

(Factors affecting rate of reaction (temperature, concentration, pressure, surface area, catalysts))

Q1. (2018)

method

- measure (indicated) volume of sodium thiosulfate
- place sodium thiosulfate in (conical) flask
- measure (indicated) volume of hydrochloric acid
- place on cross **or** between light sensor
- or**
connect to a gas syringe
- or**
other suitable method for timing a change
- add hydrochloric acid to (conical) flask
- swirl
- start stopclock / stopwatch
- measure time for cross to become no longer visible
- or**
log light transmission over time
- or**
measure time for fixed volume of gas to be produced
- repeat and find mean
- repeat for different concentrations of sodium thiosulfate
- or** change ratio of sodium thiosulfate volume : water volume

control variables

- concentration of hydrochloric acid
- volume of hydrochloric acid
- (total) volume of sodium thiosulfate solution

Q2. (2018)

(yield)

equilibrium position moves to
the product side

(because) fewer molecules /
moles / particles on product side

(rate)

more collisions per unit time

(because) more molecules /
particles per unit volume

Q3. a). (2019)

place the conical flask in a water bath at constant temperature.

use a mass of 1 g manganese dioxide each time.

Q3. b). (2019)

11 (cm³) **and** 120 (seconds)

(mean rate of reaction = $\frac{11}{120}$)
= 0.09167

= 0.092 (cm³/s)

Q3. c). (2019)

line starts at origin **and** less steep than solid line

line levelling off at 40 (cm³)

Q3. d). (2019)

(because) surface area (of fine manganese dioxide powder) greater

(so) more collisions (with hydrogen peroxide molecules / particles) per unit time

Q4. a). (2020)

all seven points plotted
correctly

line of best fit

Q4. b). (2020)

0.0038 **and** 0.0014

$$\frac{0.0038 - 0.0014}{105 - 20}$$

$$= 0.000028$$

or

$$= 2.8 \times 10^{-5}$$

mol/s

Q4. c). (2020)

(for large lumps) a smaller
number of moles of gas is
collected in the same time

or

(for large lumps) more time is
needed to collect the same
number of moles of gas

or

the line (of best fit for large
lumps) is less steep

Q5. a). (2020)

$$(\text{surface area} = 6 \times 0.5 \times 0.5) = 1.5 \text{ (cm}^2\text{)}$$

$$(\text{volume} = 0.5 \times 0.5 \times 0.5) = 0.125 \text{ (cm}^3\text{)}$$

$$(\text{surface area} : \text{volume} =) 12 : 1$$

Q5. b). (2020)

decreases by a factor of 10