N5 Chemistry: Unit 1 – Chemical Changes and Structure REVISION

Lesson 22 – Isotopes

Learning Outcomes

By the end of this lesson, you should have revised:

1. The layout of the periodic table.
2. How to use the atomic number and mass number of an element to determine its structure.
3. How to write and draw electron arrangements for different elements.

Success Criteria

You will have been successful in this lesson if you:

1. Watch the links provided
2. Complete revision questions provided
3. Complete and submit homework assigned

There is also a further reading section to help you gain more depth of understanding for this section.

If you have any questions about the content of this lesson, you should ask your class teacher either through your class MS team or via email. MS Teams will be monitored throughout the week by a chemistry teacher. If you need help or clarification with either the task or the content of the lesson, just ask.

Links to Prior Knowledge

You may wish to revise the following to help you understand this lesson:

- N5 Unit 1: Atomic Structure and Bonding Related to Properties of Materials

You do not need to copy any notes as this is all revision, but you should complete all questions and tasks as outlined in this document.

Watch the video first:

Lesson 22: Isotopes - https://youtu.be/F9aaxVFBoYM

You should also consult your Unit 1 Notes and printed notes to help further consolidate your knowledge. A digital copy of the printed notes can be found on the S4 Chemistry Team.

Further Reading

To learn more about this topic, try the following online resources:

BBC Bitesize: https://www.bbc.co.uk/bitesize/guides/zw2gpbk/revision/5

Scholar: Log in through GLOW

National 5 Chemistry → Chemical Changes and Structure
→ 2.6 Nuclide Notation
→ 2.7 Isotopes

Evans2 chem web: https://www.evans2chemweb.co.uk/

Username: snhs password: giffnock

Select any teacher → revision → National 5 → Unit 1 → Atomic Structure and Bonding related to Properties.

Extension Questions:

Yellow/Purple book	*Atomic structure*	*page 18-20*
	Relative atomic mass	*page 21-22*

Complete the following questions in your class work jotter. The answers will be posted on Teams on Wednesday for you to self-assess.

Practice Questions – Isotopes

1. Write the nuclide notation for the following:
   a. the atom that contains 5 protons and 5 neutrons.
   b. the atom that contains 17 protons and 18 neutrons.
   c. the atom that contains 7 protons and 8 neutrson. (3)

2. Carbon-12 and Carbon-14 are isotopes.
   a. State what is meant by the term isotope. (1)
   b. Write the nuclide notation for each of these isotopes. (2)

3. A sample of the element Silver was shown to exist as a mixture of two isotopes:

   48% Ag (107), 52% Ag (109)

   a. Copy and complete the table for

Isotope	Number of protons	Number of neutrons	Number of electrons
$^{107}_{47}Ag$			
$^{109}_{47}Ag$			

(2)

   b. From the percentage abundance of each isotope of silver in the sample, use the example below to calculate the relative atomic mass for this sample of silver.
   Show your working clearly (2)

The relative atomic mass of an element can be calculated using the formula:

$$\frac{(\text{mass of isotope A} \times \%\text{ of isotope A}) + (\text{mass of isotope B} \times \%\text{ of isotope B})}{100}$$

Total: 10 marks

Past-Paper Questions – Isotopes

1. The table shows the numbers of protons, electrons and neutrons in four particles, **W, X,Y and Z.**

Particle	*Protons*	*Electrons*	*Neutrons*
W	17	17	18
X	11	11	12
Y	17	17	20
Z	18	18	18

Which pair of particles are isotopes?

A W and X

B W and Y

C X and Y

D Y and Z (1)

2. A sample of nitrogen was found to contain equal amounts of two isotopes. One isotope has a mass number 14 and the other has mass number 15.

What is the relative atomic mass of this sample of nitrogen? (1)

3. Gold is the heaviest element to have only one naturally occurring isotope.
The isotope has a mass number of 197.

Complete the table to show the number of each type of particle in this gold atom.

You may wish to use the data booklet to help you. (1)

Particle	*Number*
Proton	
Electron	
Neutron	

4. A sample of argon contains three types of atom.

$^{36}_{18}Ar$ $^{38}_{18}Ar$ $^{40}_{18}Ar$

a. State the term used to describe these different types of argon atom. (1)

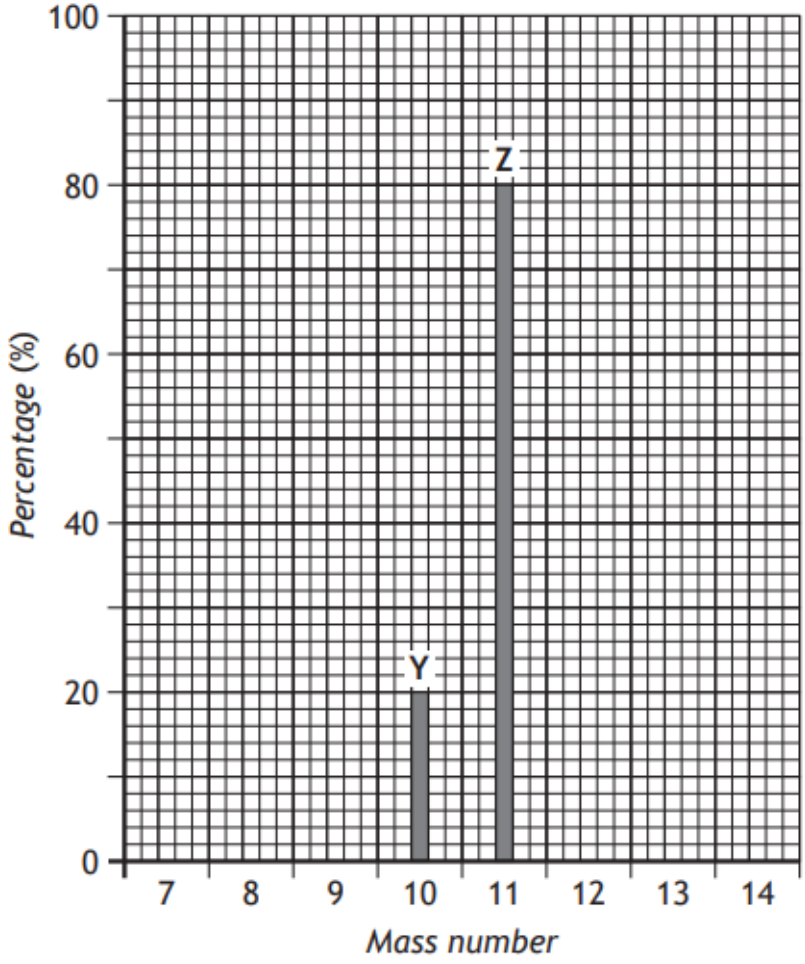
b. Explain why the mass number of each type of atom is different. (1)

c. This sample of argon has an average atomic mass of 36.2.
State the mass number of the most common type of atom in the sample of argon. (1)

(questions continued on the next page)

5. Scientists use an instrument called a mass spectrometer to determine the number of isotopes and the percentage of each isotope in a sample of an element.

a. When a sample of boron is pass through a mass spectrometer the following graph is obtained.



a. State the number of isotopes present in this sample of boron. (1)

b. The relative atomic mass can be calculated using

$$\frac{(\text{mass of isotope Y} \times \%\text{ of Y}) + (\text{mass of isotope Z} \times \%\text{ of Z})}{100}$$

Using the information from the graph, calculate the relative atomic mass of the sample of boron. (2)

Show your working clearly.

6. The group 7 element bromine was discovered by Balard in 1826.
Bromien gets its name from the Greek 'bromos' meaning stench.

A sample of bromine consists of a mixture of two isotopes, $^{79}_{35}Br$ and $^{81}_{35}Br$.

Complete the table for $^{79}_{35}Br$. (1)

Isotope	*Number of protons*	*Number of neutrons*
$^{79}_{35}Br$		

Total: 10 marks

Now complete the Unit 1 Revision – Homework 1 on the next page and submit to your class teacher via Teams (or your usual channel).

*Photos of your work should be submitted by **1pm on Friday 12th March.***

Unit 1 Revision - Homework 1 (14 marks)

Section 1 – 5 marks

1.

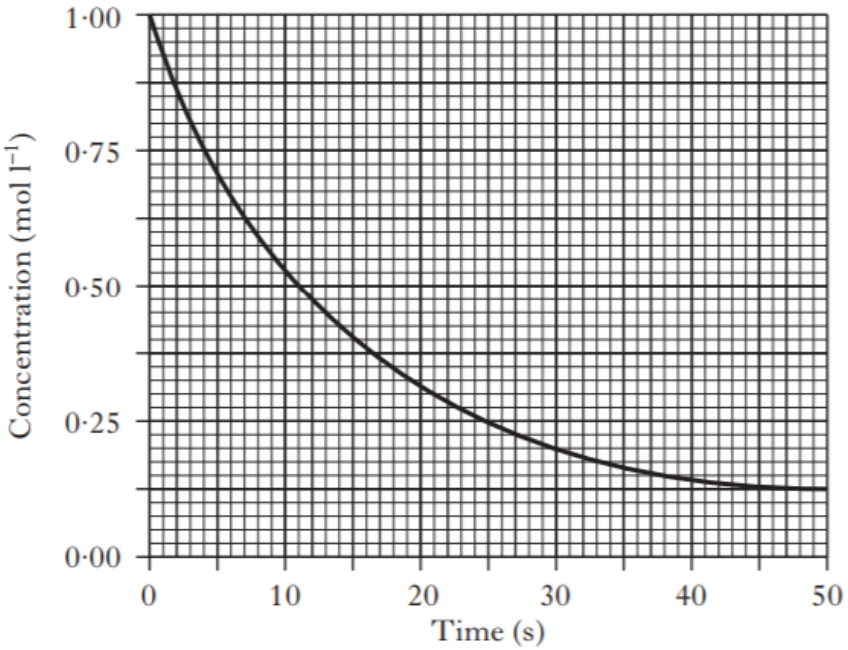
Which line in the table shows what happens when 1 gram of catalyst is added to a reaction mixture?

	Speed of reaction	Mass of catalyst left at end in grams
A	unchanged	1
B	faster	1
C	unchanged	0
D	faster	0

(1)

2.

The graph below shows the variation of concentration of a reactant with time as a reaction proceeds.

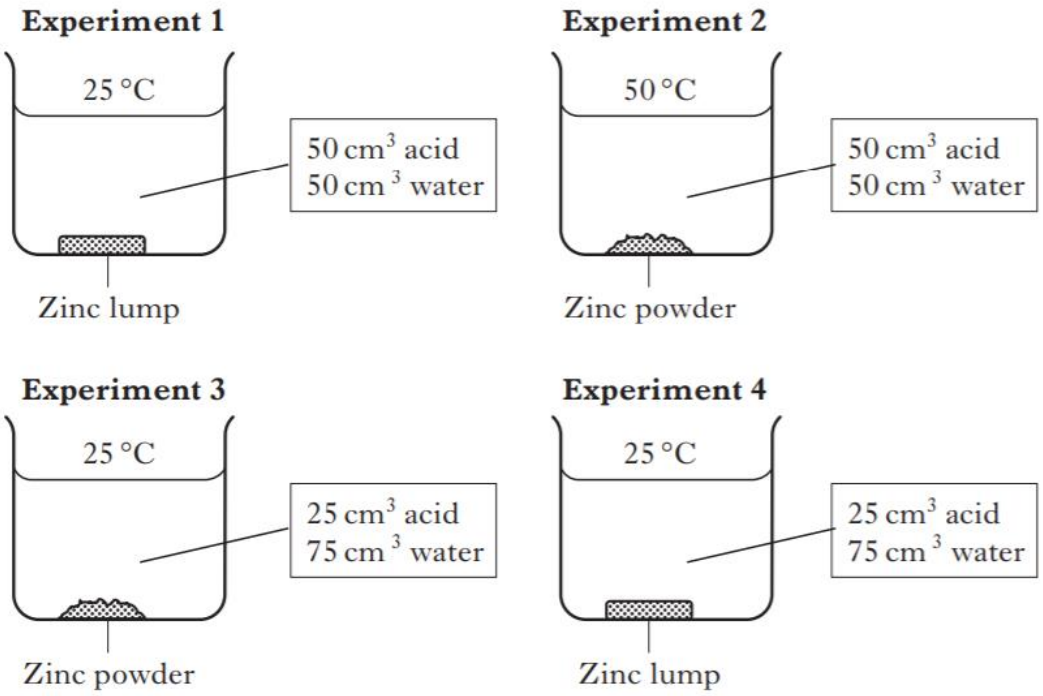


During the first 25 s, the average reaction rate, in mol l^{-1} s^{-1}, is

A 0·01
B 0·02
C 0·03
D 0·04.

(1)

3. A student investigated the reaction between zinc and dilute acid.



Which experiments show how changing acid concentration affects the rate of the reaction?

(1)

A 1 and 2

B 2 and 3

C 3 and 4

D 1 and 4

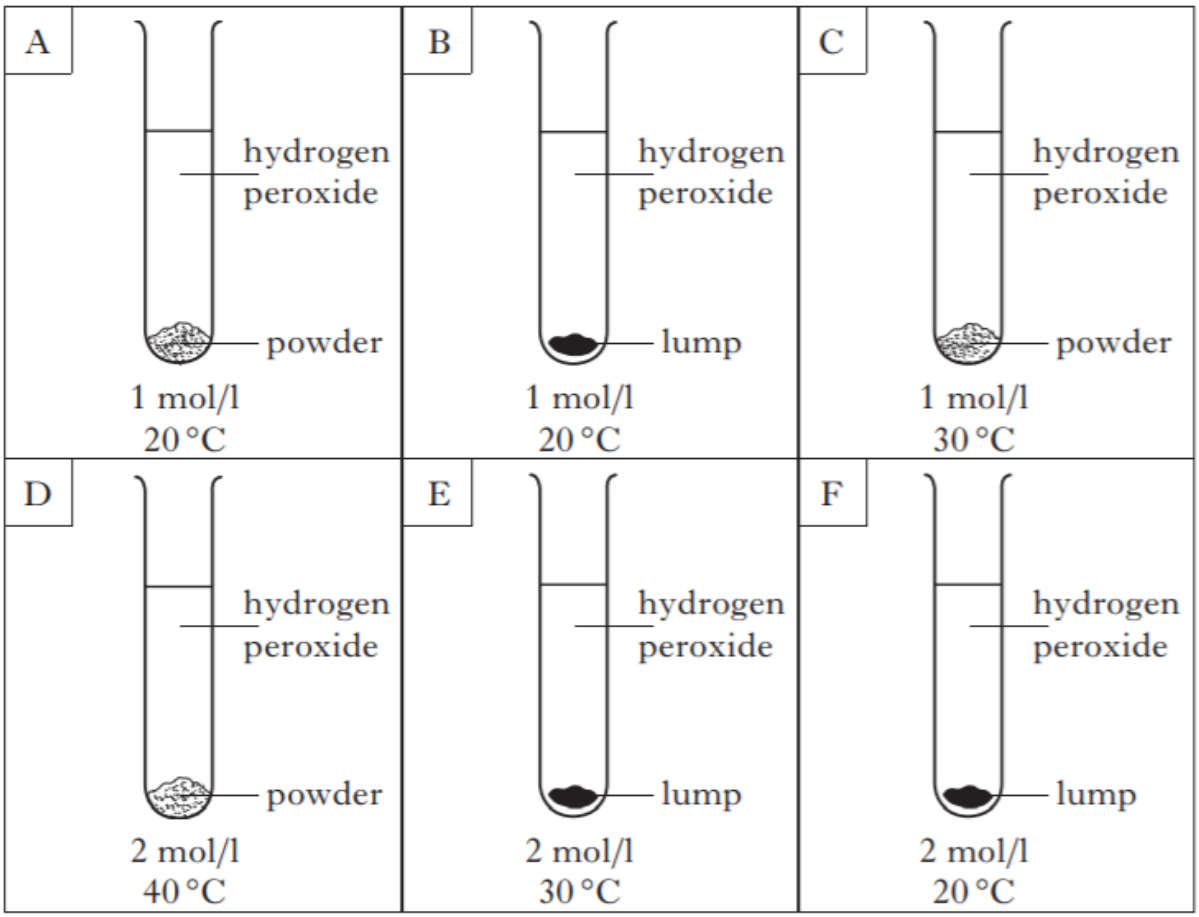
(questions continued on the next page)

4.

A catalyst speeds up the following reaction:

hydrogen peroxide ⟶ water + oxygen

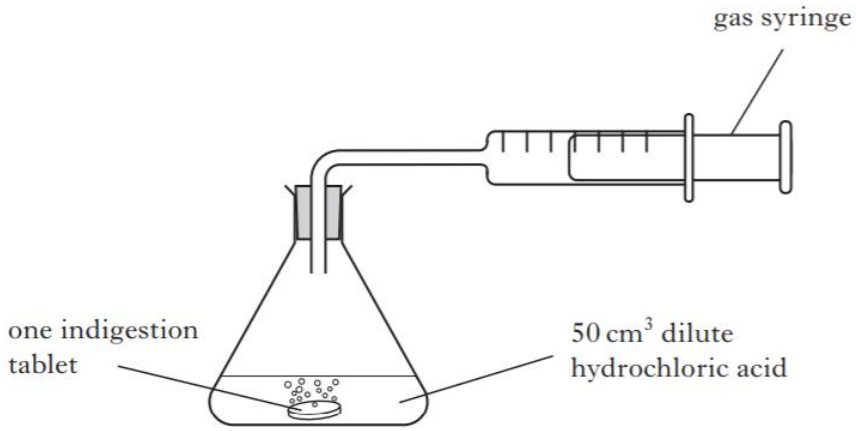
The grid shows reactions carried out using the **same** mass of catalyst with two different concentrations of hydrogen peroxide.



Identify the **two** experiments which could be used to show the effect of concentration on the speed of reaction. (1)

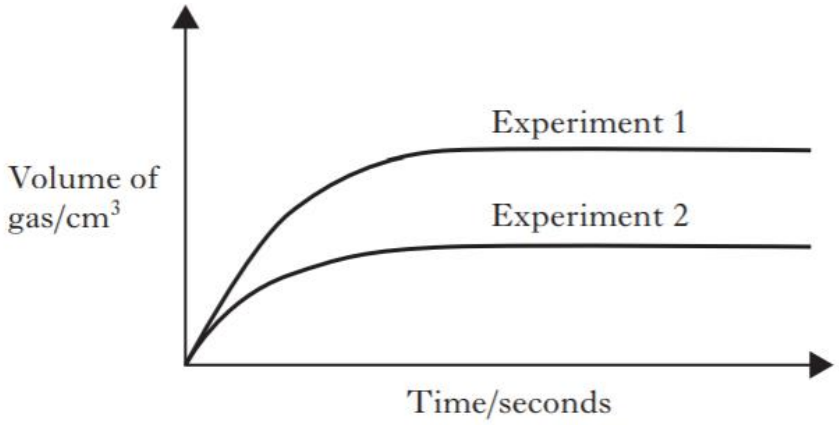
A	B	C
D	E	F

5. A student carried out 2 experiments to investigate the rate at which gas was given off when indigestion tablets were added to dilute hydrochloric acid.



Experiment 1

She used her results to draw curves on a graph.



Experiment 2 could have been carried out

A at a lower temperature

B using more concentrated hydrochloric acid

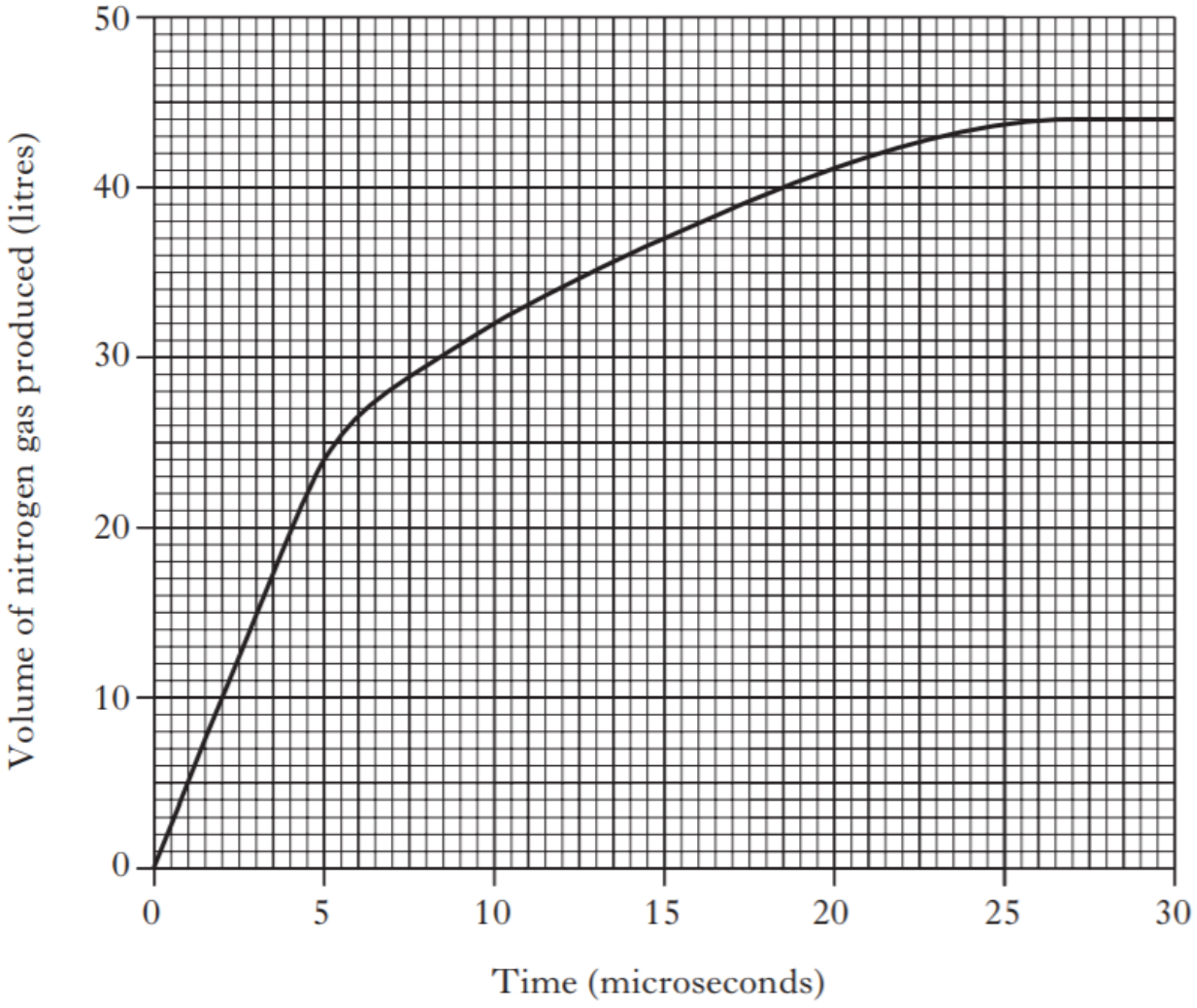
C using half an indigestion tablet

D using a crushed tablet. (1)

Section 2 – 19 marks

6. Rapid inflation of airbags in cars is caused by the production of nitrogen gas.

The graph gives information on the volume of gas produced over 30 microseconds.



(*a*) (i) Calculate the average rate of reaction between 2 and 10 microseconds.

_____ litres per microsecond (2)

(ii) At what time has half of the final volume of nitrogen gas been produced?

(1)

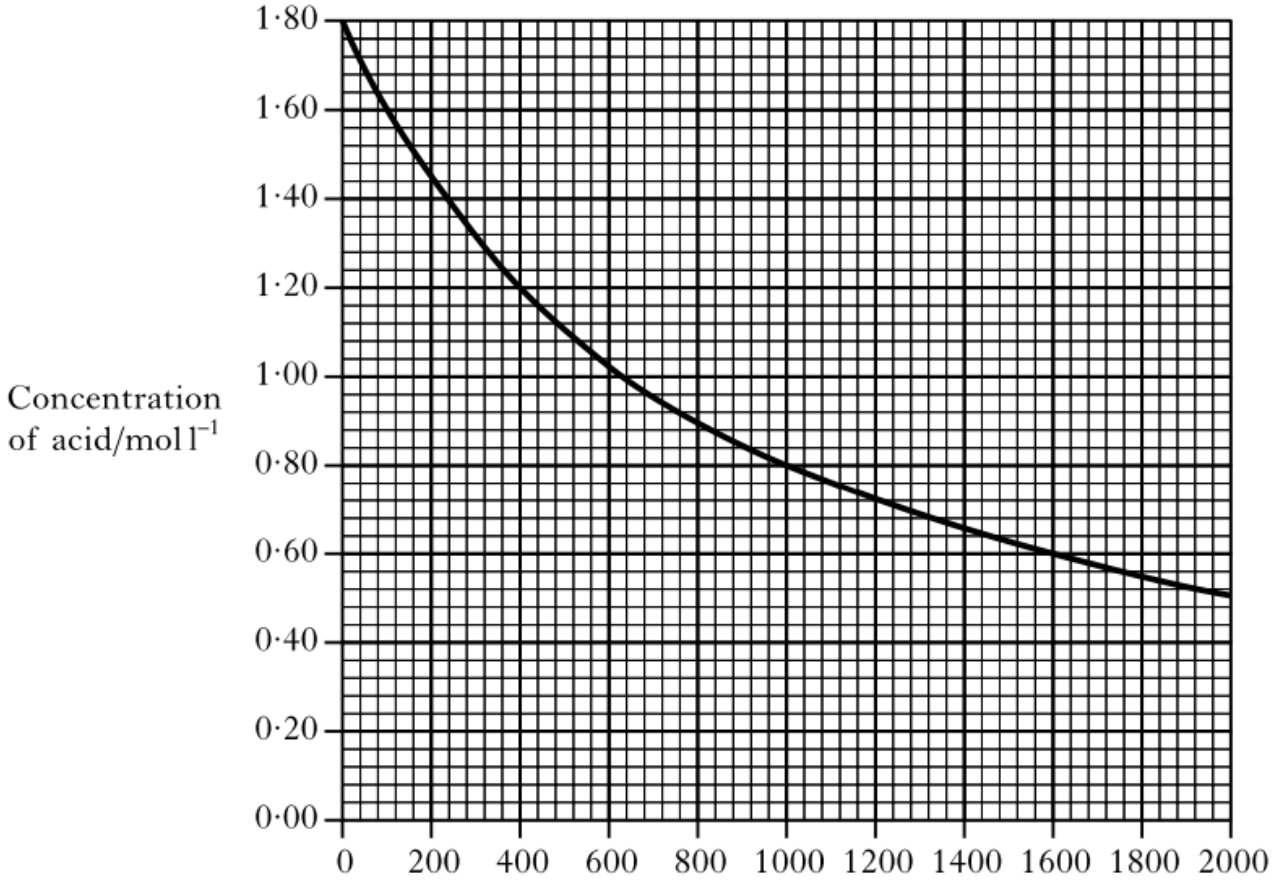
_____ microseconds

7.

Chloromethane, CH3Cl, can be produced by reacting methanol solution with dilute hydrochloric acid using a solution of zinc chloride as a catalyst.

$$CH_3OH(aq) + HCl(aq) \xrightarrow{ZnCl_2(aq)} CH_3Cl(aq) + H_2O(\ell)$$

The graph shows how the concentration of the hydrochloric acid changed over a period of time when the reaction was carried out at 20 °C.



Calculate the average rate, in mol l^{-1} min^{-1}, in the first 400 minutes.

(2)

(questions continued on the next page)

8.

Hydrogen gas can be produced in the laboratory by adding a metal to dilute acid. Heat energy is also produced in the reaction.

A student measured the volume of hydrogen gas produced when zinc lumps were added to dilute hydrochloric acid.

Time (s)	0	10	20	30	40	50	60	70
Volume of hydrogen (cm^3)	0	12	21	29	34	36	37	37

(i) Calculate the average rate of reaction, in $cm^3 s^{-1}$, between 10 and 30 seconds.

Show your working clearly.

(2)

(ii) Estimate the time taken, in seconds, for the reaction to finish.

(1)

(iii) The student repeated the experiment using the same mass of zinc.

State the effect on the rate of the reaction if zinc powder was used instead of lumps.

(1)