

Year 9

Chemistry booklet

Topic 2 – rates of reaction

Name: _____

Rates of reaction

Give a definition for each of these key words:

Reaction	
Rate	
Particles	
Collision	
Activation energy	
Concentration	
Pressure	
Surface area	
Temperature	
Catalyst	
Enzyme	
Endothermic	
Exothermic	
Yield	

Match up the fact with the reason and the model that helps explain it

Fact	Reason	Model
Reaction rate increases when a catalyst is used	This means that there is a bigger area of a solid exposed, so there is a greater chance of collisions causing a reaction.	People dancing at a party are more likely to bump into each other than people sitting down.
Reaction rate increases when temperature is increased	Small particles have a greater overall area than the same amount of big particles. This means there are more particles exposed so more collisions can happen.	If you have 100 people, they are more likely to bump into each other if in this classroom compared to the field.
Reaction rate increases when pressure is increased	Catalysts lower the 'activation energy' of a reaction, allowing it to happen with less energy input.	If you lower the bar in a high jump competition, more people can get over it.
Reactions go faster when the surface area is increased.	If particles move faster, there is more chance of them bumping into each other and therefore of a collision resulting in reaction.	A lot of children in a room are more likely to bump into each other than a few adults.
Rate of reaction increases when particle size gets smaller.	If there are more reacting particles in a given volume, then there is a greater chance of them bumping into each other.	Chips fry faster than potatoes because the oil can cover a bigger area
Reactions speed up when the reactants are more concentrated.	Reacting particles get pushed closer together so there is more chance of a successful collision happening.	More dodgems on the track means that you are more likely to bump into someone than if there were only 2 or 3

Measuring Reaction Rates

Different reactions can happen at different rates.

Reactions that happen slowly have

Reactions that happen quickly have

For example;

The chemical **weathering** of rocks is a

Explosions are very fast reactions: they have

Reactants and products

There are two ways to measure the rate of a reaction:

1.

2.

Things to measure

We can measure the rate of reaction by:

✓

✓

Equation for Measuring the Rate of Reaction:

1. What is the rate of reaction if 24cm^3 of hydrogen gas is produced in two minutes?

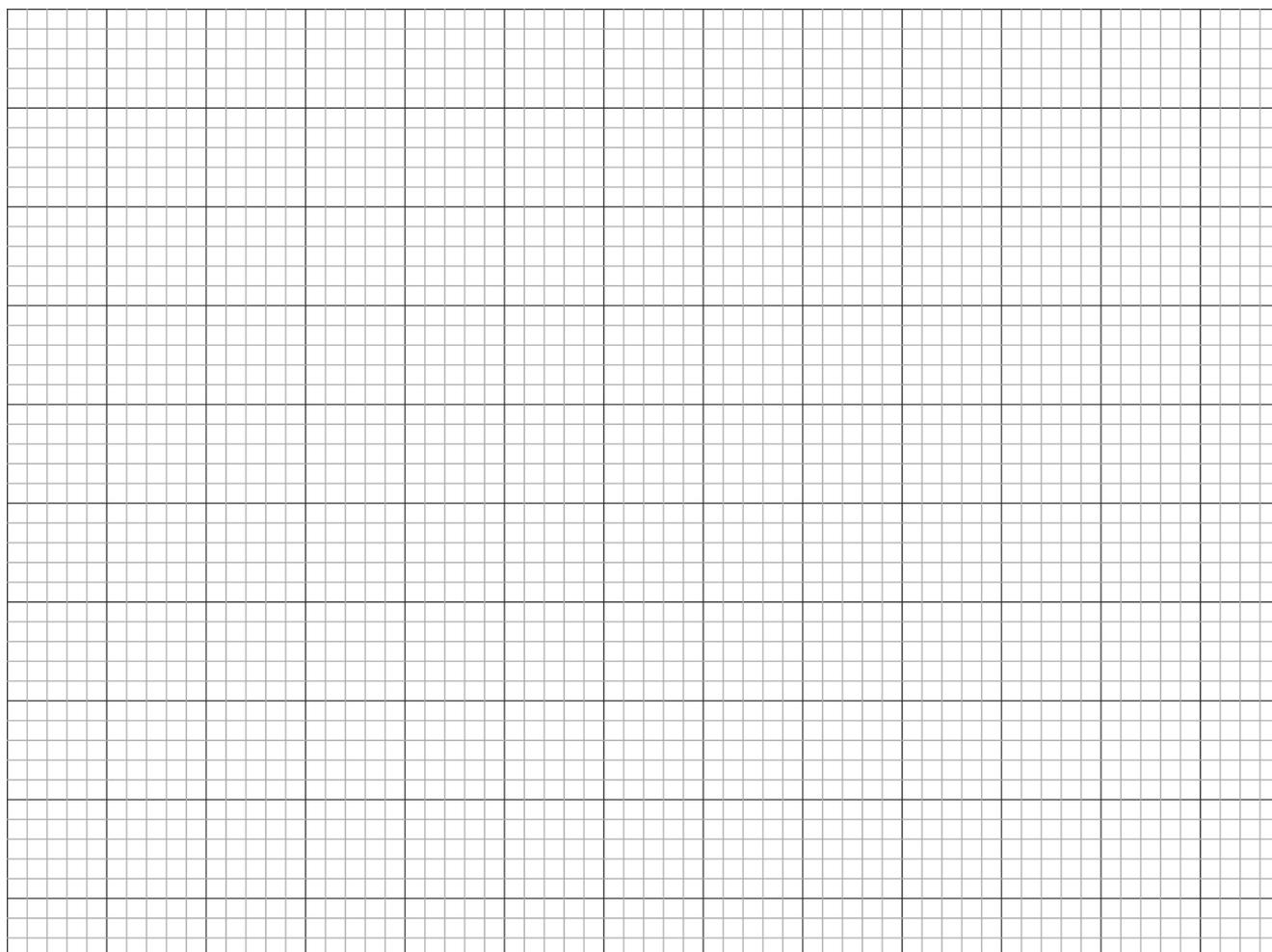
2. What is the rate of reaction if 55cm^3 of carbon dioxide gas is produced in 5 minutes?

Drawing graphs

5g of marble chips were added to 100 cm³ of 1M hydrochloric acid. The chips dissolved, producing carbon dioxide gas. The loss in mass of the chips was measured. Here is a table of results.

Time (mins)	0	2	4	6	8	10	12	14	16
Loss of mass (g)	0	2.1	3.0	3.1	3.6	3.8	4.0	4.0	4.0

Using the graph paper provided, plot a graph of the results. Join the points with a smooth curve



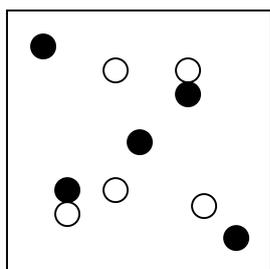
On the same graph, sketch the curve you would expect to see if 5g of marble powder was used in the experiment instead.

Collision Theory

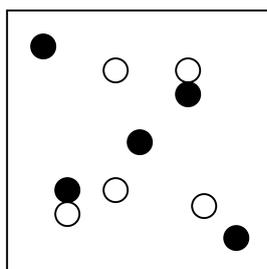
For particles to react they must collide (with sufficient energy)
The greater the number of reactive collisions, the greater the rate of the reaction.

Increased Temperature

Complete the particle diagrams by adding arrows to show particle movement



Room temp



High Temp

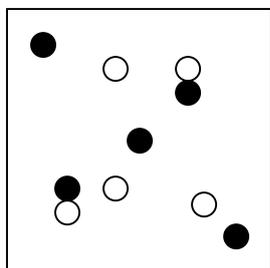
Increasing the temperature produces two effects;

1.

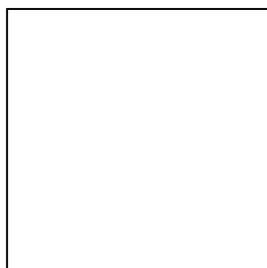
2.

Increased Concentration

Complete the diagram by adding particles as appropriate.



Low Concentration

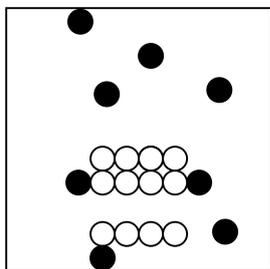


High concentration

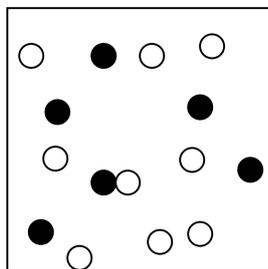
Increasing concentration increases the reaction rate because.

Increased surface Area

Add arrows to show the difference in the number of collisions



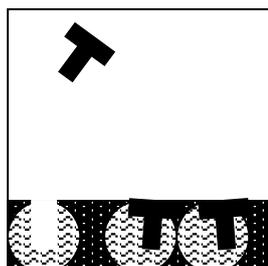
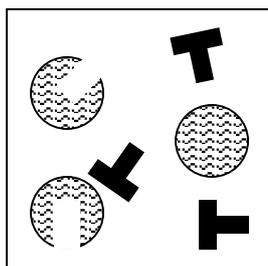
Small Surface Area



Large surface area

Increasing the surface area (Using smaller pieces) increases the reaction rate because...

Using a Catalyst.



A catalyst does 2 things to increase the rate of a reaction.

- 1.
- 2.

Catalysts work in chemical reactions where the shape of the molecules is important in the reaction. The special shaped area of the molecule involved in the reaction is called the _____ site.

Living things use specially shaped protein catalysts called _____.

There are millions of these catalysts as a different one is needed for each reaction.

Exothermic and endothermic reactions task

When the ESA (European Space Agency) launches satellites and space probes, it does so on rockets fuelled with hydrogen and oxygen. The reaction between these two chemicals produces enough energy for the rocket to reach space.

You are the safety director for the ESA's fuel plant. You have been asked to produce a safety and science briefing for new staff, explaining

- what happens when hydrogen and oxygen react (naming the products)
- the type of reaction (endothermic or exothermic)
- the evidence that the reaction is this type
- the 'types' of energy transformations that happen
- how and why the energy levels change during the reaction
- how hydrogen and oxygen are produced by electrolysis of water, and the energy changes involved in the production of these gases

BOND ENERGIES

O-H 464 kJ/mol

H-H 436 kJ/mol

O=O 498 kJ/mol

GRADE	WHAT YOU NEED TO DO
2	State how you can tell whether a reaction is exothermic or endothermic using simple lab equipment
3	Recall what energy changes are involved in exothermic and endothermic reactions; Write down the reactants and products for the reaction
4	Describe observations made during exothermic and endothermic reactions, referring to named reactions; Write a word equation for the reaction between hydrogen and oxygen
5	Explain the conditions for reactions to be endothermic or exothermic in terms of bonds; Calculate energy changes for the reaction between hydrogen and oxygen; Write a balanced symbol equation with state symbols for the reaction between hydrogen and oxygen
6	Draw a graph showing energy changes as the reaction progresses; Use correct units to describe energy changes; Describe the 'forms' of energy involved at different stages of the reaction.
7	For a reaction of your choice, demonstrate the bonds that are broken and made and use this to explain whether the reaction will be endothermic or exothermic; Link the two reactions mentioned in the briefing in terms of reactants and products, bonding and energy changes