

KIMYO FANIDAN REAKSIYA TEZLIGIGA DOIR MASALALAR YECHISH SAMARADORLIGINI OSHIRISH

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Reaksiya tezligiga doir masalalar yechish uslubiyotini mukamallashtirish.

Har qanday hisob – kitob zahirida matematik bilim yotadi. Bugun siz kimyo masalalarini yechishda matematik usullarni takomillashtirib, masalalarni tez va qulay usulda yechishni ko'rib o'tasiz.

Eslatma:

Masalalar ishlashda yaxshi natija qayd etish uchun quyidagi 2 usulni bilish sizni yaxshi natijalar sari yetaklaydi:

1. Mavzuning nazariy qismini to'la tushunish;
2. Masala ishlashning eng oson usulini topish;

Yuqorida ta'kidlangan ikkita usul ichidan ikkinchisini topish ba'zi bir o'quvchilarga qiyinchilik tug'diradi. Bu usulni dastlab oson, so'ngra qiyin masalalar orqali o'rganasiz:

1 – xil masala:

1) $\text{CO} + \text{Cl}_2 \leftrightarrow \text{COCl}_2$ sistemada CO konsentratsiyasi 0,6 M dan 1,2 M gacha, Cl_2 konsentratsiyasi 0,3 M dan 0,9 M gacha oshirildi. Reaksiya tezligi qanday o'zgarganligini toping?

- A) 6 marta ortgan B) 6 marta kamaygan
C) 3 marta ortgan D) 5 marta kamaygan

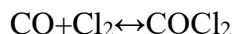
Yechimi:

Dastlab reaksiyani tenglashtirib yozib olamiz: $\text{CO} + \text{Cl}_2 \leftrightarrow \text{COCl}_2$

1– usul : Har doimgi usul orqali ishlaymiz:

a) Masala shartidan ko'rinib turibdiki CO ning dastlabki konsentratsiyasi 0,6 mol/l Cl_2 ning dastlabki konsentratsiyasi esa 0,3 mol/l ni tashkil qiladi . Endi biz «**MASALAR TA'SIRI**» qonuni qo'llagan holda dastlabki reaksiya tezligini topib olamiz:

-ushbu reaksiyaning tezlik konstantasi ikkala holatda ham o'zgarmaydi



$V_1 = K \cdot [\text{CO}] \cdot [\text{Cl}_2]$ endi tezlikni topamiz: $V_1 = K \cdot 0,6 \cdot 0,3 = 0,18K \text{ mol/(l}\cdot\text{s)}$ tezlik topildi

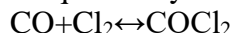
b) CO ning oxirgi konsentratsiyasi 1,2 mol/l , Cl_2 ning oxirgi konsentratsiyasi esa 0,9 mol/l ni tashkil qiladi. Endi ushbu reaksiyaning oxirgi holat uchun tezligi topiladi:

$V_2 = K \cdot [\text{CO}] \cdot [\text{Cl}_2]$ orqali tezlik topiladi : $V_2 = K \cdot 1,2 \cdot 0,9 = 1,08K \text{ mol/(l}\cdot\text{s)}$ c)

oxirgi tezlikni dastlabki tezlikka nisbatini topamiz: $V_2 : V_1 =$

$1,08K : 0,18K = 6$ Javob: 6 marta ortgan «A»

2 – usul: Qulay usul orqali ishlaymiz:



- Reaksiyasi uchun ikkala holatda ham tezlik konstantasi o'zgarmaydi , shuni bilgan holatda CO va Cl_2 larning konsentratsiyalari necha martadadan o'zgarganligini topib olamiz:

$[\text{CO}]$ uchun : $1,2 : 0,6 = 2$ marta ortgan, $[\text{Cl}_2]$ uchun: $0,9 : 0,3 = 3$ marta ortgan.

- CO va Cl_2 larning reaksiyada koeffitsiyentlari 1 ga teng bo'lganligi uchun ikkala ortish bir – biriga ko'paytiriladi : $2 \cdot 3 = 6$ Javob : 6 marta ortadi «A»

2) $\text{CO} + \text{O}_2 \leftrightarrow \text{CO}_2$ sistemada CO konsentratsiyasi 0,3 M dan 1,2 M gacha, O_2 konsentratsiyasi 0,2 M dan 0,6 M gacha oshirildi. Reaksiya tezligi qanday o'zgarganligini toping?

- A) 12 marta ortgan B) 24 marta kamaygan
C) 48 marta ortgan D) 36 marta kamaygan

Yechimi:

-Dastlab reaksiyani tenglashtirib yozib olamiz: $2\text{CO} + \text{O}_2 \leftrightarrow 2\text{CO}_2$

- masalani

ikkinchi usul orqali ishlaymiz:

[CO] uchun : $1,2 : 0,3 = 4$ marta ortgan [O₂] uchun: $0,6 : 0,2 = 3$ marta ortgan

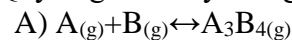
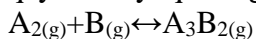
$V = K \cdot [CO]^2 \cdot [O_2]$ orqali ishlaymiz : $4^2 \cdot 3 = 48$

Javob:

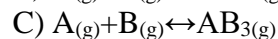
Reaksiya tezligi 48 marta ortgan «C»

2 – xil masala

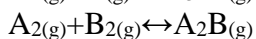
1) Reaksiyadagi A va B moddalarning konsentratsiyalari tegishli ravishda 2 va 3 marta oshirilganda to'g'ri reaksiyaning tezligi 54 marta o'zgardi. Quyidagi reaksiya tenglamalarining qaysi biri yuqoridagi shartlarni qanoatlantiradi ?



B)



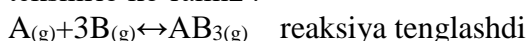
D)



Yechimi:

1 – usul : Hamma ushbu xildagi masalalarni javobdan foydalanib ishlaydi . Bu degani 4 tala javobni ham o'rniga qo'yish demakdir .

- Ushbu masalaning javobi «C» ligini bilgan holatda ishlaymiz: «C» javobdagi reaksiyani yozib tenglashtirib tekshirib ko'ramiz :



Tekshirish: $2 \cdot 3^3 = 54$ demak «C» javob to'g'ri ekan

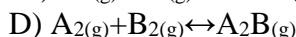
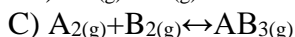
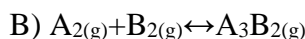
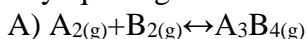
2 – usul : Bu usulda ishlashda javoblardan foydalanish shart emas .

Dastlab 54 sonini tub ko'paytuvchilarga ajratamiz:

$$\begin{array}{r|l} 54 & 2 \\ 27 & 3 \\ 9 & 3 \\ 3 & 3 \\ 1 & \end{array} \quad 54 = 2 \cdot 3^3$$

mahsulot tarkibida A elementdan 1 ta, B elementdan 3 ta bo'lib mahsulot tarkibi AB₃ ko'rinishida bo'lsa javob «C»

2) Reaksiyadagi A₂ va B₂ moddalarning konsentratsiyalari tegishli ravishda 2 va 3 marta oshirilganda to'g'ri reaksiyaning tezligi 12 marta o'zgardi. Quyidagi reaksiya tenglamalarining qaysi biri yuqoridagi shartlarni qanoatlantiradi?



Yechimi:

- Dastlab 12 sonini tub ko'paytuvchilarga ajratamiz :

$$\begin{array}{r|l} 12 & 2 \\ 6 & 2 \\ 3 & 3 \\ 1 & \end{array} \quad 12 = 2^2 \cdot 3$$

- mahsulot tarkibida A₂ elementdan 2 ta , B₂ elementdan 1 ta bo'lib mahsulot tarkibi A₄B₂ yoki A₂B ko'rinishida bo'lsa javob «D»

3 – xil masala

Yuqoridagi ikki xil masalani yechilishlari taqqoslasangiz albatta 2 – usulni qulay deb bilasiz . Qolgan xildagi masalalarni faqat ikkinchi ya'ni matematik usullarni qo'llagan holda yechiladi.

1) $CO + O_2 \leftrightarrow CO_2$ reaksiyasida idish hajmi uch marta kamaytirilib, temperatura 10°C ga tushirilsa, to'g'ri reaksiya tezligi qanday o'zgaradi? $\gamma=3$ A) 27 marta ortadi B) 3 marta kamayadi C) 9 marta ortadi D) o'zgarmaydi

Yechimi:



-Hajm

orqali tezlik o'zgarishi: $3^2 \cdot 3 = 27$ reaksiya tezligi 27 marta ortdi

-Temperatura orqali

tezlik o'zgarishi : $3^1 = 3$ reaksiya tezligi 3 marta kamaydi

-Ortish kamayishga bo'linadi:

$$27 : 3 = 9$$

«C»

Javob : reaksiya tezligi 9 marta ortadi

2) $\text{NO} + \text{O}_2 \leftrightarrow \text{NO}_2$ reaksiyasida idish bosimi ikki marta kamaytirilib, temperatura 60°C ga oshirilsa, to'g'ri reaksiya tezligi qanday o'zgaradi? $\gamma=2$ A) 8 marta ortadi B)

512 marta kamayadi C) 16 marta ortadi D) o'zgarmaydi

Yechimi:

-Dastlab reaksiya tenglashtiriladi: $2\text{NO} + \text{O}_2 \leftrightarrow 2\text{NO}_2$

-Bosim orqali tezlik o'zgarishi: $2^2 \cdot 2 = 8$ reaksiya tezligi 8 marta kamayadi -Temperatura

orqali tezlik o'zgarishi : $2^6 = 64$ reaksiya tezligi 64 marta oshadi -Ortish kamayishga

bo'linadi: $64 : 8 = 8$

Javob : reaksiya tezligi 8 marta ortadi «A»

4 – xil masala

1) 30°C da ikkita reaksiyaning tezligi bir xil bo'lib, ularning biri uchun temperatura koeffitsienti 2 ga, ikkinchisi uchun 4 ga teng. Qanday temperaturada ularning tezliklari bir-biridan 8 marta farq qiladi?

A) 40 B) 60 C) 70 D) 50

Yechimi:

QOIDA: Har – qanday sonning nolinch darajasi doimo 1 ga teng.

Istisno:

nolning nolinch darajasi 1 ga teng emas!!

Misol: $599895^0 = 1$; $0,0000897^0 = 1$; $1,24^0 = 1$; $0^0 \neq 1$

-Ikkala reaksiya uchun boshlang'ich harorat 30°C bo'lib hisoblanadi

ESLATMA: harorat ortsa darajadagi nol musbat qator bo'ylab ortib boradi , 10^0C orqali o'zgaradi

30°C	$2^0 = 1$	$4^0 = 1$	
40°C	$2^1 = 2$	$4^1 = 4$	
50°C	$2^2 = 4$	$4^2 = 16$	
$[60^\circ\text{C}]$	$2^3 = 8$	$4^3 = 64$	$64 : 8 = 8$

Javob : 60°C «B»

2) Temperatura koeffitsientlari 2 va 3 bo'lgan ikkita reaksiyaning boshlang'ich temperaturalarini tegishli ravishda 20°C va 30°C ga teng. Qanday temperaturada ($^\circ\text{C}$) ikkinchi reaksiyaning tezligi birinчисinikidan 1,125 marta katta bo'ladi ? A) 80 B) 60 C) 70 D) 50

Yechimi:

20°C	$2^0 = 1$		
30°C	$2^1 = 2$	$3^0 = 1$	
40°C	$2^2 = 4$	$3^1 = 3$	
$[50^\circ\text{C}]$	$2^3 = 8$	$3^2 = 9$	$9 : 8 = 1,125$

Javob : 50°C «D»

5 – xil masala

1) 30°C da tezligi teng bo'lgan ikkita reaksiyaning birinчisi uchun harorat koeffitsienti 3, ikkinчisi uchun 4 ga teng. 283 K da ikkinchi reaksiya tezligi birinchi reaksiya tezligidan necha marta katta bo'ladi ? A) 0,56 B) 1,77 C) 1,33 D) 0,75

ESLATMA: harorat kamaysa darajadagi nol manfiy qator bo'ylab kamayib boradi , 10^0C orqali o'zgaradi

Yechimi:

$$283\text{ K} - 273 = 10^\circ\text{C}$$

30°C	$3^0 = 1$	$4^0 = 1$
20°C	3^{-1}	4^{-1}
10°C	$3^{-2} = \frac{1}{9}$	$4^{-2} = \frac{1}{16}$
	(0,111)	(0,0625)

$$0,0625 : 0,111 = 0,56 \quad \text{Javob : } 0,56 \quad \text{«A»}$$

2) 50°C da tezligi teng bo'lgan ikki reaksiyaning birinchisi uchun harorat koeffitsienti 2, ikkinchisi uchun 4 ga teng. 313 K da ikkinchi reaksiya tezligi birinchi reaksiya tezligidan necha marta katta bo'ladi? A) 2 B) 1,33 C) 0,5 D) 4

Yechimi:

$$313 - 273 = 40^{\circ}\text{C}$$

$$50^{\circ}\text{C} \quad 2^0 = 1 \quad 4^0 = 1$$

$$40^{\circ}\text{C} \quad 2^{-1} = \frac{1}{2} \quad 4^{-1} = \frac{1}{4}$$

$$(0,5)$$

$$(0,25)$$

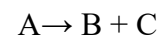
$$0,25 : 0,5 = 0,5 \quad \text{Javob : } 0,5 \quad \text{«C»}$$

6 – xil masala

1) $A \rightarrow B + C$ reaksiyada A modda miqdori 2 marta kamayishi uchun ketgan vaqt 4 marta kamayishi uchun ketgan vaqtdan 5 sekundga tezroq. A modda miqdori 5 marta kamayishi uchun necha sekund vaqt sarflanadi?

A) 12 B) 15 C) 20 D) 16

Yechimi:



-Ushbu xildagi masalani yechishda A moddaning parchalanish tezligini uchchala holatda ham o'zgarimas deb qabul qilinadi.

-Kamayishlar uchun eng kichik umumiy karrali son topiladi ya'ni 2;4 va 5 sonlariga bo'lganda butun son chiqadigan songa aytiladi: EKUK(2;4;5)=20

- A moddaning dastlabki konsentratsiyasi

20 mol/l deb olamiz

$$a) C_1 = 20 \text{ mol/l}$$

$$V = \frac{\Delta C}{t} \quad V = \frac{20-10}{x} =$$

$$\frac{10}{x}$$

$$C_2 = 20 : 2 = 10 \text{ mol/l}$$

$$t = x \text{ sek}$$

$$b) C_1 = 20 \text{ mol/l}$$

$$C_2 = 20 : 4 = 5 \text{ mol/l}$$

$$t = x + 5$$

$$c) \frac{10}{x} = \frac{15}{x+5}$$

tezliklar tengligiga asoslanib tenglamani ishlaymiz: $x = 10$

$$\text{Tezlikni topib olamiz : } V = \frac{15}{10+5} = 1 \text{ mol/(l}\cdot\text{s)}$$

$$d) C_1 = 20 \text{ mol/l}$$

$$C_2 = 20 : 5 = 4 \text{ mol/l}$$

$$t = ?$$

$$V = \frac{\Delta C}{t}$$

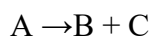
$$V = \frac{20-5}{x+5} = \frac{15}{x+5}$$

$$\frac{20-4}{t} = 1$$

$$[t = 16 \text{ sek}] \quad \text{“D”}$$

2) $A \rightarrow B + C$ reaksiyada A modda miqdori 10 marta kamayishi uchun ketgan vaqt 2 marta kamayishi uchun ketgan vaqtdan 16 sekundga sekinroq. A modda miqdori 8 marta kamayishi uchun necha sekund vaqt sarflanadi? A) 32 B) 35 C) 20 D) 16

Yechimi:



$$\text{EKUK}(10;2;8) = 40 ;$$

A moddaning dastlabki konsentratsiyasi 40 mol/l deb olamiz

$$a) C_1 = 40 \text{ mol/l}$$

$$V = \frac{\Delta C}{t}$$

$$V = \frac{40-4}{x} = \frac{36}{x}$$

$$C_2 = 40 : 10 = 4 \text{ mol/l}$$

$$t = x \text{ sek}$$

$$b) C_1 = 40 \text{ mol/l}$$

$$V = \frac{\Delta C}{t}$$

$$V = \frac{40-20}{x-16} = \frac{20}{x-16}$$

$$C_2 = 40 : 2 = 20 \text{ mol/l}$$

$$t = x - 16$$

$$\begin{array}{lcl}
 \text{c) } \frac{36}{x} = \frac{20}{x-16} & x = 36 & ; \quad V = \frac{20}{36-16} = 1 \text{ mol/(l}\cdot\text{s)} \\
 \text{d) } C_1 = 40 \text{ mol/l} & V = \frac{\Delta C}{t} & V = \frac{40-5}{t} = 1 \quad ; [t = 35 \text{ sek}] \quad \text{«B»} \\
 C_2 = 40 : 8 = 5 \text{ mol/l} & & \\
 t = ? & &
 \end{array}$$

Keltirilgan usullar bilan amaliy sinovlar o'tkazilganda taklif qilingan yangi usul bilan masala yechish juda qulay, vaqtni 2 marotaba tejaydi, talabalarning tushunishi sezilarli darajada osonlashadi. Xulosa qilib shuni aytish mumkinki taklif qilingan usulni yangiligi va keltirilgan bir qator qulayliklarini inobatga olib amalda qo'llash uchun tavsiya berish mumkin.