

Production Operator

Addition and Subtraction

Objectives:

- Define the following terms: whole number, numeral, digit, decimal, place value, addend, sum, minuend, subtrahend, and difference
- Properly place commas in large numbers
- Explain the significance of the digit zero in a number
- Differentiate between concrete and abstract numbers
- Properly prepare numbers for addition and subtraction
- Perform addition and subtraction on numbers
- Check your answers to both addition and subtraction problems
- Use a calculator to add and subtract numbers

Multiplication and Division

Objectives:

- Define the following terms: factor, multiplicand, multiplier, partial product, product, dividend, divisor, quotient, and remainder
- Recognize the various signs used for multiplication and division
- Properly prepare numbers for multiplication and division
- Perform multiplication and division on whole numbers, decimal numbers, and mixed decimal numbers
- Check your answers to both multiplication and division problems
- Find the average of a group of numbers
- Use a calculator to multiply and divide numbers

Fractions, Percents, Proportions, and Angles

Objectives:

- Define the following terms: fraction, proper fraction, improper fraction, lowest common denominator, percent, ratio, and proportion
- Add, subtract, multiply, and divide fractions
- Change fractions to decimals and decimals to fractions
- Solve problems involving percent
- Work with ratios and equivalent ratios
- Solve proportion problems
- Use a protractor to measure angles
- Lay out templates for checking angles
- Use a calculator to solve percent problems, to convert fractions to decimals, and to calculate missing terms in proportions

Metric System

Objectives:

- Name the base units most commonly used in the metric system and identify what they're used to measure
- Identify metric prefixes and their values
- Apply conversion factors to create a unit that's larger or smaller than the base unit
- Estimate lengths in metric units
- Express temperature in degrees Celsius
- Define the terms mass, density, force, torque, and pressure, and identify the metric units used to measure each one
- Use a conversion table to convert metric units to English units and English units to metric units
- Use a calculator to perform metric conversions

Formulas

Objectives:

- Explain the use of variables in formulas
- Prepare and use formulas to solve problems
- Use formulas to calculate the perimeter of a triangle and a rectangle, and the area of a triangle, a rectangle, and a circle
- Use formulas to calculate distance, current in a circuit, and the volume of a pyramid and a sphere
- Use a calculator to find square roots and solve formulas
- Substitute given numerical values for letters in a formula and find the unknown quantity
- Transform and solve equations and formulas

Introduction to Algebra

Objectives:

- Explain the difference between positive and negative numbers and their uses
- Perform basic arithmetic operations with signed numbers
- Raise a number to any power
- Use the order of operations for solving problems involving multiple operations
- Define the following words: term, constant, coefficient, exponent, monomial, trinomial, and polynomial Identify and combine like terms in an expression
- Perform basic arithmetic operations with signed terms
- Multiply and divide terms containing exponents
- Remove parentheses from an expression and simplify the expression

Linear Distance and Measurement

Objectives:

- Measure using both English and metric (SI) units of length
- Calculate the perimeters of rectangles, squares, and triangles
- Calculate the areas of objects such as rooms or machine bases
- Calculate the circumference of circular objects such as pipes or tanks
- Measure distances using rigid and flexible rules, thickness gages, and screw pitch gages
- Make precise measurements using vernier calipers and micrometers

Bulk Measurement

Objectives:

- Measure an angle by degrees
- Find the areas of rectangles, triangles, and circles
- Find the volumes of prisms, cylinders, and cones
- Find the mass of material stored in a container
- Determine the amount of material that can be stored or handled
- Discuss the types and uses of conveyors and weighing systems

Temperature Measurement

Objectives:

- Change temperature units from one system to another
- Discuss the use of the various types of thermometers
- Select the type of thermometer to be used at certain temperatures

Energy, Force, and Power

Objectives:

- Distinguish among the concepts of energy, force, and power
- Explain what the term work means and how it's measured
- Know by sight the basic machines: lever, inclined plane, wedge, wheel and axle, and screw
- Solve simple problems that involve levers, mechanical advantage, and machine efficiency
- List the forms of energy that have important industrial applications and the instruments used for measuring energy

Fluid Measurement

Objectives:

- Understand the properties of fluids
- Determine the density, specific gravity, and viscosity of fluids
- Express pressure in three different units
- Measure the pressure of fluids using manometers and Bourdon tube pressure gages
- Measure the flow rate of fluids using different types of flowmeters

Introduction to Print Reading

Objectives:

- Identify the various kinds of lines used on drawings
- Compare and contrast the various types of drawings
- Relate the information given in the title block and bill of material to the drawing
- Define different types of scales used on drawings
- Identify the different views used on drawings

Reading Shop Prints, Part 1

Objectives:

- Properly interpret working drawings (including dimensions and tolerances)
- Interpret symbols, notes, and specification
- Identify material requirements
- Interpret drawings to determine the proper procedure to make the part

Reading Shop Prints, Part 2

Objectives:

- Read and properly interpret various shop prints
- Interpret and use cam prints
- Interpret and use gear prints
- Read and understand an assembly drawing and bill of materials
- Read simple sheet metal drawings

Dimensioning

Objectives:

- Identify the height, width, and length dimensions of a drawing
- Interpret dimensions on angles, arcs, fillets, rounds, holes, and chamfers
- Interpret the surface finish symbols for roughness, waviness, and lay

Tolerancing and Symbols

Objectives:

- Tell the position method from the bracket method of dual dimensioning
- Identify the three general classes of fit
- Interpret unilateral and bilateral tolerances
- Interpret the various symbols and notations used on drawings

Sectional Views and Simplified Drafting

Objectives:

- Tell one type of section from another
- Interpret the various types of sections
- Interpret drawings using simplified drafting methods

Trades Safety: Getting Started

Objectives:

- List the physical hazards associated with chemicals and describe how to avoid them
- Name several electrical shock hazards and the techniques used to prevent shocks
- List the steps in a lockout/tagout procedure
- Explain the importance of machine guarding, and name several types of machine guards
- Name the five classes of fire and how to extinguish each of them
- Describe the proper technique used to manually lift a heavy load
- Explain how to avoid hand injuries when using hand and power tools
- List some of the hazards involved in welding and hot cutting operations and how to prevent them
- Explain how job analysis and ergonomics are used to improve the workplace
- Explain the importance of using personal protective equipment (PPE)
- Name the agencies and organizations that make and enforce safety

Working Safely with Chemicals

Objectives:

- Recognize the different ways in which a chemical can cause you physical injury
- Name the paths of entry along which chemicals enter your body
- Describe the basic types of injuries caused by chemicals
- Identify potential chemical hazards in the workplace
- Describe how to identify, store, and label hazardous chemicals
- List several methods used to prevent chemical accidents
- Explain why proper training is important to chemical handling
- Describe the types of personal protective equipment used when handling chemicals
- Explain the role of government agencies in enforcing chemical regulations

Fire Safety

Objectives:

- Describe the types of property losses and injuries associated with fires
- Explain how fires are ignited
- Identify the five classes of fire
- Describe the primary fire hazards found in the workplace
- Explain the various ways in which fires can be prevented
- Describe the operation of several different fixed fire protection systems
- Identify the proper type of portable fire extinguisher to use on a fire
- Describe the operation of several different types of fire extinguishers
- Explain how to defend yourself and others in a fire situation
- Describe how to evacuate a burning building in a safe manner

Safe Handling of Pressurized Gases and Welding

Objectives:

- Identify common welding gases and the hazards associated with each of them
- Safely handle and store different types of gas cylinders
- Recognize the safety considerations involved in the setup and operation of electric arc-welding equipment
- Explain how to safely set up and operate a basic gas welding rig
- Identify welding equipment malfunctions and take corrective action
- Utilize fire prevention and protection methods specific to welding operations
- Discuss the importance of the hot-work-permit program in your facility
- Explain the correct use of protective clothing and equipment for welding
- Understand the importance of proper ventilation when welding
- Describe how to effectively deal with confined spaces when performing welding operations

Advanced Electrical Safety

Objectives:

- Explain how electricity can harm you and property
- Discuss the importance of using quality electrical components
- Describe why it's important to properly ground electrical installations
- Understand the type of equipment used in hazardous locations
- List the safety practices required when performing electrical work
- Discuss the importance of workspace clearance around electrical enclosures

Material-Handling Safety

Objectives:

- Recognize the hazards associated with handling materials
- Know the types of injuries that can be caused by these hazards
- Understand how to effectively use safe material-handling practices
- Know how to avoid physical injury when handling loads
- Identify the parts of a powered lift truck and similar mechanized material-handling equipment
- Explain how to operate various types of mechanized material-handling equipment safely
- Know and follow the rules for safe operation of powered industrial material-handling equipment
- Understand and respect the limits and restrictions placed on powered material handling mechanisms

Machine Safety

Objectives:

- Recognize the basic machine motions that can present a hazard to you
- Recognize the types of machinery most likely to be hazardous to you
- Understand the types of injuries caused by accidents commonly associated with unsafe machine-operating procedures
- Discuss the importance of machine guarding and how to incorporate methods of guarding to avoid physical injury
- Recognize the types of machine guards commonly used in industry
- Control various forms of hazardous machine energy through the use of lockout/ tagout procedures
- Understand how and why to properly use personal protective equipment for added protection when operating industrial equipment

Nature of Electricity

Objectives:

- Explain the operation of a simple circuit
- Define the terms conductor, insulator, and resistor
- Demonstrate that unlike charges attract and like charges repel
- List some of the dangers and benefits of static electricity
- Define the terms volt, ampere, and ohm
- Describe some common notations and prefixes used to identify electrical and electronic values
- Identify carbon resistors, potentiometers, and rheostats, and explain how they work
- Identify some of the electrical symbols used in schematic diagrams
- Explain the difference between a series and a parallel circuit

Circuit Analysis and Ohm's Law

Objectives:

- Find the total resistance in series, parallel, and series-parallel circuits
- Use Ohm's law to calculate the amount of current, voltage, or resistance in circuits
- Calculate the amount of power supplied and dissipated in a DC circuit
- List the steps for reading current, voltage, and resistance with a meter

Conductors, Insulators, and Batteries

Objectives:

- Describe the various types of conductors and discuss their conductivity
- Explain the American Wire Gage system of sizing copper conductors
- Determine the size of conductor needed for an application
- Identify the various types of insulating materials and list their temperature ratings
- Explain the difference between a dry cell and a storage battery
- Connect cells together to obtain more voltage, more current, or more of both voltage and current
- Describe the proper safety precautions used when working with storage batteries
- Describe how to properly clean and care for storage batteries
- Discuss the instruments used for testing storage batteries
- Explain how NiCad, lithium, and other types of special batteries operate, and describe their ratings

Alternating Current

Objectives:

- Draw a graph of an AC voltage and describe how AC voltage is created
- Explain what an AC cycle is using the terms alternation, peak, positive, and negative
- Express the time period of an AC cycle in degrees
- List the characteristic values of an AC cycle and describe the relationship between the values
- Define phase angle and describe how it relates to reactive circuits
- Calculate power for single-phase and three-phase circuits
- Describe how a 220 VAC, single-phase circuit operates
- Calculate the phase and line voltages of multiphase wave forms
- Determine real power by reading a power factor meter
- Describe delta-connected and wye-connected three-phase circuit connections

Alternating Current Circuits

Objectives:

- Identify electric circuits in terms of their characteristics
- List several circuit characteristics used to describe a circuit for a particular load application
- Identify electrical components wired as series and parallel circuits
- Describe how to control loads from one or two switch locations
- Describe how current flows in a three-wire circuit
- Describe how current flows in delta- and wye-connected circuits
- Calculate the line-to-line and line-to-neutral voltage in a wye-connected circuit

Heat Part 1

Objectives:

- Explain the nature of heat
- Calculate the different ways in which temperature is measured
- Describe the difference between Btu's and joules
- Calculate the heat required to increase the temperature of a substance
- Explain vaporization, evaporation, sublimation and similar impacts on matter
- Calculate how heat is transferred between the various states of matter
- Describe how work is related to heat
- Apply elementary laws of gases such as Boyle's Law

Heat Part 2

Objectives:

- Explain the ideal-gas constant
- Calculate the mixing of gases
- Explain the different types of expansion of gases
- Identify how changes in energy are influenced by pressure and volume
- Define the General Law of Expansion of Gases
- Explain the General Law of Compression of Gases
- Explain the differences between isothermal and adiabatic compression of gases
- Explain the differences between open and closed cycles
- Describe heat engines such as Carnot's heat engine
- Define the Second Law of Thermodynamics

Distributed Control Systems Part 1

Objectives:

- Define basic process control
- Describe a control loop
- Name the basic types of control loop and their elements
- Name and describe four concepts of control
- List and describe five control modes
- Define a basic distributed control system (DCS)
- Outline some functions of a DCS
- List the basic components in a DCS architecture

Distributed Control Systems Part 2

Objectives:

- Describe the HART protocol and its development
- Identify the functions of a HART interface
- Distinguish between point-to-point and multidrop HART devices
- Describe the functions of a device management system
- Name the seven layers in a OSI standard
- Name the OSI layers that are used in HART messaging
- Name the parts of a HART message

Distributed Control Systems Part 3

Objectives:

- Define Foundation Fieldbus
- Explain different applications of the Foundation Fieldbus model
- Describe the different functions of block applications

Electronic Sensors

Objectives:

- Describe some important thermoelectric effects
- Explain the importance of a bridge circuit in certain types of electronic instrumentation
- Describe how certain nonlinear resistors are used in circuits
- Explain how certain components can be used as protection devices for circuits
- Define the scientific terms stress and strain

Precision Measuring Instruments Part 1

Objectives:

- Explain the difference between accuracy and precision
- Define standard, the Rule of 10, and traceability
- Describe Abbe's error
- Describe how to use a number of tools for measuring dimensions
- Read a vernier scale
- Demonstrate the skill to work with both English and metric dimensions and with their abbreviations
- Convert between millimeters and inches

Precision Measuring Instruments, Part 2

Objectives:

- Properly read standard and metric micrometers
- Read a vernier micrometer
- Choose special micrometers appropriately for various measuring tasks
- Recognize five kinds of depth and height gages and demonstrate the ability to read a depth gage
- Read the scale on a vernier bevel protractor
- Explain the uses of many kinds of indicators and gages in shopwork
- Describe how to minimize cosine error when using dial test indicators

Precision Measuring Instruments, Part 3

Objectives:

- Explain the use of optical comparators and toolmaker's microscopes
- Recognize the setup and operation of an optical alignment system—including laser and alignment telescopes
- Understand the use of digital readout gauges, and the use of both absolute and incremental measuring
- Recognize the uses for in-process and post-process gauging, including video inspection and CNC tool presettters
- Understand the use of hardness testers and video material testing
- Recognize the uses for modern nondestructive material testing, including magnetic particle inspection and ultrasonic testing

Properties of Materials

Objectives:

- Describe the types and effects of stress on a body
- Identify the characteristics of cohesive properties in materials
- Describe the relationships of working stress on different materials
- Explain and calculate safe load
- Identify the types of fasteners used with structural steel
- Describe how stress impacts rope, wire, and chains
- Identify the properties of metals

Preventive Maintenance

Objectives:

- Describe the function of inspection and scheduled maintenance as the basis of preventive maintenance
- Explain why preventive maintenance is performed and how it's scheduled
- Identify those within industry who should be part of preventive maintenance planning and execution
- Discuss the causes, effects, and goals of a successful preventive maintenance program
- Explain how a computerized preventive maintenance program can be developed and implemented

Preventive Maintenance Techniques

Objectives:

- Explain how to inspect and properly maintain a belt, chain, and gearbox power transmission system Discuss why proper alignment is necessary when operating a power transmission system
- List the steps needed to properly maintain an AC or DC motor
- Explain how to perform a start-up or bump test of a motor
- Describe how to perform PM tasks on pneumatic systems
- Describe how to maintain both floor and elevated conveyor systems
- Identify the types of elevators and vertical lifts in your plant and the proper PM procedures for this equipment
- Explain how to maintain liquid and vacuum pump systems
- Describe how to perform a basic alignment of in-line shafts
- List the proper PM procedures for electronic controllers and robot systems