LESSON 3 | What is a spectroscope?

Our sun is a star. Everyone knows this now, but the early scientists did not believe this. There was no proof! The key to the proof came in 1850 with the invention of the **spectroscope** [SPEK-truh-scohp].

A spectroscope identifies elements by the colors they give off.

Every substance gives off light when it becomes hot enough. Every element gives off its own special color. A spectroscope separates the light into colored lines. We call these lines a **spectrum.** A spectrum is like a fingerprint. No two people have the same fingerprints. And, no two elements have the same spectrum. But the spectrum is always the same for a particular element.

For example:

This is what a sodium spectrum looks like.

Only sodium looks like this. No other elements look exactly like this.

This is what a boron spectrum looks like.

Only boron looks like this. No other element looks exactly like this.

There are 92 natural elements. We know the spectrum for each one. About 67 of them have been found in sunlight. This means that the sun contains at least 67 elements that are found on Earth.

How do we know that the sun is a star? Simple! The spectroscope patterns of the sun and the stars are very similar.

UNDERSTANDING THE SPECTROSCOPE

The most important part of a spectroscope is a prism. A prism is glass shaped like a wedge. A prism can break up white light into a rainbow of colors.

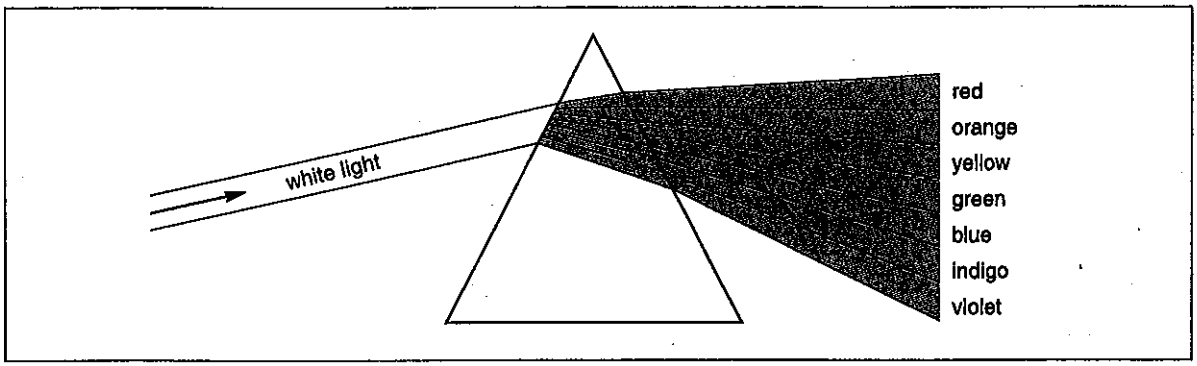

Figure A *Spectrum of white light*

HOW A SPECTROSCOPE WORKS

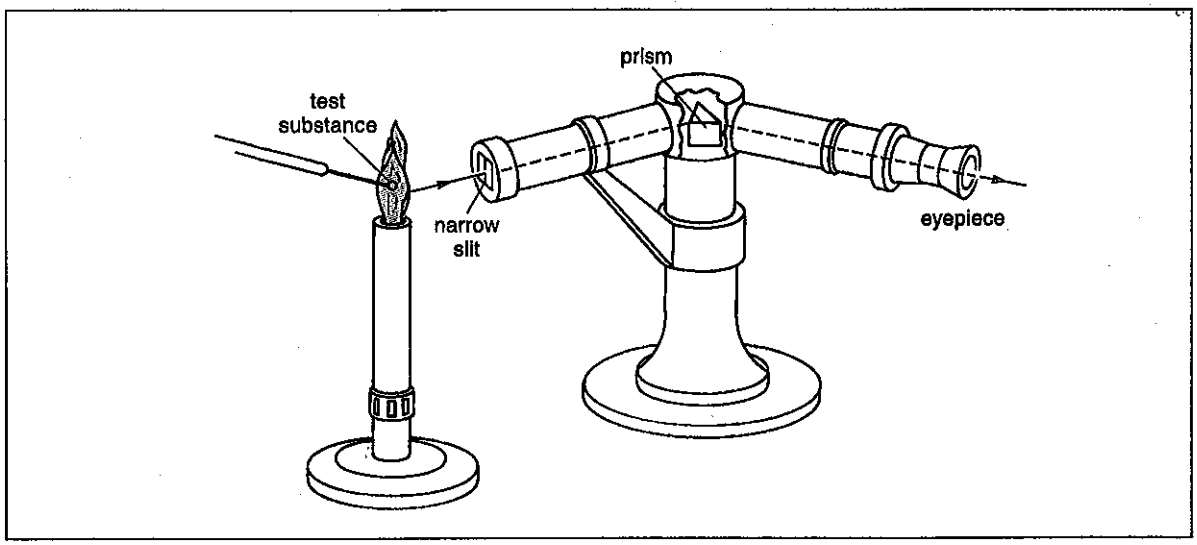

Figure B *Spectroscope*

In a spectroscope, a prism breaks up the spectrums of individual substances.

1. The substance to be tested is placed in a flame. The flame is in line with the narrow slit of the spectroscope.
2. Light from the heated substance enters the slit.
3. The light passes through the prism.
4. The prism "breaks up" the light. A particular spectrum is formed.
5. The spectrum passes through the eyepiece into the eye of the viewer. The observer identifies the spectrum.

HOW A SPECTROSCOPE IS USED

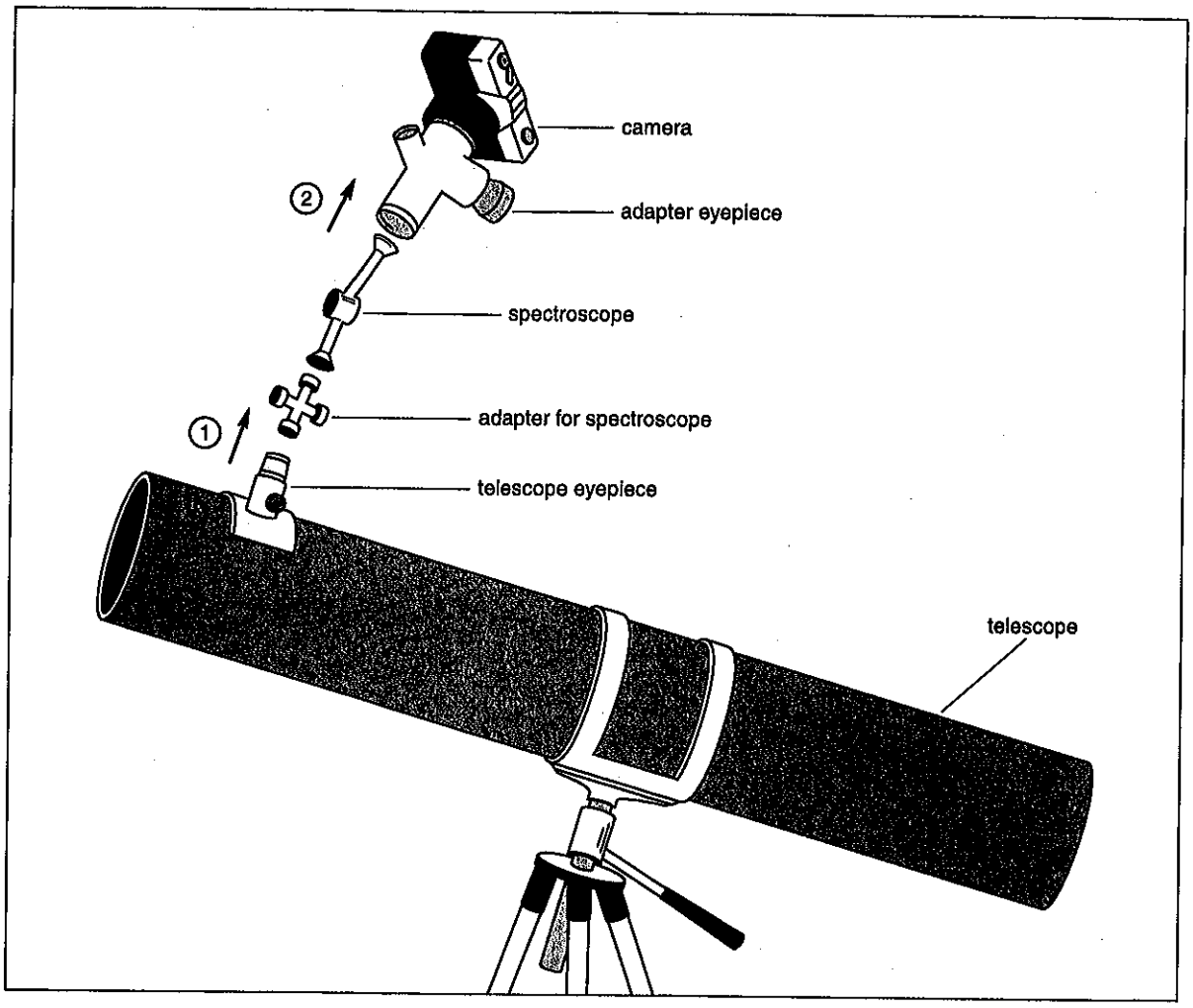

Figure C

How is a spectroscope used to study light from objects in space? Figure C shows how.

1. The spectroscope is connected to the telescope.
2. A camera is connected to the spectroscope.
3. The camera photographs the spectrum.
4. Astronomers study and identify the spectrum.

The spectroscope does more than identify the chemical makeup of the sun and the stars. We can use the spectroscope to figure out:

- the makeup of the atmosphere of planets
- how fast a heavenly body moves
- in what direction a heavenly body moves
- how hot a star is
- if a star is rotating
- if a star has a magnetic field

Figure D shows the spectrums of 9 elements. The numbers stand for different wavelengths (colors).

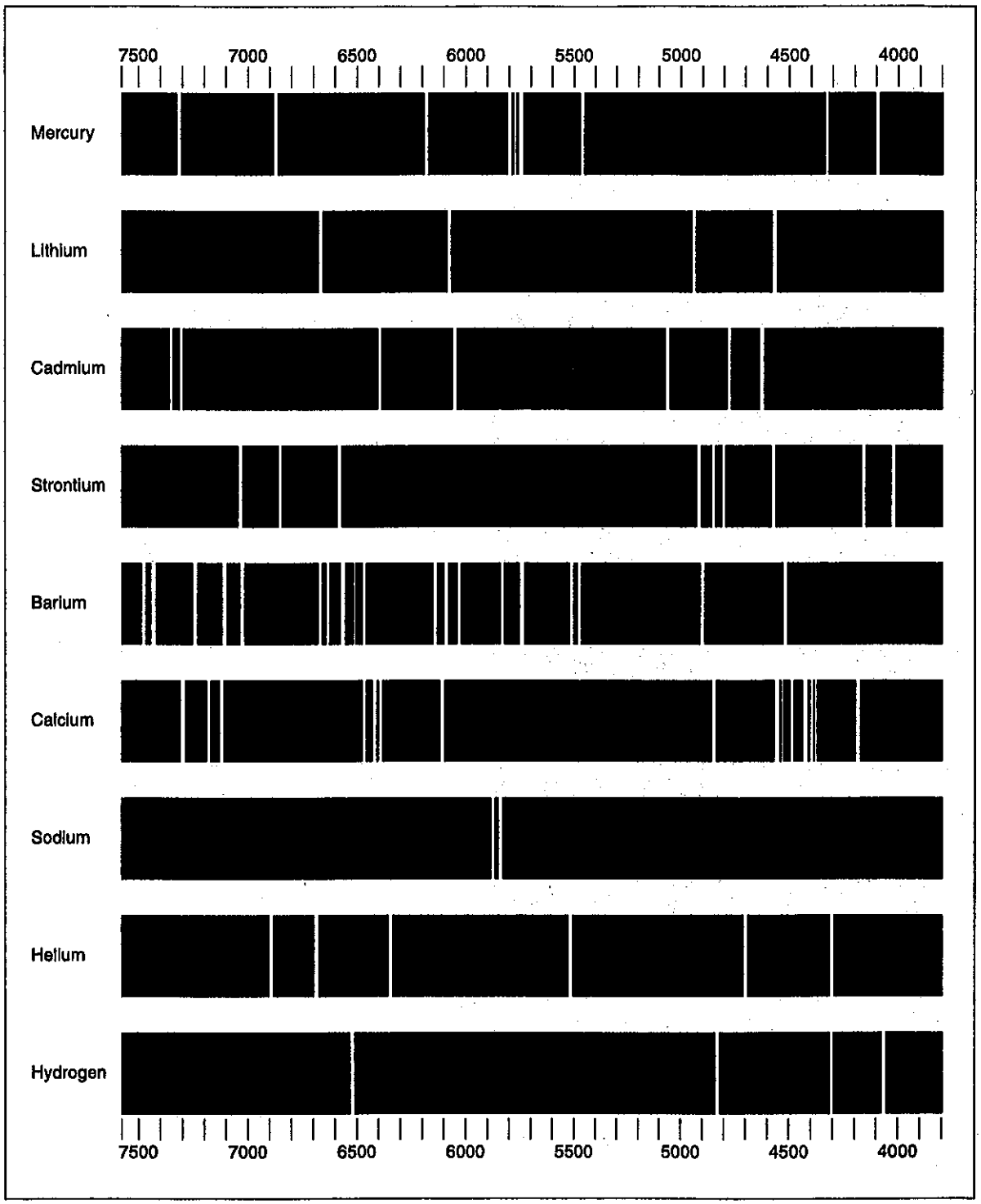

Figure D

IDENTIFYING SPECTRUMS

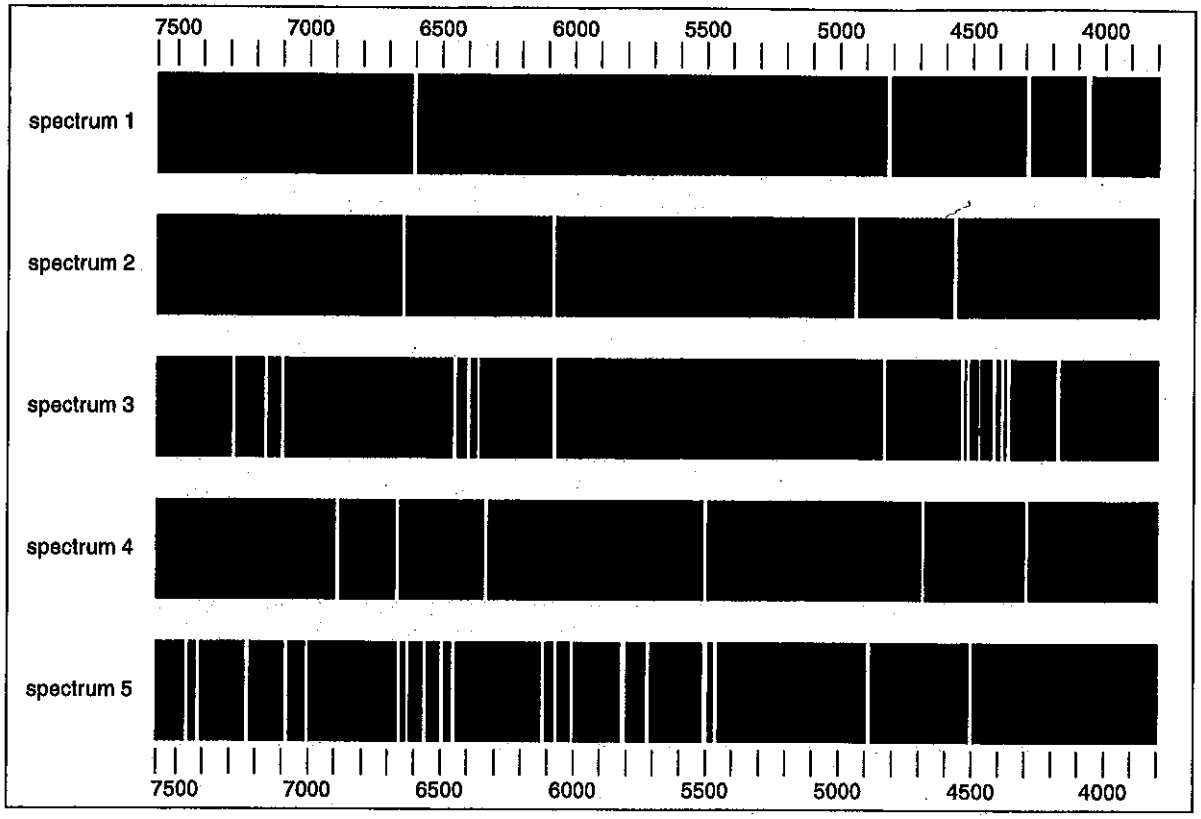

Figure E

Figure E shows five spectrums coming from a heavenly body. Use Figure D to find out which element is shown by each spectrum. Write your answers below.

1. Spectrum 1: _____
2. Spectrum 2: _____
3. Spectrum 3: _____
4. Spectrum 4: _____
5. Spectrum 5: _____

MATCHING

Match each term in Column A with its description in Column B. Write the correct letter in the space provided.

	Column A	Column B
_____	1. astronomy	a) key part of a spectroscope
_____	2. optical telescope	b) band of colors
_____	3. spectroscope	c) analyzes light
_____	4. prism	d) magnifies an image
_____	5. spectrum	e) study of the heavens