Name _____ Date _____ Period _____

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Emission Spectra

Chemistry

Use $c = \lambda\nu$ and $E = h\nu$. Change nm to m before you use an equation. Show your setup with units and round to 3 significant figures.
$c = 2.998 \times 10^{8}$ m/s $h = 6.626 \times 10^{-34}$ J·s 1 nm = 1×10^{-9} m

1. Explain what happens to an electron when an atom gives off light.

Word bank: ground state, excited state, photon, energy gap

Sentence frame: *An electron in the _____ falls back to a lower level. It gives off a _____ whose energy equals the _____.*

2. Which drop gives off a photon with more energy, n = 4 → 1 or n = 2 → 1? Which photon has the shorter wavelength?

3. A flame test turns lilac. Which metal ion is present? Why can a red flame alone not tell you whether lithium or strontium is present?

4. Sodium street lights give off light with a wavelength of 589 nm. Find its frequency.

The first step is done for you: 589 nm = 5.89×10^{-7} m. Now use $\nu = c \div \lambda$.

5. Hydrogen has a violet line at 410 nm. Find the energy of one photon of this light.

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6. A photon has an energy of 3.20×10^{-19} J. Find its frequency and its wavelength in nm.

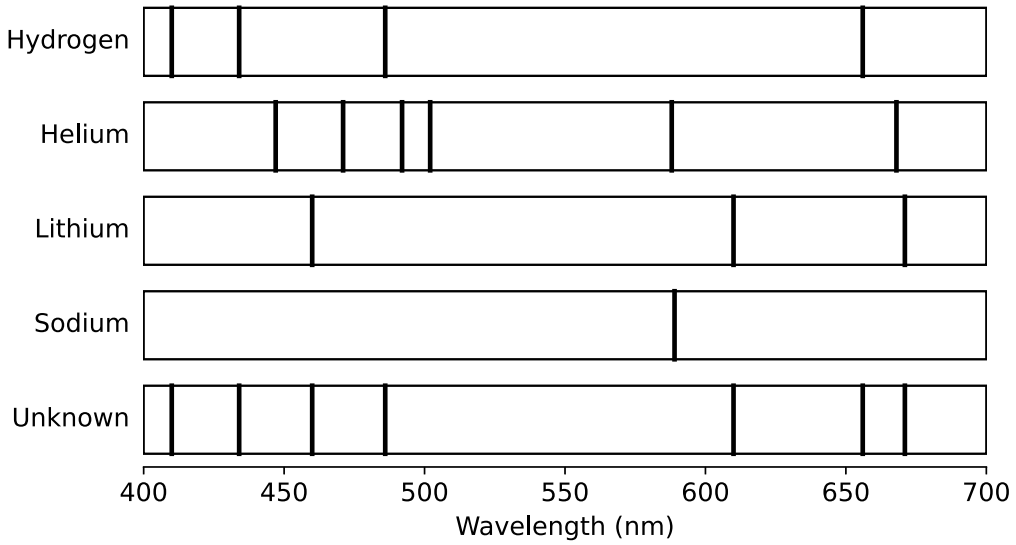
Rearrange first: $\nu = E \div h$ and $\lambda = c \div \nu$.

7. A student looks at a fluorescent light bulb through a spectroscope and sees a bright green mercury line at 546 nm.

(a) What does the bulb (a discharge tube) do, and what does the spectroscope do?

(b) Find the energy of one photon of the green light.

8. The bottom spectrum came from a tube with a mix of gases. Which elements are in the tube? How do you know?



9. Starlight passes through a cloud of cool hydrogen gas. Predict where dark lines appear in the star's spectrum, and explain.

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