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THE UNIVERSITY OF CHICAGO
DIVISION OF THE PHYSICAL SCIENCES
DEPARTMENT OF PHYSICS

PHYSICS 435
STATISTICAL MECHANICS
PROBLEM SET 1

1. Consider a system of N particles in a volume V at temperature T . The particles interact via a pair potential $\phi(r)$. The total energy is given by
$$E = \sum_{i=1}^N \frac{1}{2} m v_i^2 + \sum_{i < j} \phi(r_{ij})$$

where r_{ij} is the distance between particles i and j . The partition function is
$$Z = \int \prod_{i=1}^N d^3r_i d^3v_i \exp\left(-\beta E\right)$$

2. The virial theorem states that for a system of particles interacting via a pair potential $\phi(r) \propto r^{-n}$, the average kinetic energy $\langle K \rangle$ and potential energy $\langle V \rangle$ are related by
$$2\langle K \rangle = n\langle V \rangle$$

Derive this result using the virial theorem. Assume the system is in equilibrium and the forces are central.

3. Consider a system of particles in a volume V at temperature T . The particles interact via a pair potential $\phi(r)$. The total energy is given by
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1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that this is crucial for ensuring transparency and accountability in the organization's operations.

2. The second part of the document outlines the specific procedures and protocols that must be followed to ensure that all records are properly maintained and updated. This includes details on how data should be collected, stored, and reviewed.

3. The third part of the document provides a detailed overview of the various systems and tools that are used to manage and analyze the data. It describes how these systems are integrated and how they support the organization's overall goals and objectives.

4. The fourth part of the document discusses the role of the various departments and individuals involved in the record-keeping process. It outlines the responsibilities of each party and how they work together to ensure that all records are accurate and up-to-date.

5. The fifth part of the document provides a summary of the key findings and recommendations from the review. It highlights the areas where improvements are needed and provides specific suggestions for how these can be implemented.

6. The sixth part of the document provides a detailed overview of the various systems and tools that are used to manage and analyze the data. It describes how these systems are integrated and how they support the organization's overall goals and objectives.

7. The seventh part of the document discusses the role of the various departments and individuals involved in the record-keeping process. It outlines the responsibilities of each party and how they work together to ensure that all records are accurate and up-to-date.

8. The eighth part of the document provides a summary of the key findings and recommendations from the review. It highlights the areas where improvements are needed and provides specific suggestions for how these can be implemented.

9. The ninth part of the document provides a detailed overview of the various systems and tools that are used to manage and analyze the data. It describes how these systems are integrated and how they support the organization's overall goals and objectives.

10. The tenth part of the document discusses the role of the various departments and individuals involved in the record-keeping process. It outlines the responsibilities of each party and how they work together to ensure that all records are accurate and up-to-date.





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