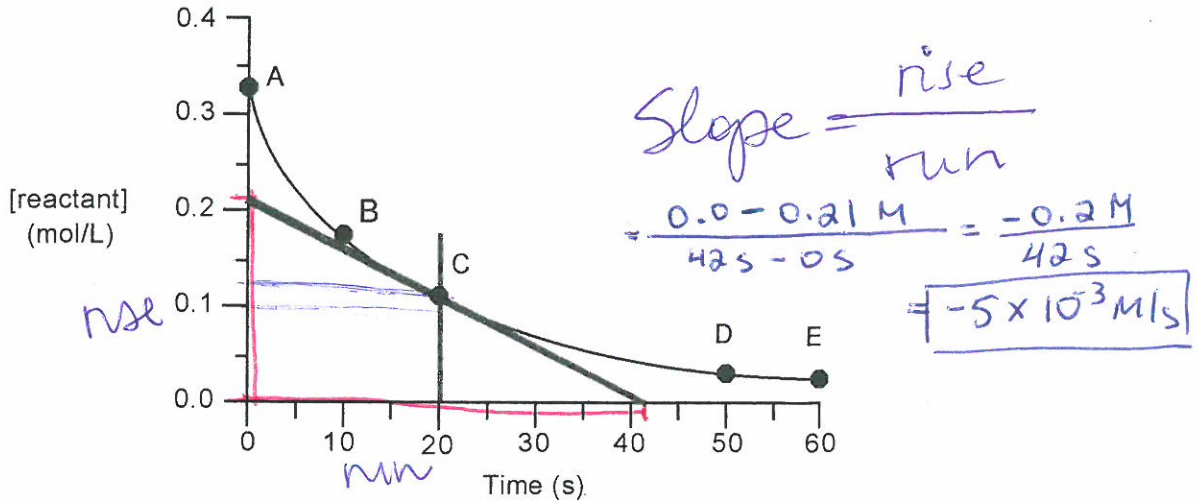


Name: Key  
 Blk: \_\_\_\_\_ Date:     

## Chemistry 12 REACTION KINETICS

### Lesson #4+5 Calculating Reaction Rates + The Collision Theory

If the concentration of a reactant is plotted versus time, the following typical behaviour is observed.



What is the reaction rate at 20 s, according to the above graph?

rise/run =  $\frac{-0.21 \text{ M}}{42 \text{ sec}} = \boxed{-5.0 \times 10^{-3}}$

The following data were collected for the reaction  $\text{Zn(s)} + 2 \text{HCl(aq)} \rightarrow \text{H}_2\text{(g)} + \text{ZnCl}_2\text{(aq)}$  in which zinc metal was reacted with 0.200 M HCl(aq).

| Time (s) | Mass Zn (g) |
|----------|-------------|
| 0        | 31.0        |
| 60       | 24.6        |
| 120      | 20.2        |
| 180      | 17.4        |

Average rate =  $\frac{\Delta \text{amount}}{\Delta \text{time}} = \frac{F - I}{F - I}$

a)  $\frac{31.0 - 24.6}{60 - 0} = \frac{-6.4 \text{ g}}{60 \text{ sec}} = -0.11 \text{ g/sec}$

b)  $\frac{17.4 \text{ g} - 20.2 \text{ g}}{180 - 120 \text{ s}} = \frac{-2.8 \text{ g}}{60 \text{ sec}} = -0.047 \text{ g/sec}$

- Calculate the average reaction rate, in g/s, from time 0 to 60 s.
- Calculate the average reaction rate, in g/s, from time 120 to 180 s.
- Explain why the average rate in part (b) is less than that in (a).

There are less reactants  $\therefore$   $\downarrow$  rxn rate.

### THE COLLISION THEORY

Recall from grade 8 Science the Kinetic Molecular Theory:

- all matter is made up of particles
- these particles are too small to be seen + are in constant motion
- particles in GASES move faster than LIQUID  $\gg$  SOLID.
- The addition of energy speeds up the motion of the particles.

In order for a reaction to occur the reactants must COLLIDE !!!!!

In order for a collision to be SUCCESSFUL the chemical species must collide with:

1. The correct geometry. (orientation/alignment)
2. Sufficient Kinetic Energy.

The Collision Theory gives us a deeper understanding to what actually causes reaction rates to change when the conditions are altered:

1. Concentration: The increase in  $[ ]$  means that more collisions are possible between molecules  $\therefore \uparrow$  in # of successful collisions/sec  $\rightarrow \uparrow$  in rxn rate.

2. Temperature: The increase in temperature means that more molecules are moving with greater KINETIC energy  $\therefore$  result in an  $\uparrow$  in successful collisions/sec  $\therefore \uparrow$  in rxn rate!

Seatwork/Homework: Exercises 20 - 22 pg 12  
PLO's: B1

$[ ]$ .

The increase in  $[ ]$  means that more collisions between particles are possible. The more collisions ~~between per~~ that occur means that the likelihood of successful collisions increase  $\therefore$  increasing the rxn rate.

Temp - the increase in temperature means that more particles are moving with increased kinetic energy. Therefore, more particles will collide with sufficient kinetic energy resulting in more successful collisions  $\therefore$  increasing reaction rate.