Thermodynamics of Enzyme-Catalyzed Reactions: Part 2. Transferases

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Equilibrium constants and enthalpy changes for reactions catalyzed by the transferase class of enzymes have been compiled. For each reaction the following information is given: the reference for the data; the reaction studied; the name of the enzyme used and its Enzyme Commission number; the method of measurement; the conditions of measurement [temperature, pH, ionic strength, and the buffer(s) and cofactor(s) used]; the data and an evaluation of it; and, sometimes, commentary on the data and on any corrections which have been applied to it or any calculations for which the data have been used. The data from 285 references have been examined and evaluated. Chemical Abstract Service registry numbers are given for the substances involved in these various reactions. There is a cross reference between the substances and the Enzyme Commission numbers of the enzymes used to catalyze the reactions in which the substances participate.

Key words: apparent equilibrium constants; chemical thermodynamics; enthalpies of reaction; enzyme-catalyzed reactions; evaluated data; transferases

Contents

1. Introduction

The first paper in this series[1] dealt with the thermodynamics of the oxidoreducatases, the first class of enzymes classified by the Nomenclature Committee of the International Union of Biochemistry.[2] In the current paper a critical compilation of thermodynamic data is provided for the second class of enzymes—the transferases. The reactions catalyzed by these enzymes play significant roles in metabolic processes such as glycolysis, oxidative phosphorylation, glycogen and starch synthesis, and also in the action of muscles. The data presented herein are limited to equilibrium and calorimetric measurements performed on these reactions under *in vitro* conditions. Thus, the thermodynamic quantities which are given are apparent equilibrium constants K' and calorimetric enthalpies of reaction $\Delta_r H$(cal). Apparent equilibrium constants calculated from kinetic data are also tabulated. If the change in hydrogen ion binding $\Delta_r N(H^+)$ for a biochemical reaction is known, the standard transformed enthalpy of reaction $\Delta_r H'^\circ$ can be calculated from the calorimetric enthalpy of reaction.[3] Equilibrium constants K and standard molar enthalpies of reaction $\Delta_r H^\circ$ for chemical reference reactions are also given if they have been reported in the literature. The standard transformed enthalpy of reaction $\Delta_r H'^\circ$ can be used to calculate the temperature dependence of apparent equilibrium constants K' in the same way that the standard molar enthalpy of reaction $\Delta_r H^\circ$ is used to calculate the temperature dependence of the equilibrium constant K.

The data are presented in the same format as in Part 1.[1] Thus, the following information is given for each entry in this review: the reference for the data; the biochemical reaction studied; the name of the enzyme used and its Enzyme Commission number; the method of measurement; the conditions of measurement [temperature, pH, ionic strength, and the buffer(s) and cofactor(s) used]; the data and an evaluation of it; and, sometimes, commentary on the data and on any corrections which have been applied to it or any calculations for which the data have been used. The absence of a piece of information indicates that it was not found in the paper cited. The arrangement of the data, its evaluation, and the thermodynamic conventions have been described previously.[1] In this regard one should note that equilibrium constants should be expressed as dimensionless quantities. However, the numerical value obtained for the equilibrium constant of an unsymmetrical reaction will depend upon the measure of composition and standard concentration selected for the reactants and products. Thus, for the chemical reaction

$$A(aq)=B(aq)+C(aq), \qquad (1)$$

$K_c=c(B)c(C)/\{c(A)c^\circ\}$, $K_m=m(B)m(C)/\{m(A)m^\circ\}$, and $K_x=x(B)x(C)/x(A)$. Here, c, m, and x are, respectively, concentration, molality, and mole fraction, $c^\circ=1$ mol dm^{-3}, and $m^\circ=1$ mol kg^{-1}. The equilibrium constant expressed in terms of mole fractions is automatically dimensionless. Similar definitions and considerations apply to the apparent equilibrium constant K'.

This effort has been given additional impetus by the recent completion of the IUBMB-IUPAC document "Recommendations for Nomenclature and Tables in Biochemical Thermodynamics."[4]

2. Some Aspects and Uses of Thermodynamic Data on Biochemical Reactions

While a full discussion of the applications of thermodynamic data would be beyond the scope of this review, it seems useful to briefly indicate the utility of the information presented in this review. The primary motivation for many of those performing thermodynamic studies on biochemical reactions is to determine the position of equilibrium of the reaction(s) studied as well as to establish the reversibility of the reaction. This information is concisely summarized in terms of the apparent equilibrium constants given herein. These apparent equilibrium constants can be conveniently used to calculate the extent of reaction under the stated set of conditions and thus can be very useful to engineers concerned with the optimization of product yield in bioreactors. The enthalpy changes accompanying these reactions are also needed to know how much heating or cooling is required to

keep a bioreactor at its proper temperature. To perform this calculation one needs to know both the standard transformed enthalpy of reaction $\Delta_r H'^\circ$, the change in the hydrogen ion binding $\Delta_r N(H^+)$, and the enthalpy of protonation of the buffer(s) in the bioreactor. In general, both $\Delta_r H'^\circ$ and $\Delta_r N(H^+)$ are functions of temperature, ionic strength, and metal ion concentration.

Apparent equilibrium constants obtained from studies of *in vitro* systems can also be used to calculate the position of equilibrium in metabolic processes involving several reactions. Glycolysis is probably the best example of a situation where data are available and for which such calculations have been performed.[5,6] The results of these calculations can then be compared with information on the concentrations of the various substrates obtained from the analysis of *in vivo* systems. This comparison can provide valuable insight into the chemical machinery of living systems.

For many biochemical reactions, the apparent equilibrium constant is a function of temperature, pH, pX, and ionic strength. Thus, when performing Hess' Law and thermochemical cycle calculations, it is necessary that the data for all of the reactions in such a calculation refer to the same set of conditions. The dependencies of apparent equilibrium constants and standard transformed enthalpies of reaction on the conditions of reaction can be very complex and the reduction of such results to a common standard state generally requires auxiliary information on the binding of protons and metal ions to the various reactants as well as information on or assumptions about the activity coefficients of the species in solution. Calculations of this type have been performed by Kuby and Noltmann,[7] Alberty,[8,9] Guynn, Gelberg, and Veech,[10] Langer *et al.*,[11] Goldberg and Tewari,[12] and others.

Tables of standard formation properties[13] have proven to be a useful way of generalizing upon and presenting thermodynamic data for many chemical substances. However, tables of this type have been prepared for only limited classes of biochemical substances.[14–16] It has recently been shown[17] how it is possible to prepare tables of standard transformed formation properties for biochemical reactants (i.e., sums of species) as distinct from standard formation properties for individual biochemical species. The adenosine 5′-triphosphate series was used as a prototype for this purpose. Thus, it appears likely and desirable that several different types of thermodynamic tables will eventually appear in the literature. Clearly, the larger the scope of such tables, the more useful they are for calculating thermodynamic quantities for reactions which have not been the subject of a direct investigation.

The subjective evaluation of the data in this review consisted of the assignment of a rating: A (high quality), B (good), C (average), or D (low quality). In making these assignments we considered the various experimental details which were provided in the study. These details include the method of measurement, the number of data points determined, and the extent to which the effects of varying temperature, pH, and ionic strength were investigated. A low rating was generally given when few details of the investigation were reported. For example, in many of the papers cited, the major aim of the study was the isolation and purification of the enzyme of interest. Thus, the equilibrium data were obtained as only a small part of an investigation to characterize many of the properties of that enzyme.

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4. References for the Introductory Discussion

[1] R. N. Goldberg, Y. B. Tewari, D. Bell, K. Fazio, and E. Anderson, J. Phys. Chem. Ref. Data **22**, 515 (1993).
[2] E. C. Webb, "Enzyme Nomenclature 1992" (Academic Press, San Diego, 1992).
[3] R. A. Alberty and R. N. Goldberg, Biophys. Chem. **47**, 213 (1993).
[4] R. A. Alberty, "Recommendations for Nomenclature and Tables in Biochemical Thermodynamics," Pure Appl. Chem., in press.
[5] S. Minakami and H. Yoshikawa, J. Biochem. (Tokyo) **59**, 139 (1966).
[6] R. A. Alberty, Biophys. Chem. **42**, 117 (1992).
[7] S. A. Kuby and E. A. Noltmann in "The Enzymes," Volume 6, edited by P. D. Boyer, H. Lardy, and K. Myrbäck (Academic Press, New York, 1962), pp. 515–603.
[8] R. A. Alberty, J. Biol. Chem. **244**, 3290 (1969).
[9] R. A. Alberty, Proc. Natl. Acad. Sci. U.S.A. **88**, 3268 (1991).
[10] R. W. Guynn, H. J. Gelberg, and R. L. Veech, J. Biol. Chem. **248**, 6957 (1973).
[11] R. S. Langer, C. R. Gardner, B. K. Hamilton, and C. K. Colton, AIChE J. **23**, 1 (1977).
[12] R. N. Goldberg and Y. B. Tewari, Biophys. Chem. **40**, 241 (1991).
[13] D. D. Wagman, W. H. Evans, V. B. Parker, R. H. Schumm, I. Halow, S. M. Bailey, K. L. Churney, and R. L. Nuttall, "The NBS Tables of Chemical Thermodynamic Properties," J. Phys. Chem. Ref. Data **11**, Supplement No. 2 (1982).
[14] R. C. Wilhoit, in "Biochemical Microcalorimetry," edited by H. D. Brown (Academic Press, New York, 1969) pp. 33–81, 305–317.
[15] R. N. Goldberg and Y. B. Tewari, J. Phys. Chem. Ref. Data **18**, 809 (1989).
[16] S. L. Miller and D. Smith-Magowan, J. Phys. Chem. Ref. Data **19**, 1049 (1990).
[17] R. A. Alberty and R. N. Goldberg, Biochemistry **31**, 10610 (1992).

5. Table of Equilibrium Constants and Enthalpies of Reaction

5.1. Enzyme: thetin-homocysteine *S*-methyltransferase (EC 2.1.1.3)

betaine(aq)+L-homocysteine(aq)=*N*,*N*-dimethylglycine(aq)+L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	7.1	−36.8

Reference: 62DUR/RAW
Method: calorimetry
Buffer: phosphate
pH: 7.1
Evaluation: A

Durell *et al.* applied ionization and buffer protonation corrections and obtained $\Delta_r H^\circ(T=298.15\ \text{K}) = -36.8\ \text{kJ mol}^{-1}$ at $T = 298.15$ K for the

chemical reference reaction: betaine(aq)+L-homocysteine(aq)= *N*, *N*-dimethylglycine(aq)+L-methionine(aq).

dimethylacetothetin(aq)+L-homocysteine(aq) =*S*-methylthioglycolate(aq) +L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	7.1	−57.7

Reference: 57DUR/STU
Method: calorimetry
Buffer: phosphate (0.034 mol dm^{-3})
pH: 7.1
Evaluation: B

Durell and Sturtevant applied ionization and buffer protonation corrections and obtained $\Delta_r H°(T=298.15\ \text{K})=-52.7\ \text{kJ mol}^{-1}$ for the chemical reference reaction: dimethylacetothetin(aq)+L-homocyteine(aq) =*S*-methylthioglycolate$^-$(aq) +L-methionine(aq)+H^+(aq). These results were superseded by those of Durell *et al.* [62DUR/RAW]

dimethylacetothetin(aq)+L-homocysteine(aq)=*S*-methylthioglycolate(aq) + L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	7.1	−52.3

Reference: 62DUR/RAW
Method: calorimetry
Buffer: phosphate
pH: 7.1
Evaluation: A

Durell *et al.* applied ionization and buffer protonation corrections and obtained $\Delta_r H°(T=298.15\ \text{K})=-47.3\ \text{kJ mol}^{-1}$ for the chemical reference reaction: dimethylacetothetin(aq)+L-homocyteine(aq) =*S*-methylthioglycolate$^-$(aq)+L-methionine(aq) +H^+(aq). This result supersedes the earlier result of Durell and Sturtevant [57DUR/STU]

dimethylacetothetin(aq)+L-homocysteine(aq)=*S*-methylthioglycolate(aq) +L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
297.15	7.07	−49.3

Reference: 66MUD/KLE
Method: calorimetry
Buffer: phosphate (0.034 mol dm^{-3})
pH: 7.07
Evaluation: A

Mudd *et al.* used $\Delta_r N(H^+)=-1.0$ and the enthalpy of ionization of the buffer to calculate $\Delta_r H'°(T=297.15\ \text{K, pH}=7.07)=-44.3\ \text{kJ mol}^{-1}$.

dimethylpropiothetin(aq)+L-homocysteine(aq) =*S*-methylpropiothetin(aq) +L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
297.15	7.07	−41.4

Reference: 66MUD/KLE
Method: calorimetry
Buffer: phosphate (0.034 mol dm^{-3})
pH: 7.07
Evaluation: A

Mudd *et al.* used $\Delta_r N(H^+)=-1.0$ and the enthalpy of ionization of the buffer to calculate $\Delta_r H'°(T=297.15\ \text{K, pH}=7.07)=-36.4\ \text{kJ mol}^{-1}$.

S-methylmethionine(aq)+L-homocysteine(aq)=2 L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	7.1	−37.2

Reference: 62DUR/RAW
Method: calorimetry
Buffer: phosphate
pH: 7.1
Evaluation: A

Durell *et al.* applied ionization and buffer protonation corrections and obtained $\Delta_r H°(T=298.15\ \text{K})=-32.2\ \text{kJ mol}^{-1}$ for the chemical reference reaction: *S*-methylmethionine$^+$(aq)+L-homocysteine(aq) =2 L-methionine(aq)+H^+(aq).

trimethylsulfonium(aq)+L-homocysteine(aq) =dimethylsulfide(aq)+ L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
297.15	7.07	−33.4

Reference: 66MUD/KLE
Method: calorimetry
Buffer: phosphate (0.034 mol dm^{-3})
pH: 7.07
Evaluation: A

Mudd *et al.* used $\Delta_r N(H^+)=-1.0$ and the enthalpy of ionization of the buffer to calculate $\Delta_r H'°(T=297.15\ \text{K, pH}=7.07)=-28.5\ \text{kJ mol}^{-1}$.

5.2. Enzyme: homocysteine *S*-methyltransferase (EC 2.1.1.10)

S-adenosyl-L-methionine(aq)+L-homocysteine(aq) =*S*-adenosyl-L-homocysteine(aq)+L-methionine(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
297.15	7.07	−65.3

Reference: 66MUD/KLE
Method: calorimetry
Buffer: phosphate (0.034 mol dm^{-3})
pH: 7.07

Evaluation: A

Mudd *et al.* used $\Delta_r N(H^+) = -1.0$ and the enthalpy of ionization of the buffer to calculate $\Delta_r H'^\circ (T = 297.15\ K, pH = 7.07) = -55.2\ kJ\ mol^{-1}$.

5.3. Enzyme: thymidylate synthase (EC 2.1.1.45)

5,10-methylenetetrahydrofolate(aq)+dUMP(aq) =dihydrofolate(aq) +dTMP(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(cal)}{kJ\ mol^{-1}}$
298.15	7.4	−40.6

Reference: 73ROT/KIS
Method: calorimetry
Buffer: Tris (0.05 mol dm^{-3})+HCl
pH: 7.4
Evaluation: A

5.4 Enzyme: glycine hydroxymethyltransferase (EC 2.1.2.1)

glycine(aq)+acetaldehyde(aq)=L-threonine(aq)

$\frac{T}{K}$	pH	K'_c
310.15	7.6	56

Reference: 57KAR/GRE
Method: spectrophotometry
Buffer: phosphate (0.001 mol dm^{-3})
pH: 7.6
Evaluation: B

glycine(aq)+formaldehyde(aq)=L-serine(aq)

$\frac{T}{K}$	pH	K'_c
310.15	7.2	2760

Reference: 56ALE/GRE
Method: spectrophotometry
Buffer: phosphate (0.02 mol dm^{-3})
pH: 7.2
Evaluation: B

The temperature is most likely 310.15 K.

5,10-methylenetetrahydrofolate(aq)+glycine(aq)+H_2O(l) =tetrahydrofolate(aq)+L-serine(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	0.098

Reference: 60BLA
Method: spectrophotometry
Buffer: potassium phosphate (0.050 mol dm^{-3})
pH: 7.4
Evaluation: B

5.5. Enzyme: glycine formiminotransferase (EC 2.1.2.4)

5-formiminotetrahydrofolate(aq)+glycine(aq)=*N*-formiminoglycine(aq) +tetrahydrofolate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	5

Reference: 56RAB/PRI
Method: spectrophotometry
Buffer: potassium maleate
pH: 7.0
Evaluation: C

This is an approximate result.

5-formiminotetrahydrofolate(aq)+glycine(aq) =*N*-formiminoglycine(aq) + tetrahydrofolate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.0	3.1

Reference: 65UYE/RAB
Method: spectrophotometry
Buffer: potassium phosphate (0.069 mol dm^{-3})
pH: 7.0
Evaluation: B

5.6 Enzyme: glutamate formiminotransferase (EC 2.1.2.5)

5-formiminotetrahydrofolate(aq)+L-glutamate(aq) = *N*-formimino-L-glutamate(aq)+tetrahydrofolate(aq)

$\frac{T}{K}$	pH	K'
298.15	6.7	1.3

Reference: 59TAB/WYN
Method: spectrophotometry
Buffer: triethanolamine sulfate
pH: 6.7
Evaluation: B

K' may be as low as 0.4. The same approximate result was also given by Tabor [62TAB]

5-formiminotetrahydrofolate(aq)+L-glutamate(aq) = *N*-formimino-L-glutamate(aq)+tetrahydrofolate(aq)

$\frac{T}{K}$	pH	K'
310.15	6.6	0.09

Reference: 62SII
Buffer: potassium phosphate (0.047 mol dm^{-3})
pH: 6.6
Evaluation: C

This is an approximate result. Few details were given.

5.7 Enzyme: D-alanine 2-hydroxymethyltransferase (EC 2.1.2.7)

2-hydroxymethylserine(aq)+tetrahydrofolate(aq)
=5,10-methylenetetrahydrofolate(aq)+D-serine(aq)+H_2O(l)

$\frac{T}{K}$	pH	K'
311.15	7.5	8.0

Reference: 62WIL/SNE
Method: spectrophotometry
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.5
Cofactor(s): pyridoxal 5-phosphate (0.0001 mol dm^{-3})
Evaluation: B

This same result was also given later by Miles [71MIL].

2-hydroxymethylserine(aq)=D-serine(aq) +formaldehyde(aq)

$\frac{T}{K}$	pH	K'_c
311.15	7.5	2.7E-4

Reference: 62WIL/SNE
Method: chromatography and spectrophotometry
Buffer: potassium maleate (0.0075 mol dm^{-3})
pH: 7.5
Evaluation: B

This reaction includes both the reaction catalyzed by D-alanine 2-hydroxymethyltransferase and the non-enzymatic reaction:
5,10-methylenetetrahydrofolate(aq)=tetrahydrofolate(aq)
+formaldehyde(aq).

2-methylserine(aq)+tetrahydrofolate(aq)
=5,10-methylenetetrahydrofolate(aq)+D-alanine(aq)+H_2O(l)

$\frac{T}{K}$	pH	K'
311.15	7.5	3.0

Reference: 62WIL/SNE
Method: spectrophotometry
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.5
Cofactor(s): pyridoxal 5-phosphate (0.0001 mol dm^{-3})
Evaluation: B

This same result was also given later by Miles [71MIL].

2-methylserine(aq)=D-alanine(aq)+formaldehyde(aq)

$\frac{T}{K}$	pH	K'
311.15	7.5	2.7E-4

Reference: 62WIL/SNE
Method: chromatography and spectrophotometry
Buffer: potassium maleate (0.0075 mol dm^{-3})
pH: 7.5
Evaluation: B

This reaction includes both the reaction catalyzed by D-alanine 2-hydroxymethyltransferase and the non-enzymatic reaction:
5,10-methylenetetrahydrofolate(aq)=tetrahydrofolate(aq)
+formaldehyde(aq).

5.8 Enzyme: methylmalonyl-CoA carboxyltransferase (EC 2.1.3.1)

oxaloacetate(aq)+propanoyl-CoA(aq)=pyruvate(aq)
+methylmalonyl-CoA(aq)

$\frac{T}{K}$	pH	K'
303.15	6.5	1.9

Reference: 61WOO/STJ
Method: enzymatic assay and spectrophotometry
Buffer: Tris (0.025 mol dm^{-3})+HCl
pH: 6.5
Evaluation: B

5.9 Enzyme: ornithine carbamoyltransferase (EC 2.1.3.3)

carbamoyl phosphate(aq)+L-ornithine(aq)=L-citrulline(aq)
+orthophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	1.0E5

Reference: 57REI
Method: radioactivity
Buffer: Tris (0.1 mol dm^{-3})
pH: 7.4
Evaluation: C

This is an approximate result.

5.10 Enzyme: oxamate carbamoyltransferase (EC 2.1.3.5)

carbamoyl phosphate(aq)+oxamate(aq)=orthophosphate(aq)
+carbamoyl oxamate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.3	0.62

Reference: 64BOJ/GAU
Method: spectrophotometry
Buffer: Tris (0.04 mol dm^{-3})
pH: 8.3
Cofactor(s): $MgSO_4$ (0.005 mol dm^{-3})
Evaluation: C

Equilibrium was approached from only one direction.

5.11 Enzyme: glycine amidinotransferase (EC 2.1.4.1)

L-arginine(aq)+glycine(aq)=L-ornithine(aq)+guanidinoacetate(aq)

$\frac{T}{K}$	pH	K'
311.15	7.5	1.1

Reference: 56RAT/ROC
Method: spectrophotometry
Buffer: phosphate (0.067 mol dm^{-3})
pH: 7.5
Evaluation: B

The same result was also given later by Ratner [62RAT].

5.12 Enzyme: transketolase (EC 2.2.1.1)

D-fructose 6-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-erythrose 4-phosphate(aq)+D-xylulose 5-phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.6	8.4E-2

Reference: 61DAT/RAC
Method: enzymatic assay and spectrophotometry
Buffer: glycylglycine (0.025 mol dm^{-3})
pH: 7.6
Cofactor(s): $MgCl_2$ (0.001 mol dm^{-3})
Evaluation: B

The same result was also reported by Racker [61RAC].

D-fructose 6-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-erythrose 4-phosphate(aq)+D-xylulose 5-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.0	0.001	0.25	3.37E-3

Reference: 86CAS/VEE
Method: enzymatic assay and spectrophotometry
Buffer: imidazole (0.1 mol $^{-3}$)
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: A

D-fructose 6-phosphate(aq)+glycolaldehyde(aq) =L-erythrulose(aq)
+D-erythrose 4-phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.6	0.015

Reference: 61DAT/RAC
Method: enzymatic assay and spectrophotometry
Buffer: glycylglycine (0.025 mol dm^{-3})
pH: 7.6
Cofactor(s): $MgCl_2$ (0.001 mol dm^{-3})
Evaluation: B

The same result was also reported by Racker [61RAC].

sedoheptulose 7-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-ribose 5-phosphate(aq)+D-xylulose 5-phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.6	0.90

Reference: 61DAT/RAC
Method: enzymatic assay and spectrophotometry
Buffer: glycylglycine (0.025 mol dm^{-3})
pH: 7.6
Cofactor(s): $MgCl_2$ (0.001 mol dm^{-3})
Evaluation: B

The same result was also reported by Racker [61RAC].

sedoheptulose 7-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-ribose 5-phosphate(aq)+D-xylulose 5-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.0	0.001	0.25	0.48

Reference: 86CAS/VEE
Method: enzymatic assay and spectrophotometry
Buffer: thiamine pyrophosphate
pH: 7.0
Cofactor(s): $MgCl_2$ and KCl
Evaluation: A

5.13 Enzyme: transaldolase (EC 2.2.1.2)

D-fructose(aq)+D-glyceraldehyde-3-phosphate(aq)
=D-fructose 6-phosphate(aq)+D-glyceraldehyde(aq)

$\frac{T}{K}$	pH	K'
303.15	7.6	0.27

Reference: 59BON/PON
Method: enzymatic assay
Buffer: triethanolamine (0.02 mol dm^{-3})
pH: 7.6
Evaluation: C

sedoheptulose 7-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-erythrose 4-phosphate(aq)+D-fructose 6-phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.6	0.82

Reference: 55HOR/SMY
Method: paper chromatography
Buffer: triethanolamine (0.005 mol dm^{-3})
pH: 7.6
Evaluation: C

sedoheptulose 7-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-erythrose 4-phosphate(aq)+D-fructose 6-phosphate(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
310.15	7.4	1.05

Reference: 61RAC2
Method: enzymatic assay
Buffer: bicarbonate
pH: 7.4
Evaluation: B

sedoheptulose 7-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-erythrose 4-phosphate(aq)+D-fructose 6-phosphate(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
310.15	7.4	1.05

Reference: 61VEN/RAC
Method: enzymatic assay
Buffer: bicarbonate (0.1 mol dm^{-3})
pH: 7.4
Evaluation: B

sedoheptulose 7-phosphate(aq)+D-glyceraldehyde 3-phosphate(aq)
=D-erythrose 4-phosphate(aq)+D-fructose 6-phosphate(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(Mg^{2+})}{\mathrm{mol\ dm^{-3}}}$	$\frac{I_c}{\mathrm{mol\ dm^{-3}}}$	K'
311.15	7.0	0.001	0.25	0.37

Reference: 86CAS/VEE
Method: enzymatic assay and spectrophotometry
Buffer: imidazole (0.05 mol dm^{-3})
pH: 7.0
Cofactor(s): $MgCl_2$ and KCl
Evaluation: A

5.14. Enzyme: imidazole *N*-acetyltransferase (EC 2.3.1.2)

acetyl phosphate(aq)+imidazole(aq)=*N*-acetylimidazole(aq)
+orthophosphate(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
299.15	6.15	0.0060
299.15	6.45	0.0073
299.15	6.95	0.0110
299.15	7.20	0.0099
299.15	7.30	0.0092

Reference: 54STA
Method: spectrophotometry
pH: 6.15–7.30
Evaluation: B

Phosphate acetyltransferase (EC 2.3.1.8) was also present. Stadtman also reports $K'(T=299.15$ K, pH=7.0)=5640 for the non-enzymatic reaction: *N*-acetylimidazole(aq)+glutathione(aq)=acetylglutathione(aq)
+imidazole(aq).

5.15 Enzyme: arylamine *N*-acetyltransferase (EC 2.3.1.5)

4-aminoazobenzene-4′-sulfonic acid(aq)+acetanilide(aq)
=*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq)+aniline(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
298.15	8.5	0.06

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

4-aminoazobenzene-4′-sulfonic acid(aq)+4′-acetylacetanalide(aq)
=*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq)
+4′-aminoacetophe
none(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
298.15	8.5	1.7

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

4-aminoazobenzene-4′-sulfonic acid(aq)+4′-chloroacetanilide(aq)
=*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq) +4′-chloroaniline(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
298.15	8.5	0.13

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

4-aminoazobenzene-4′-sulfonic acid(aq)+4′-cyanoacetanilide(aq)
=*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq) +4-cyanoaniline(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
298.15	8.5	3.7

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

4-aminoazobenzene-4′-sulfonic acid(aq)+ethyl 4-acetamidobenzoate(aq) =*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq) +ethyl 4-aminobenzoate(aq)

$\frac{T}{K}$	pH	K'
298.15	8.5	0.94

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

4-aminoazobenzene-4′-sulfonic acid(aq)+4′-methoxyacetanilide(aq) =*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq)+4-methoxyaniline(aq)

$\frac{T}{K}$	pH	K'
298.15	8.5	0.017

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

4-aminoazobenzene-4′-sulfonic acid(aq)+4′-methylacetanilide(aq) =*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq)+*p*-toluidine(aq)

$\frac{T}{K}$	pH	K'
298.15	8.5	0.034

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

4-aminoazobenzene-4′-sulfonic acid(aq)+4′-nitroacetanilide(aq) =*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq)+4-nitroaniline(aq)

$\frac{T}{K}$	pH	K'
298.15	8.5	8.5

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

This result was obtained by equilibrating p-nitroanilie (free and acetylated) with 4′-aminoacetophenone (free and acetylated) and combining this result with the equilibrium constant for the reaction of 4′-aminoacetophenone with 4-aminoazobenzene-4′-sulfonic acid.

4-aminoazobenzene-4′-sulfonic acid(aq)+α,α,α-trifluoro-m-acetanilide(aq) =*N*-acetyl-4-aminoazobenzene-4′-sulfonic acid(aq) +α,α,α-trifluoro-m-toluidine(aq)

$\frac{T}{K}$	pH	K'
298.15	8.5	0.23

Reference: 71JEN/SCH
Method: spectrophotometry
Buffer: {Tris (0.1 mol dm^{-3})+HCl} and {ethylenediaminetetraacetic acid (0.01 mol dm^{-3})}+{diothreitol (0.001 mol dm^{-3})}
pH: 8.5
Evaluation: B

5.16 Enzyme: choline *O*-acetyltransferase (EC 2.3.1.6)

acetyl-CoA(aq)+choline(aq) =CoA(aq)+*O*-acetylcholine(aq)

$\frac{T}{K}$	pH	$\frac{c(NaCl)}{mol\ dm^{-3}}$	K'
310.15	7.0	0.0	5100
310.15	7.0	0.3	145

Reference: 66SCH
Method: spectrophotometry
Buffer: potassium phosphate (0.01 mol dm^{-3})
pH: 7.0
Evaluation: C

acetyl-CoA(aq)+choline(aq)=CoA(aq)+*O*-acetylcholine(aq)

$\frac{T}{K}$	pH	K'
311.15	7.0	522

Reference: 68POT/GLO
Method: spectrophotometry and electrophoresis
Buffer: phosphate (0.010 mol dm^{-3})
pH: 7.0
Evaluation: C

acetyl-CoA(aq)+choline(aq)=CoA(aq)+*O*-acetylcholine(aq)

$\frac{T}{K}$	pH	K'
310.15	7.2	41

Reference: 71GLO/POT
Method: spectrophotometry
Buffer: phosphate (0.010 mol dm^{-3})
pH: 7.2
Evaluation: B

acetyl-CoA(aq)+choline(aq) =CoA(aq)+*O*-acetylcholine(aq)

$\frac{T}{K}$	pH	$\frac{I_c}{mol\ dm^{-3}}$	K'
298.15	7.03	0.25	11.7
311.15	7.03	0.25	12.3

Reference: 75PIE/GUY
Method: spectrophotometry
Buffer: phosphate (0.050 mol dm ^{3})
pH: 7.03
Evaluation: A

Pieklik and Guynn state that the apparent equilibrium constant is only slightly affected by changes in pH (6.50 to 7.50), ionic strength (0.03 to 0.375 mol dm^{-3}), and free magnesium ion concentration (0 to 0.005 mol dm^{-3}).

5.17 Enzyme: carnitine *O*-acetyltransferase (EC 2.3.1.7)

acetyl-CoA(aq)+L-carnitine(aq) =CoA(aq)+L-acetylcarnitine(aq)

$\frac{T}{K}$	pH	K'
308.15	7.0	1.6

Reference: 63FRI/SCH
Method: spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.0
Evaluation: B

acetyl-CoA(aq)+L-carnitine(aq) =CoA(aq)+L-acetylcarnitine(aq)

$\frac{T}{K}$	pH	K'
298.15	7.5	1.5

Reference: 69BRE/AAS
Method: spectrophotometry
Buffer: Tris (0.02 mol dm^{-3})
pH: 7.5
Evaluation: B

acetyl-CoA(aq)+L-carnitine(aq) =CoA(aq)+L-acetylcarnitine(aq)

$\frac{T}{K}$	pH	$\frac{I_c}{mol\ dm^{-3}}$	K'
298.15	7.00	0.25	1.60
311.15	7.00	0.25	1.73

Reference: 75PIE/GUY
Method: spectrophotometry
Buffer: phosphate (0.050 mol dm^{-3})
pH: 7.00
Evaluation: A

butyryl-CoA(aq)+L-carnitine(aq)=CoA(aq)+L-butyrylcarnitine(aq)

$\frac{T}{K}$	pH	K'
298.15	7.5	1.0

Reference: 69BRE/AAS
Method: spectrophotometry
Buffer: Tris (0.02 mol dm^{-3})
pH: 7.5
Evaluation: C

propionyl-CoA(aq)+L-carnitine(aq) =CoA(aq)+L-propionylcarnitine(aq)

$\frac{T}{K}$	pH	K'
298.15	7.5	1.3

Reference: 69BRE/AAS
Method: spectrophotometry
Buffer: Tris (0.02 mol dm^{-3})
pH: 7.5
Evaluation: C

5.18 Enzyme: phosphate acetyltransferase (EC 2.3.1.8)

acetyl-CoA(aq)+orthophosphate(aq)=CoA(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
301.15	8.1	1.7E 2

Reference: 52STA
Method: spectrophotometry
Buffer: Tris (0.0001 mol dm^{-3})
pH: 8.1
Evaluation: C

Also see Stadtman's later result [55STA] given below.

acetyl-CoA(aq)+orthophosphate(aq)=CoA(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
301.15	8.0	1.35E-2

Reference: 55STA
Method: spectrophotometry
Buffer: Tris
pH: 8.0
Evaluation: C

Stadtman stated that this was a more accurate result than given earlier [52STA].

acetyl-CoA(aq)+orthophosphate(aq)=CoA(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	6.8E-3

Reference: 63BER/HOL
Method: spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})
pH: ≈7.4
Evaluation: C

The temperature is assumed to be 298.15 K.

acetyl-CoA(aq)+orthophosphate(aq) =CoA(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	6.85	1.42E-2

Reference: 63SLY/STA
Method: spectrophotometric
Buffer: potassium dimethylglutarate (0.1 mol dm^{-3})
pH: 6.85
Evaluation: B

acetyl-CoA(aq)+orthophosphate(aq)=CoA(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	6.80E-3

Reference: 69KLO
Method: spectrophotometry
Buffer: Tris+HCl (0.1 mol dm^{-3})
pH: 7.4
Evaluation: C

acetyl-CoA(aq)+orthophosphate(aq) =CoA(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
300.15	7.6	7.5E-3

Reference: 71NOJ/TAN
Method: spectrophotometry
Buffer: Tris (0.067 mol dm^{-3})+HCl
pH: 7.6
Evaluation: B

acetyl-CoA(aq)+orthophosphate(aq)=CoA(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.6	6.5E-3

Reference: 73RAD/HOC
Method: spectrophotometry
Buffer: Tris (0.066 mol dm^{-3})+HCl
pH: 7.6
Evaluation: C

The temperature is assumed to be 298.15 K.

acetyl phosphate(aq)+imidazole(aq)=*N*-acetylimidazole(aq) +orthophosphate(aq)

$\frac{T}{K}$	pH	K'
299.15	6.15	0.0060
299.15	6.45	0.0073
299.15	6.95	0.0110
299.15	7.20	0.0099
299.15	7.30	0.0092

Reference: 54STA
Method: spectrophotometry
pH: 6.15−7.30
Evaluation: B

Imidazole *N*-acetyltransferase (EC 2.3.1.2) was also present. Stadtman also reports $K'(T=299.15$ K, pH=7.0)=5640 for the non-enzymatic reaction: *N*-acetylimidazole(aq)+glutathione(aq)=acetyl glutathione(aq) +imidazole(aq).

formyl-CoA(aq)+orthophosphate(aq)=CoA(aq)+formyl phosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	6.85	0.14

Reference: 63SLY/STA
Method: spectrophotometric
Buffer: potassium dimethylglutarate (0.1 mol dm^{-3})
pH: 6.85
Evaluation: B

pyruvate(aq)+orthophosphate(aq)=acetyl phosphate(aq)+formate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.2	23

Reference: 71TAN/JOH
Method: chromatography and spectrophotometry
Buffer: glycylglycine (0.050 mol dm^{-3})
pH: 7.2
Cofactor(s): $CoCl_2$ (0.0005 mol dm^{-3})
Evaluation: C

Formate *C*-acetyltransferase (EC 2.3.1.54) was also present. This is an approximate result.

CoA(aq)+acetate(aq)+ATP(aq)=acetyl-CoA(aq)+ADP(aq)
+orthophospate(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(Mg^{2+})}{\mathrm{mol\ dm^{-3}}}$	$\frac{I_c}{\mathrm{mol\ dm^{-3}}}$	K'
311.15	7.01	4.1E-3	0.25	0.171
311.15	7.01	2.7E-3	0.25	0.164
311.15	7.01	6.9E-4	0.25	0.252
311.15	7.01	2.9E-4	0.25	0.395
311.15	7.01	4.8E-5	0.25	0.695
311.15	7.01	2.5E-6	0.25	0.989

Reference: 73GUY/VEE
Method: spectrophotometry and enzymatic assay
pH: 7.01
Cofactor(s): Mg^{2+}
Evaluation: A

Acetate kinase (2.7.2.1) was also present. Guynn and Veech also performed calulations on the variation of the apparent equilibrium constant with free magnesium ion concentration and combined their results with other data to calculate the standard Gibbs energy of hydrolysis of ATP.

5.19 Enzyme: acetyl-CoA *C*-acetyltransferase (EC 2.3.1.9)

2 acetyl-CoA(aq)=CoA(aq)+acetoacetyl-CoA(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
298.15	8.1	2E-5
298.15	9.0	1E-4

Reference: 53LYN/OCH
Method: spectrophotometry
pH: 8.1–9.0
Evaluation: C

These are approximate results.

2 acetyl-CoA(aq)=CoA(aq)+acetoacetyl-CoA(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
298.15	8.1	2E-5

Reference: 53STE/COO
Method: spectrophotometric
pH: 8.1
Evaluation: C

This is an approximate result. The temperature is assumed to be 298.15 K.

2 acetyl-CoA(aq)=CoA(aq)+acetoacetyl-CoA(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
289.15	8.5	6.0E-5
289.15	8.8	8.7E-5

Reference: 54GOL
Method: spectrophotometry
Buffer: diol (0.0001 mol dm^{-3})
pH: 8.5–8.8
Cofactor(s): $MgCl_2$ (1×10^{-7} mol dm^{-3})
Evaluation: C

2 acetyl-CoA(aq)=CoA(aq)+acetoacetyl-CoA(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(Mg^{2+})}{\mathrm{mol\ dm^{-3}}}$	K'
298.15	6.0	0.0	1.48E-5
298.15	7.0	0.0	1.56E-5
298.15	8.0	0.0	1.85E-5
298.15	9.0	0.0	6.62E-5
298.15	8.0	0.013	6.17E-5
298.15	8.0	0.200	4.36E-4

Reference: 55DEC
Method: spectrophotometry
Buffer: Tris and phosphate
pH: 6.0–9.0
Cofactor(s): $MgCl_2$
Evaluation: B

5.20. Enzyme: carnitine *O*-palmitoyltransferase (EC 2.3.1.21)

palmitoyl-CoA(aq)+L-carnitine(aq)=CoA(aq) +L-palmitoylcarnitine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
310.15	7.5	0.50

Reference: 64NOR
Method: spectrophotometry and radioactivity
Buffer: Tris (0.01 mol dm^{-3})
pH: 7.5
Evaluation: B

5.21. Enzyme: glutamate *N*-acetyltransferase (EC 2.3.1.35)

N^2-acetyl-L-ornithine(aq)+L-glutamate(aq)=L-ornithine(aq)
+*N*-acetyl-L-glutamate(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
310.15	7.5	0.47

Reference: 66STA/DEN
Method: spectrophotometry, chromatography, and radioactivity
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.5
Evaluation: B

This same result was also given by Denes [70DEN].

5.22. Enzyme: [acyl-carrier-protein] *S*-acetyltransferase (EC 2.3.1.38)

acetyl-CoA(aq)+acyl-carrier protein(aq) =CoA(aq)
+acetyl-[acyl-carrier protein](aq)

$\frac{T}{K}$	pH	K'
311.15	6.5	2.09

Reference: 66WIL/WAK
Method: chromatography and radioactivity
Buffer: potassium phosphate (0.1 mol dm^{-3})
pH: 6.5
Evaluation: B

5.23. Enzyme: [acyl-carrier-protein] *S*-malonyltransferase (EC 2.3.1.39)

malonyl-CoA(aq)+acyl-carrier protein(aq)=CoA(aq)
+malonyl-[acyl-carrier protein](aq)

$\frac{T}{K}$	pH	K'
311.15	6.5	2.33

Reference: 66WIL/WAK
Method: chromatography and radioactivity
Buffer: potassium phosphate (0.1 mol dm^{-3})
pH: 6.5
Evaluation: D

This result was superseded by the result obtained later by Joshi and Wakil [71JOS/WAK].

malonyl-CoA(aq)+acyl-carrier protein(aq)=CoA(aq)
+malonyl-[acyl-carrier protein](aq)

$\frac{T}{K}$	pH	K'
298.15	6.5	0.018

Reference: 71JOS/WAK
Buffer: potassium phosphate (0.05 mol dm^{-3})
pH: 6.5
Evaluation: B

5.24. Enzyme: formate *C*-acetyltransferase (EC 2.3.1.54)

acetyl-CoA(aq)+formate(aq)=CoA(aq)+pyruvate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.1	1.33E-3

Reference: 74KNA/BLA
Method: spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 8.1
Evaluation: C

This is an approximate result calculated from kinetic data.

pyruvate(aq)+orthophosphate(aq)=acetyl phosphate(aq)+formate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.2	23

Reference: 71TAN/JOH
Method: chromatography and spectrophotometry
Buffer: glycylglycine (0.050 mol dm^{-3})
pH: 7.2
Cofactor(s): $CoCl_2$ (0.0005 mol dm^{-3})
Evaluation: C

Phosphate acetyltransferase (EC 2.3.1.8) was also present. This is an approximate result.

5.25. Enzyme: sucrose phosphorylase (EC 2.4.1.7)

sucrose(aq)+orthophosphate(aq)=α-D-glucose 1-phosphate(aq)
+D-fructose(aq)

$\frac{T}{K}$	pH	K'
303.15	5.8	11
303.15	6.6	20

Reference: 43DOU
Buffer: phosphate and (carbonate+bicarbonate)
pH: 5.8–6.6
Evaluation: C

sucrose(aq)+orthophosphate(aq)=α-D-glucose 1-phosphate(aq)
+D-fructose(aq)

$\frac{T}{K}$	pH	K'
303.15	6.6	20

Reference: 61DOU
pH: 6.6
Evaluation: D

Very few details were given. This may not be original data.

sucrose(aq)+orthophosphate(aq)=α-D-glucose 1-phosphate(aq)
+D-fructose(aq)

$\frac{T}{K}$	pH	K'
303.15	7.0	16

Reference: 67SIL/VOE
Method: spectrophotometry
Buffer: Tris maleate (0.03 mol dm^{-3})
pH: 7.0
Evaluation: C

This is an approximate result obtained from kinetic data.

sucrose(aq)+orthophosphate(aq)=α-D-glucose 1-phosphate(aq)
+D-fructose(aq)

$\frac{T}{K}$	pH	K'
298.15	8.25	31.5

Reference: 89GOL/TEW
Method: HPLC
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 8.25
Evaluation: A

5.26. Enzyme: maltose phosphorylase (EC 2.4.1.8)

maltose(aq)+orthophosphate(aq)=D-glucose(aq)
+β-D-glucose1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.23

Reference: 52FIT/DOU
Method: chromatography
Buffer: Tris+HCl
pH: 7.0
Evaluation: C

maltose(aq)+orthophosphate(aq)=D-glucose(aq)
+β-D-glucose1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.23

Reference: 61DOU
pH: 7.0
Evaluation: D

Very few details were given. This may not be original data.

5.27. Enzyme: levansucrase (EC 2.4.1.10)

sucrose(aq)+(2,6-β-D-fructosyl)$_n$(aq)=D-glucose(aq)
+(2,6-β-D-fructosyl)$_{n+1}$(aq)

$\frac{T}{K}$	pH	K'
310.15	6.0	0.036

Reference: 66DED
Method: spectrophotometry
Buffer: phosphate
pH: 6.0
Evaluation: D

It is not clear if the value of the apparent equilibrium constant given above is based on measurements or if it is an estimate. Few details were given.

5.28. Enzyme: sucrose synthase (EC 2.4.1.13)

ADPglucose(aq)+D-fructose(aq)=ADP(aq)+sucrose(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	1.6

Reference: 66MUR/SUG
Method: chromatography and radioactivity
Buffer: Tris (0.16 mol dm^{-3})
pH: 7.4
Evaluation: B

UDPglucose(aq)+D-fructose(aq)=UDP(aq)+sucrose(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	5

Reference: 55CAR/LEL
Method: spectrophotometry
Buffer: Tris
pH: 7.4
Evaluation: C

This is an approximate result.

UDPglucose(aq)+D-fructose(aq)=UDP(aq)+sucrose(aq)

$\frac{T}{K}$	pH	K'
303.15	7.6	1.6

Reference: 64AVI
Method: spectrophotometry
Buffer: Tris
pH: 7.6
Cofactor(s): $MgCl_2$
Evaluation: B

UDPglucose(aq)+D-fructose(aq)=UDP(aq)+sucrose(aq)

$\frac{T}{K}$	pH	K'
298.15	7.2	1.3

Reference: 64MIL/AVI
pH: 7.2
Evaluation: D

Few details were given in this brief communication. The temperature is assumed to be 298.15 K.

UDPglucose(aq)+D-fructose(aq)=UDP(aq)+sucrose(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	3.3

Reference: 66MUR/SUG
Method: chromatography and radioactivity
Buffer: Tris (0.16 mol dm^{-3})
pH: 7.4
Evaluation: B

UDPglucose(aq)+D-fructose(aq)=UDP(aq)+sucrose(aq)

$\frac{T}{K}$	pH	K'
298.15	7.5	6.7

Reference: 72DEL
Method: chromatography and radioactivity
Buffer: Tris
pH: 7.5
Evaluation: B

Delmer also obtained $K'(T=298.15$ K, pH=7.5)=6.3 from kinetic data.

5.29. Enzyme: sucrose-phosphate synthase (EC 2.4.1.14)

UDPglucose(aq)+D-fructose 6-phosphate(aq)=UDP(aq)+sucrose 6-phosphate(aq)

$\frac{T}{K}$	pH	K'
311.15	5.5	53
311.15	7.5	3250

Reference: 60MEN
Method: chromatography, radioactivity, and chemical analysis
Buffer: Tris and acetate
pH: 5.5–7.5
Evaluation: C

UDPglucose(aq)+D-fructose 6-phosphate(aq)=UDP(aq)+sucrose 6-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	5

Reference: 85BAR
Method: electrophoresis and radioactivity
Buffer: (Tris+HCl) and mercaptoethanol
pH: 7.5
Cofactor(s): $MgCl_2$ (0.0043 mol dm^{-3})
Evaluation: C

Barber found that K' was 1.8 when approached from the forward direction and ≈9 when approached from the reverse direction. The approximate result given above is the average of these values.

UDPglucose(aq)+D-fructose 6-phosphate(aq)=UDP(aq)+sucrose 6-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
298.15	7.0	0.0025	5.3
298.15	7.0	0.010	26
298.15	7.5	0.0025	10
298.15	7.5	0.010	62

Reference: 90LUN/APR
Method: enzymatic assay and spectrophotometry
Buffer: Pipes (0.050 mol dm^{-3})+NaOH
pH: 7.0–7.5
Cofactor(s): $MgCl_2$
Evaluation: B

5.30. Enzyme: α,α-trehalose-phosphate synthase (UDP-forming) (EC 2.4.1.15)

UDPglucose(aq)+D-glucose 6-phosphate(aq)=UDP(aq)+α,α-trehalose 6-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	6.1	40

Reference: 58CAB/LEL
Method: enzymatic assay and spectrophotometry
pH: 6.1
Cofactor(s): $MgSO_4$ (0.025 mol dm^{-3})
Evaluation: C

This is an approximate result.

5.31. Enzyme: cyclomaltodextrin glucanotransferase (EC 2.4.1.19)

cycloheptaamylose(aq)+7 H_2O(l)=7 D-glucose(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(cal)}{kJ\ mol^{-1}}$
298.15	5.0	−48.7

Reference: 72TAK/ONO
Method: calorimetry
Buffer: acetate (0.02 mol dm^{-3})
pH: 5.0
Evaluation: A

The enzyme α-amylase (EC 3.2.1.1) was also present. Since $\Delta_r N(H^+)=0$ for this reaction, $\Delta_r H'^\circ=\Delta_r H$(cal).

cyclohexaamylose(aq)+6 H_2O(l)=6 D-glucose(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(cal)}{kJ\ mol^{-1}}$
298.15	5.0	−53.5

Reference: 72TAK/ONO
Method: calorimetry
Buffer: acetate (0.02 mol dm^{-3})
pH: 5.0
Evaluation: A

Since $\Delta_r N(H^+)=0$ for this reaction, $\Delta_r H'^\circ=\Delta_r H(\text{cal})$.

cyclooctaamylose(aq)+8 H_2O(l)=8 D-glucose(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{kJ\ mol^{-1}}$
298.15	5.0	−53.0

Reference: 72TAK/ONO
Method: calorimetry
Buffer: acetate (0.02 mol dm^{-3})
pH: 5.0
Evaluation: A

Since $\Delta_r N(H^+)=0$ for this reaction, $\Delta_r H'^\circ=\Delta_r H(\text{cal})$.

5.32. Enzyme: cellobiose phosphorylase (EC 2.4.1.20)

cellobiose(aq)+orthophosphate(aq)=D-glucose(aq)
+α-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.23

Reference: 59ALE
Method: enzymatic assay
Buffer: barbital acetate (0.01 mol dm^{-3})
pH: 7.0
Evaluation: A

cellobiose(aq)+orthophosphate(aq)=D-glucose(aq)
+α-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.32

Reference: 92KIT/SAS
Method: enzymatic assay
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 7.0
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: C

cellotriose(aq)+orthophosphate(aq)=cellobiose(aq)
+α-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	0.4

Reference: 69SHE/ALE
Method: enzymatic assay
Buffer: Tris (0.01 mol dm^{-3})
pH: 7.5
Evaluation: C

5.33. Enzyme: laminaribiose phosphorylase (EC 2.4.1.31)

laminaribiose(aq)+orthophosphate(aq)=D-glucose(aq)
+α-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	6.5	0.30

Reference: 66GOL/MAR
Method: chromatography
Buffer: imidazole (0.04 mol dm^{-3})
pH: 6.5
Evaluation: B

laminaritetraose(aq)+orthophosphate(aq)=laminaritriose(aq)
+α-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	6.5	0.36

Reference: 66GOL/MAR
Method: chromatography
Buffer: imidazole (0.04 mol dm^{-3})
pH: 6.5
Evaluation: B

laminaritriose(aq)+orthophosphate(aq)=laminaribiose(aq)
+α-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	6.5	0.26

Reference: 66GOL/MAR
Method: chromatography
Buffer: imidazole (0.04 mol dm^{-3})
pH: 6.5
Evaluation: B

5.34. Enzyme: α,α-trehalose phosphorylase (EC 2.4.1.64)

α,α-trehalose(aq)+orthophosphate(aq)=D-glucose(aq)
+β-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	6.3	0.059
310.15	7.0	0.24

Reference: 72MAR/BEL
Method: enzymatic assay and spectrophotometry
Buffer: imidazole (0.040 mol dm^{-3})+HCl
pH: 6.3–7.0
Evaluation: C

5.35. Enzyme: galactinol-raffinose galactosyltransferase (EC 2.4.1.67)

1-α-D-galactosyl-*myo*-inositol(aq)+raffinose(aq)=*myo*-inositol(aq) + stachyose(aq)

$\frac{T}{K}$	pH	K'
305.15	7.0	4

Reference: 68TAN/KAN
Method: paper chromatography and radioactivity
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.0
Evaluation: C

1-α-D-galactosyl-*myo*-inositol(aq)+raffinose(aq)=*myo*-inositol(aq) +stachyose(aq)

$\frac{T}{K}$	pH	K'
298.15	6.5	4.0

Reference: 72LEH/TAN
Buffer: phosphate (0.5 mol dm^{-3})
pH: 6.0–7.0
Evaluation: C

5.36. Enzyme: sinapate 1-glucosyltransferase (EC 2.4.1.120)

UDPglucose(aq)+sinapate(aq)=UDP(aq)+1-sinapoyl-D-glucose(aq)

$\frac{T}{K}$	pH	K'
303.15	6.0	0.21

Reference: 93MOC/STR
Method: HPLC
Buffer: Mes (0.090 mol dm^{-3})
pH: 6.0,
Evaluation: C

This apparent equilibrium constant was obtained from kinetic data.

5.37. Enzyme: purine-nucleoside phosphorylase (EC 2.4.2.1)

adenosine(aq)+orthophosphate(aq)=adenine(aq) +α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.063
310.15	9.0	0.12

Reference: 67SAK/YOR2
Method: electrophoresis
Buffer: Tris (0.04 mol dm^{-3})+HCl
pH: 7.0–9.0
Evaluation: C

These results were calculated from the data shown in Sakal *et al.*'s Figs. 7 and 8.

adenosine(aq)+orthophosphate(aq)=adenine(aq) +α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.0	5.41E-3

Reference: 80CAM/SGA
Method: spectrophotometry
Buffer: Tris (0.107 mol dm^{-3})+HCl
pH: 7.0
Evaluation: B

2′-deoxyinosine(aq)+orthophosphate(aq)=hypoxanthine(aq) +2-deoxy-α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
297.15	7.4	0.019

Reference: 50FRI
Method: spectrophotometry
Buffer: Tris (0.03 mol dm^{-3})+HCl
pH: 7.4
Evaluation: C

2′-deoxyinosine(aq)+orthophosphate(aq)=hypoxanthine(aq) +2-deoxy-α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.030

Reference: 63DEV/GOU
Method: radioactivity and spectrophotometry
Buffer: Tris+phosphate
pH: 7.0
Evaluation: C

The approximate value of the apparent equilibrium constant given above was calculated from the per cent conversion data given by De Verdier and Gould.

guanosine(aq)+orthophosphate(aq)=guanine(aq) +α-D-ribose1-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.0	0.001	0.25	9.26E-3

Reference: 92KIM/KIN
Method: HPLC and enzymatic assay
Buffer: Mops
pH: 7.0
Cofactor(s): Mg^{2+}
Evaluation: A

inosine(aq)+orthophosphate(aq)=hypoxanthine(aq)
+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.025

Reference: 63DEV/GOU
Method: radioactivity and spectrophotometry
Buffer: Tris+phosphate
pH: 7.0
Evaluation: C

The approximate value of the apparent equilibrium constant given above was calculated from the per cent conversion data given by De Verdier and Gould.

inosine(aq)+orthophosphate(aq)=hypoxanthine(aq)
+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.1	0.0175

Reference: 75JEN/NYG
Method: chromatography and radioactivity
Buffer: Tris (0.025 mol dm^{-3})+succinate
pH: 7.1
Evaluation: C

inosine(aq)+orthophosphate(aq)=hypoxanthine(aq)
+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	0.048

Reference: 75MUR/TSU
Method: spectrophotometry
Buffer: Tris (0.10 mol dm^{-3})+HCl
pH: 7.5
Evaluation: B

inosine(aq)+orthophosphate(aq)=hypoxanthine(aq)
+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.1	0.038

Reference: 82SAL/JOR
Method: NMR
pH: 7.0
Evaluation: C

inosine(aq)+orthophosphate(aq)=hypoxanthine(aq)
+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	buffer	K'
298.15	5.0	succinic acid	5.38E-3
298.15	6.1	Mes	1.02E-2
298.15	7.3	Mops	2.19E-2
298.15	8.4	Tricine	2.11E-2
298.15	8.4	Tricine	2.16E-2
298.15	9.4	glycine	2.18E-2

Reference: 89LEH/SIN
Method: spectrophotometry
Buffer: succinic acid (0.2 mol dm^{-3}), Mes (0.2 mol dm^{-3}), Mops (0.2 mol dm^{-3}), Tricine (0.2 mol dm^{-3}), and glycine (0.2 mol dm^{-3})
pH: 5.0–9.4
Evaluation: B

inosine(aq)+orthophosphate(aq)=hypoxanthine(aq)
+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.0	0.001	0.25	1.64E-2

Reference: 92KIM/KIN
Method: HPLC and enzymatic assay
Buffer: Mops
pH: 7.0
Cofactor(s): Mg^{2+}
Evaluation: A

nicotinamide(aq)+α-D-ribose 1-phosphate(aq)=nicotinamide riboside(aq)
+orthophosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	3.6E-4

Reference: 51ROW/KOR
Method: fluorometry and spectrophotometry
Buffer: glcylglycine (0.05 mol dm^{-3})
pH: 7.4
Evaluation: C

The above result was calculated from the data given in Fig. 2 and the table directly beneath that figure in this paper. Equilibrium was not approached from both directions. The temperature is assumed to be 298.15 K. Few details were given. The same result was also given by Kornberg [51KOR]

xanthosine(aq)+orthophosphate(aq)=xanthine(aq)
+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.0	0.001	0.25	1.56E-2

Reference: 92KIM/KIN

Method: HPLC and enzymatic assay
Buffer: Mops
pH: 7.0
Cofactor(s): Mg^{2+}
Evaluation: A

inosine(aq)+thymine(aq)=5-methyluridine(aq)+hypoxanthine(aq)

$\frac{T}{K}$	pH	K'
313.15	7.0	0.21

Reference: 91HOR/UEH
Method: HPLC
Buffer: potassium phosphate (0.005 mol dm^{-3})
pH: 7.0
Evaluation: C

Pyrimidine-nucleoside phosphorylase (EC 2.4.2.2) was also present.

inosine(aq)+thymine(aq)=5-methyluridine(aq)+hypoxanthine(aq)

$\frac{T}{K}$	ϕ(methyl alcohol)	ϕ(ethyl alcohol)	ϕ(acetone)	pH	K'
333.15	0	0	0	7.0	0.240
333.15	5	0	0	7.0	0.240
333.15	10	0	0	7.0	0.247
333.15	15	0	0	7.0	0.246
333.15	0	5	0	7.0	0.246
333.15	0	10	0	7.0	0.248
333.15	0	0	5	7.0	0.245
333.15	0	0	10	7.0	0.250
333.15	0	0	15	7.0	0.250

Reference: 91HOR/WAT
Method: HPLC
Buffer: potassium phosphate (0.020 mol dm^{-3})
pH: 7.0
Evaluation: B

Apparent equilibrium constants were determined in solutions containing methyl alcohol, ethyl alcohol, and acetone. The volume fractions ϕ of these various solvents in the final solution are given above.

5.38. Enzyme: pyrimidine-nucleoside phosphorylase (EC 2.4.2.2)

inosine(aq)+thymine(aq)=5-methyluridine(aq)+hypoxanthine(aq)

$\frac{T}{K}$	pH	K'
313.15	7.0	0.21

Reference: 91HOR/UEH
Method: HPLC
Buffer: potassium phosphate (0.005 mol dm^{-3})
pH: 7.0
Evaluation: C

Purine-nucleoside phosphorylase (EC 2.4.2.1) was also present.

5-methyluridine(aq)+orthophosphate(aq)=thymine(aq)+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
313.15	7.0	0.062

Reference: 91HOR/UEH
Method: HPLC
Buffer: potassium phosphate (0.005 mol dm^{-3})
pH: 7.0
Evaluation: C

uridine(aq)+orthophosphate(aq)=uracil(aq)+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.44
310.15	9.0	1.0

Reference: 67SAK/YOR
Method: electrophoresis
Buffer: Tris (0.04 mol dm^{-3})+HCl
pH: 7.0–9.0
Evaluation: C

These results were calculated from the data shown in Sakai *et al.*'s Figs. 9 and 10.

5.39. Enzyme: uridine phosphorylase (EC 2.4.2.3)

uridine(aq)+orthophosphate(aq)=uracil(aq)+α-D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	3.1E-2
310.15	8.2	7.8E-2

Reference: 74BOS/YAM
Method: spectrophotometry
Buffer: Tris or glycylglycine
pH: 7.4–8.2
Evaluation: C

5.40. Enzyme: nucleoside deoxyribosyltransferase (EC 2.4.2.6)

thymidine(aq)+adenine(aq)=2′-deoxyadenosine(aq)+thymine(aq)

$\frac{T}{K}$	pH	K'
310.15	5.8	15.1

Reference: 63BEC/LEV
Method: enzymatic assay
Buffer: maleate
pH: 5.8
Evaluation: B

2′-deoxyinosine(aq)+adenine(aq)=2′-deoxyadenosine(aq)+hypoxanthine(aq)

$\frac{T}{K}$	pH	K'
313.15	6.0	1.4

Reference: 74DAN/CAR
Method: spectrophotometry
Buffer: phosphate (0.1 mol dm^{-3})
pH: 6.0
Evaluation: C

This result was obtained from kinetic data. The approximate result given above is the average of the apparent equilibrium constants obtained from both directions of the reaction.

5.41. Enzyme: adenine phosphoribosyltransferase (EC 2.4.2.7)

adenine(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)=AMP(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.4	290

Reference: 66HOR/HEN
Buffer: Tris (0.2 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgSO_4$ (0.001 mol dm^{-3})
Evaluation: C

adenine(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)=AMP(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{\text{mol dm}^{-3}}$	$\frac{I_c}{\text{mol dm}^{-3}}$	K'
311.15	7.4	0.001	0.25	2E3

Reference: 92KIM/KIN
Method: spectrophotometry and fluorimetry
Buffer: {Tris (0.025 mol dm^{-3})+HCl} and {(Na_2HPO_4 +NaH_2PO_4) (0.060 mol dm^{-3})}
pH: 7.4
Cofactor(s): Mg^{2+}
Evaluation: A

5-amino-4-imidazolecarboxamide(aq)+5-phospho-α-D-ribose 1-diphosphate(aq) =5-amino-1-β-D-ribosyl-4-imidazolecarboxamide 5′-phosphate(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
311.15	8.0	9.7

Reference: 57FLA/ERW
Method: spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$ (0.002 mol dm^{-3})
Evaluation: B

The same result was also given by Flaks [63FLA].

5.42. Enzyme: hypoxanthine phosphoribosyltransferase (EC 2.4.2.8)

GMP(aq)+hypoxanthine(aq)=IMP(aq)+guanine(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	0.38

Reference: 82SAL/GIA
Method: spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.01 mol dm^{-3})
Evaluation: C

Salerno and Giacomello state that the apparent equilibrium constant is not significantly affected by the temperature (303 to 343 K), pH (6.1 to 7.65), pyrophosphate concentration (0.0001 to 0.001 mol dm^{-3}), $MgCl_2$ concentration (0.001 to 0.01 mol dm^{-3}), or Tris concentration (0.01 to 0.1 mol dm^{-3}).

guanine(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)=GMP(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.4	0.001	0.25	1E5

Reference: 92KIM/KIN
Method: spectrophotometry and fluorimetry
Buffer: {Tris (0.025 mol dm^{-3})+HCl} and {(Na_2HPO_4 +NaH_2PO_4) (0.060 mol dm^{-3})}
pH: 7.4
Cofactor(s): Mg^{2+}
Evaluation: A

hypoxanthine(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)=IMP(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.4	0.001	0.25	1E5

Reference: 92KIM/KIN
Method: spectrophotometry and fluorimetry
Buffer: {Tris (0.025 mol dm^{-3})+HCl} and {(Na_2HPO_4 +NaH_2PO_4) (0.060 mol dm^{-3})}
pH: 7.4
Cofactor(s): Mg^{2+}
Evaluation: A

5.43. Enzyme: orotate phosphoribosyltransferase (EC 2.4.2.10)

orotidine 5′-phosphate(aq)+pyrophosphate(aq)=orotate(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	8.3

Reference: 55LIE/KOR
Method: spectrophotometry
Buffer: Tris (0.02 mol dm^{-3})
pH: 8.0
Cofactor(s): $MgCl_2$ (0.002 mol dm^{-3})
Evaluation: C

Few details were given. The data may not be based upon work of Lieberman *et al.* The temperature is assumed to be 298.15 K. The same result was also given by Flaks [63FLA].

orotidine 5′-phosphate(aq)+pyrophosphate(aq)=orotate(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	14

Reference: 77TRA/JON
Method: TLC and radioactivity
Buffer: Tris (0.02 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.002 mol dm^{-3})
Evaluation: B

orotidine 5′-phosphate(aq)+pyrophosphate(aq)=orotate(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	8.0	2

Reference: 79VIC/GRE
Method: spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$ (0.001 mol dm^{-3})
Evaluation: C

The apparent equilibrium constant given above was calculated from kinetic data. Victor *et al.* state that this result is approximate.

orotidine 5′-phosphate(aq)+pyrophosphate(aq)=orotate(aq)+5-phospho-α-D-ribose 1-diphosphate(aq)

$\frac{T}{K}$	pH	K'
301.15	8.0	1.4

Reference: 87TAV/LEE
Method: NMR
Buffer: Hepes (0.025 mol dm^{-3})+KOH
pH: 8.0
Cofactor(s): $MgCl_2$ (0.008 mol dm^{-3})
Evaluation: B

orotidine 5′-phosphate(aq)+thiopyrophosphate(aq)=orotate(aq)+phosphoribosyl-1-*O*-(2-thiodiphosphate)(aq)

$\frac{T}{K}$	pH	K'
301.15	8.0	0.026

Reference: 87TAV/LEE
Method: NMR
Buffer: Hepes (0.025 mol dm^{-3})+KOH
pH: 8.0
Cofactor(s): $MgCl_2$ (0.008 mol dm^{-3})
Evaluation: B

5.44. Enzyme: guanosine phosphorylase (EC 2.4.2.15)

guanosine(aq)+orthophosphate(aq)=guanine(aq)+D-ribose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	0.019

Reference: 61YAM
Method: spectrophotometry

Buffer: phosphate
pH: 7.0
Evaluation: C

This is an approximate result.

5.45. Enzyme: thiamine pyridinylase (EC 2.5.1.2)

thiamine(aq)+aniline(aq)=4-methyl-5-(2′-hydroxyethyl)-thiazole(aq)+heteroanilithiamine(aq)

$\frac{T}{K}$	pH	K'
303.15	6.5	0.030

Reference: 84PUZ/GOR
Method: chemical analysis and radioactivity
Buffer: phosphate (0.05 mol dm^{-3})
pH: 6.5
Evaluation: C

thiamine(aq)+nicotinamide(aq)=4-methyl-5-(2′-hydroxyethyl)-thiazole(aq)+heteronicotinathiamine(aq)

$\frac{T}{K}$	pH	K'
303.15	6.5	0.022

Reference: 84PUZ/GOR
Method: chemical analysis and radioactivity
Buffer: phosphate (0.05 mol dm^{-3})
pH: 6.5
Evaluation: C

5.46. Enzyme: thiamin-phosphate pyrophosphorylase (EC 2.5.1.3)

2-methyl-4-amino-5-hydroxymethylpyrimidine diphosphate(aq)+4-methyl-5-(2-phosphonoxyethyl)-thiazole(aq)=pyrophosphate(aq)+thiamine monophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	9.2	6

Reference: 61LED
Method: fluorescence and chemical analysis
Buffer: glycine (0.10 mol dm^{-3})
pH: 9.2
Cofactor(s): $MgSO_4$ (0.0001 mol dm^{-3})
Evaluation: C

5.47. Enzyme: aspartate transaminase (EC 2.6.1.1)

L-aspartate(aq)+2-oxoglutarate(aq)=oxaloacetate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
311.15	7.4	0.25

Reference: 40COH
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.4
Evaluation: C

This is an approximate result determined from kinetic data.

L-aspartate(aq)+2-oxoglutarate(aq)=oxaloacetate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.15	0.18

Reference: 45DAR
Method: spectrophotometry
Buffer: phosphate (0.2 mol dm^{-3})
pH: 7.15
Evaluation: C

These results are based on kinetic data.

L-aspartate(aq)+2-oxoglutarate(aq)=oxaloacetate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
311.15	7.3	0.3

Reference: 45GRE/LEL
Method: spectrophotometry
Buffer: phosphate (0.2 mol dm^{-3})
pH: 7.3
Evaluation: C

This is an approximate result.

L-aspartate(aq)+2-oxoglutarate(aq)=oxaloacetate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	0.148

Reference: 53KRE
Method: manometry
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.4
Evaluation: A

L-aspartate(aq)+2-oxoglutarate(aq)=oxaloacetate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.65	7.4	0.13

Reference: 53NIS/BAR
Method: spectrophotometry
Buffer: phosphate (0.033 mol dm^{-3})
pH: 7.4
Evaluation: B

L-aspartate(aq)+2-oxoglutarate(aq)=oxaloacetate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	$\frac{I_c}{\text{mol dm}^{-3}}$	K'
310.15	7.4	0.13	0.165

Reference: 64HEN/CLE
Method: spectrophotometry
Buffer: Tris
pH: 7.4
Evaluation: B

From kinetic data, it was also found that K' was ≈0.15.

L-aspartate(aq)+2-oxoglutarate(aq)=oxaloacetate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	$\frac{I_c}{\text{mol dm}^{-3}}$	K'
311.15	7.0	0.25	0.151

Reference: 69VEE/EGG
pH: 7.0
Evaluation: C

The result given above is the unpublished result of Krebs and Stubbs. Few details were given.

erythro-3-hydroxyaspartate(aq)+2-oxoglutarate(aq)=
2-oxo-3-hydroxybutanedioic acid(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.9	12

Reference: 66JEN/DAR
Method: spectrophotometry
Buffer: pyrophosphate (0.05 mol dm^{-3})
pH: 7.9
Evaluation: C

This is an approximate result.

L-glutamate(aq)+(*S*)-malate(aq)+NAD(aq)=L-aspartate(aq)
+2-oxoglutarate(aq)+NADH(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	4.1E-5

Reference: 80PET/AMI
Method: spectrophotometry
Buffer: Tris (0.090 mol $dm^{[3]}$)+HCl
pH: 7.4
Evaluation: C

Malate dehydrogenase (EC 1.1.1.37) was also present. This is an approximate result.

5.48. Enzyme: alanine transaminase (EC 2.6.1.2)

L-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
313.15	7.4	1

Reference: 39COH
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.4
Evaluation: C

This is an approximate result.

L-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.3	0.70

Reference: 42LEN/STR
Method: chemical anlaysis
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.3
Evaluation: C

L-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.15	0.48
308.15	7.15	0.48

Reference: 45DAR
Method: spectrophotometry
Buffer: phosphate (0.2 mol dm^{-3})
pH: 7.15
Evaluation: C

These results are based on kinetic data.

L-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
311.15	7.3	1.0

Reference: 45GRE/LEL
Method: spectrophotometry
Buffer: phosphate (0.2 mol dm^{-3})
pH: 7.3
Evaluation: C

This is an approximate result.

L-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	0.658

Reference: 53KRE
Method: manometry
Buffer: phosphate (0.5 mol dm^{-3})
pH: 7.4
Evaluation: A

L-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.3	0.610

Reference: 62SEG/BEA
Method: spectrophotometry
Buffer: phosphate (0.1 mol dm^{-3})
pH: 7.3
Evaluation: B

L-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
298.15	8.0	2.2

Reference: 65BUL/HAN
Method: spectrophotometry
Buffer: glyclyglycine
pH: 8.0
Evaluation: C

This result was calculated from kinetic data.

5.49. Enzyme: histidinol-phosphate transaminase (EC 2.6.1.9)

L-histidinol phosphate(aq)+2-oxoglutarate(aq)=
3-(imidazol-4-yl)-2-oxopropyl phosphate(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.1	25

Reference: 56AME/HOR
Method: spectrophotometry
Buffer: pyrophosphate (0.092 mol dm^{-3})
pH: 8.1
Evaluation: B

5.50. Enzyme: ornithine-oxo-acid transaminase (EC 2.6.1.13)

L-ornithine(aq)+2-oxoglutarate(aq)=DL-Δ^1-pyrroline-5-carboxylate(aq)
+ L-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.1	71

Reference: 65STR
Method: spectrophotometry
Buffer: potassium phosphate (0.05 mol dm^{-3})
pH: 7.1
Evaluation: C

5.51. Enzyme: glutamine-pyruvate transaminase (EC 2.6.1.15)

L-glutamine(aq)+glyoxylate(aq)=2-oxoglutaramate(aq)+glycine(aq)

$\frac{T}{K}$	pH	K'
310.15	8.4	607

Reference: 72COO/MEI
Method: spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 8.4
Evaluation: B

L-glutamine(aq)+2-oxo-4-methiolbutyrate(aq)=2-oxoglutaramate(aq)
+L-methionine(aq)

$\frac{T}{K}$	pH	K'
310.15	8.4	69

Reference: 72COO/MEI
Method: spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 8.4
Evaluation: B

L-glutamine(aq)+pyruvate(aq)=2-oxoglutaramate(aq)+L-alanine(aq)

$\frac{T}{K}$	pH	K'
310.15	8.4	340

Reference: 72COO/MEI
Method: spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 8.4
Evaluation: B

5.52. Enzyme: succinyldiaminopimelate transaminase (EC 2.6.1.17)

N-succinyl-2-L-amino-6-oxoheptanedioate(aq)+L-glutamate(aq)
=*N*-succinyl-L-2,6-diaminoheptanedioate(aq)+2-oxoglutarate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.0	1.2

Reference: 62PET
Method: spectrophotometry
Buffer: Tris
pH: 8.0
Cofactor(s): $CoCl_2$
Evaluation: C

Few details were given.

5.53. Enzyme: β-alanine-pyruvate transaminase (EC 2.6.1.18)

L-alanine(aq)+3-oxopropanoate(aq)=β-alanine(aq)+pyruvate(aq)

$\frac{T}{K}$	pH	K'
308.15	8.0	0.2

Reference: 62HAY/NIS
Method: spectrophotometry
Buffer: phosphate (0.5 mol dm^{-3})
pH: 8.0
Evaluation: C

This is an approximate result. Few details were given.

5.54. Enzyme: 4-aminobutyrate transaminase (EC 2.6.1.19)

4-aminobutanoate(aq)+2-oxoglutarate(aq)=4-oxobutanoate(aq)
+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
311.15	8.1	0.14

Reference: 59SCO/JAK
Method: spectrophotometry
Buffer: pyrophosphate (0.1 mol dm^{-3})
pH: 8.1
Evaluation: C

Scott and Jakoby state that the apparent equilibrium constant was found to be independent of pH (7.4 to 8.8) and temperature (293 to 311 K). The same result was also given by Jakoby [62JAK].

5.55. Enzyme: D-alanine transaminase (EC 2.6.1.21)

D-alanine(aq)+2-oxoglutarate(aq)=pyruvate(aq)+D-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.3	0.59

Reference: 65MAR/JEN
Method: spectrophotometry
Buffer: Tris (0.067 mol dm^{-3})
pH: 8.3
Evaluation: B

Also see entries under EC 2.6.1.2.

5.56. Enzyme: pyridoxamine-pyruvate transaminase (EC 2.6.1.30)

5-deoxypyridoxamine(aq)+pyruvate(aq)=5-deoxypyridoxal(aq)
+L-alanine(aq)

$\frac{T}{K}$	pH	K'
298.15	8.85	0.17

Reference: 68AYL/SNE2
Method: spectrophotometry
Buffer: sodium pyrophosphate (0.05 mol dm^{-3})
pH: 8.85
Evaluation: B

The equilibrium constant was determined by direct measurement and from kinetic data.

3-hydroxy-4-aminomethylpyridine(aq)+pyruvate(aq)=
3-hydroxypyridine-4-aldehyde(aq)+L-alanine(aq)

$\frac{T}{K}$	pH	K'
298.15	8.85	0.70

Reference: 68AYL/SNE2
Method: spectrophotometry
Buffer: sodium pyrophosphate (0.05 mol dm^{-3})
pH: 8.85
Evaluation: B

The equilibrium constant was determined by direct measurement and from kinetic data.

ω-methylpyridoxamine(aq)+pyruvate(aq)=ω-methylpyridoxal(aq)
+L-alanine(aq)

$\frac{T}{K}$	pH	K'
298.15	8.85	1.26

Reference: 68AYL/SNE
Method: spectrophotometry
Buffer: sodium pyrophosphate (0.05 mol dm^{-3})
pH: 8.85
Evaluation: B

The equilibrium constant was determined by direct measurement and from kinetic data.

norpyridoxamine(aq)+pyruvate(aq)=norpyridoxal(aq)+L-alanine(aq)

$\frac{T}{K}$	pH	K'
298.15	8.85	1.96

Reference: 68AYL/SNE2
Method: spectrophotometry
Buffer: sodium pyrophosphate (0.05 mol dm^{-3})
pH: 8.85
Evaluation: B

The equilibrium constant was determined by direct measurement and from kinetic data.

pyridoxamine(aq) + pyruvate(aq) = pyridoxal(aq) + L-alanine(aq)

$\frac{T}{K}$	pH	K'
298.15	8.85	1.21

Reference: 68AYL/SNE
Method: spectrophotometry
Buffer: sodium pyrophosphate (0.05 mol dm^{-3})
pH: 8.85
Evaluation: C

5.57. Enzyme: dTDP-4-amino-4,6-dideoxy-D-glucose transaminase (EC 2.6.1.33)

dTDP-4-amino-4,6-dideoxy-D-glucose(aq)+2-oxoglutarate(aq)=
dTDP-4-dehydro-6-deoxy-D-glucose(aq)+L-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.0	2.0

Reference: 66MAT/STR
Method: spectrophotometry
Buffer: phosphate (0.12 mol dm^{-3})
pH: 7.0
Cofactor(s): pyridoxal phosphate
Evaluation: B

5.58. Enzyme: glycine-oxaloacetate transaminase (EC 2.6.1.35)

glycine(aq)+oxaloacetate(aq)=glyoxylate(aq)+L-aspartate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.1	0.016

Reference: 66GIB/MOR
pH: 7.1
Evaluation: D

Few experimental details were given.

5.59. Enzyme: 2-aminoadipate transaminase (EC 2.6.1.39)

L-2-aminoadipate(aq)+2-oxoglutarate(aq)=2-oxoadipate(aq)+
L-glutamate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	1.32

Reference: 70NAK/FUJ
Method: spectrophotometry
Buffer: phosphate (0.17 mol dm^{-3})
pH: 7.5
Evaluation: B

5.60. Enzyme: serine-pyruvate transaminase (EC 2.6.1.51)

L-alanine(aq)+hydroxypyruvate(aq)=L-serine(aq)+pyruvate(aq)

T/K	pH	$c(MgCl_2)$/mol dm^{-3}	I_c/mol dm^{-3}	K'
311.15	7.0	0	0.25	5.50
298.15	7.0	0	0.25	4.26
303.15	7.0	0	0.25	4.42
323.15	7.0	0	0.25	6.60
311.15	7.0	0	0.060	5.73
311.15	7.0	0	1.00	5.47
311.15	9.0	0	0.25	9.23
311.15	7.0	0.0083	0.25	5.27

Reference: 82GUY
Method: spectrophotometry
Buffer: potassium phosphate (0.025 mol dm^{-3})
pH: 7.0–9.0
Cofactor(s): Mg^{2+}
Evaluation: A

Guynn calculated K(T=311.15 K, I=0.25 mol dm^{-3})=5.4 for the chemical reference reaction: L-alanine(aq)+hydroxypyruvate$^-$(aq)=L-serine(aq) +pyruvate$^-$(aq). We calculate $\Delta_r H'°$(T=311 K, pH=7.0, I_c=0.25 mol dm^{-3})=(15±3) kJ mol^{-1} from the temperature dependence of K'.

5.61. Enzyme: phosphoserine transaminase (EC 2.6.1.52)

3-phosphonooxypyruvate(aq)+L-glutamate(aq)=2-oxoglutarate(aq) +O-phospho-L-serine(aq)

T/K	pH	K'
298.15	8.2	0.15

Reference: 67HIR/GRE
Method: spectrophotometry and radioactivity
Buffer: Tris+HCl
pH: 8.2
Evaluation: D

The result given above is the average of those obtained from both directions of reaction. It appears to have a very large systematic error (see Merrill *et al.* [81MER/MCA]).

3-phosphonooxypyruvate(aq)+L-glutamate(aq)=2-oxoglutarate(aq) + O-phospho-L-serine(aq)

T/K	pH	$c(Mg^{2+})$/mol dm^{-3}	I_c/mol dm^{-3}	K'
311.15	6.81	0	0.25	85.4
311.15	6.83	0	0.25	78.0
311.15	6.91	0	0.25	87.7
311.15	6.92	0	0.25	100
311.15	6.92	0	0.25	82.6
311.15	6.94	0	0.25	98.8
311.15	6.94	0	0.25	93.9
311.15	6.94	0	0.25	90.7
311.15	6.94	0	0.25	83.7
311.15	6.96	0	0.25	81.8
311.15	6.98	0	0.25	101
311.15	6.98	0	0.25	85.0
311.15	6.98	0	0.25	88.1
311.15	7.00	0	0.25	89.5
311.15	7.01	0	0.25	81.5
311.15	7.01	0	0.25	84.4
311.15	7.02	0	0.25	93.0
311.15	7.03	0	0.25	99.5
311.15	7.15	0	0.25	89.6
311.15	7.15	0	0.25	88.4
311.15	7.17	0	0.25	93.6
311.15	7.19	0	0.25	96.4
311.15	7.22	0	0.25	92.2
311.15	7.23	0	0.25	96.2
311.15	7.51	0	0.25	86.1
311.15	7.53	0	0.25	88.6
311.15	7.00	1.31E-3	0.25	93.4
311.15	7.00	1.31E-3	0.25	95.1
311.15	7.00	2.02E-3	0.25	79.6
311.15	7.00	2.03E-3	0.25	80.6
311.15	7.00	2.65E-3	0.25	91.6
311.15	7.00	2.68E-3	0.25	88.9
311.15	7.00	4.10E-3	0.25	83.6
311.15	7.00	4.12E-3	0.25	88.6
311.15	7.00	5.34E-3	0.25	74.9
311.15	7.00	5.26E-3	0.25	76.9
311.15	7.00	5.55E-3	0.25	86.1
311.15	7.00	5.58E-3	0.25	84.8
311.15	7.00	1.12E-2	0.25	73.5
311.15	7.00	1.10E-2	0.25	73.0
311.15	7.00	0	0.07	103
311.15	7.00	0	0.07	101
311.15	7.00	0	0.07	110
311.15	7.00	0	0.07	112
311.15	7.00	0	0.50	73.9
311.15	7.00	0	0.50	69.5
311.15	7.00	0	0.50	84.7
311.15	7.00	0	0.50	74.6
311.15	7.00	0	0.75	67.9
311.15	7.00	0	0.75	68.0
311.15	7.00	0	0.75	64.0
311.15	7.00	0	0.75	65.5

Reference: 81MER/MCA
Method: enzymatic assay and spectrophotometry
Buffer: phosphate (0.025 mol dm^{-3})
pH: 6.81–7.53
Cofactor(s): $MgCl_2$
Evaluation: A

Merrill *et al.* state that the apparent equilibrium constant is insignificantly affected by temperature over the range 277 K to 316 K. They also calculated K(T=311.15 K, I=0.25 mol dm^{-3})=(133±1) for the chemical reference reaction: 3-phosphonooxypyruvate^{3-}(aq)+L-glutamate(aq) −2-oxoglutarate^{2-}(aq)+O-phospho-L-serine^{2-}(aq). The pH of the solutions

given in their Tables VII and VIII is (7.00±0.05) [R. Guynn, personal communication].

5.62. Enzyme: hexokinase (EC 2.7.1.1)

ATP(aq)+6-aminoglucose(aq)=ADP(aq)+6-aminoglucose 6-phosphate(aq)

T/K	pH	$c(MgCl_2)$/mol dm^{-3}	K'
298.15	9.25	0.017	0.182

Reference: 91SEM/CLE
Method: NMR and spectrophotometry
Buffer: Ches (0.10 mol dm^{-3})
pH: 9.25
Cofactor(s): $MgCl_2$ (0.017 mol dm^{-3})
Evaluation: B

ATP(aq)+D-fructose(aq)=ADP(aq)+D-fructose 6-phosphate(aq)

T/K	pH	I_m/mol kg^{-1}	$\Delta_r H$(cal)/kJ mol^{-1}
298.19	8.61	0.10	−63.0
298.19	8.63	0.098	−61.9
301.66	8.63	0.12	−63.0
305.11	8.61	0.12	−63.1

Reference: 75GOL
Method: calorimetry
Buffer: Tris (0.18 mol kg^{-1})+HCl
pH: 8.61−8.63
Cofactor(s): $MgCl_2$ (trace amount)
Evaluation: A

Goldberg applied ionization and buffer protonation corrections to obtain $\Delta_r H°(T=298.15\ K, I=0)=-(15.0\pm0.9)$ kJ mol^{-1} for the chemical reference reaction: $ATP^{4-}(aq)+D\text{-fructose}(aq)=ADP^{3-}(aq)+D\text{-fructose 6-phosphate}^{2-}(aq)+H^+(aq)$.

ATP(aq)+D-glucose(aq)=ADP(aq)+D-glucose 6-phosphate(aq)

T/K	pH	$c(MgCl_2)$/mol dm^{-3}	K'
303.15	6.07	0.00214	294
303.15	6.07	0.00214	299
303.15	6.07	0.00214	303
303.15	6.00	0.00395	304
303.15	6.03	0.00756	245
303.15	6.02	0.01084	203
303.15	6.03	0.0140	186
303.15	6.04	0.0903	184
303.15	6.00	0.00250	430
303.15	6.01	0.00485	300
303.15	6.00	0.0855	193
303.15	5.94	0.00217	230
303.15	5.94	0.00217	222
303.15	6.02	0.00216	249
303.15	6.12	0.00205	277
303.15	6.01	0.080	123
303.15	6.04	0.119	154
303.15	6.03	0.177	205
303.15	6.03	0.177	214
303.15	7.00	0.155	1310
303.15	6.67	0.153	540
303.15	6.34	0.151	286
303.15	5.99	0.149	139
303.15	5.70	0.146	88
303.15	6.03	0.117	260
303.15	6.00	0.105	222
303.15	6.00	0.00250	618
303.15	6.08	0.00492	356
303.15	5.94	0.099	172

Reference: 57ROB/BOY
Method: radioactivity
Buffer: phosphate
pH: 5.94–7.00
Cofactor(s): $MgCl_2$
Evaluation: A

ATP(aq)+D-glucose(aq)=ADP(aq)+D-glucose 6-phosphate(aq)

T/K	pH	K'
310.15	7.25	340

Reference: 57VLA/VLA
Method: radioactivity
Buffer: glycine
pH: 7.25
Cofactor(s): Mg^{2+}
Evaluation: C

The result given above is the average of the results given in the paper. The reaction may not be at equilibrium. The same result was also given by Vladimirov *et al.* [57VLA/VLA2].

ATP(aq)+D-glucose(aq)=ADP(aq)+D-glucose 6-phosphate(aq)

T/K	pH	I_m/mol dm^{-1}	$\Delta_r H$(cal)/kJ mol^{-1}
298.19	6.69	0.22	−52.0
298.19	6.71	0.23	−44.0
298.19	6.75	0.48	−41.8
298.19	7.06	0.23	−57.7
298.19	7.25	0.22	−62.9
298.19	7.45	0.20	−67.8
298.19	7.46	0.21	−67.7
298.19	7.64	0.21	−69.8
298.19	7.67	0.19	−69.2
298.19	7.84	0.18	−69.6
298.19	7.99	0.17	−70.4
298.19	8.00	0.16	−68.9
298.19	8.09	0.16	−71.6
298.19	8.20	0.13	−71.3
298.19	8.41	0.10	−69.2
298.19	8.42	0.10	−70.4
298.19	8.44	0.11	−71.4
298.19	8.56	0.17	−72.7
298.19	8.64	0.12	−73.7
298.19	8.66	0.093	−70.8
298.19	8.66	0.099	−72.7
298.19	8.66	0.12	−71.2
298.19	8.67	0.12	−72.5
298.19	8.68	0.094	−70.9
298.19	8.69	0.092	−71.4
298.19	8.71	0.15	−71.8
298.19	9.01	0.099	−70.4
298.19	9.01	0.095	−72.4
298.19	8.66	0.018	−73.1
298.19	8.65	0.019	−68.4
298.19	8.71	0.045	−69.8
298.19	8.67	0.049	−71.5
298.19	8.68	0.078	−71.3
298.19	8.72	0.25	−71.6
298.19	8.41	0.15	−70.2
298.19	8.54	0.10	−71.1
301.66	8.63	0.12	−72.1
305.11	8.65	0.12	−71.6

Reference: 75GOL
Method: calorimetry
Buffer: Tris+HCl
pH: 6.69–9.01
Cofactor(s): $MgCl_2$ (trace amount)
Evaluation: A

Goldberg applied ionization and buffer protonation corrections to obtain $\Delta_r H°(T=298.15\ \text{K},\ I=0)=-(23.8\pm0.7)$ kJ mol^{-1} for the chemical reference reaction: $ATP^{4-}(aq)$+D-glucose(aq)=$ADP^{3-}(aq)$+D-glucose 6-phosphate^{2-} (aq)+$H^+(aq)$.

ATP(aq)+D-glucose(aq)=D-glucose 6-phosphate(aq)+ADP(aq)

$\frac{T}{K}$	pH	buffer	$\frac{\Delta_r H(cal)}{kJ\ mol^{-1}}$	$\frac{\Delta_r H'^\circ}{kJ\ mol^{-1}}$
298.15	8.0	Tris	−74.9	−27.6
298.15	8.0	glycylglycine	−71.5	−27.2
298.15	8.0	glycylglycylglycine	−66.1	−28.5
298.15	8.0	*N*,*N*-bis(2-hydroxyethyl)-glycine	−54.0	−27.6

Reference: 75MCG/JOR
Method: calorimetry
Buffer: Tris, glycylglycine, glycylglycylglycine, and *N*,*N*-bis(2-hydroxyethyl)-glycine
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: A

McGlothlin and Jordan used $\Delta_r N(H^+)=-1.0$ and the enthalpies of ionization of the buffers to obtain the values of $\Delta_r H'^\circ$ given above.

ATP(aq)+D-glucose(aq)=ADP(aq)+D-glucose 6-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{m(MgCl_2)}{mol\ kg^{-1}}$	pMg	$\frac{I_m}{mol\ kg^{-1}}$	$\frac{\Delta_r H(cal)}{kJ\ mol^{-1}}$
298.16	8.85	0.322	0.51	1.01	−67.7
298.16	8.90	0.258	0.62	0.78	−67.7
298.16	8.86	0.157	0.90	0.45	−67.8
298.16	8.90	0.100	1.17	0.27	−68.1
298.16	8.92	0.0545	1.86	0.11	−69.9
298.16	8.86	0.0346	2.36	0.09	−72.8
298.16	8.87	0.0293	2.59	0.09	−74.5
298.16	8.88	0.0212	3.02	0.10	−78.1
298.16	8.90	0.0187	3.10	0.10	−78.8
298.16	8.89	0.0180	3.22	0.10	−79.8
298.16	8.64	0.0156	3.37	0.15	−80.4
298.16	8.92	0.0140	3.55	0.11	−81.9
298.16	8.92	0.0106	3.97	0.11	−82.7
298.16	8.93	0.00453	4.64	0.14	−78.5
298.16	8.98	0.00127	5.45	0.15	−73.2
298.16	8.98	0.00027	6.01	0.16	−71.9

Reference: 76GOL
pH: 8.64–8.98
Method: calorimetry
Cofactor(s): $MgCl_2$
Buffer: Tris+HCl
Evaluation: A

Goldberg also performed calculations on the dependence of $\Delta_r H(cal)$ on pMg.

$\Delta_r H^\circ(T=298.15\ K, I=0)=-(21.9\pm0.7)\ kJ\ mol^{-1}$ for the chemical reference reaction: $ATP^{4-}(aq)$+D-mannose(aq) $=ADP^{3-}(aq)$+D-mannose 6-phosphate$^{2-}(aq)+H^+(aq)$.

ATP(aq)+D-mannose(aq)=ADP(aq)+D-mannose 6-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{I_m}{mol\ kg^{-1}}$	$\frac{\Delta_r H(cal)}{kJ\ mol^{-1}}$
298.19	8.57	0.12	−68.9
298.19	8.62	0.10	−69.7
301.66	8.60	0.12	−68.8
305.11	8.63	0.12	−69.1

Reference: 75GOL
Method: calorimetry
Buffer: Tris (0.18 mol kg^{-1})+HCl
pH: 8.57–8.63
Cofactor(s): $MgCl_2$ (trace amount)
Evaluation: A

Goldberg applied ionization and buffer protonation corrections to obtain

5.63. Enzyme: galactokinase (EC 2.7.1.6)

ATP(aq)+D-galactose(aq)=ADP(aq)+α-D-galactose 1-phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
298.15	7.00	0.010	24
298.15	7.00	0.025	26

Reference: 61ATK/BUR
Method: electrophoresis and enzymatic assay
Buffer: HCl+NaOH
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: A

These results were also given in Atkinson *et al.* [59ATK/JOH].

5.64. Enzyme: 6-phosphofructokinase (EC 2.7.1.11)

ATP(aq)+D-fructose 6-phosphate(aq)=ADP(aq)
+ D-fructose1,6-biphosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.0	8.0E2
303.15	7.0	1.0E3
310.15	7.0	2.7E3
298.15	8.0	2.8E3
303.15	8.0	2.9E3
310.15	8.0	4.8E3

Reference: 75BOH/SCH
Method: calorimetry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.0–8.0
Cofactor(s): $MgCl_2$ (0.030 mol dm^{-3})
Evaluation: C

ATP(aq)+D-fructose 6-phosphate(aq)=ADP(aq)
+D-fructose 1,6-biphosphate(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	7.0	−84.2
303.15	7.0	−77.4
310.15	7.0	−72.9
298.15	8.0	−70.4
303.15	8.0	−67.3
310.15	8.0	−60.4

Reference: 75BOH/SCH
Method: calorimetry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.0–8.0
Cofactor(s): $MgCl_2$
Evaluation: B

ATP(aq)+D-fructose 6-phosphate(aq)=ADP(aq)
+D-fructose 1,6-biphosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	2.29E3

Reference: 73HAN/RUD
Method: enzymatic assay; spectrophotometry
Buffer: Tris (0.033 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$ (0.00694 mol dm^{-3})
Evaluation: A

ATP(aq)+D-fructose 6-phosphate(aq)=ADP(aq)
+D-fructose 1,6-biphosphate(aq)

$\frac{T}{K}$	pH	buffer	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	9.0	(NH_3+NH_4Cl) (0.1 mol dm^{-3})	−61.2
298.15	9.0	glycylglycine (0.1 mol dm^{-3})	−53.0
298.15	9.0	Taps (0.1 mol dm^{-3})	−50.3
298.15	9.0	Tris (0.1 mol dm^{-3})	−56.7

Reference: 82RED
Method: calorimetry
Buffer: (NH_3+NH_4Cl), glycylglycine, Taps, and Tris
pH: 9.0
Cofactor(s): Mg^{2+}
Evaluation: A

Redman-Furey used $\Delta_r N(H^+)=-1.0$ and the enthalpies of ionization of the buffers to calculate $\Delta_r H'°(T=298.15\text{ K}, \text{pH}=9.0)=-9.5\text{ kJ mol}^{-1}$.

ATP(aq)+D-fructose 6-phosphate(aq)=ADP(aq)
+D-fructose 1,6-biphosphate(aq)

$\frac{T}{K}$	pH	buffer	K'
303.15	6.8	imidazole	150
303.15	8.0	Tris	2900

Reference: 87RAO/HAR
Method: enzymatic assay and spectrophotometry
Buffer: {imidazole (0.10 M)+HCl} and {Tris (0.10 M)+HCl}
pH: 7.0 and 8.0
Cofactor(s): Mg^{2+}
Evaluation: B

These results were calculated from kinetic data.

5.65. Enzyme: NAD^+ kinase (EC 2.7.1.23)

ATP(aq)+NAD(aq)=ADP(aq)+NADP(aq)

$\frac{T}{K}$	pH	K'
303.15	6.1	29.3

Reference: 77APP/NAI
Method: enzymatic assay and chromatography
Buffer: sodium cacodylate (0.1 mol dm^{-3})
pH: 6.1
Cofactor(s): $MgCl_2$ (0.01 mol dm^{-3})
Evaluation: B

Apps and Nairn report $K'c(H^+)=29.3E\text{-}7$ at pH=7.0. The result given above was calculated from this result. The approximate result K' (T =303.15 K, pH=7.0)≈37 was also obtained from kinetic data.

5.66. Enzyme: dephospho-CoA kinase (EC 2.7.1.24)

ATP(aq)+3′-dephospho-CoA(aq)=ADP(aq)+CoA(aq)

$\frac{T}{K}$	pH	K'
310.15	7.3	1.6

Reference: 56FEU/WOL
Method: chromatography
Buffer: borate
pH: 7.2–7.4
Cofactor(s): $MgSO_4$
Evaluation: C

This is an approximate result.

5.67. Enzyme: glcerol kinase (EC 2.7.1.30)

ATP(aq)+glycerol(aq)=ADP(aq)+*sn*-glycerol 3-phosphate(aq)

$\frac{T}{K}$	pH	buffer	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	9.0	Bicine (0.1 mol dm^{-3})	−56.0
298.15	9.0	glycylglycine (0.1 mol dm^{-3})	−73.9
298.15	9.0	Taps (0.1 mol dm^{-3})	−69.8
298.15	9.0	Tris (0.1 mol dm^{-3})	−77.3

Reference: 82RED
Method: calorimetry
Buffer: Bicine, glycylglycine, Taps, and Tris
pH: 9.0
Cofactor(s): Mg^{2+}
Evaluation: A

Redman–Furey used $\Delta_r N(H^+)=-1.0$ and the enthalpies of ionization of the buffers to calculate $\Delta_r H'°(T=298.15\text{ K}, \text{pH}=9.0)=-29.9\text{ kJ mol}^{-1}$.

5.68. Enzyme: protein kinase (EC 2.7.1.37)

ATP(aq)+lysozyme(aq)=ADP(aq)+phospholysozyme(aq)

$\frac{T}{K}$	pH	K'
303.15	6.9	24

Reference: 75SHI/BEA
Method: radioactivity
Buffer: Mes (0.05 mol dm^{-3})
pH: 6.9
Cofactor(s): magnesium acetate (0.01 mol dm^{-3})
Evaluation: B

ATP(aq)+phosvitin(aq)=ADP(aq)+dephosvitin(aq)

$\frac{T}{K}$	pH	K'
310.15	5.9	40

Reference: 62RAB
Method: radioactivity
Buffer: Tris-imidazole (0.03 mol dm^{-3})
pH: 5.9
Cofactor(s): Mg^{2+}
Evaluation: C

This is an approximate result. There is an arithmetic error in the calculation of the first apparent equilibrium constant given in Rabinowitz' Table V.

ATP(aq)+pyruvate kinase(aq)=ADP(aq)+phospho*enol*pyruvate kinase(aq)

$\frac{T}{K}$	pH	K'
303.15	6.7	22

Reference: 80ELM/HAS
Method: radioactivity and spectrophotometry
Buffer: Tris(hydroxymethyl)methyl-2-aminoethanesulfonic acid (0.025 mol dm^{-3})
pH: 6.7
Cofactor(s): $MgCl_2$ (0.010 mol dm^{-3})
Evaluation: B

5.69. Enzyme: pyruvate kinase (EC 2.7.1.40)

ATP(aq)+pyruvate(aq)=ADP(aq)+phospho*enol*pyruvate(aq)

$\frac{T}{K}$	K'
303.15	5.56E-4

Reference: 49MEY/OES
Method: spectrophotometry, chemical analysis, and radioactivity
Buffer: bicarbonate
Cofactor(s): Mg^{2+}
Evaluation: C

The pH was not reported.

ATP(aq)+pyruvate(aq)=ADP(aq)+phospho*enol*pyruvate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.72	4.90E-4
303.15	7.72	3.86E-4
303.15	7.72	4.50E-4
303.15	7.94	6.85E-4
303.15	7.94	5.52E-4
303.15	7.94	7.35E-4
303.15	8.31	2.08E-3
303.15	8.31	1.52E-3
303.15	8.31	1.79E-4
303.15	8.70	4.95E-3
303.15	8.70	4.13E-3
303.15	8.70	4.29E-4

Reference: 59KRI
Method: enzymatic assay
Buffer: Tris (0.067 mol dm^{-3})

pH: 7.72–8.70
Cofactor(s): $MgCl_2$ (0.0006 / mol dm^{-3})
Evaluation: B

The apparent equilibrium constants given above were calculated from the concentrations given in Krimsky's Tables V and VI.

Evaluation: A

McQuate and Utter calculated values of the equilibrium constant that varied from 1.78E-12 to 4.33E-12 at T=303.15 K for the chemical reference reaction: $ATP^{4-}(aq)+pyruvate^{-}(aq)=ADP^{3-}(aq)+phospho\textit{enol}pyruvate^{3-}(aq)+H^{+}(aq)$. These results were reported in a preliminary communication by McQuate [58MCQ].

ATP(aq)+pyruvate(aq)=ADP(aq)+phospho*enol*pyruvate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.4	1.55E-4
303.15	8.0	4.51E-4
303.15	8.4	1.10E-3
303.15	9.0	2.72E-3

Reference: 59MCQ/UTT
Method: enzymatic assay and spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})
pH: 7.4–9.0
Cofactor(s): $MgCl_2$ (0.002 mol dm^{-3})

ATP(aq)+pyruvate(aq)=ADP(aq)+phospho*enol*pyruvate(aq)

$\frac{T}{K}$	pH	K'
288.15	8.0	3E-4

Reference: 79RAO/KAY
Method: NMR
Buffer: Hepes (0.1 mol dm^{-3})
pH: 8.0
Cofactor(s): $MgCl_2$ (0.0020 mol dm^{-3})
Evaluation: B

ATP(aq)+pyruvate(aq)=ADP(aq)+phospho*enol*pyruvate(aq)

$\frac{T}{K}$	pH	buffer	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$	$\frac{\Delta_r H'^{\circ}}{\text{kJ mol}^{-1}}$
298.15	8.02	Hepes	−14.5	6.2
298.15	8.06	triethanolamine	−26.4	7.4
298.15	8.00	Tris	−38.2	8.8
298.15	8.54	Tris	−38.6	8.8

Reference: 80CHE/HED
Method: flow microcalorimetry
Buffer: (Tris+HCl), (triethanolamine+HCl), and (Hepes+KOH)
pH: 8.0–8.54
Cofactor(s): $MgCl_2$
Evaluation: A

The calorimetric enthalpies of reaction given above (Cheer *et al.* actually carried out this reaction starting with ADP and phospho*enol*pyruvate) were corrected for the enthalpies of protonation of the buffer using $\Delta_r N(H^+) = -1.00$. These results can be made consistent for all three buffers if one uses $\Delta_r N(H^+) = -0.91$. In such a case one obtains $\Delta_r H'^{\circ}(T=298.15, pH=8.03) = -4.7$ kJ mol^{-1}. Cheer *et al.* have also calculated $\Delta_r H^{\circ}(T=298.15\ K, I=0) = 4.4$ kJ mol^{-1} for the chemical reference reaction: $ATP^{4-}(aq)+pyruvate^{-}(aq) = ADP^{3-}(aq)+phospho\textit{enol}pyruvate^{3-}(aq)+H^{+}(aq)$.

ATP(aq)+pyruvate(aq)=ADP(aq)+phospho*enol*pyruvate(aq)

$\frac{T}{K}$	pH	buffer	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	8.5	glycylglycine (0.1 mol dm^{-3})	−35.1
298.15	8.5	Taps (0.1 mol dm^{-3})	−31.9
298.15	8.5	Tris (0.1 mol dm^{-3})	−39.3
298.15	8.5	Tricine (0.1 mol dm^{-3})	−22.9

Reference: 82RED
Method: calorimetry
Buffer: Tricine, glycylglycine, Taps, and Tris
pH: 8.5
Cofactor(s): Mg^{2+}
Evaluation: A

Redman–Furey used $\Delta_r N(H^+) = -1.0$ and the enthalpies of ionization of the buffers to calculate $\Delta_r H'^{\circ}(T=298.15\ K, pH=8.5) = 8.1$ kJ mol^{-1}.

5.70. Enzyme: 1-phosphatidylinositol kinase (EC 2.7.1.67)

ATP(aq)+1-phosphatidyl-1D-*myo*-inositol(aq)=ADP(aq) + 1-phosphatidyl-1D-*myo*-inositol 4-phosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	3E-3

Reference: 88BEL/BAE
Method: chromatography and radioactivity
Buffer: Tris maleate (0.050 mol dm^{-3})
pH: 8.0
Cofactor(s): $MgCl_2$ (0.030 mol dm^{-3})
Evaluation: B

5.71. Enzyme: pyrophosphate-serine phosphotransferase (EC 2.7.1.80)

pyrophosphate(aq)+L-serine(aq)=orthophosphate(aq) +*O*-phospho-L-serine(aq)

$\frac{T}{K}$	pH	$\frac{c(\text{phosphate})}{\text{mol dm}^{-3}}$	K'
310.15	6.7	0.10	470
310.15	6.7	0.075	480
310.15	6.7	0.050	480
310.15	6.7	0.025	391
310.15	6.7	0.020	388
310.15	7.7	0.10	991
310.15	7.7	0.075	918

Reference: 72CAG/FRI
Method: spectrophotometry
Buffer: phosphate
pH: 6.7–7.7
Cofactor(s): $MgSO_4$ (0.001 mol dm^{-3})
Evaluation: C

5.72. Enzyme: pyrophosphate-fructose-6-phosphate 1-phosphotransferase (EC 2.7.1.90)

pyrophosphate(aq)+D-fructose 6-phosphate(aq)=orthophosphate(aq) +D-fructose 1,6-biphosphate(aq)

Reference: 84BER/COO
Method: NMR
Buffer: Taps (0.10 mol dm^{-3})
pH: 8.0
Cofactor(s): Mg^{2+} (0.0107 mol dm^{-3})
Evaluation: B

Bertagnolli and Cook report $K_c(T=298.15\ K)=(0.007\pm0.002)$ for the chemical reference reaction: magnesium pyrophosphate^{2-}(aq)+D-fructose 6-phosphate^{2-}(aq)=Mg^{2+}(aq)+orthophosphate^{2-}(aq)+D-fructose 1,6-biphosphate^{4-}(aq). From kinetic data they also obtained $K_c(T=298.15\ K)=(0.005\pm0.0015)$ for this reaction.

5.73. Enzyme: acetate kinase (EC 2.7.2.1)

ATP(aq)+acetate(aq)=ADP(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	6.5	5.6E-3

Reference: 44LIP
Method: chemical analysis
Buffer: phosphate (0.1 mol dm^{-3})
pH: 6.5
Evaluation: C

This is an approximate result.

ATP(aq)+acetate(aq)=ADP(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	K'
302.15	7.3	8.7E-3

Reference: 54ROS/GRU
Method: spectrophotometry
Buffer: Tris (0.05 mol dm^{-3})
pH: 7.3
Cofactor(s): $MgCl_2$ (0.010 mol dm^{-3})
Evaluation: B

ATP(aq)+acetate(aq)=ADP(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	K'
298.15	0.013

Reference: 52KOR
Evaluation: D

Few details were given. The temperature is assumed to be 298.15 K.

ATP(aq)+acetate(aq)=ADP(aq)+acetyl phosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	K'
298.15	7.4	0.002	2.48E-5	2.10E-2
298.15	7.4	0.002	2.40E-5	2.07E-2
298.15	7.4	0.005	7.02E-5	7.87E-3
298.15	7.4	0.005	7.22E-5	8.55E-3
298.15	7.4	0.010	3.33E-4	6.25E-3
298.15	7.4	0.010	3.91E-4	5.65E-3
298.15	7.4	0.015	1.49E-3	4.65E-3
298.15	7.4	0.015	1.46E-3	5.49E-3
298.15	7.4	0.016	1.97E-3	4.08E-3
298.15	7.4	0.016	1.76E-3	3.60E-3
298.15	7.4	0.020	4.92E-3	2.70E-3
298.15	7.4	0.020	4.24E-3	2.68E-3
298.15	7.4	0.030	1.23E-2	2.55E-3
298.15	7.4	0.040	2.05E-2	2.82E-3
298.15	7.4	0.040	2.10E-2	2.79E-3
298.15	7.4	0.080	5.67E-2	2.88E-3
298.15	7.4	0.080	5.72E-2	2.76E-3
298.15	7.4	0.200	0.174	2.51E-3
298.15	7.4	0.200	0.175	2.92E-3

Reference: 74LAN
Method: enzymatic assays and spectrophotometry
Buffer: Tris (0.2 mol dm^{-3})
pH: 7.4
Evaluation: A

Langer calculated $K(T=298.15\ K,\ I=0.2\ mol\ dm^{-3})=(48\pm9)$ for the chemical reference reaction: $ADP^{3-}(aq)+acetyl\ phosphate^{2-}(aq)=ATP^{4-}(aq)+acetate^{-}(aq)$. These results were also given later by Langer *et al.* [77LAN/GAR] with the data presented graphically.

CoA(aq)+acetate(aq)+ATP(aq)=acetyl-CoA(aq) +ADP(aq) +orthophospate(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.01	4.1E-3	0.25	0.171
311.15	7.01	2.7E-3	0.25	0.164
311.15	7.01	6.9E-4	0.25	0.252
311.15	7.01	2.9E-4	0.25	0.395
311.15	7.01	4.8E-5	0.25	0.695
311.15	7.01	2.5E-6	0.25	0.989

Reference: 73GUY/VEE
Method: spectrophotometry and enzymatic assay
pH: 7.01
Cofactor(s): Mg^{2+}
Evaluation: A

Phosphate acetyltransferase (EC 2.3.1.8) was also present. Guynn and Veech also performed calulations on the variation of the apparent equilibrium constant with free magnesium ion concentration and combined their results with other data to calculate the standard Gibbs energy of hydrolysis of ATP.

5.74. Enzyme: carbamate kinase (EC 2.7.2.2)

ATP(aq)+ammonium carbamate(aq)=ADP(aq)+carbamoyl phosphate(aq)

$\frac{T}{K}$	pH	K'
283.15	9.4	0.042

Reference: 60JON/LIP
Method: chemical analysis
Buffer: Tris
pH: 9.4
Cofactor(s): $MgCl_2$
Evaluation: C

ATP(aq)+ammonium carbamate(aq)=ADP(aq)+carbamoyl phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	8.14	0.027

Reference: 66MAR/COH
Method: radioactivity
Buffer: bicarbonate
pH: 8.14
Cofactor(s): $MgCl_2$ (0.010 mol dm^{-3})
Evaluation: B

This result was also given by Marshall and Cohen [70MAR/COH].

5.75. Enzyme: phosphoglycerate kinase (EC 2.7.2.3)

ATP(aq)+3-phospho-D-glycerate(aq)=ADP(aq) +3-phospho-D-glyceroyl phosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	6.9	3.1E-4

Reference: 47BUC
Method: spectrophotometry
pH:≈7.0
Evaluation: C

The same result was also given by Bücher [55BUC].

ATP(aq)+3-phospho-D-glycerate(aq)=ADP(aq) +3-phospho-D-glyceroylphosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.6	3.0E-4

Reference: 70KRI/BUC
Method: spectrophotometry
Buffer: triethanolamine (0.080 mol dm^{-3})
pH: 7.6
Cofactor(s): $MgSO_4$ (0.008 mol dm^{-3})
Evaluation: C

ATP(aq)+3-phospho-D-glycerate(aq)=ADP(aq)
+ 3-phospho-D-glyceroyl phosphate(aq)

$\frac{T}{\text{K}}$	pH	$\frac{c(Mg^{2+})}{\text{mol dm}^{-3}}$	$\frac{I_c}{\text{mol dm}^{-3}}$	K'
311.15	7.0	0.01	0.25	1.43E-3
311.15	7.0	0.059	0.25	1.02E-3
311.15	7.0	0.22	0.25	5.29E-4
311.15	7.0	0.24	0.25	5.49E-4
311.15	7.0	0.30	0.25	5.48E-4
311.15	7.0	0.42	0.25	4.00E-4
311.15	7.0	0.44	0.25	3.92E-4
311.15	7.0	0.46	0.25	3.49E-4
311.15	7.0	0.79	0.25	3.18E-4
311.15	7.0	1.03	0.25	2.72E-4
311.15	7.0	1.04	0.25	2.78E-4
311.15	7.0	1.09	0.25	3.18E-4
311.15	7.0	1.23	0.25	2.78E-4
311.15	7.0	1.28	0.25	2.42E-4
311.15	7.0	1.34	0.25	2.74E-4
311.15	7.0	1.39	0.25	2.25E-4
311.15	7.0	1.41	0.25	2.41E-4
311.15	7.0	1.46	0.25	2.51E-4

Reference: 79COR/LEA
Method: enzymatic assay and spectrophotometry
Buffer: potassium phosphate and triethanolamine
pH: 7.0
Cofactor(s): $MgCl_2$ and KCl
Evaluation: A

ATP-β-S(aq)+3-phospho-D-glycerate(aq)=ADP-β-S(aq)
+ 3-phospho-D-glyceroyl phosphate(aq)

$\frac{T}{\text{K}}$	pH	K'
280.15	7.6	2.3E-3

Reference: 80JAF/COH
Method: NMR
Buffer: triethylamine bicarbonate (0.20 mol dm^{-3})
pH: 7.6
Cofactor(s): $MgCl_2$ (0.030 mol dm^{-3})
Evaluation: C

This is an approximate result.

D-glyceraldehyde 3-phosphate(aq)+ADP(aq)+NAD(aq)
+orthophosphate(aq) =3-phospho-D-glycerate(aq)+ATP(aq)+NADH(aq)

$\frac{T}{\text{K}}$	pH	$\frac{I_c}{\text{mol dm}^{-3}}$	K'_c
311.15	6.88	0.25	28
311.15	6.89	0.25	41
311.15	6.91	0.25	45
311.15	6.92	0.25	35
311.15	6.94	0.25	41
311.15	6.97	0.25	68
311.15	6.98	0.25	61
311.15	6.99	0.25	58
311.15	7.00	0.25	59
311.15	7.01	0.25	71
311.15	7.02	0.25	78

Reference: 68VEE
Method: spectrophotometry
Buffer: phosphate
pH: 6.88–7.02
Cofactor(s): $MgCl_2$ (0.0006 mol dm^{-3})
Evaluation: B

Glyceraldehyde-3-phosphate dehydrogenase (EC 1.2.1.12) was also present. Veech reports $K'_c c(H^+)/c^\circ$ in his Table III.5. The apparent equilibrium constants given above were calculated from these results. Also see the results of Veech *et al.* [70VEE/RAI] below.

D-glyceraldehyde 3-phosphate(aq)+ADP(aq)+NAD(aq)
+orthophosphate(aq) =3-phospho-D-glycerate(aq)+ATP(aq)+NADH(aq)

$\frac{T}{\text{K}}$	pH	$\frac{I_c}{\text{mol dm}^{-3}}$	K'_c
311.15	7.00	0.25	59

Reference: 70VEE/RAI
Method: spectrophotometry
Buffer: phosphate
pH: 6.88–7.02
Cofactor(s): $MgCl_2$ (0.0006 mol dm^{-3})
Evaluation: B

Veech *et al.* report $K'_c c(H^+)/c^\circ$=5.9E-6 over the pH range 6.88 to 7.02. The apparent equilibrium constant given above was calculated from this result. Also see the results of Veech [68VEE] above.

D-glyceraldehyde 3-phosphate(aq)+ADP(aq)+NAD(aq)
+orthophosphate(aq) =3-phospho-D-glycerate(aq)+ATP(aq)+NADH(aq)

$\frac{T}{\text{K}}$	pH	$\frac{c(Mg^{2+})}{\text{mol dm}^{-3}}$	K'_c
310.15	7.0	2.34E-3	1.93E3
310.15	7.0	2.19E-3	1.54E3
310.15	7.0	8.91E-4	1.31E3
310.15	7.0	7.41E-4	1.13E3
310.15	7.0	3.80E-4	9.75E2
310.15	7.0	3.31E-4	8.17E2
310.15	7.0	2.09E-4	6.22E2
310.15	7.0	1.66E-4	6.70E2
310.15	7.0	1.48E-4	5.86E2
310.15	7.0	8.32E-5	4.90E2
310.15	7.0	6.17E-5	4.12E2
310.15	7.0	2.34E-5	3.53E2
310.15	7.0	1.78E-5	2.88E2
310.15	7.0	3.02E-6	3.06E2
310.15	7.0	2.00E-6	2.88E2

Reference: 78MEE/AKE
Method: spectrophotometry
Buffer: phosphate (0.020 mol dm^{-3})
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: B

The apparent equilibrium constants given above were taken from van der Meer *et al.*'s Fig. 2.

D-glyceraldehyde 3-phosphate(aq)+ADP(aq)+NAD(aq)
+orthophosphate(aq) =3-phospho-D-glycerate(aq)+ATP(aq)+NADH(aq)

$\frac{T}{\text{K}}$	pH	$\frac{c(Mg^{2+})}{\text{mol dm}^{-3}}$	K'_c
311.15	7.0	1.2E-3	2.17E3

Reference: 79COR/LEA
Method: enzymatic assay and spectrophotometry
Buffer: potassium phosphate
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: A

The apparent equilibrium constant given above was calculated from the results given in Cornell *et al.*'s Table V.

5.76. Enzyme: aspartate kinase (EC 2.7.2.4)

ATP(aq)+L-aspartate(aq)=ADP(aq)+4-phospho-L-aspartate(aq)

$\frac{T}{\text{K}}$	pH	K'
288.15	7.0	3.5E-4

Reference: 55BLA/WRI
Method: chromatography
Buffer: imidazole (0.05 mol dm^{-3})
pH: 7.0
Cofactor(s): $MgCl_2$ (0.02 mol dm^{-3})
Evaluation: C

5.77. Enzyme: guanidinoacetate kinase (EC 2.7.3.1)

ATP(aq)+guanidinoacetate(aq)=ADP(aq)+phosphoguanidinoacetate(aq)

$\frac{T}{\text{K}}$	pH	K'
308.15	7.25	29

Reference: 89ELL
Method: NMR and enzymatic assay
Buffer: mercaptoethanol (0.014 mol dm^{-3})+Hepes (0.050 mol dm^{-3})
pH: 7.25
Cofactor(s): magnesium acetate (0.050 mol dm^{-3})
Evaluation: C

Ellington determined the ratio $\{(K'$ (the above reaction)$/K'_{CK}\}$ to be 0.29, where K'_{CK} is the apparent equilibrium constant for the reaction: ATP(aq) +creatine(aq)=ADP(aq)+phosphocreatine(aq). The result given here was obtained using $K'_{CK}=100$ from Lawson and Veech [79LAW/VEE].

5.78. Enzyme: creatine kinase (EC 2.7.3.2)

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{\text{K}}$	pH	K'
293.15	7.7	0.13
293.15	8.8	0.48

Reference: 36LEH
Method: chemical analysis
Buffer: carbonate+bicarbonate
pH: 7.7–8.8
Evaluation: C

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{\text{K}}$	pH	buffer	K'
311.15	7.50	borate	0.0023
311.15	7.60	borate	0.0049
311.15	7.80	borate	0.0239
311.15	8.20	borate	0.0925
311.15	8.50	borate	0.191
311.15	9.05	borate	0.365
311.15	9.50	borate	0.138
311.15	9.70	borate	0.0061
311.15	8.55	veronal	0.039

Reference: 43BAN
Method: chemical analysis
Buffer: borate and veronal acetate
pH: 7.50–9.70
Evaluation: C

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	$\frac{c(CaCl_2)}{mol\ dm^{-3}}$	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
310.15	9.1	0	0	7.94
310.15	6.02	0	0	0.37
310.15	8.72	0.077	0	0.26
310.15	5.98	0.077	0	0.15
310.15	9.1	0.042	0	0.10
310.15	9.1	0	0.042	0.13
310.15	9.1	0.0148	0	0.13
310.15	9.1	0.0074	0	0.17
310.15	9.1	0.0037	0	0.45
310.15	9.1	0	0.074	0.0926
310.15	9.1	0	0.037	0.24
310.15	9.1	0.0052	0	0.15
310.15	9.1	0	0.0052	0.15
310.15	9.1	0.0052	0	0.23
310.15	9.1	0	0.0052	0.29
310.15	9.1	0.0105	0	0.10
310.15	9.1	0	0.0105	0.10
310.15	9.1	0.0105	0	0.13
310.15	9.1	0	0.0105	0.12

Reference: 48SOR/DEG
Method: chemical analysis and spectrophotometry
Buffer: glycocol
pH: 5.98–9.1
Cofactor(s): $MgCl_2$ and $CaCl_2$
Evaluation: B

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	buffer	K'
311.15	8.5	borate	0.20
311.15	8.5	veronal	0.040

Reference: 52ASK
Buffer: borate, veronal acetate, glycine, and ethanolamine
pH: 8.45–8.8
Cofactor(s): Mg^{2+} and Mn^{2+}
Evaluation: C

Askonas also investigated the dependence of K' on pH and pMg. It is not clear that equilibrium was established.

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	buffer	$\frac{c(MdSO_4)}{mol\ dm^{-3}}$	$\frac{c(MnSO_4)}{mol\ dm^{-3}}$	K'
293.15	9.02	glycine	0.020	0	0.30
293.15	9.02	glycine	0.010	0	0.31
293.15	9.02	glycine	0.006	0	0.35
293.15	9.02	glycine	0.002	0	0.78
303.15	7.4	glycylglycine	0.020	0	0.0096
303.15	7.4	glycylglycine	0.010	0	0.010
303.15	7.4	glycylglycine	0.006	0	0.010
303.15	7.4	glycylglycine	0.002	0	0.032
303.15	8.0	glycylglycine	0.020	0	0.037
303.15	8.0	glycylglycine	0.010	0	0.038
303.15	8.0	glycylglycine	0.006	0	0.044
303.15	8.0	glycylglycine	0.002	0	0.078
303.15	8.9	glycine	0.020	0	0.22
303.15	8.9	glycine	0.010	0	0.24
303.15	8.9	glycine	0.006	0	0.29
303.15	8.9	glycine	0.002	0	0.61
303.15	8.9	glycine	0.001	0	0.78
303.15	9.8	glycine	0.020	0	1.3
303.15	9.8	glycine	0.010	0	1.4
303.15	9.8	glycine	0.006	0	1.7
303.15	9.8	glycine	0.002	0	2.7
303.15	8.60	glycine	0	0.010	0.12
303.15	8.77	glycine	0	0.010	0.17
303.15	8.82	glycine	0	0.006	0.29
303.15	8.78	glycine	0	0.006	0.18
303.15	8.87	glycine	0	0.002	0.88
311.15	8.82	glycine	0.020	0	0.18
311.15	8.82	glycine	0.010	0	0.19
311.15	8.82	glycine	0.006	0	0.22
311.15	8.82	glycine	0.002	0	0.52

Reference: 54NOD/KUB
Method: spectrophotometry
Buffer: glycine (0.10 mol dm^{-3}) and glycylglycine (0.10 mol dm^{-3})
pH: 7.4–9.8
Cofactor(s): $MgSO_4$ and $MnSO_4$
Evaluation: A

The values given above are averages of individual results given in this paper. The equilibrium constant was found to be independent of the enzyme concentration.

ATP(aq) + creatine(aq) = ADP(aq) + phosphocreatine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
303.15	8.0	3.6E-2

Reference: 65MOR/JAM
Method: spectrophotometry
Buffer: *N*-ethylmorpholine+HCl
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: C

Morrison and James report $K'c(H^+)=3.6E\text{-}10$ based upon the analysis of kinetic data. The apparent equilibrium constant given above was calculated from this result.

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
310.15	7.0	0.0054
310.15	7.5	0.041
310.15	8.0	0.084

Reference: 67EPP/DAW
Method: spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.0–8.0
Evaluation: C

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(MgCl_2)}{\mathrm{mol\ dm^{-3}}}$	$\frac{c(CaCl_2)}{\mathrm{mol\ dm^{-3}}}$	$\frac{c(MnCl_2)}{\mathrm{mol\ dm^{-3}}}$	K'
303.15	8.0	0.001	0	0	0.407
303.15	8.0	0.002	0	0	0.300
303.15	8.0	0.003	0	0	0.186
303.15	8.0	0.004	0	0	0.136
303.15	8.0	0.005	0	0	0.079
303.15	8.0	0.006	0	0	0.054
303.15	8.0	0.007	0	0	0.043
303.15	8.0	0.008	0	0	0.043
303.15	8.0	0.009	0	0	0.043
303.15	8.0	0.010	0	0	0.043
303.15	8.0	0	0.001	0	0.400
303.15	8.0	0	0.002	0	0.284
303.15	8.0	0	0.003	0	0.196
303.15	8.0	0	0.004	0	0.154
303.15	8.0	0	0.005	0	0.096
303.15	8.0	0	0.006	0	0.083
303.15	8.0	0	0.007	0	0.071
303.15	8.0	0	0.008	0	0.060
303.15	8.0	0	0.009	0	0.050
303.15	8.0	0	0.010	0	0.050
303.15	8.0	0	0	0.001	0.379
303.15	8.0	0	0	0.002	0.271
303.15	8.0	0	0	0.003	0.209
303.15	8.0	0	0	0.004	0.105
303.15	8.0	0	0	0.005	0.091
303.15	8.0	0	0	0.006	0.059
303.15	8.0	0	0	0.007	0.050
303.15	8.0	0	0	0.008	0.053
303.15	8.0	0	0	0.009	0.039
303.15	8.0	0	0	0.010	0.039

Reference: 67MOR/WHI
Method: chromatography
Buffer: triethanolamine+HCl
pH: 8.0
Cofactor(s): $MgCl_2$, $CaCl_2$, and $MnCl_2$
Evaluation: B

The apparent equilibrium constants given above were calculated from data given in Fig. 1 of Morrison and White's paper.

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

T/K	pH	$c(CaCl_2)$/mol dm^{-3}	$c(MgCl_2)$/mol dm^{-3}	K'
303.15	7.0	0.0001	0	1.2E-2
303.15	7.0	0.00025	0	9.0E-3
303.15	7.0	0.0005	0	5.0E-3
303.15	7.0	0.0010	0	3.0E-3
303.15	7.0	0.0020	0	2.0E-3
303.15	7.0	0.0001	0	5.0E-3
303.15	7.0	0.0005	0	4.0E-3
303.15	7.0	0.0010	0	3.0E-3
303.15	7.0	0.0020	0	2.5E-3
303.15	7.0	0	0.0001	2.5E-2
303.15	7.0	0	0.0003	1.5E-2
303.15	7.0	0	0.001	1.0E-2
303.15	7.0	0	0.003	4.0E-3
303.15	7.0	0	0.010	3.0E-3

Reference: 71CHE/ALI
Method: chemical analysis
Buffer: Tris (0.025 mol dm^{-3})+HCl
pH: 7.0
Cofactor(s): Mg^{2+} and Ca^{2+}
Evaluation: C

Tables 4 and 5 in this paper are ambiguous.

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

T/K	pH	$c(Mg^{2+})$/mol dm^{-3}	K'_c
310.15	7.07	5.6E-3	3.62E-2
310.15	7.04	8.9E-7	3.05E-2
310.15	7.04	5.1E-7	3.22E-2
310.15	7.01	6.4E-7	2.88E-2
310.15	6.99	1.9E-6	3.22E-2
310.15	6.99	1.8E-6	2.97E-2
310.15	7.01	1.5E-6	3.05E-2
310.15	7.02	1.9E-6	3.11E-2
310.15	7.12	3.4E-6	3.46E-2
310.15	7.11	3.5E-6	3.51E-2
310.15	7.11	3.5E-6	3.58E-2
310.15	7.00	5.6E-6	2.60E-2
310.15	7.01	5.4E-6	2.17E-2
310.15	7.00	5.5E-6	2.54E-2
310.15	7.14	4.8E-5	3.39E-2
310.15	7.15	4.6E-5	3.38E-2
310.15	7.14	4.7E-5	3.47E-2
310.15	7.01	7.3E-5	1.72E-2
310.15	7.01	7.1E-5	1.80E-2
310.15	7.00	7.2E-5	1.82E-2
310.15	7.07	8.2E-4	7.87E-3
310.15	7.10	8.8E-4	7.69E-3
310.15	7.10	8.7E-4	7.81E-3
310.15	7.08	8.3E-4	7.69E-3
310.15	7.09	8.9E-4	8.06E-3
310.15	7.11	8.6E-4	8.47E-3
310.15	7.12	8.4E-4	8.13E-3
310.15	7.12	8.7E-4	7.81E-3
310.15	7.11	3.36E-3	5.78E-3
310.15	7.11	3.53E-3	6.06E-3
310.15	7.16	3.48E-3	6.49E-3
310.15	7.09	3.42E-3	6.02E-3
310.15	7.16	3.32E-3	6.17E-3
310.15	7.12	3.38E-3	6.10E-3
310.15	7.19	3.42E-3	6.49E-3
310.15	7.14	3.53E-3	6.67E-3
310.15	7.32	1.19E-2	6.41E-3
310.15	7.33	1.21E-2	6.76E-3
310.15	7.33	1.20E-2	6.49E-3
310.15	7.34	1.18E-2	7.58E-3
310.15	7.39	1.17E-2	7.52E-3
310.15	7.37	1.19E-2	7.14E-3
310.15	7.38	1.17E-2	6.10E-3
310.15	7.35	1.20E-2	6.90E-3

Reference: 79LAW/VEE
Method: enzymatic assay; spectrophotometry
Buffer: phosphate and Tris
pH: 6.99–7.39
Cofactor(s): $MgCl_2$
Evaluation: A

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

T/K	pH	K'
303.15	8.0	5.3E-2

Reference: 80LER/COH
Method: NMR
Buffer: Hepes (0.2 mol dm^{-3})
pH: 8.0
Cofactor(s): magnesium acetate (0.038 mol dm^{-3})
Evaluation: B

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	K'
277.15	7.8	0.08

Reference: 81RAO/COH
Method: NMR
Buffer: potassium Hepes (0.15 mol dm^{-3})
pH: 8.0
Cofactor(s): magnesium acetate (0.006 mol dm^{-3})
Evaluation: B

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	K'
303.15	7.4	0.011

Reference: 86KIM/LEE
Buffer: Hepes (0.020 mol dm^{-3})
pH: 7.4
Cofactor(s): $MgCl_2$ (0.004 mol dm^{-3})
Evaluation: C

This is an approximate result obtained from kinetic data using two different sources of this enzyme.

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	K'
286.65	8.2	3.30E-2
295.15	8.2	4.06E-2
303.15	8.2	4.17E-2
308.15	8.2	4.53E-2

Reference: 89ELD/DEG
Method: NMR
Buffer: Hepes (0.050 mol dm^{-3})
pH: 8.2
Cofactor(s): $MgCl_2$ (0.035 mol dm^{-3}) and KCl (0.070 mol dm^{-3})
Evaluation: B

Eldar and Degani report $\{K'c(H^+)\}^{-1}$. The values of K' given above were calculated from these results. From the temperature dependence of K' we calculate $\Delta_r H'°(T=295\ K, pH=8.2)=(10\pm4)$ kJ mol^{-1}.

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	K'
309.15	7.0	5.81E-3

Reference: 89LOP/COH
Method: NMR
Buffer: potassium acetate (0.140 mol dm^{-3})+$KHCO_3$ (0.006 mol dm^{-3})+(KH_2PO_4 +Na_2HPO4) (0.001mol dm^{-3})
pH: 6.7–7.2
Cofactor(s): magnesium acetate (0.011 mol dm^{-3})
Evaluation: C

LoPresti and Cohn report $\{K'c(H^+)\}^{-1}=1.72E9$. The apparent equilibrium constant given above was calculated from this result.

ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
278.15	7.03	0.000803	0.25	4.44E-3
278.15	7.03	0.000803	0.25	4.39E-3
278.15	7.03	0.000635	0.25	4.44E-3
278.15	7.03	0.000619	0.25	4.81E-3
278.15	7.02	0.000757	0.25	3.76E-3
278.15	7.02	0.000748	0.25	3.88E-3
278.15	7.07	0.000693	0.25	3.82E-3
278.15	7.07	0.000689	0.25	3.89E-3
288.15	7.00	0.000745	0.25	5.00E-3
288.15	7.00	0.000733	0.25	5.35E-3
288.15	7.00	0.000563	0.25	4.90E-3
288.15	7.00	0.000575	0.25	5.52E-3
288.15	6.99	0.000689	0.25	4.67E-3
288.15	6.99	0.000701	0.25	4.65E-3
288.15	7.04	0.000628	0.25	4.67E-3
288.15	7.04	0.000630	0.25	4.50E-3
298.15	6.97	0.000686	0.25	6.02E-3
298.15	6.97	0.000666	0.25	5.65E-3
298.15	6.98	0.000525	0.25	6.90E-3
298.15	6.98	0.000509	0.25	6.29E-3
298.15	6.96	0.000633	0.25	5.10E-3
298.15	6.96	0.000625	0.25	5.18E-3
298.15	7.01	0.000556	0.25	5.35E-3
298.15	7.01	0.000551	0.25	5.00E-3
311.15	6.93	0.000612	0.25	6.99E-3
311.15	6.93	0.000612	0.25	7.30E-3
311.15	6.94	0.000462	0.25	7.04E-3
311.15	6.94	0.000457	0.25	6.85E-3
311.15	6.93	0.000573	0.25	5.92E-3
311.15	6.93	0.000573	0.25	6.13E-3
311.15	6.98	0.000508	0.25	6.37E-3
311.15	6.98	0.000514	0.25	6.29E-3

Reference: 92TEA/DOB
Method: spectrophotometry and fluorimetry
Buffer: potassium phosphate (0.05 mol dm^{-3})
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: A

Teague and Dobson calculated $\Delta_r H'°$(pH=7.0, pMg=3.0, I=0.25 mol dm^{-3})=11.9 kJ mol^{-1} from the dependence of the apparent equilibrium constant on temperature. They also calculated $\Delta_r G°$=51.1 kJ mol^{-1}, $\Delta_r H°$=16.7 kJ mol^{-1}, and $\Delta_r S°$=−110.4 J K^{-1} mol^{-1} at T=311.15 K and I_c=0.25 mol dm^{-3} for the chemical reference reaction: ATP^{4-}(aq)+creatine(aq)=ADP^{3-}(aq)+phosphocreatine^{2-}(aq)+H^+(aq).

ATP(aq)+cyclocreatine(aq)=ADP(aq)+phosphocyclocreatine(aq)

$\frac{T}{K}$	pH	K'
309.15	7.0	0.178

Reference: 89LOP/COH
Method: NMR
Buffer: potassium acetate (0.140 mol dm^{-3})+$KHCO_3$ (0.006 mol dm^{-3})+(KH_2PO_4 +Na_2HPO4) (0.001 mol dm^{-3})

pH: 6.7–7.2
Cofactor(s): magnesium acetate (0.011 mol dm^{-3})
Evaluation: C

Phosphocyclocreatine is 1-carboxymethyl-2-imino-3-phosphoimidazolidine. LoPresti and Cohn report $\{K'c(H^+)\}^{-1}$=5.62E7. The apparent equilibrium constant given above was calculated from this result.

ATP-β-S(aq)+creatine(aq)=ADP-β-S(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	3.1

Reference: 80LER/COH
Method: NMR
Buffer: Hepes (0.2 mol dm^{-3})
pH: 8.0
Cofactor(s): magnesium acetate (0.038 mol dm^{-3})
Evaluation: B

adenosine 5′-(α,β-methylene)triphosphate(aq)+creatine(aq)
=adenosine 5′-(α,β-methylene)diphosphate(aq)+phosphocreatine(aq)

$\frac{T}{K}$	pH	K'
303.15	8.79	1.43E-3

Reference: 83MIL/RYC
Method: NMR
Buffer: Bicine (0.025 mol dm^{-3})+NaOH
pH: 8.79
Cofactor(s): magnesium acetate (0.0325 mol dm^{-3})
Evaluation: B

The apparent equilibrium constant given above was calculated from the result given in Table 2 in this paper.

phosphocreatine(aq)+cyclocreatine(aq)=creatine(aq)
+phosphocyclocreatine(aq)

$\frac{T}{K}$	pH	buffer	K'
310.15	7.0	triethanolamine+HCl	25
310.15	9.0	sodium gylcine	26

Reference: 77ANN/WAL
Method: spectrophotometry
Buffer: (triethanolamine+HCl) and sodium glycine
pH: 7.0–9.0
Cofactor(s): Mg^{2+}
Evaluation: B

Phosphocyclocreatine is 1-carboxymethyl-2-imino-3-phosphoimidazolidine.

phosphocreatine(aq)+cyclocreatine(aq)=creatine(aq)
+phosphocyclocreatine(aq)

$\frac{T}{K}$	pH	K'
309.15	7.0	34.6

Reference: 89LOP/COH
Method: NMR
Buffer: potassium acetate (0.140 mol dm^{-3})+$KHCO_3$ (0.006 mol dm^{-3})+(KH_2PO_4+Na_2HPO4) (0.001 mol dm^{-3})
pH: 6.7–7.2
Cofactor(s): magnesium acetate (0.011 mol dm^{-3})
Evaluation: B

Phosphocyclocreatine is 1-carboxymethyl-2-imino-3-phosphoimidazolidine.

phosphocreatine(aq) +H_2O(l)=creatine(aq)+orthophosphate(aq)

$\frac{T}{K}$	pH	$\frac{\Delta_r H(\text{cal})}{\text{kJ mol}^{-1}}$
298.15	8.0	−37.4

Reference: 60GEL/STU
Method: calorimetry
Buffer: Tris (0.045 mol dm^{-3})
pH: 8.0
Cofactor(s): $CaCl_2$ (0.001 mol dm^{-3})
Evaluation: A

Myosin ATPase (EC 3.6.1.32) was also present. Gellert and Sturtevant obtained $\Delta_r H'^\circ(T=298.15\text{ K}, \text{pH}=8.0)=-37.4$ kJ mol^{-1} for the above reaction using $\Delta_r N(H^+)=0$.

5.79. Enzyme: arginine kinase (EC 2.7.3.3)

ATP(aq)+L-arginine(aq)=ADP(aq)+N^ω-phospho-L-arginine(aq)

$\frac{T}{K}$	pH	K'
293.15	7.7	0.323

Reference: 36LEH
Method: chemical analysis
Buffer: carbonate+bicarbonate
pH: 7.7
Evaluation: C

ATP(aq)+L-arginine(aq)=ADP(aq)+N^ω-phospho-L-arginine(aq)

$\frac{T}{K}$	pH	K'
298.15	6.1	0.002
298.15	9.1	0.17

Reference: 49SOR/DVO
Buffer: glycocol
pH: 6.1–9.1
Evaluation: C

This is an approximate result obtained from kinetic data. The temperature is assumed to be 298.15 K.

ATP(aq)+L-arginine(aq)=ADP(aq)+N^{ω}-phospho-L-arginine(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(\mathrm{MgCl_2})}{\mathrm{mol\ dm^{-3}}}$	K'
303.15	8.0	0.0040	1.2
303.15	8.0	0.0060	2.1
303.15	8.0	0.0080	2.4

Reference: 66UHR/MAR
Buffer: triethanolamine (0.1 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: C

ATP(aq)+L-arginine(aq)=ADP(aq)+N^{ω}-phospho-L-arginine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
303.15	8.0	0.80

Reference: 69SMI/MOR
Buffer: triethanolamine (0.1 mol dm^{-3})
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: B

ATP(aq)+L-arginine(aq)=ADP(aq)+N^{ω}-phospho-L-arginine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
285.15	7.25	0.10

Reference: 76RAO/BUT
Method: NMR
Buffer: Hepes (0.15 mol dm^{-3})
pH: 7.25
Cofactor(s): $MgCl_2$ (0.017 mol dm^{-3})
Evaluation: B

ATP(aq)+L-arginine(aq)=ADP(aq)+N^{ω}-phospho-L-arginine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
303.15	8.0	0.17

Reference: 80LER/COH
Method: NMR
Buffer: Hepes (0.2 mol dm^{-3})
pH: 8.0
Cofactor(s): magnesium acetate (0.038 mol dm^{-3})
Evaluation: B

ATP(aq)+L-arginine(aq)=ADP(aq)+N^{ω}-phospho-L-arginine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
298.15	7.1	1.86E-2

Reference: 86GRA/ELL
Method: NMR
Buffer: imidazole (0.050 mol dm^{-3})+HCl
pH: 7.1
Cofactor(s): $MgCl_2$ (0.006 mol dm^{-3})
Evaluation: B

ATP(aq)+L-arginine(aq)=ADP(aq)+N^{ω}-phospho-L-arginine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
308.15	7.25	13

Reference: 89ELL
Method: NMR and enzymatic assay
Buffer: mercaptoethanol (0.014 mol dm^{-3})+Hepes (0.050 mol dm^{-3})
pH: 7.25
Cofactor(s): magnesium acetate (0.050 mol dm^{-3})
Evaluation: C

Ellington determined the ratio {K' (the above reaction)/K'_{CK}} to be 0.132, where K'_{CK} is the apparent equilibrium constant for the reaction: ATP(aq)+creatine(aq)=ADP(aq)+phosphocreatine(aq). The result given here was obtained using K'_{CK}=100 from Lawson and Veech [79LAW/VEE].

ATP-β-S(aq)+L-arginine(aq)=ADP-β-S(aq)+N^{ω}-phospho-L-arginine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
303.15	8.0	11

Reference: 80LER/COH
Method: NMR
Buffer: Hepes (0.2 mol dm^{-3})
pH: 8.0
Cofactor(s): magnesium acetate (0.038 mol dm^{-3})
Evaluation: B

5.80. Enzyme: taurocyamine kinase (EC 2.7.3.4)

ATP(aq) + taurocyamine(aq)=ADP(aq)+N^{ω}-phosphotaurocyamine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
303.15	7.1	0.526

Reference: 61PRA
Buffer: Tris
pH: 7.1
Evaluation: C

This result is attributed by T. E. Barman [69BAR] to L. A. Pradel [61PRA].

ATP(aq)+taurocyamine(aq)=ADP(aq)+N^{ω}-phosphotaurocyamine(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
308.15	7.25	29

Reference: 89ELL
Method: NMR and enzymatic assay

Buffer: mercaptoethanol (0.014 mol dm^{-3})+Hepes (0.050 mol dm^{-3})
pH: 7.25
Cofactor(s): magnesium acetate (0.050 mol dm^{-3})
Evaluation: C

Ellington determined the ratio {K' (the above reaction)/K'_{CK}} to be 0.293, where K'_{CK} is the apparent equilibrium constant for the reaction: ATP(aq) +creatine(aq)=ADP(aq)+phosphocreatine(aq). The result given here was obtained using K'_{CK}=100 from Lawson and Veech [79LAW/VEE].

5.81. Enzyme: lombricine kinase (EC 2.7.3.5)

ATP(aq)+lombricine(aq)=ADP(aq)+N^{ω}-phospholombricine(aq)

$\frac{T}{K}$	pH	K'
308.15	7.25	32

Reference: 89ELL
Method: NMR and enzymatic assay
Buffer: mercaptoethanol (0.014 mol dm^{-3})+Hepes (0.050 mol dm^{-3})
pH: 7.25
Cofactor(s): magnesium acetate (0.050 mol dm^{-3})
Evaluation: C

Ellington determined the ratio {K' (the above reaction)/K'_{CK}} to be 0.323, where K'_{CK} is the apparent equilibrium constant for the reaction: ATP(aq) +creatine(aq)=ADP(aq)+phosphocreatine(aq). The result given here was obtained using K'_{CK}=100 from Lawson and Veech [79LAW/VEE].

5.82. Enzyme: phosphomevalonate kinase (EC 2.7.4.2)

ATP(aq)+(*R*)-5-phosphomevalonate(aq)=ADP(aq) +(*R*)-5-diphosphomevalonate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.3	1.0

Reference: 69POP
Method: spectrophotometry
Buffer: Tris (0.050 mol dm^{-3}) + HCl
pH: 7.3
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: C

This is an approximate result.

ATP(aq)+(*R*)-5-phosphomevalonate(aq)=ADP(aq) +(*R*)-5-diphosphomevalonate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	1.70

Reference: 85LEE/OSU
Method: NMR and radioassay
Buffer: Hepes (0.10 mol dm^{-3})+KOH
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: B

The apparent equilibrium constant given above is the average of the results obtained by NMR and by radioassay.

ATP-α-*S*(aq)+(*R*)-5-phosphomevalonate(aq)=ADP-α-*S*(aq) +(*R*)-5-diphosphomevalonate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	3.25

Reference: 85LEE/OSU
Method: NMR and radioassay
Buffer: Hepes (0.10 mol dm^{-3})+KOH
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: B

The apparent equilibrium constant given above is the average of the results obtained by NMR and by radioassay.

ATP-β-*S*(aq)+(*R*)-5-phosphomevalonate(aq)=ADP-β-*S*(aq) +(*R*)-5-diphosphomevalonate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	80

Reference: 85LEE/OSU
Method: NMR and radioassay
Buffer: Hepes (0.10 mol dm^{-3})+KOH
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: B

The apparent equilibrium constant given above is the average of the results obtained by NMR and by radioassay.

ATP-γ-*S*(aq)+(*R*)-5-phosphomevalonate(aq)= ADP(aq) +2-thio-5-diphosphomevalonate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	0.97

Reference: 85LEE/OSU
Method: NMR and radioassay
Buffer: Hepes (0.10 mol dm^{-3})+KOH
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: B

The apparent equilibrium constant given above is the average of the results obtained by NMR and by radioassay.

5.83. Enzyme: adenylate kinase (EC 2.7.4.3)

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	K'
303.15	7.5	0.30

Reference: 43KAL
Method: spectrophotometry
pH: 7.5
Cofactor(s): $MgCl_2$

Evaluation: C

This is an approximate result based upon per cent conversion data.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	K'
298.15	7.4	0.444

Reference: 52EGG/HEM
Method: paper chromatography
Buffer: triethanolamine (0.02 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.01 mol dm^{-3})
Evaluation: C

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	K'
300.15	6.7	0.45

Reference: 53GRE/BRO
Method: chromatography
pH: 6.7
Cofactor(s): $MgCl_2$ (0.004 mol dm^{-3})
Evaluation: C

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	K'
303.15	1.0

Reference: 53SIE/POT
Method: spectrophotometry
Cofactor(s): Mg^{2+} (0.003 mol dm^{-3})
Evaluaton: C

This is an approximate result. The buffer and the pH were not reported.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
274.15	6.0	0	0.38
293.15	6.0	0	0.39
293.15	6.0	0.001	0.31
313.15	6.0	0	0.48

Reference: 54BOW/KER
Method: enzymatic assay
Buffer: sodium succinate (0.04 mol dm^{-3})
pH: 6.0
Evaluation: C

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
293.15	6.0	1.0E-6	0.37
293.15	6.0	1.0E-5	0.36
293.15	6.0	1.0E-4	0.52
293.15	6.0	1.44E-4	0.96
293.15	6.0	2.97E-4	1.24
293.15	6.0	5.31E-4	1.09
293.15	6.0	1.00E-3	0.76
293.15	6.0	1.58E-3	0.68
293.15	6.0	2.48E-3	0.47

Reference: 56BOW/KER
Method: enzymatic assay
Buffer: sodium succinate (0.04 mol dm^{-3})
pH: 6.0
Cofactor(s): $MgCl_2$
Evaluation: C

The buffer and the pH are assumed to be the same as used by Bowen and Kerwin in their earlier study [54BOW/KER]. The equilibrium constants have been taken from Bowen and Kerwin's Fig. 2.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$		pH	K'
303.15	—	6.12	0.69
303.15		6.81	0.47
303.15		7.50	0.46
303.15		7.88	0.40

Reference: 57CAL
Method: chromatography
Buffer: 2-amino 2-hydroxymethylpropane-1,3 diol (0.075 mol dm^{-3})
pH: 6.12–7.88
Cofactor(s): $MgCl_2$ (0.010 mol dm^{-3})
Evaluation: C

The apparent equilibrium constants given above were taken from Callaghan's Fig. 6.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	K'
303.15	7.5	0.42

Reference: 59CAL/WEB
Method: chromatography
Buffer: Tris (0.020 mol dm^{-3})+HCl
pH: 7.5
Cofactor(s): $MgCl_2$ (0.0015 mol dm^{-3})
Evaluation: C

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(MgCl_2)}{\mathrm{mol\ dm^{-2}}}$	K'
298.15	7.0	0.010	0.48
298.15	7.0	0.025	0.28

Reference: 61ATK/BUR
Method: electrophoresis and enzymatic assay
Buffer: HCl+NaOH
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: C

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{\mathrm{K}}$	pH	K'
303.15	7.4	0.81

Reference: 66MAR/WAD
Method: electrophoresis and spectrophotometry
Buffer: Tris acetate (0.040 mol dm^{-3})
pH: 7.4
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: B

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(MgCl_2)}{\mathrm{mol\ dm^{-3}}}$	K'
280.3	7.0	0.032	0.303
300.4	7.0	0.032	0.272
303.15	5.0	0.032	0.496
303.15	6.0	0.032	0.418
303.15	7.0	0.0081	0.640
303.15	7.0	0.016	0.413
303.15	7.0	0.032	0.245
303.15	7.0	0.032	0.269
303.15	7.0	0.065	0.216
303.15	8.0	0.032	0.236
303.15	9.0	0.032	0.205
303.15	10.0	0.032	0.197
322.6	7.0	0.032	0.245

Reference: 68SU/RUS
Method: paper chromatography and spectrophotometry
Buffer: Tris (0.016 mol dm^{-3})+HCl
pH: 5.0–10.0
Cofactor(s): $MgCl_2$
Evaluation: C

The results given above were taken from Su and Russel's Tables I and II and Fig. 4.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{\mathrm{K}}$	K'
298.15	0.5

Reference: 68BOM/PRA
Method: chromatography and radioactivity
Cofactor(s): Mg^{2+}
Evaluation: D

Few experimental details were given. The temperature is assumed to be 298.15 K. This is an approximate result.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{\mathrm{K}}$	pH	$\frac{c(MgCl_2)}{\mathrm{mol\ dm^{-3}}}$	$\frac{c(KCl)}{\mathrm{mol\ dm^{-3}}}$	K'
298.15	7.5	1.00E-5	0.0	0.333
298.15	7.5	2.00E-4	0.0	0.567
298.15	7.5	4.30E-4	0.0	0.847
298.15	7.5	7.36E-4	0.0	1.226
298.15	7.5	1.17E-3	0.0	1.342
298.15	7.5	2.15E-3	0.0	0.900
298.15	7.5	3.98E-3	0.0	0.543
298.15	7.5	1.00E-5	0.075	0.433
298.15	7.5	2.09E-4	0.075	0.637
298.15	7.5	3.98E-4	0.075	0.833
298.15	7.5	6.31E-4	0.075	1.153
298.15	7.5	1.08E-3	0.075	1.367
298.15	7.5	1.58E-3	0.075	1.167
298.15	7.5	2.15E-3	0.075	1.000
298.15	7.5	3.86E-3	0.075	0.600

Reference: 70BLA
Method: anion exchange chromatography
Buffer: triethanolaminehydrochloride (0.01 mol dm^{-3}) + tetramethylammonium hydroxide
pH: 7.5
Cofactor(s): $MgCl_2$
Evaluation: B

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_{tot})}{mol\ dm^{-3}}$	$\frac{c(nucleotide)}{mol\ dm^{-3}}$	K'
303.15	7.6	2.0E-3	2.06E-3	1.01
303.15	7.6	3.0E-3	3.30E-3	1.03
303.15	7.6	4.0E-3	4.82E-3	1.04
303.15	7.6	4.0E-3	4.99E-3	1.09
303.15	7.6	4.0E-3	6.08E-3	1.14
303.15	7.6	5.0E-3	0.58E-3	0.534
303.15	7.6	40.0E-3	3.10E-3	0.265
303.15	7.6	40.0E-3	6.48E-3	0.279
303.15	7.6	40.0E-3	3.32E-3	0.272
303.15	8.2	2.43E-3	5.0E-3	1.23
303.15	7.9	2.43E-3	5.0E-3	1.25
303.15	7.9	2.43E-3	5.0E-3	1.23
303.15	7.5	2.43E-3	5.0E-3	1.15
303.15	7.5	2.43E-3	5.0E-3	1.14
303.15	7.5	2.43E-3	5.0E-3	1.28
303.15	7.5	5.35E-3	5.0E-3	0.704
303.15	7.0	2.43E-3	5.0E-3	1.09
303.15	7.0	5.35E-3	5.0E-3	0.752
303.15	7.0	5.35E-3	5.0E-3	0.699
303.15	6.56	2.43E-3	5.0E-3	1.11
303.15	6.50	5.35E-3	5.0E-3	0.694
303.15	6.06	2.43E-3	5.0E-3	0.909
303.15	6.06	2.43E-3	5.0E-3	1.23
303.15	6.04	5.35E-3	5.0E-3	0.870
303.15	5.60	2.43E-3	5.0E-3	0.709
303.15	5.57	5.35E-3	5.0E-3	0.826
303.15	5.49	2.43E-3	5.0E-3	0.840
303.15	5.00	2.43E-3	5.0E-3	0.662
303.15	5.00	5.35E-3	5.0E-3	0.862
303.15	4.90	5.35E-3	5.0E-3	0.787

Reference: 71HOR/HUS
Method: paper chromatography and spectrophotometry
Buffer: triethanolamine (0.1 mol dm^{-3})+HCl
pH: 4.9–8.2
Cofactor(s): Mg^{2+}
Evaluation: B

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	pMg	K'
288.15	7.25	1.65	0.317
288.15	7.25	1.70	0.321
288.15	7.25	1.85	0.352
288.15	7.25	1.90	0.380
288.15	7.25	2.15	0.588
288.15	7.25	2.20	0.549
288.15	7.25	2.25	0.383
288.15	7.25	2.30	0.617
288.15	7.25	2.67	0.971
288.15	7.25	2.68	0.935
288.15	7.25	2.80	0.877
288.15	7.25	2.80	1.24
288.15	7.25	2.93	1.27
288.15	7.25	3.12	1.41
288.15	7.25	3.30	1.37
288.15	7.25	3.50	1.45
288.15	7.25	3.50	1.23
288.15	7.25	3.78	1.14
288.15	7.25	4.00	0.794
288.15	7.25	4.10	0.820
288.15	7.25	4.15	0.794
288.15	7.25	4.35	0.694
288.15	7.25	4.80	0.562
288.15	7.25	4.90	0.521
288.15	7.25	5.00	0.472
288.15	7.25	5.15	0.341
288.15	7.25	5.28	0.461
288.15	7.25	5.30	0.518
288.15	7.25	5.40	0.488
288.15	7.25	5.45	0.478
288.15	7.25	6.25	0.461
288.15	7.25	6.35	0.461
288.15	7.25	6.40	0.444
288.15	7.25	6.45	0.444
288.15	7.25	6.60	0.483
288.15	7.25	6.70	0.518
288.15	7.25	6.75	0.469
288.15	7.25	6.80	0.444
288.15	7.25	7.25	0.422
288.15	7.25	7.40	0.452

Reference: 73DEW/LOW
Method: spectrophotometry
Buffer: triethanolamine
pH: 7.25
Cofactor(s): $MgCl_2$
Evaluation: B

De Weer and Lowe report only calculated values of the free magnesium ion concentration. The results given above were obtained from De Weer and Lowe's Fig. 4.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
298.15	7.4	0.005	0.550

Reference: 74JEB/TY
Method: enzymatic assay and spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: B

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	buffer	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0015	6.23E-5	0.296	0.490
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0015	5.11E-5	0.311	0.515
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0050	2.85E-4	0.288	0.595
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0050	2.40E-4	0.298	0.513
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0100	8.73E-4	0.283	0.763
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0100	7.64E-4	0.288	0.671
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0200	3.60E-3	0.284	0.758
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0200	3.33E-3	0.287	0.709
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0500	2.60E-2	0.343	0.429
298.15	6.4	Tris (0.2 mol dm^{-3})	0.0500	2.53E-2	0.343	0.459
298.15	6.4	Tris (0.2 mol dm^{-3})	0.1000	7.41E-2	0.482	0.259
298.15	6.4	Tris (0.2 mol dm^{-3})	0.1000	7.38E-2	0.483	0.292
298.15	6.4	Tris (0.2 mol dm^{-3})	0.2000	0.173	0.777	0.200
298.15	6.4	Tris (0.2 mol dm^{-3})	0.2000	0.172	0.777	0.220
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	1.13E-4	0.283	0.549
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	1.10E-4	0.286	0.541
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0075	2.16E-4	0.276	0.658
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0075	2.15E-4	0.276	0.662
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0100	3.65E-4	0.272	0.741
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0100	3.51E-4	0.274	0.725
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0125	6.60E-4	0.263	0.758
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0125	6.03E-4	0.268	0.758
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0300	8.60E-3	0.266	0.508
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0300	7.84E-3	0.268	0.505
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0400	1.91E-2	0.286	0.348
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0400	1.74E-2	0.287	0.357
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0800	5.27E-2	0.395	0.233
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0800	5.15E-2	0.395	0.233
298.15	7.4	Tris (0.2 mol dm^{-3})	0.1300	0.102	0.541	0.206
298.15	7.4	Tris (0.2 mol dm^{-3})	0.1300	0.0999	0.540	0.186
298.15	7.4	Tris (0.2 mol dm^{-3})	0.2000	0.170	0.748	0.145
298.15	7.4	Tris (0.2 mol dm^{-3})	0.2000	0.171	0.748	0.143
298.15	7.4	Tris (0.2 mol dm^{-3})	0.5000	0.477	1.65	0.123
298.15	7.4	Tris (0.2 mol dm^{-3})	0.5000	0.474	1.65	0.121
298.15	7.4	Tris (0.2 mol dm^{-3})	0.1000	0.974	3.15	0.109
298.15	7.4	Tris (0.2 mol dm^{-3})	0.1000	0.975	3.15	0.112
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0005	5.74E-6	0.216	0.417
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0005	5.26E-6	0.227	0.427
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0020	2.68E-5	0.208	0.465
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0020	2.50E-5	0.214	0.465
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0050	9.10E-5	0.191	0.538
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0050	8.94E-5	0.193	0.568
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0100	3.19E-4	0.179	0.769
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0100	2.95E-4	0.183	0.704
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0500	2.46E-2	0.216	0.265
298.15	8.4	Tris (0.2 mol dm^{-3})	0.0500	2.33E-2	0.216	0.274
298.15	8.4	Tris (0.2 mol dm^{-3})	0.2000	0.173	0.654	0.153
298.15	8.4	Tris (0.2 mol dm^{-3})	0.2000	0.173	0.654	0.167
298.15	7.4	TEA (0.205 mol dm^{-3})	0.0050	9.88-5	0.283	0.633
298.15	7.4	TEA (0.205 mol dm^{-3})	0.0050	1.02E-4	0.281	0.538
298.15	7.4	TEA (0.205 mol dm^{-3})	0.0125	6.95E-4	0.255	0.735
298.15	7.4	TEA (0.205 mol dm^{-3})	0.0125	6.29E-4	0.258	0.870
298.15	7.4	TEA (0.205 mol dm^{-3})	0.0400	1.57E-2	0.282	0.334
298.15	7.4	TEA (0.205 mol dm^{-3}	0.0400	1.62E-2	0.282	0.326
298.15	7.4	none	0.0020	3.22E-5	0.160	0.474
298.15	7.4	none	0.0020	2.96E-5	0.170	0.444
298.15	7.4	none	0.0250	7.69E-e	0.110	0.488
298.15	7.4	none	0.0250	4.50E-3	0.129	0.645
298.15	7.4	none	0.0500	2.87E-2	0.163	0.261
298.15	7.4	none	0.0500	2.41E-2	0.172	0.293
298.15	7.4	Tris (0.01 mol dm^{-3})	0.0005	2.23E-4	0.013	1.54
298.15	7.4	Tris (0.01 mol dm^{-3})	0.0005	2.30E-4	0.013	1.72
298.15	7.4	Tris (0.01 mol dm^{-3})	0.0008	4.26E-4	0.013	1.41
298.15	7.4	Tris (0.01 mol dm^{-3})	0.0008	4.44E-4	0.013	1.56
298.15	7.4	TEA (0.01 mol dm^{-3})	0.0005	2.19E-4	0.012	1.59
298.15	7.4	TEA (0.01 mol dm^{-3})	0.0005	2.34E-4	0.012	1.61

2 ADP(aq)=AMP(aq)+ATP(aq) — Continued

$\frac{T}{K}$	pH	buffer	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
298.15	7.4	TEA (0.01 mol dm^{-3})	0.0008	4.36E-4	0.012	1.25
298.15	7.4	TEA (0.01 mol dm^{-3})	0.0008	4.48E-4	0.012	1.33
298.15	7.4	Tris (0.1 mol dm^{-3})	0.0005	2.35E-4	0.093	0.833
298.15	7.4	Tris (0.1 mol dm^{-3})	0.0005	2.40E-4	0.093	0.667
298.15	7.4	Tris (0.1 mol dm^{-3})	0.0008	4.49E-4	0.093	0.775
298.15	7.4	Tris (0.1 mol dm^{-3})	0.0008	4.54E-4	0.093	0.781
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	not given	not given	0.606
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	not given	not given	0.575
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	not given	not given	0.562
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	not given	not given	0.559
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	not given	not given	0.485
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0050	not given	not given	0.483
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0100	4.94E-5	0.594	0.510
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0100	5.22E-5	0.592	0.490
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0500	1.28E-3	0.454	0.667
298.15	7.4	Tris (0.2 mol dm^{-3})	0.0500	1.26E-3	0.461	0.645
298.15	7.4	Tris (0.2 mol dm^{-3})	0.1100	2.66E-2	0.474	0.322
298.15	7.4	Tris (0.2 mol dm^{-3})	0.1100	2.94E-2	0.472	0.313
298.15	7.4	Tris (0.2 mol dm^{-3})	0.2000	1.40E-3	1.55	0.526
298.15	7.4	Tris (0.2 mol dm^{-3})	0.2000	1.25E-3	1.67	0.508
298.15	7.4	Tris (0.2 mol dm^{-3})	0.2000	0.100	0.704	0.182
298.15	7.4	Tris (0.2 mol dm^{-3})	0.2000	0.027	0.723	0.287

Reference: 74LAN
Method: enzymatic assay and spectrophotometry
Buffer: Tris and triethanolamine (TEA)
pH: 6.4–8.4
Cofactor(s): $MgCl_2$
Evaluation: A

Langer used $K(T=298.15\ K, I=0.2\ mol\ dm^{-3})=2.75$ from Alberty [69ALB] for the chemical reference reaction: $AMP^{2-}(aq)+ATP^{4-}(aq)=2\ ADP^{3-}(aq)$. He found that this value and his model gave a good representation of the data. These results were also given by Langer *et al.* [77LAN/GAR] with the data presented graphically.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
310.15	6.91	1.08E-3	0.25	0.983
310.15	6.89	1.10E-3	0.25	0.964
310.15	6.91	1.08E-3	0.25	0.980
310.15	6.90	1.08E-3	0.25	0.982
310.15	6.97	0.38E-3	0.25	0.981
310.15	6.97	0.38E-3	0.25	0.929
310.15	6.98	0.37E-3	0.25	0.946
310.15	6.98	0.36E-3	0.25	0.871
310.15	6.99	0.10E-3	0.25	0.708
310.15	6.99	0.25E-3	0.25	0.899
310.15	6.99	0.44E-3	0.25	1.014
310.15	6.99	0.66E-3	0.25	1.044
310.15	6.99	0.83E-3	0.25	1.060
310.15	6.99	1.95E-3	0.25	0.842
310.15	6.99	4.45E-3	0.25	0.572
310.15	6.99	9.98E-3	0.25	0.380

Reference: 76LAW/GUY
Method: enzymatic assay; spectrophotometry
Buffer: phosphate (0.0095 to 0.0097 mol dm^{-3})
pH: 6.89–6.99
Cofactor(s): $MgCl_2$
Evaluation: A

Lawson *et al.* calculated $K(T=311.15\ K, I=0.25\ mol\ dm^{-3})=0.419$ for the chemical reference reaction: $2\ ADP^{3-}(aq)=AMP^{2-}(aq)+ATP^{4-}(aq)$. These results were also given by Lawson and Veech [79LAW/VEE].

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	K'
277.15	7.0	2.6

Reference: 78RAO/COH
Method: NMR
Buffer: Hepes
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: B

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
310.15	6.91	1.08E-3	0.25	0.980
310.15	6.90	1.08E-3	0.25	0.982
310.15	6.91	1.08E-3	0.25	0.983
310.15	6.89	1.10E-3	0.25	0.964
310.15	6.98	0.37E-3	0.25	0.946
310.15	6.98	0.36E-3	0.25	0.871
310.15	6.97	0.38E-3	0.25	0.981
310.15	6.97	0.38E-3	0.25	0.929
310.15	6.99	0.10E-3	0.25	0.708
310.15	6.99	0.25E-3	0.25	0.899
310.15	6.99	0.44E-3	0.25	1.014
310.15	6.99	0.66E-3	0.25	1.044
310.15	6.99	0.83E-3	0.25	1.060
310.15	6.99	1.95E-3	0.25	0.842
310.15	6.99	4.45E-3	0.25	0.572
310.15	6.99	9.98E-3	0.25	0.380

Reference: 79LAW/VEE
Method: enzymatic assay; spectrophotometry
Buffer: phosphate (0.0095 to 0.0097 mol dm^{-3})
pH: 6.89–6.99
Cofactor(s): $MgCl_2$
Evaluation: A

Lawson and Veech calculated $K(T=311.15\ K, I=0.25\ mol\ dm^{-3})=0.419$ for the chemical reference reaction: $2\ ADP^{3-}(aq)=AMP^{2-}(aq)+ATP^{4-}(aq)$. These results were also given by Lawson *et al.* [76LAW/GUY].

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	K'
303.15	7.4	1.09

Reference: 81RAM/PIC
Method: radioactivity
Buffer: Tris (0.075 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.015 mol dm^{-3})
Evaluation: C

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl^2)}{mol\ dm^{-3}}$	K'
297.15	6.1	0.001	0.80
297.15	7.0	0.001	0.60
297.15	8.0	0.001	0.55
297.15	9.0	0.001	0.57
297.15	10.1	0.001	0.42
297.15	8.0	0.0003	0.52
297.15	8.0	0.0010	0.57
297.15	8.0	0.0017	0.70
297.15	8.0	0.0023	0.99
297.15	8.0	0.0031	0.84
297.15	8.0	0.0037	0.67
297.15	8.0	0.0046	0.64
297.15	8.0	0.0052	0.46
297.15	8.0	0.0055	0.40
297.15	8.0	0.0061	0.27
297.15	8.0	0.0089	0.25
297.15	8.0	0.0099	0.24

Reference: 83KHO/KAR
Method: paper chromatography
Buffer: Tris (0.05 mol dm^{-3})+HCl
pH: 6.1–10.1
Cofactor(s): $MgCl_2$
Evaluation: B

The apparent equilibrium constants were taken from Fig. 3 in this paper.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	pMg	K'
298.15	8.0	5.83	0.34
298.15	8.0	5.53	0.37
298.15	8.0	5.37	0.49
298.15	8.0	4.88	0.52
298.15	8.0	4.37	0.92
298.15	8.0	3.84	1.28
298.15	8.0	3.20	1.14
298.15	8.0	3.04	1.06
298.15	8.0	3.00	0.92
298.15	8.0	2.68	0.67
298.15	8.0	2.49	0.46
298.15	8.0	2.28	0.34
298.15	8.0	2.17	0.32
298.15	8.0	2.08	0.30

Reference: 91KLE/RAN
Method: enzymatic assay and spectrophotometry
Buffer: Tricine (0.10 mol dm^{-3})
pH: 8.0
Cofactor(s): $MgCl_2$
Evaluation: B

These results were taken from Fig. 1 in the paper of Kleczowski and Randall [91KLE/RAN].

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{m(MgCl_2)}{mol\ kg^{-1}}$	$\frac{m(KCl)}{mol\ kg^{-1}}$	$\frac{I_m}{mol\ kg^{-1}}$	pMg	K'
298.15	8.31	0.0005101	0.0	0.072	6.72	0.343
298.15	8.54	0.0005099	0.0	0.081	6.71	0.346
286.05	8.68	0.0005101	0.0	0.072	6.59	0.355
286.05	8.85	0.0005099	0.0	0.080	6.59	0.356
292.15	8.46	0.0005101	0.0	0.071	6.66	0.352
292.15	8.67	0.0005099	0.0	0.080	6.65	0.349
304.15	8.16	0.0005101	0.0	0.072	6.78	0.357
304.15	8.34	0.0005099	0.0	0.080	6.78	0.351
310.25	7.98	0.0005101	0.0	0.071	6.84	0.351
310.25	8.13	0.0005099	0.0	0.078	6.84	0.348
298.15	8.34	0.002412	0.0	0.070	6.02	0.381
298.15	8.54	0.002410	0.0	0.080	6.02	0.378
298.15	8.28	0.02433	0.0	0.061	4.70	0.861
298.15	8.51	0.02432	0.0	0.068	4.69	0.854
298.15	8.40	0.2372	0.0	0.093	2.24	0.260
298.15	8.56	0.2371	0.0	0.096	2.27	0.258
298.15	8.33	0.07690	0.0	0.056	3.12	0.634
298.15	8.53	0.07688	0.0	0.062	3.16	0.603
298.15	8.30	0.007455	0.0	0.069	5.49	0.475
298.15	8.50	0.007453	0.0	0.076	5.48	0.484
298.15	8.32	0.03994	0.0	0.057	4.07	1.302
298.15	8.50	0.03993	0.0	0.063	4.13	1.268
298.15	8.40	0.0001959	0.0	0.071	7.12	0.349
298.15	8.54	0.0001957	0.0	0.079	7.12	0.361
298.15	8.49	0.0001958	0.0491	0.125	6.92	0.408
298.15	8.67	0.0001950	0.0489	0.132	6.93	0.412
298.15	8.57	0.0001957	0.1506	0.228	6.67	0.450
298.15	8.73	0.0001934	0.1488	0.233	6.70	0.444
298.15	8.68	0.0001958	0.2540	0.329	6.46	0.462
298.15	8.87	0.0001922	0.2493	0.326	6.46	0.458
298.15	7.79	0.0002121	0	0.052	7.13	0.366
298.15	7.93	0.0002119	0	0.061	7.15	0.364
298.15	6.04	0.0002121	0	0.026	6.34	0.366
298.15	6.67	0.0002119	0	0.037	6.84	0.377
298.15	6.77	0.0001700	0	0.034	6.97	0.364
298.15	6.88	0.0001699	0	0.038	7.05	0.365
298.15	7.41	0.0001700	0	0.044	7.22	0.365
298.15	7.45	0.0001699	0	0.048	7.24	0.366
311.15	6.83	0.02426	0.2303	0.249	3.51	0.934
311.15	7.04	0.02429	0.2264	0.245	3.54	0.928

Reference: 91TEW/GOL
Method: high-pressure liquid-chromatography
Buffer: Tris (0.05 mol kg^{-1})+HCl
pH: 6.83–8.87
Cofactor(s): $MgCl_2$
Evaluation: A

Tewari and Goldberg calculated $K=0.225$, $\Delta_r G°=3.70$ kJ mol^{-1}, $\Delta_r H°=-1.5$ kJ mol^{-1}, and $\Delta_r C_p^\circ \approx -46$ J K^{-1} mol^{-1} at $T=298.15$ K and $I=0$ for the chemical reference reaction: $2\ ADP^{3-}(aq) = AMP^{2-}(aq) + ATP^{4-}(aq)$.

2 ADP(aq)=AMP(aq)+ATP(aq)

$\frac{T}{K}$	pH	$\frac{m(MgCl^2)}{mol\ kg^{-1}}$	pMg	$\frac{I_m}{mol\ kg^{-1}}$	$\frac{\Delta_r H(cal)}{kg\ mol^{-1}}$
298.15	8.37	0.0002643	6.89	0.058	−1.20
304.55	8.20	0.0002927	6.90	0.056	−0.79
310.25	8.10	0.0002827	6.97	0.059	−1.43

Reference: 91TEW/GOL
Method: calorimetry
Buffer: Tris (0.05 mol kg^{-1})+HCl
pH: 8.10–8.37
Cofactor(s): $MgCl_2$
Evaluation: A

Tewari and Goldberg calculated $\Delta_r H°=-1.5$ kJ mol^{-1} and $\Delta_r C_p^\circ \approx -46$ J K^{-1} mol^{-1} at $T=298.15$ K and $I_m=0$ for the chemical reference reaction: $2\ ADP^{3-}(aq) = AMP^{2-}(aq) + ATP^{4-}(aq)$.

ADP(aq)+ADP-N^1-oxide(aq)=ATP-N^1-oxide(aq)+AMP(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl^2)}{mol\ dm^{-3}}$	K'
298.15	7.4	0.005	0.908

Reference: 74JEB/TY
Method: enzymatic assay and spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: B

2 dADP(aq)=dAMP(aq)+dATP(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
303.15	7.0	0.0081	0.830
303.15	7.0	0.016	0.563
303.15	7.0	0.032	0.306
303.15	7.0	0.065	0.270

Reference: 68SU/RUS
Method: paper chromatography and spectrophotometry
Buffer: Tris (0.016 mol dm^{-3})+HCl
pH: 7.0
Cofactor(s): $MgCl_2$
Evaluation: B

ATP(aq)+ADP(aq)=adenosine 5′-tetraphosphate(aq)+AMP(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	0.1

Reference: 86KUP/FER
Method: NMR
Buffer: {Tris (0.10 mol dm^{-3})+HCl} and {triethanolamine (0.10 mol dm^{-3}) + HCl}
pH: 8.0
Cofactor(s): $MgSO_4$ (0.002 mol dm^{-3})
Evaluation: C

5.84. Enzyme: nucleoside-phosphate kinase (EC 2.7.4.4)

ATP(aq)+UDP(aq)=ADP(aq)+UTP(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	1.28

Reference: 69GAR/CLE
Method: radioactivity and chromatography
Buffer: triethanolamine acetate (0.1 mol dm^{-3})
pH: 8.0
Cofactor(s): Mg^{2+}
Evaluation: B

This result is based both upon kinetic data and an equilibrium measurement.

ATP(aq)+UDP(aq)=ADP(aq)+UTP(aq)

$\frac{T}{K}$	pH	K'
303.15	8.0	0.91

Reference: 59KIR/TUR
Method: paper chromatography and spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$ (0.0025 mol dm^{-3})
Evaluation: B

UTP(aq)+UMP(aq)=2 UDP(aq)

$\frac{T}{K}$	pH	K'
309.15	7.5	0.94

Reference: 55LIE/KOR2
Method: chromatography
Buffer: glycylglycine (0.067 mol dm^{-3})
pH: 7.5
Cofactor(s): $MgCl_2$ (0.0067 mol dm^{-3})
Evaluation: B

5.85. Enzyme: nucleoside-diphosphate kinase (EC 2.7.4.6)

ATP(aq)+IDP(aq)=ADP(aq)+ITP(aq)

$\frac{T}{K}$	pH	K'
310.15	6.0	1

Reference: 54BER/JOK
Method: radioactive labeling and spectrophotometry
Buffer: sodium succinate (0.02 mol dm^{-3})
pH: 6.0
Cofactor(s): $MgCl_2$ (0.01 mol dm^{-3})
Evaluation: C

This is an approximate result.

ATP(aq)+GDP(aq)=ADP(aq)+GTP(aq)

$\frac{T}{K}$	pH	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.0	0.25	1.04

Reference: 78LYN/GUY
Method: fluorimetry and spectrophotometry
Buffer: potassium phosphate (0.025 mol dm^{-3})
pH: 7.00
Cofactor(s): $MgCl_2$
Evaluation: A

Lynn and Guynn found that K′ was essentially constant over the range $c(MgCl_2)$= 0.001 to 0.020 mol dm^{-3}.

5.86. Enzyme: guanylate kinase (EC 2.7.4.8)

ATP(aq)+GMP(aq)=ADP(aq)+GDP(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	0.24

Reference: 71SHI/SUG
Method: spectrophotometry
Buffer: Tris (0.04 mol dm^{-3})
pH: 7.5
Cofactor(s): $MgCl_2$ (0.006 mol dm^{-3})
Evaluation: C

ATP(aq)+dGMP(aq)=ADP(aq)+ dGDP(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	0.28

Reference: 71SHI/SUG
Method: spectrophotometry
Buffer: Tris (0.04 mol dm^{-3})
pH: 7.5
Cofactor(s): $MgCl_2$ (0.006 mol dm^{-3})
Evaluation: C

5.87. Enzyme: nucleoside-triphosphate-adenylate kinase (EC 2.7.4.10)

GTP(aq)+AMP(aq)=ADP(aq)+GDP(aq)

$\frac{T}{K}$	pH	K'
298.15	8.5	0.82

Reference: 70ALB
Method: enzymatic assay
Buffer: triethanolamine (0.05 mol dm^{-3})+HCl
pH: 8.5
Cofactor(s): Mg^{2+} (0.005 mol dm^{-3})
Evaluation: B

5.88. Enzyme: (deoxy)nucleoside-phosphate kinase (EC 2.7.4.13)

ATP(aq)+dTMP(aq)=ADP(aq)+ dTDP(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	1.4

Reference: 65BES/HER
Method: radioactivity and spectrophotometry
Buffer: Tris (0.08 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.008 mol dm^{-3})
Evaluation: C

5.89. Enzyme: cytidylate kinase (EC 2.7.4.14)

ATP(aq)+CMP(aq)=ADP(aq)+CDP(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	1.0

Reference: 62MEN
Method: chromatography and spectrophotometry
Buffer: Tris (0.002 mol dm^{-3})+HCl
pH: 7.5
Cofactor(s): $MgCl_2$ (0.004 mol dm^{-3})
Evaluation: C

ATP(aq)+dCMP(aq)=ADP(aq)+dCDP(aq)

$\frac{T}{K}$	pH	K'
303.15	7.5	1.49

Reference: 58MAL/OCH
Method: spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.5
Cofactor(s): $MgCl_2$(0.02 mol dm^{-3})
Evaluation: B

This same result was also given by Bessman [62BES].

5.90. Enzyme: ribose-phosphate pyrophosphokinase (EC 2.7.6.1)

ATP(aq)+D-ribose 5-phosphate(aq)=AMP(aq)
+5-phospho-α-D-ribose 1-diphosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.5	28.6

Reference: 69SWI
Method: enzymatic assay and spectrophotometry
Buffer: potassium phosphate (0.050 mol dm^{-3})
pH: 7.5
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: A

ATP(aq)+D-ribose 5-phosphate(aq)=AMP(aq)
+5-phospho-α-D-ribose1-diphosphate(aq)

$\frac{T}{K}$	pH	$\frac{c(MgCl^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.4	0.001	0.25	64.8

Reference: 92KIM/KIN
Method: spectrophotometry and fluorimetry
Buffer: {Tris (0.025 mol dm^{-3})+HCl} and {(Na_2HPO_4+NaH_2PO_4) (0.060 mol dm^{-3})}
pH: 7.4
Cofactor(s): Mg^{2+}
Evaluation: A

5.91. Enzyme: nicotinamide-nucleotide adenylyltransferase (EC 2.7.7.1)

ATP(aq)+β-nicotinamide mononucleotide(aq)=NAD(aq)
+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
311.15	7.4	0.4

Reference: 48KOR
Method: spectrophotometry
Buffer: glycylglycine (0.05 mol dm^{-3})
pH: 7.4
Cofactor(s): $MgCl_2$
Evaluation: B

ATP(aq)+β-nicotinamide mononucleotide(aq)=NAD(aq)
+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
311.15	7.4	0.45

Reference: 50KOR
Method: spectrophotometry
Buffer: glycylglycine (0.06 mol dm^{-3})
pH: 7.4
Cofactor(s): $MgCl_2$ (0.003 mol dm^{-3})
Evaluation: B

5.92. Enzyme: sulfate adenylyltransferase (EC 2.7.7.4)

ATP(aq)+sulfate(aq)=adenosine 5′-phosphosulfate(aq)
+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.0	1.1E-8

Reference: 58ROB/LIP
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: C

ATP(aq)+sulfate(aq)=adenosine 5′-phosphosulfate(aq)
+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.5	4E-8

Reference: 58WIL/BAN
Method: chemical analysis and radioactivity
Buffer: Tris (0.02 mol dm^{-3})+HCl
pH: 7.5
Cofactor(s): $MgCl_2$ (0.001 mol dm^{-3})
Evaluation: C

This is an approximate result.

ATP(aq)+sulfate(aq)=adenosine 5′-phosphosulfate(aq)
+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.2	1.8E-8
303.15	8.0	6.2E-9

Reference: 62AKA/CAM
Method: radioactivity
Buffer: Tris (0.067 mol dm^{-3})
pH: 7.2–8.0
Cofactor(s): $MgCl_2$ (0.0067 mol dm^{-3})
Evaluation: B

ATP(aq)+sulfate(aq)+H_2O(l)=2 orthophosphate(aq)
+adenosine 5′-phosphosulfate(aq)

$\frac{T}{K}$	pH	K'_c
303.15	7.5	6E-7

Reference: 58WIL/BAN
Method: chemical analysis and radioactivity
Buffer: Tris (0.02 mol dm^{-3})+HCl
pH: 7.5
Cofactor(s): $MgCl_2$ (0.001 mol dm^{-3})
Evaluation: C

Inorganic pyrophosphatase (EC 3.6.1.1) was also present. This is an approximate result.

5.93. Enzyme: DNA-directed DNA polymerase (EC 2.7.7.7)

dTTP(aq)+9/20-DNA oligomer(aq)=10/20-DNA oligomer(aq)
+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
295.15	7.4	513

Reference: 87KUC/MIZ
Method: gel electrophoresis and radioactivity
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 7.4
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: B

9/20-DNA oligomer is:

```
          OH(3′)
           |
     TCGCAGCCG
     AGCGTCGGCAGGTTCCCAAA
```

10/20-DNA oligomer is:

```
          OH(3′)
           |
     TCGCAGCCGT
     AGCGTCGGCAGGTTCCCAAA
```

dTTP is thymidine 5′-triphosphate; G is guanine; C is cytosine; A is adenine; and T is thymine.

5.94. Enzyme: UTP-glucose-1-phosphate uridylyltransferase (EC 2.7.7.9)

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

T/K	pH	K'
310.15	7.4	1.5

Reference: 55MUN
Method: spectrophotometry
Buffer: Tris (0.05 mol dm^{-3})+HCl
pH: 7.4
Evaluation: C

This is an approximate result calculated from per cent conversion data.

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

T/K	pH	$c(MgCl_2)$/mol dm^{-3}	K'
303.15	7.9	0.0025	0.119
303.15	7.9	0.0050	0.139
303.15	7.9	0.010	0.263
303.15	7.0	0.0025	0.286

Reference: 58TUR/TUR
Method: chromatography and spectrophotometry
Buffer: Tris (0.2 mol dm^{-3})+HCl
pH: 7.9
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: B

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

T/K	K'
298.15	1.0

Reference: 61KLE
Cofactor(s): Mg^{2+}
Evaluation: D

This is an approximate result. The temperature is assumed to be 298.15 K. Few details were given.

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

T/K	pH	K'
303.15	7.45	1

Reference: 63VIL/LAR
Method: spectrophotometry
Buffer: Tris (0.025 mol dm^{-3})
pH: 7.45
Cofactor(s): $MgCl_2$ (0.002 mol dm^{-3})
Evaluation: C

This is an approximate result. Few details were given.

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

T/K	pH	K'
303.15	7.8	0.32

Reference: 66ALB/BAS
Method: spectrophotometry
Buffer: Tris acetate (0.1 mol dm^{-3})
pH: 7.8
Cofactor(s): Mg^{2+} (0.002 mol dm^{-3})
Evaluation: B

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

T/K	pH	K'
298.15	7.8	0.31

Reference: 66HAN/ALB
Method: spectrophotometry
Buffer: Tris acetate (0.1 mol dm^{-3})
pH: 7.8
Cofactor(s): magnesium acetate
Evaluation: C

This is an approximate result. Few details were given.

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

T/K	pH	K'
303.15	7.8	0.155

Reference: 70KNO/HAN
Buffer: Tris acetate (0.10 mol dm^{-3})
pH: 7.8
Cofactor(s): magnesium acetate (0.001 mol dm^{-3})
Evaluation: B

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

$\frac{T}{K}$	pH	$\frac{c(MgSO_4)}{mol\ dm^{-3}}$	K'
310.15	8.5	0.0002	0.13
310.15	8.5	0.0004	0.17
310.15	8.5	0.0006	0.20
310.15	8.5	0.0010	0.26
310.15	8.5	0.0040	0.33
310.15	8.5	0.0100	0.63

Reference: 72GUS/GAN
Method: enzymatic assay and spectrophotometry
Buffer: Tris (0.04 mol dm^{-3})+HCl
pH: 8.5
Cofactor(s): $MgSO_4$
Evaluation: B

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
311.15	7.07	0.001	0.25	0.220

Reference: 74GUY/VEL
Method: enzymatic assay and spectrophotometry
Buffer: Tris+HCl
pH: 7.07
Cofactor(s): $MgCl_2$
Evaluation: A

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

$\frac{T}{K}$	pH	K'
305.15	7.8	0.16

Reference: 74TUR/GIL
Method: spectrophotometry
Buffer: Tris acetate (0.09 mol dm^{-3})
pH: 7.8
Cofactor(s): magnesium acetate (0.002 mol dm^{-3})
Evaluation: C

This is an approximate result.

UTP(aq)+α-D-glucose 1-phosphate(aq)= pyrophosphate(aq)+UDPglucose(aq)

$\frac{T}{K}$	pH	$\frac{c(MgSO_4)}{mol\ dm^{-3}}$	K'
310.15	7.2	0.0002	0.33
310.15	7.2	0.0004	0.32
310.15	7.2	0.0006	0.32
310.15	7.2	0.0008	0.30
310.15	7.2	0.0010	0.32
310.15	7.2	0.0020	0.36
310.15	7.2	0.0040	0.44
310.15	7.2	0.0100	0.44

Reference: 81HSI/SU
Method: enzymatic assay and spectrophotometry
Buffer: Tris (0.00020 mol dm^{-3})+HCl
pH: 7.2
Cofactor(s): $MgSO_4$
Evaluation: B

UTP(aq)+α-D-glucose 1-phosphate(aq)=pyrophosphate(aq)+UDPglucose(aq)

$\frac{T}{K}$	pH	K'
310.15	8.0	0.48

Reference: 83HON/HAR
Method: spectrophotometry
Buffer: Tris (0.04 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$ (0.010 mol dm^{-3})
Evaluation: B

5.95. Enzyme: UDPglucose-hexose-1-phosphate uridylyltransferase (EC 2.7.7.12)

UDPglucose(aq)+α-D-galactose 1-phosphate(aq) =α-D-glucose 1-phosphate(aq) + UDPgalactose(aq)

$\frac{T}{K}$	pH	K'
303.15	8.75	1.1

Reference: 60KUR/SUG
Method: spectrophotometry and enzymatic assay
Buffer: glycine (0.1 mol dm^{-3})
pH: 8.75
Cofactor(s): $MgCl_2$ (0.1 mol dm^{-3})
Evaluation: C

UDPglucose(aq)+α-D-galactose 1-phosphate(aq) =α-D-glucose 1-phosphate(aq) + UDPgalactose(aq)

$\frac{T}{K}$	pH	K'
300.15	8.5	2.1

Reference: 74WON/FRE
Method: enzymatic assay
Buffer: sodium bicinate (0.1 mol dm^{-3})
pH: 8.5

Evaluation: B

This result was obtained from direct equilibrium measurements and from kinetic data.

α-D-galactose 1-phosphate(aq)=α-D-glucose 1-phosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	3

Reference: 52LEL/CAR
Method: paper chromatography and chemical analysis
pH: 7.4
Evaluation: C

UDPglucose4-epimerase (EC 5.1.3.2) was also present. This is an approximate result obtained from per cent conversion data.

5.96. Enzyme: mannose-1-phosphate guanylyltransferase (EC 2.7.7.13)

GTP(aq)+α-D-mannose 1-phosphate(aq)=GDPmannose(aq) +pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.26	2.5

Reference: 64PRE/WOO
Method: paper chromatography and chemical analysis
Buffer: Tris (0.06 mol dm^{-3})+HCl
pH: 8.26
Cofactor(s): $MgCl_2$ (0.004 mol dm^{-3})
Evaluation: B

5.97. Enzyme: ethanolamine-phosphate cytidylyltransferase (EC 2.7.7.14)

CTP(aq)+*O*-phosphorylethanolamine(aq)=pyrophosphate(aq) + CDPethanolamine(aq)

$\frac{T}{K}$	pH	K'
310.15	7.8	0.46

Reference: 75SUN
Method: radioactivity
Buffer: Tris (0.020 mol dm^{-3})+HCl
pH: 7.8
Cofactor(s): $MgCl_2$ (0.010 mol dm^{-3})
Evaluation: C

5.98. Enzyme: choline-phosphate cytidylyltransferase (EC 2.7.7.15)

CTP(aq)+phosphorylcholine(aq)=pyrophosphate(aq)+CDPcholine(aq)

$\frac{T}{K}$	pH	$\frac{c(Mg^{2+})}{mol\ dm^{-3}}$	$\frac{I_c}{mol\ dm^{-3}}$	K'
310.15	7.5	3.0	0.15	0.2

Reference: 78INF/KIN
Method: paper chromatography
Buffer: Hepes and Tris
pH: 7.5
Cofactor(s): Mg^{2+}
Evaluation: B

5.99. Enzyme: UDP-*N*-acetylglucosamine pyrophosphorylase (EC 2.7.7.23)

UTP(aq)+*N*-acetyl-α-D-glucosamine 1-phosphate(aq) =UDP-*N*-acetyl-D-glucosamine(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.4	0.5

Reference: 59STR/SMI
Method: chromatography and spectrophotometry
Buffer: Tris (0.1 mol dm^{-3})
pH: 7.4
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: C

This is an approximate result.

5.100. Enzyme: glucose-1-phosphate thymidylyltransferase (EC 2.7.7.24)

dTTP(aq)+α-D-glucose 1-phosphate(aq)=dTDPglucose(aq) +pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	8.0	0.67

Reference: 61KOR/GLA
Method: enzymatic assay
Buffer: Tris (0.01 mol dm^{-3})+HCl
pH: 8.0
Cofactor(s): $MgCl_2$ (0.002 mol dm^{-3})
Evaluation: B

5.101 Enzyme: glucose-1-phosphate adenylyltransferase (EC 2.7.7.27)

ATP(aq)+α-D-glucose 1-phosphate(aq)=ADPglucose(aq) +pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	7.9	1.1

Reference: 62ESP
Method: radioactivity and spectrophotometry
Buffer: Tris (0.050 mol dm^{-3})+HCl
pH: 7.9
Cofactor(s): $MgCl_2$ (0.020 mol dm^{-3})
Evaluation: C

5.102. Enzyme: glucose-1-phosphate cytidylyltransferase (EC 2.7.7.33)

CTP(aq)+D-glucose 1-phosphate(aq)=CDPglucose(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.0	1.0

Reference: 65MAY/GIN
Method: radioactivity and spectrophotometry
Buffer: Tris (0.05 mol dm^{-3})
pH: 8.0
Cofactor(s): $MgCl_2$ (0.01 mol dm^{-3})
Evaluation: B

CTP(aq)+D-glucose 1-phosphate(aq)=CDPglucose(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
310.15	8.5	0.57

Reference: 66KIM/SUZ
Method: spectrophotometry and enzymatic assay
Buffer: Tris (0.063 mol dm^{-3})+HCl
pH: 8.5
Cofactor(s): $MgCl_2$
Evaluation: B

5.103. Enzyme: glucose-1-phosphate guanylyltransferase (EC 2.7.7.34)

GTP(aq)+α-D-glucose 1-phosphate(aq)=GDPglucose(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.8	0.25

Reference: 66VER/ROD
Method: enzymatic assay and spectrophotometry
Buffer: Tris
pH: 7.8
Cofactor(s): Mg^{2+}
Evaluation: C

This result was also given by Hansen *et al.* [66HAN/VER].

5.104. Enzyme: [glutamate-ammonia-ligase] adenylyltransferase (EC 2.7.7.42)

ATP(aq)+[L-glutamate:ammonia ligase(ADP-forming)](aq)=pyrophosphate(aq)+ adenylyl-[L-glutamate:ammonia ligase(ADP-forming)](aq)

$\frac{T}{K}$	pH	K'
310.15	7.36	8.5

Reference: 70MAN/HOL
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 7.36
Cofactor(s): Mg^{2+}
Evaluation: B

The apparent equilibrium constant given above is based upon the stoichiometry of the reaction given here.

5.105. Enzyme: glucuronate-1-phosphate uridylyltransferase (EC 2.7.7.44)

1-phospho-α-D-glucuronate(aq)+UTP(aq)=UDP-D-glucuronate(aq)+ pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	8.2	0.34

Reference: 71ROB
Method: chromatography, electrophoresis, and radioactivity
Buffer: Tris (0.1 mol dm^{-3})+HCl
pH: 8.2
Cofactor(s): Mg^{2+}
Evaluation: C

5.106. Enzyme: pyruvate,orthophosphate dikinase (EC 2.7.9.1)

ATP(aq)+pyruvate(aq)+orthophosphate(aq)=AMP(aq)+phospho*enol*pyruvate(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
295.15	8.3	2E-4

Reference: 68HAT/SLA
Buffer: Tris (0.038 mol dm^{-3})+HCl
pH: 8.3
Cofactor(s): $MgCl_2$ (0.015 mol dm^{-3})
Evaluation: C

This is an approximate result.

ATP(aq)+pyruvate(aq)+orthophosphate(aq)=AMP(aq)+phospho*enol*pyruvate(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	buffer	K'
298.15	6.51	none	1.75E-4
298.15	6.91	none	9.35E-4
298.15	7.00	none	8.77E-4
298.15	7.06	none	8.26E-4
298.15	7.18	none	1.19E-3
298.15	7.22	none	1.45E-3
298.15	7.39	none	5.55E-3
298.15	7.53	imidazole (0.021 mol dm^{-3})	1.0E-2
298.15	7.88	Tris (0.023 mol dm^{-3})	7.1E-2
298.15	8.19	Tris (0.023 mol dm^{-3})	0.17
298.15	8.39	Tris (0.023 mol dm^{-3})	0.50

Reference: 68REE/MEN
Method: enzymatic assay and spectrophotometry
Buffer: (imidazole+HCl) and (Tris+HCl)
pH: 6.51−8.39
Cofactor(s): $MgCl_2$
Evaluation: B

The dependence of K' on pH is consistent with $\Delta_r N(H^+)=2$ (see Fig. 3 of Reeves *et al.*).

ATP(aq)+pyruvate(aq)+orthophsophate(aq)=AMP(aq)+phospho*enol*pyruvate(aq)+pyrophosphate(aq)

$\frac{T}{K}$	pH	K'
298.15	7.24	4.9E-3

Reference: 73SUG
Method: enzymatic assay and spectrophotometry
pH: 7.24
Cofactor(s): $MgCl_2$ (0.0042 mol dm^{-3})
Evaluation: C

The apparent equilibrium constant given above was calculated from the concentrations given in Sugiyama's Table II.

5.107. Enzyme: aryl sulfotransferase (EC 2.8.2.1)

3,5-dinitrophenol(aq)+3′-phosphoadenylylsulfate(aq)=3,5-dinitrophenolsulfate(aq)+adenosine 3′,5′-biphosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.8	4.1

Reference: 57GRE/LIP
Method: spectrophotometry
Buffer: Tris (0.11 mol dm^{-3})+HCl
pH: 7.8
Evaluation: B

4-nitrophenol(aq)+3′-phosphoadenylylsulfate(aq)=4-nitrophenol sulfate(aq) + adenosine 3′,5′-biphosphate(aq)

$\frac{T}{K}$	pH	K'
303.15	7.8	26.4

Reference: 57GRE/LIP
Method: spectrophotometry
Buffer: Tris (0.11 mol dm^{-3})+HCl
pH: 7.8
Evaluation: B

5.108. Enzyme: 3-oxoacid CoA-transferase (EC 2.8.3.5)

succinyl-CoA(aq)+acetoacetate(aq)=succinate(aq)+acetoacetyl-CoA(aq)

$\frac{T}{K}$	pH	K'
298.15	8.1	0.01

Reference: 53LYN/OCH
Method: spectrophotometry
pH: 8.1
Cofactor(s): $MgCl_2$
Evaluation: C

This is an approximate result.

succinyl-CoA(aq)+acetoacetate(aq)=succinate(aq)+acetoacetyl-CoA(aq)

$\frac{T}{K}$	pH	K'
298.15	8.1	0.01

Reference: 53STE/COO
Method: spectrophotometric
pH: 8.1
Evaluation: C

This is an approximate result. The temperature is assumed to be 298.15 K. Also see Stern [56STE] and Stern *et al.* [56STE/COO] given below.

succinyl-CoA(aq)+acetoacetate(aq)=succinate(aq)+acetoacetyl-CoA(aq)

$\frac{T}{K}$	pH	buffer	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
303.15	7.00	Tris (0.10 mol dm^{-3})	0	2.8E-3
303.15	7.00	Tris (0.10 mol dm^{-3})	0.0053	4.9E-3
303.15	7.50	Tris (0.10 mol dm^{-3})	0	4.2E-3
303.15	7.50	Tris (0.10 mol dm^{-3})	0.0053	5.9E-3
303.15	8.10	Tris (0.10 mol dm^{-3})	0	4.3E-3
303.15	8.10	Tris (0.10 mol dm^{-3})	0.0053	8.8E-3
303.15	9.20	glycine (0.1 mol dm^{-3})	0	8.6E-3
303.15	9.20	glycine (0.1 mol dm^{-3})	0.0053	1.5E-2

Reference: 56STE/COO
Method: spectrophotometry
Buffer: Tris and glycine
pH: 7.0–9.2
Cofactor(s): $MgCl_2$
Evaluation: B

Also see the results of Stern [56STE] given below.

succinyl-CoA(aq)+acetoacetate(aq)=succinate(aq)+acetoacetyl-CoA(aq)

$\frac{T}{K}$	pH	buffer	$\frac{c(MgCl_2)}{mol\ dm^{-3}}$	K'
303.15	7.00	Tris (0.10 mol dm^{-3})	0	2.8E-3
303.15	7.00	Tris (0.10 mol dm^{-3})	0.0053	4.6E-3
303.15	7.50	Tris (0.10 mol dm^{-3})	0	4.0E-3
303.15	7.50	Tris (0.10 mol dm^{-3})	0.0053	4.9E-3
303.15	8.10	Tris (0.10 mol dm^{-3})	0	3.9E-3
303.15	8.10	Tris (0.10 mol dm^{-3})	0.0053	4.8E-3
303.15	9.20	glycine (0.1 mol dm^{-3})	0	5.5E-3
303.15	9.20	glycine (0.1 mol dm^{-3})	0.0053	3.0E-3

Reference: 56STE
Method: spectrophotometry
Buffer: Tris (0.067 mol dm^{-3})+HCl
pH: 7.0–9.2
Cofactor(s): $MgCl_2$
Evaluation: C

Stern recalculated the earlier data of Stern *et al.* [56STE/COO] on the assumption that only the oxo form of acetoacetyl-CoA is a substrate of 3-oxoacid CoA-transferase.

succinyl-CoA(aq)+acetoacetate(aq)=succinate(aq)+acetoacetyl-CoA(aq)

$\frac{T}{K}$	pH	K'
298.15	8.1	0.067

Reference: 67HER/JEN
Method: spectrophotometry
Buffer: Tris
pH: 8.1
Evaluation: C

This result is based upon an analysis of kinetic data.

5.109. Enzyme: acetate CoA-transferase (EC 2.8.3.8)

acetyl-CoA(aq)+acetoacetate(aq)=acetoacetyl-CoA(aq)+acetate(aq)

$\frac{T}{K}$	pH	K'
298.15	8.1	0.13

Reference: 77SRA/FRE
Method: spectrophotometry
Buffer: Tris (0.067 mol dm^{-3})+HCl
pH: 8.1
Cofactor(s): $MgCl_2$ (0.005 mol dm^{-3})
Evaluation: C

This result was obtained from kinetic data.

6. List of Substances with Chemical Abstract Service (CAS) Registry Numbers with Cross References to Enzyme Commission Numbers

Substance	CAS Registry Number[a]	Enzyme Commission Numbers
acetaldehyde	75-07-0	2.1.2.1
acetanilide	103-84-4	2.3.1.5
acetate	64-19-7	2.3.1.8, 2.7.2.1, 2.8.3.8
acetoacetate	541-50-4	2.8.3.5, 2.8.3.8
acetoacetyl-coenzyme A	102029-52-7	2.3.1.9, 2.8.3.5, 2.8.3.8
4′-acetylacetanalide	2719-21-3	2.3.1.5
acetyl-[acyl-carrier protein]	154835-39-9	2.3.1.38
N-acetyl-4-aminoazobenzene-4′-sulfonic acid	51777-22-1	2.3.1.5
L-acetylcarnitine	5080-50-2	2.3.1.7
O-acetylcholine	51-84-3	2.3.1.6
acetyl-coenzyme A	102029-73-2	2.3.1.6, 2.3.1.7, 2.3.1.8, 2.3.1.9, 2.3.1.38, 2.3.1.54, 2.7.2.1, 2.8.3.8
N-acetyl-α-D-glucosamine 1-phosphate	3128-5-91	2.7.7.23
N-acetyl-L-glutamate	1188-37-0	2.3.1.35
N-acetylimidazole	2466-76-4	2.3.1.2, 2.3.1.8
N^2-acetyl-L-ornithine	6205-08-9	2.3.1.35
acetyl phosphate	94249-01-1	2.3.1.2, 2.3.1.8, 2.3.1.54, 2.7.2.1
acyl-carrier protein	77322-37-3	2.3.1.38, 2.3.1.39
adenine	73-24-5	2.4.2.1, 2.4.2.6, 2.4.2.7
adenosine	58-61-7	2.4.2.1
adenosine 3′,5′-biphosphate	75431-54-8	2.8.2.1

6. List of Substances with Chemical Abstract Service (CAS) Registry Numbers with Cross References to Enzyme Commission Numbers — Continued

Substance	CAS Registry Number[a]	Enzyme Commission Numbers
adenosine 5′-diphosphate	58-64-0	2.3.1.8, 2.4.1.13, 2.7.1.1, 2.7.1.6, 2.7.1.11, 2.7.1.23, 2.7.1.24, 2.7.1.30, 2.7.1.37, 2.7.1.40, 2.7.1.67, 2.7.2.1, 2.7.2.1, 2.7.2.2, 2.7.2.3, 2.7.2.4, 2.7.3.1, 2.7.3.2, 2.7.3.3, 2.7.3.4, 2.7.3.5, 2.7.4.2, 2.7.4.3, 2.7.4.4, 2.7.4.6, 2.7.4.8, 2.7.4.10, 2.7.4.13, 2.7.4.14
adenosine 5′-diphosphoglucose	102129-65-7	2.4.1.13, 2.7.7.27
adenosine 5′-diphospho-N^1-oxide	146-92-9	2.7.4.3
adenosine 5′-(α,β-methylene)diphosphate	3768-14-7	2.7.3.2
adenosine 5′-(α,β-methylene)triphosphate	104809-20-3	2.7.3.2
adenosine 5′-monophosphate	18422-05-4	2.4.2.7, 2.7.4.3, 2.7.4.10, 2.7.6.1, 2.7.9.1
adenosine 5′-phosphosulfate	102029-95-8	2.7.7.4
adenosine 5′-tetraphosphate	58337-43-2	2.7.4.3
adenosine 5′-*O*-(1-thiodiphosphate)	51777-22-1	2.7.4.2
adenosine 5′-*O*-(2-thiodiphosphate)	73536-95-5	2.7.2.3, 2.7.3.2, 2.7.3.3, 2.7.4.2
adenosine 5′-*O*-(1-thiotriphosphate)	29220-54-0	2.7.4.2
adenosine 5′-*O*-(2-thiotriphosphate)	60478-94-6	2.7.2.3, 2.7.3.2, 2.7.3.3, 2.7.4.2
adenosine 5′-*O*-(3-thiotriphosphate)	93839-89-5	2.7.4.2
adenosine 5′-triphosphate	56-65-5	2.3.1.8, 2.7.1.1, 2.7.1.6, 2.7.1.11, 2.7.1.23, 2.7.1.24, 2.7.1.30, 2.7.1.37, 2.7.1.40, 2.7.1.67, 2.7.2.1, 2.7.2.2, 2.7.2.3, 2.7.2.4, 2.7.3.1, 2.7.3.2, 2.7.3.3, 2.7.3.4, 2.7.3.5, 2.7.4.2, 2.7.4.3, 2.7.4.4, 2.7.4.6, 2.7.4.8, 2.7.4.10, 2.7.4.13, 2.7.4.14, 2.7.6.1, 2.7.7.1, 2.7.7.4, 2.7.7.27, 2.7.7.42, 2.7.9.1
adenosine 5′-triphospho-N^1-oxide	102029-91-4	2.7.4.3
S-adenosyl-L-homocysteine	979-92-0	2.1.1.10
S-adenosyl-L-methionine	29908-03-0	2.1.1.10
adenylyl-[L-glutamate:ammonia ligase(ADP-forming)]	155039-15-9	2.7.7.42
D-alanine	338-69-2	2.1.2.7, 2.6.1.21
L-alanine	56-41-7	2.6.1.2, 2.6.1.15, 2.6.1.18, 2.6.1.30, 2.6.1.51
β-alanine	107-95-9	2.6.1.18
4′-aminoacetophenone	99-92-3	2.3.1.5
L-2-aminoadipate	542-32-5	2.6.1.39
4-aminoazobenzene-4′-sulfonic acid	104-23-4	2.3.1.5
4-aminobutanoate	56-12-2	2.6.1.19
6-aminoglucose	576-47-6	2.7.1.1
6-aminoglucose 6-phosphate	133473-41-3	2.7.1.1
5-amino-4-imidazolecarboxamide	360-97-4	2.4.2.7
5-amino-1-β-D-ribosyl-4-imidazolecarboxamide 5′-phosphate	3031-94-5	2.4.2.7
ammonium carbamate	111-78-0	2.7.2.2
aniline	62-53-3	2.3.1.5, 2.5.1.2
L-arginine	74-79-3	2.1.4.1, 2.7.3.3
L-aspartate	56-84-8	2.6.1.1, 2.6.1.35, 2.7.2.4
betaine	107-43-7	2.1.1.3
L-butyrylcarnitine	25576-40-3	2.3.1.7
butyryl-coenzyme A	102282-28-0	2.3.1.7
carbamoyl oxamate	585-05-7	2.1.3.5
carbamoyl phosphate	590-55-6	2.1.3.3, 2.1.3.5, 2.7.2.2
L-carnitine	541-15-1	2.3.1.7, 2.3.1.21
cellobiose	528-50-7	2.4.1.20
cellotriose	33404-34-1	2.4.1.20
4′-chloroacetanilide	53-03-7	2.3.1.5
4′-chloroaniline	106-47-8	2.3.1.5
choline	62-49-7	2.3.1.6
L-citrulline	372-75-8	2.1.3.3
coenzyme A	85-61-0	2.3.1.6, 2.3.1.7, 2.3.1.8, 2.3.1.9, 2.3.1.21, 2.3.1.38, 2.3.1.39, 2.3.1.54, 2.7.1.24, 2.7.2.1
creatine	57-00-1	2.7.3.2
4′-cyanoacetanilide	35704-19-9	2.3.1.5
4-cyanoaniline	873-74-5	2.3.1.5
cyclocreatine	35404-50-3	2.7.3.2
cycloheptaamylose	7585-39-9	2.4.1.19
cyclohexaamylose	10016-20-3	2.4.1.19
cyclooctaamylose	17465-86-0	2.4.1.19
cytidine 5′-diphosphate	34393-59-4	2.7.4.14
cytidine 5′-diphosphocholine	33818-15-4	2.7.7.15

6. List of Substances with Chemical Abstract Service (CAS) Registry Numbers with Cross References to Enzyme Commission Numbers — Continued

Substance	CAS Registry Number[a]	Enzyme Commission Numbers
cytidine 5′-diphosphoethanolamine	72842-05-8	2.7.7.14
cytidine 5′-diphosphoglucose	102601-30-9	2.7.7.33
cytidine 5′-monophosphate	63-37-6	2.7.4.14
cytidine 5′-triphosphate	81012-87-5	2.7.7.14, 2.7.7.15, 2.7.7.33
2′-deoxyadenosine	16373-93-6	2.4.2.6
2′-deoxyadenosine 5′-diphosphate	72003-83-9	2.7.4.3
2′-deoxyadenosine 5′-monophosphate	653-63-4	2.7.4.3
2′-deoxyadenosine 5′-triphosphate	1927-31-7	2.7.4.3
2′-deoxycytidine 5′-diphosphate	102783-57-3	2.7.4.14
2′-deoxycytidine 5′-monophosphate	1032-65-1	2.7.4.14
2′-deoxyguanosine 5′-diphosphate	102783-74-4	2.7.4.8
2′-deoxyguanosine 5′-monophosphate	902-04-5	2.7.4.8
2′-deoxyinosine	890-38-0	2.4.2.1, 2.4.2.6
5-deoxypyridoxal	1849-49-6	2.6.1.30
5-deoxypyridoxamine	20485-33-0	2.6.1.30
2-deoxy-α-D-ribose 1-phosphate	102783-28-8	2.4.2.1
2′-deoxyuridine 5′-monophosphate	42155-08-8	2.1.1.45
3′-dephospho-coenzyme A	3633-59-8	2.7.1.24
dephosvitin	[b]	2.7.1.37
dihydrofolate	4033-27-6	2.1.1.45
dimethylacetothetin	4727-41-7	2.1.1.3
N,*N*-dimethylglycine	1118-68-9	2.1.1.3
dimethylpropiothetin	7314-30-9	2.1.1.3
dimethylsulfide	75-18-3	2.1.1.3
3,5-dinitrophenol	586-11-8	2.8.2.1
3,5-dinitrophenolsulfate	153484-03-8	2.8.2.1
(*R*)-5-diphosphomevalonate	103025-21-4	2.7.4.2
9/20-DNA oligomer	153549-07-6	2.7.7.7
10/20-DNA oligomer	153549-08-7	2.7.7.7
D-erythrose 4-phosphate	585-18-2	2.2.1.1, 2.2.1.2
L-erythrulose	533-50-6	2.2.1.1
ethyl 4-acetamidobenzoate	20628-20-0	2.3.1.5
ethyl 4-aminobenzoate	94-09-7	2.3.1.5
formaldehyde	50-00-0	2.1.2.1, 2.1.2.7
formate	64-18-6	2.3.1.8, 2.3.1.54
N-formimino-Lglutamate	816-90-0	2.1.2.5
N-formiminoglycine	2140-03-6	2.1.2.4
5-formiminotetrahydrofolate	2311-81-1	2.1.2.4, 2.1.2.5
formyl-coenzyme A	13131-49-2	2.3.1.8
formyl phosphate	1189-72-6	2.3.1.8
D-fructose	57-48-7	2.2.1.2, 2.4.1.7, 2.4.1.13, 2.7.1.1
D-fructose 1,6-biphosphate	488-69-7	2.7.1.11, 2.7.1.90
D-fructose 6-phosphate	26177-86-6	2.2.1.1, 2.2.1.2, 2.4.1.14, 2.7.1.1, 2.7.1.11, 2.7.1.90
$(2,6\text{-}\beta\text{-D-fructosyl})_n$	9013-95-0	2.4.1.10
D-galactose	59-23-4	2.7.1.6
α-D-galactose 1-phosphate	19046-60-7	2.7.1.6, 2.7.7.12
1-α-D-galactosyl-*myo*-inositol	3687-64-7	2.4.1.67
D-glucose	50-99-7	2.4.1.8, 2.4.1.10, 2.4.1.19, 2.4.1.20, 2.4.1.31, 2.4.1.64, 2.7.1.1
D-glucose 1-phosphate	59-56-3	2.7.7.33
α-D-glucose 1-phosphate	59-56-3	2.4.1.7, 2.4.1.20, 2.4.1.31, 2.7.7.9, 2.7.7.12, 2.7.7.24, 2.7.7.27, 2.7.7.34
β-D-glucose 1-phosphate	32972-46-6	2.7.7.33, 2.4.1.8, 2.4.1.64
D-glucose 6-phosphate	56-73-5	2.4.1.15, 2.7.1.1
D-glutamate	6893-26-1	2.6.1.21
L-glutamate	56-86-0	2.1.2.5, 2.3.1.35, 2.6.1.1, 2.6.1.2, 2.6.1.9, 2.6.1.13, 2.6.1.17, 2.6.1.19, 2.6.1.33, 2.6.1.39, 2.6.1.52
L-glutamate:ammonia ligase(ADP-forming)	9023-70-5	2.7.7.42
L-glutamine	56-85-9	2.6.1.15
D-glyceraldehyde	453-17-8	2.2.1.2
D-glyceraldehyde 3-phosphate	142-17-8	2.2.1.1, 2.2.1.2, 2.7.2.3
glycerol	142-10-9	2.7.1.30
sn-glycerol 3-phosphate	57-03-4	2.7.1.30
glycine	56-40-6	2.1.2.1, 2.1.2.4, 2.1.4.1, 2.6.1.15, 2.6.1.35
glycolaldehyde	23147-58-2	2.2.1.1
glyoxylate	298-12-4	2.6.1.15, 2.6.1.35

6. List of Substances with Chemical Abstract Service (CAS) Registry Numbers with Cross References to Enzyme Commission Numbers — Continued

Substance	CAS Registry Number[a]	Enzyme Commission Numbers
guanidinoacetate	352-97-6	2.1.4.1, 2.7.3.1
guanine	73-40-5	2.4.2.1, 2.4.2.8, 2.4.2.15
guanosine	118-00-3	2.4.2.1, 2.4.2.15
guanosine 5′-diphosphate	43139-22-6	2.7.4.6, 2.7.4.8, 2.7.4.10
guanosine 5′-diphosphoglucose	103301-72-0	2.7.7.34
guanosine 5′-diphosphomannose	103301-73-1	2.7.7.13
guanosine 5′-monophosphate	85-32-5	2.4.2.8, 2.7.4.8
guanosine 5′-triphosphate	36051-31-7	2.7.4.6, 2.7.4.10, 2.7.7.13, 2.7.7.34
*hetero*anilithiamine	1886-29-9	2.5.1.2
*hetero*nicotinathiamine	153484-04-9	2.5.1.2
L-histidinol phosphate	25679-93-0	2.6.1.9
H_2O	7732-18-5	2.1.2.1, 2.1.2.7, 2.4.1.19, 2.7.3.2, 2.7.7.4
L-homocysteine	6027-13-0	2.1.1.3, 2.1.1.10
3-hydroxy-4-aminomethylpyridine	20485-35-2	2.6.1.30
erythro-3-hydroxyaspartate	7298-98-8	2.6.1.1
2-hydroxymethylserine	17149-11-0	2.1.2.7
3-hydroxypyridine-4-aldehyde	1849-54-3	2.6.1.30
hydroxypyruvate	1113-60-6	2.6.1.51
hypoxanthine	68-94-0	2.4.2.1, 2.4.2.2, 2.4.2.6, 2.4.2.8
imidazole	288-32-4	2.3.1.2, 2.3.1.8
3-(imidazol-4-yl)-2-oxopropyl phosphate	99979-59-6	2.6.1.9
inosine	58-63-9	2.4.2.1, 2.4.2.2
inosine 5′-diphosphate	81012-88-6	2.7.4.6
inosine 5′-monophosphate	131-99-7	2.4.2.8
inosine 5′-triphosphate	35908-31-7	2.7.4.6
laminaribiose	34980-39-7	2.4.1.31
laminaritetraose	26212-72-6	2.4.1.31
laminaritriose	3256-04-0	2.4.1.31
lombricine	18416-85-8	2.7.3.5
lysozyme	9001-63-2	2.7.1.37
(*S*)-malate	138-09-0	2.6.1.1
malonyl-[acyl-carrier protein]	154835-40-2	2.3.1.39
malonyl-coenzyme A	108347-84-8	2.3.1.39
maltose	69-79-4	2.4.1.8
D-mannose	3458-28-4	2.7.1.1
α-D-mannose 1-phosphate	99749-54-9	2.7.7.13
D-mannose 6-phosphate	70442-25-0	2.7.1.1
L-methionine	63-68-3	2.1.1.3, 2.1.1.10, 2.6.1.15
4′-methoxyacetanilide	51-66-1	2.3.1.5
4-methoxyaniline	104-94-9	2.3.1.5
4′-methylacetanilide	103-89-9	2.3.1.5
2-methyl-4-amino-5-hydroxymethylpyrimidine diphosphate	841-01-0	2.5.1.3
5,10-methylenetetrahydrofolate	3432-99-3	2.1.1.45, 2.1.2.1, 2.1.2.7
4-methyl-5-(2′-hydroxyethyl)-thiazole	137-00-8	2.5.1.2
4-methyl-5-(2-phosphonoxyethyl)-thiazole	3269-79-2	2.5.1.3
methylmalonyl-coenzyme A	104809-02-1	2.1.3.1
S-methylmethionine	4727-40-6	2.1.1.3
S-methylpropiothetin	646-01-5	2.1.1.3
ω-methylpyridoxal	15937-96-9	2.6.1.30
ω-methylpyridoxamine	20485-32-9	2.6.1.30
2-methylserine	3398-40-1	2.1.2.7
S-methylthioglycolate	244-37-3	2.1.1.3
5-methyluridine	1463-10-1	2.4.2.1, 2.4.2.2
myo-inositol	87-89-8	2.4.1.67
nicotinamide	98-92-0	2.4.2.1, 2.5.1.2
β-nicotinamide-adenine dinucleotide (oxidized)	53-84-9	2.6.1.1, 2.7.1.23, 2.7.2.3, 2.7.7.1
β-nicotinamide-adenine dinucleotide (reduced)	606-68-8	2.6.1.1, 2.7.1.23, 2.7.2.3
β-nicotinamide-adenine dinucleotide phosphate (oxidized)	53-59-8	2.7.1.23, 2.7.2.3
β-nicotinamide mononucleotide	1094-61-7	2.7.7.1
nicotinamide riboside	1341-23-7	2.4.2.1
4′-nitroacetanilide	104-04-1	2.3.1.5
4-nitroaniline	100-01-6	2.3.1.5
4-nitrophenol	100-02-7	2.8.2.1
4-nitrophenol sulfate	27991-93-1	2.8.2.1
norpyridoxal	15031-18-2	2.6.1.30
norpyridoxamine	15031-19-3	2.6.1.30
L-ornithine	70-26-8	2.1.3.3, 2.1.4.1, 2.3.1.35, 2.6.1.13

6. List of Substances with Chemical Abstract Service (CAS) Registry Numbers with Cross References to Enzyme Commission Numbers — Continued

Substance	CAS Registry Number[a]	Enzyme Commission Numbers
orotate	65–86–1	2.4.2.10
orotidine 5′-phosphate	68244–58–6	2.4.2.10
orthophospate	10049–21–5	2.1.3.3, 2.1.3.5, 2.3.1.2, 2.3.1.8, 2.3.1.54, 2.4.1.7, 2.4.1.8, 2.4.1.20, 2.4.1.31, 2.4.1.64, 2.4.2.1, 2.4.2.2, 2.4.2.3, 2.4.2.15, 2.7.1.80, 2.7.1.90, 2.7.2.1, 2.7.2.3, 2.7.3.2, 2.7.7.4, 2.7.9.1
oxaloacetate	328–42–7	2.1.3.1, 2.6.1.1, 2.6.1.35
oxamate	471–47–6	2.1.3.5
2-oxoadipate	3184–35–8	2.6.1.39
4-oxobutanoate	692–29–5	2.6.1.19
2-oxoglutaramate	18465–19–5	2.6.1.15
2-oxoglutarate	328–50–7	2.6.1.1, 2.6.1.2, 2.6.1.9, 2.6.1.13, 2.6.1.17, 2.6.1.19, 2.6.1.21, 2.6.1.33, 2.6.1.39, 2.6.1.52
2-oxo-3-hydroxybutanedioic acid	5651–05–8	2.6.1.1
2-oxo-4-methiolbutyrate	583–92–6	2.6.1.15
3-oxopropanoate	926–61–4	2.6.1.18
L-palmitoylcarnitine	18877–64–0	2.3.1.21
palmitoyl-coenzyme A	1763–10–6	2.3.1.21
1-phosphatidyl-1D-*myo*-inositol	[b]	2.7.1.67
1-phosphatidyl-1D-*myo*-inositol 4-phosphate	[b]	2.7.1.67
3′-phosphoadenylylsulfate	102029–54–9	2.8.2.1
N^{ω}-phospho-L-arginine	108321–86–4	2.7.3.3
4-phospho-L-aspartate	22138–53–0	2.7.2.4
phosphocreatine	6190–45–0	2.7.3.2
phosphocyclocreatine	61839–19–8	2.7.3.2
phospho*enol*pyruvate	73–89–2	2.7.1.40, 2.7.9.1
phospho*enol*pyruvate kinase	9001–59–6	2.7.1.37
1-phospho-α-D-glucuronate	13168–11–1	2.7.7.44
3-phospho-D-glycerate	80731–10–8	2.7.2.3
3-phospho-D-glyceroyl phosphate	38168–82–0	2.7.2.3
phosphoguanidinoacetate	5115–19–5	2.7.3.1
N^{ω}-phospholombricine	25540–15–2	2.7.3.5
phospholysozyme	155039–16–0	2.7.1.37
(*R*)-5-phosphomevalonate	1189–94–2	2.7.4.2
3-phosphonooxypyruvate	3913–50–6	2.6.1.52
5-phospho-α-D-ribose 1-diphosphate	108321–05–7	2.4.2.7, 2.4.2.8, 2.4.2.10, 2.7.6.1
phosphoribosyl-1-*O*-(2-thiodiphosphate)	91385–22–7	2.4.2.10
phosphorylcholine	108321–32–0	2.7.7.15
O-phosphorylethanolamine	1071–23–4	2.7.7.14
O-phospho-L-serine	407–41–0	2.6.1.52, 2.7.1.80
N^{ω}-phosphotaurocyamine	4189–99–5	2.7.3.4
phosvitin	9008–96–2	2.7.1.37
propanoyl-coenzyme A	317–66–8	2.1.3.1
L-propionylcarnitine	113817–31–5	2.3.1.7
propionyl-coenzyme A	108321–21–7	2.3.1.7
pyridoxal	66–72–8	2.6.1.30
pyridoxamine	524–36–7	2.6.1.30
pyrophosphate	2466–09–3	2.4.2.7, 2.4.2.8, 2.4.2.10, 2.5.1.3, 2.7.1.80, 2.7.1.90, 2.7.7.1, 2.7.7.4, 2.7.7.7, 2.7.7.9, 2.7.7.13, 2.7.7.14, 2.7.7.15, 2.7.7.23, 2.7.7.24, 2.7.7.27, 2.7.7.33, 2.7.7.34, 2.7.7.42, 2.7.7.44, 2.7.9.1
DL-Δ^1-pyrroline-5-carboxylate	23141–14–2	2.6.1.13
pyruvate	127–17–3	2.1.3.1, 2.3.1.8, 2.3.1.54, 2.6.1.2, 2.6.1.15, 2.6.1.18, 2.6.1.21, 2.6.1.30, 2.7.1.40, 2.7.1.51, 2.7.9.1
pyruvate kinase	9001–59–6	2.7.1.37
raffinose	512–69–6	2.4.1.67
D-ribose 1-phosphate	14075–00–4	2.4.2.15
α-D-ribose 1-phosphate	18646–11–2	2.4.2.2, 2.4.2.3, 2.4.2.15
D-ribose 5-phosphate	4300–28–1	2.2.1.1, 2.7.6.1
sedoheptulose 7-phosphate	17187–72–3	2.2.1.1, 2.2.1.2
D-serine	312–84–5	2.1.2.7
L-serine	56–45–1	2.1.2.1, 2.6.1.51, 2.7.1.80
sinapate	530–59–6	2.4.1.120
1-sinapoyl-D-glucose	29881–39–8	2.4.1.120
stachyose	10094–58–3	2.4.1.67
succinate	110–15–6	2.8.3.5
N-succinyl-2-L-amino-6-oxoheptanedioate	153484–05–0	2.6.1.17

6. List of Substances with Chemical Abstract Service (CAS) Registry Numbers with Cross References to Enzyme Commission Numbers — Continued

Substance	CAS Registry Number[a]	Enzyme Commission Numbers
succinyl-coenzyme A	108347-97-3	2.8.3.5
N-succinyl-L-2, 6-diaminoheptanedioate	26605-36-7	2.6.1.17
sucrose	57-50-1	2.4.1.7, 2.4.1.10, 2.4.1.13
sucrose 6-phosphate	36064-19-4	2.4.1.14
sulfate	7664-93-9	2.7.7.4
taurocyamine	543-18-0	2.7.3.4
tetrahydrofolate	135-16-0	2.1.2.1, 2.1.2.4, 2.1.2.5, 2.1.2.7
thiamine	67-03-8	2.5.1.2
thiamine monophosphate	532-40-1	2.5.1.3
2-thio-5-diphosphomevalonate	99795-34-3	2.7.4.2
thiopyrophosphate	68488-87-9	2.4.2.10
L-threonine	72-19-5	2.1.2.1
thymidine	50-89-5	2.4.2.6
thymidine 5′-diphosphate	108322-12-9	2.7.4.13
thymidine 5′-diphospho-4-amino-4,6-dideoxy-D-glucose	154689-07-3	2.6.1.33
thymidine 5′-diphospho-4-dehydro-6-deoxy-D-glucose	16752-71-9	2.6.1.33
thymidine 5′-diphosphoglucose	108393-33-5	2.7.7.24
thymidine 5′-monophosphate	365-07-1	2.1.1.45, 2.7.4.13
thymidine 5′-triphosphate	18423-43-3	2.7.7.7, 2.7.7.24
thymine	65-71-4	2.4.2.1, 2.4.2.2, 2.4.2.6
p-toluidine	106-49-0	2.3.1.5
α,α-trehalose	99-20-7	2.4.1.64
α,α-trehalose 6-phosphate	136632-28-5	2.4.1.15
α,α,α-trifluoro-m-acetanilide	351-36-0	2.3.1.5
α,α,α-trifluoro-m-toluidine	455-14-1	2.3.1.5
trimethylsulfonium	2181-42-2	2.1.1.3
uracil	66-22-8	2.4.2.2, 2.4.2.3
uridine	58-96-8	2.4.2.2, 2.4.2.3
uridine 5′-diphosphate	58-98-0	2.4.1.13, 2.4.1.14, 2.4.1.15, 2.4.1.120, 2.7.4.4
uridine 5′-diphospho-*N*-acetyl-D-glucosamine	91183-98-1	2.7.7.23
uridine 5′-diphosphogalactose	89705-69-1	2.7.7.12
uridine 5′-diphosphoglucose	133-89-1	2.4.1.13, 2.4.1.14, 2.4.1.15, 2.4.1.120, 2.7.7.9, 2.7.7.12
uridine 5′-diphospho-D-glucuronate	63700-19-6	2.7.7.44
uridine 5′-monophosphate	58-97-9	2.7.4.4
uridine 5′-triphosphate	63-39-8	2.7.4.4, 2.7.7.9, 2.7.7.23, 2.7.7.44
xanthine	69-89-6	2.4.2.1
xanthosine	146-80-5	2.4.2.1
D-xylulose 5-phosphate	105931-44-0	2.2.1.1

[a]In some cases the CAS registry number refers to a salt of the substance.
[b]A CAS registry number has not been assigned to this substance.

7. Abbreviations

ADP	adenosine 5′-diphosphate
dADP	2′-deoxyadenosine 5′-diphosphate
ADP-α-S	adenosine 5′-*O*-(1-thiodiphosphate)
ADP-β-S	adenosine 5′-*O*-(2-thiodiphosphate)
ATP-α-S	adenosine 5′-*O*-(1-thiotriphosphate)
ATP-β-S	adenosine 5′-*O*-(2-thiotriphosphate)
ATP-γ-S	adenosine 5′-*O*-(3-thiotriphosphate)
AMP	adenosine 5′-monophosphate
dAMP	2′-deoxyadenosine 5′-monophosphate
ATP	adenosine 5′-triphosphate
dATP	2′-deoxyadenosine 5′-triphosphate
ATP-α-S	adenosine 5′-*O*-(1-thiotriphosphate)
ATP-β-S	adenosine 5′-*O*-(2-thiotriphosphate)
ATP-γ-S	adenosine 5′-*O*-(3-thiotriphosphate)
Bicine	*N*,*N*-bis(2-hydroxyethyl)glycine
CDP	cytidine 5′-diphosphate
dCDP	2′-deoxycytidine 5′-diphosphate
CMP	cytidine 5′-monophosphate
dCMP	2′-deoxycytidine 5′-monophosphate
Ches	2-(*N*-cyclohexylamino)ethanesulfonic acid
CoA	coenzyme A
CTP	cytidine 5′-triphosphate
GDP	guanosine 5′-diphosphate
dGDP	2′-deoxyguanosine 5′-diphosphate
GMP	guanosine 5′-monophosphate
dGMP	2′-deoxyguanosine 5′-monophosphate
GTP	guanosine 5′-triphosphate
Hepes	*N*-(2-hydroxyethyl)piperazine-*N*′-2-ethanesulfonic acid
IDP	inosine 5′-diphosphate
IMP	inosine 5′-monophosphate
ITP	inosine 5′-triphosphate
Mes	2-(*N*-morpholino)ethanesulfonic acid
Mops	3-(*N*-morpholino)propanesulfonic acid
NAD	β-nicotinamide-adenine dinucleotide (oxidized)
NADH	β-nicotinamide-adenine dinucleotide (reduced)
NADP	β-nicotinamide-adenine dinucleotide phosphate (oxidized)
Pipes	piperazine-*N*,*N*′-bis(2-ethanesulfonic acid)
Taps	*N*-tris(hydroxymethyl)methyl-3-aminopropanesulfonic acid

dTDP	thymidine 5′-diphosphate
dTMP	thymidine 5′-monophosphate
Tricine	*N*-[tris(hydroxymethyl)methyl]glycine
Tris	tris(hydroxymethyl)aminomethane
dTTP	thymidine 5′-triphosphate
UDP	uridine 5′-diphosphate
UMP	uridine 5′-monophosphate
dUMP	2′-deoxyuridine 5′-monophosphate
UTP	uridine 5′-triphosphate

8. Reference Codes and References in the Table

36LEH	Lehman, H.; Biochem. Z.; **286**, 336 (1936).
39COH	Cohen, P.P.; Biochem. J.; **33**, 1478 (1939).
40COH	Cohen, P.P.; J. Biol. Chem.; **136**, 585 (1940).
42LEN/STR	Lenard, P.; Straub, F.B.; Stud. Inst. Med. Chem. Univ. Szeged; **2**, 59 (1942).
43BAN	Banga, I.; Stud. Inst. Med. Chem. Univ. Szeged; **3**, 59 (1943).
43DOU	Doudoroff, M.; J. Biol. Chem.; **151**, 351 (1943).
43KAL	Kalckar, H.M.; J. Biol. Chem.; **148**, 127 (1943).
44LIP	Lipmann, F.; J. Biol. Chem.; **155**, 55 (1944).
45DAR	Darling, S.; Acta Physiol. Scand.; **10**, 150 (1945).
45GRE/LEL	Green, D.E.; Leloir, L.F.; Nocito, V.; J. Biol. Chem.; **161**, 559 (1945).
47BUC	Bücher, T.; Biochim. Biophys. Acta; **1**, 292 (1947).
48KOR	Kornberg, A.; J. Biol. Chem.; **176**, 1475 (1948).
48SOR/DEG	Soreni, E.T.; Degtyar, R.G.; Ukr. Biokhim. Zh.; **20**, 234 (1948).
49MEY/OES	Meyerhof, O.; Oesper, P.; J. Biol. Chem.; **179**, 1371 (1949).
49SOR/DVO	Sorenyi, E.T.; Dvornikova, P.D.; Degtyar, R.G.; Dokl. Akad. Nauk. SSSR; **67**, 341 (1949).
50FRI	Friedkin, M.; J. Biol. Chem.; **184**, 449 (1950).
50KOR	Kornberg, A.; J. Biol. Chem.; **182**, 779 (1950).
51KOR	Kornberg, A.; in "Phosphorus Metabolism—A Symposium on the Role of Phosphorus in the Metabolism of Plants and Animals"; W.D. McElroy and B. Glass, eds.; John Hopkins Press, Baltimore, Maryland (1951), pp. 392–414.
51ROW/KOR	Rowen, J.W.; Kornberg, A.; J. Biol. Chem.; **193**, 497 (1951).
52ASK	Askonas, B.A.; Thesis, Cambridge University (1952).
52EGG/HEM	Eggleston, L.V.; Hems, R.; Biochem. J.; **52**, 156 (1952).
52FIT/DOU	Fitting, C.; Doudoroff, M.; J. Biol. Chem.; **199**, 153 (1952).
52KOR	Korey, S.; personal communication cited in Korkes, S.; Brookhaven Symp. Biol.; **5**, 192 (1952).
52LEL/CAR	Leloir, L.F.; Cardini, C.E.; Cabib, E.; An. Asoc. Quim. Argent.; **40**, 228 (1952).
52STA	Stadtman, E.R.; J. Biol. Chem.; **196**, 535 (1952).
53GRE/BRO	Green, I.; Brown, J.R.C.; Mommaerts, W.F.H.M.; J. Biol. Chem.; **205**, 493 (1953).
53KRE	Krebs, H.A.; Biochem. J.; **54**, 82 (1953).
53LYN/OCH	Lynen, F.; Ochoa, S.; Biochim. Biophys. Acta; **12**, 299 (1953).
53NIS/BAR	Nisonoff, A.; Barnes, F.W., Jr.; Enns, T.; J. Biol. Chem.; **204**, 957 (1953).
53SIE/POT	Siekevitz, P.; Potter, V.R.; J. Biol. Chem.; **200**, 187 (1953).
53STE/COO	Stern, J.R.; Coon, M.J.; del Campillo, A.; J. Am. Chem. Soc.; **75**, 1517 (1953).
54BER/JOK	Berg, P.; Joklik, W.K.; J. Biol. Chem.; **210**, 657 (1954).
54BOW/KER	Bowen, W.J.; Kerwin, T.D.; Arch. Biochem. Biophys.; **49**, 149 (1954).
54GOL	Goldman, D.S.; J. Biol. Chem.; **208**, 345 (1954).
54NOD/KUB	Noda, L.; Kuby, S.A.; Lardy, H.A.; J. Biol. Chem.; **210**, 83 (1954).
54ROS/GRU	Rose, I.A.; Grunberg-Manago, M.; Korey, S.R.; Ochoa, S.; J. Biol. Chem.; **211**, 737 (1954).
54STA	Stadtman, E.R.; in "The Mechanism of Enzyme Action"; W.D. McElroy and B. Glass, eds.; John Hopkins Press, Baltimore, Maryland (1954) pp. 581–598.
55BLA/WRI	Black, S.; Wright, N.G.; J. Biol. Chem.; **213**, 27 (1955).
55BUC	Bücher, T.; Methods Enzymol.; **1**, 415 (1955).
55CAR/LEL	Cardini, C.E.; Leloir, L.F.; Chiriboga, J.; J. Biol. Chem.; **214**, 149 (1955).
55DEC	Decker, K.; "Die biologischen Reacktionen der aktivierten Acetessigsaeure"; Thesis, Muënchen, Germany (1955).
55HOR/SMY	Horecker, B.L.; Smyrniotis, P.Z.; J. Biol. Chem.; **212**, 811 (1955).
55LIE/KOR	Lieberman, I.; Kornberg, A.; Simms, E.S.; J. Biol. Chem.; **215**, 403 (1955).
55LIE/KOR2	Lieberman, I.; Kornberg, A.; Simms, E.S.; J. Biol. Chem.; **215**, 429 (1955).
55MUN	Munch-Petersen, A.; Acta Chem. Scand.; **9**, 1523 (1955).
55STA	Stadtman, E.R.; Methods Enzymol.; **1**, 596 (1955).
56ALE/GRE	Alexander, N.; Greenberg, D.M.; J. Biol. Chem.; **220**, 775 (1956).
56AME/HOR	Ames, B.N.; Horecker, B.L.; J. Biol. Chem.; **220**, 113 (1956).
56BOW/KER	Bowen, W.J.; Kerwin, T.D.; Arch. Biochem. Biophys.; **64**, 278 (1956).
56FEU/WOL	Feuer, G.; Wollemann, M.; Acta Physiol. Acad. Sci. Hung.; **10**, 1 (1956).
56RAB/PRI	Rabinowitz, J.C.; Pricer, W.E.; J. Am. Chem. Soc.; **78**, 4176 (1956).
56RAT/ROC	Ratner, S.; Rochovansky, O.; Arch. Biochem. Biophys.; **63**, 277 (1956).
56STE	Stern, J.R.; J. Biol. Chem.; **221**, 33 (1956).
56STE/COO	Stern, J.R.; Coon, M.J.; del Campillo, A.; Schneider, M.C.; J. Biol. Chem.; **221**, 15 (1956).
57CAL	Callaghan, O.H.; Biochem. J.; **67**, 651 (1957).
57DUR/STU	Durell, J.; Sturtevant, J.M.; Biochim. Biophys. Acta; **26**, 282 (1957).
57FLA/ERW	Flaks, J.G.; Erwin, M.J.; Buchanan, J.M.; J. Biol. Chem.; **228**, 201 (1957).
57GRE/LIP	Gregory, J.D.; Lipmann, F.; J. Biol. Chem.; **229**, 1081 (1957).
57KAR/GRE	Karasek, M.A.; Greenberg, D.M.; J. Biol. Chem.; **227**, 191 (1957).
57REI	Reichard, P.; Acta Chem. Scand.; **11**, 523 (1957).
57ROB/BOY	Robbins, E.A.; Boyer, P.D.; J. Biol. Chem.; **224**, 121 (1957).
57VLA/VLA	Vladimirov, G.E.; Vlassova, V.G.; Kolotilova, A.I.; Lyzlova, S.N.; Panteleyeva, N.S.; Biokhimiya; **22**, 963 (1957).
57VLA/VLA2	Vladimirov, G.E.; Vlassova, V.G.; Kolotilova, A.I.; Lyzlova, S.N.; Panteleyeva, N.S.; Nature; **179**, 1350 (1957).

58CAB/LEL Cabib, E.; Leloir, L.F.; J. Biol. Chem.; **231**, 259 (1958).

58MAL/OCH Maley, F.; Ochoa, S.; J. Biol. Chem.; **233**, 1538 (1958).

58MCQ McQuate, J.T,; Fed. Proc., Fed. Am. Soc. Exp. Biol.; **17**, 273 (1958).

58ROB/LIP Robbins, P.W.; Lipmann, F.; J. Biol. Chem.; **233**, 686 (1958).

58TUR/TUR Turner, D.H.; Turner, J.F.; Biochem. J.; **69**, 448 (1958).

58WIL/BAN Wilson, L.G.; Bandurski, R.S.; J. Biol. Chem.; **233**, 975 (1958).

59ALE Alexander, J.K.; "Studies on a Purified Cellobiose Phosphorylase"; Thesis, Montana State College (1959).

59ATK/JOH Atkinson, M.R.; Johnson, E.; Morton, R.K.; Nature; **184**, 1925 (1959).

59BON/PON Bonsignore, A.; Pontremoli, S.; Grazi, E.; Mangiarotti, M.; Biochem. Biophys. Res. Commun.; **1**, 79 (1959).

59CAL/WEB Callaghan, O.H.; Weber, G.; Biochem. J.; **73**, 473 (1959).

59KIR/TUR Kirkland, R.J.A.; Turner, J.F.; Biochem. J.; **72**, 716 (1959).

59KRI Krimsky, I.; J. Biol. Chem.; **234**, 232 (1959).

59MCQ/UTT McQuate, J.T.; Utter, M.F.; J. Biol. Chem.; **234**, 2151 (1959).

59SCO/JAK Scott, E.M.; Jakoby, W.B.; J. Biol. Chem.; **234**, 932 (1959).

59STR/SMI Strominger, J.L.; Smith, M.S.; J. Biol. Chem.; **234**, 1822 (1959).

59TAB/WYN Tabor, H.; Wyngarden, L.; J. Biol. Chem.; **234**, 1830 (1959).

60BLA Blakley, R.L.; Biochem. J.; **74**, 71 (1960).

60GEL/STU Gellert, M.; Sturtevant, J.M.; J. Am. Chem. Soc.; **82**, 1497 (1960).

60JON/LIP Jones, M.E.; Lipmann, F.; Proc. Natl. Acad. Sci. USA; **46**, 1194 (1960).

60KUR/SUG Hurahashi, K.; Sugimura, A.; J. Biol. Chem.; **235**, 940 (1960).

60MEN Mendicino, J.; J. Biol. Chem.; **235**, 3347 (1960).

61ATK/BUR Atkinson, M.R.; Burton, R.M.; Morton, R.K.; Biochem. J.; **78**, 813 (1961).

61DAT/RAC Datta, A.G.; Racker, E.; J. Biol. Chem.; **236**, 617 (1961).

61DOU Doudoroff, M.; in "Biochemist's Handbook"; C. Long, ed.; D. Van Nostrand Co., Princeton, New Jersey (1961), pp. 477–478.

61KLE Klenow, H.; in "Biochemist's Handbook"; C. Long, ed.; D. Van Nostrand Co., Princeton, New Jersey (1961), pp. 483–484.

61KOR/GLA Kornfeld, S.; Glaser, L.; J. Biol. Chem.; **236**, 1791 (1961).

61LED Leder, I.G.; J. Biol. Chem.; **236**, 3066 (1961).

61MAH Mahler, H.R.; in "Biochemist's Handbook"; C. Long, ed.; D. Van Nostrand Co., Princeton, New Jersey (1961), pp. 418–419.

61PRA Pradel, L.A.; Tèse Doct. Sci. Phys. Paris (1961); data given in Barman, T.E.; "Enzyme Handbook—Vol. I"; Springer-Verlag, New York (1969), p. 443.

61RAC Racker, E.; in "The Enzymes", Vol. 5, 2nd edition; P.D. Boyer, H. Lardy, and K. Myrbäck, eds.; Academic Press, New York (1961), pp. 397–406.

61RAC2 Racker, E.; in "The Enzymes", Vol. 5, 2nd edition; P.D. Boyer, H. Lardy, and K. Myrbäck, eds.; Academic Press, New York (1961), pp. 407–412.

61VEN/RAC Venkataraman, R.; Racker, E.; J. Biol. Chem.; **236**, 1876 (1961).

61WOO/STJ Wood, H.G.; Stjernholm, R.; Proc. Natl. Acad. Sci. USA; **47**, 289 (1961).

61YAM Yamada, E.W.; J. Biol. Chem.; **236**, 3043 (1961).

62AKA/CAM Akagi, J.M.; Campbell, L.L.; J. Bacteriol.; **84**, 1194 (1962).

62BES Bessman, M.J.; Methods Enzymol.; **6**, 166 (1962).

62DUR/RAW Durell, J.; Rawitscher, M.; Sturtevant, J.M.; Biochim. Biophys. Acta; **56**, 552 (1962).

62ESP Espada, J.; J. Biol. Chem.; **237**, 3577 (1962).

62HAY/NIS Hayaishi, O.; Nishizuka, Y.; Methods Enzymol.; **5**, 698 (1962).

62JAK Jakoby, W.B.; Methods Enzymol.; **5**, 765 (1962).

62MEN Mendicino, J.; J. Biol. Chem.; **237**, 165 (1962).

62PET Peterkofsky, B.; Methods Enzymol.; **5**, 853 (1962).

62RAB Rabinowitz, M.; in "The Enzymes", Vol. 6, 2nd edition; P.D. Boyer, H. Lardy, and K. Myrbäck, eds.; Academic Press, New York (1962), pp. 119–131.

62RAT Ratner, S.; Methods Enzymol.; **5**, 843 (1962).

62SEG/BEA Segal, H.L.; Beattie, D.S.; Hopper, S.; J. Biol. Chem.; **237**, 1914 (1962).

62SIL Silverman, M.; Methods Enzymol.; **5**, 790 (1962).

62TAB Tabor, H.; Methods Enzymol.; **5**, 785 (1962).

62WIL/SNE Wilson, E.M.; Snell, E.E.; J. Biol. Chem.; **237**, 3171 (1962).

63BEC/LEV Beck, W.S.; Levin, M.; J. Biol. Chem.; **238**, 702 (1963).

63BER/HOL Bergmeyer, H.U.; Holz, G.; Klotzsch, H.; Lang, G.; Biochem. Z.; **338**, 114 (1963).

63DEV/GOU de Verdier, C.-H.; Gould, B.J.; Biochim. Biophys. Acta; **68**, 333 (1963).

63FLA Flaks, J.G.; Methods Enzymol.; **6**, 136 (1963).

63FRI/SCH Fritz, I.B.; Schultz, S.K.; Srere, P.A.; J. Biol. Chem.; **238**, 2509 (1963).

63SLY/STA Sly, W.S.; Stadtman, E.R.; J. Biol. Chem.; **238**, 2639 (1963).

63VIL/LAR Villar-Palasi, C.; Larner, J.; Methods Enzymol.; **6**, 355 (1963).

64AVI Avigad, G.; J. Biol. Chem.; **239**, 3613 (1964).

64BOJ/GAU Bojanowski, R.; Gaudy, E.; Valentine, R.C.; Wolfe, R.S.; J. Bacteriol.; **87**, 75 (1964).

64HEN/CLE Henson, C.P.; Cleland, W.W.; Biochemistry; **3**, 338 (1964).

64MIL/AVI Milner, Y.; Avigad, G.; Israel J. Chem.; **2**, 316 (1964).

64NOR Norum, K.R.; Biochim. Biophys. Acta; **89**, 95 (1964).

64PRE/WOO Preiss, J.; Wood, E.; J. Biol. Chem.; **239**, 3119 (1964).

65BES/HER Bessman, M.J.; Herriott, S.T.; Van Bibber Orr, M.J.; J. Biol. Chem.; **240**, 439 (1965).

65BUL/HAN Bulos, B.; Handler, P.; J. Biol. Chem.; **240**, 3283 (1965).

65MAR/JEN Martinez-Carrion, M.; Jenkins, W.T.; J. Biol. Chem.; **240**, 3538 (1965).

65MAY/GIN Mayer, R.M.; Ginsburg, V.; J. Biol. Chem.; **240**, 1900 (1965).

65MOR/JAM Morrison, J.F.; James, E.; Biochem. J.; **97**, 37 (1965).

65STR Strecker, H.J.; J. Biol. Chem.; **240**, 1225 (1965).

65UYE/RAB Uyeda, K.; Rabinowitz, J.C.; J. Biol. Chem.; **240**, 1701 (1965).

66ALB/BAS Albrecht, G.J.; Bass, S.T.; Seifert, L.L.; Hansen, R.G.; J. Biol. Chem.; **241**, 2968 (1966).

66DED Dedonder, R.; Methods Enzymol.; **8**, 500 (1966).

66GIB/MOR Gibbs, R.G.; Morris, J.G.; Biochem. J.; **99**, 27P (1966).

66GOL/MAR Goldemberg, S.H.; Marechal, L.R.; DeSouza, B.C.; J. Biol. Chem.; **241**, 45 (1966).

66HAN/ALB Hansen, R.G.; Albrecht, G.J.; Bass, S.T.; Seifert, L.L.; Methods Enzymol.; **8**, 248 (1966).

66HAN/VER Hansen, R.G.; Verachtert, H.; Rodriguez, P.; Bass, S.T.; Methods Enzymol.; **8**, 269 (1966).

66HOR/HEN Hori, M.; Henderson, J.F.; J. Biol. Chem.; **241**, 3404 (1966).

66JEN/DAR Jenkins, W.T.; D'Ari, L.; J. Biol. Chem.; **241**, 2845 (1966).

66KIM/SUZ Kimata, K.; Suzuki, S.; J. Biol. Chem.; **241**, 1099 (1966).

66MAR/COH Marshall, M.; Cohen, P.P.; J. Biol. Chem.; **241**, 4197 (1966).

66MAR/WAD Markland, F.S.; Wadkins, C.L.; J. Biol. Chem.; **241**, 4136 (1966).

66MAT/STR Matsuhashi, M.; Strominger, J.L.; Methods Enzymol.; **8**, 317 (1966).

66MUD/KLE Mudd, S.H.; Klee, W.A.; Ross, P.D.; Biochemistry; **5**, 1653 (1966).

66MUR/SUG Murata, T.; Sugiyama, T.; Minamikawa, T.; Akazawa, T.; Arch. Biochem. Biophys.; **113**, 34 (1966).

66SCH Schuberth, J.; Biochim. Biophys. Acta; **122**, 470 (1966).

66STA/DEN Staub, M.; Denes, G.; Biochim. Biophys. Acta; **128**, 82 (1966).

66UHR/MAR Uhr, M.L.; Marcus, F.; Morrison, J.F.; J. Biol. Chem.; **241**, 5428 (1966).

66VER/ROD Verachtert, H.; Rodriguez, P.; Bass, S.T.; Hansen, R.G.; J. Biol. Chem.; **241**, 2007 (1966).

66WIL/WAK Williamson, I.P.; Wakil, S.J.; J. Biol. Chem.; **241**, 2326 (1966).

67EPP/DAW Eppenberger, H.M.; Dawson, D.M.; Kaplan, N.O.; J. Biol. Chem.; **242**, 204 (1967).

67HER/JEN Hersh, L.B.; Jencks, W.P.; J. Biol. Chem.; **242**, 3468 (1967).

67HIR/GRE Hirsch, H.; Greenberg, D.M.; J. Biol. Chem.; **242**, 2283 (1967).

67MOR/WHI Morrison, J.F.; White, A.; Eur. J. Biochem.; **3**, 145 (1967).

67SAK/YOR Sakai, T.; Yorifuji, T.; Tochikura, T.; Ogata, K.; Agr. Biol. Chem.; **31**, 525 (1967).

67SAK/YOR2 Sakai, T.; Yorifuji, T.; Tochikura, T.; Ogata, K.; Agr. Biol. Chem.; **31**, 533 (1967).

67SIL/VOE Silverstein, R.; Voet, J.; Reed, D.; Abeles, R.H.; J. Biol. Chem.; **242**, 1338 (1967).

68AYL/SNE Ayling, J.E.; Snell, E.E.; Biochemistry; **7**, 1616 (1968).

68AYL/SNE2 Ayling, J.E.; Snell, E.E.; Biochemistry; **7**, 1626 (1968).

68BOM/PRA Bomsel, J.; Pradet, A.; Biochim. Biophys. Acta; **162**, 230 (1968).

68HAT/SLA Hatch, M.D.; Slack, C.R.; Biochem. J.; **106**, 141 (1968).

68POT/GLO Potter, L.T.; Glover, V.A.S.; Saelens, J.K.; J. Biol. Chem.; **243**, 3864 (1968).

68REE/MEN Reeves, R.E.; Menzies, R.A.; Hsu, D.S.; J. Biol. Chem.; **243**, 5486 (1968).

68SU/RUS Su, S.; Russell, P.J., Jr.; J. Biol. Chem.; **243**, 3826 (1968).

68TAN/KAN Tanner, W.; Kandler, O.; Eur. J. Biochem.; **4**, 233 (1968).

68VEE Veech, R.; "Measurement of Respiratory Metabolism in Animal Tissues"; Thesis, Oxford University (1968).

69ALB Alberty, R.A.; J. Biol. Chem.; **244**, 3290 (1969).

69BAR Barman; T. E.; "Enzyme Handbook—Vol. I"; Springer-Verlag, New York (1969).

69BRE/AAS Bremer, J.; Aas, M.; in "Mitochondria Structure and Function"; L.Ernster and Z. Drahota, eds.; Academic Press, New York (1969), pp. 127–135.

69GAR/CLE Garces, E.; Cleland, W.W.; Biochemistry; **2**, 633 (1969).

69KLO Klotzsch, H.R.; Methods Enzymol.; **13**, 381 (1969).

69POP Popjak, G.; Methods Enzymol.; **15**, 393 (1969).

69SHE/ALE Sheth, K.; Alexander, J.K.; J. Biol. Chem.; **244**, 457 (1969).

69SMI/MOR Smith, E.; Morrison, J.F.; J. Biol. Chem.; **244**, 4224 (1969).

69SWI Switzer, R.L.; J. Biol. Chem.; **244**, 2854 (1969).

69VEE/EGG Veech, R.L.; Eggleston, L.V.; Krebs, H.A.; Biochem. J.; **115**, 609 (1969).

70ALB Albrecht, G.J.; Biochemistry; **9**, 2462 (1970).

70BLA Blair, J.McD.; Eur. J. Biochem.; **13**, 384 (1970).

70DEN Denes, G.; Methods Enzymol.; **17A**, 273 (1970).

70KNO/HAN Knop, J.K.; Hansen, R.G.; J. Biol. Chem.; **245**, 2499 (1970).

70KRI/BUC Krietsch, W.K.G.; Bücher, T.; Eur. J. Biochem.; **17**, 568 (1970).

70MAN/HOL Mantel, M.; Holzer, H.; Proc. Natl. Acad. Sci. USA; **65**, 660 (1970).

70MAR/COH Marshall, M.; Cohen, P.P.; Methods Enzymol.; **17A**, 229 (1970).

70NAK/FUJ Nakatani, Y.; Fujioka, M.; Higashino, K.; Biochim. Biophys. Acta; **198**, 219 (1970).

70VEE/RAI Veech, R.L.; Raijman, L.; Krebs, H.A.; Biochem. J.; **117**, 499 (1970).

71CHE/ALI Chetverikova, E.P.; Alievskaya, L.L.; Krinskaya, A.V.; Biokhimiya (Moscow); **36**, 717 (1971).

71GLO/POT Glover, V.A.S.; Potter, L.T.; J. Neurochem.; **18**, 571 (1971).

71HOR/HUS Horn, A.; Husung, R.; Schröder, M.; Börnig, H.; Acta Biol. Med. Germ. **27**, 821 (1971).

71JEN/SCH Jencks, W.P.; Schaffhausen, B.; Tornheim, K.; White, H.; J. Am. Chem. Soc.; **93**, 3917 (1971).

71JOS/WAK Joshi, V.C.; Wakil, S.J.; Arch. Biochem. Biophys.; **143**, 493 (1971).

71MIL Miles, E.W.; Methods Enzymol.; **17B**, 341 (1971).

71NOJ/TAN Nojiri, T.; Tanaka, F.; Nakayama, I.; J. Biochem. (Tokyo); **69**, 789 (1971).

71ROB Roberts, R.M.; J. Biol. Chem.; **246**, 4995 (1971).

71SHI/SUG Shimono, H.; Sugino, Y.; Eur. J. Biochem.; **19**, 256 (1971).

71TAN/JOH Tanaka, N.; Johnson, M.J.; J. Bacteriol.; **108**, 1107 (1971).

72CAG/FRI Cagen, L.M.; Friedmann, H.C.; J. Biol. Chem.; **247**, 3382 (1972).

72COO/MEI Cooper, A.J.L.; Meister, A.; Biochemistry; **11**, 661 (1972).

72DEL Delmer, D.P.; J. Biol. Chem.; **247**, 3822 (1972).

72GUS/GAN Gustafson, G.L.; Gander, J.E.; J. Biol. Chem.; **247**, 1387 (1972).

72LEH/TAN Lehle, L.; Tanner, W.; Methods Enzymol.; **38**, 522 (1972).

72MAR/BEL Marechal, L.R.; Belocopitow, E.; J. Biol. Chem.; **247**, 3223 (1972).

72TAK/ONO Takahashi, K.; Ono, S.; J. Biochem. (Tokyo); **72**, 679 (1972).

73DEW/LOW De Weer, P.; Lowe, A.G.; J. Biol. Chem.; **248**, 2829 (1973).

73GUY/VEE Guynn, R.W.; Veech, R.L.; J. Biol. Chem.; **248**, 6966 (1973).

73HAN/RUD Hanson, R.L.; Rudolph, F.B.; Lardy, H.A.; J. Biol. Chem.; **248**, 7852 (1973).

73RAD/HOC Rado, T.A.; Hoch, J.A.; Biochim. Biophys. Acta; **321**, 114 (1973).

73ROT/KIS Rothman, S.W.; Kisliuk, R.L.; Langerman, N.; J. Biol. Chem.; **248**, 7845 (1973).

73SUG Sugiyama, T.; Biochemistry; **12**, 2862 (1973).

74BOS/YAM Bose, R.; Yamada, E.W.; Biochemistry; **13**, 2051 (1974).

74DAN/CAR Danzin, C.; Cardinaud, R.C.; Eur. J. Biochem.; **48**, 255 (1974).

74GUY/VEL Guynn, R.W.; Veloso, D.; Lawson, J.W.R.; Veech, R.L.; Biochem. J.; **140**, 369 (1974).

74JEB/TY Jebeleanu, G.; Ty, N.G.; Mantsch, H.H.; Barzu, O.; Niac, G.; Abrudan, I.; Proc. Natl. Acad. Sci. U.S.A.; **71**, 4630 (1974).

74KNA/BLA Knappe, J.; Blaschowski, H.P.; Gröbner, P.; Schmitt, T.; Eur. J. Biochem.; **50**, 253 (1974).

74LAN Langer, R.S.; "Enzymatic Regeneration of ATP"; Thesis, Massachusetts Institute of Technology (1974).

74TUR/GIL Turnquist, R.L.; Gillett, T.A.; Hansen, R.G.; J. Biol. Chem.; **249**, 7695 (1974).

74WON/FRE Wong, L.-J.; Frey, P.A.; Biochemistry; **13**, 3889 (1974).

75BOH/SCH Böhme, H.-J.; Schellenberger, W.; Hofmann, E.; Acta Biol. Med. Germ.; **34**, 15 (1975).

75GOL Goldberg, R.N.; Biophys. Chem.; **3**, 192 (1975).

75JEN/NYG Jensen, K.F.; Nygaard, P.; Eur. J. Biochem.; **51**, 253 (1975).

75MCG/JOR McGlothlin, C.D.; Jordan, J.; Anal. Chem.; **47**, 786 (1975).

75MUR/TSU Murakami, K.; Tsushima, K.; Biochim. Biophys. Acta; **384**, 390 (1975).

75PIE/GUY Pieklik, J.R.; Guynn, R.W.; J. Biol. Chem.; **250**, 4445 (1975).

75SHI/BEA Shizuta, Y.; Beavo, J.A.; Bechtel, P.J.; Hofmann, F.; Krebs, E.G.; J. Biol. Chem.; **250**, 6891 (1975).

75SUN Sundler, R.; J. Biol. Chem.; **250**, 8585 (1975).

76GOL Goldberg, R.N.; Biophys. Chem.; **4**, 215 (1976).

876LAW/GUY Lawson, J.W.R.; Guynn, R.W.; Cornell, N.; Veech, R.L.; in "Gluconeogenesis: Its Regulation in Mammalian Species"; R.W. Hanson and M.A. Mehlman, eds.; John Wiley and Sons, New York (1976), pp. 481–512.

76RAO/BUT Rao, B.D.N.; Buttlaire, D.H.; Cohn, M.; J. Biol. Chem.; **251**, 6981 (1976).

77ANN/WAL Annesley, T.M.; Walker, J.B.; Biochem. Biophys. Res. Commun.; **74**, 185 (1977).

77APP/NAI Apps, D.K.; Nairn, A.C.; Biochem. J.; **167**, 87 (1977).

77LAN/GAR Langer, R.S.; Gardner, C.R.; Hamilton, B.K.; Colton, C.K.; AIChE J.; **23**, 1 (1977).

77SRA/FRE Sramek, S.J.; Frerman, F.E.; Arch. Biochem. Biophys.; **181**, 178 (1977).

77TRA/JON Traut, T.W.; Jones, M.E.; J. Biol. Chem.; **252**, 8374 (1977).

78INF/KIN Infante, J.P.; Kinsella, J.E.; Biochim. Biophys. Acta; **526**, 440 (1978).

78LYN/GUY Lynn, R.; Guynn, R.W.; J. Biol. Chem.; **253**, 2546 (1978).

78MEE/AKE van der Meer, R.; Akerboom, T.P.M.; Groen, A.K.; Tager, J.M.; Eur. J. Biochem.; **84**, 421 (1978).

78RAO/COH Rao, B.D.N.; Cohn, M.; Noda, L.; J. Biol. Chem.; **253**, 1149 (1978).

79COR/LEA Cornell, N.W.; Leadbetter, M.; Veech, R.L.; J. Biol. Chem.; **254**, 6522 (1979).

79LAW/VEE Lawson, J.W.R.; Veech, R.L.; J. Biol. Chem.; **254**, 6528 (1979).

79RAO/KAY Rao, B.D.N.; Kayne, F.J.; Cohn, M.; J. Biol. Chem.; **254**, 2689 (1979).

79VIC/GRE Victor, J.; Greenberg, L.B.; Sloan, D.L.; J. Biol. Chem.; **254**, 2647 (1979).

80CAM/SGA Camici, M.; Sgarrella, F.; Ipata, P.L.; Mura, U.; Arch. Biochem. Biophys.; **205**, 191 (1980).

80CHE/HED Cheer, R.L.; Hedwig G.R.; Watson, I.D.; Biophys. Chem.; **12**, 73 (1980).

80ELM/HAS El-Maghrabi, M.R.; Haston, W.S.; Flockhart, D.A.; Claus, T.H.; Pilkis, S.J.; J. Biol. Chem.; **255**, 668 (1980).

80JAF/COH Jaffe, E.K.; Cohn, M.; J. Biol. Chem.; **255**, 3240 (1980).

80LER/COH Lerman, C.L.; Cohn, M.; J. Biol. Chem.; **255**, 8756 (1980).

880PET/AMI Petrucci, D.; Amicarelli, F.; Paponetti, B.; Ragnelli, A.M.; Comp. Biochem. Physiol. B; **66**, 1 (1980).

81HSI/SU Hsiao, P.-H.; Su, J.-C.; Sung, H.-Y.; Proc. Natl. Sci. Counc. Repub. China; **5**, 31 (1981).

81MER/MCA Merrill, D.K.; McAlexander, J.C.; Guynn, R.W.; Arch. Biochem. Biophys.; **212**, 717 (1981).

81RAM/PIC Ramotar, K.; Pickard, M.A.; Can. J. Microbiol.; **27**, 1053 (1981).

81RAO/COH Rao, B.D.N.; Cohn, M.; J. Biol. Chem.; **256**, 1716 (1981).

82GUY Guynn, R.W.; Arch. Biochem. Biophys.; **218**, 14 (1982).

82RED Redman-Furey, N.L.; "Biochemical Thermodynamics and Analytical Enthalpimetry"; Thesis, Pennsylvania State University (1982).

82SAL/GIA Salerno, C.; Giacomello, A.; Experientia; **38**, 1196 (1982).

82SAL/JOR Salamone, S.J.; Jordan, F.; Jordan, R.R.; Arch. Biochem. Biophys.; **217**, 139 (1982).

83HON/HAR Hondo, T.; Hara, A.; Funaguma, T.; Plant Cell Physiol.; **24**, 61 (1983).

83KHO/KAR Kholodenko, N.Ya.; Kartashov, I.M.; Makarov, A.D.; Biokhimiya (Moscow); **48**, 471 (1983).

83MIL/RYC Milner-White, J.; Rycroft, D.S.; Eur. J. Biochem.; **133**, 169 (1983).

84BER/COO Bertagnolli, B.L.; Cook, P.F.; Biochemistry; **23**, 4101 (1984).

84PUZ/GOR Puzach, S.S.; Gorbach, E.V.; Ostrovskii, Yu.M.; Biokhimiya (Moscow); **49**, 1178 (1984).

85BAR Barber, G.A.; Plant Physiol.; **79**, 1127 (1985).

85LEE/OSU Lee, C.H.; O'Sullivan, W.J.; J. Biol. Chem.; **260**, 13909 (1985).

86CAS/VEE Casazza, J.P.; Veech, R.L.; Anal. Biochem.; **159**, 243 (1986).

86GRA/ELL Graham, R.A.; Ellington, W.R.; Chih, C.P.; Biochim. Biophys. Acta; **887**, 157 (1986).

86KIM/LEE Kim, I.-H.; Lee, H.-J.; Korean Biochem. J.; **19**, 47 (1986).

86KUP/FER Kupriyanov, V.V.; Ferretti, J.A.; Balaban, R.S.; Biochim. Biophys. Acta; **869**, 107 (1986).

87KUC/MIZ Kuchta, R.D.; Mizrahi, V.; Benkovic, P.A.; Johnson, K.A.; Benkovic, S.J.; Biochemistry; **26**, 8410 (1987).

87RAO/HAR Rao, G.S.J.; Harris, B.G.; Cook, P.F.; J. Biol. Chem.; **262**, 14074 (1987).

87TAV/LEE Tavares, A.; Lee, C.S.; O'Sullivan, W.J.; Biochim. Biophys. Acta; **913**, 279 (1987).

87WOL/REI Woledge, R.C.; Reilly, P.J.; Biophys. J.; **54**, 97 (1987).

88BEL/BAE Belunis, C.J.; Bae-Lee, M.; Kelley, M.J.; Carman, G.M.; J. Biol. Chem.; **263**, 18897 (1988).

89ELD/DEG Eldar, H.; Degani, H.; Magn. Reson. Med.; **11**, 121 (1989).

89ELL Ellington, W.R.; J. Exp. Biol.; **143**, 177 (1989).

89GOL/TEW Goldberg, R.N.; Tewari, Y.B.; Ahluwalia, J.C.; J. Biol. Chem.; **264**, 9901 (1989).

89LEH/SIN Lehikoinen, P.K.; Sinnott, M.L.; Krenitsky, T.A.; Biochem. J.; **257**, 355 (1989).

89LOP/COH LoPresti, P.; Cohn, M.; Biochim. Biophys. Acta; **998**, 317 (1989).

90LUN/APR Lunn, J.E.; Ap Rees, T.; Biochem. J.; **267**, 739 (1990).

91HOR/UEH Hori, N.; Uehara, K.; Mikami, Y.; Agric. Biol. Chem.; **55**, 1071 (1991).

91HOR/WAT Hori, N.; Watanabe, M.; Mikami, Y.; Biocatalysis; **4**, 297 (1991).

91KLE/RAN Kleczkowski, L.A.; Randall, D.D.; J. Exp. Bot.; **42**, 537 (1991).

91SEM/CLE Sem, D.S.; Cleland, W.W.; Biochemistry; **30**, 4978 (1991).

91TEW/GOL Tewari, Y.B.; Goldberg, R.N.; Advani, J.V.; Biophys. Chem.; **40**, 263 (1991).

92KIM/KIN Kim, Y.-A.; King, M.T.; Teague, W.E., Jr.; Rufo, G.A., Jr.; Veech, R.L.; Passonneau, J.V.; Am. J. Physiol.; **262**, E344 (1992).

92KIT/SAS Kitaoka, M.; Sasaki, T.; Taniguchi, H.; Biosci. Biotech. Biochem.; **56**, 652 (1992).

92TEA/DOB Teague, W.E., Jr.; Dobson, G.P.; J. Biol. Chem.; **267**, 14084 (1992).

93MOC/STR Mock, H.-P.; Strack, D.; Phytochemistry; **32**, 575 (1993).