AQA GCSE Chemistry

The rate and extent of chemical change mark scheme · goes with “The rate and extent of chemical change · Higher tier” · whiteboardchemistry.com/revision/gcse-chemistry/exam-questions

Mark schemes

The rate and extent of chemical change · Higher tier · 5 questions

Q1 · June 2023 · Paper 2 Foundation · Q8 · Paper 2 Higher · Q1 · [10 marks]

08.1

to reduce the escape of gas

[1 mark]

08.2

(mean rate =)

$$\frac{0.78 + 0.81 + 0.81}{3}$$

allow $\frac{0.78 + 0.81 + 0.68 + 0.81}{4}$

0.80 (cm^3/s)

= 0.77 (cm^3/ s) for 1 mark

$0.80 = \frac{20}{\text{mean time taken}}$

allow correct use of incorrectly determined mean rate

(mean time taken =) $\frac{20}{0.80}$

= 25 (s)

alternative approach:

$0.78 = \frac{20}{\text{time}}$

or

$0.81 = \frac{20}{\text{time}}$ (1)

(trial 1 time = $\frac{20}{0.78}$ =) 25.6 (1)

(trial 2 and 4 time = $\frac{20}{0.81}$ =) 24.7 (1)

(mean time =)

$\frac{25.6 + (2 \times 24.7)}{3}$ (1)

allow correct use of incorrectly determined value(s) for time

= 25 (s) (1)

allow $\frac{25.6 + 29.4 + (2 \times 24.7)}{4}$

= 26.1 (s)

for 1 mark

[5 marks]

08.3

use a lower temperature

use sulfuric acid of a lower concentration

[2 marks]

08.4

MP2 is dependent upon MP1 being awarded

(test)

burning / lit splint

allow flame

do not accept glowing splint

(result)

burns with a (squeaky) pop sound

allow pops

[2 marks]

Q2 · June 2023 · Paper 2 Higher · Q7 · [10 marks]

07.1

(a catalyst) provides a different pathway for the reaction

(which has a) lower activation energy

[2 marks]

07.2

(oxygen is) a gas

(which) escaped from the flask

[2 marks]

07.3

correct value for x step **and** y step from tangent

(rate =) $\frac{\text{value for y step}}{\text{value for x step}}$

allow correct use of incorrectly determined x and/or y step

correct calculation of rate

answer to 2 significant figures

allow an answer correctly rounded to 2 significant figures from an incorrect calculation which uses values determined from the graph.

[4 marks]

07.4

line starting at 0,0 which is less steep than existing line

which becomes level at 0.80 g

allow a tolerance of ± ½ a small square

[2 marks]

Q3 · June 2024 · Paper 2 Higher · Q7 · [8 marks]

07.1

ignore (hydrochloric / nitric / sulfuric) acid

(test) add barium chloride (solution)

allow add barium nitrate (solution)

(result) white precipitate

MP2 is dependent upon MP1 being awarded

[2 marks]

07.2

the yield is smaller at higher temperatures because the reaction is exothermic

[1 mark]

07.3

allow converse

there are more moles / molecules (of gas) on the left

ignore particles

(so the position of) equilibrium shifts to the right

[2 marks]

07.4

any **two** from:

- the yield is already high
- more energy required
- risk of explosion is increased
- higher income from increased yield is outweighed by the extra expenditure
- increased cost of safety precautions

allow requires stronger vessels

allow requires thicker walls

[2 marks]

07.5

vanadium (V)

[1 mark]

Q4 · June 2024 · Paper 2 Higher · Q9 · [16 marks]

09.1

(some) hydrogen / gas escapes (from the flask)

(because the reaction starts) before the stopper is put in

allow (because) stopper cannot be inserted instantly

*allow for **1** mark some air (from the conical flask) is collected*

or

allow some hydrogen remains in the conical flask

or

allow some hydrogen remains in the delivery tube

[2 marks]

09.2

(volume = 39 – 25 =) 14 (cm^3)

(14 cm^3 =) 0.014 (dm^3)

allow correct use of an incorrectly determined volume

(moles of hydrogen =)

$$\frac{0.014}{24}$$

allow correct use of an incorrectly determined volume

allow correct use of an incorrect / no conversion of volume

= 5.8×10^{-4} (mol)

allow 5.833333×10^{-4} correctly rounded to at least 2 significant figures

allow 0.00058 (mol)

alternative approach 1:

(24 dm^3 =) 24 000 (cm^3) (1)

(volume = 39 – 25 =)

14 (cm^3) (1)

(moles of hydrogen =)

$$\frac{14}{24000}$$ (1)

allow correct use of an incorrectly determined volume

allow correct use of an incorrect / no conversion of volume

= 5.8 x 10^{-4} (mol) (1)

allow 5.833333 x 10^{-4} correctly rounded to at least 2 significant figures

allow 0.00058 (mol)

alternative approach 2:

(24 dm^3 =) 24 000 (cm^3) (1)

(moles of hydrogen at 100 s = $\frac{39}{24000}$ =) 0.001625

allow correct use of an incorrect / no conversion of volume

and

(moles of hydrogen at 40 s = $\frac{25}{24000}$ =) 0.00104 (1)

(moles 100 s – moles 40 s =)

0.001625 – 0.00104 (1)

allow correct use of an incorrectly determined number of moles

= 5.8 x 10^{-4} (mol) (1)

allow 5.833333 x 10^{-4} correctly rounded to at least 2 significant figures

allow 0.00058 (mol)

alternative approach 3:

(39 cm^3 =) 0.039 (dm^3)

and

(25 cm^3 =) 0.025 (dm^3) (1)

(moles of hydrogen at 100 s = $\frac{0.039}{24}$ =) 0.001625

allow correct use of an incorrect / no conversion of volume

and

(moles of hydrogen at 40 s = $\frac{0.025}{24}$ =) 0.00104 (1)

(moles 100 s – moles 40 s =)

0.001625 – 0.00104 (1)

allow correct use of an incorrectly determined number of moles

= 5.8 x 10^{-4} (mol) (1)

allow 5.833333 x 10^{-4} correctly rounded to at least 2 significant figures

allow 0.00058 (mol)

[4 marks]

09.3

tangent drawn at 45 s

correct values for y step **and** x step from tangent

allow correct use of an incorrectly drawn tangent

allow a tolerance of ± ½ a small square for each coordinate

$$\text{(rate =)}\ \frac{\text{value for y step}}{\text{value for x step}}$$

allow correct use of incorrectly determined value(s) from the tangent for y step and/or x step

correct calculation of rate (mol/s)

rate given in standard form (mol/s)

allow a correctly calculated answer in standard form from an incorrect attempt at rate determination

[5 marks]

09.4

line starting at 0,0.000 and less steep than existing line

becomes level at 0.0084 mol

allow a tolerance of ± ½ a small square

[2 marks]

09.5

(increasing the temperature) increases the rate of reaction

(because) particles have more energy

allow (because) particles move faster

(so) the frequency of collisions increases

allow (so) a greater proportion of collisions have enough energy to react

ignore successful

[3 marks]

Q5 · June 2025 · Paper 2 Higher · Q8 · [13 marks]

08.1

allow oxygen for gas

a gas was produced

(and the gas) escaped from the flask

[2 marks]

08.2

catalysts provide a different pathway for the reaction

(and) the activation energy using B is lower

allow converse

(so) the rate of reaction is higher using B

allow converse

allow (so) the reaction using B

has more particles with an energy exceeding the activation energy

[3 marks]

08.3

tangent at 60 s

value for x step **and** y step from tangent

allow a tolerance of ± ½ a small square

allow correct use of an incorrect tangent

(rate =) (value for y step)/(value for x step)

allow correct use of incorrectly determined x and / or y step from a drawn tangent

correct calculation of rate

answer in standard form

allow an answer correctly given in standard form from an incorrect calculation which uses values determined from the graph

[5 marks]

08.4

allow converse

the rate (of decomposition / reaction) increases at higher temperatures

(because) particles have more energy

allow (because) particles move faster

(so) collide more frequently

allow (and) a greater proportion collide with sufficient energy to exceed the activation energy

[3 marks]

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