Eksamen i fag (715 45) Teoretisk fysikk IIIa

Lørdag 17. januar 1970

Kl. 9 - 16.

(Tillatte hjelpemidler: Regnestav og logaritmetabell. Utlånt kompendium.)

Kompendiet leveres tilbake sammen med besvarelsen.

Examination

You may refer only to the notes for this course handed out at the time of the examination.

1. Solve Problem I.8, p.19 of notes.
2. Solve Problem I.11, p.23 of notes.
3. Solve Problem I.17, p.32 of notes.
4. Is the operator $\underset{\sim}{p}_1 \cdot \underset{\sim}{S}_2 + \underset{\sim}{p}_2 \cdot \underset{\sim}{S}_3 + \underset{\sim}{p}_3 \cdot \underset{\sim}{S}_1$ a possible physical observable of a system of three electrons? Here $\underset{\sim}{p}_j = (\hbar/i)\nabla_j$, and $\underset{\sim}{S}_j$ is the operator for the spin angular momentum of the j^{th} electron. Explain the reason for your answer.
5. Solve Problem I.27, p.42 of notes.
6. Evaluate the vacuum expectation value $\langle 0 | a_k^2 \exp(\Sigma_q c_q a_q^\dagger) | 0 \rangle$ where the a_k and $a_k^\dagger$ are Bose annihilation and creation operators and the c_k are c-number parameters.
7. Solve Problem I.63, p.80 of notes.
8. For the many-boson Hamiltonian (I.187), calculate the ground-state energy by first-order perturbation theory, where the interaction Hamiltonian is the perturbation.
9. Explain the physical ideas involved in the Born-Oppenheimer approximation, and its relation to the concept of interatomic potentials.
10. Explain the physical origin of the attractive R^{-6} interatomic potential for large atomic separations R.

NB! Eksaminanden kan skrive besvarelsen på norsk eller engelsk etter eget ønske.