**Course 5, “Charge Measurements & Papermaking,” Final Quiz**

**Complete the following form and take the quiz to receive a certificate of course completion. Please enter your information in the way you would like it to appear on your certificate. Send your completed form (in WORD or PDF format) as an email attachment to hubbe@ncsu.edu.**

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**Having taken this course will help me to…**

**This course could be improved by…**

**My idea for a future course in this series would be…**

FINAL QUIZ FOR COURSE 5 (ten questions)

1 – A titration is required to determine which of the following quantities?

1. Zeta potential
2. Electrophoretic mobility
3. Sign of charge
4. Cationic demand

2 – Which of the following quantities is proportional to the change in measured electrical potential when a certain pressure is applied to an aqueous solution flowing through a pad of fibers?

1. Charge density of the fiber surfaces
2. Zeta potential of the fiber surfaces
3. Electrical conductivity of the material
4. Electrical resistivity of the material

3 – Which of the following is a common cationic (positive charge) titrant that is used for determination of cationic demand? (Hint: Its charge is not affected by pH.)

1. Potassium salt of poly(vinylsulfate), i.e. PVSK
2. Aluminum sulfate, which is called papermaker’s alum
3. Cationic starch with tertiary ammonium groups
4. Poly(diallyldimethylammonium chloride), i.e. PolyDADMAC

4 – What is the sign of charge of typical cellulosic fibers before any additives are used?

1. Negative
2. Near to zero
3. Positive
4. The sign is different for different wood types

5 – When using the streaming current device for charge demand testing, what quantity will be proportional to the cationic demand of a sample?

1. The signal shown on the device display when the sample is added
2. The amount of titrant needed to achieve a “purple-pink” coloration
3. The point at which a double layer has been fully developed on the plastic surfaces
4. The volume of titrant when the signal from the device is zero

6 – When the pH is below 3, about what proportion of the carboxylic acid groups on the fiber surfaces will be protonated (neutral in charge)?

1. About half of them
2. Almost none of them
3. Almost all of them
4. More information is needed

7 – Which of the following is usually the main contributor to the negative charge of papermaking fibers?

1. Cellulose
2. Hemicellulose
3. Lignin
4. Cationic starch

8 – What was the relationship found between wet tensile strength of paper and the electrophoretic mobility when adding different amounts of a cationic additive and an anionic strength additive?

1. Highest wet tensile strength at positive electrophoretic mobility (i.e. zeta potential)
2. Highest wet tensile strength at near-zero electrophoretic mobility (i.e. zeta potential)
3. Highest wet tensile strength at negative electrophoretic mobility (i.e. zeta potential)
4. No relationship between wet tensile strength and electrophoretic mobility (i.e. zeta potential)

9 – Which of the following contributions of charge demand to a papermaking system is likely to be most disruptive to smooth operation of the paper machine and uniform product attributes as a function of time?

1. Intermittent addition of large quantities of coated broke
2. High cationic demand due to peroxide bleaching of high-yield pulp, e.g. CTMP
3. Variations in pH during operation of a paper machine in the presence of calcium carbonate filler
4. Addition of retention aid at varying levels, with the goal of keeping the tray water solids constant

10 – What kind of addition point will tend to minimize the migration of cationic polymers into the mesopore spaces within the cell walls of kraft fibers before forming the sheet?

1. To the thick stock, where the proportion of cellulosic fines is not as high as later
2. At the machine chest, so that the polymers can interact strongly with the fibers
3. At the white water silo, giving the agent equilibration time with the water before it contacts the solids (at the fan pump)
4. Relatively late in the process leading up to the headbox of the paper machine