Quiz: Electron Energy Analyzers & Monochromators

Q1. What is the primary purpose of an electron energy analyzer as described in the text?

A. To generate ions by electron impact

B. To sort ions by mass-to-charge ratio

C. To measure the energy distribution of electrons from processes like photoionization

D. To accelerate electrons for collision experiments

Q2. Which technique is used in the book to produce nearly monoenergetic electrons around 0-15 eV?

A. Quadrupole analyzer

B. Trochoidal electron monochromator

C. Time-of-flight spectrometry

D. Magnetic sector analyzer

Q3. Monochromators are essential because:

A. They amplify the electron current

B. They filter electrons by mass

C. They narrow the energy spread of emitted electrons for high-resolution analysis

D. They increase electron beam intensity

Q4. A typical narrowest electron energy spread achieved in these monochromators is approximately:

A. ±1 eV

B. ±0.5 eV

C. ±0.1 eV

D. ±0.03 eV

Q5. Why are energy analyzers useful in studies such as electron capture or photoionization?

A. They detect heavier molecular fragments

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B. They help correlate electron energy with resonance features in ion yield curves

C. They substitute magnetic sector mass analyzers

D. They adjust kinetic energy of molecular ions

Q6. Which parameter primarily determines the resolution of an electron monochromator?

A. Electron beam intensity

B. Energy width of the incoming electrons

C. Type of ion detector used

D. Path length of the analyzer tube

Q7. What configuration is often used to bend the electron path and select energies in a trochoidal monochromator?

A. Magnetic focusing

B. Electrostatic deflection plates

C. Time-of-flight selection

D. Collimation slits only

Q8. Which of the following does not affect the energy resolution of an analyzer?

A. Electron beam divergence

B. Temperature of the gas

C. Analyzer geometry

D. Applied voltage stability

Q9. In energy analyzers, increasing the slit width leads to:

A. Improved energy resolution

B. Decreased electron throughput

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C. Increased signal intensity but lower resolution

D. Reduced electron energy

Q10. What is the typical application of electron monochromators in gas-phase experiments?

A. Isotope separation

B. Measuring chemical shifts

C. Investigating electron attachment and ionization processes

D. Magnetic resonance studies

Q11. What is the primary reason for maintaining a low pressure in the electron interaction region?

A. To allow faster electrons

B. To prevent multiple scattering of electrons

C. To cool the sample

D. To improve beam collimation

Q12. Which voltage controls the kinetic energy of electrons in a trochoidal electron monochromator?

A. Filament voltage

B. Retarding field voltage

C. Acceleration voltage

D. Grid bias voltage

Q13. Electron energy analyzers measure electrons that are typically emitted from:

A. Ion traps

B. Dissociation events

C. Electron sources only

D. Mass analyzers

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Q14. Which of these components is most critical in defining the energy passband of a monochromator?

A. The emission current

B. The analyzer slits

C. The magnetic field

D. The pressure in the ion source

Q15. In the discussed experiments, what does a resonance structure in the ion yield curve typically indicate?

A. Rapid electron acceleration

B. Instrumental noise

C. Temporary negative ion state formation

D. Inelastic electron scattering

Answer Key

Q1. C

Q2. B

Q3. C

Q4. D

Q5. B

Q6. B

Q7. B

Q8. B

Q9. C

Q10. C

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Q11. B

Q12. C

Q13. B

Q14. B

Q15. C