COMPONENTS:
1. Cadmium selenite; CdSeO$_3$; [13814-59-0]
2. Water; H$_2$O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Ripan, R.; Verlceanu, G.

VARIABLES:
One temperature: 291 K

PREPARED BY:
Mary R. Masson

EXPERIMENTAL VALUES:
All concentrations are expressed in units of mol dm$^{-3}$.

<table>
<thead>
<tr>
<th>Concentration</th>
<th>$K_{s0}$</th>
<th>Mean $K_{s0}$</th>
<th>p$K_{s0}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.152 x 10$^{-5}$</td>
<td>6.6 x 10$^{-9}$</td>
<td>6.0 ± 1.1 x 10$^{-9}$</td>
<td>8.22</td>
</tr>
<tr>
<td>8.075 x 10$^{-5}$</td>
<td>6.5 x 10$^{-9}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.107 x 10$^{-5}$</td>
<td>6.7 x 10$^{-9}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.306 x 10$^{-5}$</td>
<td>5.3 x 10$^{-9}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.356 x 10$^{-5}$</td>
<td>5.4 x 10$^{-9}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.887 x 10$^{-5}$</td>
<td>5.5 x 10$^{-9}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The concentration $c$ in the saturated solution was calculated from the measured conductivity $k$ from the equation

$$c = \frac{1000k}{\Lambda^0}$$

Compiler's note
Neither in the determination of the ionic conductivity of the selenite ion nor in the evaluation of the solubility product was hydrolysis of the selenite ion taken into account. This would give rise to errors, since, for example, in a 0.001M solution, $[\text{SeO}_3^{2-}] = 0.000095\text{M}$, $[\text{HSeO}_3] = 0.000045\text{M}$ and $[\text{OH}^-] = 0.000045\text{M}$, and hydroxide and hydrogen selenite have different ionic conductivities from selenite. If the ionic conductivity of hydrogen selenite were known, the experimental results could have been interpreted correctly (cf. ref. 2), but this value does not seem to be available.

However, because the calibration and sample solutions had concentrations of about the same order of magnitude, the errors would cancel to some extent, but the $K_{s0}$ value cannot be regarded as reliable.

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
The ionic conductivity of the selenite ion in water was determined by measuring the mean molar conductivities of a series of aqueous solutions of lithium selenite with concentrations below 2 x 10$^{-3}$mol dm$^{-3}$. The mean molar conductivity at infinite dilution was found by extrapolation to be 172 ± 2.9 $\Omega^{-1}\text{cm}^2\text{mol}^{-1}$ at 18°C. At that temperature, the ionic conductivity of the lithium ion is 33.4 $\Omega^{-1}\text{cm}^2\text{mol}^{-1}$, so the ionic conductivity of the selenite ion is 105.2 $\Omega^{-1}\text{cm}^2\text{mol}^{-1}$.

The well washed cadmium selenite was mixed with 150 ml of water and agitated intermittently for 1 hr. From this, 10-20 ml was taken in the conductivity cell and the conductivity measured. The sampling and measurement were repeated until a constant value for the conductivity was obtained.

The value of $\Lambda^0 = (\lambda_+ + \lambda_-)$, the molar conductivity, was calculated with $\lambda_- = 105.2$ and $\lambda_+ = 90.2$ $\Omega^{-1}\text{cm}^2\text{mol}^{-1}$.

SOURCE AND PURITY OF MATERIALS:
Lithium selenite was prepared from sublimed selenium dioxide by neutralization with lithium hydroxide. An approximately 0.05M solution was standardized gravimetrically, and this was used to prepare the various dilutions. The composition of the selenite was checked by analysis.

ESTIMATED ERROR:
Temperature: 29.5 K
Error in $K_{s0}$ (2s) = 1.1 x 10$^{-9}$ (compiler)

REFERENCES:
1. Landolt-Bornstein *Physicalisch-Chemische Tabellen II* 1923, p. 1105.
COMPONENTS:
1. Cadmium selenite; CdSeO₃; [13814-59-0]
2a. Nitric acid; HNO₃; [7697-37-2]
2b. Sulfuric acid; H₂SO₄; [7664-93-9]
3. Water; H₂O; [7732-18-5]

ORIGINAL MEASUREMENTS:
Chukhlantsev, V.G.

VARIABLES:
HNO₃ and H₂SO₄ concentrations
One temperature: 293 K

EXPERIMENTAL VALUES:
All concentrations are expressed in units of mol dm⁻³.

<table>
<thead>
<tr>
<th>Soln.</th>
<th>Initial pH</th>
<th>Final pH</th>
<th>[Cd²⁺]</th>
<th>pCd</th>
<th>log aL(H)</th>
<th>p[SeO₃²⁻]</th>
<th>KₛO (pKₛO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HNO₃</td>
<td>2.97</td>
<td>4.86</td>
<td>1.87 x 10⁻³</td>
<td>2.73</td>
<td>3.13</td>
<td>5.86</td>
<td>8.59</td>
</tr>
<tr>
<td></td>
<td>2.27</td>
<td>3.28</td>
<td>7.85 x 10⁻³</td>
<td>2.11</td>
<td>4.77</td>
<td>6.88</td>
<td>8.99</td>
</tr>
<tr>
<td></td>
<td>2.00</td>
<td>2.86</td>
<td>1.52 x 10⁻²</td>
<td>1.82</td>
<td>5.24</td>
<td>7.06</td>
<td>8.88</td>
</tr>
<tr>
<td>H₂SO₄</td>
<td>2.53</td>
<td>4.23</td>
<td>3.03 x 10⁻³</td>
<td>2.52</td>
<td>3.75</td>
<td>6.27</td>
<td>8.79</td>
</tr>
<tr>
<td></td>
<td>2.12</td>
<td>3.02</td>
<td>9.25 x 10⁻³</td>
<td>2.03</td>
<td>5.10</td>
<td>7.13</td>
<td>9.14</td>
</tr>
<tr>
<td></td>
<td>2.03</td>
<td>2.91</td>
<td>1.22 x 10⁻²</td>
<td>1.92</td>
<td>5.17</td>
<td>7.07</td>
<td>8.99</td>
</tr>
</tbody>
</table>

The average value is KₛO = 1.29 x 10⁻⁹ mol² dm⁻⁶.
(pKₛO = 8.89)

Notes.
[Se₅₀] = [Cd²⁺] and [SeO₃²⁻] = [Se₀] / aL(H)
where aL(H) = (1 + [H⁺]²/K₂ + [H⁺]²/K₁K₂)
and the acid dissociation constants have the values K₁ = 4 x 10⁻³ and K₂ = 1.0 x 10⁻⁸ (ref. 1).

AUXILIARY INFORMATION

METHOD APPARATUS/PROCEDURE:
Solutions of nitric and sulfuric acids were saturated with cadmium selenite by stirring in a thermostat at 20°C for 8 hr. The remaining solid phase was removed by centrifugation, then the pH was measured ("Moskip" pH meter, to 0.01 pH unit) and the cadmium concentration was determined (method not stated).

SOURCE AND PURITY OF MATERIALS:
C.P.-grade reagents were used. Cadmium selenite was prepared by mixing 0.1N sodium selenite solution with a stoichiometric amount of 3% cadmium chloride solution. The precipitate was removed by centrifugation and dried at 40°C. Cadmium was determined gravimetrically as the sulfate, and selenium gravimetrically as the element.

ESTIMATED ERROR:
The spread in the results is 0.55 of a log unit.
Temperature: probably ±0.05 K

REFERENCES:
### COMPONENTS:

1. Cadmium selenite; CdSeO$_3$; [13814-59-0]
2. Water; H$_2$O; [7732-18-5]

### ORIGINAL MEASUREMENTS:

Redman, M.J.; Harvey, W.W.


### VARIABLES:

One temperature, probably 293 or 298 K

### EXPERIMENTAL VALUES:

A solution in contact with a precipitate of CdSeO$_3$ was found to contain

\[ 2.35 \times 10^{-5} \text{ mol dm}^{-3} \text{ cadmium(II)} \] and

\[ 1.70 \times 10^{-3} \text{ mol dm}^{-3} \text{ total selenite} \]

at pH 6.0.

A value for the solubility product can be calculated as follows (compiler).

At pH 6.0, \( \log a_{L(H)} = 2.00 \) when \( K_1 = 4 \times 10^{-3} \), \( K_2 = 1 \times 10^{-8} \) (ref. 1).

Then, since \( [\text{SeO}_3^{2-}] = \frac{[\text{Se}_{\text{Total}}]}{a_{L(H)}} = 1.7 \times 10^{-5} \), and \( [\text{Cd}^{2+}] = 2.35 \times 10^{-5} \text{ mol dm}^{-3} \),

\( K_{SO} = 4.0 \times 10^{-10} \text{ mol}^2 \text{ dm}^{-6} \), and \( pK_{SO} = 9.40 \).

The temperature of the determination is not stated.

### AUXILIARY INFORMATION

#### METHOD APPARATUS/PROCEDURE:

The filtrate after precipitation of cadmium selenite was analysed for cadmium with dithizone, and for selenite with 3,3'-diaminobenzidine.

#### SOURCE AND PURITY OF MATERIALS:

Not stated.

#### ESTIMATED ERROR:

Errors of \( \pm 1\% \) in determination of Cd$^{2+}$ and selenite, and of \( \pm 0.1 \) pH unit would cause an error of \( \pm 1.0 \times 10^{-10} \) in \( K_{SO} \) (\( \pm 0.12 \) in \( pK_{SO} \)).

#### REFERENCES: