

Review Sheet for Scientific Method/Intro Unit

- 1) How do you perform scientific experiments.
- 2) What is the most important step in the scientific method?
- 3) How does this aid in the acquisition of knowledge better than random experimentation?
- 4) What is a control?
- 5) You develop what you think is a hair dye. In order to make it appealing you dilute it with some other chemicals so that it resembles conditioner. When you pour this mixture on hair, the hair changes color. Does this experiment show your dye causes color change? What would be the control experiment you would need to also run?
- 6) You are testing a hormone which was developed to make cows produce more milk. You give this hormone to some cows and they seem to produce a lot of milk. What can you conclude from this experiment? What would be the control experiment you would have to run?
- 7) Be able to identify some properties and classify them as chemical or physical.
- 8) Know the difference between a compound and mixture.
- 9) What is a molecule?
- 10) Draw an example of an element, a compound, a mixture of elements, a mixture of compounds, a mixture of elements and compounds
- 11) In the chromatography experiments we did with the markers:
 - a) What was the solvent?
 - b) What was the mixture?
 - c) What was the chromatographic column?
- 14) Describe how solubility and adsorption work together to separate mixtures.
- 15) Why might a chromatography experiment not show any separation?
- 16) Differences in properties can also be used to separate mixtures using other techniques. What property of a substance is used in distillation to allow for its separation from other substances?
- 17) When will distillation not allow for a good separation of a mixture?

Answers:

- 1) You need to use the scientific method and a control whenever possible.
- 2) Repetition of your experiment. You need to make sure that the results you got were not an accident or due to some other factor that you were not aware of.
- 3) If you are meticulous about describing your procedure using exact quantities and you repeat it then others can reproduce and learn from your experiment.
- 4) A control is the "normal" group, the experiment in which you don't test whatever it is you are testing so that you have normal results to compare with your experimental group.
- 5) No. It could be caused by the diluting chemicals or the mixture that is created when you add the "dye" and the diluting chemicals together. You need to test the dye, the diluting chemicals, and the mixture in three separate experiments. Each experiment should be the same as much as possible - same hair, same time, same environment (in light or in dark), etc. The test in which only the diluting chemicals is used would be the control test.
- 6) You can't conclude anything. You don't know that the hormone made the cows produce more milk or if they just happened to produce more milk during the same time period that you gave them the hormone. You would need a control which would be a set of cows not getting the hormone. The two groups of cows, those getting the hormone and those not, will have to be as identical as possible - same age, same type of cow, same type of food, same amount of food, same health, same living conditions, etc.
- 7) Physical properties describe something about a substance which can be measured without doing a chemical reaction: density, color, hardness, solubility, etc.
Chemical properties describe how a substance will chemically react with another substance - reacts with acids, corrodes easily, is combustible, etc.
- 8) A compound has one or more different kinds of atoms bonded together to form a molecule. You can have a pure compound if all the molecules are the same. For example, water is a compound, and pure water only consists of water molecules (two hydrogens bonded to an oxygen).
- 9) A molecule is a group of two or more atoms bonded together with covalent bonds. The atoms don't have to be of different kinds. If all the atoms bonded are of the same kind, then you have an element.
- 10) See the worksheet you did on "Elements, Compounds, and Mixtures".
- 11) The solvent was the liquid we used (water, alcohol, or paint thinner).
- 12) The mixture was the marker.
- 13) The paper was the chromatographic column.
- 14) Solubility is the ability to dissolve into (or stick to) the solvent. Adsorption is the ability to stick to the column. As the solvent creeps up the paper, it will encounter the mixture of dyes that make up the color of the marker. Depending on the differences in solubility and adsorption for each of the dyes, some will move up the column with the solvent better, and some will stay adsorbed to the paper better, keeping the dye from moving up the paper. Eventually, the different dyes in the color can be separated by their different properties of solubility and adsorption.
- 15) There are two reasons for no separation:
 - You started with a pure substance, so there was no mixture to separate.
 - You started with a mixture, but every component of the mixture had similar properties of solubility and adsorption, causing them to move up the column at the same speed.
- 16) Boiling point is used to separate mixtures in distillation. The substance with the lowest boiling point will boil off first, then the next highest, and so on.
- 17) If the different substances in the mixture have similar boiling points then it will be hard to separate them using distillation.