

STUDY GUIDE
SP324 APPLICATIONS OF QUANTUM MECHANICS 1, TEST 2
Draft Version 080403 – anticipate a revision

Note: You may bring a 3"x5" card with writing on both sides to the exam and use it.
Note: You may bring a calculator to this exam.

0. Know your Exercises and Homework backwards and forwards. Simple calculations are fair game.

Solid State / Condensed Matter

1. Ionic vs Covalent Bonding
2. Molecular, Ionic, Covalent, Metallic Solids
3. Band Structure
 - causes
 - energy gaps
 - temperature effects
 - conductors, semiconductors, insulators
 - doping
4. Diodes
5. Electron Models
 - Free-Electron Model
 - Density of States
 - 'Nearly-Free' Electron Models
 - Effective Mass
 - Energy gaps / Brillouin Zones
6. Temperature Dependence of Resistivity
 - Insulators
 - Conductors
 - Superconductors
 - BCS
 - Cooper Pairs
 - Type I
 - Type II
 - vortices
 - Meissner Effect
 - SQUIDs and Josephson Junctions
 - Typical band gap energies for insulators, semiconductors, & superconductors

Nuclear Physics

1. Nuclear Shell Model
 - Orbital Sequence up through $f_{7/2}$.
 - Ground State Configurations

2. Collective Models
 - Vibrational Model
 - Energy Level Spacing
 - Shapes of oscillation
 - Phonon energy and oscillation frequency
 - Rotational Model
 - Energy Level Spacings
 - Moment of Inertia

3. Semi Empirical Mass Formula
 - Justification for the various terms.

5. Q-values
 - What is Q-value?
 - What does $Q > 0$ and $Q < 0$ imply?
 - Q-value calculation for reactions $X(a,b)Y$
 - Q-value calculations for decays
 - α decay
 - β^+ decay, β^- decay, Electron Capture

- items below not on test -----

4. Classifying reactions
 - Names for reactions
 - Compound Nucleus or Direct ?
 - Conservation of Energy and Angular Momentum

6. Cross Sections and Count Rates
 - How to calculate the count rate given the cross section and experimental geometries.
 - Differential cross section
 - Angle integrated cross section
 - Resonances and Resonance reactions

21CENTIMETER	FLACHENBACH	PMOMENTUM
21CM	FLUORESCENCE	QEDCOUPLINGCONSTANT
41CENTIMETER	FLUX	QNUMBER
41CM	FREE	QUANTUM
ALIGNED	GAUGE	QUARKFLOWDIAGRAM
ANOMALOUS	GFACTOR	QUARKS
ASYM	GRIFFITHS	R10Y00
ASYMMETRIC	GUTS	R20Y00
BALL	HAMILTONIAN	R2DRSINTHDTHTDPhi
BAND	HELIUM	RC
BARDEEN	HYPERFINE	RESIDUAL
BARDSTON	II	ROTOR
BEAGLE	INTERACTION	RRATIO
BLACKBODY	INVERSE	RUBY
BOLTZMANN	INVERT	RUSSELLSAUNDERS
BOND	IONIC	RYDBERG
BOSE	IVB	SCHRIEFFER
BOSON	JET	SCHRO
CHARGE	JJ	SCHRODINGER
CHEMICAL	JOSEPHSON	SECONDDORDER
COLLISIONALTRANSFER	JUNCTION	SHO
COLOR	LAMBDA	SINGLET
CONDUCTION	LAMBSHIFT	SPACIAL
CONFINEMENT	LANDE	SPATIAL
COOPERPAIR	LEPTONS	SPECIAL
COULOMBIC	LS	SPIN
COVALENT	MASS	SPINGFACTOR
COW	MATRIX	SPINOR
CPT	MATRIXELEMENT	SQUID
DARWIN	MAXBORN	STM
DEGENERATE	MICROWAVE	STRONGFIELDZEEMAN
DENSITYOFSTATES	MODEL	SYMM
DETAILEDBALANCE	MOLECULE	TESLA
DF	NEARLYFREE	THEORY
DIAGONALIZE	NEON	THREE
DIATOMIC	NITROGEN	TRIPLET
DIRAC	NONDEGENERATE	TYPEI
DISCHARGE	NORMAL	TYPEII
DOUGHNUT	NORMALIZE	VALENCE
DR	NUCLEAR	VALENCIA
EFFECTIVECHARGE	OCEANOPTICS	VANADIUM
EIGENFUNCTION	OPTICAL	VANDERWAALS
EIGENSTATE	ORBITALGFACTOR	VIBRATOR
EIGENVALUE	OSCILLATOR	VIII
ELECTRONSPINORBIT	PASCHENBACH	WAVEFUNCTION
ELECTROWEAK	PASCHENBACK	WEAKFIELDZEEMAN
EXCHANGEFORCE	PERTURBATION	WMINUS
EXPECTATONVAL	PHONON	WPLUS
EXPONENTIAL	PHONONGAS	X2
FERMI	PHOSPHORESCENCE	X4
FERMION	PHOTON	XENON
FEYNMANNDIAGRAM	PHOTONGAS	Y20
FIELDPARTICLES	PICKET	ZEEMANEFFECT
FINESTRUCTURE	PLANCK	ZERO
FINESTRUCTURECONSTANT	PLANCKBLACKBODY	ZZERO