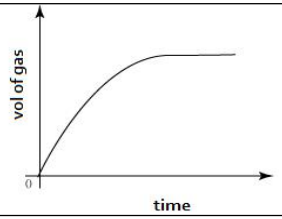
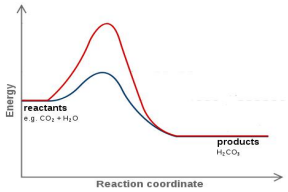
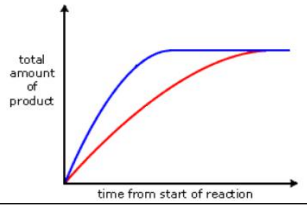
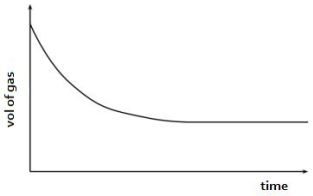
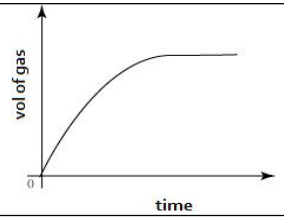
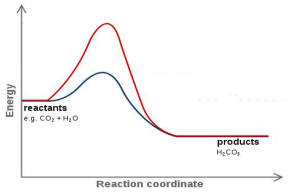
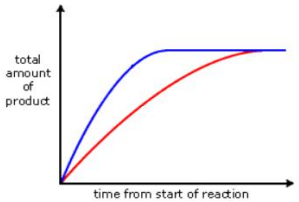
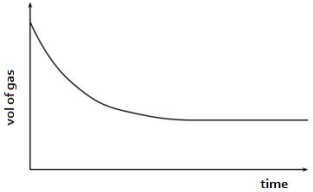
	1	2	3	4	5	6
1	amount of product made per unit time	requires sufficient energy to happen	allows rate of industrial processes to increase, whilst lowering temperature	tangent to the curve	comparable to people running around a room or walking calmly	more frequent and more energetic collisions
2	change the rate of a chemical reaction, but are not used up in the reaction	producing ammonia requires an iron catalyst		many catalysts are spread over an inert support medium	25cm^3 of hydrogen gas is produced in 5 minutes	factors affecting the reaction rate
3	catalytic converters are used in car exhausts	specific to certain reactions	plot graph and determine gradient	the minimum amount of energy required for particles to react	MILK IS PUT IN THE FRIDGE WHEN NOT BEING USED	the breakdown of hydrogen peroxide or cracking of long chain hydrocarbons
4	e.g. cm^3 per second [or H tier mol/s]		sodium thiosulfate solution and hydrochloric acid	measured with a gas syringe, or sometimes an upside down measuring cylinder		amount of reactant used per unit time
5	only affects the frequency of the collisions, not the energy	comparable to.. 5 people run around a room and then 50 people run around the same room – compare the two	e.g. adding water to orange squash	what if particles collide with insufficient energy?	flour mills could sometimes suffer explosions if the millstones were allowed to rub together with no grain and cause sparks	why use vegetable oil to cook chips instead of water?
6	activation energy		increases the average kinetic energy			comparable to lowering the bar in the high jump

	1	2	3	4	5	6
1	amount of product made per unit time	requires sufficient energy to happen	allows rate of industrial processes to increase, whilst lowering temperature	tangent to the curve	comparable to people running around a room or walking calmly	?
2	change the rate of a chemical reaction, but are not used up in the reaction	?		many catalysts are spread over an inert support medium	25cm³ of hydrogen gas is produced in 5 minutes	factors affecting the reaction rate
3	?	specific to certain reactions	plot graph and determine gradient [H tier at given time]	the minimum amount of energy required for particles to react	milk is put in the fridge when not being used	the breakdown of hydrogen peroxide or cracking of long chain hydrocarbons
4	e.g. cm^3 per second [or H tier mol/s]		?	measured with a gas syringe, or sometimes an upside down measuring cylinder		amount of reactant used per unit time
5	only affects the frequency of the collisions, not the energy	comparable to.. 5 people run around a room and then 50 people run around the same room – compare the two	e.g. adding water to orange squash	?	flour mills could sometimes suffer explosions if the millstones were allowed to rub together with no grain and cause sparks	why use vegetable oil to cook chips instead of water?
6	activation energy		increases the average kinetic energy			?

4.6.1 Reaction rates revision checklist

Can you…	☹	😐	☺
a) state the meaning of the term '*rate of reaction*' and determine the units			
b) calculate the mean rate of a reaction from given information about the quantity of a reactant used or the quantity of a product formed and the time taken			
c) draw, and interpret, graphs showing the quantity of product formed or quantity of reactant used up against time			
d) draw tangents to the curves on these graphs and use the slope of the tangent as a measure of the rate of reaction			
e) [HT only] calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time			
f) recall how changing temperature, concentration, pressure, surface and catalysts affects the rate of chemical reactions			
g) predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction			
h) predict and explain the effects of changes in the size of pieces of a reacting solid in terms of surface area to volume ratio			
i) use simple ideas about proportionality when using collision theory to explain the effect of a factor on the rate of a reaction			
j) identify catalysts in reactions from their effect on the rate of reaction and because they are not included in the chemical equation for the reaction			
k) explain catalytic action in terms of activation energy			