CHEMISTRY

UNIT 4(IAL)

2020 — 2025

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1 - (WCH11/4(IAL)_Summer_2020_Q1) - *Rates, Equilibria And Further Organic Chemistry*

Bromine oxidises methanoic acid to carbon dioxide.

The equation for the reaction is

$$HCOOH(aq) + Br_2(aq) \rightarrow 2H^+(aq) + 2Br^-(aq) + CO_2(g)$$

Which of the following methods would **not** be suitable for measuring the progress of this reaction?

☒ **A** colorimetry

☒ **B** measuring electrical conductivity

☒ **C** quenching and titrating with acid

☒ **D** measuring the volume of gas

2 - (WCH11/4(IAL)_Summer_2020_Q2) - *Rates, Equilibria And Further Organic Chemistry*

The rate of the reaction between two compounds, **Y** and **Z**, was investigated.
The results are shown.

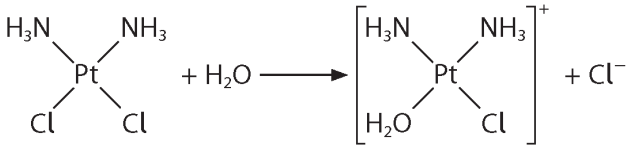
Experiment	Initial concentration of **Y** / mol dm^{-3}	Initial concentration of **Z** / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	0.64	0.24	8.00×10^{-3}
2	0.64	0.48	3.20×10^{-2}
3	0.32	0.48	3.20×10^{-2}

What are the orders of reaction with respect to **Y** and **Z**?

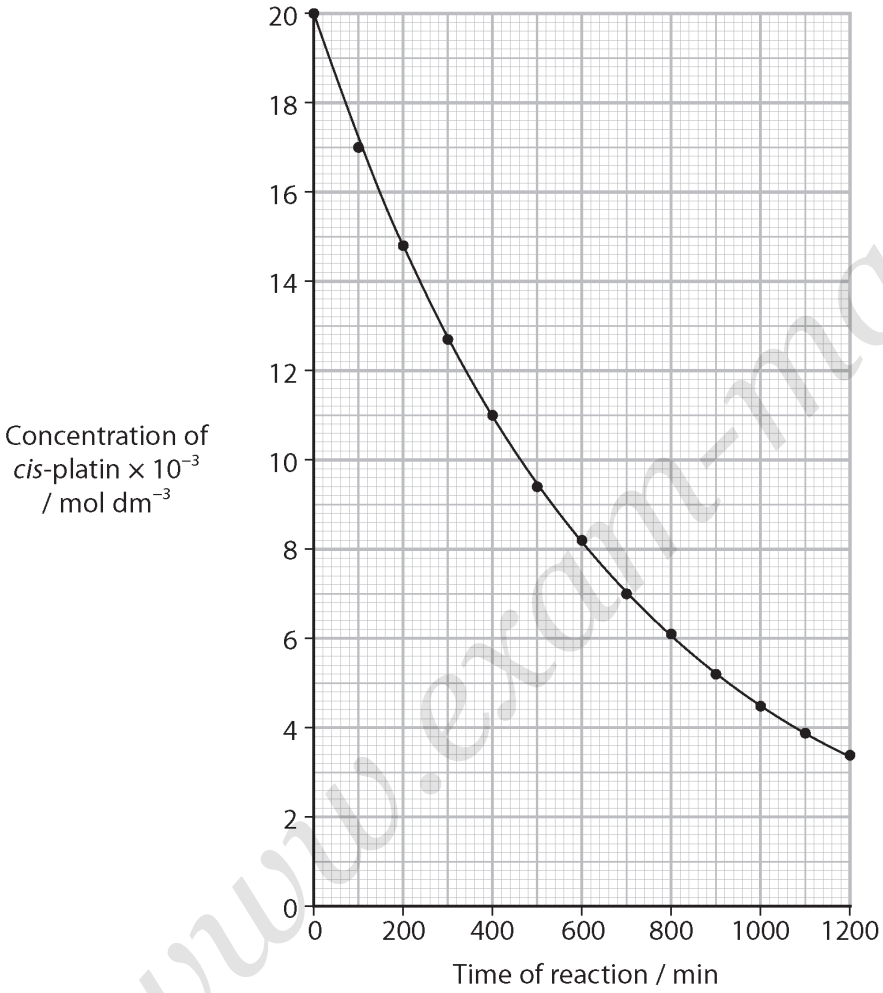
	Order with respect to **Y**	Order with respect to **Z**
☒ **A**	0	1
☒ **B**	0	2
☒ **C**	1	1
☒ **D**	1	2

3 – (WCH11/4(IAL)_Summer_2020_Q3) – *Rates, Equilibria And Further Organic Chemistry*

The inorganic anti-cancer drug *cis*-platin, $Pt(NH_3)_2Cl_2$, is hydrolysed by water to make it active. The reaction is



The hydrolysis is first order overall. The half-life can be found from a graph of the concentration of *cis*-platin against time.



The half-life of the reaction is

- ☐ **A** 430 min
- ☐ **B** 460 min
- ☐ **C** 590 min
- ☐ **D** 600 min

4 - (WCH11/4(IAL)_Summer_2020_Q4) - *Rates, Equilibria And Further Organic Chemistry*

Propanone reacts with iodine in acidic solution.

$$CH_3COCH_3(aq) + I_2(aq) \rightarrow CH_3COCH_2I(aq) + H^+(aq) + I^-(aq)$$

The rate equation for the formation of iodopropanone is found to be

$$\text{rate} = k[CH_3COCH_3(aq)][H^+(aq)]$$

(a) Which of the following is true?

(1)

- ☐ **A** the units for the rate constant are $dm^3\ mol^{-1}\ s^{-1}$
- ☐ **B** the reaction is a first order reaction overall
- ☐ **C** the units for the rate are $dm^3\ mol^{-1}\ s^{-1}$
- ☐ **D** doubling the concentrations of propanone and of iodine quadruples the rate

(b) Which of the following is **not** true?

(1)

- ☐ **A** the reaction rate increases if the temperature is raised
- ☐ **B** the rate constant increases if the temperature is raised
- ☐ **C** the addition of a small amount of sodium hydroxide decreases the reaction rate
- ☐ **D** the rate is unchanged when the hydrogen ion concentration is doubled

5 - (WCH11/4(IAL)_Summer_2020_Q5) - *Rates, Equilibria And Further Organic Chemistry*

The equation shows the hydrolysis of a bromoalkane.

$$RBr + OH^- \rightarrow ROH + Br^-$$

The rate equation is rate = k[RBr]

RBr is most likely to be

- ☒ **A** bromomethane
- ☒ **B** 2-bromopropane
- ☒ **C** 1-bromo-2-methylpropane
- ☒ **D** 2-bromo-2-methylpropane

6 - (WCH11/4(IAL)_Summer_2020_Q6) - *Rates, Equilibria And Further Organic Chemistry*

The equation for an exothermic reaction is shown.

$$Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$$

Which of these is true?

☒ **A** ΔH is positive

☒ **B** $\Delta S_{surroundings}$ is positive

☒ **C** ΔS_{system} is negative

☒ **D** ΔS_{total} is negative

7 - (WCH11/4(IAL)_Summer_2020_Q7) - *Rates, Equilibria And Further Organic Chemistry*

The equation for the equilibrium decomposition of hydrogen iodide into hydrogen and iodine can be written in two ways.

$2HI(g) \rightleftharpoons H_2(g) + I_2(g)$ Equilibrium constant = K_c

or

$HI(g) \rightleftharpoons \frac{1}{2}H_2(g) + \frac{1}{2}I_2(g)$ Equilibrium constant = K_c'

What is the expression linking the two equilibrium constants?

☒ **A** $K_c = (K_c')^2$

☒ **B** $K_c = K_c'$

☒ **C** $K_c = 2(K_c')$

☒ **D** $K_c = \sqrt{K_c'}$

8 - (WCH11/4(IAL)_Summer_2020_Q8) - *Rates, Equilibria And Further Organic Chemistry*

A buffer solution contains ethanoic acid, with a concentration of 0.10 mol dm^{-3}, and sodium ethanoate, with a concentration of 0.050 mol dm^{-3}.

K_a for ethanoic acid = 1.7×10^{-5} mol dm^{-3}

The pH of this buffer solution is

☒ **A** 2.88

☒ **B** 4.47

☒ **C** 4.77

☒ **D** 5.07

ANSWERS

1 – (WCH11/4(IAL)_Summer_2020_Q1) – *Rates, Equilibria And Further Organic Chemistry*

C

2 – (WCH11/4(IAL)_Summer_2020_Q2) – *Rates, Equilibria And Further Organic Chemistry*

B

3 – (WCH11/4(IAL)_Summer_2020_Q3) – *Rates, Equilibria And Further Organic Chemistry*

B

4 – (WCH11/4(IAL)_Summer_2020_Q4) – *Rates, Equilibria And Further Organic Chemistry*

Question Number	Answer	Mark
(a)	**The only correct answer is A** (the units for the rate constant are $dm^3\ mol^{-1}\ s^{-1}$) ***B*** *is incorrect because the reaction is second order overall* ***C*** *is not correct because the units of rate are always mol* $dm^{-3}\ s^{-1}$ ***D*** *is not correct because the rate would double as iodine is zero order*	(1)

Question Number	Answer	Mark
(b)	**The only correct answer is D** (the rate is unchanged when the hydrogen ion concentration is doubled) ***A*** *is incorrect because the rate of reaction does increase with temperature* ***B*** *is incorrect because the rate constant depends on the temperature and increases as temperature rises* ***C*** *is not correct because sodium hydroxide would neutralise some of the* $[H^+]$ *catalyst so change rate*	(1)

5 – (WCH11/4(IAL)_Summer_2020_Q5) – *Rates, Equilibria And Further Organic Chemistry*

D

6 – (WCH11/4(IAL)_Summer_2020_Q6) – *Rates, Equilibria And Further Organic Chemistry*

B

7 – (WCH11/4(IAL)_Summer_2020_Q7) – *Rates, Equilibria And Further Organic Chemistry*

A

8 – (WCH11/4(IAL)_Summer_2020_Q8) – *Rates, Equilibria And Further Organic Chemistry*

B