SCH3U Reactivity of Alkali Metals POE

Hypothesis:

State the order of reactivity (highest to lowest) of lithium, sodium and potassium. Provide a brief explanation.

I think that it will be Potassium → Sodium → Lithium because of the Atomic Radius increasing.

Procedure:

Watch this video and write observations in the tables below.

Observations:

Lithium

	Observations
State and colour of Li metal	State: Solid Colour: Dark gray, metallic
Was it difficult to cut the Li metal?	No, but hard compared to sodium and potassium
How quickly did the cut piece of Li tarnish?	Semi quickly
What happened when Li was put in water?	It started floating and producing a gas. It also produced bubbles.
What gas was produced? How did you know?	Hydrogen because there was a pop
What happens to the solution when an indicator is added? What does the colour tell us?	It turns pink. That tells us that it is a base.

Sodium

Time	Observations
State and colour of Na metal	State: Solid Colour: It is a darker silver colour

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Was it difficult to cut the Na metal?	No, easier than lithium, harder than potassium
How quickly did the cut piece of Na tarnish?	Quicker
What happened when Na was put in water?	It floated, moved around a lot, and produced a gas
What gas was produced? How did you know?	Hydrogen because there was a pop
What happens to the solution when an indicator is added? What does the colour tell us?	It turns pink. That tells us that it is a base.

Potassium

Time	Observations
State and colour of K metal	State: Solid Colour: Silvery
Was it difficult to cut the K metal?	Easier than Na and Li
How quickly did the cut piece of K tarnish?	Quickly
What happened when K was put in water?	It started to catch fire and produce gas and move around
What gas was produced? How did you know?	Hydrogen, there looked like there was a pop, but I am not sure because there was no sound for that part of the video.
What happens to the solution when an indicator is added? What does the colour tell us?	It turns pink. That tells us that it is a base.

Analysis:

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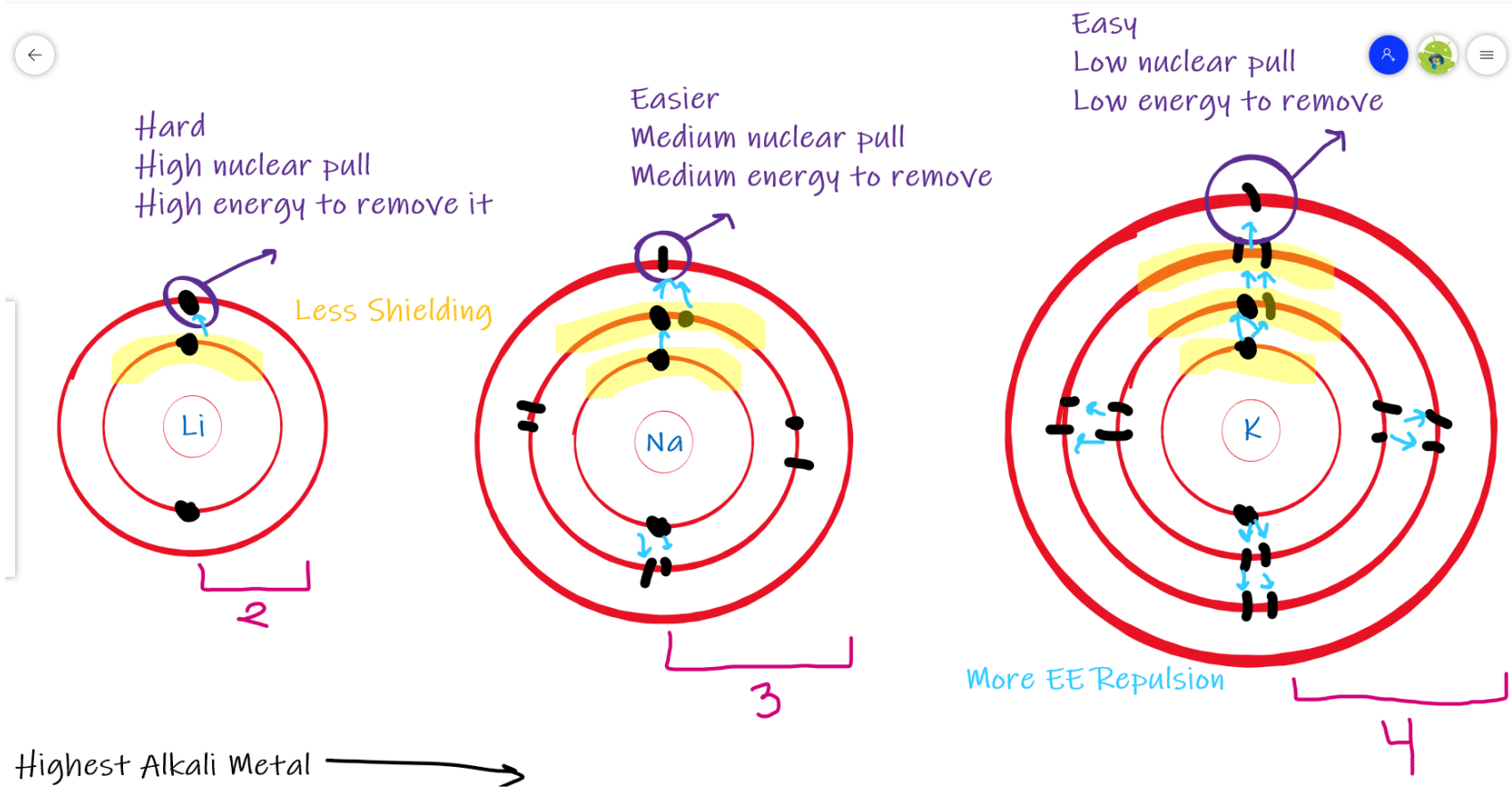
Explain the general trend of reactivity of alkali metals as observed in this lab by referring to lab data and concepts covered in class. Refer to at least two other trends, and explain their impact on metal reactivity.
Hint: Diagrams would be very helpful in your explanation.



The lower down the element is in the group, the more reactive it will be because the atomic radius will increase, and the ionization energy will decrease.

The lower down the alkali metal is on the periodic table, the bigger the reaction will be. Li is the top alkali metal in the periodic table, followed by Na, and then K as can be seen in the diagram. Potassium's reaction will be bigger because if the atom is lower

down (which potassium is), it will have more electrons in total and therefore more energy levels to hold that many electrons. Also, each period on the periodic table has a set number of energy levels. Lithium's period has 2, sodium's has 3 and potassium's has 4. For each energy level, it means another barrier to shield the valence layer of electrons (which are what cause the reactivity) from the nuclear pull (Yellow on diagram). With less nuclear pull, it is easier for the electron to separate from the atom. Since the atom has more electrons, there will be more electron electron repulsion (light blue in diagram). That happens because electrons repel each other (because they are all negative) which will cause an increase in the distance between the energy levels. That repulsion will increase the distance from the nucleus to the valence shell (the atomic radius, shown in pink on diagram) which will make the valence layer further from the nucleus, which will further reduce nuclear pull which will make it easier for the electron on the valence layer to be removed. Because potassium is much easier to remove the electron from the valence layer, it has much less Ionization Energy (the energy required to remove the electrons from the valence shell) than the atom of Lithium because it will take much less energy to remove the last electron on the valence layer of potassium than it will on an atom of lithium. That is why Potassium reacts much more violently than lithium or sodium.

We can also predict that rubidium, cesium, and francium will react even more violently because they have more energy levels and electrons than potassium, sodium, and lithium.

In conclusion, when the atomic radius of an atom increases, there is more shielding, and more electron electron repulsion which makes it easier for the valence electron to be removed. That means that the bigger the atomic radius of the atom, the more reactive it will be which means that Potassium is the most reactive of the three that were tested.

Concluding sentence:

Use 1 sentence that includes the relationship between the 3 trends!

In conclusion, Lithium is the least reactive of the three elements followed by sodium and then potassium which is the most reactive of the three elements because it has the biggest atomic radius, least ionization energy, and the least nuclear pull.