***Teacher’s Notes***

***Course:*** *This exercise could be used with grades 9, 11 and 12. Applied and locally developed classes might need more support like anchor charts.*

***Goal****: Writing with the 4 C’s is an exercise to get students to write science explanations that are not just a stream of words that may contain the answer if you search hard enough. It provides students with general goals for writing - the four C’s - and short hand symbols that teachers can use when evaluating later work. As well as improving their writing skills – it also promotes clearer understanding of the science concepts.*

***Context****: This particular version of the exercise is meant to come after students have already manipulated charged objects and observed how objects can be charged by friction, like charges repel, opposite charges attract and neutral objects are attracted to both charges. They should also have had a chance to explore the underling explanation of these phenomena with a simulation like* <https://phet.colorado.edu/en/simulation/balloons>.

**Writing using the Four C’s Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

If a balloon is rubbed on your hair it becomes negatively charged and your hair becomes positively charged. It is attracted to your hair and other positively charged objects. It is repelled by other negatively charged objects. Why is the balloon attracted to neutral objects?

Draw a diagram of a charged balloon and a neutral wall that will help support your explanation.

*Students should be encouraged to use diagrams whenever it is helpful. The more ways they can represent their knowledge the deeper that knowledge will be. All explanations that deal with how things are distributed in space should have a diagram. If there is no diagram, then you need a lot more words to describe this distribution and then the reader then has to take these words and turn them into a diagram in their head.*

*Have students answer this in small groups using the whiteboards. Prompt them with suggestions to improve the diagram. A good diagram shows understanding, makes the explanation clearer and can lead to more understanding.*

*A* ***complete*** *and* ***correct*** *diagram should show the wall with* ***equal*** *numbers of negative and positive charges. It should show that the negative charges are* ***farther*** *from the balloon.*

*It should show that the attractive forces are larger than the repulsive ones.*

*A* ***clear*** *and* ***concise*** *diagram will show* ***few*** *charges and the larger force arrows will be* ***much*** *larger.*

What are the 3 key points that are needed? In what order should they be made?

*Students should be encouraged to jot down point form ideas before starting to write their answer. Very few do this and that’s why their answers are so disorganized and rambling. Have the small groups of students write the three ideas in point form on the whiteboard.*

1. *Neutral objects contain negative and positive* ***charges*** *in* ***equal*** *numbers.*
2. *The negative charges in the wall* ***are able to move*** *and are repelled away from the balloon.*
3. *The repulsive forces are now weaker because the negative charges are* ***farther*** *from the balloon than the positive charges.*

*By the end of this part, the students should have a good diagram and the 3 key points. Now they are ready to consider how to write their understanding in words.*

**Correct:** If the answer contains information that is wrong, mark that with an X.

**Complete:** The answer should include the essential points with emphasis. Mark each with a check mark.

**Concise**: If there is irrelevant information, repetition or wordiness, draw a line through that material.

**Clear:** If you are not quite sure what they mean – add question marks.

Mark the sample answers below using the symbols described above.

 *Have the students mark these first on their own before discussing their choices.*

*The students are asked to mark the answers below because it will help them become more critical of their own writing. The answers provide examples lack at least one of the 4 C’s. As well recognizing that the answers are poor, they should be able to explain why they are poor.*

1. The positive balloon is attracted to the neutral wall because positive charges are attracted to both **neutral charges** X and negative chargesaccording to the Law of Electrostatic Forces.

***Not Complete****! This answer does not provide any explanation. It just states the fact and refers to a law that summarizes this fact.*

***Not Correct!*** *Neutral is not a charge.*

1. The balloon is attracted to a wall because a neutral wall contains equal numbers of positive and negative charges. The positive **charges are stronger** X than the negative charges that try to repel the balloon.

***Correct: Point #1*** *is made with the first sentence.*

***Not Correct:*** *The positive charges are not stronger – the forces from them are stronger. This might be what they meant but they still didn’t explain why the forces are stronger.*

1. Positive charges in the wall pull harder on the balloon than the negative charges repel. Negative charges in the wall move away.

***Correct****:* ***Point #3*** *is partially made and is followed* ***point #2****.*

***Not Clear****: The order should be reversed because the movement* ***causes*** *the change in force.*

1. the wall is not just neutral. It has protons, and electrons in it. l.

***Not Concise****! It has a wordy lead into the first sentence that says nothing. It provides unnecessary information about neutrons.*

1. A negatively charged balloon is an attraction?? of a neutral ?? wall that keeps it generating a static attraction that overcompensates for the repulsing forces?? and also friction and gravity help.

***Not Clear!***

Write an answer that is clear, complete, concise and correct. Include a diagram.

This last part could be used as an exit card for assessment or collected for evaluating.