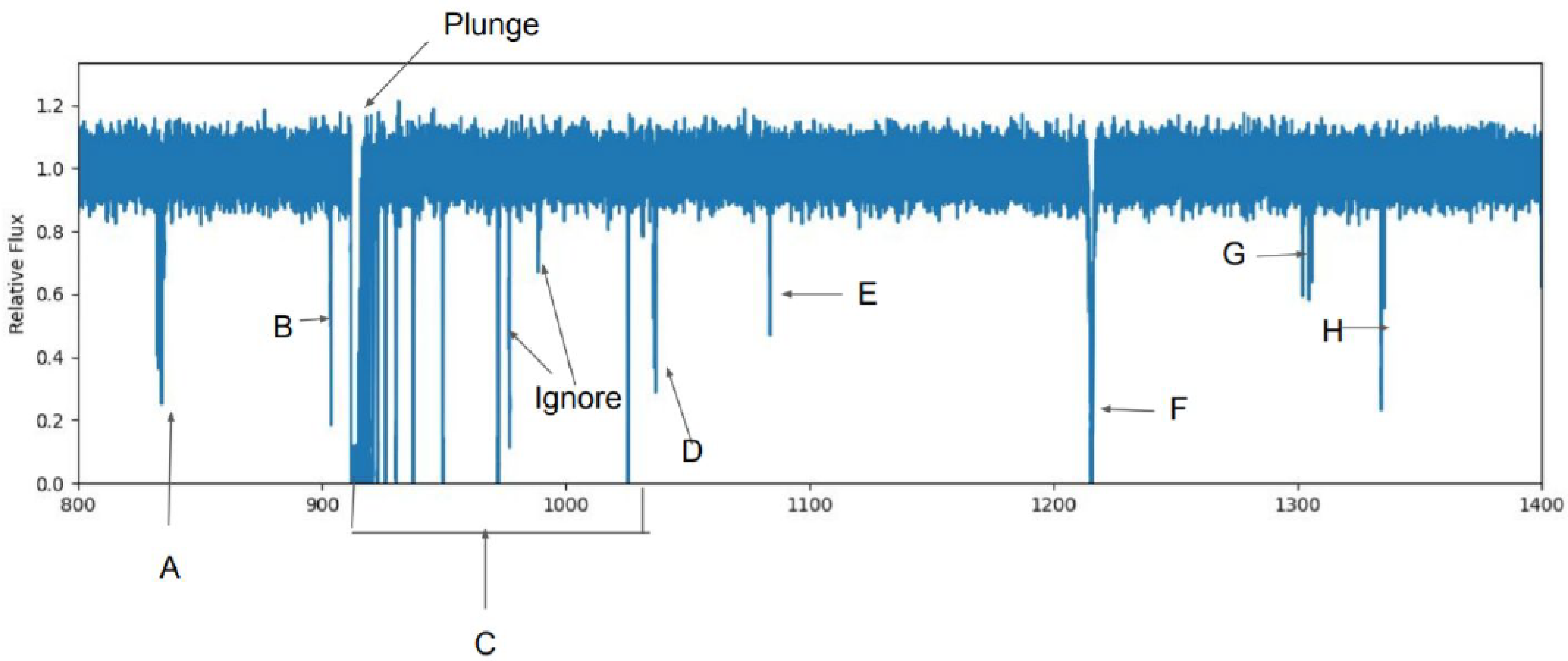
Task 1



Task 1. A

For features A-H, identify the atom responsible, and its ionic state. Assume there is no close grouping of lines from different elements.

Answer

Feature Name	Atom	Sp. Name	Ground Shells	Ground Level
A	Oxygen	O II	$1s^22s^22p^3$	${}^4S^\circ{}_{3/2}$
B	Carbon	C II	$1s2^2s^22p$	${}^2P^\circ{}_{1/2}$
C	Hydrogen	H I	$1s$	${}^2S_{1/2}$
D	Oxygen	O I	$1s^22s^22p^4$	${}^3P_2$
E	Nitrogen	N II	$1s^22s^22p^2$	${}^3P_0$
F	Hydrogen	H I	$1s$	${}^2S_{1/2}$
G	Oxygen	O I	$1s^22s^22p^4$	${}^3P_2$
H	Carbon	C I	$1s2^2s^22p^2$	${}^3P_0$

Task 1. B

How are the lines in feature C related? And what causes the plunge near 900 Angstroms? You can explain in words, but reference an equation as well.

Answer

In the previous subtask we have detected feature C as hydrogen. If we want to find wavelengths of Hydrogen we need to apply Rydberg formula to Lyman Series.
Rydberg Formula for hydrogen:

$$\frac{1}{\lambda_{vac}} = R_h\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

λ_{vac} is the wavelength of electromagnetic radiation emitted in vacuum.
R_h is the Rydberg constant for hydrogen, approximately $1.09677583 \times 10^7 m^{-1}$.
n_1 is the principal quantum number of an energy level.
n_2 is the principal quantum number of an energy level for the atomic electron transition.

For using Lyman Series we need to set n_1 to 1 and because of $n_1 < n_2$ we can set $n_2 = 2, 3, 4, 5, \ldots\ldots \infty$. As a result we get Rydberg formula for hydrogen:

$$\frac{1}{\lambda_{vac}} = R_h\left(1 - \frac{1}{n^2}\right)$$

When n gets closer to the infinity, there will be infinitely spectral lines. And at $n = \infty$ wavelength will be 911.753 angstrom. Also known as Lyman limit and because of that limit there is a plunge at 911.753 angstrom. Also we can say all lines in feature C are related because of all of them hydrogen.