This study guide is designed to aid individuals preparing to take the Georgia Teacher Certification Test (TCT) in industrial arts. The test covers seven subareas: (1) drafting; (2) electrical energy; (3) graphics; (4) metal fabrication; (5) power and power machines; (6) woodworking; and (7) general building construction and manufacturing. The guide contains a listing of content objectives for each subarea with specific readings from current publications. (JD)
STUDY GUIDE FOR TCT IN INDUSTRIAL ARTS

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National Evaluation Systems, Inc., has prepared for distribution by the Georgia Department of Education the set of content objectives found in this Study Guide. These objectives have been verified as important content requirements for initial certification. Not all of the listed objectives have had test items written for them. The selected objectives have not been identified. All objectives which appear here are certification requirements and a sampling of them will be tested.

When the project to develop the Georgia Teacher Certification Tests (TCT) was begun in November 1976, an Ad Hoc Committee composed of Georgia educators was appointed to work with NES on each TCT. The function of these Ad Hoc Committees was to review all NES-generated materials with a goal of making the materials more reflective of Georgia education needs. The first step in the test development process was that of content domain specification. Educators identified all content knowledge that an applicant would need to know to function effectively in a Georgia school. This content was further defined into content objectives, which were sent to currently practicing Georgia educators for verification. These educators provided actual ratings of the "job-relatedness" of the content objectives. At that point, it was possible to identify, from the original domain specification, the extent of essentiality of specific content skills for successful performance on the job. Test items were written for the most essential objectives which spanned the content of the field.

The purpose of providing objectives is to explicitly define the content required of an applicant for certification in this field. Further, the statement of these objectives should assist in preparing for the criterion-reference content knowledge test. We encourage applicants to study these materials, which will enhance their understanding of the content field and alleviate any unnecessary concerns about the nature of the Georgia Teacher Certification Tests.

Along with these materials go hopes for a rewarding career in education.

If you have questions or desire further information, contact:

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STUDY GUIDE FOR TCT IN INDUSTRIAL ARTS EDUCATION

Georgia Teacher Certification Testing Program

Field 09: Industrial Arts

INTRODUCTION

This study guide was designed specially for persons preparing to take the Georgia Teacher Certification Test (TCT) in Industrial Arts Education. The Industrial Arts Education Test was developed by the National Evaluation System, Inc., and educators in the state of Georgia. The test covers seven subareas: Drafting, Electrical, Graphics, Metal Fabrication, Power and Power Machines, Woodworking, and General.

This Study Guide has been organized by these subareas and follows the sequential order found within the published content objectives of the TCT in Industrial Arts Education. This Study Guide contains a listing of content objectives for each subarea with specific readings from current publications. In some cases, several objectives have been referenced to the same reading because those readings cover several topics. The references used are not a complete listing. The testee can option to add and/or delete references in preparation for the Teacher Certification Test.

In addition to the content objectives and readings that will follow, you should be aware that:

1. The TCT items are multiple choice with four possible answers.
2. There are no penalties for guessing when unsure of an answer.
3. While examinees are given 3-1/2 hours of actual test time, they
may request up to an additional hour if needed.

4. In order to pass the TCI one does not have to pass each subarea. Your total score is determined by the number of correct answers.

Examinees wanting specific help with test-taking skills should ask for assistance from their college/university counseling center and/or refer to one or more of the references listed below:


Georgia Teacher Certification Testing Program
Field 09: Industrial Arts Objectives and Suggested References

I. DRAFTING

Identify reasons why drawings are the universal language of industry.


Identify the different drafting tools by sight and description.


Identify examples of various types of drawings (oblique, isometric, orthographic, auxiliary, etc.)

- Oblique - pp. 533-534
- Isometric - p. 500
- Orthographic - pp. 11, 498
- Auxiliary - pp. 229, 233
- Perspective - pp. 9, 498, 543

- Oblique - pp. 257-260
- Isometric - pp. 246-256
- Orthographic - pp. 19, 21, 95, 96
- Auxiliary - pp. 145-157
- Perspective - pp. 260-268


Name the alphabet of lines.


Identify: parallel, perpendicular, rectangle, pentagon, octagon, and hexagon.
Understand the relationship of top, front, and side views.


Identify examples of various types of sectional views (full, half, removed, revolved).

- Full - p. 203
- Half - p. 210
- Removed - p. 212
- Revolved - p. 211
- Offset - p. 214
- Conventions - p. 215

- Full - p. 187
- Half - p. 188
- Removed - p. 192-193
- Revolved - pp. 192, 195-197
- Offset - pp. 187-188
- Conventions - pp. 184-197


Identify the purposes of an auxiliary view.


Identify dimensioning symbols and conventions.


Describe the basic procedures for drawing orthographic and pictorial drawings.

Understand tolerance and allowance on working drawings.


Identify principles of intersections and development.


Identify types of working drawings (detail, sub-assembly, assembly, etc).


- Detail - pp. 270-407
- Sub-Assembly - p. 422
- Installation - p. 422
- Working - pp. 271, 391


- Detail - pp. 228-230, 234
- Sub-Assembly pp. 230-233
- Combination - p. 230
- Working - pp. 114, 227-233


Identify the shop processes noted on drawings.

Identify common processes of reproducing drawings.

Reproductions - pp. 487-495


- Aperture Card - p. 294
- Blueprint - p. 291
- Dixo - pp. 291-292
- Electrostatic - pp. 292-293
- Microfilm - p. 294
- Photographic - p. 294
- Thermographic - pp. 293-294


Identify material symbols on drawings (wood, steel, concrete, etc.)


Understand the process of designing products:


Identify thread and fastener terminology and forms.


Identify framing components in wood construction (studs, rafters, plates, sills, headers, stops, joists, etc).

Frame Construction - pp. 169-176


Distinguish among the roles of engineer, architect, and draftsman.

*Drafting, Technology and Practice,* Spence, William P., Bennett
II. ELECTRICAL

Demonstrate an understanding of the principles of magnetism and the applications of these principles to useful devices.


Identify the types of magnets


Explain the operation of step-up and/or step-down transformers.


Understand the terminology and characteristics of static and current electricity.


Differentiate between potential and kinetic energy.


Identify ways of producing both AC and DC electric current.


Understand the ways in which water and steam are used to produce electricity.

*Power: Mechanics of Energy Control*, Bohn, Ralph and MacDonald,
Understand how electricity is transmitted and distributed.


Identify the social effects of electrical and electronic technological developments.


Identify basic electrical safety rules.


Identify various electrical measuring meters and the procedures for their safe use.


Understand the design of simple circuits using protective devices such as switches, outlets, sockets, etc.


Identify and explain the operation of circuit protective devices (e.g., fuse, circuit breaker, fusestat, ground fault interruption).


Identify safety precautions for electrical devices used in the home.

Energy and Transportation: Power, Geil, John J., Prentice-Hall,
Identify the purposes and contents of the National Electrical Code and what is covered by the code.


Identify the meaning of the UL label on an electrical device.


Understand the operation of protective devices used on motors.

Understand words and/or terms used in the electrical and electronics industry.


Identify the characteristics of the following circuits: parallel, series, open, closed, short.


Identify the basic physical effect that can be achieved through the application of electricity (heat, light, motion, chemical reaction).


Contrast various kinds of conductors in terms of material, size, capacity, and types of insulation.


*Introduction to Electricity*, Schick, Kurt, McGraw Hill, New York,
Read a schematic containing electrical and electronic symbols.


Identify various electronic components from descriptions of their functions.


Identify the value of resistors by interpreting their color code.


Identify the major characteristics and significant points of an AC sine wave (RMS, peak amplitude, maximum, minimum, frequency).


Identify the differences in AM and FM waves.


Understand FCC regulations governing transmission.

Analyze the effects of the development of solid state devices on the history of communications.


Analyze how the development of solid state devices has affected the electronics industries, especially those used for switching, power control, computers, and communications.


Identify the types of wire communication systems.


Understand the operation of the telephone receiver.


Identify the types, characteristics, and functions of electrical motors.


Identify some of the ways that photo control devices and circuits are used in industry.


List occupations in the electricity and electronics industries.


Solve problems based on Ohm's Law, Watt's Law, Joule's Law, and Kirchhoff's Law.


Identify the various ways in which electrical connections are made in electronics (e.g., solder-flux, splices, solderless connectors, lugs, post, clips, etc.).


Identify the various tools of the electric and electronics industries.


III. GRAPHICS

Indicate an understanding of the nomenclature of the common tools used in relief, offset, and screen printing.

Offset Printing - pp. 281-308.

Relief Printing - p. 9.
Screen Printing - p. 10.

Relief Printing - pp. 43-86.
Screen Printing - pp. 165-184.

Offset Printing - pp. 229-274.
Screen Printing - p. 184.


Compare lithographic, relief, and screen printing in terms of the processes used and final products.


Describe the processes used in carving and printing from a linoleum block.


Understand the uses of screen systems of printing (e.g., for athletic shirts, signs, posters, etc.).


Describe the grades and kinds of paper used in industry (writing paper, packaging paper, and newsprint).

Paper - pp. 484-489.

Paper - pp. 100-103.

Paper - pp. 277-278.
Identify the processes involved in paper manufacturing.


Identify various techniques for binding printed materials (books, pamphlets, periodicals, spirals, pads, etc.).


Identify employment opportunities in the printing industry, including with the Government Printing Office.

Careers - pp. 519-527.

Careers - pp. 21-27.


Careers - pp. 30-38.

Compare the characteristics and qualities of print and non-print communications media.


Identify applications of photographic principles within the graphic arts industries.


Understand the nomenclature and uses of basic darkroom equipment.


Identify some occupational opportunities associated with photography.


Distinguish among the following images: positive, negative, reverse, screened, continuous tone and line.

Continuous Tone - pp. 42-47.
Line - pp. 57-59.

Images - pp. 90-149.


Understand the chemistry of film processing and platemaking.
No references given.

Identify various occupations and their prerequisites in the graphic arts industries.

Careers - pp. 519-527.

Careers - pp. 21-27.

Careers - pp. 30-38.

Analyze various economic aspects of the graphic arts industries.
No references given.

Understand the copyright laws.
No references given.

IV. METAL FABRICATION

Identify basic metalworking tools and their uses.

Read micrometer and vernier scales.


Identify the various sheetmetal and wire gauge sizes and their relationship to stock sizes:


Identify the various types of metalworking files and the uses of each.


Identify the major uses of aluminum and the primary steps in its production.


- Uses of Aluminum - pp. 49-50, 57
- Aluminum Production - pp. 46-49

Identify the basic raw materials and processes used in the production of iron and steel.


- Materials and Processes - pp. 29-46

Identify several metalworking safety precautions.


- Personal Safety - pp. 23-28
Identify the names and uses of various sheetmetal tools and machines.


Identify the basic sheetmetal seams and joints and their applications.

Sheetmetal seams and joints - pp. 228-257


Differentiate between bolts and screws in terms of heads, threads, and uses.

Bolts and Screws - pp. 372-384
Thread Forms - pp. 355-372

Bolts and Screws - pp. 176-179
Thread Forms - pp. 144-145


Describe the use of tap and die sets in the production of various thread forms.


Compare hard soldering and brazing in terms of the different materials, temperatures, and procedures used for each.

Identify the basic welding processes (gas, MIG-TIG, arc, resistance) and their characteristics.

Welding - p. 288

Gas - p. 323
MIG-TIG - p. 324
Arc - pp. 323-324
Resistance - pp. 324, 328, 329

Gas - pp. 199-205
MIG-TIG - pp. 215-216
Arc - pp. 197-213
Resistance - pp. 214-215


Identify important safety measures in welding, brazing, and soldering.

Welding - Sec. 30-16
Brazing - Sec. 29
Soldering - Sec. 29.

Distinguish among the various types of heat treating and their products.

Annealing - p. 318
Hardening - pp. 316-317
Tempering - pp. 316-318
Normalizing - p. 319


Identify safety precautions for foundry, heat treating, and forging.

Identify foundry tools and the processes of sand casting.


- Tools - pp. 272-275
- Processes - pp. 266-272


Describe hot and cold forging, and the physical property change resulting from each.


Identify the basic operations performed in milling, turning, drilling, shaping, grinding, or sawing metals.


- Milling - pp. 453-490
- Turning - pp. 413-449
- Drilling - pp. 386-402
- Shaping - pp. 491-496
- Grinding - pp. 497-514
- Sawing - pp. 373-385

Identify safety precautions for using a metal lathe, shaper, mill, drill press, grinder, or metal spinning lathe.


- Lathe Safety - pp. 417, 424, 442
- Shaper Safety - pp. 490-495
- Mill Safety - pp. 459, 460, 479
- Drill Press Safety - pp. 395, 399, 401, 410
- Grinder Safety - pp. 340, 342, 343, 506, 508
- Spinning Lathe Safety - pp. 253-255
- Saw Safety - pp. 378-379
Understand the systems by which drills are sized (letter, decimal, number, fraction, metric).


Identify the processes and industrial applications of metal spinning.


Describe various methods of finishing metals to provide a protective and attractive appearance.


Identify various steps in the manufacture and assembly of a mass-produced product.

Identify occupations in the metalworking industry (professional, technical, skilled, unskilled, sales).


Occupations - pp. 2-16
Analyze the relationship between the development of metal technology and civilization:


V. POWER AND POWER MACHINES

Identify the principle land, sea, and air transportation industries.


*Power: Mechanics of Energy Control, Bohn, Ralph G. and Angus J. MacDonald, McKnight and McKnight, Bloomington, Illinois, pp. 243-248*

Identify major present or potential uses of electricity in the transportation industry.

*Power: Mechanics of Energy Control, Bohn, Ralph C., and Angus J. MacDonald, McKnight and McKnight, Bloomington, Illinois, pp. 240-245*


Understand how solar energy is used to produce electricity.


Identify major sources of power and at least one device using each.


Identify how water is used as an energy source.


Identify the "simple" machines and give an example of a use for each.


Simple Machines - pp. 53-85, 89-93


Early Power Sources - pp. 19-24

Compare the operation of two and four-cycle engines.


Two Cycle - p. 198

Four Cycle - p. 197


Two Cycle - p. 176

Four Cycle - p. 175

Identify the major differences between the gasoline engine and the diesel engine.


Analyze the fuel systems of typical small four and two-cycle engines.


Identify the parts on diagram of the typical 8-cylinder engine ignition system.


Understand the octane ratings, additives, and uses of gasoline.


Understand the designations of oil weights, grades, additives, and uses.


Analyze the economic and social impact of the petroleum industry.


Explain the differences in the operational principles of rocket, jet and turbine engines.

*Power: Mechanics of Energy Control, Bohn, Ralph and MacDonald, McKnight and McKnight, Bloomington, Illinois, 1970*
  - Rocket - pp. 183, 184, 230
  - Jet - pp. 180, 181
  - Turbine - pp. 124, 170, 173, 182


  - Turbine - pp. 6, 12, 167-171

  - Rocket - pp. 151-160
  - Jet - pp. 127-144
  - Turbine - pp. 145-150

Explain how gas, water, and steam turbines work.


*Power: Mechanics of Energy Control, Bohn, Ralph and MacDonald, McKnight and McKnight, Bloomington, Illinois, 1970.*
  - Gas Turbine - p. 182
  - Water Turbine - pp. 12, 161, 168
  - Steam Turbine - pp. 170, 173

  - Steam Turbine - pp. 7, 167-171

  - Gas Turbine - pp. 145-150
  - Steam Turbine - pp. 195-196

Explain the operation of a hydraulic system capable of raising an object.
Demonstrate a knowledge of how engine power is rated.

Identify the parts of AC and DC motors and explain the operation of each.

Explain how an automobile storage battery produces electricity.

Explain how magnetos, auto generators, and alternators function.


Exploring Power Technology: Basic Fundamentals, Walker, John,

Magneto - p. 84
Generator - p. 89, 161, 215
Alternator - p. 162

Explain the theory of electron flow.


VI. WOODWORKING

Describe the processes of sharpening, adjusting, and cleaning woodworking tools.


Entire book


Describe a finished bill of materials and stock cutting list.


Solve problems concerning board feet.

Identify different layout tools and their uses.


Describe the process of squaring stock.


Identify methods of enlarging and transferring designs on wood and other materials.


Identify woodworking hand tools used for specific types of cutting operations.


Compare the process of crosscutting and ripping stock.

Modern Wood Technology, Hacket, Donald F., and Patrick E. Spielman,
Identify the various sawing operations and safety rules for the use of power sawing equipment.


Identify the tools, machines, and processes for cutting irregular pieces.


Describe the various planning, joining, shaping, turning and routing operations and the rules for the safe use of hand tools and machine tools when performing each.


Differentiate among chamfers, bevels, tapers, and the methods for laying out and cutting each.

Identify the various sanding, drilling, boring, and mortising operations, and the rules for the safe use of power machines and hand tools for each operation.

- Sanding - pp. 312, 340, 398, 409, 415, 419-421
- Drilling - pp. 239-241, 298-312, 362
- Boring - pp. 239-241, 304-310
- Mortising - pp. 24, 129-130, 139, 311, 316-320, 349


- Sanding - pp. 68, 126, 130-132, 153, 159, 165-167, 169, 170, 201, 203
- Drilling - pp. 65-67, 124, 127-132, 392
- Boring - pp. 65-67, 127-129
- Mortising - pp. 129, 133-136

- Sanding - p. 142
- Drilling - pp. 97, 150-157
- Boring - pp. 63-65, 96, 97
- Mortising - pp. 23, 77, 93, 94, 136, 137
Identify major wood joints and their uses.


Identify processes involved in the production of plywood, veneer, and laminated wood.


Compare plywood, lumber, particle board, masonite, and celotex in terms of their structural properties.


Identify processes used in the application of plastic laminates to plywood, solid wood, or hard-board.


Identify tools, machines and materials used in preparing wood surfaces for finishing.

Identify how the following finishes are selected and applied: varnish, lacquer, bleaches, shellac, enamel, paint, and stains.


Identify materials and tools (hand and power) used for wood fastening.


Analyze how forest conservation benefits mankind.


Identify the common processes used for producing lumber (sawing, planing, grading, and drying).

Identify the ways in which wood and wood products are used in housing construction.


Identify popular types of house framing built over foundation walls.


Distinguish between pre-cut and pre-fabricated building construction.


Identify occupational roles in the administration and operation of the construction industry.


Identify lumbering and sawmill occupations.


VII. GENERAL

Compare mass and custom production in terms of the economic advantages and disadvantages of each.
Identify essential aspects of the free enterprise system.


Identify the functions of the following occupational areas in industry: production design, quality control, safety engineering, plant layout, tooling, accounting, and office and clerical work.


Identify the functions of the following roles in the construction industry: architect, contractor, civil engineer, skilled tradesman, realtor, clerk, and materials supplier.


Analyze the role of labor and labor unions in American history.


Identify current and projected future employment opportunities in the wood products industry.
