CHEAT SHEET

What is the difference between XRF and XRD?

What are they?

- **XRF (X-ray fluorescence):**
  Identifies and quantifies elements in a sample. Works on crystalline and non-crystalline materials.
- **XRD (X-ray diffraction):**
  Identifies and analyzes crystalline materials based on their crystal structures.

Key Differences

Feature	XRF	XRD
What it analyzes	Elemental composition (what elements are present and their amounts)	Crystal structure (how atoms are arranged)
Types of samples	Solids, powders, liquids, pellets	Primarily powdered crystalline materials
Detection limit	Can detect elements down to sub-ppm (parts per million) levels	Generally around 1-5% for crystalline phases
Instrument cost	Relatively inexpensive handheld devices to more costly floor-standing systems	More expensive due to complexity and precision required
Advantages	Fast, non-destructive, high sensitivity for elemental analysis	Provides detailed information about crystal structure and phases
Disadvantages	Cannot differentiate polymorphs (different crystal forms of the same chemical composition)	Less sensitive to trace phases, requires more specialized sample preparation
Common applications	Environmental monitoring, metallurgy, quality control, archaeology	Materials science, geology, pharmaceuticals, quality control for materials like cement, ceramics, and metals

When to use which technique?

Use XRF when:

- You need to know the elemental composition of your sample
- You need a quick and reliable analysis
- You are working with various sample types, including amorphous or liquid samples

Use XRD when:

- You need to differentiate materials by their crystal structures
- You need detailed information about the crystal structure
- You are working with crystalline materials

Remember: XRF and XRD can be complementary techniques!

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