Science 9: 2.3 Practice Test – PARTIAL Key

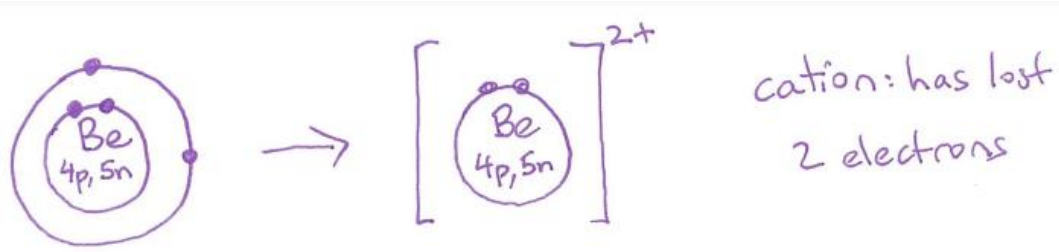
GENERAL (DEV/PRF)

1. Complete this table.

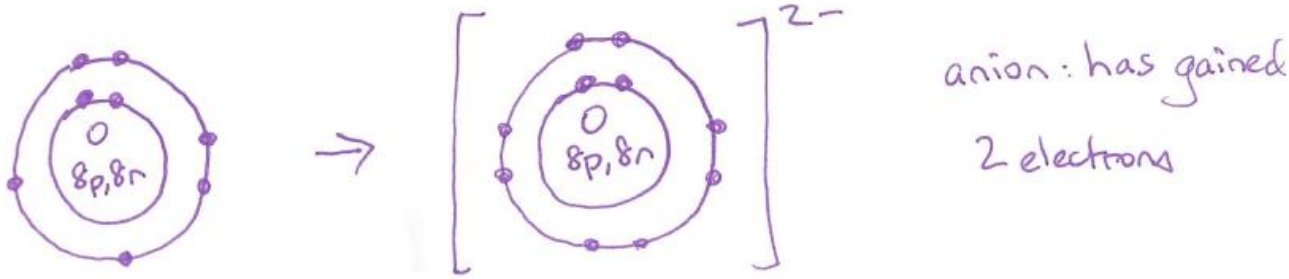
	Protons	Neutrons	Electrons
Hydrogen	1	0	1
Magnesium	12	12	12
Titanium	22	26	22
Chlorine	17	19	17
Neon	10	10	10
Bromine	35	45	35
Nickel	28	31	28
Rubidium	37	49	37

2. Draw the Bohr model of each of the following atoms and their ions: Be, O, P, F.

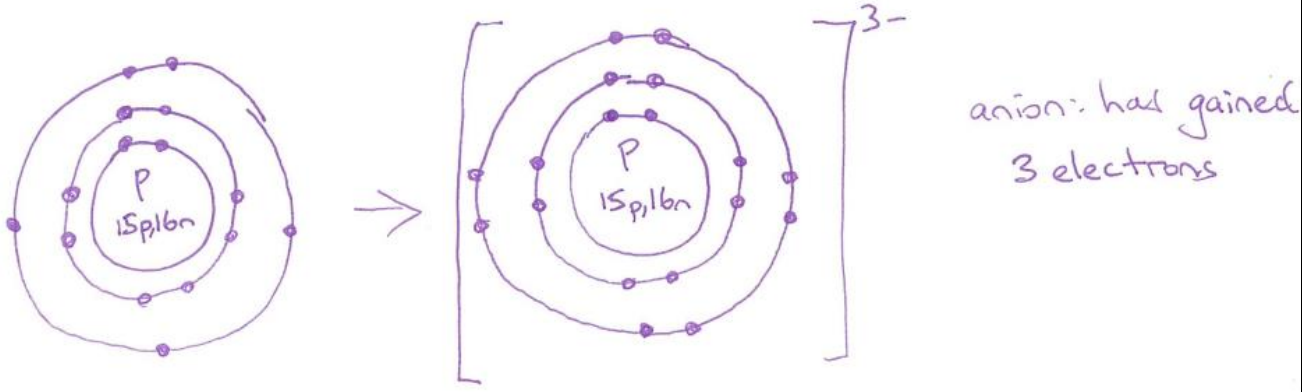
Be



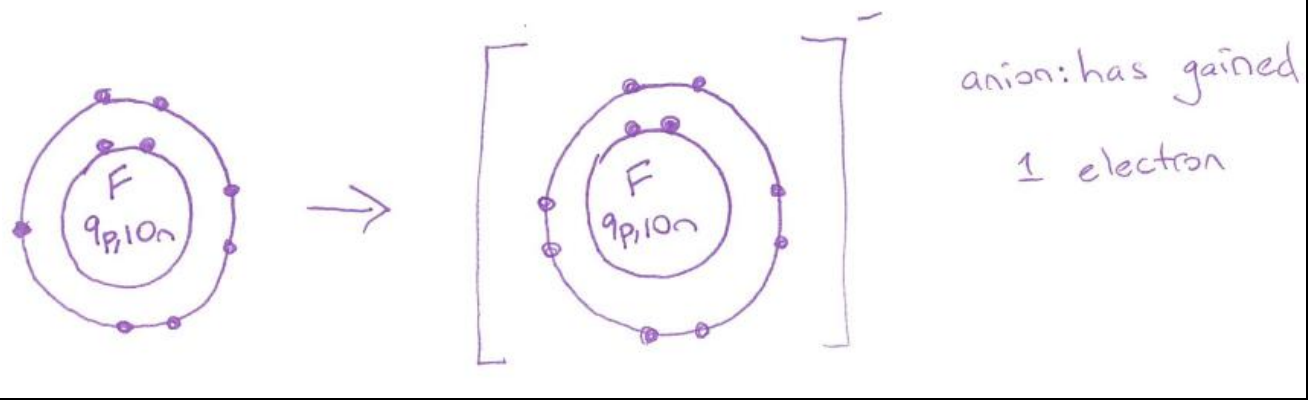
O



P

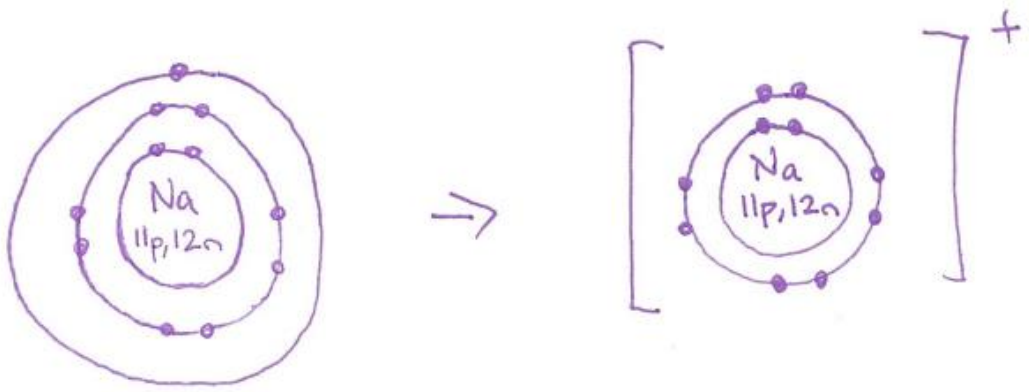


F



3. What is the charge on a sodium atom? Ion? Explain, using Bohr models and writing, how and why the ion forms.

   Atom: neutral. Ion: +1. The ion forms when the sodium atom loses an electron to have a full valence shell.



4. In a nitrogen ion, are there more protons or electrons? Explain how you know.

   More electrons. The ion forms when three electrons are added to have a full valence shell. As a result, the ion will have 7 protons and 10 electrons.

5. What is a valence shell? Why is it important for the study of atoms, ions, and chemical reactions?

   The valence shell is the outermost energy shell of an atom that has electrons in it. It is important because atoms are unstable until they achieve a full valence shell: some elements do this by forming ions by gaining or losing electrons. This ion formation is the key to many chemical reactions.

6. How does the Bohr model of a neutral atom differ from that of its ion? List three differences.

   - Square brackets
   - Charge
   - Different number of electrons (it has a full valence shell)

7. Why do neon ions not exist?

   Neon is a noble gas and is inert. It is stable because it already has a full valence shell. Therefore it has no need to form an ion.

8. Why do carbon ions not exist? (Note: carbon *can* get a full valence shell, but it does so in a different way…not through ions. We will learn about this next chapter.)

   Carbon cannot form ions because it is too far away from getting a full valence shell. It could gain 4 electrons or lose 4 electrons; because this would 'take too much work', it does not form ions.

9. What charge is there on a neutral atom? What charge is there on a cation? What charge is there on an anion?

   Atom: neutral, no charge. Cation: positive. Anion: negative.

10. An atom loses electrons. What kind of ion will it form: cation or anion? Explain briefly.

    Cation. After having lost electrons, it has more protons than electrons. It will be positively charged overall.

11. An atom gains electrons. What kind of ion will it form: cation or anion? Explain briefly.

    Anion. After having gained electrons, it has more electrons than protons. It will be negatively charged overall.

12. Explain why the number of protons and electrons is equal in a neutral atom.

    Neutral atoms are uncharged overall. Protons have a charge of +1 and electrons have a charge of -1. To be neutral, an atom needs to have the same number of protons and neutrons.

MODIFIED MULTIPLE CHOICE

Use the choices in the table below to help you answer questions 13-16.

Questions	Trend	Reasons: Pick one for each question.
13. What is the trend in atomic size going down in a group? Why? Increase; number of valence shells	a) Increase b) Decrease c) No trend d) Other: explain	i. Number of valence shells ii. Different number of valence electrons iii. Location of valence electrons iv. More attraction to the nucleus
14. What is the trend in atomic size going left to right in a period? Why? Decrease; more attraction to the nucleus		
15. Within a group, what is the trend in reactivity? Why? Increase as you go down the group. Location of valence electrons: they are farther away so they are easier to remove or add to the atom.		
16. Going left to right in a period, what is the trend in reactivity? Why? Other: different number of valence electrons (the closer the valence shell is to being full, the more reactive it is). Noble gases are unreactive because they have full valence shells. Alkali metals and halogens are the most reactive because they are 1 electron away from stability. Alkaline earth metals and group 16 would be second-most reactive because they are 2 electrons away from stability.		

TRUE/FALSE (DEV/PRF/EXT)

Determine whether each of the following statements is true or false. Support your answer with what we have learned in class.

17. There are 18 groups of elements. TRUE. Groups are vertical columns in the periodic table. There are 18 groups.
18. Elements in the same group are similar in size. FALSE. Going down in a group, the size increases as valence shells are added.
19. Elements in the same period have similar levels of reactivity. FALSE. The reactivity within a period differs widely from noble gases (nonreactive) to alkali metals and halogens (very reactive).
20. Elements in the same period have the same number of energy shells. TRUE. E.g. hydrogen and helium both have a single energy shell because they are in period 1. All period 2 elements have two occupied energy shells, etc.

21. Elements in the same period have the same number of valence electrons. FALSE. Elements in the same period have the same number of energy shells, but the number of valence electrons depends on the group you are in. E.g. all elements in group 1 have 1 valence electron.
22. Potassium and rubidium are equally reactive when placed in water. FALSE. Both are in the same group: alkali metals. Within that group, rubidium is a larger atom. Its valence electron is farther away and easier to remove from the atom to form the ion. Therefore, rubidium is the more reactive element.
23. Elements with larger atoms are always more reactive. FALSE. Although this trend holds true for the metal atoms generally, it breaks down when looking at the non-metals. The most clear example are the halogens which are very reactive but also quite small (with only noble gases being smaller).
24. Metal elements can form cations, and non-metal elements can form anions. TRUE.

WRITTEN (EXT)

25. What is the formula to calculate the number of neutrons in a neutral atom? Explain why this is logical.

    Atomic mass minus atomic number. Of the subatomic particles, protons and neutrons each have a mass of 1, while the mass of an electron is so small it is basically 0. The atomic mass is the average mass of an atom of a given element, and is therefore the mass of the protons and neutrons. Since the atomic number tells us how many protons are in an atom and therefore the mass of the protons in that atom, we need to subtract the atomic number from the atomic mass to give us the mass (and number) of neutrons in an atom.

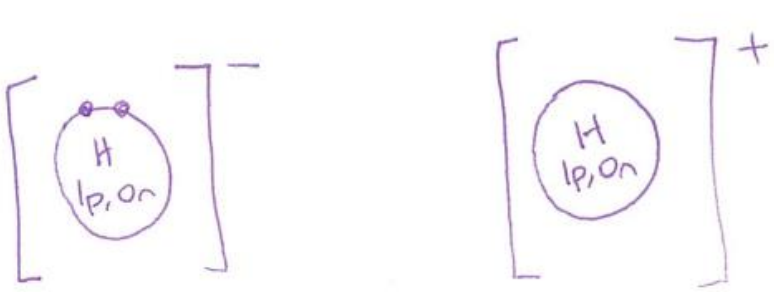
    Rounded to the nearest whole number: subatomic particles like protons, neutrons, and electrons must be whole and cannot be decimals...E.g. there is no such thing as 0.1 of a neutron.

26. Determine a formula to calculate the number of electrons in an ion, using information provided on the periodic table.

    atomic number minus ion charge of the atom

27. On your periodic table (black and white), hydrogen is shown twice: once with a ion charge of +1, and once with an ion charge of -1.

    a) Draw the Bohr models of both hydrogen ions.



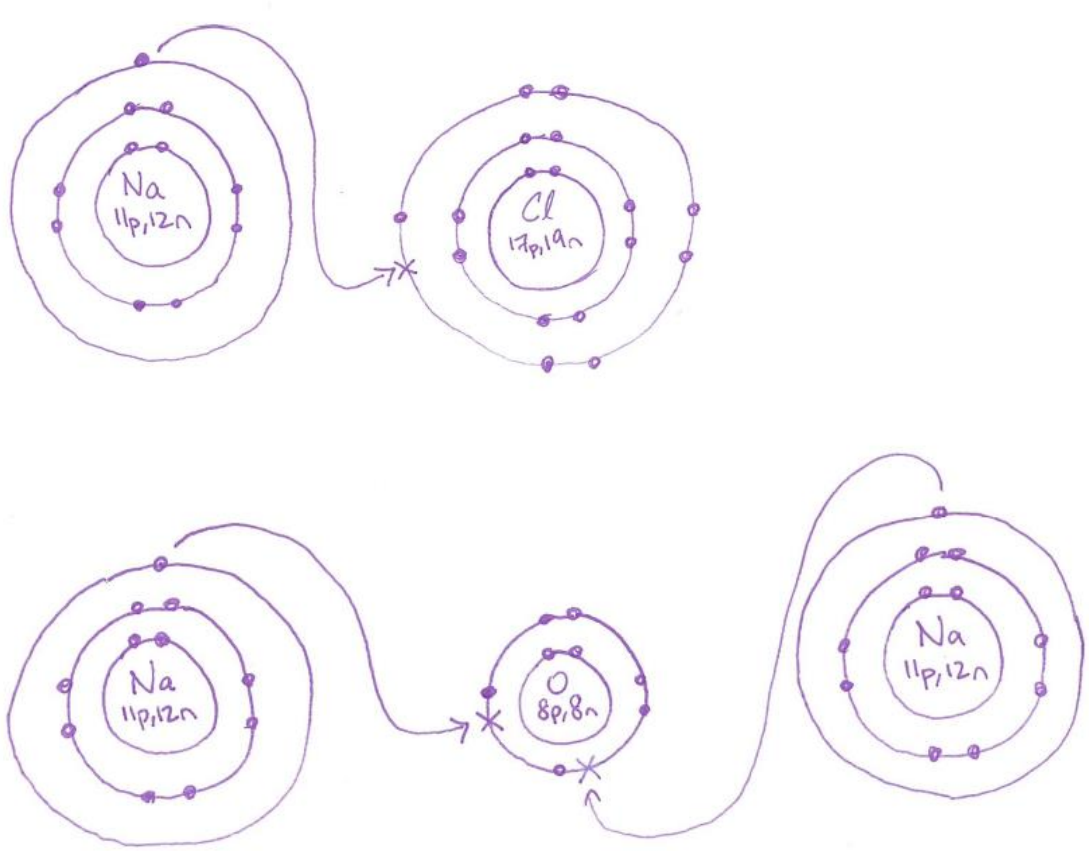
    b) Why do you think hydrogen is capable of making two different ion charges? Explain using your understanding of ion charges and valence shell stability.

    answers may vary

28. The ionic compound between Na and Cl requires only one Na ion and one Cl ion. The ionic compound between Na and O requires two Na ions and one O ion. Explain why this is, using your knowledge of how and why ions form. (Hint: use Bohr models to show the electron transfers from one atom to another as the atoms form their ions.)

    Na needs to lose one electron while Cl needs to gain one. In the chemical reaction, the single electron is transferred from Na to Cl.

    Na needs to lose one electron while O needs to gain two. Therefore, you need two Na atoms to donate their single valence electrons in order to satisfy the valence shell of oxygen and make it stable.



29. Follow-up question to #28: For the ionic compound formed between Mg and N, how many magnesium ions would you need and how many nitrogen ions would you need?

    3 Mg ions, 2 N ions