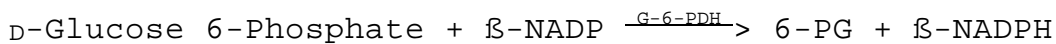
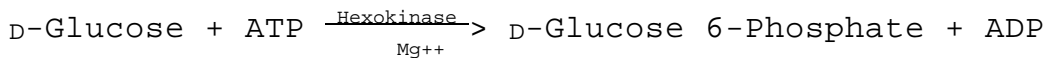
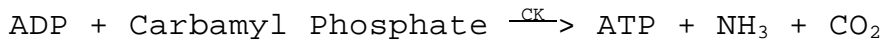


**Enzymatic Assay of CARBAMATE KINASE  
(EC 2.7.2.2)**

**PRINCIPLE:**



Abbreviations used:

ADP = Adenosine 5'-Phosphate

CK = Carbamate Kinase

ATP = Adenosine 5'-Triphosphate

ADP = Adenosine 5'-Diphosphate

$\beta$ -NADP =  $\beta$ -Nicotinamide Adenine Dinucleotide Phosphate,  
Oxidized Form

G-6-PDH = Glucose 6-Phosphate Dehydrogenase

6-PG = 6-Phospho-D-Gluconate

$\beta$ -NADPH =  $\beta$ -Nicotinamide Adenine Dinucleotide Phosphate,  
Reduced Form

**CONDITIONS:** T = 37°C, pH = 8.3, A<sub>340nm</sub>, Light path = 1 cm

**METHOD:** Continuous Spectrophotometric Rate Determination

**REAGENTS:**

- A. 20 mM Tris HCl Buffer, pH 8.3 at 37°C  
(Prepare 100 ml in deionized water using Trizma Base, Sigma Prod. No. T-1503. Adjust to pH 8.3 at 37°C with 1 M HCl.)
- B. 10 mM  $\beta$ -D(+)-Glucose, 34 mM Magnesium Chloride, 1.0 mM  $\beta$ -Nicotinamide Adenine Dinucleotide Phosphate, Oxidized Form, and 5.0 mM Adenosine 5'-Diphosphate Solution, pH 8.3 at 37°C (Reagent Soln)  
(Prepare 10 ml in Reagent A using  $\beta$ -D(+)-Glucose, Sigma Prod. No. G-5250, Magnesium Chloride, Hexahydrate, Sigma Prod. No. M-0250,  $\beta$ -Nicotinamide Adenine Dinucleotide Phosphate, Sigma Prod. No. N-7004, and Adenosine 5'-Diphosphate, Sodium Salt, Sigma Prod. No. A-6646. Adjust to pH 8.3 at 37°C with either 1 M HCl or 1 M NaOH if necessary.)

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**REAGENTS:**

- C. 30 mM Carbamyl Phosphate Solution (Carbamyl Phosphate) (Immediately before use prepare 1 ml in deionized water using Carbamyl Phosphate, Dilithium Salt, Sigma Prod. No. C-5625. This solution is unstable. **PREPARE FRESH.**)
- D. 0.05% (w/v) Bovine Serum Albumin Solution (BSA) (Prepare 10 ml in Reagent A using Albumin, Bovine, Sigma Prod. No. A-4503.)
- E. Glucose-6-P-Dehydrogenase and Hexokinase Enzyme Solution (G-6-PDH/HK) (Immediately before use, prepare 1 ml of a solution containing 100 units/ml each of Glucose-6-Phosphate Dehydrogenase, Sigma Prod. No. G-5760, and Hexokinase, Sigma Prod. No. H-5500, in cold Reagent A.)
- F. Carbamate Kinase Enzyme Solution (CK) (Immediately before use, prepare a solution containing 50 units/ml of Carbamate Kinase in cold deionized water. Then dilute to 0.3 - 0.4 unit/ml with Reagent D.)

**PROCEDURE:**

Pipette (in milliliters) the following reagents into suitable containers:

	<u>Test</u>	<u>Blank</u>
Reagent C (Carbamyl Phosphate)	0.10	0.10
Reagent B (Reagent Soln)	2.70	2.70
Reagent E (G-6-PDH/HK)	0.10	0.10

Mix by inversion and equilibrate to 37°C. Monitor the  $A_{340\text{nm}}$  until constant using a suitably thermostatted spectrophotometer. Then add:

Reagent F (CK)	0.10	-----
Reagent D (BSA)	-----	0.10

Immediately mix by inversion and record the increase in  $A_{340\text{nm}}$  for approximately 5 minutes. Obtain the  $r A_{340\text{nm}}/\text{minute}$  using the maximum linear rate for both the Test and Blank.

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**CALCULATIONS:**

$$\text{Units/ml enzyme} = \frac{(r_{A_{340\text{nm}}/\text{min Test}} - r_{A_{340\text{nm}}/\text{min Blank}})(3)(\text{df})}{(6.22)(0.1)}$$

3 = Total volume (in milliliters) of assay

df = Dilution factor

6.22 = Millimolar extinction coefficient of  $\beta$ -NADPH at 340 nm

0.1 = Volume (in milliliter) of carbamate kinase used

$$\text{Units/mg solid} = \frac{\text{units/ml enzyme}}{\text{mg solid/ml enzyme}}$$

$$\text{Units/mg protein} = \frac{\text{units/ml enzyme}}{\text{mg protein/ml enzyme}}$$

**UNIT DEFINITION:**

One unit will form 1.0  $\mu$ mole of ATP from ADP and carbamyl phosphate per minute at pH 8.3 at 37°C.

**FINAL ASSAY CONCENTRATIONS:**

In a 3.00 ml reaction mix, the final concentrations are 19 mM Tris, 9 mM  $\beta$ -D(+)glucose, 31 mM magnesium chloride, 0.9 mM  $\beta$ -nicotinamide adenine dinucleotide phosphate, 4.5 mM adenosine 5'-diphosphate, 1 mM carbamyl phosphate, 0.002% bovine serum albumin, 10 units glucose-6-phosphate dehydrogenase, 10 units hexokinase, and 0.03 - 0.04 unit carbamate kinase.

**REFERENCE:**

Schimke, R.T., Berlin, C.M., Sweeney, E.W., and Carrol, W.R. (1966) *Journal of Biological Chemistry* **241**, 2228-2236

**NOTES:**

1. Hexokinase Unit Definition: One unit will phosphorylate 1.0  $\mu$ mole of D-glucose per minute at pH 7.6 at 25°C.
2. Glucose 6-Phosphate Dehydrogenase Unit Definition: One unit will oxidize 1.0  $\mu$ mole of glucose 6-phosphate to 6-phospho-D-gluconate per minute in the presence of NAD at pH 7.8 at 30°C.

**Enzymatic Assay of CARBAMATE KINASE  
(EC 2.7.2.2)**

**NOTES:** (continued)

3. This assay is based on the cited reference.
2. Where Sigma Product or Stock numbers are specified, equivalent reagents may be substituted.

**This procedure is for informational purposes. For a current copy of Sigma's quality control procedure contact our Technical Service Department.**