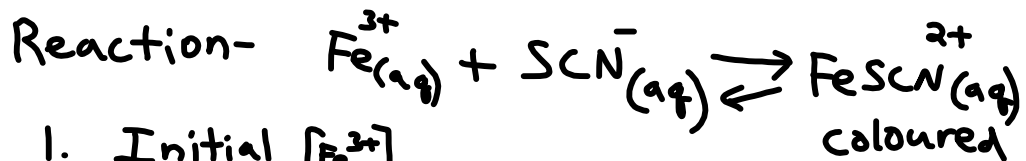


### Equilibrium Lab Activity-Calculations

Well	Drops of Reference
D3	—
C3	9
D4	7
E3	5
D2	3



1. Initial  $[\text{Fe}^{3+}]$

a) Well D3 (reference)

$$[\text{Fe}^{3+}] = 0.200 \times \frac{5}{10} = 0.100 \text{ mol/L}$$

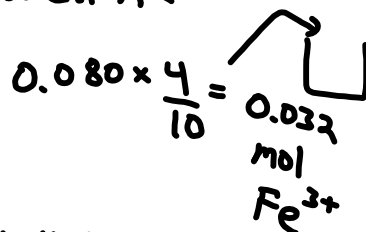
b) Well A1



$$0.200 \times \frac{4}{10} = 0.080 \text{ mol/L Fe}^{3+}$$

$$0.080 \times \frac{5}{10} = 0.040 \text{ mol/L Fe}^{3+}$$

c) Well A2



Well D4

$$0.032 \times \frac{5}{10} = 0.016 \text{ mol/L Fe}^{3+}$$

d) Well A3

$$0.032 \times \frac{4}{10} = 0.0128$$

Well E3

$$0.0128 \times \frac{5}{10} = 0.0064 \text{ mol/L}$$

e) Well A4

$$0.0128 \times \frac{4}{10} = 0.00512$$

$$0.00512 \times \frac{5}{10} = 0.00256 \text{ mol/L}$$

D2

### Calculations Continued

2. Initial  $[\text{SCN}^-] = 0.0020 \times \frac{5}{10} = 0.0010$  mol/L
3. Find equilibrium  $[\text{FeSCN}^{2+}]$
- D3 (reference)

### ICE chart

		$\text{Fe}^{3+}$	$+$	$\text{SCN}^-$	$\rightleftharpoons$	$\text{FeSCN}^{2+}$
initial	I	0.100		0.0010		0
change	C	-0.0010		-0.0010		+0.0010
equil.	E	X		0		0.0010

assume all  $\text{SCN}^-$  is used

Calculations

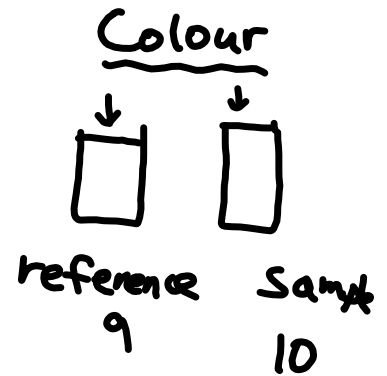
Find  $[FeSCN^{2+}]$  in wells

C3  $0.0010 \times \frac{9}{10} = 0.0009$  mol/L

D4  $0.0010 \times \frac{7}{10} = 0.0007$  mol/L

E3 0.0005

D2 0.0003



4. Find all  $[ ]$ 's in wells

C3

	$Fe^{3+}$	$SCN^{-}$	$FeSCN^{2+}$
I	0.040	0.0010	0
C	-0.0009	-0.0009	+0.0009
E	0.0391	0.0001	0.0009

A2

D4

	$Fe^{3+}$	$SCN^{-}$	$FeSCN^{2+}$
I	0.016	0.0010	0
C	-0.0007	-0.0007	+0.0007
E	0.0153	0.0003	0.0007

$$\frac{0.0160}{0.0007} = \frac{153}{1}$$

A3  
E3

Finding a Pattern

See handout quest. 4

Relationship- 
$$\frac{[\text{FeSCN}^{2+}]}{[\text{Fe}^{3+}][\text{SCN}^{-}]} = ?$$

$$\frac{0.0009}{0.0391 \times 0.0001} = 230$$

Well D4

$$\frac{0.0007}{0.0153 \times 0.0003} = 152$$

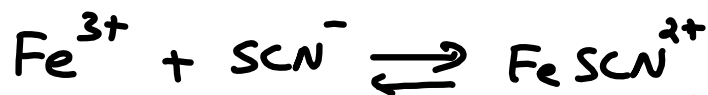
Well E3

$$= 169$$

Well D2

$$= 189$$

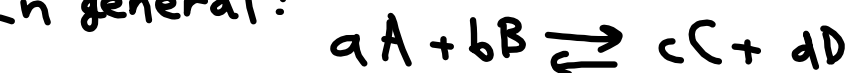
## Mass Action Expression



Mass Action Expression  $\frac{[\text{FeSCN}^{2+}]}{[\text{Fe}][\text{SCN}^{-}]}$  "constant" at equilibrium

↙ products  
↘ reactants

In general:

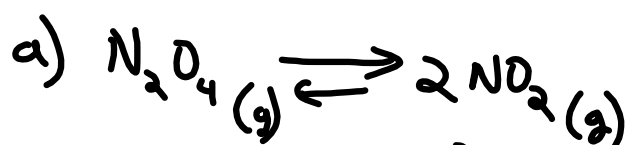


Mass Action

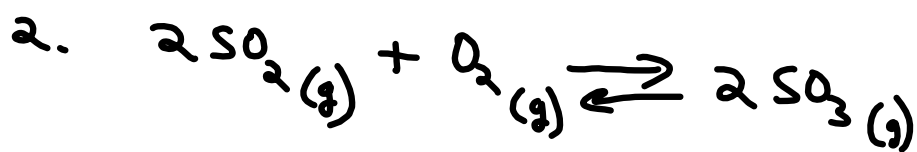
$$K_{eq} = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

Examples-

Write mass action expressions-



$$K_{eq} = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]}$$



$$K_{eq} = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]}$$

Note- For heterogeneous equil. substances in solid or liquid state are omitted.

Questions p. 497 # 1-5