



throughput sensitivity budget

Easy choices for RNA and DNA quantification

NanoDrop spectrophotometers | Qubit fluorometers



UV-Vis technology

The spectrophotometric measurement of nucleic acids is based on the intrinsic absorptivity of nucleic acids. When an absorbance spectrum is measured, nucleic acids absorb light with a characteristic peak at 260 nm. Using the Beer-Lambert equation, the absorbance at 260 nm measured on a spectrophotometer can be used to calculate the concentration of nucleic acids.

UV-Vis spectrophotometers allow absorbance readings of nucleic acids to be taken using a variety of formats, including microvolumes for precious samples, cuvettes for dilute samples, and microplate readers for high-throughput detection. Spectrophotometers can simplify analysis by automatically calculating nucleic acid concentration along with measuring sample purity.

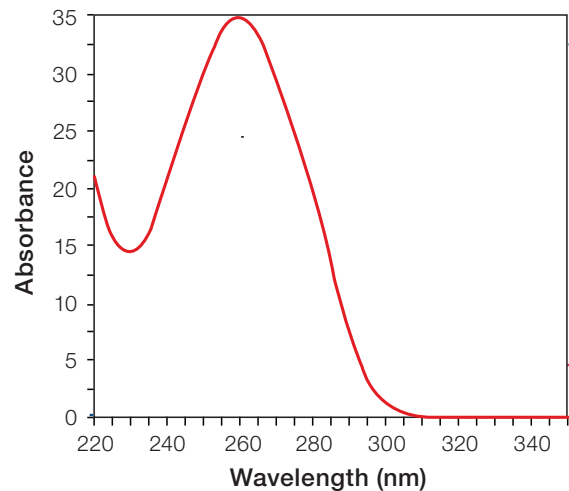


Figure 1. Typical nucleic acid absorbance spectrum.

Detection range: one selection criterion among instruments

Instrument		dsDNA quantification range (ng/μL)
UV-Vis	NanoDrop One	2–27,500
	NanoDrop One ^c	0.2–27,500
	NanoDrop 8000	2.5–3,700
	NanoDrop Lite	4–1,500
Fluorescence	Qubit 4	0.005–2,000
	Qubit Flex	0.005–2,000



Fluorescence technology

Sensitivity and specificity are two good reasons to use fluorometers to detect, quantify, and monitor analytes and their reactions in the lab. These instruments measure the intensity of the fluorescent signal from dyes attached to biological molecules as well as naturally fluorescent molecules based on their signature excitation (Ex) and emission (Em) wavelengths. Fluorometers help to simplify fluorescence analysis while minimizing the amount of sample required and saving time.

Fluorometric measurement of nucleic acids is based upon the use of fluorogenic dyes that bind selectively to DNA or RNA. These dyes only emit a fluorescent signal when bound to the target. Concentrations of nucleic acids are measured using the fluorescence signals of the samples. A calibration curve is generated from standard samples with known concentrations and fit to appropriate regression models. The limit of detection and linear response of the measurements are specific to each assay.

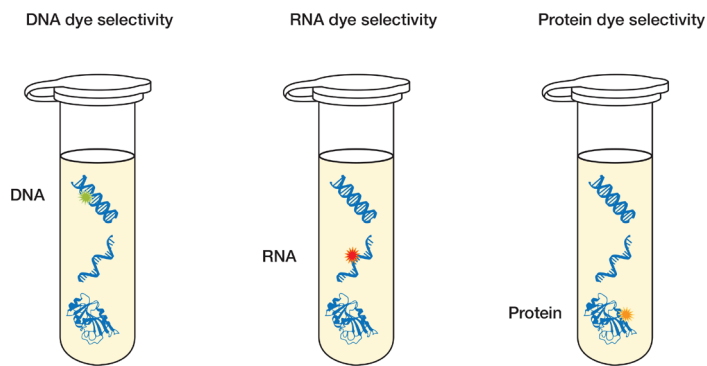


Figure 2. Specificity. Different dyes selectively binding to specific target molecules to be quantified.

Benefits and limitations of quantification technologies

	Spectrophotometry (UV-Vis)	Fluorescence
Benefits	<ul style="list-style-type: none"> • Simple—no sample preparation, dyes, or standards are required • Provides direct measurements of purity ratios—A_{260}/A_{280} and A_{260}/A_{230} • Provides information on contaminants—can identify non-nucleic acid contamination in samples (proteins, phenol, guanidine salts) 	<ul style="list-style-type: none"> • Specific—measurement for DNA, dsDNA, ssDNA, and RNA according to your needs • Sensitive—can measure pg/mL; recommended method for very dilute nucleic acid samples • Accurate—quantifies target accurately despite contamination being present in the sample, including nucleic acid contaminants
Limitations	<ul style="list-style-type: none"> • Lacks specificity—does not distinguish between DNA or RNA • Limited sensitivity—detection limits are higher than fluorescence-based methods 	<ul style="list-style-type: none"> • Extra step—additional time is needed for reagent and sample preparation • No purity information—contaminants like proteins, phenol, and guanidine salts are not measured

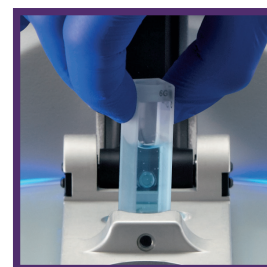
Learn more at thermofisher.com/naq

NanoDrop One and One^c Spectrophotometers

Quantify with the NanoDrop One or One^c instrument and analyze with Acclaro technology

Check the quantity and quality of DNA, RNA, and protein with only 1–2 μL of sample in seconds with no dilutions using the Thermo Scientific™ NanoDrop™ One and One^c microvolume UV-Vis spectrophotometers. Gain a more complete understanding of sample quality before using samples in downstream applications, with Thermo Scientific™ Acclaro™ Sample Intelligence technology built into every NanoDrop One instrument.

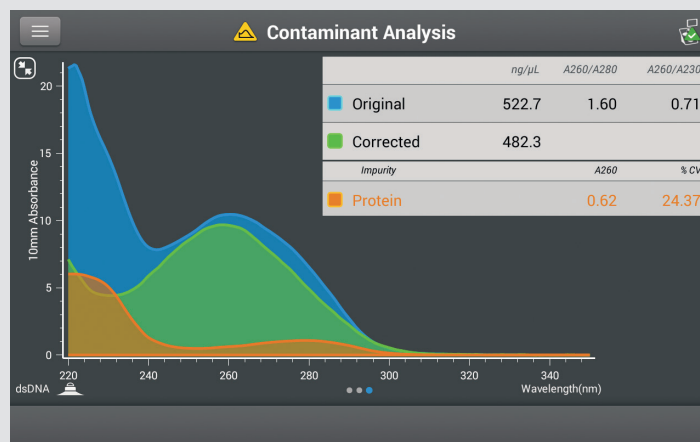
The NanoDrop One^c spectrophotometer adds experimental flexibility and increases the dynamic range. Use cuvettes to measure dilute samples and optical density of bacterial cultures, or to perform kinetic experiments, including with cuvette temperature control and stirring. The cuvette position can be used with the instrument arm up or down.



Identify contaminants in samples with Acclaro technology

Save days of troubleshooting experiments when you make informed decisions on sample suitability for your application. Acclaro technology offers enhanced sample analysis with:

- Contaminant identification and corrected results
- Instant feedback about sample quality with on-demand technical support and guided troubleshooting
- Embedded sensor and digital image analysis that ensures measurement integrity



Acclaro technology detects dsDNA sample contaminated with protein. The absorbance contribution from the protein (orange) is subtracted from the original result (blue) to obtain the corrected dsDNA concentration (green).



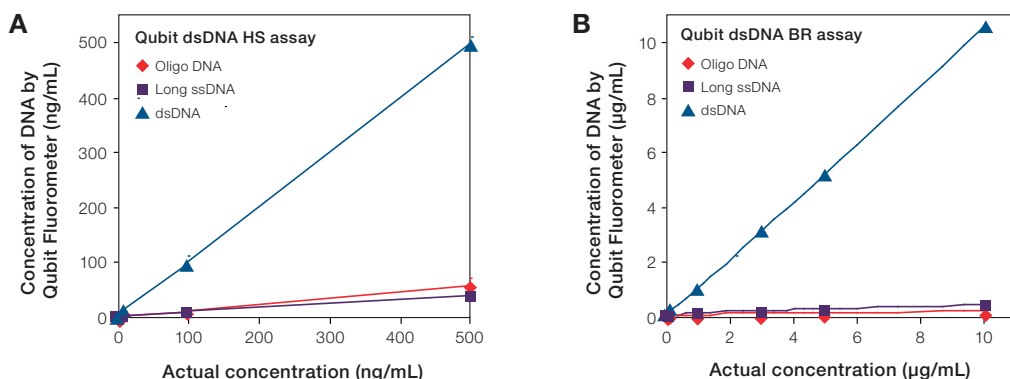
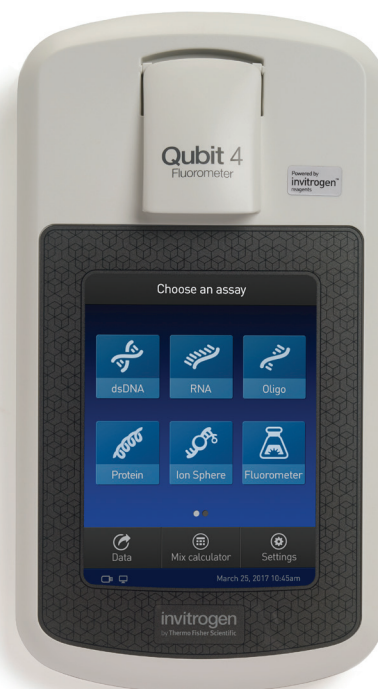
Qubit 4 Fluorometer

Fast and sensitive quantification of DNA, RNA, and protein

The Invitrogen™ Qubit™ 4 Fluorometer is a benchtop microvolume fluorometer designed to accurately measure DNA, RNA, and protein quantity, one sample at a time. Whether you are an expert or a novice, the easy-to-use touchscreen menus make it easy to perform assays, with accurate and reliable results displayed in just a few seconds.

Key benefits

- **High sensitivity**—more sensitive than UV absorbance-based quantification
- **Accuracy and speed**—accurately quantifies DNA, RNA, or protein in less than 3 seconds per sample
- **Helpful sample prep calculator**—integrated reagent calculator determines amount of dye and buffer needed
- **Ideal for precious samples**—uses as little as 1 μL of sample
- **Plenty of data storage**—stores data for up to 1,000 samples internally
- **Flexible data export**—Wi-Fi, USB drive, or direct connection with a USB cable
- **Portable with small footprint**—small enough to fit in lab coat pocket
- **Optimized reagents and tubes**—Invitrogen™ Qubit™ reagents and tubes work optimally with Qubit fluorometers
- **Intuitive touchscreen**—quickly get to data generation



Use high-sensitivity (HS) assays for low concentrations and broad-range (BR) assays for high concentrations of dsDNA

Figure 3. Detection of double-stranded DNA by the Invitrogen™ Qubit™ dsDNA HS (A) and BR (B) Assay Kits. Duplicate samples of long ssDNA, oligo DNA, or lambda dsDNA at concentrations of 0.5 to 500 ng/mL in the assay tube were quantified using the Qubit dsDNA HS assay, and at concentrations of 0.01 to 10 $\mu\text{g/mL}$ in the assay tube using the Qubit dsDNA BR assay, according to kit protocols.

Learn more at thermofisher.com/qubit4

NanoDrop 8000 spectrophotometer

Measure more samples in less time without sacrificing reliability and ease of use

The Thermo Scientific™ NanoDrop™ 8000 spectrophotometer takes full-spectrum UV-Vis absorbance measurements of up to 8 samples simultaneously. Using an 8-channel pipette to dispense samples on a linear array of pedestals, you can easily measure 96 samples in less than 6 minutes.



Key benefits

- Improved productivity with capability of analyzing up to eight 1 μ L samples at one time
- Innovative software to create custom methods and options to design reports and export data
- Increased efficiency with the sample position illuminator, which helps reduce error by keeping track of the samples to be measured
- High throughput for environments such as biorepositories, genotyping facilities, and quality control labs
- Improved productivity for busy labs where multiple researchers use a single-sample NanoDrop instrument

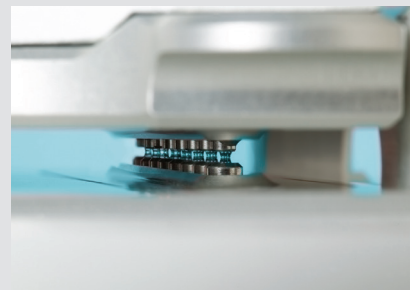
Sample position illuminator



Multi-sample loading



Multi-sample measurement



Qubit Flex Fluorometer

Accurate and sensitive quantification of DNA, RNA, and protein with flexible throughput

With the same convenience and ease of use as the Qubit 4 Fluorometer (p. 5), the Invitrogen™ Qubit™ Flex Fluorometer provides improved throughput. The Qubit Flex instrument can selectively and accurately measure the concentrations of up to 8 samples of DNA, RNA, or protein simultaneously.



Key benefits

- **High sensitivity**—more sensitive than UV absorbance-based quantification
- **Accuracy and speed**—accurately quantifies DNA, RNA, or protein in less than 3 seconds per sample
- **Helpful sample prep calculators**—integrated calculators help determine the amount of dye, buffer, and sample needed
- **Specialized calculators for NGS workflows**—easily determine molarity and normalize sample concentrations
- **Ideal for precious samples**—uses as little as 1 μ L of sample
- **Plenty of data storage**—stores data for up to 10,000 samples internally
- **Flexible data export**—Wi-Fi, USB drive, or direct connection with a USB cable
- **Flexible, improved throughput**—measure up to 8 samples per run
- **Portable with small footprint**—easy to move and store on shelves in the lab
- **Optimized reagents and tubes**—Qubit reagents and tubes work optimally with Qubit fluorometers
- **Intuitive touchscreen**—quickly get to data generation

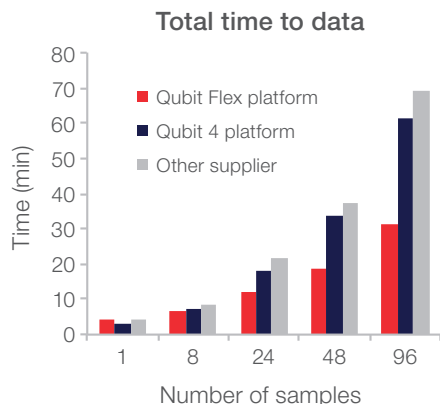


Figure 4. Time trial on 1 to 96 samples shows up to 50% time savings with the Qubit Flex Fluorometer. Time savings began with 8 samples, with more time saved when measuring even more samples.

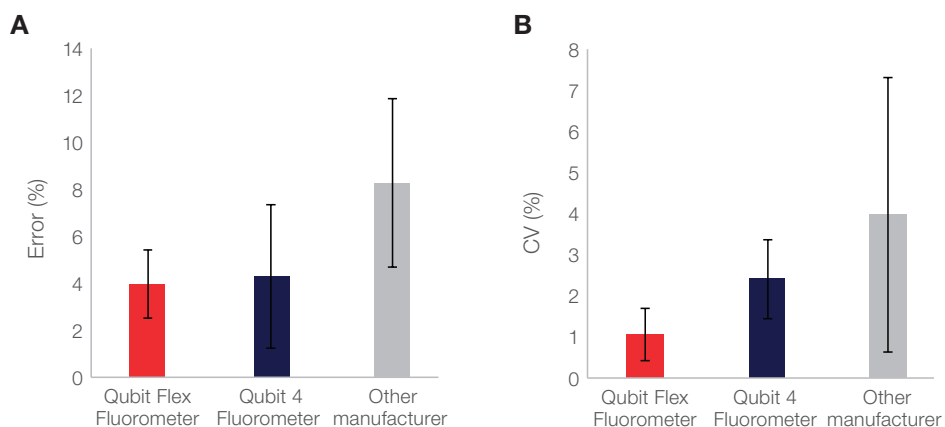


Figure 5. Qubit instruments deliver better accuracy and precision. The Qubit dsDNA BR and 1X dsDNA HS Assay Kits were run with 4 DNA sample concentrations (HS: 0.1, 1, 5, and 10 ng/ μ L; BR: 2, 20, 50, and 100 ng/ μ L) in 8 replicates on the Qubit 4 Fluorometer, Qubit Flex Fluorometer, and another manufacturer's fluorometer. The percent relative error (lower is more accurate) and CV (lower is more precise) were determined for each concentration and averaged across all concentrations for each instrument.

Learn more at thermofisher.com/qubitflex

Product listings

Nucleic acid quantification instruments

Instrument	Cat. No.
NanoDrop One Microvolume UV-Vis Spectrophotometer	ND-ONE-W or ND-ONE*
NanoDrop One ^c Microvolume UV-Vis Spectrophotometer	ND-ONEC-W or ND-ONEC*
NanoDrop Lite Microvolume UV-Vis Spectrophotometer	ND-LITE
NanoDrop 8000 Microvolume UV-Vis Spectrophotometer	ND-8000-GL
Qubit 4 Fluorometer, with Wi-Fi	Q33238
Qubit Flex Fluorometer	Q33327

* Cat. No. is region-specific.

For use with Qubit 4 and Qubit Flex Fluorometers

Qubit assay	Target	Cat. No.
Qubit 1X dsDNA HS Assay Kit	dsDNA	Q33230
Qubit dsDNA HS Assay Kit	dsDNA	Q32851
Qubit dsDNA BR Assay Kit	dsDNA	Q32850
Qubit ssDNA Assay Kit	ssDNA	Q10212
Qubit RNA HS Assay Kit	RNA	Q32852
Qubit RNA BR Assay Kit	RNA	Q10210
Qubit microRNA Assay Kit	microRNA	Q32880
Qubit RNA IQ Assay Kit [†]	RNA	Q33221

[†] Qubit RNA IQ Assay Kit is only compatible with Qubit 4 Fluorometer.

Get more information on Qubit assays at [fishersci.com](https://www.fishersci.com)

Contact us today:

In the United States

Order online: [fishersci.com](https://www.fishersci.com)

Fax an order: 1-800-926-1166

Call customer service: 1-800-766-7000

In Canada

Order online: [fishersci.ca](https://www.fishersci.ca)

Fax an order: 1-800-463-2996

Call customer service: 1-800-234-7437



For Research Use Only. Not for use in diagnostic procedures. © 2020 Thermo Fisher Scientific Inc.

All rights reserved. Trademarks used are owned as indicated at [fishersci.com/trademarks](https://www.fishersci.com/trademarks). **BN20200719 0620**