1. Scheduled maintenance that is planned, with materials on hand, personnel on site, and production planning advised is called ________________ maintenance.
   a. predictive
   b. preventive
   c. corrective
   d. troubleshooting

2. What standard defining quality policy and procedures is recognized as the "de facto" requirement for doing business in Europe?
   a. ISA12.11
   b. ISO 9000
   c. NFPA: 70-84
   d. CENELEC

3. How is a transmitter’s current output signal converted to a voltage-input signal required by an electronic controller?
   a. a resistor is placed across the input terminals of the controller
   b. all wiring in the loop is tied positive-to-negative
   c. a forward bias diode is placed between the transmitter and controller
   d. a capacitor is placed across the output terminals of the transmitter

4. An analog electronic d/p transmitter has an output of 4-20 mA which represents 0 to 100 gpm (0 to 378.5 lpm). On a properly calibrated transmitter, what is the output in gpm (lpm), if the transmitter output is 12 mA?
   a. 25 (94 lpm)
   b. 33.3 (126 lpm)
   c. 70.7 (267.6 lpm)
   d. 50 (189.3 lpm)

5. A test instrument (standard) against which the accuracy of all others are compared is referred to as a ____________ standard.
   a. primary
   b. secondary
   c. shop
   d. ISA
6. During calibration of a differential pressure transmitter it was determined that the ideal value at 100% of span was 20 mA, the as found value was 20.04 mA. Knowing that the span of the ideal values is 16, what is the PERCENT DEVIATION?

a. 0%
b. .0625%
c. .1875%
d. .25%

7. This calibration chart was completed during the calibration of an electronic d/p transmitter. An analysis of the data indicates that a __________ error was found.

a. zero
b. span
c. linearity
d. hysteresis

<table>
<thead>
<tr>
<th>% of Span</th>
<th>Actual Input 0 to 150&quot; H2O (Span = 150&quot;)</th>
<th>Ideal Values</th>
<th>As Found Values</th>
<th>% Deviation (Error)</th>
<th>Calibration 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0&quot;</td>
<td>4 mA</td>
<td>4 mA</td>
<td>0%</td>
<td>4 mA</td>
</tr>
<tr>
<td>25%</td>
<td>37.5&quot;</td>
<td>8 mA</td>
<td>8.01 mA</td>
<td>.0625%</td>
<td>8 mA</td>
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<tr>
<td>50%</td>
<td>75&quot;</td>
<td>12 mA</td>
<td>12.02 mA</td>
<td>.125%</td>
<td>12 mA</td>
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<tr>
<td>75%</td>
<td>112.5&quot;</td>
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<td>16.03 mA</td>
<td>.1875%</td>
<td>16 mA</td>
</tr>
<tr>
<td>100%</td>
<td>150&quot;</td>
<td>20 mA</td>
<td>20.04 mA</td>
<td>.25%</td>
<td>20 mA</td>
</tr>
</tbody>
</table>

8. Reviewing the information on the calibration chart in question 7 above, it is evident that the error was ______________.

a. uncorrected
b. partially corrected
c. corrected
d. converted

9. When calibrating a RTD temperature transmitter, which device could be connected to the transmitter’s input terminals to simulate the RTD probe signal?

a. resistance decade box
b. milliammeter
c. frequency generator
d. oscilloscope
10. In a level control system using a capacitance probe as the sensor, if the process liquid medium changes:

   a. the transmitter will need to be recalibrated.
   b. the probe’s grounding system will need to be relocated.
   c. adaptive control action will need to be added to the controller.
   d. there should be no effect on the control loop performance.

11. The function of an A/D converter in a “smart” transmitter is to:

   a. convert input power from ac to dc
   b. convert output power from dc to ac
   c. convert the input analog signal to digital format
   d. convert the output digital signal to analog format

12. The procedure that allows you to change a “smart” transmitter’s parameters such as tag, engineering units output type (linear/square root), damping, etc. is:

   a. digital trim
   b. a/d conversion
   c. configuration
   d. characterization

13. A typical location for an I/P transducer in an electronic control loop would be:

   a. between the sensor and controller.
   b. between the controller and the control valve.
   c. at the measurement point in the process.
   d. at the control point in the process.

14. The time between the initiation of an input change and the start of the resulting change in an instrument’s output signal response is called:

   a. reset time
   b. real time
   c. function time
   d. dead time

15. If the proportional band on a controller is 100%, then the controller gain is equal to:

   a. 0.50
   b. 0.20
   c. 1
   d. 100
16. What type of control mode is usually added to a proportional controller to eliminate offset?
   a. derivative (rate) control
   b. on/off control
   c. integral (reset) control
   d. cascade control

17. If the controller you have installed is set as _______ acting, an increase in measurement (process variable) causes the controller output to increase.
   a. direct
   b. reverse
   c. proportional
   d. on/off

18. A validated control system in a pharmaceutical operation means________.
   a. the system logic is provided by a PLC.
   b. the controller is microprocessor based.
   c. like for like replacement parts is the acceptable alternative in a critical loop.
   d. circuit isolators are used.

19. On a P&ID, what type of instrument is indicated by the tag number FT-100?
   a. flow indicating controller
   b. series 100 flow transducer
   c. flow transmitter
   d. flow control valve

20. The proper method for field mounting an instrument, connecting it to the process, and positioning it for proper operation would most likely be found on the:
   a. P&ID
   b. instrument index
   c. process flow diagram
   d. installation detail drawing
21. Ideally, a control system is grounded:
   a. at every field mounted instrument.
   b. every 25 feet in the loop.
   c. every 50 feet in the loop.
   d. at a single location near the control room or panel.

22. An autoclave is used for:
   a. disposing of unwanted items
   b. sterilization of product or tools used in manufacturing.
   c. an automatic system used in manufacturing
   d. automatic dispensing of pharmaceutical drugs.

23. There are three factors necessary for an explosion to occur due to the presence of electrical equipment. Which of the following is NOT one of those factors?
   a. ignition source
   b. > 110 amps
   c. fuel
   d. oxidizer

24. Which code of federal regulations covers calibration and documentation:
   a. ANSI 311b
   b. ISA 5.1 2009
   c. CFR21
   d. 29 CFR

25. ___________ typically represents a process response curve indicating “good” control and a properly tuned loop:
   a. A one-quarter decay ratio.
   b. An offset of < 25%.
   c. A one-half enhanced ratio.
   d. A steady-state gain of 0.5.