CURRICULUM GUIDE

Junior High School Industrial Arts

Interim Edition

Vocational Education Section
EDUCATION DIVISION
Northern Administration Branch
Department of Northern Affairs
and National Resources
OTTAWA
1963

FOREWORD

The development of this interim curriculum guide for Industrial Arts, Grades VII, VIII and IX, marks another milestone in the construction of a distinctive educational program for pupils in northern Canadian schools. The value and importance of Industrial Arts as an integral and essential part of general education is particularly apparent in the north, where the advancement toward modern technology has been extremely rapid.

The invaluable and irreplaceable experience of people who have first-hand knowledge of the Territorial setting, and especially that of teachers, has been utilized in an effort to infuse the program with authenticity, and to assure that the specific and unique needs of northern students are being adequately satisfied. Much credit should be given to these people for their creative work in the face of many difficulties involving vast distances and isolation.

The first classroom experiment on this course of studies will take place in Grades VII and VIII during the school year 1963-64. It will be extended to Grade IX in 1964-65. At the end of this period, there will be a major assessment, evaluation and revision. To make this ambitious program possible, the continued co-operation of all of the staff is essential. Teachers and superintendents are earnestly requested to use this booklet as a notebook for suggestions and criticisms that will assist in future revisions and developments.

B. Thorsteinsson

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INTRODUCTION

> Our educational system is stifled by the Victorian notion that a technical education and a liberal one are opposite. Science and technology, imaginatively taught, are the humanities. We must get rid of the narrow approach which treats them as isolated fields of knowledge.[1]

The tendency toward specific training in vocational education mandates that the position of industrial arts as an integral part of a liberal education should be re-emphasized.

In his "Aims of Education" Alfred North Whitehead says:

> There can be no adequate technical education which is not liberal and no liberal education which is not technical. That is, there is no education which does not impart both technique and intellectual vision . . . . . The problem of education is to retain the dominant emphasis, whether literary, scientific, or technical, and without loss of co-ordination, to infuse into each way of education something of the other two.[2]

All subjects in industrial arts should be taught primarily as culture, that is to say they should include the following factors:

1. A technique or a way of doing.
2. A science or a body of principles and facts.
3. Adequate scope for intellectual, aesthetic and social growth in the pupil.

This course of studies should offer a tremendous challenge to teachers to meet the demands inherent in the above approach. The technique aspect of the subjects should be treated with great respect and every effort should be made to

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[1] Dowliny, H.M., "Science and Culture A False Antithesis", Panorama Spring 1962, Page 5.

[2] Whitehead A.N. "The Aims of Education" (Mentor Books) Pages 58, 64.

apply good, practical, and up-to-date trade techniques to all operations performed in our shops. Fundamentally, industrial arts is a "doing subject" and must always be taught as such.

Industrial arts is very valuable as a vehicle of vocational exploration. Pursuit of this aim tends to cause the subject offerings to be so large in number as to reduce their effectiveness. To attempt to combat this tendency, a core of drafting and transportation has been used, and the more usual industrial arts subjects, wood, metal and electricity have been built around this core. Time allotments, of necessity, were rather arbitrary, however, all decisions were based on a great deal of discussion with teachers in the field and with various responsible supervisory officers.

To adequately teach the subjects outlined in this course certain equipment is absolutely necessary. This will be particularly apparent in the transportation course. If this equipment is not available, the course should not be attempted.

GENERAL OBJECTIVES

1. To develop elementary skills in the use of tools and materials.
2. To demonstrate the integration of other school subjects. For example, science, mathematics, and English.
3. To develop the ability to read and understand mechanical and architectural drafting.
4. To develop the ability to express ideas on paper by means of drawing.
5. To develop a pride in workmanship which leads to self-confidence and an appreciation of aesthetic values in consumer living.
6. To develop the ability to work with a minimum amount of direct supervision, thus encouraging initiative and creative ability.
7. To develop the ability to carry a project through all of its stages from conception to actuality in a well-ordered carefully executed manner.
8. To broaden the real experiences of the pupil to include some of the industrial fields.
9. To provide an opportunity for the application of the scientific method to the discovering and enunciation of principles.
10. To provide a practical application of principles already known.
11. To expose the students to some of the vocational fields available in Canada.
12. To assist the pupil to appreciate the work of others in a co-operative situation.
13. To develop an attitude of readiness to assist others when they need help and to join in group undertakings.

PROGRAM ORGANIZATION

Starting from the premise that industrial arts in the Junior High School is basically an exploratory subject this course outline has been written in a series of subject-grade units:

Transportation	-	Grades VII, VIII, IX
Drafting	-	Grades VII, VIII, IX
Woodwork	-	Grades VII, VIII, IX
Metalwork	-	Grades VIII and IX
Electricity	-	Grade IX

Note: Grade VII and VIII units are fixed. In grade IX there is one choice open to the teacher; only two of metalwork, woodwork, and electricity may be offered but not all three.

The chart shows the subject grade time distribution based on:

4 PERIODS OF APPROXIMATELY 45 MINUTES PER WEEK

40 WEEKS PER YEAR

SUBJECT	VII	VIII	IX
Transportation	15 weeks	10 weeks	10 weeks
Drafting	15 weeks	10 weeks	10 weeks
Woodwork	10 weeks	10 weeks	10 weeks)
Metalwork		10 weeks	10 weeks) 2 only
Electricity			10 weeks)

SAFETY

Every shop must have an effective safety program. This does not mean merely that the promulgation of a set of rules and regulations will satisfy this end. Students must be taught, in each and every subject studied within the industrial arts framework, the "how's and why's" inherent in the safety program. Dress and deportment play an important part in the operation of a safe shop program. Students and instructor should be neatly dressed at all times and the instructor should take care to ensure that no loose and dangerous clothing is worn. Safety aprons, goggles and gloves should be used wherever necessary. It is the responsibility of the instructor to supply continuous and vigilant supervision and to ensure that all students engage in only safe shop practices. A good safety program would include:

1. regular and thorough instruction and revision
2. constant vigilance
3. checking and evaluation by the instructor
4. complete first aid equipment kept in first-class condition
5. non-skid paint and clearly marked working areas around all machinery
6. proper clothing with particular attention to eye protection
7. machines and tools in good working condition
8. routine reporting of all accidents and an adequate system of record keeping This record of accidents, cause and treatment given, is extremely important for two reasons:
   1. To indicate recurrent accident patterns so that they can be remedied
   2. In case of suit for liability
9. good housekeeping

The following is a sample of safety regulations which the instructor might be expected to enforce:

1. No power machines shall be used by any student before specific instruction has been given with regard to safe operation and safety precautions.
2. No power machine shall be used by any student without the specific permission of the instructor each time the machine is used.
3. No power machine shall be used while the instructor is absent from the shop.
4. Safety guards must be in place on all power machinery.
5. Approved eye protection must be worn for certain operations.

NOTE A good safety slogan which should be put into practice at all times - "A place for everything and everything in its place."

There are five basic steps in safety education:

1. Set a good safety example for students.
2. Instruct each student thoroughly in the safety precautions of his job. Check lists for power machinery.
3. Keep all tools sharp and in good condition, older students will assist in maintenance of tools.
4. Keep all safety devices in proper use.
5. Follow up safety instructions constantly. The shop will be as safe as the instructor makes it.

It should be pointed out that failure to comply with every reasonable safety precaution, may jeopardize the instructor's position in any claim for compensation. Each school should receive the excellent publications and bulletins dealing with accident prevention and safety procedures distributed by the Workman's Compensation Board.

CLASS SIZE

In an industrial arts shop, where there may be more than one activity in progress simultaneously, adequate class supervision is essential to an effective, safe, program. It is considered that 12 to 15 students would be an optimum size of class with 20 students as the maximum. When the class size exceeds 20 students, the risk of accidents and the inadequacy of supervision increase to a point where the teaching situation is no longer satisfactory. The recommendation applies only to shops of at least 1400 square feet.

EVALUATION

STUDENT ACHIEVEMENT EVALUATION

A good testing program is essential to good teaching. Every teacher is expected to use established testing techniques as a diagnostic aid to effective teaching as well as an evaluation device administered at the end of each unit of instruction. To obtain maximum benefit from this testing program, an adequate system of recording marks and of action taken as a result of these marks, should be established.

Project Evaluation

In choosing and evaluating projects for use in the industrial arts program, we should endeavour to keep in mind the basic principles of education and psychology. It has been shown that Grade VII and VIII students have relatively short interest spans. We should, therefore, avoid projects which require many weeks to complete. The maturation level of some students will place limits on the standard of workmanship to which they may aspire. A general guide could be that standards should be as high as possibly attainable for each student. Every project constructed in the shop should contribute to the realization of some of the general objectives of industrial arts. These projects should be of interest to the pupil and should possess a degree of aesthetic and utilitarian value with reasonable economic feasibility.

It is essential that projects be chosen carefully and that a rating scale be established which should endeavour to be as objective as possible.

Students should be encouraged wherever practicable to evaluate their own work and to compare and discuss this evaluation with that of the teacher. A sample score sheet is shown.

Centre Punch

Operation	Possible Score	Your Score	Teacher's Score
1. Design or Drawing			
2. Turn to Size			
3. Knurling			
4. Taper			
5. Grinding			
6. Heat Treatment			
7. Finish			
Total	100		

COURSE OUTLINES

1. TRANSPORTATION

GRADES VII, VIII AND IX

Introduction

There is a growing awareness of the importance of vocational education for today's rapidly changing world of work. With this awareness, comes a discontent with some industrial arts programs now being offered in some schools. These programs were designed, and were suitable for the 1860's. They are not adapted to today's conditions.

Nowhere is the rapid rate of change quite as evident as in transportation in the north where we have bridged the gap from dog team to aircraft in a very few years. In the north transportation is of paramount importance, as indeed it is in the south where it is estimated that 50¢ of each consumer dollar is spent on distribution of goods.

As industrial arts teachers we must make every effort to accept our responsibility to familiarize our students with today's industrial problems, and, to this end, this interim course outline has been prepared. The basic objective is to give the student a much broader view of the applications of different types of sources of power than is possible in the normal course in Motor Mechanics.

The course must be oriented toward life-size equipment wherever possible. There should be no tendency to carry the model building approach of the Grade VII and VIII air transport unit beyond the stage where the educational values start to decline and the hobby values increase. Please note there is no implication that anyone should suppress hobbies, but rather that they should be carried on as extra-curricular activities.

It is understood that perhaps not all of the topics will be suitable for the particular situations encountered in the north, for example, in a community which has never seen a bicycle, it would be unnecessary to teach the first unit in the Grade VII course outline, nevertheless the principles involved may be taught using another basic example. We must keep this course within the realm of the experiences, vicarious or otherwise, of our students.

Any course in any subject is only as good as the teacher teaching it. This brief outline has been prepared as a starting point for the development of a curriculum in what we believe to be a vitally important field which should be covered by a good industrial arts program.

TRANSPORTATION

GRADE VII — 15 WEEKS

Skills and Processes	Related Knowledge
The Bicycle	
1. The Bicycle as a Machine	Pulleys and gear ratio What is work? Horse power versus boy power Crankshaft principle Note - boy is integral part of the machine Most efficient way of using body, easiest way to lift objects Steel and Alloy Frames (strength, lightness and durability) Application of simple machines Two or three speed transmission
2. Operational Maintenance	
(a) Change tire - Repair puncture	Pneumatic pressure - air as a cushion Springs - saddle, valves and bicycle pumps
(b) Line up wheels Principle of Castor angle Gyroscopic effect of rotating wheels Replace spokes	Discuss adequate wheel bearings, axle, spindle lubrication
(c) Adjust chain tension Adjust chain length Add links	Discuss lubrication and twisting force (Torque) on back wheel Gear Ratio
(d) Adjust saddle height	Efficiency at various heights of saddle
(e) Adjust handlebars	"C" wrench and cones
(f) Brakes - Adjustment Replacement of brake blocks	Cable brakes and cone brakes Safety - cables, levers, lubrication
(g) Lights	Law with regard to bicycles

GRADE VII (cont'd.) — 15 WEEKS

Skills and Processes	Related Knowledge
The Aircraft	
	Importance of air transportation
(a) Building of rubber driven aircraft - using kits	Names of component parts of aircraft Principle of "Lift" - Simple aerodynamics - propellers variable pitch Wing design - classification of the design
Accurate cutting and fitting Finishing Use of Ex Acto knife	Names, functions and location of main parts fuselage, wing and tail assembly Purpose of components, wing ribs, longerons, strutts, spars
Boats	
If possible build and sail model sail boats	Names of component parts of boats Buoyancy, streamlines, stability, keels, sails Man's use of wind as source of power, windmills and wells, pumps, etc. Types of Hull construction, brass fittings and screws Marine glue and plywood, fibre glass, aluminum, frame and canvas
Make models of water wheels and use them to drive some small mechanical gadgets	The use of wind as a primary source of power could lead very easily to turbine theory and from there to water turbines and an introductory lesson on Jet Engines - Experiments on water wheel turbines showing importance of angle of blade and velocity of the water striking the blade

Due to limitations of time it may be desirable to divide the class into two groups: one working on aircraft, the other on boats.

GRADE VIII — 10 WEEKS

Skills and Processes	Related Knowledge
Work on small single cylinder air cooled engines - e.g. pumps, garden tillers, winches Skidoo	Principles of internal combustion engine - two stroke cycle and four stroke cycle Changing reciprocating motion to circular motion - crank shaft connecting rod principle. Principle of cooling system Basic service procedure - oil and gas Lubrication - cleanliness Use of manuals
Construction of aircraft flying models Flight controls - control column and rudder bar Home made wind tunnel	Much more detailed reading of drawings Development of assembly skill Use of instruction manuals Effect of velocity and area on lift Streamline flow Demonstration of the development of a lifting surface using Venturi tube principle. "Glow Type" model engine
The extension of grade VII course in turbines	Study of filmstrips and charts Principles of turbo-generator Not details of generator, but principle of change of energy forms e.g. potential and kinetic energy from water to mechanical to electrical to heat Chemical to electrical Conservation of energy
Boats	
Use of model engines of various types in model boats. Familiarity with live outboards. Basic service : gas, oil, lubrication, adjustments	Use of manuals How to prepare for winter storage What to do if the engine is submerged. N.B. This is a very important unit in the north and should be suitably emphasized.

GRADE IX — 10 WEEKS

Skills and Processes	Related Knowledge
1. Automobile Engines	
(a) Study of carburetion system	Trace fuel system Pressure vacuum Venturi-compare with principle of airfoil
(b) Lubrication system	Pressure lubrication system Splash types of rotary pumps
(c) Cooling system Flushing	Radiators - transfer of heat - refrigeration Anti-freeze Air cooled-fins - cleanliness Area exposed
(d) Valve operation Adjustments	Use of cams and springs Tappets
(e) Electrical service	Battery, coil ignition, generator, Alternator and starter Magneto ignition system Regulators
Applications to:	
(a) Power Plants	Compare diesel cycle - simple explanation of similarities and differences between diesel and four stroke cycle
(b) Automobiles	
(c) Aircraft - Note differences e.g. cooling system, carburetion	Points of similarity and difference
(d) Ships and boats	
2. Extension of knowledge in outboards	Examination of gearing in lower unit More extensive servicing - decarbonizing, - adjustments - carburetors and ignition Principle of the magneto Cooling systems
3. Transmission of Power	Gear box, clutch, universal joints, two of them, rear axle
(a) Applied to Autos	Automatic transmission

GRADE IX (cont'd.) — 10 WEEKS

Skills and Processes	Related Knowledge
(b) Outboards	Lower unit, gear shift, clutch, shear pin
4. Aircraft Theory	
(a) Calculate air speed and ground speed	Plot a simple course - magnetic compass Simple rules of air
(b) Study of instruments found in small aircraft	Altimeter, airspeed indicator, turn and bank indicator Radio procedure Fuel gauge Oil pressure gauge Thermometer Tachometer
Jet Engines	Very simple explanation of principles of jet engines and rockets
Applications: in model aircraft, and boats.	

TRANSPORTATION

SUGGESTED REFERENCE BOOKS

Bradley, Cliff Building the Small Boat Collier-Macmillan $5.50

Burns, W.A. Man and His Tools McGraw-Hill $3.75

Colby, C.B. The Earthmovers Coward-McCann (Longmans) $3.00

Frazee, Irving and others Tractors and Crawlers American Technical Society (General Pub. Co.) $9.00

Halacy, D.S. Fun with the Sun Collier-Macmillan $3.25

Heitner, J. Automotive Mechanics Van Nostrand $6.00

Morgan, A. The Boy's Book of Engines, Motors and Turbines S.J. Reginald Saunders $4.25

Purvis, Jud All About Small Gas Engines Goodheart-Willcox (General Pub. Co.) $5.50

Shaw, M.M. Bush Pilots Clarke, Irwin $3.00

Staff of "Flight" Flight Handbook Iliffe (British Book Service) $5.50

Throm, E.L. The Boy Engineer Musson $5.00

Veale, Sidney E. How Planes Fly Penguin $0.75

Venk, Ernest Complete Outboard Boating Manual American Technical Society (General Pub. Co.) $6.00

H.T. Glenn Exploratory Power Mechanics and Work Book Chas. A. Bennett Co., Inc. Peoria, Ill.

TRANSPORTATION

LIST OF REFERENCE MATERIALS AVAILABLE

ACADEMY OF MODEL AERONAUTICS
1025 Connecticut Avenue, N.W., Washington, D.C.
Model Airplane Club and Charter Manual

AEROSPACE INDUSTRIES ASSOCIATION
610 Shoreham Bldg., Washington 5, D.C.

AIRCRAFT INDUSTRIAL ASSOCIATION (Public Relations Dept.)
601 Shoreham Building, Washington 5, D.C.
Career Opportunities in the Aircraft Industry
Planes - Monthly Magazine of Aircraft Facts and Statistics
Plane Views - A Booklet of Cartoon Drawings and Explanation of Facts about Aircraft Manufacturing and Aviation
Speeds and Altitudes - Three color chart
Shape of Flight - Three color chart
Space and Man - Three color chart
Missiles - Three color chart
Around the World in 48 Hours - Three color chart
America Takes the Sky Road - Three color chart
Aeronautical Power Plants - Three color chart

AMERICAN ROCKET SOCIETY, INC.
500 Fifth Avenue, New York 36, N.Y.
Resource materials

BEECH AIRCRAFT CORPORATION
Wichita 1, Kansas
Beechcrafter (Periodical)
Pictures of Planes
Beechcrafts - 1958 - Chart Picturing Aircraft and Specifications

BELL HELICOPTER CORP.
P.O. Box 482, Fort Worth 1, Texas
1957 Review (Pictorial Report)

CESSNA AIRCRAFT CO.
P.O. Box 1521, Wichita, Kansas
Aviation Growth for the Next Twenty Years (Summary of Forecast on the Growth of General Aviation)
The New Cessna 310 B
Commercial and Military Aircraft
Chart: Cessna 172

CIVIL AIR PATROL HEADQUARTERS, U.S. AIR FORCE
Bolling Air Force Base, Washington 25, D.C.
Ellington Air Force Base, Texas

Bibliography. A selected and annotated bibliography of current air age and space age books.

CAP Pamphlet No. 5. The Record. The History and Mission of Civil Air Patrol.

CAP Pamphlet No. 1. Questions and answers about Civil Air Patrol Cadets. Explains CAP's Cadet program.

CAP Pamphlet No. 2. Questions and answers about Civil Air Patrol. Explains the organizations and activities of Civil Air Patrol especially as they relate to Senior Members.

CAP Pamphlet No. 3. The Eagle's Nest. Describes CAP's Youth Aviation Program.

CAP Leaflet No. 5. Facts about Civil Air Patrol. A Fact Sheet on CAP.

CAP Leaflet No. 13. Aviation Education and Your High School. A statement on how aviation education can contribute to the secondary school curricula.

CAP Pamphlet No. 12 Aviation Education Defined. A series of definitions or interpretations of aviation education made by leaders in aviation education, state departments of education, etc.

CAP Pamphlet No. 21. The Teaching Learning Process. Teaching methods based on the Nature of the Learning Process. Illustrated with cartoon-type drawings.

DOUGLAS AIRCRAFT COMPANY, INC.
Advertising Film Services, Attn: D.D. Barkell, A 20-G-183,
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Resource Materials.

GENERAL ELECTRIC CO. (PROMOTION AND PUBLICITY)
Building 100, Aircraft Gas Turbine Division, Cincinnati 15, Ohio

Adventure in Jet Power (Comic Booklet)
Jet Facts
Jet Horizons
Jet Power (History of jet engine progress)
Pictures of Planes

GENERAL MOTORS CORPORATION (PUBLIC RELATIONS STAFF)
Detroit 2, Michigan, and/or Warren, Michigan

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Short Stories of Science and Invention (Request must be sent on school stationery.) A collection of short stories of famous inventions. A number of these apply to aviation.

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A power Primer (Request must be sent on school stationery.) An illustrated booklet on Automobile, Diesel, and Aircraft Engines.

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(EDUCATIONAL SERVICES BRANCH)
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Echo
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Pioneer V
Projects Mercury and Apollo
The Space of Astronaut Shepard and the Freedom Seven
The Flight of Astronaut Grissom and the Liberty Bell 7
NASA Facts, an educational service publication for distribution to teachers, and to news media editors and others. These fact sheets are issued whenever appropriate, prior to or soon after, a significant launching.

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1025 Connecticut Avenue, N.W., Washington 6, D.C.

Jets. (50 cents) How jets are built, how they operate, and aircraft speed records. Illustrated. For intermediate and upper grades.
Helicopters. (50 cents) How helicopters operate and their many uses. Illustrated. For intermediate and upper grades.
Aircraft Number 116. (50 cents) The aircraft plant and its many kinds of workers are described in this story of the building of an airplane. Suitable guidance material. For intermediate and upper grades.
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Mathematics Teaching Aids for a Stronger America. (75 cents) Resource unit for enriching secondary school mathematics courses with aviation facts and principles.
The Space Frontier (with astronautics glossary). (25 cents) Gives excellent concepts of space and describes problems of space exploration. Clear, colorful chart and photographs illustrate the text. The glossary includes over 200 astronautical terms.
Teachers' Kit of Aviation Materials. Includes pictures, booklets, pamphlets, charts, maps and other up-to-date aviation information for the bulletin board and to supplement textbook materials.

SMITHSONIAN INSTITUTION (DISTRIBUTION SECTION)
Editorial and Publication Division, Washington 25, D.C.

Monographs on Lindbergh, Langley

Masters of the Air. (50 cents) Highlights of man's conquest of flight. Stories of a number of famous aircraft in the National Aeronautical Collection and biographies of pioneers of aviation. Activities for students to pursue as individuals or in groups.

Adventures in Science at the Smithsonian. (25 cents) A colorful booklet about a few of civilization's scientific milestones and how the Smithsonian Institution has contributed to the advancement of science. The last three sections deal with aviation and space exploration.

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c/o Willis C. Brown, Specialist for Aviation Education, Washington 25, D.C.
If We Are to Ride in 'Copters'
How to Develop a Teaching Unit on Rockets and Space Travel

U.S.A.F. RECRUITING OFFICE, U.S.A.F. RECRUITING DETACHMENT NO. 101
135-03 Roosevelt Avenue, Flushing, New York
Pocket Guide to Air Force Opportunities
The Training of an Air Force Navigator
The Training of an Air Force Pilot
Aviation Cadet Program
Occupational Handbook.

DRAFTING

GRADES VII, VIII AND IX

Introduction

Drafting or technical drawing has been referred to as "the language of industry". Our civilization is so highly industrialized that the ability to interpret a drawing is almost as much a requirement of an educated person as the ability to read. Because of its universal nature, drafting spans ordinary language barriers with ease. For example, an engine lathe operator in India, who speaks no English, can produce a machine part, designed and drawn in the United States, and construction workers can translate architects' dreams into building realities.

Almost everything we use today has passed through a design and drawing stage before manufacture. This is an essential and very important step in any industrial process. The importance of this step can be translated into dollar values if we consider the immense saving which will result if a faulty design is corrected on the drawing board rather than after a production line has been set up, and possibly thousands of faulty and useless parts produced. Making a series of working drawings ensures that detailed planning of every step has been carried out.

Drafting contributes to the liberal educational growth of the student through its requirements of careful planning, meticulous attention to detail and complete accuracy in the use of measuring devices and instruments.

It is essential that before projects are built in the shop a working sketch or drawing be made. These drawings are not necessarily done during the time allotted to drafting. (This planning is a suitable subject area for home-work assignments, particularly in Grades VIII and IX.) Drafting can and should

be made an interesting and enjoyable experience for students at any level.

The following outline should be used as a guide and is not intended to be completely comprehensive. The individual teacher must always feel free to adapt the course to fit the particular local needs of his community. He should, however, clear any major changes with the Superintendent of Vocational Education.

Note: Speed is an essential attribute of the skilled worker in any field. Therefore, very soon after the student has become familiar with the use of the instruments, speed combined with accuracy should be stressed.

JUNIOR HIGH SCHOOL

DRAFTING

GRADE VII — 15 WEEKS

Note

Drafting may be considered as a subject having two distinct parts. The first is the mental gymnastics required to visualize and understand the various conventions and concepts used in the field. The second is the acquisition of the considerable manipulative skill required to produce an acceptable finished drawing. It is the prime purpose of this course in Grades VII, VIII and IX to teach the conceptual aspect of drafting. This should not be taken as license to accept poor draftsmanship, but as a plea to take the emphasis from the purely manipulative skills of, for example, lettering, and place it on comprehension.

PART I — 6 WEEKS

Skills and Processes	Related Theory
1. Given pictorial view of object - construct the object (Approximately ten examples See pages 30a and 30b)	Use squared paper Reading of sizes and transferring from the sizes given to the development of the object Squares should be used as unit of measurement Note: Use only pencil and straight edge as drafting aids
2. From some of the simple objects constructed draw three views (Approximately six examples.)	Introduction of top view, front view and end view Relationships should be pointed out, but the position of each view on the sheet is unimportant
3. Given three views for object (Approximately ten examples)	The views are placed in the usual 3rd angle projection positions Students now must understand which views will give him which sizes Consequently he will quickly associate the views with each other and with the concrete object
4. Practise in constructing objects from Isometric (when three views will also be drawn) and orthographic projection Add the names of the views	Increase complexity of the problems given until the student is quite familiar with this work Introduce hidden lines Introduce foreshortening caused by sloping lines When competence at this level is apparent change the unit of measurement from squares to inches
5. Practise lettering	Vertical capitals 1/4" and 1/8" high Emphasize stroke sequence of each letter and number, and correct spacing

Note In 1, 3 and 4 above the student actually constructs the objects by drawing a development, cutting out and folding square paper. This is essential to teach the relationship between conceptual and concrete objects. The teacher is expected to design his own job and assignment sheets. A few examples have been included for guidance.

PART II — 9 WEEKS

Skills and Processes	Related Knowledge
Introduction to Drawing Board	All drawings must have a margin and suitable title block Types of line required
1. Draw three views of given blocks - start with rectangular prism	Cut blocks of graded difficulty can be given to drive home principles of orthographic projection 1. Broken lines 2. Sloping surface
Cut Blocks	Teaching aids should be made by the teacher for almost all of these blocks so that the student is aided in relating what is on the drawing board to a concrete object
2. Construct a working drawing of a simple shop project	If possible this should be full scale although better classes could handle a scaled drawing

DRAFTING

GRADE VIII — 10 WEEKS

Skills and Processes	Related Knowledge
Review of Grade VII accomplished by one or two sheets	Improve the standard of accuracy required and the general appearance of the finished drawing, e.g. lettering spacing, line weight, dimensioning
1. Introduce sections Sectional elevations	It is essential to have constructed teaching aids at this stage Technical manuals can be used to illustrate sections and partial sections Reasons for sections Sectioning different material e.g. Wood, steel, cast iron, concrete
2. Introduction to curved and circular work	Simple tangency Circle and straight line
3. More difficult visualization using cut blocks as examples	
Introduce Isometric views Straight lines	Use isometric paper at first
4. Working drawing of a simple project to be built in the shop	Scale drawing - discuss various scales 1/2, 1/4, 1/8 Architects' and engineers' scales

DRAFTING

GRADE IX — 10 WEEKS

Skills and Processes	Related Knowledge
Revision of Grade VII and VIII work	More difficult examples
1. Developments:	
(a) straight line	Development of square, triangular and hexagonal prisms
(b) true shape of sloping surfaces	Development of cylinders
(c) radial line	Development of pyramids and cone Principle of triangulation
2. Machine drawing of a simple familiar machine part, including problems in tangency	Make an assembly from an actual part used in one of the shop subjects, students may work in small teams on different parts in the initial stages
	Arc to arc tangency problems
	Study of blueprints
	Introduction Canadian Association Standards
	Students should take measurements and make a technical sketch, from the actual machine part before making the finished drawing
3. Isometric circles and arcs	
4. Study of building plans	How to make a floor plan - introduction to building standards and conventions, e.g. windows, doors, stairways, fittings etc.
Make a simple floor plan	
512 huts or low cost housing	See local engineers for sample plans
	Architect's scale

DRAFTING

SUGGESTED REFERENCE BOOKS

Berg, Edward Mechanical Drawing Bruce (Ryerson) $4.00

Coover, S.L. Industrial Arts Drawing and Blueprint Reading McGraw-Hill $4.80

French, Thomas E. and Carl L. Svensen Mechanical Drawing 6th ed. McGraw-Hill $7.50

Giesecke, F.E. and others Technical Drawing Collier-Macmillan $10.00

Grant, H.E. Engineering Drawing McGraw-Hill $10.25

Jensen, C.H. and F.H.S. Mason Drafting Fundamentals McGraw-Hill $2.60

McCabe, F.T. and others Mechanical Drafting Essentials 3rd ed. Prentice-Hall $5.25

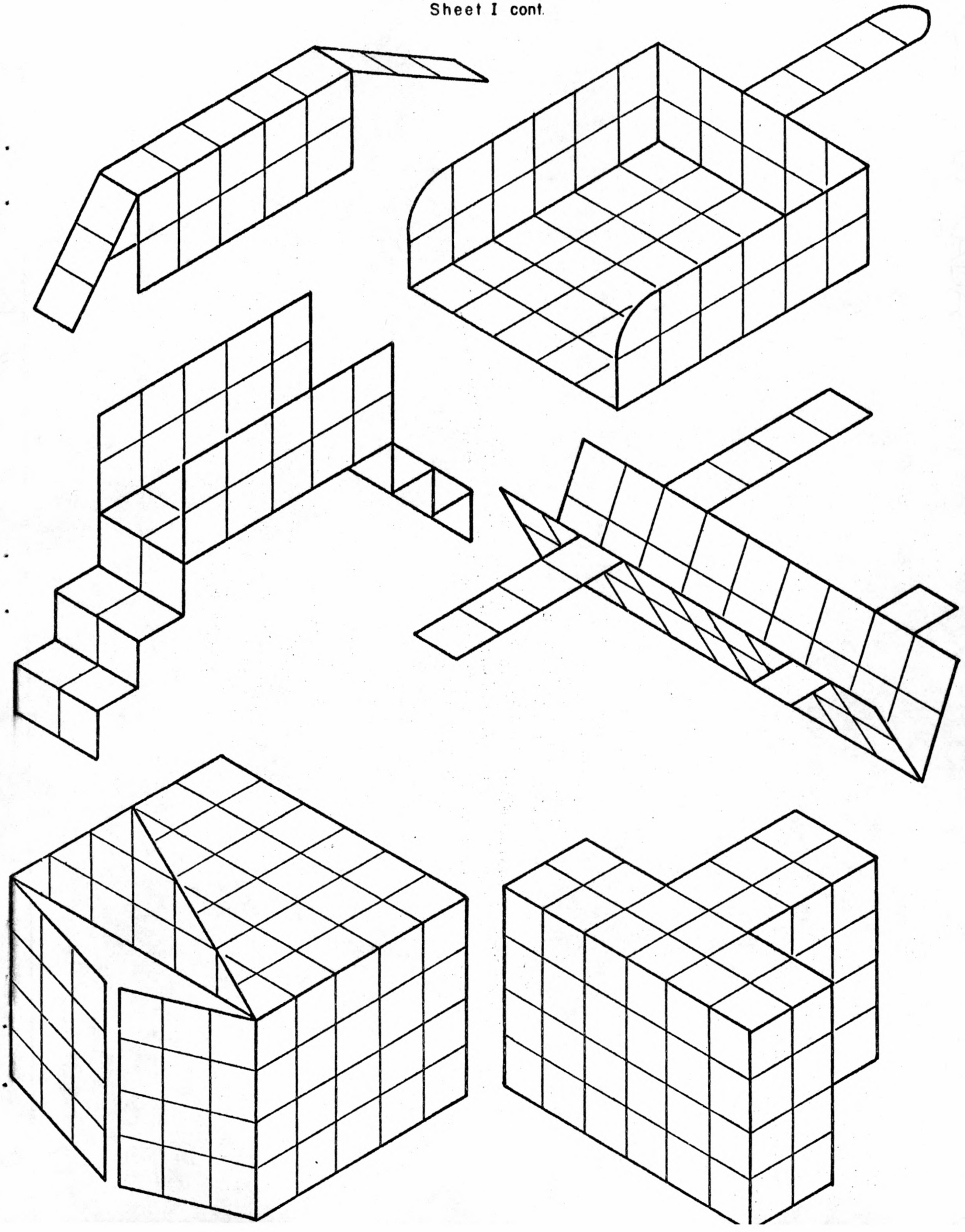
McLaughlin, J.J. and others A Course of Study in Drafting for Canadian High Schools Tyrell Press, Ottawa $1.50

Scrogin, E. and W. Bettencourt Applied Drawing and Design McKnight (General Pub. Co.) $5.75

Spencer, H.C. Basic Technical Drawing Collier-Macmillan $6.50

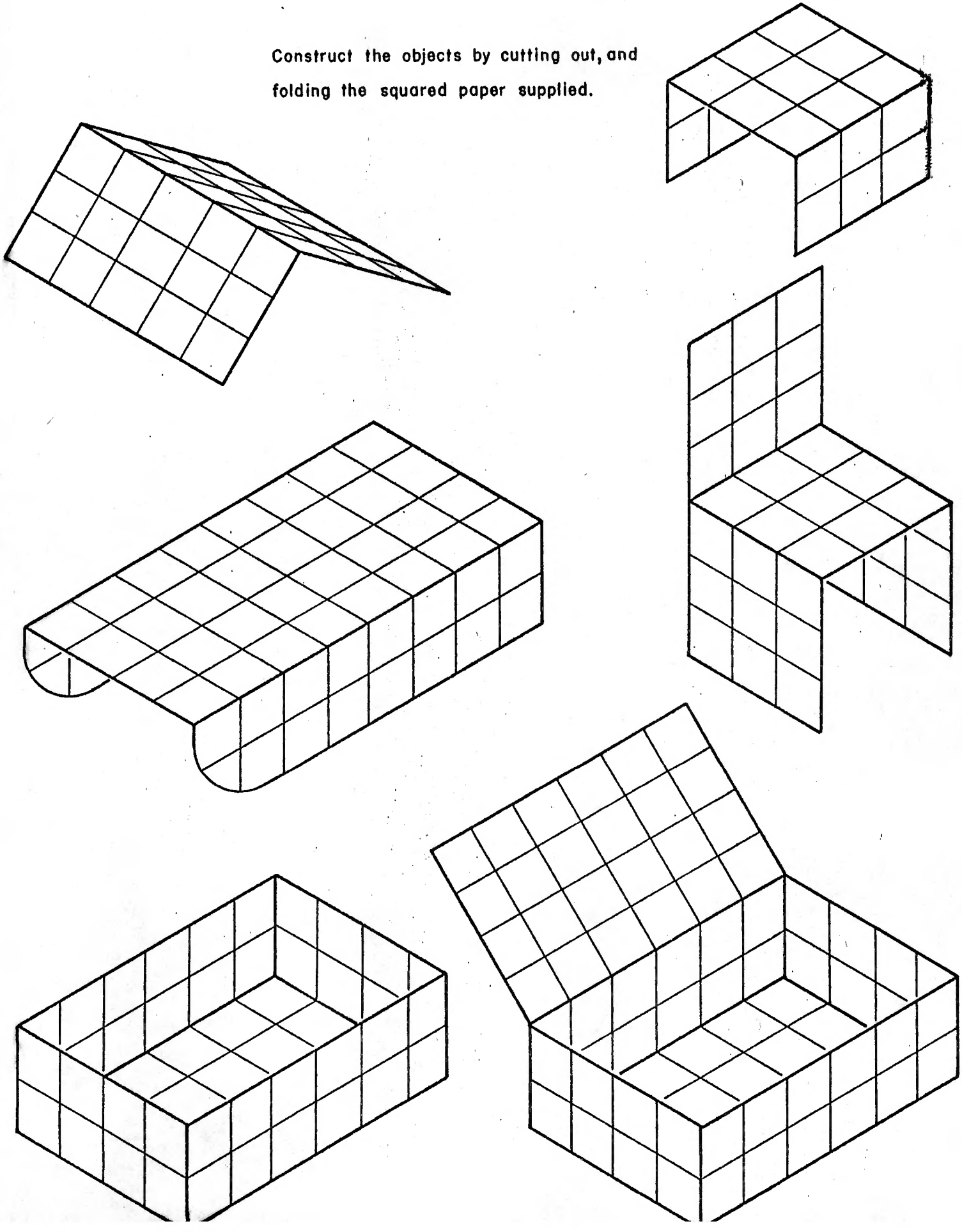
Zozzora, Frank Engineering Drawing 2nd ed. McGraw-Hill $9.50

Sheet I cont.



SAMPLE JOB SHEET Part I Sheet I

Construct the objects by cutting out, and folding the squared paper supplied.



SAMPLE JOB SHEET Part II Sheet I

GIVEN: CUT BLOCKS SHOWN. Note sizes may be in "squares" and/or inches.

REQUIRED:- DRAW

a. Front View (A)

b. End View (B)

c. Top View (C)

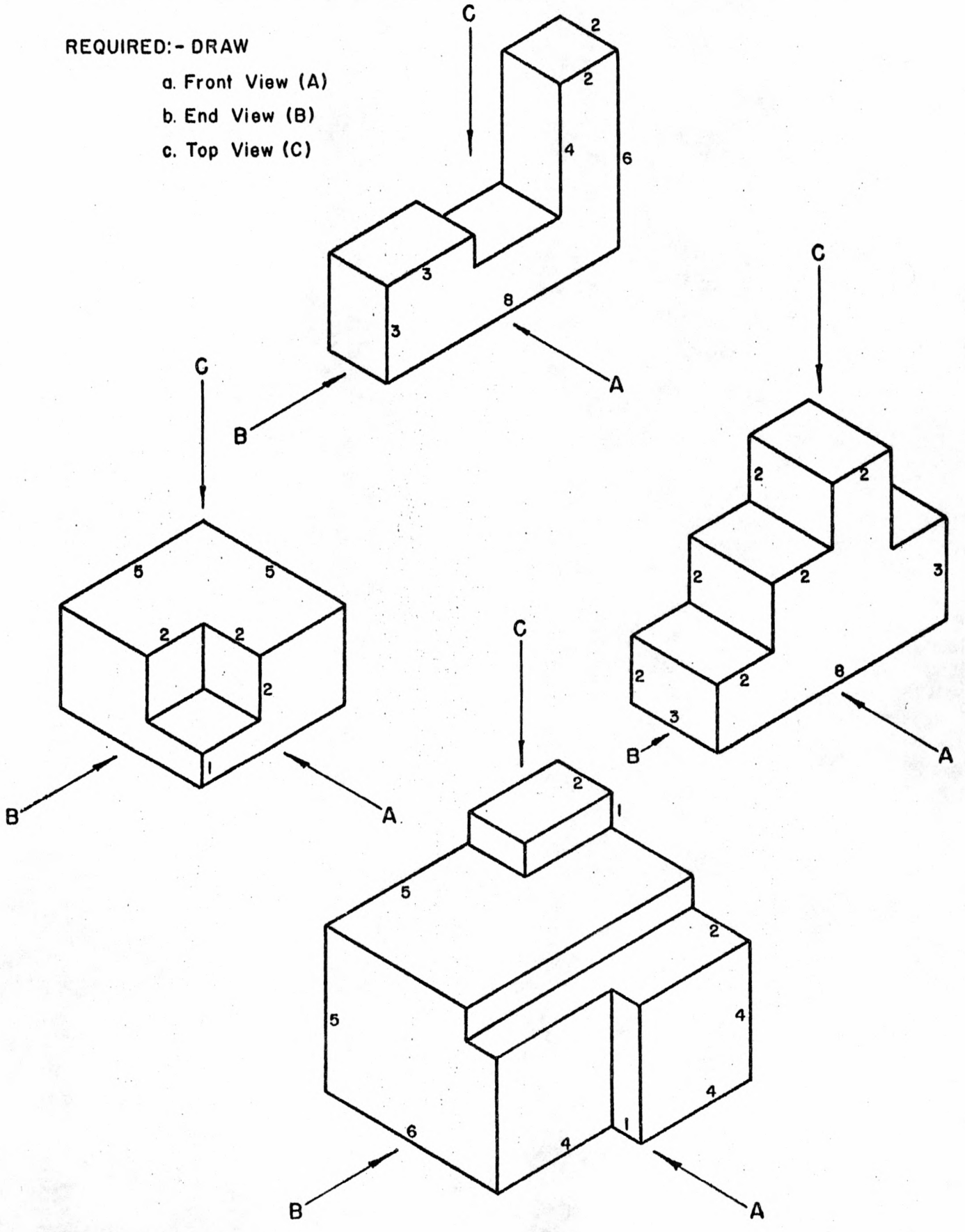
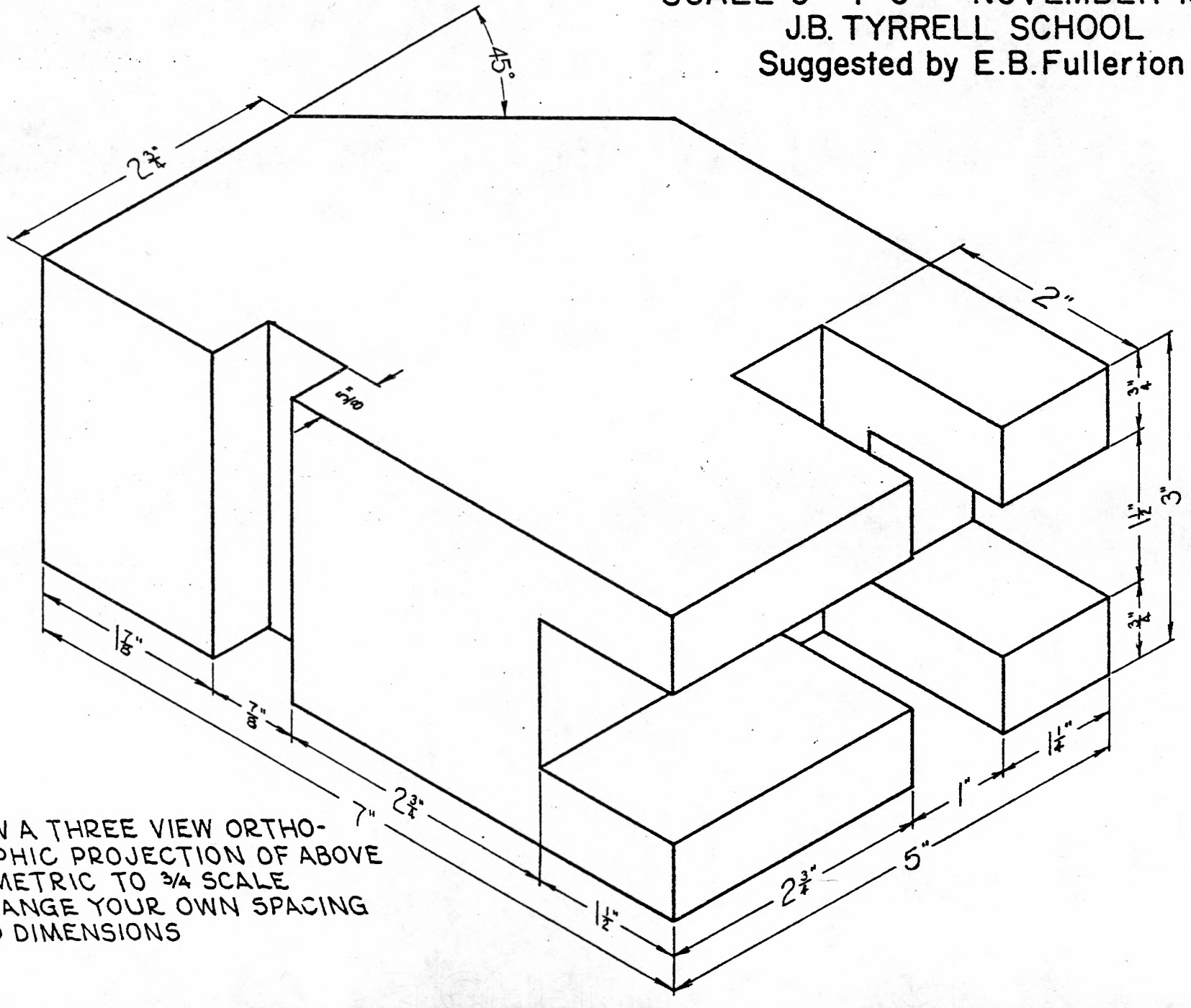


PLATE #9B

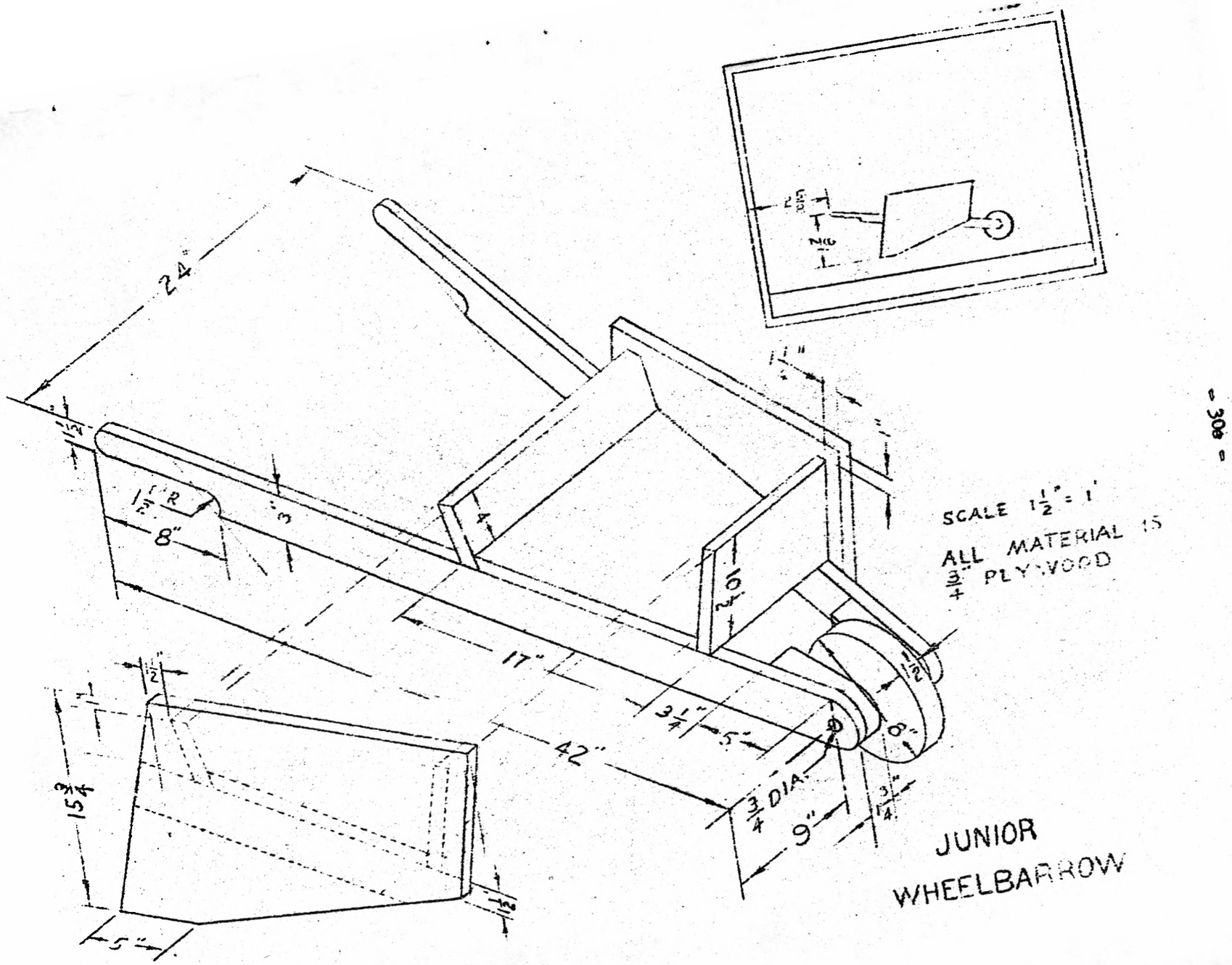
SCALE: 9" = 1'-0" NOVEMBER 1962

J.B. TYRRELL SCHOOL

Suggested by E.B. Fullerton



DRAW A THREE VIEW ORTHOGRAPHIC PROJECTION OF ABOVE ISOMETRIC TO 3/4 SCALE ARRANGE YOUR OWN SPACING AND DIMENSIONS


24"
1½"
1½" R
8"
3"
4"
10"
17"
3¼"
5"
42"
1½"
8"
¾ DIA.
9"
¾"
15¾"
1"
5"
SCALE 1½" = 1'
ALL MATERIAL IS ¾" PLYWOOD
JUNIOR
WHEELBARROW

COURSE OUTLINES

3. WOODWORK

GRADES VII, VIII, IX

Introduction

Despite the rapid change in the pace of modern life, the joys and satisfactions to be derived from working with wood are as much a motivating force in our schools today as ever. Woodwork has proved to be an eminently suitable medium for teaching the basic hand and machine operations of manufacture applicable to many vocational fields. While many of the operations to be taught are traditional in nature, it should be remembered that the woodworking industry is taking large steps forward in techniques of construction, for example, in laminating, bending, finishing, adhesives and in automated processes. It is the duty of the instructor to try to stay abreast of these developments and where possible to incorporate them in the curriculum. The instructor should realize that the topics outlined in the following course outline are not sequentially arranged. Since woodwork is essentially a "doing" subject, it should be taught using carefully planned and graded projects, the construction of which will include the particular processes that the teacher wishes to teach.

The instructor is expected to produce work sheets and drawings of the projects for the use of the students, although the student must learn the basic principles of design and of technical sketching as it relates to this subject.

WOODWORK

GRADE VII — 10 WEEKS

Skills and Processes	Related Knowledge
1. Shop Orientation	Conducted tour of the shop emphasizing safety procedures, during which the students are introduced to the names of common tools and machines and are introduced to shop rules and safety These rules should be few and simple and consistently enforced
2. Planning	
(a) Technical sketching	Use of squared paper and isometric paper
(b) Costing	Simple dimensioning
Bill of material	Board feet, linear feet, square feet
3. Use of the rule	Division to 1/32 nd of inch Use a large demonstration model
4. Use of try square	Names and functions of parts Testing for square, inside and outside, testing for "wind"
5. Use of Hand Saws	
(a) Straight sawing	1. Cross cut Students should 2. Rip saw be able to recognize 3. Back saw saws by shape of teeth. Use enlarged models of teeth as visual aid Demonstration of incorrect use of rip saw as crosscut - emphasize why teeth are different shapes
(b) Sawing a curve (i) Use of coping saw (ii) Use of jig saw	Names and functions of parts Safety should be stressed and similarity of saws pointed out
6. Use of the plane	Names of parts of plane - adjustments Different names and sizes of planes Large model of the plane iron

GRADE VII (cont'd.) — 10 WEEKS

Skills and Processes	Related Knowledge
7. Stages of work	(a) face side
	(b) face edge
	(c) gauge and plane to width
	(d) gauge and plane to thickness
	(e) saw one end square
	(f) saw to length
8. Use of marking gauge	Names of parts
9. Use of chisels	Names of parts Position of hands and head behind the blade
(a) Horizontal paring	
(b) Vertical paring	
10. Use of hammers, nail set, nails	Nailing, setting and filling Types of nails
11. Use of boring tools	Ratchets Types of bits - expansion bits, auger bit, centre bit Depth gauge for blind holes Depth of countersink
(a) Brace and bit	
(b) Hand drill	
(c) Countersinking	
Finishing	Care of brushes Discussion on suitability of various types of finish for projects Examples of well finished work
(a) Sanding and filling	
(b) Stain and varnish	
(c) Paint	
Use of power tools	Introduction Names of parts Safety Replacing blades and sandpaper
(a) Jig saw	
(b) Portable tools	
Adhesives	Various types

GRADE VII (cont'd.) 10 WEEKS

Skills and Processes Related Knowledge

Suggested Activities

Joints to be incorporated

1. Butt
2. Dado and through
3. Crosslap, face and edge
4. Other simple joints as required by projects

Project Suggestions

Skin stretchers, line winder, door stop, window prop, wall shelf, cutting board, toothbrush holder, pull toys, book rack, tray, shoe shine box.

Note: Consideration should always be given to the production of one project by assembly line methods. This has many advantages including:

(a) Lessons in planning.

(b) Lessons in work organization from an industrial point of view.

(c) Lessons in quality control.

(d) Importance of accuracy in the mass production process.

(e) Interest stimulation.

(f) Application of many varied activities, co-ordination of effort and development of co-operative attitudes.

(g) Costing:

1. Labour
2. Material

WOODWORK

GRADE VIII — 10 WEEKS

Skills and Processes	Related Knowledge
Review of skills and processes of Grade VII.	
1. The extension of technical sketching to production of working drawing	Technical sketching technique used in design stage - then from the sketch a working drawing should be produced. N.B. this MAY be worked into the drafting program, or may be assigned as homework or study time work.
2. Use of power tools	
(a) Band saw	How to rip, crosscut, resaw and do curved work Names of parts adjustments, lubrication
(b) Lathe	Names of parts Lubrication Set up for turning between centres - simple turning as part of project or as in a lamp, etc. Varying speeds Local lumber
(c) Grinder: -	This is a very important step How to grind and whet tools
Tool sharpening Sharpen one chisel - axe, ice chisel, skinning knives	Lay foundation for Grade 9
3. How to deal with end grain	Saw, plane, shooting board (see example work sheets)
4. Use of hand jointer plane	
5. Use of mitre box	
6. Mortise and tenon joint	Layout Suitability Procedure
(a) Use of mortise gauge (b) Use of mortise chisel (c) Use of mallet (d) Use of Tenon Saw	Tenon should fit "off the saw"

GRADE VIII (cont'd.) — 10 WEEKS

Skills and Processes	Related Knowledge
11. Building Construction	
Introduction to box sill construction (Western Frame) Build a frame wall in the shop Leave allowance for door and window	The aim is to familiarize the student with some of the terms used in constructing a frame wall e.g. Sole plate, stud, top plate, header, sill, cripple, brace, sheeting This project should be carried out as a group project
12. Use of screws	Size of screws (a) length (b) diameter (c) type of head
13. Finishing	
(a) "Sealacell" and other modern celulose processes	See reference material

Suggested Activities

Joints

(a) Dowelled edge to edge

(b) Mitred joint

(c) Mortise and tenon joint

(d) Half lap dovetail

Suggested Projects

Sled handle, book shelf, towel holder, corner shelf, mallets, toys, lamps of various designs, various types and sizes of boxes, shoe polishing stand and box, small stool, saw horse, pack board, sleds, whip handle, hatchet and hammer handles, bow and arrow, dog pack, grub box.

Building Construction

Introduction to frame building. Construction of frame wall within the shop. Allowances for windows and doors.

WOODWORK (OPTIONAL)

GRADE IX — 10 WEEKS

Skills and Processes	Related Knowledge
Review Grades VII and VIII Entrenchment of skills Addition of less commonly used tools as a need is felt in construction of projects	
Power Tools	
1. Introduction to table saw	Ripping and crosscutting. Rabbet and dado cuts Emphasis on safety - guards must be in place at all times Use of push sticks Recognition of different types of blades Crosscut, rip, combination and hollow ground planer blade
2. Lathe	Face plate turning
3. Building construction Use of De Walt for cut off	Full size small building, e.g. privy, including installation or dog house Use of the steel square
4. Boat building Do either 3 or 4 do not attempt both	
Suggested Activities	
Joints	
1. Dovetails	4 pin - dovetails
2. Drawer construction	
3. Carcass construction	

Suggested Projects

Cabinets, bookshelves, medicine cabinets, tool box, tables, folding tables, bench stool lamps, bowls, chests for camping or boating, ice fishing shack, playhouse.

The building to be constructed may be made indoors in sections if necessary and assembled outside. This program will require very extensive planning, direction and time budgeting by the teacher.

WOODWORK

SUGGESTED REFERENCE BOOKS

Ashcroft, C.C. and J.A.G. Easton General Shop Work Collier-Macmillan $5.25

Barocci, Louis and others Instructional Units in Hand Woodwork Bruce (Ryerson) $3.75

Douglass, J.H. and R.H. Roberts Projects in Woodwork McKnight (General Pub. Co.) $5.00

Feirer, John L. Industrial Arts Woodworking Bennett (Copp Clark) $5.00

Fryklund, V.C. and A.J. LaBerge General Shop Woodworking McKnight (General Pub. Co.) $4.50

Glenister, S.H. Contemporary Design in Woodworking Longmans $4.20

Groneman, C.H. General Woodworking McGraw-Hill $7.00

Leckey, W.C. How to Build Your Own Garage Popular Mechanics Press, 200 East Ontario Street, Chicago 11, Ill.

Lukowitz, Joseph Fifty Popular Woodworking Projects Bruce (Ryerson) $3.25

Miller, H.G. Hand and Machine Woodwork Macmillan of Canada $1.90

Mix, Floyd and Ernest H. Cirou Practical Carpentry Goodheart-Willcox

VISUAL AIDS

Woodwork:

Films: (1) Stanley Film Strips - Stanley Tools Education Department
New Britain, Conn.

(2) Shopwork Senses - Strip films
McGraw-Hill

FINISHES

"Sealacell Process"
General Finishes Sales and Service Co.
1548 W. Bruce St. Milwaukee 46 Wis. U.S.A.

"Deft" wood finish
Desmond Bros.
Alliance, Ohio, U.S.A.

DANISH OIL FINISH

Write Watco-Dennis Corporation, 1756 - 22nd Street, Santa Monica, California, approximately $4.00 a quart.

PRACTICAL PROBLEMS

BOARD MEASURE

1. The Bill of Material for a book rack made of Basswood is as follows: -

   (a) Two end pieces each $\frac{3}{4}$" x $7\frac{1}{2}$" x 9"

   (b) Two rails each $\frac{1}{2}$" x $2\frac{1}{2}$" x 18"

Find the number of board feet required to construct it.

2. A serving tray is made from the following lumber:-

   (a) Handles - 2 pieces each $\frac{3}{4}$" x 2" x 1' - Basswood

   (b) Side Rails - 2 pieces each $\frac{1}{2}$" x $1\frac{1}{2}$" x 18" - Basswood

   (c) Bottom - 1 piece of plywood $\frac{1}{4}$" x 12" x 18"

Find the cost of the material for the tray if basswood sells at $240.00 per M and the plywood at 18¢ a square foot.

3. A magazine rack is made of $\frac{3}{4}$" Pine and masonite. The material list is as follows: -

   Pine 4 pieces each $\frac{3}{4}$" x 2" x 24"

   2 pieces each $\frac{3}{4}$" x 2" x 15"

   1 piece $\frac{3}{4}$" x 3" x 15"

   1 piece $\frac{3}{4}$" x 1" x 15"

   Masonite 2 pieces each 12" by 15"

Find the TOTAL COST of the rack if Pine is priced at $240.00 per M and Masonite at 16¢ a square foot.

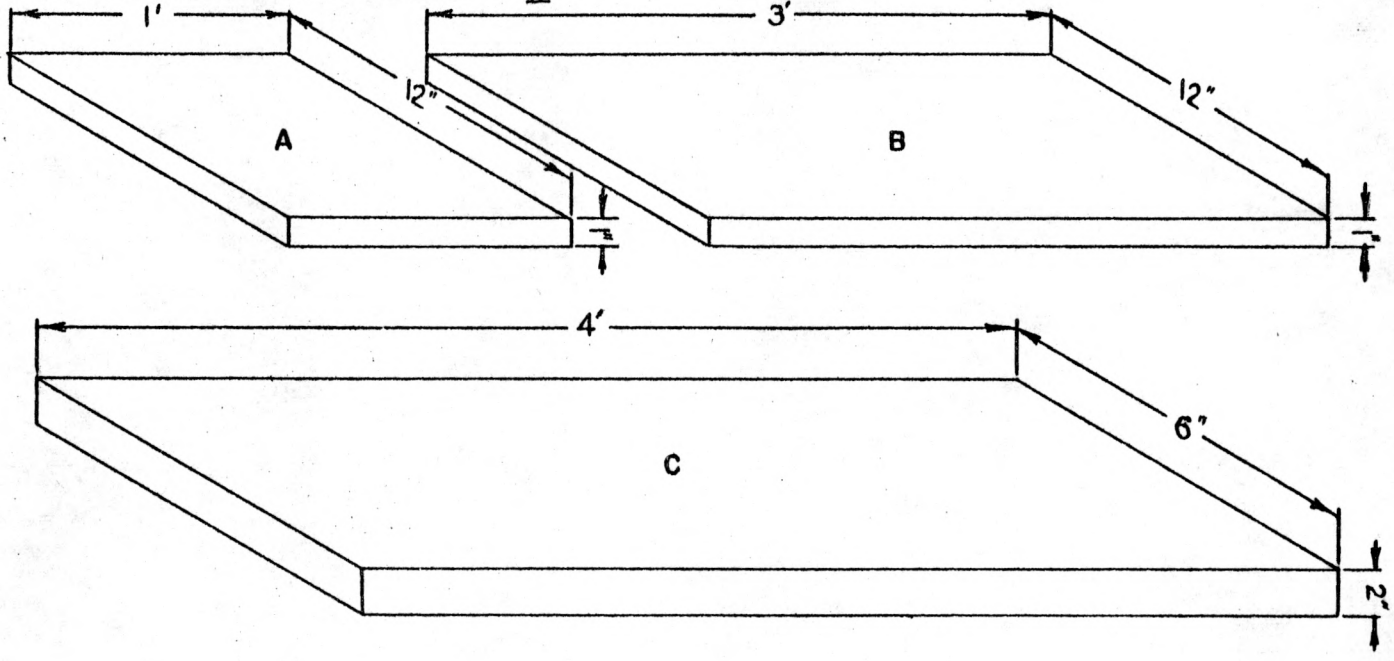
INFORMATION SHEET LUMBER

BOARD MEASURE

In working with the dimensions of a piece of lumber, the thickness is given in inches, the width in inches and the length in feet.

A formula for calculating board measure is as follows:-

$$\text{Thickness} \times \text{Width} \times \text{Length} = \frac{TWL}{12} = \text{Board Feet}$$



Examples: (See figures A, B & C above.) Using the formula.

Fig. A - $\frac{TWL}{12} = \frac{1 \times 12 \times 1}{12} =$ 1 board foot.

Fig. B - $\frac{TWL}{12} = \frac{1 \times 12 \times 3}{12} =$ 3 board feet.

Fig. C $\frac{TWL}{12} = \frac{2 \times 6 \times 4}{12} =$ 4 board feet.

Find the number of board feet in the following pieces of lumber:-

1. 2" x 8" x 16'
2. 4" x 12" x 10'
3. 1" x 10" x 12'
4. 1" x 4" x 14'
5. 2" x 4" x 10'
6. 8" x 8" x 6'

Lumber which is less than one inch in thickness is considered as if it were one inch in thickness because of the extra cost for cutting and dressing it.

7. Three boards 5/8" x 9" x 14'

8. Four boards $\frac{3}{4}$" x 8" x 15'

The price of lumber is usually given per thousand board feet. (1000 is written as M) Therefore 12 boards 2" x 8" x 18' at $150.00 per M cost:

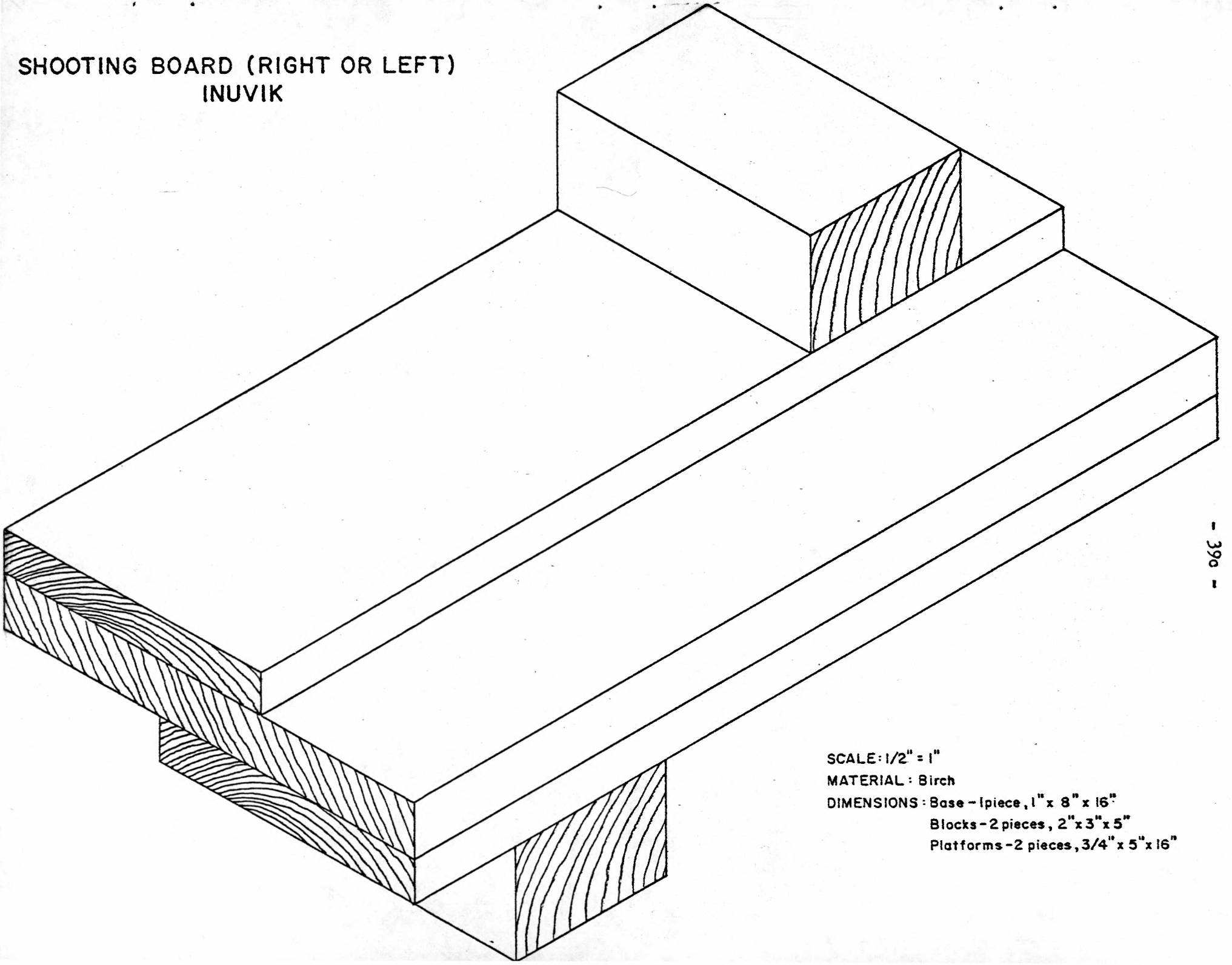
$$\frac{12 \times 2 \times 8 \times 18}{12} \times \frac{150.00}{1000} = \$43.20$$

Find the cost of:

9. Ten boards 1" thick x 12" wide x 15' long at $150.00 per M.

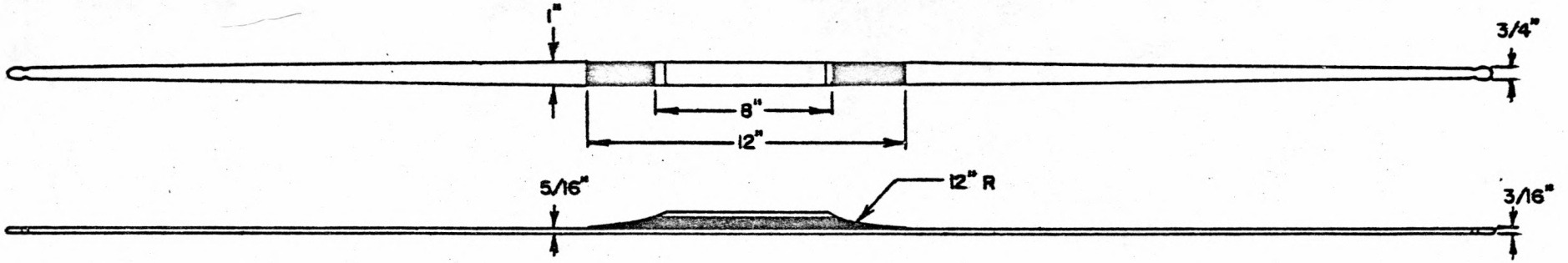
10. Fifteen boards 2" x 10" x 12' at $180.00 per M.

SHOOTING BOARD (RIGHT OR LEFT)
INUVIK



SCALE: 1/2" = 1"
MATERIAL : Birch
DIMENSIONS : Base - 1piece, 1" x 8" x 16"
Blocks - 2 pieces, 2" x 3" x 5"
Platforms - 2 pieces, 3/4" x 5" x 16"

TARGET BOW



Stock Required

1 pc. Oak or Hickory	1" x 5/16" x 48"	(old hockey stick)
1 pc. Walnut	1" x 3/8" x 12"	
1 Birch	1" x 3/8" x 8"	

1. Find one-half the length of each piece and using a try square and pencil, draw a pencil line around each piece.

2. Lay out and plane the taper on the long piece.

3. Glue and clamp the three pieces of wood together, being sure to get the pencil lines on each piece of wood lined up with each other. Make sure you have your clamps and glue ready before you start to work.

4. After the glue has dried, layout the curve on the handle. To do this, draw the arc of a circle 12" in diameter on a piece of cardboard and use this as a templet.

5. Saw carefully along the lines.

6. Using a block plane, half round file, spokeshave, curve the edges of the bow.

7. Sand smooth.

8. Soak in hot water until pliable enough to bend.

9. Using string, draw the bow into shape and allow to dry.

10. After the bow is dry, sand clean and finish with three coats of varnish.

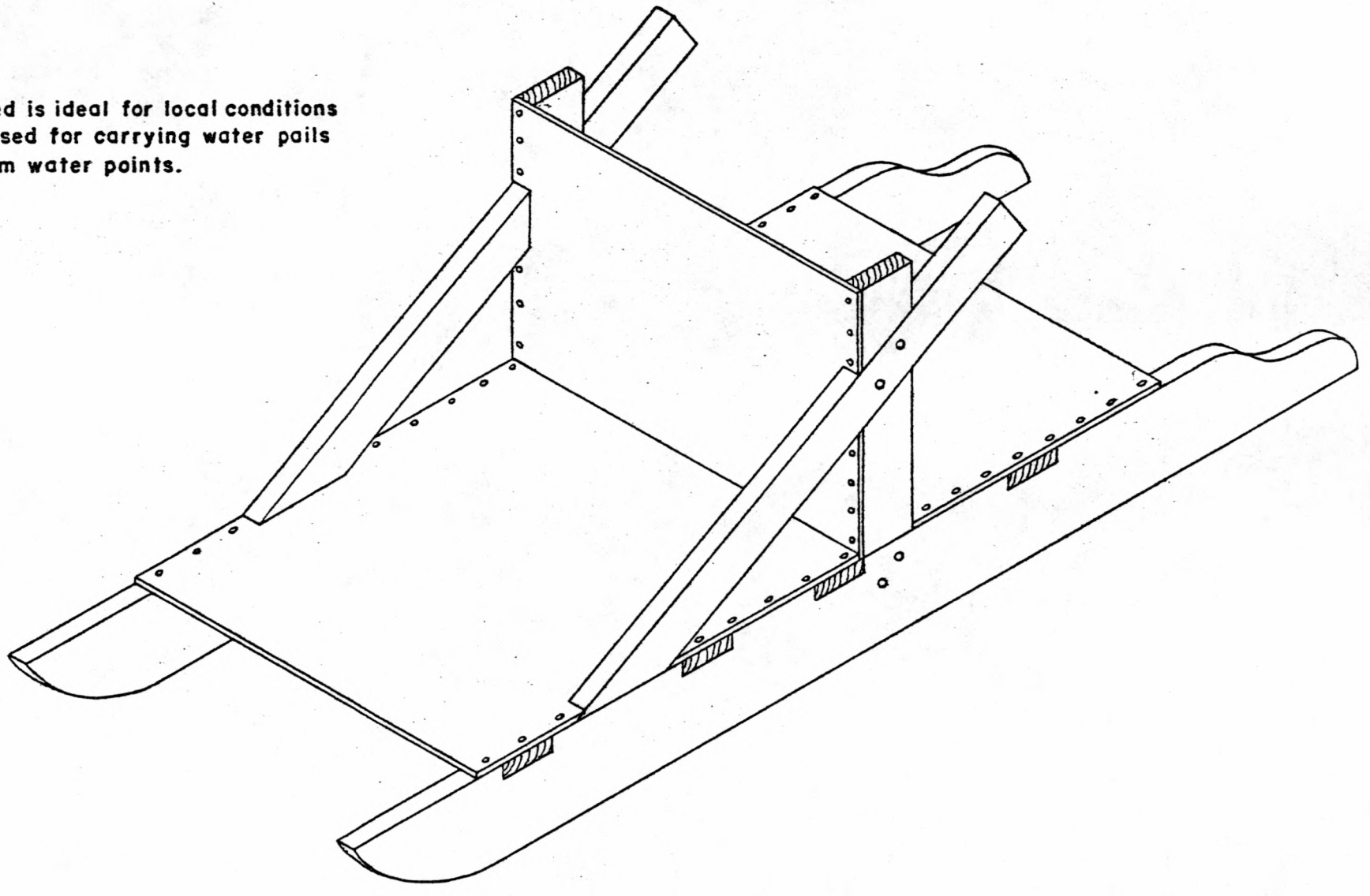
Note: You may make arrow shafts by planing and sanding 3/8" square sticks to a round shape. Plane the four corners at a 45 degree angle first and then sand round with a coarse piece of sandpaper.

J.B. TYRRELL SCHOOL
FORT SMITH, N.W.T.

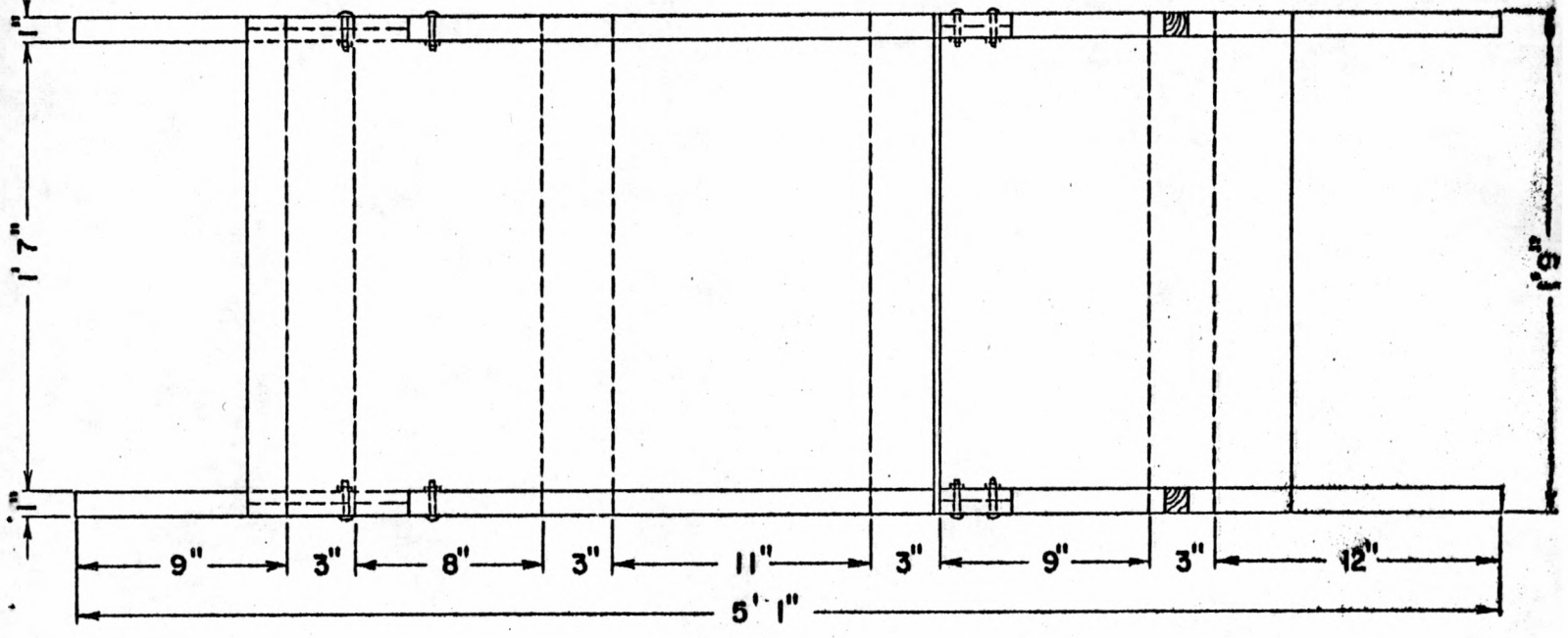
E.B.F. 29/5/63

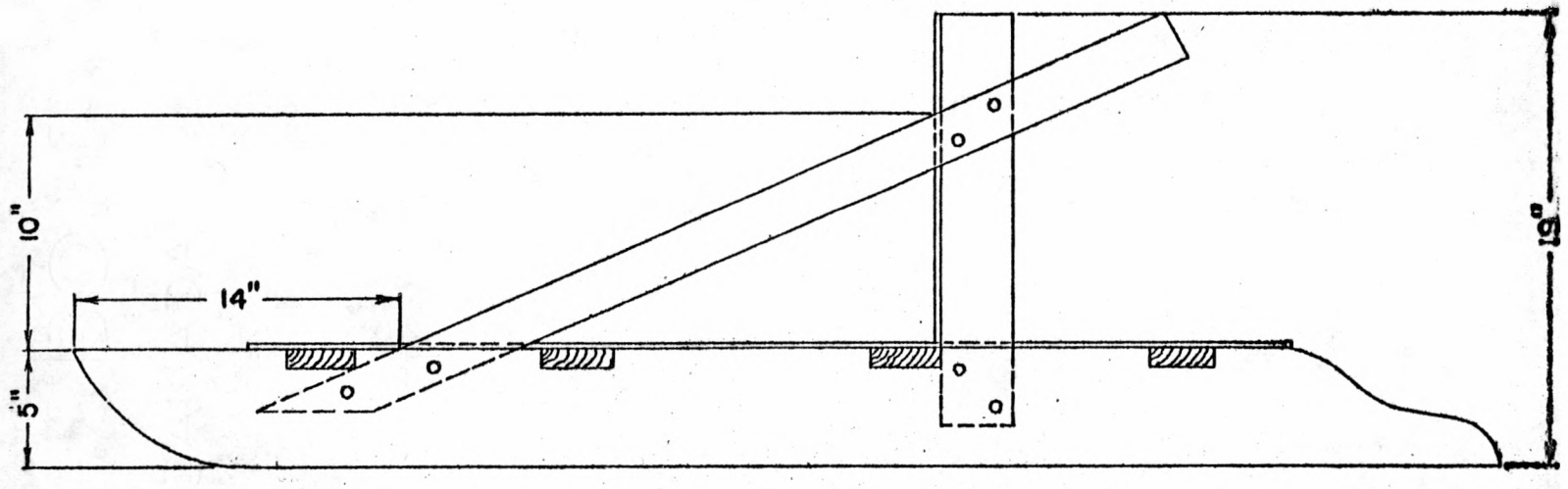
FORT McPHERSON SHOP PROJECT VC SLED

This sled is ideal for local conditions and is used for carrying water pails etc. from water points.

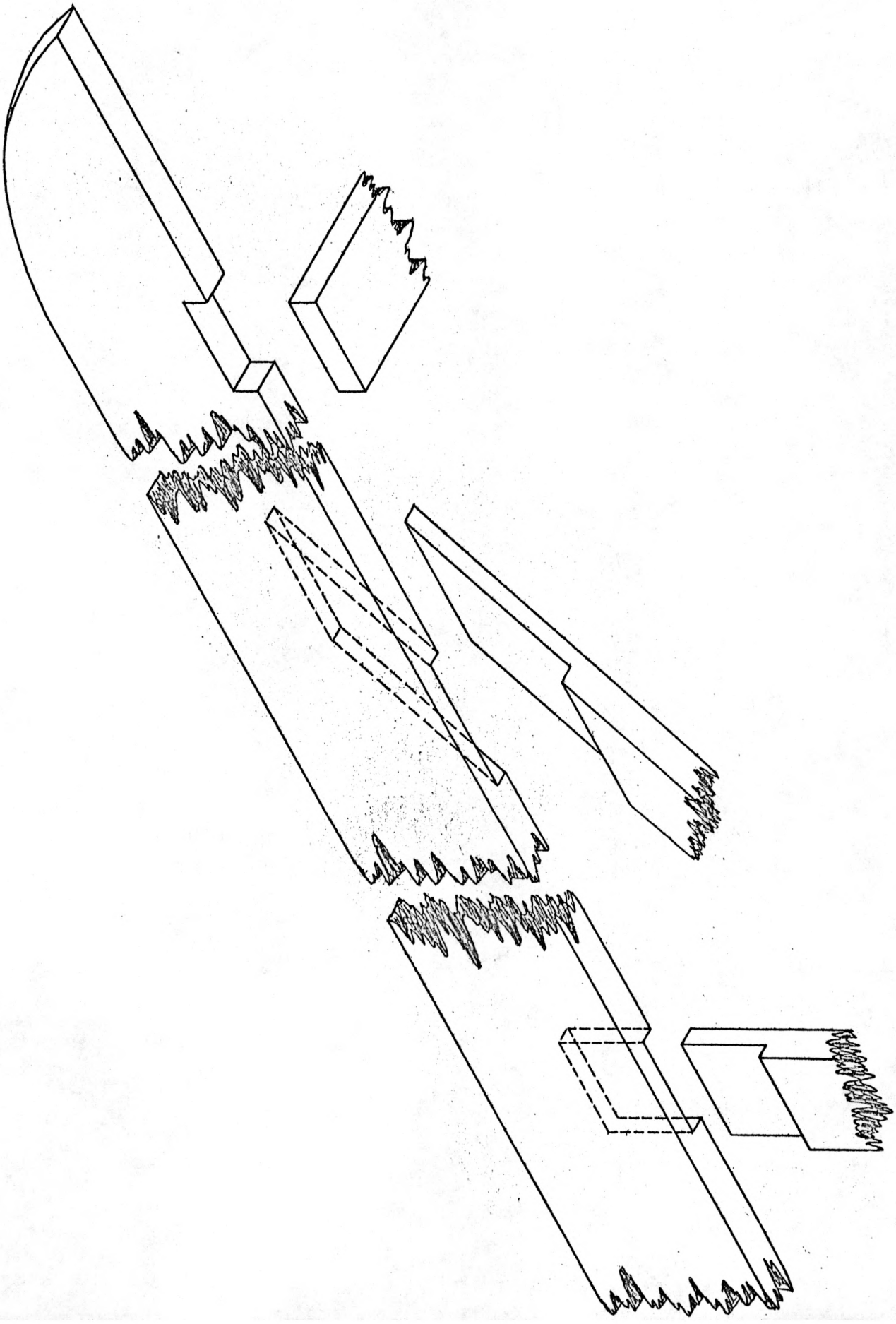


PLAN

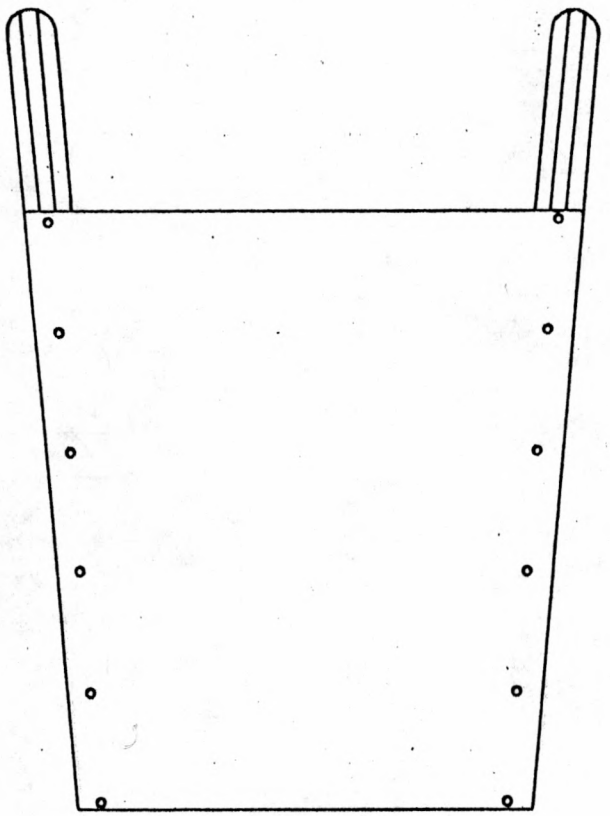


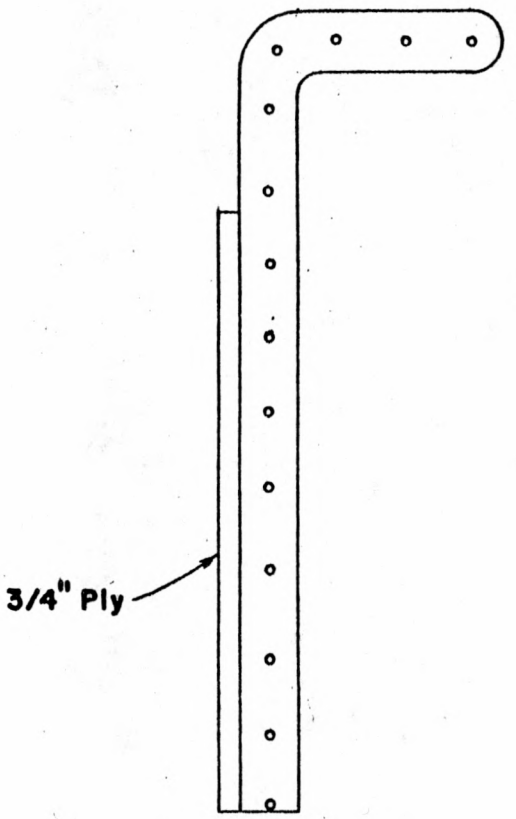


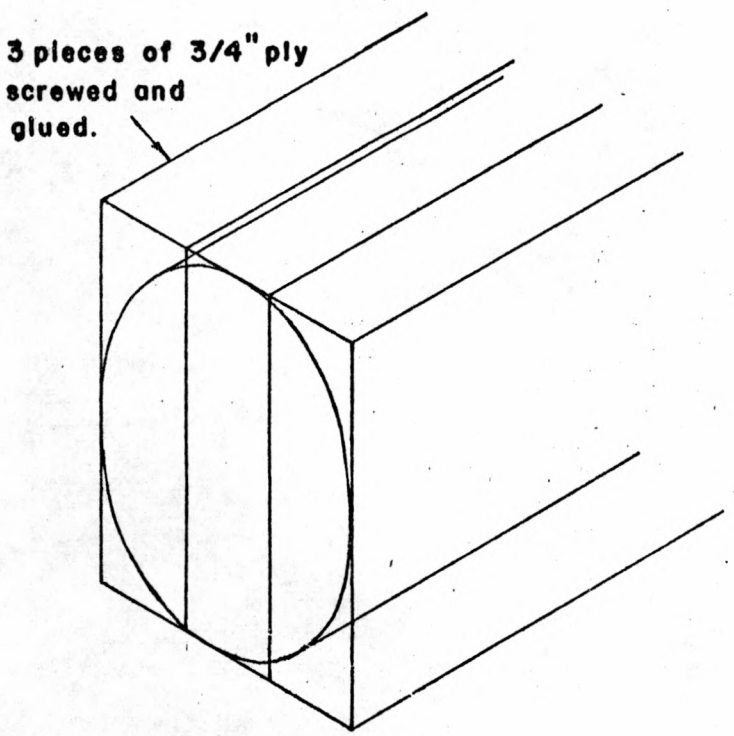
SIDE ELEVATION

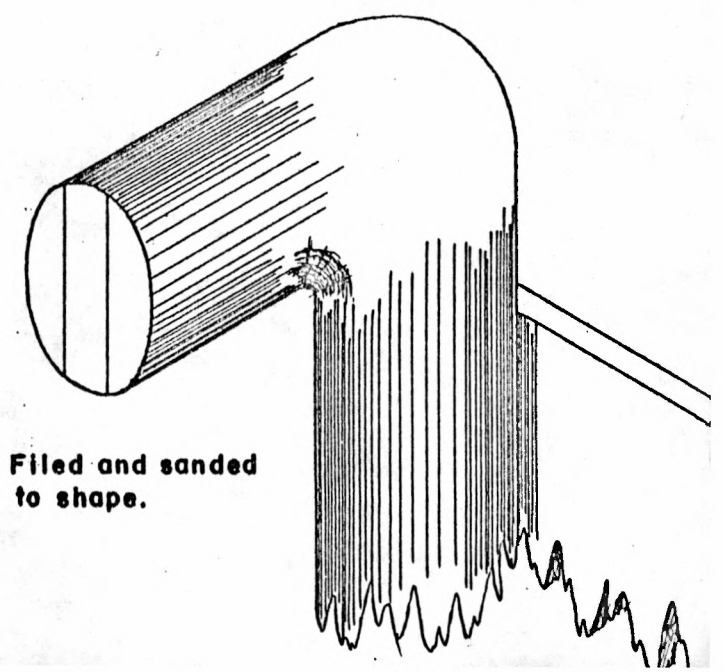


FORT McPHERSON
SLED HANDLES–LOUCHEUX PATTERN

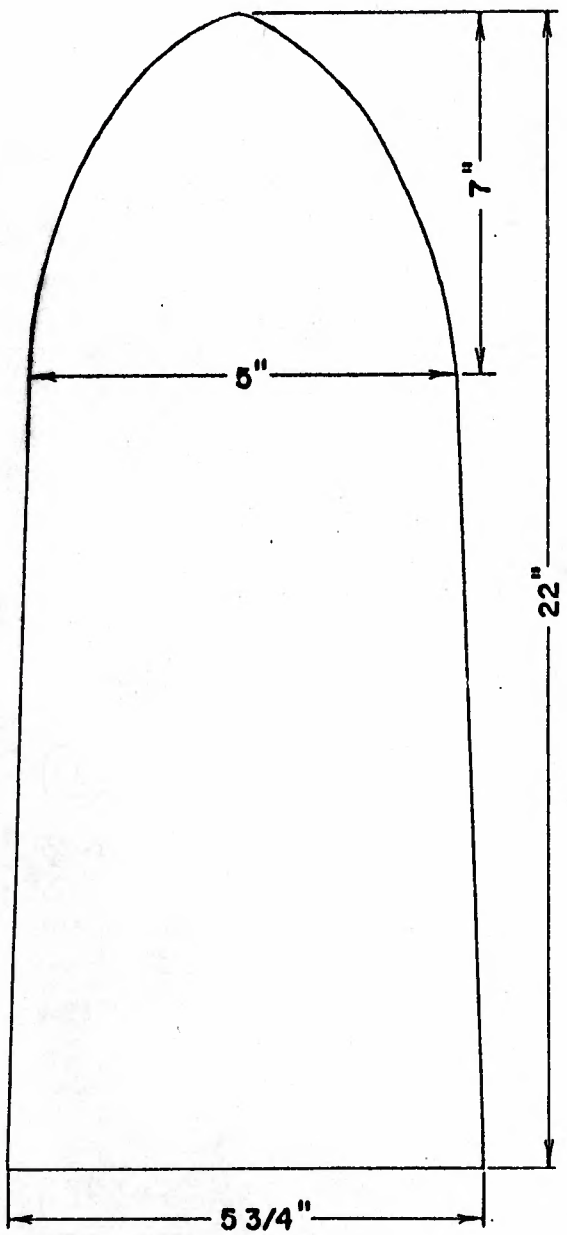


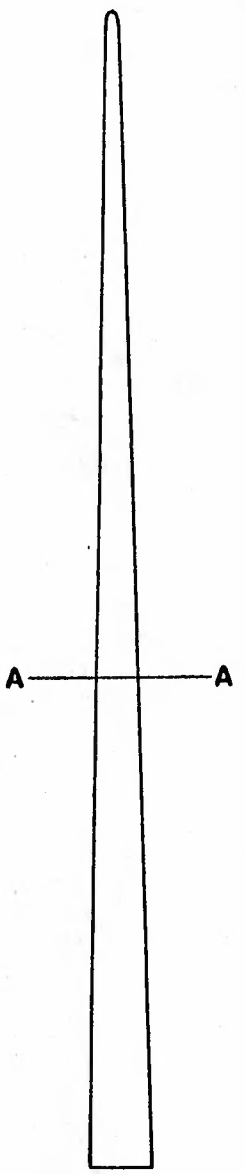




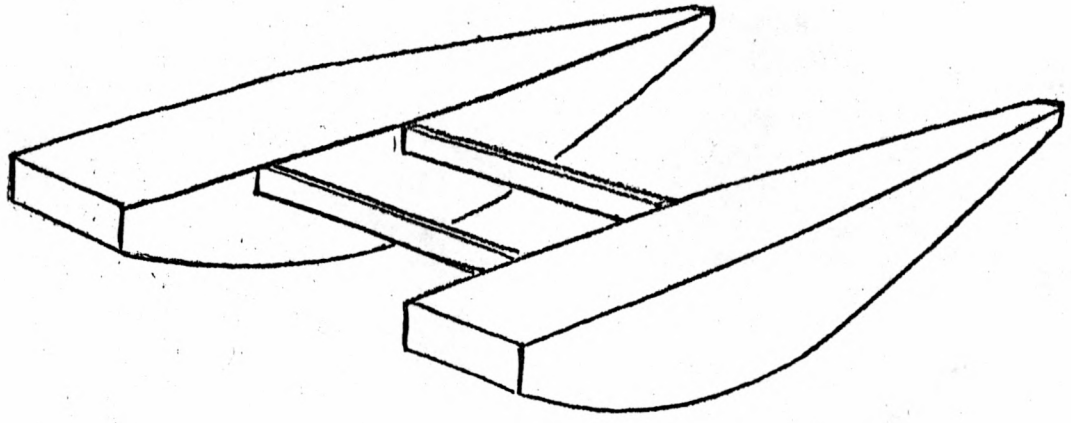


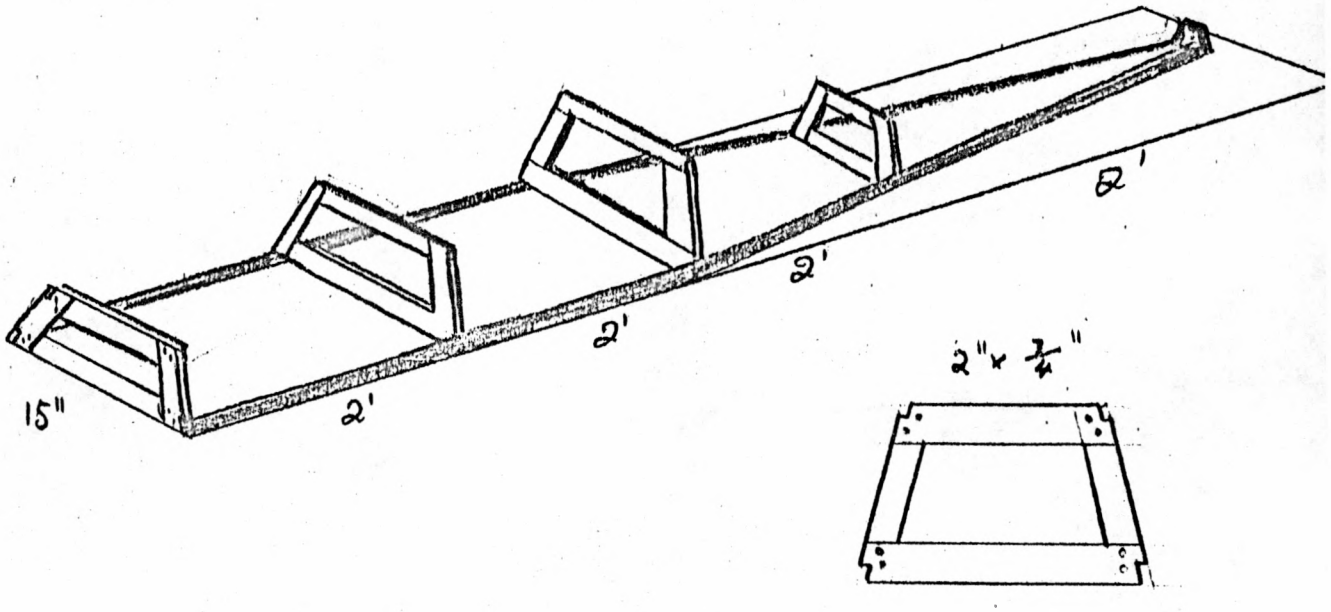
FORT McPHERSON SHOP-1962
MUSKRAT STRETCHERS





PROJECT VIID FORT Mc PHERSON
PADDLE FLOAT NOT TO SCALE J. MORGAN 1963





THE ABOVE SKETCHES PRESENTS THE BASIC IDEA OF A WATER FLOAT WHICH WILL SUPPORT TWO ADULTS. JIG CONSTRUCTION WAS USED FOR FRAMES WHICH WERE THEN BOLTED AND GLUED. 3/4" x 1" STRIP WAS USED FOR STRINGERS. EACH STUDENT MADE ONE FLOAT THEN WORKED IN PAIRS ON FINAL CONSTRUCTION DETAILS AND FINISHING.

IF MATERIALS AVAILABLE A FLAT DECK COULD BE ADDED.

PLANNING SHEET

Name _____ Grade _____ Teacher's App. _____

Date Started _____

Project _____ Date Finish _____

Bill of Material - Finished Size

Part	Pieces	T	W	L	Material	Cost

Bill of Material - Rough Size

Part	Pieces	T	W	L	Material	Cost

Steps	Tools and Equipment
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Planning _____ Surface Prep. _____ Finishing _____

Accuracy _____ Tool operation _____ Shop Efficiency _____

TOTAL _____

GRUB BOX - INUVIK

Rough Stock

Sides	2 pcs.	$\frac{3}{4}$" x $9\frac{1}{4}$" x 26"
Ends	1 pc.	$\frac{3}{4}$" x $9\frac{1}{4}$" x 24"
Top	1 pc.	$\frac{3}{4}$" x $12\frac{1}{4}$" x 26"
Bottom	1 pc.	$\frac{3}{4}$" x $12\frac{1}{4}$" x 26"

Note: It is not necessary to follow the Steps for Planing Stock since the wood is already planed to thickness.

The Cover and Box are made as one unit and sawn apart after being assembled.

Sides and Ends

1. Plane one edge of each piece straight and square.

2. Gauge width on all pieces.

3. Plane to the gauge line.

   (Note: When squaring the end on these pieces saw about 1/16" outside the line and finish with a plane set very fine.) Do not plane all the way across the end. Plane part way then finish by planing from the other edge.

4. Square one end on the two side pieces.

5. Square both ends of the piece to be used for the ends.

6. Square the sides to length. Square the ends to length.

7. Lay out and cut the end rabbet on the side pieces. (This must be done very accurately.)

8. Have the rabbet cut in the sides to receive the lip which seals the joint between the box and the cover.

Top and Bottom

The procedure for the top and botton is the same. You will not find a piece wide enough to make the top and bottom so you will have to glue up three or four narrow pieces to make your $12\frac{1}{4}$" width.

1. Glue up enough narrow pieces (3" or 4" wide) to make your top and bottom $12\frac{1}{4}$" wide when glued. Be careful to have all the surfaces level with one another.

   (SEE THE INSTRUCTION SHEET FOR GLUING TO SECURE GREATER WIDTH)

2. Square one edge of each piece

3. Gauge width on each piece

4. Plane to the gauge line

5. Square one end

6. Square to length

7. Have a rabbet cut along the sides and ends of each piece

Lip

1. The Lip is a piece of hardwood 3/8" x 1" mitred into the grove cut in the box.

Assembly

1. Sand all inside surfaces

2. Assemble the sides and ends using finish nails and glue

3. Fit the top and bottom

4. Glue the top and bottom in place; secure with finish nails

5. Have box and cover sawn apart

6. Glue the Lip in place

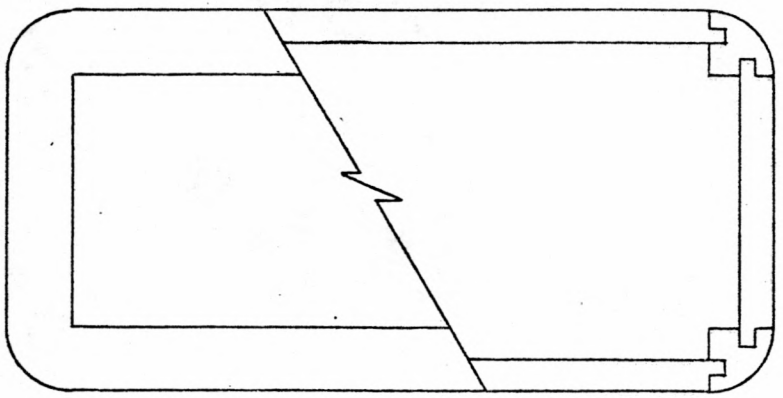
7. Fit hinges, hasp and handle

8. Remove all hardware, round edges slightly, sand the outside surface clean and smooth

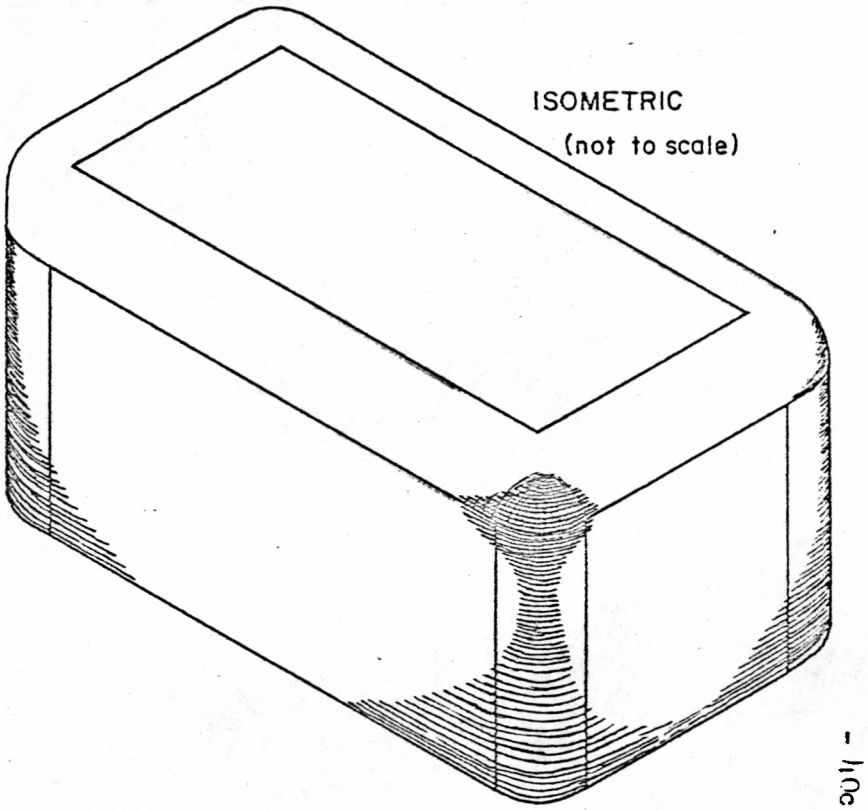
9. Finish with four coats of clear varnish

ALTERNATE DESIGN FOR GRUB BOX
INUVIK

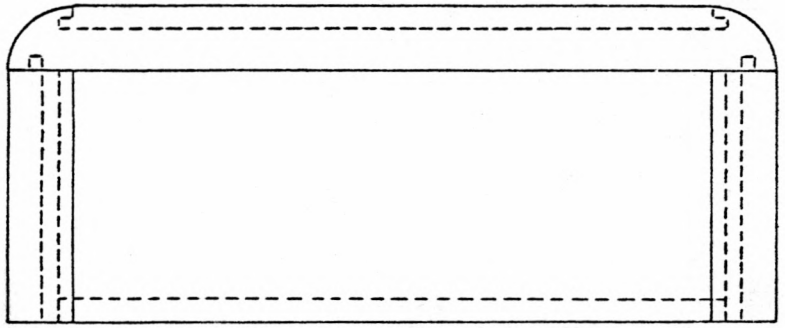
Scale: 2"=1'-0"



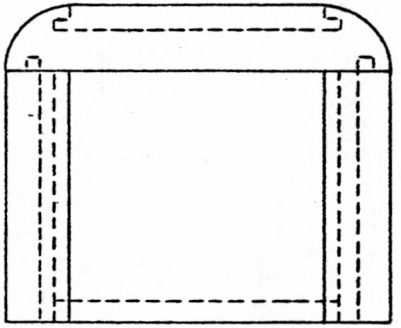
PLAN



ISOMETRIC
(not to scale)



FRONT ELEVATION

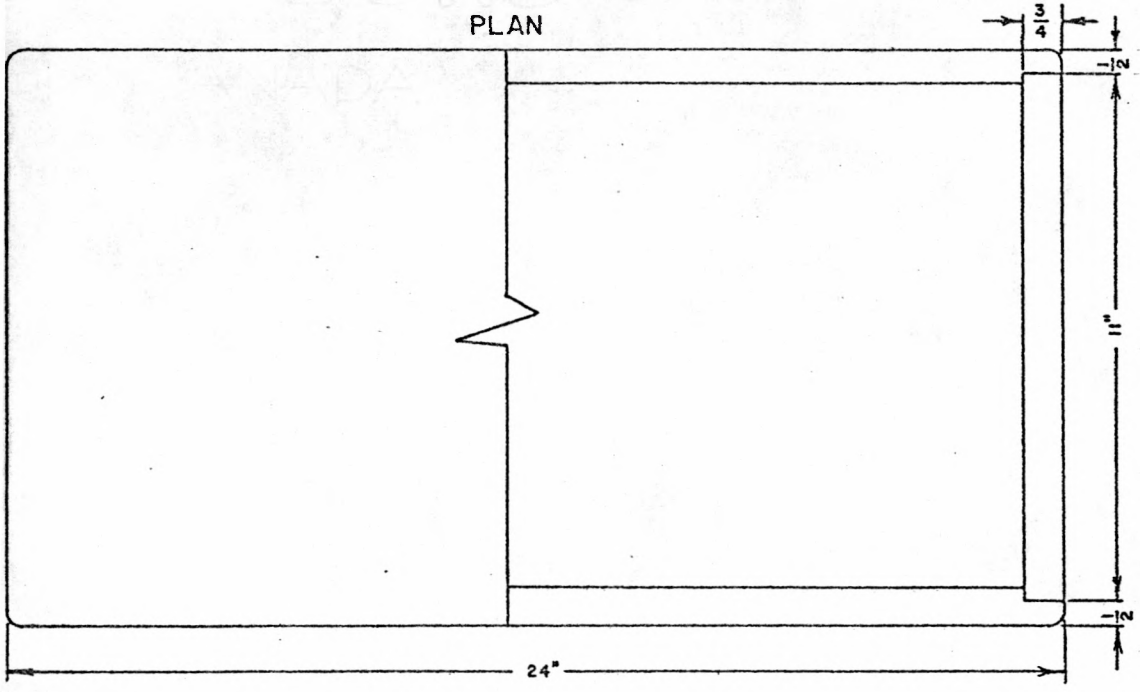


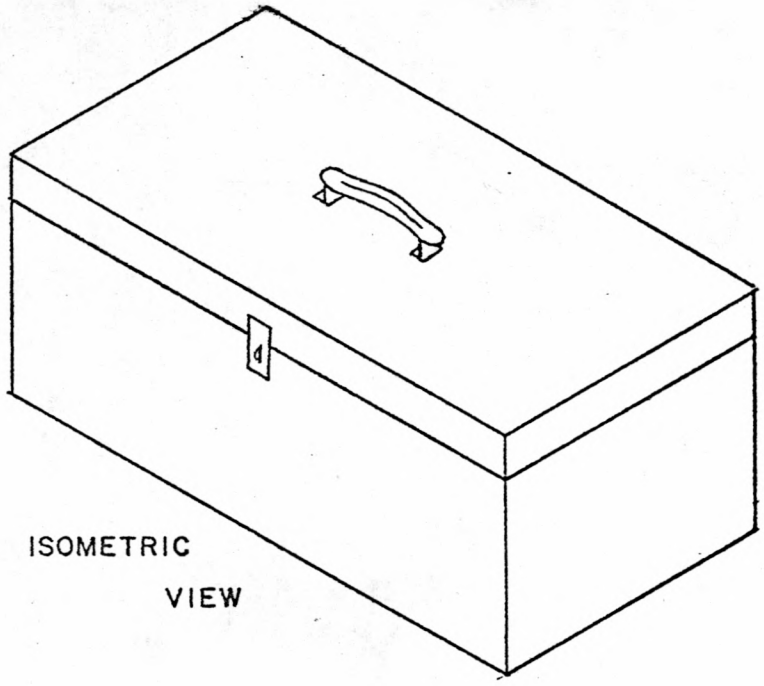
END ELEVATION

SPECIFICATIONS

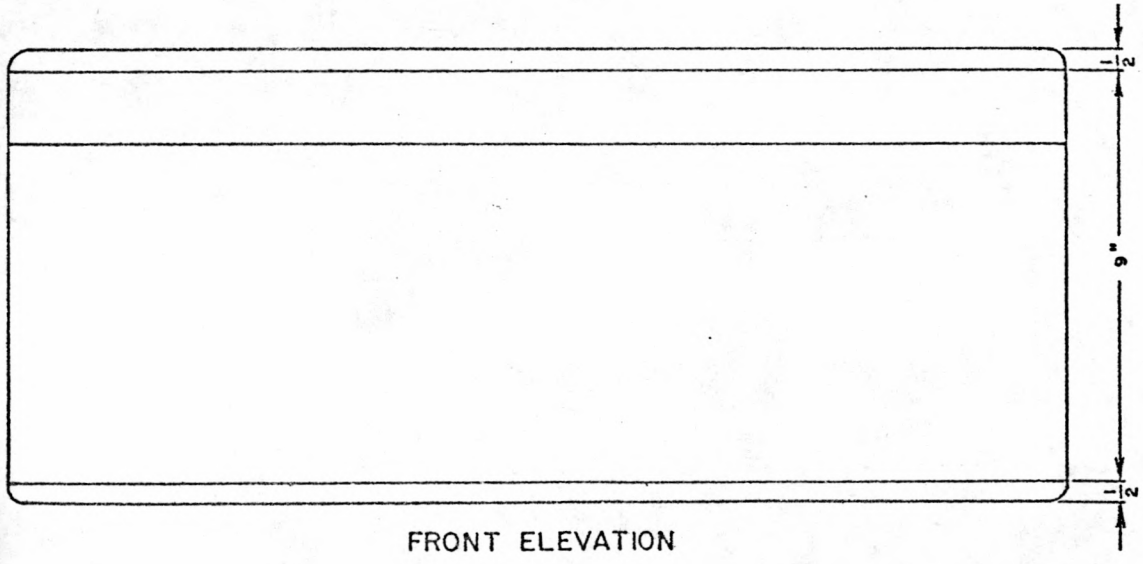
4 pieces 2" x 2" x 8" for corner posts , 2 pieces, 2" x 2" x 12" for ends of lid
2 pieces 2" x 2" x 24" for sides of lid , 2 pieces 3/4" plywood 8 1/2" x 21" for sides
2 pieces 3/4" plywood 8 1/2" x 9" for ends 1 piece 3/4" plywood 9" x 21" for top
1 piece, 3/4" x 10" x 22 1/2" for bottom

PLAN

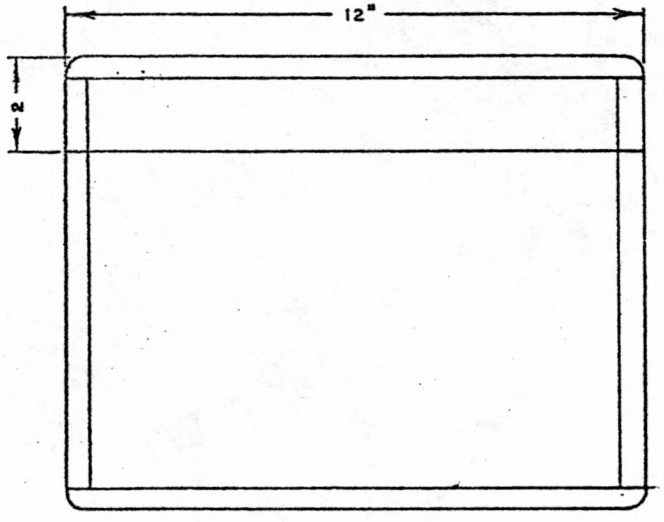




ISOMETRIC VIEW



FRONT ELEVATION



END ELEVATION

GRUB BOX
INUVIK

SCALE : 3" = 1'-0'

COURSE OUTLINES

4. METAL WORK

GRADES VIII, IX

Introduction

Due to the limitations of time the metal work program for this Industrial Arts course has been restricted to one mandatory unit in Grade VIII and an optional unit in Grade IX. To try to cover all of the various areas in the metal working field in this time would be impractical. However, the various fields of metal work have played an important role in the development of civilization and are today the backbone of modern industry. Millions of people are employed in the metal working industry and the life of everyone is affected directly or indirectly by it. The student who receives training in metal work will gain some insight into the industry and into the tools and processes used in this extremely important field. This insight should prove to have vocational and cultural value. The course has been divided into sheet metal and bench metal working units. The extent to which machine work can be carried on will be determined by the facilities and time available. It should be pointed out that metal work is a "doing" subject, and any tendency to have students spend an excessive amount of metal work time doing drafting should not be encouraged.

GRADE VIII — 10 WEEKS

PART I SHEET METAL — 5 WEEKS

Skills and Processes	Related Knowledge
1. Planning	
(a) Technical sketching (b) Drafting (c) Layout on tin Use of templates Use of rule, square, dividers	The student will be familiar with the drawing instruments and the concept of development through the drafting course in Grade VII. It should be noted that this is a Practical application of these concepts - the student should work with metal Allowances for safe edge and allowances for soldering, single and double edge seam
2. Tinsnips Cutting to a straight line Cutting notches	Correct technique
3. Folding Use of bar folder and pan brake Substitutes	Safe edges Vertical bending
4. Soldering Soldering technique Use of soldering irons Tinning an iron (a) Copper (b) Electric Correct heat Cleanliness - physical and chemical Closely fitted joints	Composition of solder Flux - use of zinc chloride (killed acid) and one other flux

GRADE VIII (cont'd.) 5 WEEKS

Skills and Processes	Related Knowledge
5. Punching	Use of hand punch - principles explained
Rivetting	Rivet sets Types of head 1. Round head 2. Flat
6. Finishing	Preparation for painting Painting - various kinds of thinners, care of brushes and equipment

Project Suggestions

Name tag, whistle, drill bit holder, small box, kitchen shelf, wall pocket, cookie sheets, fish lures, ulu.

GRADE VIII — 10 WEEKS

PART II BENCH METAL — 5 WEEKS

Skills and Processes	Related Knowledge
1. Layout on Steel	
Use of layout dye, scriber, engineer's square, steel rule Combination square, odd leg calipers, centre punch and prick punch	Division to 1/64th of an inch Names of tools and their functions
2. Use of Hacksaw	Types of blades Reasons for variety of blades Care of tool Replacement of blade
3. Use of File	Types of files Testing
(a) Filing straight	Explanation of various degrees of accuracy possible in metalwork
(b) Filing square	Cleaning and caring for files
(c) Draw filing	
4. Drilling	
(a) Use of hand drill - names of parts	Names of parts
	Safety precautions
	How to change speeds - why
	Rate of feed
	Blind holes, depth gauge
	Lubrication in drilling
Drill bits	Recognition - names of parts markings
	Correct angles for cutting and clearance
	Recognition of a sharp bit
(c) Use of holding devices	Use of T bars and clamps
	Use of Vise

GRADE VIII (cont'd.) — 10 WEEKS

PART II BENCH METAL — 5 WEEKS

Skills and Processes	Related Knowledge
5. Rivetting	Diameter of drill
	Types of head
	Round
	Flat
	Countersunk
	Correct length of rivet
6. Forming	
Bending Use of bending jigs	Cold bending of band steel
	Allowances for bending
	Methods used for cold twisting
	Danger of shearing
	Allowances for twist
	How to keep stock "in line"

Project Suggestion

Shelf bracket, foot scraper, gaff, lamp bracket, bicycle carrier, nail box, cookie cutter, drill gauge - centre gauge.

METALWORK (OPTIONAL)

GRADE IX — 10 WEEKS

PART I SHEET METAL — 5 WEEKS

Skills and Processes	Related Knowledge
1. Review of Grade VIII skills	Tinplate and galvanized iron
2. Layout of circular work e.g. scoop	Galvanizing and tinning processes
	Advantage and disadvantage of each
(a) Cutting a curve	Calculate circumference of circle
(b) Use of wiring machine	
3. Complex soldering processes	Soldering two pieces on same job - control of heat flow
4. Forming a seam joint	Use of templates
	Size of wire
5. Use of hand groovers	Allowances required for wired edge
6. Familiarity with transition pieces as used in chimneys	Allowances
	Layout
	How to fit stove pipe and chimney pieces
	Elbow bends

Project Suggestions

Round scoop, tool box, fishing tackle box, stove pipe, elbow bend, filler funnel.

GRADE IX (cont'd.) — 10 WEEKS

PART II BENCH METAL — 5 WEEKS

Skills and Processes	Related Knowledge
1. Continuation of skills introduced in Grade VIII	More complex layout - accuracy to 1/64th of an inch
2. Accurate filing	Use of micrometer and vernier calipers Names of parts - arithmetic involved Recognition of metals cast iron mild steel tool steel aluminum brass copper
3. Brazing NOTE: - Subject to fire regulations for room Use of special clothing	Safety as in welding below Simple brasing technique using flux coated rod Jigs Methods of holding job in position Type of flame used Silver soldering
4. Welding NOTE: - Gas welding subject to fire regulations for room	
(a) Safety	Care of cylinders
Use of goggles Safety and protective clothing	Cracking the cylinder Pressure in each cylinder Color scheme Different threads Danger from oil or grease Testing for leaks
(b) Set up and adjustment	Regulators

GRADE IX (cont'd.) — 10 WEEKS

PART II BENCH METAL — 5 WEEKS

Skills and Processes	Related Knowledge
	Line pressures
	Types of flame
	Effect of different types of flame
	Tip size
(c) Carry puddle on 16 gauge steel - No rod	Travel direction
	Torch angle, position and motion
	Speed
	Penetration
(d) Run bead on 3/16 inch plate with 1/8 inch filler rod	Welding symbols
	Tip size
	Rod and torch manipulation
	Penetration
	Recognition of correct bead
	Diagnosing faulty technique from appearance of the bead
	Discussion on industrial field of welding
5. Familiarization with power machines as available and at the discretion of teacher	Essential parts of metal lathe
Engine Lathe	
(a) Turning a cylinder	Set-up for turning between centres
(b) Taper turning using compound rest	Recognition of common turning tools

GRADE IX (cont'd.) — 10 WEEKS

PART II BENCH METAL — 5 WEEKS

Skills and Processes	Related Knowledge
(c) Knurling	Left hand
(d) Use of micrometer collars	Right hand
	Knurling
	Round nose
	Parting
5. Power Machine (cont'd.)	Discussion on the importance of machines in modern society
	1. Interchangability of parts
	2. Mass production
	3. Tolerances

Project Suggestions:

Screw driver, camp stove. See Linde Co., Union Carbide, Practical Welding, Projects for School and Shop. Toboggan brake.

METALWORK

SUGGESTED REFERENCE BOOKS

Anderson, Algot E. 56 Graded Problems in Elementary Sheet Metalwork McKnight (General Pub. Co.) $4.75

Ashcroft, C.C. and J.A.G. Easton General Shop Work Collier-Macmillan $5.25

Barber, Clifford L. Solder - Its Fundamentals and Usage Kester Solder Company, Brantford, Ontario

Baudek, Anthony C. and G. Graham Whipple Engine Lathe Operations McKnight (General Pub. Co.) paper $3.00

Bruce, Leroy F. Sheet Metal Shop Practice American Technical Society (General Pub. Co.) $5.75

Feirer, John L. General Metals McGraw-Hill $7.00

Giachino, J.W. and John L. Feirer Basic Bench-metal Practice Bennett (Copp Clark) $4.50

Jennings, Royalston F. Gas and A.C. Arc Welding and Cutting McKnight (General Pub. Co.) paper $2.00

Jones, Harry A. Machine Shop Practice, Books 1 and 2 Thomas Nelson $2.00 ea.

Knight, Roy E. Machine Shop Projects for Trade, Vocational and High School Shops McKnight (General Pub. Co.) paper $2.25

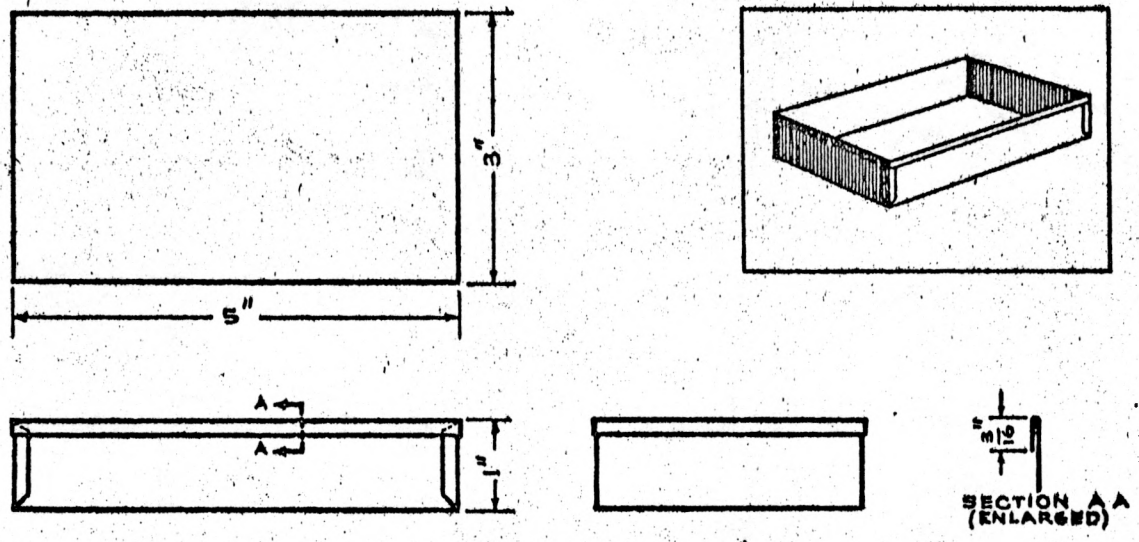
Lux, Donald G. and Edward R. Towers Contemporary Metal Home Furnishings McKnight (General Pub. Co.) $5.00

Practical Welding Projects for School and Shop Union Carbide Canada Limited, Linde Gases Division, 1580 Star Top Road, Ottawa 1.

Ruley, M.J. Practical Metal Projects McKnight (General Pub. Co.) $3.75

SHEET METAL WORK SAMPLE JOB SHEET

ONE-PIECE SUPPLY BOX



SCALE $\frac{1}{2}$" = 1"

NOTE! SOLDER SEAMS ON OUTSIDE.

MATERIALS AND SUPPLIES

IC Bright Tin Plate 5-5/8" x 7-5/8"

Drawing Paper 9" x 12"

Solder and Flux

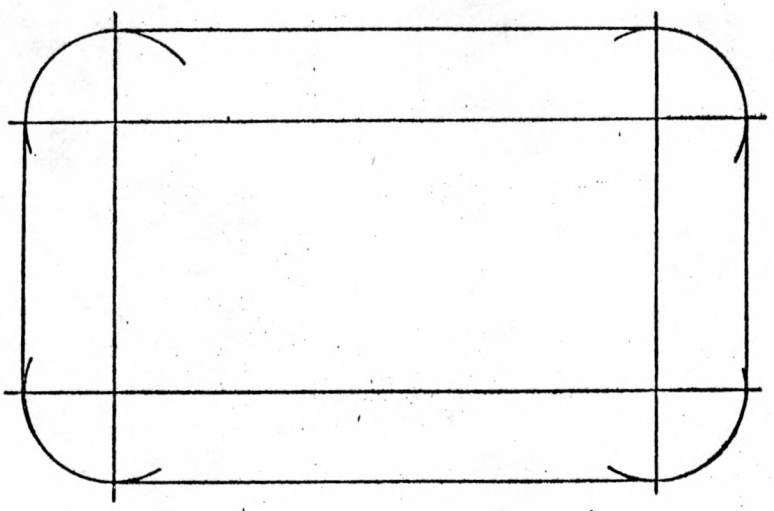
TOOLS AND EQUIPMENT

Scale
4H Pencil
Straight Edge
Flat Steel Square
Pencil Compass
Combination Snips
Prick Punch
Hammer
Scratch Awl
Cold Chisel
Mallet
Soldering Copper
C-Clamp or Weights
Bar Folder
Hard Wood Block
Beakhorn Stake
Flux
Dip Cup or Damp Cloth

JOB SHEET

ONE-PIECE SUPPLY BOX

1. Lay out the pattern for the box on drawing paper.

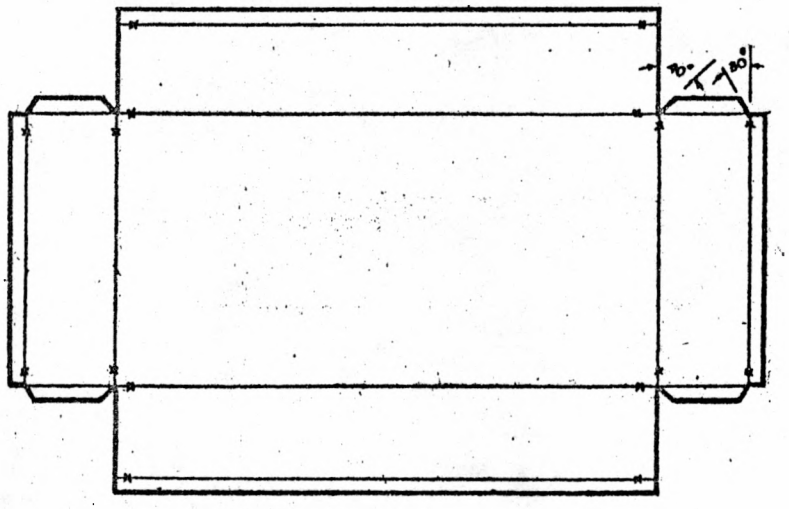


2. Lay out the allowances for the single hems.

3. Lay out the allowances for the lap seams.

4. Lay out the notches.

5. Place x marks where brakes are to be made.



6. Check the pattern for accuracy.

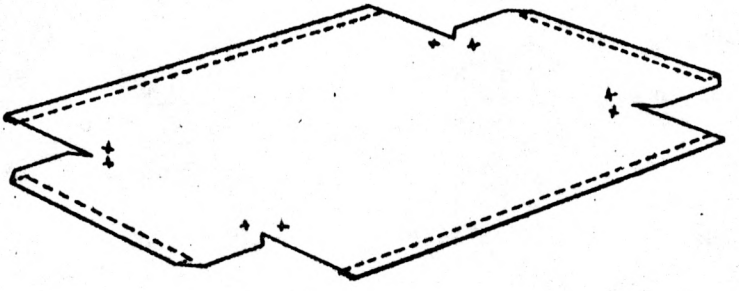
7. Cut out and notch the paper pattern.

8. Select the stock as specified.

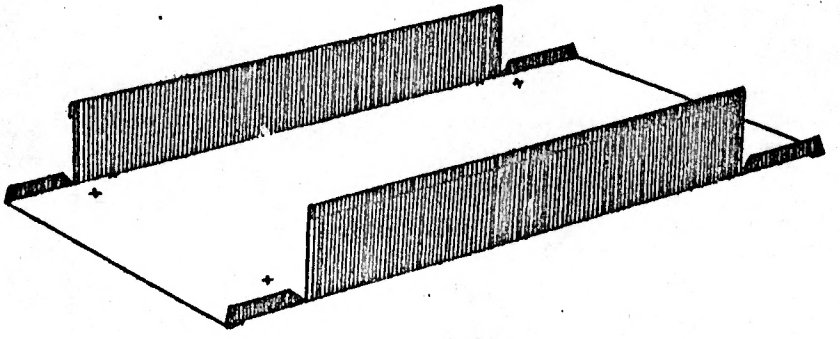
9. Transfer the paper pattern to metal.

10. Cut out the metal and notch the corners.

11. Bend the single hem on the four sides of the job in the bar folder.



12. Bend up the long sides to a 90° angle in the bar folder with the hemmed edge on the outside of the job.

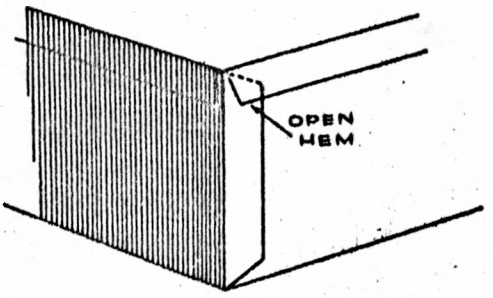


JOB SHEET

ONE-PIECE SUPPLY BOX

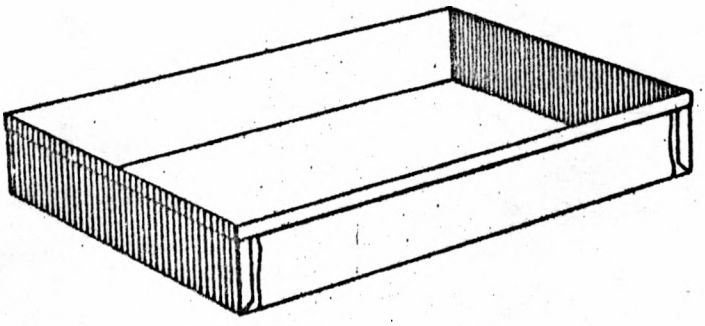
13. Open the ends of the lengthwise hems slightly with a cold chisel.

14. Bend the short sides of the box to a 90° angle. Keep the laps on the outside of the box and inside the hems.



15. Close the ends of the lengthwise hems on the beakhorn stake with a mallet.

16. Solder the lap seams on the outside of the box.



17. Check the dimensions of the completed box.

COURSE OUTLINES

5. ELECTRICITY

GRADE IX

Introduction

Electricity will be offered as an optional subject in Grade IX only (see page 4.) Practically every part of our daily life has been revolutionized by the application and development of electricity. Electrical appliances are so extensively used that most people, even in the north, take them for granted. Some of our students will find their life-time work in this trade area, therefore, we must approach the subject from the vocational as well as the general educational point of view. This course outline parallels the science program in some aspects, but it should be kept very practical in its application. Most basic types of wiring used in the average home have been included, and it is suggested that a section of frame wall, perhaps from the woodwork course could be used for the house wiring section. The teacher should make a few circuit boards and assignment sheets to assist him to cover the work in simple circuitry and joints. This is a job-centred course which suggested that each basic lesson be associated with some shop practice. Shop prepared demonstration and work station equipment is essential.

JUNIOR HIGH SCHOOL

ELECTRICITY

GRADE IX — 10 WEEKS

Skills and Processes	Related Knowledge
1. Joints	Explanation of power supplies - AC and DC
Making:	Expand
(a) Pigtail	Insulators and conductors type
(b) Pigtail Hook	Sizes of conductors
(c) Western Union joints in signal wire	
Soldering	Types of solder
As above in #14 gauge wire	Types of fluxes
Taping joints	Heat transfer
Connecting with solderless connectors	Types of soldering irons
Make an extension cord	
2. Circuits	
Symbols	
Simple series circuit with dry cell	Simple series circuit
Two bells in series with push button and two dry cells in series	Make and break action of push button
As above with two dry cells in parallel	Construction of dry cells and principles of operation wet cell
Two buzzers in parallel with one push button and bell transformer	Electro-Magnetic action of coil with iron core Magnetic fields
Door chime with two push buttons in parallel and transformer	Series and parallel connection
	Measurement of voltage and current in series and parallel circuits

GRADE IX (cont'd.) — 10 WEEKS

Skills and Processes	Related Knowledge
	Principle of voltmeter and ammeter action
	Units of measurement - volt, amp, ohm, Ohm's Law
	Action of transformer
3. House Wiring	
One light and single pole switch from 115V AC supply using non-metallic sheath conductor, 2 conductors with ground	Types of conductors and current capacities
	Colour codes
	Types of electrical power AC, DC
Two lights in parallel and single pole switch plus duplex convenience outlet from 115V AC supply using non-metallic sheath conductor, 2 conductors with ground	Voltages available and distribution systems
	Action, use and sizes of fuses
One light with two three way switches from 115V supply using non-metallic sheath conductor, 2 conductors and 3 conductors with ground	Reading the kilowatt-hour meter
	Action of switches
	Grounding
Wire a house service including main disconnect switch, meter and distribution box	
4. Appliances	
Connecting AC, DC motors	DC, AC motor theory (tie in with science course)
Repair of small appliances	

ELECTRICITY

SUGGESTED REFERENCE BOOKS

Bubon and Schmitt Understanding Electricity and Electronics McGraw-Hill Publications in Industrial Arts

Lush, Clifford K. and Glenn E. Eagle Industrial Arts Electricity Bennett (Copp Clark) $3.75

Mix, Floyd and E.C. Pritchard All About House Wiring Goodheart-Willcox (General Pub. Co.) $3.00

Morgan, A.A. First Electrical Book for Boys Scribner (S.J. Reginald Saunders) $5.00

Van Valkenburgh, Nooger and Neville, Inc. Basic Electricity 5v John F. Rider Publisher, Inc., 116 West 14th St., New York 11. paper $3.00 ea. 5v. in 1, $15.00