

1- How do you prepare 0,2 M 250 mL calcium citrate solution from calcium citrate tetrahydrate? Calculate the %(w/v) concentration of this solution.

First part of the question

($\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 4\text{H}_2\text{O}$, Ca:40; C:12; O:16; H:1.)

Molecular weight of $\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 4\text{H}_2\text{O}$ = 570.49 g/mol

$M=n/v$ $0,2=n/0,25$ $n=0,05$

$m=n \times \text{MW}$ $m=0,05 \times 570,49 = 28,5245 \text{ g}$

Alternative way for the solution of the first part of the question.

0,2 M means 0,2 mol in 1000 mL

X mol in 250 mL

$X=0,05 \text{ mol}$

If 1 mol of calcium citrate tetrahydrate is 570.49 g

0,05 mol of calcium citrate tetrahydrate is 28,5245 g

Preparing the solution

If your balance is analytical (which means capable of weighing 0,1 mg or 0,0001 g you may leave your result as it is.

But if your balance's sensitivity is 0,01 g then you should round your result to 2 digit which is 28.52 g.

Select the appropriately sized flask. Measure and transfer the calculated mass of solid material into the flask, preferably using a funnel to assure no material is lost during transfer. Rinse the sides of the funnel with your solvent (e.g. water for aqueous solutions) down into the flask to capture any residual material adhering to the funnel. Next, fill the flask about halfway with your solvent, cap the flask and swirl to dissolve the solid material into solution. Once the solid material has been dissolved, fill the flask with your solvent by carefully adding enough solvent to raise the base of the meniscus of the solution to the level of the etched line. Finally, cap, mix, swirl and store your prepared solution until ready to use.

Second part of the question from moles

This solution contains 0,05 mol calcium citrate tetrahydrate in 250 mL solution

0,05 mol calcium citrate tetrahydrate contains 0,05 mol calcium citrate.

MW calcium citrate = $570.49 - 72 = 498,49$

$m=n \times \text{MW}$ $m=0,05 \times 498,49 = 24,9245 \text{ g}$

% w/v means grams of solute in a 100 mL solution therefore;

if 24,9245 g calcium citrate presents in 250 mL
x g presents in 100 mL

x=9,9698 This solution is 9,96% (w/v).

Second part of the question from grams

This solution contains 28,5245 g calcium citrate tetrahydrate in 250 mL solution

If 570.49 g calcium citrate tetrahydrate contains 498,49 g calcium citrate

28,5245 g calcium citrate tetrahydrate contains x g of calcium citrate 24,9245 g

% w/v means grams of solute in a 100 mL solution therefore;

if 24,9245 g calcium citrate presents in 250 mL
x g presents in 100 mL

x=9,9698 This solution is 9,96% (w/v).

2- How do you prepare 0,04 N 100 mL of Zinc sulfate solution from Zinc sulfate heptahydrate? If you take 5 mL from this solution and diluted to 1L using distilled water what is the % w/v concentration and ppm of the final solution.

Reaktifler	Formül	Tesir Değerliği
Alüminyum potasyum sülfat	$Al.K(SO_4)_3.12H_2O$	4
Amonyak	NH_3	1
Amonyum hidrojen ortofosfat	$(NH_4)_2HPO_4$	3
Amonyum hidroksit	NH_4OH	1
Amonyum karbonat	$(NH_4)_2CO_3$	2
Amonyum klorür	NH_4Cl	1
Amonyum molibdat	$(NH_4)_6Mo_7O_{24}.4 H_2O$	6
Amonyum okzalit	$(NH_4)_2C_2O_4.H_2O$	2
Amonyum sodyum hidrojen ortofosfat	NH_4NaHPO_4	3
Amonyum sülfat	$(NH_4)_2SO_4$	2

Reaktifler	Formül	Tesir Değerliği
Amonyum tiyosiyanat	NH ₄ CNS	1
Arsenik (III) oksit	As ₂ O ₃	4
Arsenik trisülfid	As ₂ S ₃	4
Asetik asit	C ₂ H ₄ O ₂	1
Bakır oksit	CuO	2
Bakır sülfat 5H ₂ O	CuSO ₄ .5H ₂ O	2
Baryum hidroksit	Ba(OH) ₂	2
Baryum karbonat	BaCO ₃	2
Baryum klorür. 2H ₂ O	BaCl ₂ .2H ₂ O	2
Baryum oksit	BaO	2
Baryum peroksit	BaO ₂	2
Borik asit	H ₃ BO ₃	3
Civa (II) klorür	HgCl ₂	2
Çinko sülfat 7H ₂ O	ZnSO ₄ 7H ₂ O	2
Demir (II) sülfat	FeSO ₄ .7H ₂ O	1
Ferro oksit	FeO	1
Ferro (II) amonyum sülfat	FeSO ₄ (NH ₄) ₂ .SO ₄ .6H ₂ O	1
Formik asit	HCOOH	1
Fosforik asit	H ₃ PO ₄	3
Gümüş nitrat	AgNO ₃	1
Hidroferrosiyamik asit	H ₄ Fe(CN) ₆	1
Hidrojen peroksit	H ₂ O ₂	2
Hidrojen sülfür	H ₂ S	2
Hidroklorik asit	HCl	1
İyot	I	1
Kalay klorür	SnCl ₂	2
Kalay oksit	SnO	2
Kalsiyum hidroksit	Ca(OH) ₂	2
Kalsiyum karbonat	CaCO ₃	2
Kalsiyum klorür 6H ₂ O	CaCl ₂ .6H ₂ O	2
Kalsiyum oksit	CaO	2
Krom (VI) oksit	CrO ₃	4
Kurşun (IV) – oksit	PbO ₂	2
Kükürtdioksit	SO ₂	2
Laktik asit	C ₃ H ₆ O ₃	1
Magnezyum karbonat	MgCO ₃	2
Magnezyum klorür	MgCl ₂	2
Magnezyum klorür 6H ₂ O	MgCl ₂ .6H ₂ O	2
Malik asit	C ₄ H ₆ O ₅	2

Reaktifler	Formül	Tesir Deęerlięi
Mangan sülfat	MnSO ₄	2
Manganez peroksit	MnO ₂	2
Nitrik asit	HNO ₃	1
Oksalik anhidrit	C ₂ O ₃	2
Okzalik asit 2H ₂ O	C ₂ H ₂ O ₄ . 2H ₂ O	2
Perklorik asit	HClO ₄	1
Potasyum tiyosiyanat	KSCN	1
Potasyum bikarbonat	KHCO ₃	1
Potasyum bromür	HBr	1
Potasyum bikromat	K ₂ Cr ₂ O ₇	6
Potasyum hidroksit	KOH	1
Potasyum iyodat	KIO ₃	6
Potasyum iyodit	KI	1
Potasyum karbonat	K ₂ CO ₃	2
Potasyum klorür	KCl	1
potasyum nitrat	KNO ₃	1
Potasyun nitrit	KNO ₂	2
Potasyum permanganat	KmnO ₄	5
Potasyum siyanür	KCN	1
Potasyun sülfat	K ₂ SO ₄	2
Potasyum sodyum tartarat	NaKC ₄ H ₄ O ₆ (4H ₂ O)	2
Potasyum tiyosiyanat	KSCN	1
Potasyum kromat	K ₂ CrO ₄	3
Sitrik asit	C ₆ H ₈ O ₇ . H ₂ O	3
Sodyum hidroksit	NaOH	1
Sodyum karbonat	Na ₂ CO ₃	2
Sodyum klorat	NaClO ₃	6
Sodyum klorür	NaCl	1
Sodyum nitrat	NaNO ₃	1
Sodyum nitrit	NaNO ₂	2
Sodyum oksalat	Na ₂ C ₂ O ₄	2
Sodyum oksit	Na ₂ O	2
Sodyum sülfit	Na ₂ S	2
Sodyum tiyosülfat	Na ₂ S ₂ O ₃ .5H ₂ O	1
Sodyumbikarbonat	NaHCO ₃	1
Süksinik asit	H ₂ C ₄ H ₄ O ₄	2
Sülfürik asit	H ₂ SO ₄	2
Tartarik asit	C ₄ H ₆ O ₆	2

Solution of the first part of the question.

($\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, Zn:65,39; S:32; O:16; H:1.)

First we should convert normality to molarity

$$N = e \times M \quad 0,04 = 2 \times M \quad M = 0,02$$

0,02 M means 0,02 mol in 1000 mL

0,002 mol in 100 mL

$$0,002 \times \text{MW of } \text{ZnSO}_4 \cdot 7\text{H}_2\text{O} (287.56 \text{ g/mol}) = 0,57512 \text{ g of } \text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$$

Do not forget to explain how you prepare this solution!

Second part of the question from grams

This solution contains 0,57512 g $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ in 100 mL

287,56 g $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ contains 161,56 g ZnSO_4

0,57512 g $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ contains x g ZnSO_4

X = 0,32312 g ZnSO_4 in 100 mL

If 0,32312 g ZnSO_4 in 100 mL

X g in 5 mL

X = 0,016156 g

If 0,016156 g ZnSO_4 presents in 5 mL solution when diluted to 1 L using distilled water this value does not change.

If 0,016156 g ZnSO_4 in 1000 mL

X g in 100 mL

X = 0,0016156 g in 100 mL This solution is %0,0016156 (w/v) or %0,0016.

Third part of the question

If 0,016156 g ZnSO_4 in 1000 mL

16,156 mg in 1000 mL

16,156 ppm

3 How do you prepare 0,8 N 500 mL hydrogen peroxide solution from 30% H_2O_2 stock solution $d=1,11 \text{ g/mL}$ $\text{MW}=34 \text{ g/mol}$

Solution

1- Convert normality to molarity

$$N = e \times M \quad 0,8 = 2 \times M \quad M=0,4$$

2- Calculate how many gram do you need to prepare this solution.

0,4 M means 0,4 mol in 1000 mL

0,2 mol in 500 mL

$$0,2 \times 34 = 6,8 \text{ g H}_2\text{O}_2$$

3- Calculate real density

1 mL H_2O_2 solution contains 1,11 g total matter but only 30% of this matter is H_2O_2

Therefore 1 mL H_2O_2 solution contains $1,11 \times 0,30 = 0,333 \text{ g H}_2\text{O}_2$

4- Calculate the needed mL of the solute

If 1 mL of solution contains 0,333 g H_2O_2

X mL of solution contains 6,8 g H_2O_2

$X=20,42042042042042 \text{ mL}$ or $x=20,42 \text{ mL}$

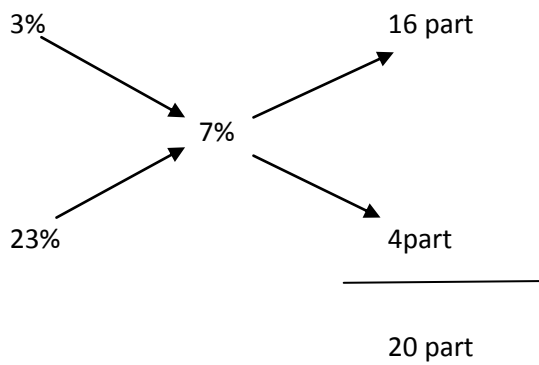
Preparing the solution

Select 500 mL volumetric flask. Measure and transfer the calculated volume of the liquid material into the flask, preferably using a funnel to assure no material is lost during transfer. Rinse the sides of the funnel with your solvent (e.g. water for aqueous solutions) down into the flask to capture any residual material adhering to the funnel. Next, fill the flask about halfway with your solvent, cap the flask and swirl. Then, fill the flask with your solvent by carefully adding enough solvent to raise the base of the meniscus of the solution to the level of the etched line. Finally, cap, mix, swirl and store your prepared solution until ready to use.

This 500 mL solution contains 6,8 g of H_2O_2 , therefore %1.36 (w/v) or 13600 ppm

4- How do you prepare 7% (v/v) ethanol solution using 3% and 23 % stock solutions. What is the molarity of this solution (Density of absolute ethanol is 0.789 g/mL)?

For 100 mL final solution.



If 20 part is 100 mL

4 part is x mL

X = 20 mL

In order to prepare this solution we should take 4 part (or 20 mL) from 23% stock solution, transfer it to 100 mL volumetric flask and complete the volume using 3% stock solution.

7% (v/v) means 7 mL of ethanol in 100 mL solution.

If 1 mL of ethanol is 0,789 g

7 mL of ethanol is x g

X = 5,523 g ethanol in 100 mL solution

55,23g ethanol in 1000 mL

$55,23/46,07 = 1,1988278$ mol or 1,2 M.

4- The reaction between propionaldehyde and hydrocyanic acid has been studied at 25 °C. In a certain aqueous solution at 25 °C the concentrations at various times were as follows.

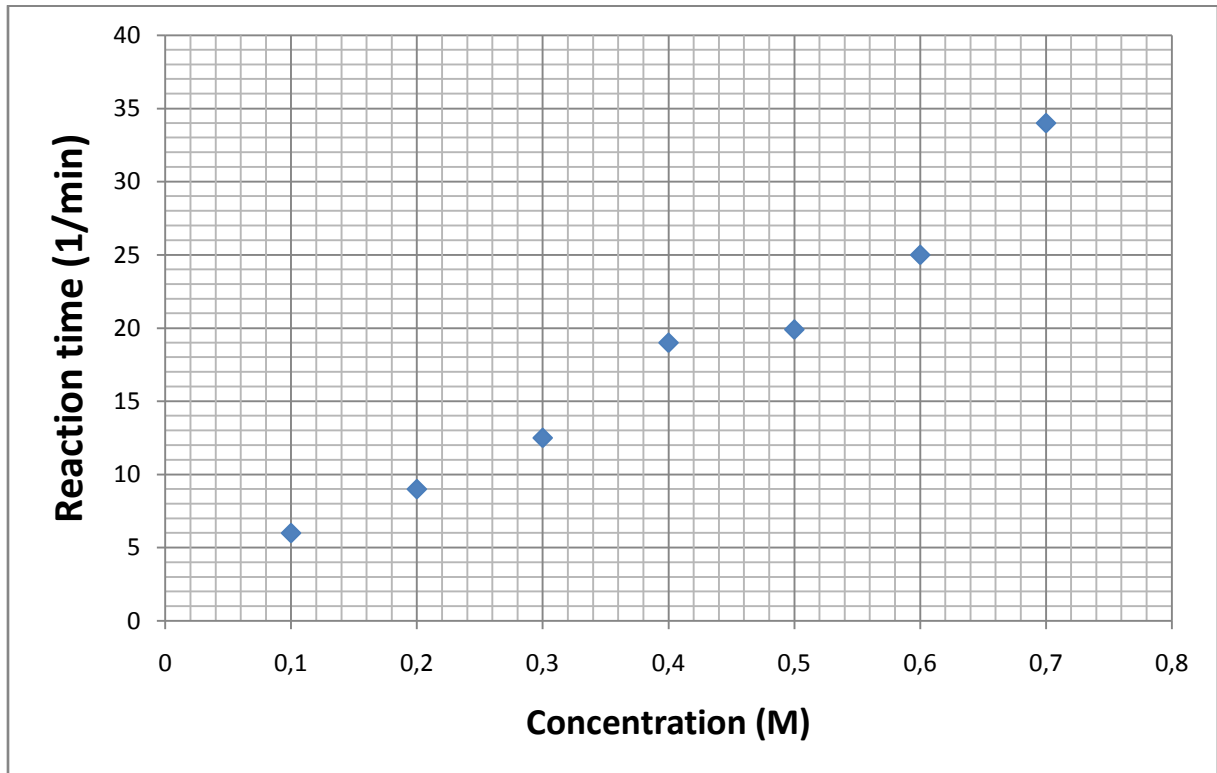
[HCN] Reaction time (min)

0,1	0,24
0,2	0,12
0,3	0,08
0,4	0,06
0,5	0,05
0,6	0,04
0,7	0,03

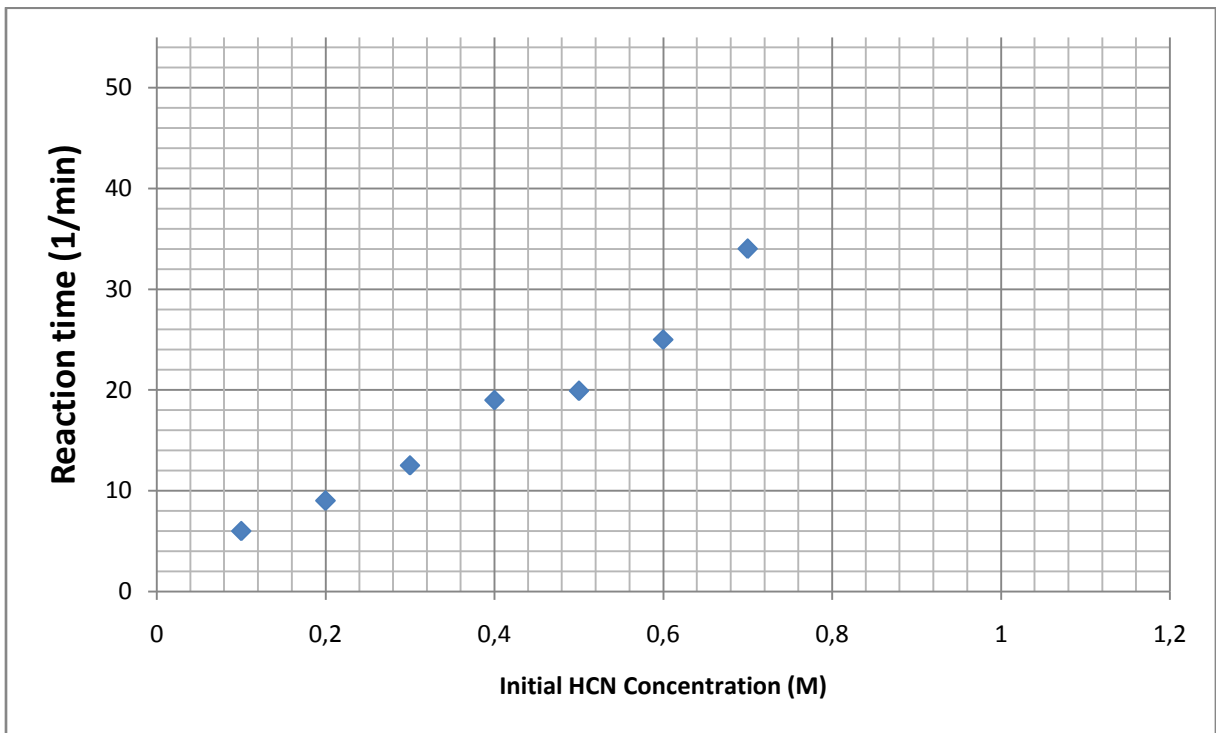
If initial HCN concentration is 1.2M, 0,35M or 0,05 M what is the expected reaction times?

We should draw the graphic of Initial conc. Versus 1/ reaction time

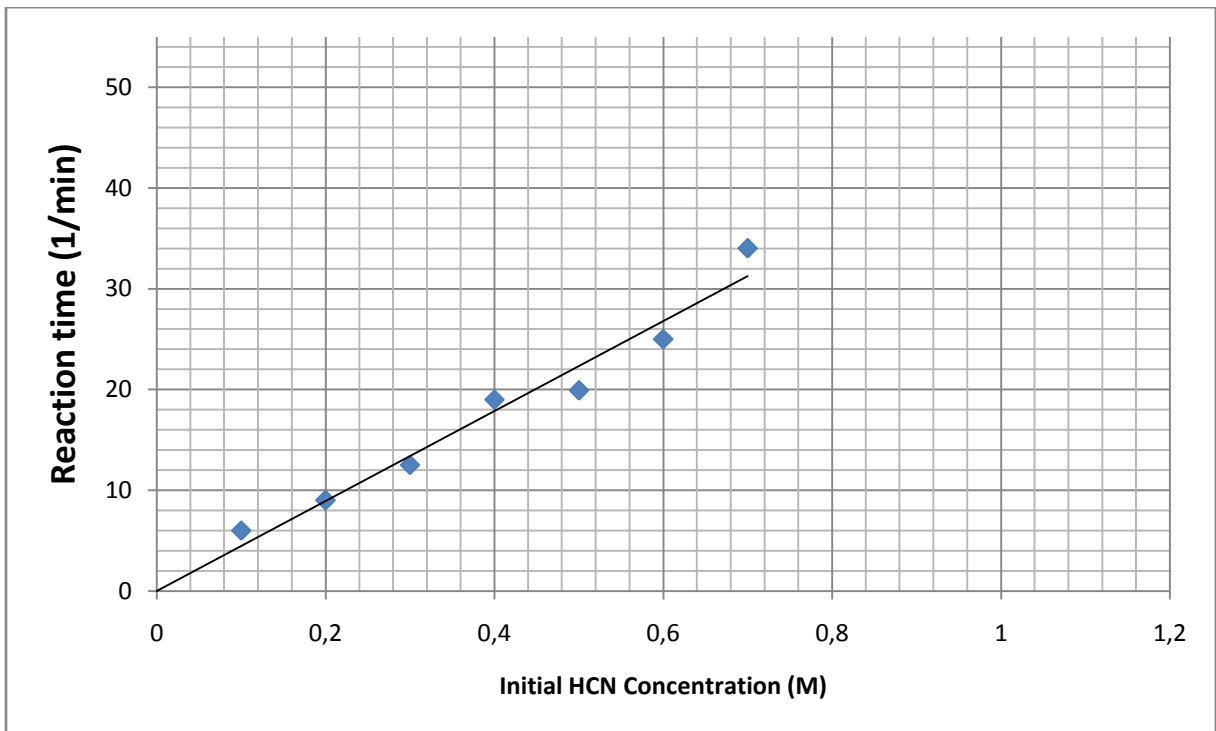
[HCN]	Reaction time (min)	1/Reaction time
0,1	0,24	6
0,2	0,12	9
0,3	0,08	12,5
0,4	0,06	19
0,5	0,05	19,9
0,6	0,04	25
0,7	0,03	34



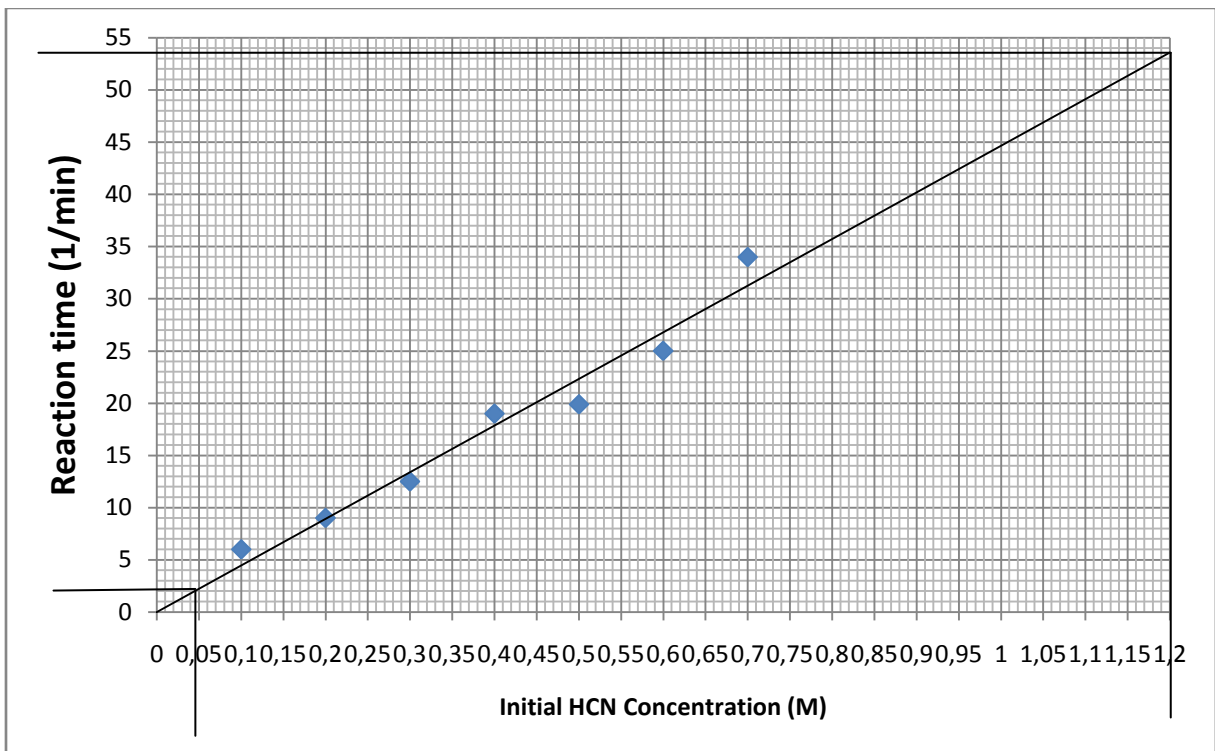
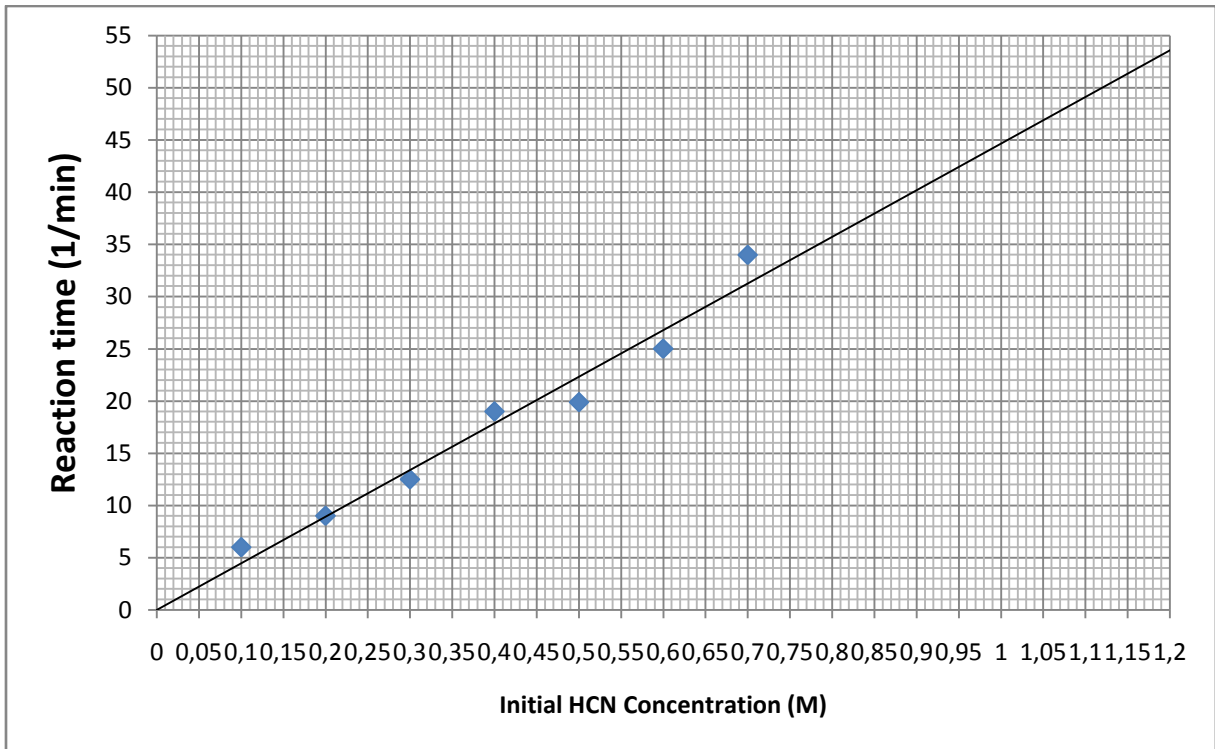
You should carefully choose your limit values. For this problem we have to find out the rate of the reaction with the 1.2 M initial concentration therefore your graphic should include 1.2 M.



Draw your trend line and find the answers.



For values outside your experimental area extrapolate the answer.



You can also calculate the slope and determine the graphics equation. For this purpose either use your best fitted experimental data or directly calculate from the trendline.

For graphics intercept at zero $y=mx$

For graphics not intercept at zero $y=mx+c$

For this problem when $x=0,2$ $y= 9$ $y/x= 45$ $y=45x$

$$Y=45 \times 1.2 = 54$$

You may use computer programs to calculate this value.

$$y = 44,64x$$

$$R^2 = 0,962$$

5- Hydrogen peroxide reacts with thiosulfate ion in slightly acidic solution as follows.



This reaction rate is independent of the hydrogen-ion concentration in the pH range 4 to 6. The following data were obtained at 25 °C and pH 5.0. Draw the graphic between initial concentration and 1/reaction rate.

Flask	0,5 M H ₂ O ₂	0,1 M Na ₂ S ₂ O ₃	CH ₃ COOH/ NaCH ₃ COOH Buffer pH 5	Distilled Water	Reaction rate s
1	10 mL	0mL	50 mL	40 mL	4200
2	10 mL	1 mL	50 mL	39 mL	2900
3	10 mL	2 mL	50 mL	38 mL	2500
4	10 mL	5 mL	50 mL	35 mL	1200
5	10 mL	8mL	50 mL	32 ml	900
6	10 mL	10 mL	50 mL	30 mL	720

First we have to calculate the molarity of Na₂S₂O₃ in each flask.

For flask 1 concentration is zero.

For Flask 2 we take 1 mL from 0,1 M solution

$$0,1 \text{ mol} \quad 1000 \text{ mL}$$

$$0,0001 \text{ mol} \quad 1 \text{ mL}$$

Then we make up to volume to 100 mL.

$$0,0001 \text{ mol in } 100 \text{ mL}$$

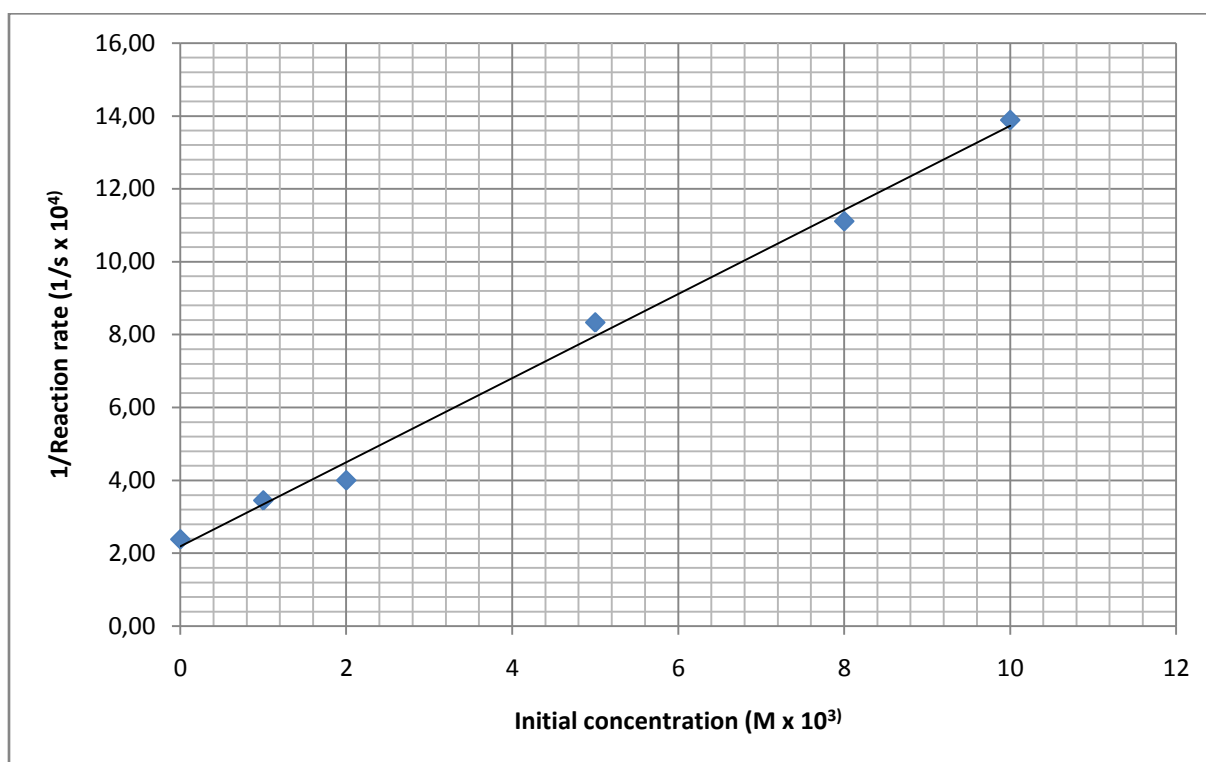
$$0,001 \text{ mol in } 1000 \text{ mL or } 0,001 \text{ molar.}$$

Since this value is hard to write down we can use mmolar (mM) or exponential value $1 \times 10^{-3} \text{ M}$

Other values are proportional with the second value.

Flask	0,5 M H ₂ O ₂	0,1 M Na ₂ S ₂ O ₃	CH ₃ COOH/ NaCH ₃ COOH Buffer pH 5	Distilled Water	[Na ₂ S ₂ O ₃] M	Reaction rate s	1/Reaction rate s ⁻¹
1	10 mL	0mL	50 mL	40 mL	0	4200	0,000238
2	10 mL	1 mL	50 mL	39 mL	0,001	2900	0,000345
3	10 mL	2 mL	50 mL	38 mL	0,002	2500	0,000400
4	10 mL	5 mL	50 mL	35 mL	0,003	1200	0,000833
5	10 mL	8mL	50 mL	32 ml	0,008	900	0,001111
6	10 mL	10 mL	50 mL	30 mL	0,010	720	0,001389

Flask	0,5 M H ₂ O ₂	0,1 M Na ₂ S ₂ O ₃	CH ₃ COOH/ NaCH ₃ COOH Buffer pH 5	Distilled Water	[Na ₂ S ₂ O ₃] M	Reaction rate s	1/Reaction rate s ⁻¹
1	10 mL	0mL	50 mL	40 mL	0	4200	2,38 x10 ⁻⁴
2	10 mL	1 mL	50 mL	39 mL	1 x 10 ⁻³	2900	3,45 x 10 ⁻⁴
3	10 mL	2 mL	50 mL	38 mL	2 x 10 ⁻³	2500	4x10 ⁻⁴
4	10 mL	5 mL	50 mL	35 mL	5 x 10 ⁻³	1200	8,33 x 10 ⁻⁴
5	10 mL	8mL	50 mL	32 ml	8 x 10 ⁻³	900	11,11x10 ⁻⁴
6	10 mL	10 mL	50 mL	30 mL	10 x 10 ⁻³	720	13,89 x 10 ⁻⁴



In order to determine graphics equation we have to know the slope and intercepts.

$$Y=mx+c$$

$$y = 1,154x + 2,193$$

$$R^2 = 0,994$$

