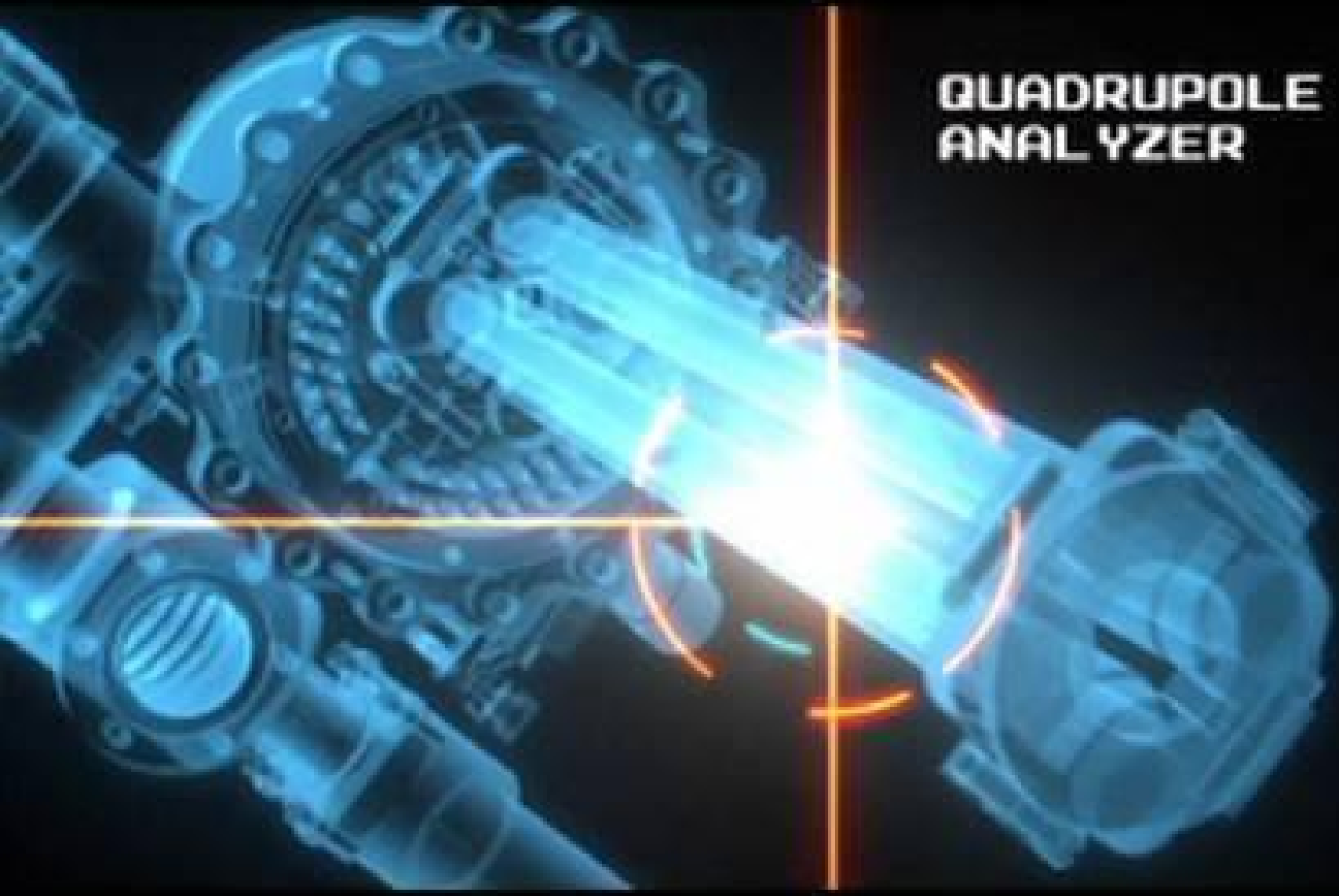
QUADRUPOLE
ANALYZER

1
00:00:00,010 --> 00:00:04,110
[music, sound effects]

2
00:00:04,130 --> 00:00:08,230
Narrator: What happens if you have something like this, and you want to find out if something

3
00:00:12,440 --> 00:00:08,330
like this is inside? Obviously, you can

4
00:00:12,460 --> 00:00:16,510
but if you separate things out, the answer becomes

5
00:00:16,530 --> 00:00:20,580
clear. Scientists have the same problem. How do you know if there was

6
00:00:20,600 --> 00:00:24,640
once water on Mars...or, for that matter, life? Obviously

7
00:00:24,660 --> 00:00:28,670
you can't tell just by looking at pictures of Mars, but scientists think the answer may lie hidden in

8
00:00:28,690 --> 00:00:32,710
tiny molecules in Martian soil. So, how do you take apart

9
00:00:32,730 --> 00:00:36,730
a molecule to see what's inside? Luckily, scientists have a tool to do just

10
00:00:36,750 --> 00:00:40,750
that. It's called a mass spectrometer, and it lets us take an extremely close look

11
00:00:40,770 --> 00:00:44,900
at whatever we're studying. And even though Mars immediately comes to mind, mass

12
00:00:44,920 --> 00:00:49,020
spectrometers are used in multiple NASA missions. They're also used in labs for hundreds

13
00:00:49,040 --> 00:00:53,100

of scientific purposes. But the important question is: How does it work?

14
00:00:53,120 --> 00:00:57,190
Today, we'll be looking at a special kind of spectrometer called the quadrupole mass

15
00:00:57,210 --> 00:01:01,280
spectrometer. It's called this because of the four long poles that make up the center

16
00:01:01,300 --> 00:01:05,350
of the instrument. So say you have a sample that's been turned into a gas, and you want to

17
00:01:05,370 --> 00:01:09,400
find out if it contains certain things. The gas is sent into the mass spectrometer

18
00:01:09,420 --> 00:01:13,450
first hitting a piece called the ion source. Here, a stream of electrons

19
00:01:13,470 --> 00:01:17,490
hits the molecule, breaking it into fragments and giving each fragment a charge.

20
00:01:17,510 --> 00:01:21,510
Next, the fragments enter what's called the analyzer. Here,

21
00:01:21,530 --> 00:01:25,520
they're separated based on their mass, and the analyzer is tuned so that only

22
00:01:25,540 --> 00:01:29,630
the fragments we want to see make it through. Everything else flies off in a different

23
00:01:29,650 --> 00:01:33,710
direction. After this, the fragments hit what's called the detector,

24
00:01:33,730 --> 00:01:37,810
and scientists record the data. If you're looking for more than one kind, the analyzer

25
00:01:37,830 --> 00:01:41,910
can scan across a range of fragments, building up a record of not only what kind,

26
00:01:41,930 --> 00:01:46,010
but how many. Once you have these results, called a mass spectrum,

27
00:01:46,030 --> 00:01:50,080
you can verify that your sample in fact contains what you're looking for. And here,

28
00:01:50,100 --> 00:01:54,130
the real work begins. The mass spectrometer is a powerful tool, and

29
00:01:54,150 --> 00:01:58,170
by taking many samples, looking at the results, and studying what we find,

30
00:01:58,190 --> 00:02:02,200
scientists can work to discover not only the secrets of water and life on Mars, but

31
00:02:02,220 --> 00:02:06,210
also answers to bigger questions about the universe. And all by studying something

32
00:02:06,230 --> 00:02:10,280
as tiny as a molecule.

33
00:02:10,300 --> 00:02:14,390
[music, beeping]

34
00:02:14,410 --> 00:02:18,460
[beeping]