

## AQS 110 - Module 2 Exam – Spring 2015 (75 pts)

1. Why do we measure? Include reference to the 3 “F’s” (5 pts)

Evaluate the fitness for use / form free of defect / function as intended

Customers what expectations/needs met consistently; manufacturing process has variation and can change over time.

Quality is product with characteristics which determine desirability and can be controlled to meet certain basic requirements.

Measurement is method for evaluating and describing with numerical/nominal value - removes subjectivity

2. When presenting measurement data (results) why are the following considerations important? Provide examples (6 pts)

a. Format presentation (table of numbers, type of graph, etc.)

b. Readability ease of interpretation (convey the desired message)

c. Confidentiality internal use versus public release

3. Match the measurement capability characteristic with its descriptor (5 pts)

- |                     |   |
|---------------------|---|
| i. Bias             | systemic offset                                     |
| ii. Linearity       | equally decreasing increments                       |
| iii. Repeatability  | precision of instrument used to conduct measurement |
| iv. Reproducibility | precision of person conducting measurement          |
| v. Stability        | measurement drift                                   |

4. Because of high heat and low humidity in the desert, a visitor requires 1 quart of water for every 2 miles traveled on foot. Calculate the number of L required for 20 km. Show calculation. (4 pts)

Note: 1 L = 1.06 quart 1 km = 0.62 mile

$$\frac{1 \text{ quart}}{2 \text{ miles}} \times \frac{1 \text{ L}}{1.06 \text{ quart}} \times \frac{0.62 \text{ mile}}{1 \text{ km}} \times 20 \text{ km} = 5.85 \text{ L required}$$

Known ratio      convert quart to L      convert miles to km      distance to be travelled

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5. Random selection of a sample:
- Assures that the sample average will equal the population average
  - Theoretically means that each item in the lot has an equal chance to be selected
  - Means that a table of random numbers was used to dictate the selection
  - Is a meaningless theoretical requirement
6. Which of the following statements describes attribute data
- Number of employees wearing green shirts
  - Number of gallons of chemical used in a process
  - Diameter of hole
  - Miles per gallon fuel economy
7. Describe three of the eight measurement fundamentals. (6 pts)
- Methods
- Equipment specifications
- Quality (confidence)
- Environmental Controls
- System
- Capability
- Standards Usage
- Data
8. Product specifications are used throughout a manufacturing organization, describe how they're used by the Customer and Quality. (4 pts)
- Customer --- to provide detail regarding what they expect
- Quality --- to measure product
- Evaluate business capability to meet expectations (are the tools available)
9. When determining the purchase of a new measurement tool, describe two key considerations regarding equipment specifications (2 pts)
- Selection of the correct tool
- Ability to measure within the range necessary
- Ease of use and readability
- Manual versus automation
10. Circle the correct standards traceability chain (2 pts)
- User equipment → working metrology lab → reference lab → NMI
  - User equipment → reference standard → working standard → primary standard
  - User equipment → working standard → secondary standard → reference standard

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11. The recommended dose for an asthma treatment is 6.0 mg/kg of body mass. Calculate the dose in milligrams for a 115-lb person. (1 lb = 453.59 g) (4 pts)

$$\begin{array}{ccccccc}
 \frac{6.0 \text{ mg}}{\text{kg}} & \times & \frac{\text{kg}}{1000\text{g}} & \times & \frac{453.59 \text{ g}}{\text{lb}} & \times & \frac{115 \text{ lb}}{\text{patient weight}} = 312 \text{ mg dose}
 \end{array}$$

Recommended Dose      convert kg to g      convert g to lb      patient weight

12. Quality can be inspected into the product.      T      F
13. Acceptance sampling is conducted only at final release.      T      F
14. Sampling fish using a catch and release method is an example of non-destructive testing.      T      F
15. A minor product characteristic would cause failure of the product.      T      F
16. Counting the number of green cars passing through an intersection is an example of continuous data.      T      F
17. Lot rejection versus piece rejection is an advantage of using a sampling method.      T      F
18. Describe how the measurement equipment may be affected by the environment, providing examples. (3 pts)

Temperature (i.e. contraction / expansion)  
 Moisture or Air Quality  
 Lighting  
 Electromagnetic field, Vibration, etc.

19. Describe how the sample to be measured may be affected by the environment, providing examples. (3 pts)

Temperature (i.e. contraction / expansion)  
 Moisture or Air Quality (contamination)  
 Lighting (reaction to UV)  
 Electromagnetic field, Vibration, etc. (interference)

20. A measurement tool is found to be out of calibration, the following information is documented. Describe the importance of each aspect (why is documentation necessary) (6 pts)

- a. Individual test points and their results.

This demonstrates what range was measured and the as found status (how far off)

- b. Observations of the equipment of and its surroundings.

Is there evidence of misuse, improper handling, improper maintenance, etc.?

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22. Define accuracy and precision (4pts)

Accuracy – how close to the target value

Precision - how close together the results are

23. Describe the difference between producers risk and consumer risk. (2 pts)

Producers risk is rejecting a batch that was actually good.

Consumer risk is accepting (releasing) a batch that was actually defective.

24. The dimensional specifications for the length of a nail are listed below. Identify which is a unilateral dimension versus a limiting dimension. Why are they different? (4 pts)

A. Specification: 1.25 inches maximum

B. Specification:  $1.20 +0.05 / -0.00$

“A” is a limiting dimension whereas “B” is a unilateral dimension

“A” can theoretically be from 0 – 1.25 inches in length

Whereas

“B” can measure specifically between 1.20 and 1.25.

“B” is unilateral because it can only be + 0.05. There is no lower tolerance allowed (- 0.00)

24. Why is a flow chart useful when determining inspection points? Include examples for set-up, in-process and final inspection. (3 pts)

Provides a list of the individual steps necessary to build the product; indicates where various hand-off points may be

25. Using the attached print, provide the specification for the following features (4 pts)

a. Flatness 0.004

b. Parallelism 0.015

c. Concentricity 0.005

d. Perpendicularity 0.002

Name \_\_\_\_\_

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