

HAMILTONIAN FORMULATION

Clazzical Mechanicz

Project PHYSNET Physics Bldg. Michigan State University East Lansing, MI

HAMILTONIAN FORMULATION by C. P. Frahm

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Title: Hamiltonian Formulation

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Input Skills:

1. Vocabulary: Hamiltonian (MISN-0-499).

Output Skills (Knowledge):

K1. Vocabulary: generalized momenta, canonically conjugate quantities.

Evaluation: Stage B0

- K2. Derive Hamilton's equations of motion from the definition of the Hamiltonian in terms of the Lagrangian.
- K3. Derive the virial theorem for a system with bounded position vectors and momenta.

Output Skills (Problem Solving):

S1. For a given system find the Hamiltonian function and hence write down the Hamiltonian equations of motion for the system.

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New authors, reviewers and field testers are welcome.

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1. Introduction

The formulation of mechanics due to Hamilton is particularly useful for illuminating many of the theoretical subtleties of mechanics as well as for solving certain kinds of problems in celestial mechanics and continuum mechanics. This unit is devoted to an introduction to Hamilton's formulation of mechanics.

2. Procedures

- 1-2. Read sections 7.10 and 7.11 of Marion. Write down definitions for the items in Output Skill K1. Fill in the details for Output Skill K2. Be sure you can do Output Skill K2 without the aid of the text and starting from Lagrange's equations and the definitions of the Hamiltonian and generalized momenta.
- 3. Read section 7.13 in Marion. Fill in any missing details.
- 4. Work problems 7-25 and 7-30 of Marion.

Work problem 7-32 of Marion omitting the last part concerned with phase space.

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