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*Michelin North America*

*Industrial Maintenance Technical Interview Outline*

# Industrial Maintenance Technical Interview Outline

The Technical Interview consists of the following components:

- Aptitude Battery (*no calculators allowed*)
- **Electrical, Mechanical** or **Multi Skill Test** (*calculators allowed*)
- Recommendation for a Personnel Interview (*application required*)

The 1<sup>st</sup> step in the process is the Aptitude battery (see outline). The aptitude testing session is conducted in a mass screening atmosphere, normally in a lecture, class or conference room. A presentation precedes the testing to inform applicants of our client's company, benefits, career opportunities, and to answer your questions. A one and one-half (1 ½)-hour block of time is required to conduct a session and feedback is given to each individual. [Successful completion of this step is required in order to proceed to the next step.](#)

Depending upon the type of job opening that the candidate is applying for, the 2<sup>nd</sup> step will consist of either a Mechanical, Electrical or Multi Skill Test. Either test has a two (2) hour maximum time limit. The results will be reviewed with the candidate upon completion. [Successful completion of this step is required in order to proceed to the next step.](#)

Upon successful completion of Step #1 and Step #2, the candidate will be referred for a Personnel Interview. Usually, this interview will be scheduled with the company within 5-10 business days. Occasionally, it could be completed on the same day as the Technical Interview.

## Other Notes:

- Confirm a testing session (*see invitation letter/email*)
- Bring a calculator
- Bring a completed application (go to [www.centecinc.com/application.pdf](http://www.centecinc.com/application.pdf) to download an application from our web site)
- Go to our resources page [www.centecinc.com](http://www.centecinc.com) to obtain study information for the skills assessments from our web site

# Outline of the Aptitude Test Battery

\*\*\* CALCULATORS NOT ALLOWED \*\*\*

## Test #1: Applied Math Skills (20 minutes long)

- Ability to apply math skills to practical applications of everyday life
- Ability to add, subtract, multiply and divide
- Ability to function with whole numbers, decimals and fractions

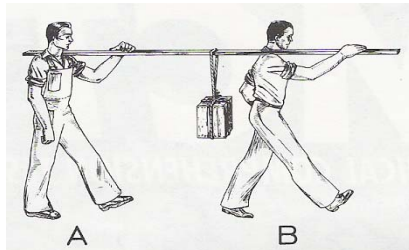
### Examples:

- (A) What is the total weight of four kegs of nails if each keg weighs 100 pounds?
- (B) There are 8 gallons of water in a tank which can hold 16.5 gallons. How many gallons can be added to this tank?
- (C) How many feet are there in 100 inches?

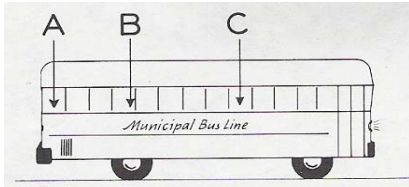
## Test #2: Mechanical Comprehension (30 minutes long)

- Ability to analyze pictures and determine elements and principles of mechanical concepts.

Look at Sample X and Y on this page. It shows two men carrying a weighted object on a plank, and it asks, "Which man carries more weight?" Because the object is closer to man B than to man A, man B is shouldering more weight.



X  
Which man carries more weight?  
(If equal, mark C.)

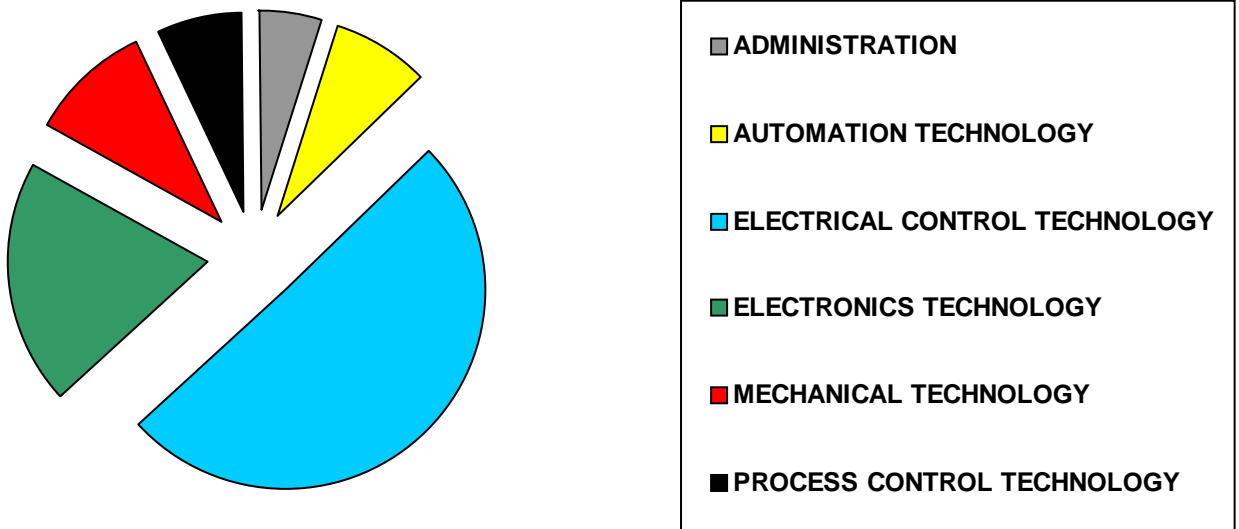


Y  
Which letter shows the seat where  
a passenger will get the smoothest ride?

# Michelin North America, Greenville SC

## *Electrical New Hire Assessment*

### Assessment Topic Percentages



**Number of Questions: 100**  
**Number of Task Statements Assessed: 44**

<u>Major Topic</u>	<u># of Questions</u>	<u>Percentage</u>
ADMINISTRATION	5	5%
AUTOMATION TECHNOLOGY	8	8%
ELECTRICAL CONTROL TECHNOLOGY	50	50%
ELECTRONICS TECHNOLOGY	20	20%
MECHANICAL TECHNOLOGY	10	10%
PROCESS CONTROL TECHNOLOGY	7	7%

# *Knowledge and Skill Assessment Task Statements*

## 5% *ADMINISTRATION*

### *100% OFFICE COMPUTERS*

- 2 Knowledge of basic PC hardware and functions*
- 3 Knowledge of Microsoft Office software*

## 8% *AUTOMATION TECHNOLOGY*

### *100% INTRODUCTION TO PLC*

- 1 Knowledge of PLC concepts (ladder diagrams, flow diagrams, etc...)*
- 3 Knowledge of PLC concepts (number systems, memory, addressing, processor scan, etc...)*
- 4 Knowledge of PLC hardware fundamentals (Discrete Input and Output modules)*

## 50% *ELECTRICAL CONTROL TECHNOLOGY*

### *14% AC MOTORS*

- 1 *Able to change direction of rotation of a three phase motor*
- 1 *Able to troubleshoot motors (opens, grounds, and shorts)*
- 1 *Knowledge of AC motor operation (squirrel cage, wound rotor, etc...)*
- 2 *Knowledge of nameplate data*
- 2 *Knowledge of wiring configurations*

### *16% AC THEORY*

- 2 *Able to calculate AC voltages and currents (effective, average, and peak)*
- 1 *Able to calculate Inductive/Capacitive Reactance and Impedance*
- 1 *Knowledge of AC voltage and current (effective, average, and peak)*
- 1 *Knowledge of Inductive/Capacitive Reactance and Impedance*
- 3 *Knowledge of phase relationships between voltage, current and power (Inductive, Capacitive, and Resistive circuits)*

### *6% ACTUATORS AND SENSORS*

- 3 *Knowledge of operation of proximity sensors*

### *6% BREAKERS AND FUSES*

- 3 *Knowledge of fuse and breaker types and ratings*

### *12% DC THEORY*

- 6 *Able to apply Ohm's law to solve problems in series and parallel resistor circuits*

### *10% POWER AND CONTROL DEVICES*

- 1 *Able to determine faulty relays or contactors*
- 2 *Knowledge of control relay operation*
- 1 *Knowledge of solenoid operation*
- 1 *Knowledge of timer operations*

### *10% THREE PHASE THEORY*

- 4 *Able to calculate line and phase voltages and currents*
- 1 *Knowledge of 3 phase AC*

### *6% TRANSFORMERS*

- 1 *Knowledge of nameplate data and ratings*
- 2 *Knowledge of single phase transformer theory*

### *20% TROUBLESHOOT POWER AND CONTROL CIRCUITS*

- 3 *Able to troubleshoot relay control circuits*
- 3 *Able to troubleshoot single and three phase power circuits*
- 4 *Knowledge of analyzing machine sequence from a schematic diagram*

## 20% *ELECTRONICS TECHNOLOGY*

### *15% AC DRIVE CONTROLLERS*

3 *Knowledge of the Volts/Hz curve.*

### *20% COMPONENTS*

3 *Able to identify standard symbols for electronic devices*

1 *Knowledge of test procedures for SCRs, diodes, resistors, capacitors, transistors, etc*

### *15% DC DRIVE CONTROLLERS*

3 *Knowledge of the DC Drive Interface circuits.*

### *20% DC MOTORS*

3 *Knowledge of basic DC motor theory*

1 *Knowledge of DC motor types, wiring configurations and applications*

### *20% MOTION CONTROL SYSTEMS*

4 *Knowledge of Tachometer, Incremental Encoder, Absolute Encoder and Resolver feedback devices.*

### *10% POWER SUPPLIES*

2 *Knowledge of half wave and full wave bridge rectifiers*

## 10% *MECHANICAL TECHNOLOGY*

### *40% DRIVE SYSTEMS*

4 *Able to determine direction of rotation in a drive system*

### *10% FASTENERS*

1 *Knowledge of standard and metric fasteners*

### *30% LEVERS*

3 *Knowledge of force, distance and fulcrum*

### *20% SHOP PROJECTS*

2 *Able to apply math to shop projects*

## 7% *PROCESS CONTROL TECHNOLOGY*

### *86% ELECTRONIC CONTROLS*

2 *Knowledge of transducers and transmitters*

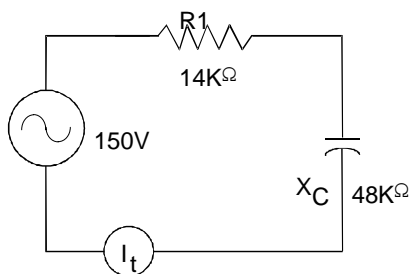
4 *Knowledge of tuning component terminology and applications (P, I, D)*

### *14% ELECTRONIC FEEDBACK DEVICES*

1 *Knowledge of different types of thermocouples*

## Electrical Written Test Examples

In the figure below, what is the total current of the circuit?

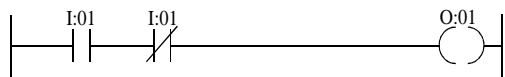


- A. 1.2 mA
- B. 2.4 mA
- C. 3.0 mA
- D. 10.7 mA

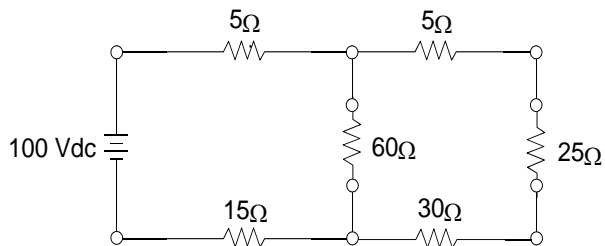
To prevent a voltmeter from loading the circuit being measured, the

- A. meter impedance should be low
- B. ohms per volt should be high
- C. sensitivity should be low
- D. circuit impedance should be high

Identify (if any) the logic traps that appear in the PLC ladder logic below.



- A. always on
- B. no trap, rung okay
- C. no way to turn rung off once true
- D. always off



The total resistance of the above circuit is \_\_\_\_\_ ohms.

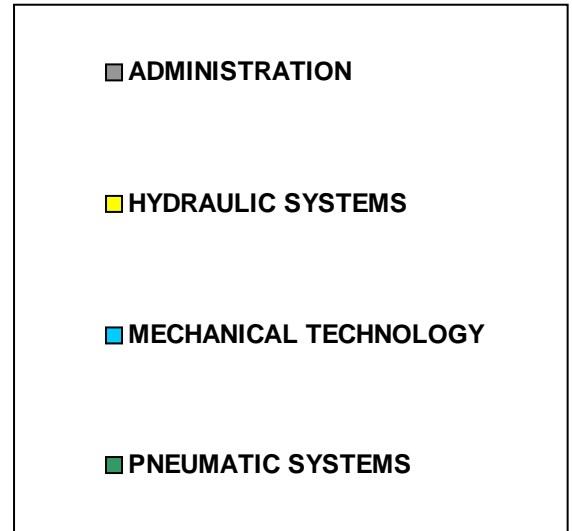
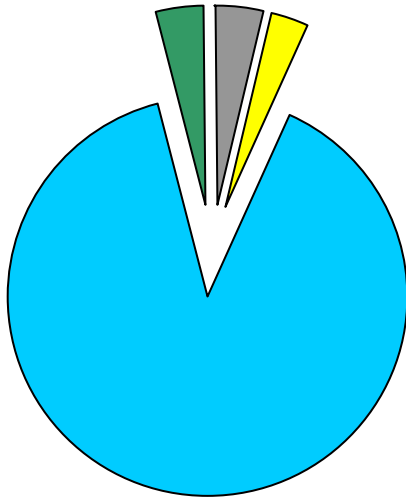
- A. 50
- B. 100
- C. 150
- D. 200



# Michelin North America, Greenville SC

## *Mechanical Prehire Assessment*

### Assessment Topic Percentages



**Number of Questions: 100**  
**Number of Task Statements Assessed: 32**

<u>Major Topic</u>	<u># of Questions</u>	<u>Percentage</u>
ADMINISTRATION	4	4%
HYDRAULIC SYSTEMS	3	3%
MECHANICAL TECHNOLOGY	89	89%
PNEUMATIC SYSTEMS	4	4%

# *Knowledge and Skill Assessment Task Statements*

## 4% *ADMINISTRATION*

### *100% OFFICE COMPUTERS*

- 4 Knowledge of Microsoft Office software*

## 3% *HYDRAULIC SYSTEMS*

### *100% FLUID THEORY*

- 1 Knowledge of the relationship between pressure, force, and area*
- 2 Knowledge of the relationship between pressure, volume, and temperature*

## 89% MECHANICAL TECHNOLOGY

### 25% BEARINGS

- 4 Able to clean, store, handle and lubricate bearings
- 1 Able to install and remove various types of bearings
- 2 Able to recognize bearing types
- 1 Knowledge of bearing failures
- 7 Knowledge of bearing installation techniques
- 7 Knowledge of plain and anti-friction bearings

### 17% DRIVE SYSTEMS

- 5 Able to determine direction of rotation in a drive system
- 1 Able to recognize gear types
- 1 Able to use chain breakers
- 3 Knowledge of coupling types
- 1 Knowledge of gear types
- 1 Knowledge of the type of belt drives
- 3 Knowledge of types of chain drives

### 8% FASTENERS

- 3 Knowledge of proper torquing procedures
- 4 Knowledge of standard and metric fasteners

### 2% FITS AND TOLERANCES

- 1 Knowledge of dimensional alignments and tolerances
- 1 Knowledge of types of fits

### 2% LEVERS

- 2 Knowledge of force, distance and fulcrum

### 4% LUBRICATION

- 4 Knowledge of the properties of lubricants

### 10% MEASUREMENT

- 1 Able to accurately lay out parts for fabrication
- 1 Able to measure accurately to 0.001 inch or 0.02 millimeters
- 7 Able to use calipers, micrometers, height gauges, feeler gauges, dial indicators, and squares

### 20% PRINT READING

- 9 Able to determine the function of an assembly from a drawing
- 1 Able to identify common components and their symbols
- 7 Able to use drawings to assemble/disassemble equipment
- 1 Knowledge of sectional views

### 8% SHOP PROJECTS

- 7 Able to apply math to shop projects

### 3% TORQUE AND SPEED

- 3 Knowledge of common units of torque

## 4% PNEUMATIC SYSTEMS

### 100% FLUID THEORY

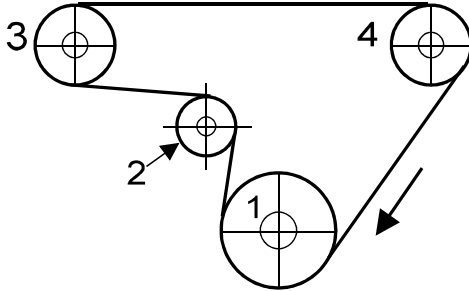
- 4 Knowledge of pressure, force and area

## Mechanical Written Test Examples

Which tool would you use to put threads inside a hole?

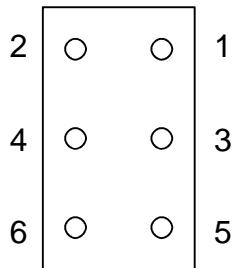
- A. file card
- B. snips
- C. pin punch
- D. tap

Which of the following pulleys turn the same direction as #1?



- A. 2 & 4
- B. 2 & 3
- C. 3 & 4
- D. 1 & 2

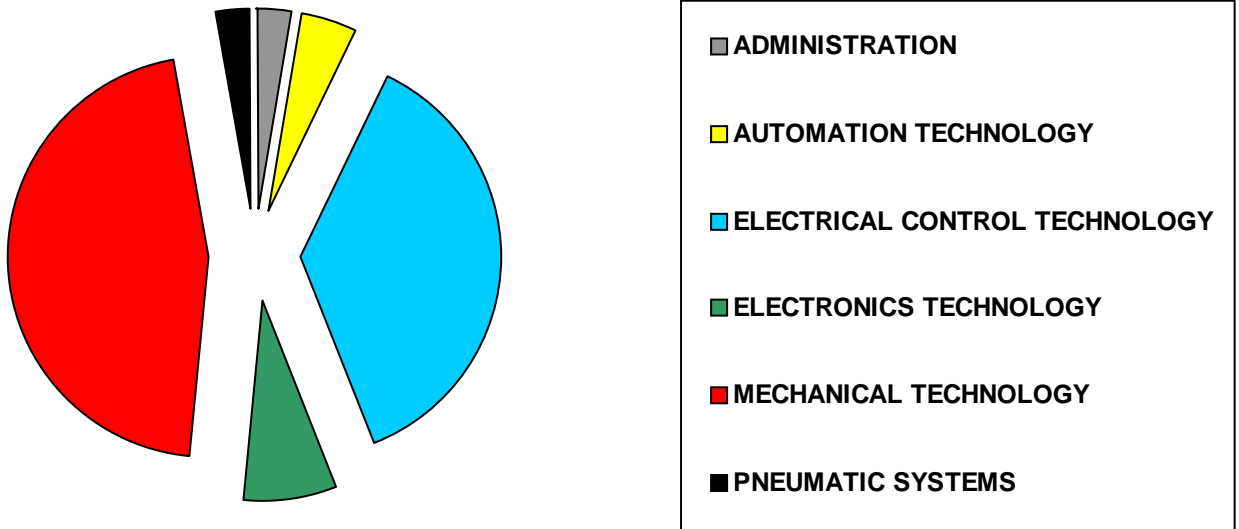
A correct torquing pattern for the figure below would be



- A. 123456
- B. 164235
- C. 341625
- D. 634125

# Multi Skill Assessment

## Assessment Topic Percentages



**Number of Questions: 150**  
**Number of Task Statements Assessed: 57**

<u>Major Topic</u>	<u># of Questions</u>	<u>Percentage</u>
ADMINISTRATION	4	3%
AUTOMATION TECHNOLOGY	7	5%
ELECTRICAL CONTROL TECHNOLOGY	55	37%
ELECTRONICS TECHNOLOGY	11	7%
MECHANICAL TECHNOLOGY	69	46%
PNEUMATIC SYSTEMS	4	3%

# *Knowledge and Skill Assessment Task Statements*

## 3% *ADMINISTRATION*

### *100% OFFICE COMPUTERS*

- 4 Knowledge of Microsoft Office software*

## 5% *AUTOMATION TECHNOLOGY*

### *100% INTRODUCTION TO PLC*

- 2 Knowledge of PLC concepts (number systems, memory, addressing, processor scan, etc...)*
- 4 Knowledge of PLC hardware fundamentals (Discrete Input and Output modules)*
- 1 Knowledge of PLC programming fundamentals (relay logic conversion, software, basic instructions, et ...)*

## 37% *ELECTRICAL CONTROL TECHNOLOGY*

### *11% AC MOTORS*

- 1 *Able to change direction of rotation of a three phase motor*
- 1 *Able to troubleshoot motors (opens, grounds, and shorts)*
- 2 *Knowledge of nameplate data*
- 2 *Knowledge of wiring configurations*

### *2% AC THEORY*

- 1 *Able to calculate AC voltages and currents (effective, average, and peak)*

### *15% ACTUATORS AND SENSORS*

- 3 *Knowledge of common detectors*
- 1 *Knowledge of different operator heads and contact configurations*
- 4 *Knowledge of operation of proximity sensors*

### *5% BREAKERS AND FUSES*

- 3 *Knowledge of fuse and breaker types and ratings*

### *15% DC THEORY*

- 8 *Able to apply Ohm's law to solve problems in series and parallel resistor circuits*

### *16% POWER AND CONTROL DEVICES*

- 1 *Able to determine faulty relays or contactors*
- 1 *Knowledge of contactor applications*
- 3 *Knowledge of control relay operation*
- 1 *Knowledge of electrical and mechanical interlocks*
- 2 *Knowledge of solenoid operation*
- 1 *Knowledge of timer operations*

### *2% THREE PHASE THEORY*

- 1 *Knowledge of 3 phase AC*

### *5% TRANSFORMERS*

- 1 *Knowledge of nameplate data and ratings*
- 2 *Knowledge of single phase transformer theory*

### *29% TROUBLESHOOT POWER AND CONTROL CIRCUITS*

- 1 *Able to recognize electrical symbols and components*
- 6 *Able to troubleshoot relay control circuits*
- 4 *Able to troubleshoot single and three phase power circuits*
- 1 *Able to use test equipment*
- 4 *Knowledge of analyzing machine sequence from a schematic diagram*

## 7% *ELECTRONICS TECHNOLOGY*

### *18% AC DRIVE CONTROLLERS*

- 2 *Knowledge of the Volts/Hz curve.*

### *36% DC MOTORS*

- 2 *Knowledge of basic DC motor theory*
- 2 *Knowledge of DC motor types, wiring configurations and applications*

### *45% MOTION CONTROL SYSTEMS*

- 5 *Knowledge of Tachometer, Incremental Encoder, Absolute Encoder and Resolver feedback devices.*

## 46% *MECHANICAL TECHNOLOGY*

### *28% BEARINGS*

- 4 *Able to clean, store, handle and lubricate bearings*
- 6 *Knowledge of bearing installation techniques*
- 9 *Knowledge of plain and anti-friction bearings*

### *25% DRIVE SYSTEMS*

- 5 *Able to determine direction of rotation in a drive system*
- 1 *Able to recognize gear types*
- 1 *Able to use chain breakers*
- 2 *Knowledge of coupling types*
- 1 *Knowledge of gear types*
- 4 *Knowledge of the type of belt drives*
- 3 *Knowledge of types of chain drives*

### *9% FASTENERS*

- 3 *Knowledge of proper torquing procedures*
- 3 *Knowledge of standard and metric fasteners*

### *7% FITS AND TOLERANCES*

- 2 *Knowledge of cumulative tolerances*
- 2 *Knowledge of the effects of temperature on tolerances*
- 1 *Knowledge of types of fits*

### *3% LEVERS*

- 2 *Knowledge of force, distance and fulcrum*

### *6% LUBRICATION*

- 4 *Knowledge of the properties of lubricants*

### *12% MEASUREMENT*

- 1 *Able to accurately lay out parts for fabrication*
- 2 *Able to measure accurately to 0.001 inch or 0.02 millimeters*
- 5 *Able to use calipers, micrometers, height gauges, feeler gauges, dial indicators, and squares*

### *3% PRINT READING*

- 1 *Able to identify common components and their symbols*
- 1 *Knowledge of sectional views*

### *6% SHOP PROJECTS*

- 4 *Able to apply math to shop projects*

### *3% TORQUE AND SPEED*

- 2 *Knowledge of common units of torque*

## 3% *PNEUMATIC SYSTEMS*

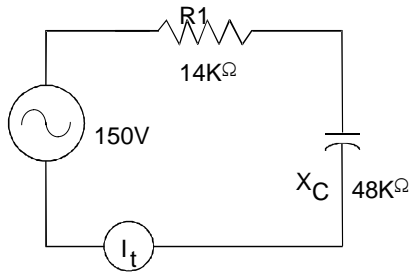
### *100% FLUID THEORY*

- 4 *Knowledge of pressure, force and area*



## Multi Skill Written Test Examples

In the figure below, what is the total current of the circuit?



- E. 1.2 mA
- F. 2.4 mA
- G. 3.0 mA
- H. 10.7 mA

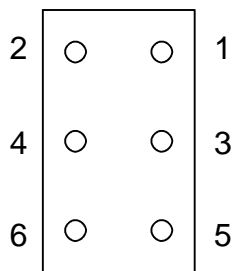
To prevent a voltmeter from loading the circuit being measured, the

- E. meter impedance should be low
- F. ohms per volt should be high
- G. sensitivity should be low
- H. circuit impedance should be high

Which tool would you use to put threads inside a hole?

- E. file card
- F. snips
- G. pin punch
- H. tap

A correct torquing pattern for the figure below would be



- E. 123456
- F. 164235
- G. 341625
- H. 634125