joined by a curve that rises to a peak above both; activation energy labelled from the reactant level to the peak; overall energy change labelled from the reactant level down to the product level.

- reactants and products both labelled, with the products at a lower energy than the reactants (1)
- a curve from the reactants that rises to a peak above both levels and then falls to the products (1)
- activation energy shown by an arrow or line from the reactant level up to the top of the peak (1)
- overall energy change shown by an arrow or line from the reactant level down to the product level (1)

Notes: Ignore the exact heights, provided the products are clearly below the reactants. Do not accept an activation energy arrow drawn from the product level.

Question 7 (6 marks)

07.1 [4 marks]

Answer: Product line above the reactant line, a curve rising to a peak above both, activation energy from the reactants to the peak, energy change from the reactants up to the products.

- product line drawn above the reactant line and labelled $\text{CaO} + \text{CO}_2$ (1)
- curve that rises from the reactants to a maximum above the product level and then falls to the products (1)
- activation energy shown from the reactant level to the top of the curve (1)
- overall energy change shown from the reactant level to the product level (1)

Notes: Ignore arrowheads. Activation energy and energy change marks can be awarded if the lines are labelled clearly without arrows.

07.2 [2 marks]

Answer: The reaction is endothermic, so it takes in energy; energy must keep being supplied for particles to have the activation energy.

- the reaction is endothermic / takes in energy from the surroundings (1)
 - so energy must keep being supplied for particles to reach the activation energy / the reaction does not release energy to keep itself going (1)
-