This curriculum guide has been developed as a resource for teachers (especially in North Carolina) to use in planning and implementing a competency-based instructional management technology program in their schools. The guide contains three main sections. The first section contains introductory materials and a course blueprint that lists the competencies the student is to attain and time guidelines for a one-semester course. The second section contains five units of instruction that contain detailed information directly correlated to the blueprint and test-item bank. The units explain in more detail what information or behavior the student is expected to acquire. They list the resources and page numbers on which more detailed information can be found and offer suggested learning activities and strategies. The five units cover the following topics: (1) introduction; (2) fundamental scientific and technical concepts and principles; (3) historical developments of transportation systems; (4) vehicular systems and subsystems; and (5) transportation occupational opportunities. The third section (appendixes) contains a bibliography and reference section listing 15 references; a vendors' address list for texts, literature, and films; an equipment list; and a VoCATS (Vocational Competency Achievement Tracking System) test-item bank and tests. (KC)
TRANSPORTATION SYSTEMS

TE8126

TECHNOLOGY EDUCATION

Public Schools of North Carolina
State Board of Education - Jay Robinson, Chairman
Department of Public Instruction - Bob Etheridge, State Superintendent

Vocational and Technical Education Services
July 1995
Activities and procedures within the Division of Instructional Services is governed by the philosophy of simple fairness to all. Therefore, the policy of the Division is that all operations will be performed without regard to race, sex, color, national origin or handicap.
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Section I
ACKNOWLEDGMENTS

This guide is dedicated to Dr. Eddie Butler whose fine service to the students and teachers of North Carolina will always be felt.

The Division of Instructional Services and the Technology Education staff wish to give special thanks to the individuals who spent many hours developing the Transportation Systems course. The process included a review of international literature, review of suggestions offered by teachers and administrators from throughout the state, and many hours spent in constructive debate and discussion.

Two teams were involved. The first team designed the course (blueprints, and curriculum guide, references, resources, and equipment list). Membership of the first team contained the following members:

Aaron Clark  
Doctoral Student, TE  
NCSU

Mike Hinshaw  
Technology Teacher  
East Randolf H.S.

Wanda Jackson  
Technology Teacher  
New Hanover H.S.

Wayne Miller  
Technology Teacher  
South Stokes H.S.

Tom Shown  
Technology Consultant  
NCDPI

The second team wrote the test-items which make up the Transportation Systems test-item bank. The following were the test-item team members:

Aaron Clark  
Doctoral Student, TE  
NCSU

Deborah Levin  
Textile Eng. Graduate  
NCSU

Tom Shown  
Technology Consultant  
NCDPI

Special thanks is also extended to the N.C. Technology Education Curriculum Advisory Board who freely gave their time to help us produce the highest quality curriculum materials possible. Throughout the developmental process they contributed to the making of a curriculum which would have been of much lesser quality without their collective insights, suggestions and direction. The board was comprised of the following members:

Don Ball  
English Teacher  
Wake Technical Community College

Dr. Elazer Barnette  
Professor  
NCA&T

Kathleen Barrows  
Technology Teacher  
Clinton H.S.

David Crane  
Technology Teacher  
Douglas Byrd H.S.

Deborah Hartman  
Technology Teacher  
Philo M.S.

Dr. Jim Haynie  
Professor  
NCSU

Wanda Jackson  
Technology Teacher  
New Hanover H.S.

Dr. Robert Pierce  
Professor  
Elizabeth City State University

Dr. Kenneth Volk  
Professor  
NCECU

Finally, we extend our thanks to the teachers, directors, and others who have taken their time to critique our progress and offer suggestion during this process. Our work is better for their effort.

Debbie Barber  
Secretary  
NCDPI

Deborah Shumate  
Consultant, TE  
NCDPI

Tom Shown  
Consultant, TE  
NCDPI
Using the Curriculum Guide

Purpose

The Transportation Systems Curriculum Guide has been developed as a resource for teachers to use in planning and implementing a competency-based instructional management technology program in their school. This guide is one tool used in the VoCATS process.

Description

Transportation Systems has been designed to be a semester in length. The following description is from the North Carolina Vocational and Technical Education Programs of Studies and Support Services Guide:

Transportation Systems introduces the student to the history and modes of transportation through experimentation and model making. Land, water, air, space, and intermodal transportation systems are explored with hand-on activities emphasizing relevant scientific and engineering concepts. Activities include defining problems, designing prototypes, using computer assisted applications, constructing models, and testing prototypes and using appropriate tools such as wind tunnels and performance tests. The course was designed for students pursuing technical or engineering careers in transportation related areas or individuals who like creating model rockets, planes, cars, and water vehicles.

General Instruction

This course may be taught using individualized, whole class, team, or a combination of each strategy. Regardless of which method is used, it is essential that the activities reflect the competencies and objectives of the course.

The course demands much from the student and teacher in terms of its complexity of materials and brevity of time in which the materials are to be mastered. Because of time limitations and the amount of material to be covered, one cannot teach objectives as discrete units of instructions. Objectives must be taught concurrently within the larger context of an activity. Not only does this method address the need for the efficient use of time, but it is reflective of good pedagogy and reflects the way we teach. (This newest edition of the course reflects the effort of our team in reducing the amount of information to be covered by the students and teacher. It also reflects a refocusing on essential information).

Since Transportation Systems is an activity centered curriculum with competencies and objectives to be mastered, it is important that the teacher use activities which collectively address all the course objectives.

Blueprint

The blueprint (See the Transportation Systems Blueprint on the following pages) lists the competencies the student is to attain. Competencies are mastered when a student masters the objectives which make up the competency.

Suggested time in hours is offered as a general rule-of-thumb for teachers to use in planning.

Course weight is the degree of importance given to each objective in relation to the entire course of study. This in turn will determine the number of test-items per objective on any test developed by the state department.
Using the Curriculum Guide

Units of Instruction

The Units of Instruction section is designed to give the teacher detailed information directly correlated to the blueprint and test-item bank. It attempts to explain in more detail what information or behavior the student is expected to know or do. It lists the resource and page number on which more detailed information can be found. This section also offers suggested activities and strategies.

Bibliography/References (Appendix A)

This section provides the author(s) name of text, and publisher of the references listed within the Units of Instruction "Resources" column.

Vendor's Addresses for Texts, Literature, and Films (Appendix B)

All texts, literature, software, and videos may be purchased through one of the resources listed.

Equipment List (Appendix C)

The equipment list gives the minimum number of tools, equipment, and software necessary for the instruction of Transportation Systems. If you have any questions regarding any aspect of this course, including equipment needs, please call one of your technology consultants.

VoCATS Test-Item Bank and Tests (Appendix D)

You should have access to the Transportation Systems Test-item Bank which will be released August 1995. This bank is made up of multiple choice test items and performance test-items. Under the "Attribute" section of each test-item will be found the exact text and page number of the information used to write the test-item. Appendix D contains a hard copy of all the bank test-items. Note that the last page of this appendix contains a formula sheet for students to use when computing questions within the bank.
## TECHNOLOGY EDUCATION
## COURSE BLUEPRINT for 8126 (CIP# 21 0101): TRANSPORTATION SYSTEMS
(Course Length: 1 semester; Class Length: 1 period)

<table>
<thead>
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<th>Comp#</th>
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<th>COURSE Weight</th>
<th>Type Behavior</th>
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<td>001.</td>
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<td>Assess the role and importance of transportation systems to society.</td>
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<td>001.01</td>
<td>001.01</td>
<td>Define transportation systems and explain their importance to society.</td>
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<td>C3</td>
<td>SS</td>
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<tr>
<td>001.02</td>
<td>001.02</td>
<td>Identify and define the four major modes of transportation and their intermodal relationship.</td>
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<td>001.03</td>
<td>001.03</td>
<td>Identify and define the five major transportation vehicular systems.</td>
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<tr>
<td>002.</td>
<td>002.</td>
<td>Participate in a responsible and efficient manner as an individual or group member to plan, organize, and carry out activities and projects.</td>
<td>8.0</td>
<td>64%</td>
<td>10%</td>
<td>C3P</td>
<td>H/C</td>
<td>Core</td>
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<tr>
<td>002.01</td>
<td>002.01</td>
<td>Identify and explain management skills and quality tools.</td>
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<td>C3</td>
<td>C</td>
<td>Core</td>
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<tr>
<td>002.02</td>
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<td>Apply management skills and quality tools effectively.</td>
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<td>20%</td>
<td>3%</td>
<td>C3P</td>
<td>C</td>
<td>Core</td>
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<tr>
<td>002.03</td>
<td>002.03</td>
<td>Explain classroom and lab safety rules and procedures.</td>
<td>2.0</td>
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<td>C1</td>
<td>H</td>
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<td>002.04</td>
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<td>Apply classroom and lab safety rules and procedures appropriately.</td>
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<td>003.</td>
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<td>Define and apply scientific concepts and principles used specifically in transportation systems.</td>
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<td>5%</td>
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(Course Length: 1 semester; Class Length: 1 period)

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<th>Design, conduct and evaluate lab experiments relating to scientific principles found in transportation systems.</th>
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<th>C3P</th>
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<td>HISTORICAL DEVELOPMENTS OF TRANSPORTATION SYSTEMS.</td>
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<td>004.01</td>
<td>Analyze important historical developments in transportation systems.</td>
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<td>SS/SC</td>
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<td>Organize and explain major developments in the evolution of transportation systems.</td>
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<td>33%</td>
<td>2%</td>
<td>C3</td>
<td>SS/SC</td>
<td>Core</td>
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<tr>
<td>004.02</td>
<td>Design, conduct and evaluate laboratory experiments relating to the evolution of transportation systems.</td>
<td>5.0</td>
<td>67%</td>
<td>4%</td>
<td>C3P</td>
<td>SS/SC</td>
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<td>D</td>
<td>VEHICULAR SYSTEMS AND SUB-SYSTEMS</td>
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<td>64%</td>
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<td>005.01</td>
<td>Explain the fundamental concepts and principles of Transportation Vehicular Sub-systems.</td>
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<td>005.01</td>
<td>Explain the fundamental concepts, principles and applications of transportation propulsion systems.</td>
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<td>005.02</td>
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<td>005.03</td>
<td>Explain the fundamental concepts, principles, and application of transportation control systems.</td>
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*(Course Length: 1 semester; Class Length: 1 period)*

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<th>006.01</th>
<th>Explain the fundamental concepts and principles used in the design and fabrication of actual and model land transportation vehicles.</th>
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<td>Design, build and evaluate a simple land transportation vehicle model.</td>
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<td>007.</td>
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<td>007.01</td>
<td>Explain the fundamental concepts and principles used in the design and fabrication of actual and model water transportation vehicles.</td>
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<tr>
<td>007.02</td>
<td>Design, build and evaluate a simple water transportation vehicle model.</td>
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<td>Design, build and evaluate a simple air or space transportation vehicle model.</td>
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<tr>
<td>008.01</td>
<td>Explain the fundamental concepts and principles used in the design and fabrication of actual and model air or space transportation vehicles.</td>
<td>3.0</td>
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<td>008.02</td>
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<td>E</td>
<td>Transportation Occupational Opportunities</td>
<td>3.0</td>
<td>100%</td>
<td>3%</td>
<td>C1</td>
<td>SS</td>
<td>Core</td>
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<td>009.</td>
<td>Assess personal career goals with respect to transportation occupations.</td>
<td>3.0</td>
<td>100%</td>
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<td>009.01</td>
<td>Identify occupational opportunities and trends within transportation systems.</td>
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<td>Evaluate personal interests and attributes in relation to transportation occupations.</td>
<td>2.0</td>
<td>67%</td>
<td>2%</td>
<td>C3</td>
<td>SS</td>
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</tbody>
</table>
Section II

Units of Instruction
Unit A

Introduction
COURSE: Transportation Systems

UNIT: Introduction

COMPETENCY: 001.00: Assess the role and importance of transportation systems to society.

OBJECTIVE: 001.01: Define transportation systems and explain their importance to society.

OUTLINE

A. Definition: Transportation systems move people and/or products.

B. Advantages: Speed, people, product movement
   General improvement of our lives

C. Disadvantages: Pollution, dangerous, energy consumption
   1. Excess speeds is the primary cause of accidents
   2. Internal combustion engines produce carbon monoxide
   3. One half of all transportation energy is produced by automobiles
   4. Transportation consumes the highest amount of controlled energy of the four basic systems
   5. Transportation consumes around 15% of average adults income
   6. Air pollution caused by transportation systems may change environment
   7. All land transportation systems consume large amounts of land
   8. Transportation systems consume 25% of all energy.
   9. Transportation systems produce the most carbon monoxide of all industries.

SUGGESTED ACTIVITIES:

Produce a pie chart showing energy consumption by mode of transportation, then show ton/mile.
D. Importance of transportation: five major reasons
   1. Economic
   2. Tech. Interdependence
   3. Improve life
   4. Satisfy human needs
   5. Solves problems (sewage)
   6. Strategic Defense

E. All systems are inter-related. (Communication, Manufacturing, Structural Systems)

   A system is a combination of parts working together for a common purpose or goal
## COURSE: Transportation Systems

## UNIT: Introduction

### COMPETENCY: 001.00: Assess the role and importance of transportation systems to society.

### OBJECTIVE: 001.02: Identify and define the four major modes of transportation and their intermodal relationship.

### OUTLINE

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<td>R1/55; 37-42</td>
</tr>
<tr>
<td>R2/25; 27</td>
</tr>
<tr>
<td>R1/142</td>
</tr>
</tbody>
</table>

### A. List and describe five types of transportation; land, water, air, space, and intermodal

### B. Define land transportation

**Definition**

- three types of land transportation vehicles and the importance of each

**EXAMPLES:** Pipelines - most efficient for moving fluids, quiet, and have low theft rate

- Car - most flexible

- Order of most efficient (ton per mile) to least: rail, truck, bus, car, plane

- Trucks consume more energy than rail, water or pipelines

### C. Define water transportation

1. **Definition**

2. **List three types of water transportation vehicles and the importance of each**
   - a. Hovercrafts ride on a cushion of air
   - b. Water transportation is less expensive than truck or airplanes but is slow and therefore used mostly for freight

### D. Define air transportation

1. **Definition**
   - a. Air transportation refers to craft which operates in the earth's atmosphere

2. **List three types of air transportation vehicles and the importance of each**
   - a. Vertical take-off by helicopter
b. Lighter-than-air example is a (blimp, dirigible, or balloon) R2/27

c. Helium is used to float dirigibles R1/138

d. Dirigibles can lift heaviest loads R1/137

e. Heavier-than-air example is a (airplane, glider, jet) R1/137

E. Define space transportation

1. Definition R1/56; 149-155

2. List three types of space transportation vehicles and the importance of each R2/27

3. Space travel for humans is currently limited because of the great time need to travel to planets and stars CG

F. Intermodal

1. Definition R1/159

   a. Intermodal is the use of more than one mode of transportation R1/82

   b. Requires a great deal of planning and coordination

2. List three examples of intermodal transportation and the importance of each

   a. TOFC stands for "Truck on Flat Car" R1/161

   b. COFC stand for "Container on Flat Car" R1/161

   c. Piggyback "Truck trailers on railroad cars" R1/161
COURSE: Transportation Systems

UNIT: Introduction

COMPETENCY: 001.00: Assess the role and importance of transportation systems to society.

OBJECTIVE: 001.03: Identify and define the five major transportation vehicular systems.

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
</table>
| A. Define vehicular propulsion systems  
Examples: sails, jet engines, electric motors | R1/173; R2/28  
R1/165 |
| B. Define vehicular guidance systems  
Examples: compasses, maps, road signs | |
| C. Define vehicular control systems  
Examples: gas pedal, rudders, steering wheels | R1/203; R2/29 |
| D. Define vehicular suspension systems  
Examples: tires, wings, boat hulls | R1/219; R2/29-30 |
| E. Define vehicular structural systems  
Examples: car frame and body, fuselage, boat hulls | R1/233; R2/30 |
| F. Define and give examples of major related systems | R1/247; R2/30 |
| 1. Communication systems  
a. Radio, Radar, and VOR communication systems | |
| 2. Manufacturing and maintenance systems  
a. Make and repair devices used in transportation systems | |
| 3. Structural systems  
a. Roads, bridges, tunnels, sea and air ports, space stations, etc. | |
| 4. Legal and governing systems | |
COURSE: Transportation Systems

UNIT: Introduction

COMPETENCY: 002.00: Participate in a responsible and efficient manner as an individual or group member to plan, organize, and carry out activities and projects.

OBJECTIVE: 002.01: Identify and explain management skills and quality tools.

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. List and explain the steps of the IDEAL Problem Solving Method</td>
<td>FR5</td>
</tr>
<tr>
<td>1. Identify</td>
<td>FR5/20</td>
</tr>
<tr>
<td>2. Define</td>
<td>FR5/24</td>
</tr>
<tr>
<td>3. Explore</td>
<td>FR5/27</td>
</tr>
<tr>
<td>4. Act</td>
<td>FR5/33</td>
</tr>
<tr>
<td>5. Look</td>
<td>FR5/20; 36</td>
</tr>
<tr>
<td>B. Use of Parliamentary Procedure</td>
<td>CG</td>
</tr>
<tr>
<td>1. Quorum</td>
<td>CG</td>
</tr>
<tr>
<td>2. Robert's Rules of Order</td>
<td>CG</td>
</tr>
<tr>
<td>3. Presenting amendments</td>
<td>CG</td>
</tr>
<tr>
<td>C. Quality Tools</td>
<td>FR4</td>
</tr>
<tr>
<td>1. Force Field Analysis</td>
<td>FR4/298</td>
</tr>
<tr>
<td>2. Nominal Group Technique</td>
<td>FR4/299</td>
</tr>
<tr>
<td>3. Fishbone Diagram (Cause and Effect)</td>
<td>FR4/276</td>
</tr>
<tr>
<td>4. Run Chart</td>
<td>FR4/278</td>
</tr>
<tr>
<td>5. Flow Chart</td>
<td>FR4/267</td>
</tr>
<tr>
<td>6. Other</td>
<td>FR4/266</td>
</tr>
</tbody>
</table>
COURSE: Transportation Systems

UNIT: Introduction

COMPETENCY: 002.00: Participate in a responsible and efficient manner as an individual or group member to plan, organize, and carry out activities and projects.

OBJECTIVE: 002.02: Apply management skills and quality tools effectively.

OUTLINE

Performance:

See Performance Item 2.02.01 and accompanying directions.  

RESOURCES

CG
COURSE: Transportation Systems

UNIT: Introduction

COMPETENCY: 002.00: Participate in a responsible and efficient manner as an individual or group member to plan, organize, and carry out activities and projects.

OBJECTIVE: 002.03 Explain classroom and lab safety rules and procedures.

OUTLINE

A. Ten safety rules - general and specific
   1. All tools should be properly stored when not in use
   2. Ask your teacher when in doubt about the operation of any machinery
   3. Safety glasses must be worn at all times in the lab and when launching model rockets
   4. Leave space for fuel expansion when filling fuel tanks
   5. When working with machinery and electrical equipment:
      a. Remove all jewelry
      b. Tie back long hair
      c. Wear safety glasses (include face shields when grinding)
      d. Wear snug (not loose) fitting clothes
   5. Batteries should be stored in well ventilated places
   7. Push a wrench with an opened hand
   8. Keep rags off of hot engines
   9. Engine parts should be cleaned with kerosene
   10. Carbon monoxide poisoning symptoms include headache, nausea, ringing ears, and tiredness

RESOURCES

FR3-15-20
R3/231
FR2/18; R3/232
FR2/18
R3/234
R3/231
R3/231
R3/231
R3/235
R3/232
R3/233
R3/233
R1/xii
COURSE: Transportation Systems

UNIT: Introduction

COMPETENCY: 002.00: Participate in a responsible and efficient manner as an individual or group member to plan, organize, and carry out activities and projects.

OBJECTIVE: 002.04 Apply classroom and lab safety rules and procedures appropriately.

OUTLINE

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Generals Student Behavioral Standards</td>
<td>R2/xii</td>
</tr>
<tr>
<td>1. Safety minded attitude</td>
<td></td>
</tr>
<tr>
<td>2. Respectful of self and others</td>
<td></td>
</tr>
<tr>
<td>3. Cooperative (works well with others)</td>
<td></td>
</tr>
<tr>
<td>B. See Performance Item 002.04.01 and accompanying directions</td>
<td>CG</td>
</tr>
</tbody>
</table>

ERIc
Unit B

Fundamental Scientific and Technical Concepts and Principles
COURSE: Transportation Systems

UNIT: Fundamental Scientific and Technical Concepts and Principles

COMPETENCY: 003.00: Define and apply scientific concepts and principles used specify in transportation systems.

OBJECTIVE: 003.01: Define scientific concepts and principles used within transportation systems.

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Aerodynamics</td>
<td>R1/226</td>
</tr>
<tr>
<td>B. Angle of attack</td>
<td>R2/116</td>
</tr>
<tr>
<td>C. Apogee</td>
<td>R1/151</td>
</tr>
<tr>
<td>D. Buoyancy</td>
<td>R1/127; 227</td>
</tr>
<tr>
<td>E. Ballast (Ships and balloons)</td>
<td>R1/227</td>
</tr>
<tr>
<td>F. Center of buoyancy (The location of the center of the boat's displacement) (See Advanced Transportation Systems)</td>
<td>R8</td>
</tr>
<tr>
<td>G. Centrifugal force</td>
<td>R1/90</td>
</tr>
<tr>
<td>H. Centripetal (A force acting inwards- the force exerted by a string on an object being swung around in a circle)</td>
<td>R1/90</td>
</tr>
<tr>
<td>I. Coefficient of drag</td>
<td>R2/62</td>
</tr>
<tr>
<td>J. Control</td>
<td>R1/203; 217</td>
</tr>
<tr>
<td>K. Coordinates</td>
<td>R1/195</td>
</tr>
<tr>
<td>L. Displacement</td>
<td>R2/401</td>
</tr>
<tr>
<td>M. Draft/Displacement</td>
<td>R1/127; 128</td>
</tr>
<tr>
<td>N. Drag</td>
<td>R1/147; 226</td>
</tr>
<tr>
<td>O-1 Draft</td>
<td>R1/128</td>
</tr>
<tr>
<td>O-2 Dynamometer</td>
<td>R2/286</td>
</tr>
<tr>
<td>P-1 Efficiency = energy out/energy in X 100%</td>
<td>R3/149; R1/49</td>
</tr>
<tr>
<td>P-2 Electro-magnetic induction</td>
<td>R1/78</td>
</tr>
<tr>
<td>Q-1 Energy (Potential and kinetic)</td>
<td>R1/17</td>
</tr>
<tr>
<td>Q-2 Equator</td>
<td>R1/195</td>
</tr>
<tr>
<td>R. Friction</td>
<td>R1/45</td>
</tr>
<tr>
<td>OUTLINE</td>
<td>RESOURCES</td>
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<tr>
<td>--------------</td>
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</tr>
<tr>
<td>S-1 Force</td>
<td>R3/151</td>
</tr>
<tr>
<td>S-2 Foot-pounds</td>
<td>R1/19</td>
</tr>
<tr>
<td>T-1 Geostationary/Geosynchronous orbit: having an equatorial orbit requiring an angular velocity the same as that of the earth so that the position of a satellite in such an orbit is fixed with respect to the earth</td>
<td>CG</td>
</tr>
<tr>
<td>T-2 Gravity</td>
<td>R1/226</td>
</tr>
<tr>
<td>U. Horsepower defined</td>
<td>R2/284</td>
</tr>
<tr>
<td>V. Hydraulic systems</td>
<td>R1/85</td>
</tr>
<tr>
<td>W. Hydrodynamics</td>
<td>R1/125; 134</td>
</tr>
<tr>
<td>X. Knot (equals 1.15 miles per hour)</td>
<td>R2/83</td>
</tr>
<tr>
<td>Y. Latitude</td>
<td>R1/195</td>
</tr>
<tr>
<td>Z. Lift</td>
<td>R1/138; 141</td>
</tr>
<tr>
<td>AA Linear Motion</td>
<td>R3/149</td>
</tr>
<tr>
<td>BB Longitude</td>
<td>R1/195</td>
</tr>
<tr>
<td>CC Magnetism (Like magnetic poles repulse, unlike attract) Magnetic Flux</td>
<td>R1/77; 78; 187; 225</td>
</tr>
<tr>
<td>DD Mechanical advantage (Actual mechanical advantage)</td>
<td>R1/60</td>
</tr>
<tr>
<td>EE Navigation</td>
<td>R1/126; 192; 200</td>
</tr>
<tr>
<td>FF Newton's Laws of Motion</td>
<td>R2/139</td>
</tr>
<tr>
<td>GG Newton (As measurement of force) 1 pound of force = 4.448 newtons A newton is the amount of force required to impact an acceleration of one meter per second to a mass of one kilogram</td>
<td>R1/151</td>
</tr>
<tr>
<td>HH Perigee</td>
<td>R2/83 &amp; 404</td>
</tr>
<tr>
<td>I Pitch (Movement of an aircraft about its lateral axis. Also the angle of the blade of a propeller)</td>
<td>R1/85</td>
</tr>
<tr>
<td>JJ-1 Pneumatic systems</td>
<td>R1/195</td>
</tr>
<tr>
<td>JJ-2 Prime Meridian</td>
<td>R1/19</td>
</tr>
<tr>
<td>KK Power (Power - work/time)</td>
<td>R1/90</td>
</tr>
<tr>
<td>LL Reciprocating motion (Back and forth motion)</td>
<td>R2/83</td>
</tr>
<tr>
<td>MM Roll (Movement of an aircraft about its longitudinal axis. Also the side to side motion on a boat or ship)</td>
<td>R3/149</td>
</tr>
<tr>
<td>NN Rotary motion (Circular motion)</td>
<td>R3/149</td>
</tr>
<tr>
<td>OUTLINE</td>
<td>RESOURCES</td>
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<td>---------</td>
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</tr>
<tr>
<td>OO</td>
<td>Rudder</td>
</tr>
<tr>
<td>PP</td>
<td>Sails (Mainsails, jibs, and spinnaker)</td>
</tr>
<tr>
<td>QQ</td>
<td>Sines and Tangents</td>
</tr>
<tr>
<td>RR</td>
<td>Stall (The point at which the lift become so small that it no longer supports the craft or device)</td>
</tr>
<tr>
<td>SS</td>
<td>Tacking</td>
</tr>
<tr>
<td>TT</td>
<td>Thrust</td>
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<tr>
<td>UU</td>
<td>Torque</td>
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<tr>
<td></td>
<td>Watt</td>
</tr>
<tr>
<td></td>
<td>Work</td>
</tr>
<tr>
<td>VV</td>
<td>Vortex (Vortices)</td>
</tr>
<tr>
<td>WW</td>
<td>Yaw (Different shades of meaning for ships, planes, and windmills)</td>
</tr>
</tbody>
</table>
COURSE: Transportation Systems

UNIT: Fundamental Scientific and Technical Concepts and Principles

COMPETENCY: 003.00: Define and apply scientific concepts and principles used specify in transportation systems.

OBJECTIVE: 003.02: Design, conduct, and evaluate lab experiments relating to scientific principles found in transportation systems.

OUTLINE

Working individually or as team members have the students conduct the following or comparable experiments.

A. Land transportation experiment

1. Friction
   - Have the student(s) make two land vehicles that are the same in all aspects except: friction on axles. One set made with no friction reduction methods and the second with friction reduction methods (such as bushings, bearings, and/or lubricants. Test by rolling the two different types down a ramp and record the distances traveled. Have students construct a graph of all vehicles and compare.

2. Magnetism
   - a. Magnet experiment
   - b. Compass experiment

B. Water transportation experiment

1. Displacement, draft, and buoyancy
   - Hull shapes, materials, weight

2. Hydrodynamics
   - Use a shallow water tank as well as a device to hold different hull cross-sections. Place food coloring at the front of each hull to test for drag, eddies, and current flow.

C. Air transportation experiment

1. Lift:
   - Construct a device using a triple beam balance scale to hold an airfoil cross section in front of a fan. Measure the lift at different air speeds and test different airfoil shapes.
2. Pitch, roll, and yaw

Construct paper gliders from a stiff paper. Cut elevators, ailerons, and a rudder. Manipulate the control flaps on each glider to demonstrate changes in pitch, roll, and yaw.

D. Space transportation experiment

1. Stability (Center of effort and center of gravity):

Test the stability of model rockets using either a string test, cardboard silhouette, or wind tunnel.

2. Thrust

Using a balloon, conduct a thrust experiment

E. See Performance Test-item 3.02.01 and accompanying directions
Unit C

Historical Developments of Transportation Systems
COURSE: Transportation Systems

UNIT: Historical Developments of Transportation Systems

COMPETENCY: 004.00: Analyze important historical developments in transportation systems.

OBJECTIVE: 004.01: Organize and explain major developments in the evolution of transportation systems.

OUTLINE

Recognize and explain the importance of the following transportation developments

Major developments of transportation systems

1. Wheel - On flat terrain wheel is more efficient and faster than sled
   - R1/63; R2/34; FR1/144

2. Sails - Lateen sail improved efficiency and freedom of movement
   - R1/173; R2-301

3. Steam engines - Central importance to industrial revolution and ships and trains
   - R1/137; R2/27

4. Hot air balloon
   - R1/138; R2/27

5. First power driven aircraft
   - R1/139

6. First powered heavier than air flight - Wright Brothers 1903
   - R1/110

7. Ford Model T (Freedom of movement for citizens)
   - R1/147

8. Rocket
   - R1/148

9. First satellite - Russian Sputnik 1, 1957
   - R1/148; FR1/320

10. First human space flight - Russia’s Yuri Gagarin, 1961
    - R1/149; FR1/321

    - FR1/321

12. Dugout canoe - preceded the wheel, horse, and sailing vessels
    - FR1/10

13. Subways - Development depended on electric propulsion
    - FR1/178

14. Rail Transport verses horse-drawn vehicle - less expensive, more reliable
    - FR1/177

15. Unmanned space flight (Mariner & Pioneer) - Allow gathering of information from distances to far for manned flight
    - FR1/322

16. Modern jet commercial airlines such as the Boeing 747 travel over 300 mph
    - FR1/317

17. Quadrant - Early sailors used this for determining latitude
    - FR1/110
18. Pack animals can carry more weight than humans (a camel can carry up to 1000 lbs)

19. Compass allowed for maintaining a constant course of travel

20. Steamships were less expensive and more reliably powered than sailing ships

21. Roman roads allowed for increased trade, communications, and movement of troops
Unit D

Vehicular Systems and Sub-Systems
COURSE: Transportation Systems

UNIT: Historical Development of Transportation Systems

COMPETENCY: 004.00: Analyze important historical developments in transportation systems.

OBJECTIVE: 004.02: Design, conduct, and evaluate laboratory experiments relating to the evolution of transportation systems.

OUTLINE

A. Working as individuals or team members have the students complete the following:
   1. Research, design, and build a model of a historical transportation device.
   2. Evaluate the social, economic, and environment impacts of the device.
   3. Write a technical report reporting on the preceding information.
   4. Present the research finding to the class using appropriate presentation media.

B. See Performance Item 4.02.01 and accompanying instruction

RESOURCES

CG
COURSE: Transportation Systems

UNIT: Vehicular Systems and Sub-Systems

COMPETENCY: 005.00: Explain the fundamental concepts and principles of Transportation Vehicular Sub-systems.

OBJECTIVE: 005.01: Explain the fundamental concepts, principles, and applications of transportation propulsion systems.

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Purpose of propulsion systems and devices</td>
<td>R1/173; R2/28</td>
</tr>
<tr>
<td>B. Types of propulsion systems and devices and their uses and theories of operation:</td>
<td></td>
</tr>
<tr>
<td>1. Heat engines</td>
<td>R3/150-164</td>
</tr>
<tr>
<td>a. General Information</td>
<td></td>
</tr>
<tr>
<td>Heat engines are less than 40% efficient</td>
<td>R3/17</td>
</tr>
<tr>
<td>b. External combustion</td>
<td>R3/149</td>
</tr>
<tr>
<td>1. Steam engine engines</td>
<td></td>
</tr>
<tr>
<td>a. Steam engine - reciprocating motion</td>
<td>R3/154</td>
</tr>
<tr>
<td>b. Steam Turbine - rotary motion (power nuclear subs)</td>
<td></td>
</tr>
<tr>
<td>2. Stirling engine - passes heated gas between two cylinders</td>
<td>R3/154</td>
</tr>
<tr>
<td>c. Internal combustion engines</td>
<td>R3/154</td>
</tr>
<tr>
<td>1. General information:</td>
<td></td>
</tr>
<tr>
<td>a. Most transportation devices are powered by internal combustion engines</td>
<td>R3/159</td>
</tr>
<tr>
<td>b. Major sources of energy is petroleum</td>
<td>CG</td>
</tr>
<tr>
<td>2. Gasoline piston engines</td>
<td>R3/159</td>
</tr>
<tr>
<td>a. Pistons produce a reciprocating motion</td>
<td>R3/159</td>
</tr>
<tr>
<td>b. Most cars are powered by gasoline piston engines</td>
<td>R3/159</td>
</tr>
<tr>
<td>c. Gasoline engines operate on two-stroke or four-stroke cycles</td>
<td>R3/160</td>
</tr>
<tr>
<td>d. The four cycles of a four stroke engine are intake, compression, power, and exhaust</td>
<td>R3/160</td>
</tr>
<tr>
<td>OUTLINE</td>
<td>RESOURCES</td>
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<tr>
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</tr>
<tr>
<td><strong>3. Diesel engines</strong></td>
<td></td>
</tr>
<tr>
<td>a - Fuel is ignited in a diesel engine by compression</td>
<td>R3/161</td>
</tr>
<tr>
<td>b - One advantage of a diesel engine is its fuel economy and reliability</td>
<td>R3/162</td>
</tr>
<tr>
<td>c - Diesels are around 40% efficient</td>
<td>R3/149</td>
</tr>
<tr>
<td>d - Most ships and large trucks are powered by diesel</td>
<td>R2/28; R3/161</td>
</tr>
</tbody>
</table>

| **4. Rotary engines "Wankel"** | |
| a - Rotary engine output is measured in torque | R3/165 |

| **5. Jet engines** | |
| a - General information | R3/164 |
| 1 - Jet engines produce a linear motion | R3/159 |
| 2 - Principle same as balloon | R3/165 |
| 3 - Jet engines are open on both ends (intake and exhaust) | R3/165 |
| 4 - Action of jet engine is continuous and measured in thrust | R3/165 |
| b - Turbojet | R3/165 |
| c - Ramjet (missiles) (simplest of all reaction engines) | |
| d - Turbopfan (airlines) (Fans provide additional thrust) | R1/182 |
| e - Turboprop (small airplanes) (engine powers compressor and propeller) | R3/167 |
| f - Gas turbines (Exposed to high temperatures) (Used to power ships) | R3/167 |

| **6. Rocket Engines** | |
| a - General information | R3/169 |
| The most powerful of the internal combustion engines | |
| b - Liquid propellent (power can be regulated) | R3/169 |
| c - Solid propellent (power can not be regulated) (no need to pump fuel into combustion chamber) | R3/169 |
2. Electric motors
   a. Universal
   b. Induction
   c. Magnetic Levitation (propulsion and suspension)
3. Diesel-electric motors (drive trains)
   a. Modern locomotive use diesel engines to generate power to drive electric motors.
4. Sails and Propellers (types of sails and purpose)
   a. Sails
      1 - Mainsail - Captures most of the wind
      2 - Jib - Forward of main sail
      3 - Spinnaker - Placed opposite or along mainsail
      4 - Lateen - Improved maneuverability for early sailors
   b. Propellers
      1 - Pitch is the angle of the propeller blades
      2 - Pitch measurement determines the number of inches it will move forward per rotation
      3 - Lower pitch, greater pulling power, higher pitch less
5. Transmission Systems
   a. Clutches - Friction and centrifugal
   b. Drive shafts - Transfers power from engine to drive wheels
6. Other
   a. Pumps (types of, hydraulic, gear, centrifugal, and reciprocating)
   b. Photovoltaic Cells
OUTLINE

A. Purpose of Guidance (navigation and warning system)

Tell device or operator the direction, speed, location (latitude, longitude, altitude, depth) pressure and/or warn of danger.

B. Types of Guidance Systems and their uses and theories of operation

1. Graphic (maps, charts, and marker) Systems

   a. Road signs and signals and navigational markers
      Purpose: give location, instructions, or warning
      1. Land - road signs, stop lights
      2. Sea and air - buoys, lighthouses

   b. Maps and charts
      1. General information
         a - The greater the denominator, the less detail but the greater the land area shown
         b - There is a total of 360 degrees latitude and longitude
      2. Types of maps and charts
         a - Road maps
         c - Aeronautical charts
            1 - Show location of radio transmitters
         d - Nautical charts
            1 - Show church steeples, water towers, and other high structures
         e - Globes
            1 - Show large land and water masses

RESOURCES

R1/191; R2/29
R1/191
R1/192
R1/192
R1/192
R1/193-95
R1/193-195
R1/193-95
R1/193-95
R1/195
R1/195
2. Mechanical and electro-mechanical devices
   a. Location, direction, speed, and time devices
      1. Compasses
         a - Allow for crossing wide bodies of water for early sailors
         b - Magnetic north differs from true north by up to 1000 miles
      2. Sextants
         a - Mechanical sextant
         b - Radio sextant (measures radio waves given off by sun to determine location)
      3. Gyrocompasses (can be set to point to true north or maintain fixed point in space)
      4. Radio (radio transmitters, land-based, government owned)
      5. Radar (bounces radio waves off of objects to determine distance)
      6. Speedometers
      7. Airspeed indicators (works off of a pressure differential)
      8. Logs (activated by water pressure-measures speed in knots)
      9. Sonar (bounces sound waves off of objects to determine distance or depth)
   b. Pressure and temperature devices
      1. Pressure sensors
      2. Heat sensors
   c. Integrating devices
      1. Computers
3. Navigational Processes
   
a. Dead reckoning
      Estimate how far and in what direction the vehicle has gone

b. Piloting
   1. Uses reading of visible landmarks with compass and chart

c. VOR (Very High Frequency Omni-directional Range)

d. NAVSAT
   1. Uses multiple satellites to determine location of vehicle

e. Omega
   International system used to aid ships approaching land
**COURSE:** Transportation Systems

**UNIT:** Vehicular Systems and Sub-Systems

**COMPETENCY:** 005.00: Explain the fundamental concepts and principles of Transportation Vehicular Sub-systems.

**OBJECTIVE:** 005.03: Explain the fundamental concepts, principles, and application of Transportation Control Systems.

### OUTLINE

<table>
<thead>
<tr>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Purpose of Transportation Control Systems</td>
</tr>
<tr>
<td>1. Control systems are designed to control location, speed and/or vehicle</td>
</tr>
<tr>
<td>2. Degrees of freedom</td>
</tr>
<tr>
<td>Train-1; Car-2; helicopter-3</td>
</tr>
</tbody>
</table>

| B. Types of Transportation Control Systems and their uses and theories of operation |
| 1. Speed control systems and devices |
| a. Measurement of speed |
| 1. Land-kilometers per hour or miles per hour |
| 2. Water-knots |
| 3. Air-miles per hour and knots |
| b. Acceleration |
| 1. Increase applied forces |
| a - Increase fuel |
| b - Increase applied energy (sail opened or turned to capture greater lift or glider pitch to use gravity to increase assent or sub use of air tanks) |
| c - Change propeller pitch/speed |
| 2. Increase mechanical advantage (gear up) |
| R1/203 |
| R1/203-208 |
OUTLINE

1. Deceleration
   a. Decrease applied forces
      i. Decrease fuel consumption
      ii. Decrease applied energy (sail folded or turned to lessen lift, etc.)
      iii. Change propeller pitch/speed
   b. Decrease mechanical advantage (gear down)
   c. Braking systems
      i. Drum
      ii. Disc

2. Controlling direction
   a. Fixed rails and guideways (trains, elevators)
   b. Steering systems
      1. Wheel and track (bulldozer, tanks) systems (friction systems)
         i. Caster
         ii. Camber
      2. Rudders (boats, ships, and planes)
         (Includes propellers, rotors, ailerons, and elevators)
         (Fluid- aerodynamic/hydrodynamic) (Helicopter cyclical pitch)
      3. Change of propulsion direction or application (on or off)
         i. Propulsion fans (dirigibles)
         ii. Rockets and jets (change of nozzle direction) (on or off)
   4. Hot air balloons
      a. Heated air less dense, floats in cooler air

RESOURCES
3. Transmitting Power (Transmission systems)
   a. Clutches - used to engage and disengage power source to wheels, propellers, etc.
   b. Drive shafts
   c. Transmissions - multiply, divide, or reverse mechanical power
   d. Gearing

   A power device such as a motor or engine turning a large gear driving a small gear which in turn is driving a wheel or propeller provides greater speed and less torque than a motor or engine turning a small gear driving a large gear turning a driving wheel or propeller. While the later will move more slowly, it will provide greater force (torque).
COURSE: Transportation Systems
UNIT: Vehicular Systems and Sub-Systems
COMPETENCY: 005.00: Explain the fundamental concepts and principles of Transportation Vehicular Sub-systems.
OBJECTIVE: 005.04: Explain the fundamental concepts, principles, and application of Transportation Suspension Systems.

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Purpose of Transportation Suspension Systems</td>
<td>R1/219-232</td>
</tr>
<tr>
<td>Suspension systems are designed to support the vehicular system in the environment in which it is designed to operate. This includes enabling it to operate efficiently and to provide comfort and/or freedom from damage to people or things being carried.</td>
<td></td>
</tr>
<tr>
<td>B. Types of Transportation Suspension Systems and their uses and theories of operation</td>
<td></td>
</tr>
<tr>
<td>1. Land</td>
<td></td>
</tr>
<tr>
<td>a. Tires (Pneumatic tires filled with air) Hydroplaneing may cause lose of control</td>
<td>R1/219</td>
</tr>
<tr>
<td>b. Springs</td>
<td>R1/220</td>
</tr>
<tr>
<td>c. Shock absorbers (Reduce spring oscillation)</td>
<td>R1/224</td>
</tr>
<tr>
<td>d. Stabilizer bars (Prevents excess leaning going around curves)</td>
<td>R1/224</td>
</tr>
<tr>
<td>2. Fluid, water, and air (Aerodynamic/Hydrodynamic)</td>
<td>R1/227</td>
</tr>
<tr>
<td>a. Water</td>
<td></td>
</tr>
<tr>
<td>1. General information</td>
<td></td>
</tr>
<tr>
<td>a - Hull &quot;chine&quot; reduces roll and splashing</td>
<td></td>
</tr>
<tr>
<td>b - Bulkhead isolate sections of ship to reduce likelihood of sinking</td>
<td>R1/228</td>
</tr>
<tr>
<td>2. Hulls</td>
<td></td>
</tr>
<tr>
<td>a - Round (Least stable)</td>
<td>R1/228</td>
</tr>
<tr>
<td>b - Flat</td>
<td>R1/228</td>
</tr>
<tr>
<td>c - V-hull</td>
<td></td>
</tr>
</tbody>
</table>
d - Catamaran (One of the most stable)

e - Tri-hull

f - Hydrofoils (Rides on "wings" attached to hull)

g - Planing hulls (Skim on water at cruising speed)

h - Displacement hull (Designed to carry great weight)

3. Flotation tanks
   a - Control the buoyancy of submarines
   b. Air

1. Wings
   a - All heavier than air vehicles rely on airfoils to provide lift

2. Envelopes (balloon)
   a - Blimps rely on helium to provide lift
   b - Hot air balloons rely on hot air to provide lift

3. Rotor blades
   a - Helicopters rely on "rotor blades" (Rotating wings) to provide lift

3. Land and water (air cushioned vehicles)
   a. Float on cushion of air
   b. Plenum chamber
   c. Annular jet
COURSE: Transportation Systems

UNIT: Vehicular Systems and Sub-Systems

COMPETENCY: 005.00: Explain the fundamental concepts and principles of Transportation Vehicular Sub-systems.

OBJECTIVE: 005.05: Explain the fundamental concepts, principles, and application of Transportation Structural Systems.

OUTLINE

<table>
<thead>
<tr>
<th>RESOURCES</th>
<th>A. Definition and Purpose of Transportation Structural Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1/233</td>
<td>1. Definition: Parts of vehicles which hold or carry other vehicular systems and the things being carried</td>
</tr>
<tr>
<td>R1/235</td>
<td>2. Purpose: To provide mounting places for the systems of propulsion, control, suspension and guidance systems and to provide space for the people and/or cargo being transported</td>
</tr>
<tr>
<td>R1/234</td>
<td>B. Types of Transportation Structural Systems and their uses and theories of operation</td>
</tr>
<tr>
<td>R1/239</td>
<td>1. Land</td>
</tr>
<tr>
<td>R1/140</td>
<td>a. General information</td>
</tr>
<tr>
<td>R1/233</td>
<td>1. Plastics tend to not be as strong as steel, nor does it withstand the impact of crashes as well</td>
</tr>
<tr>
<td>R1/233</td>
<td>2. Larger cars tend to be quieter and safer than smaller cars</td>
</tr>
<tr>
<td>R1/239</td>
<td>b. Types of Frames</td>
</tr>
<tr>
<td>R1/239</td>
<td>1. Chassis &quot;frame&quot;</td>
</tr>
<tr>
<td>R1/239</td>
<td>2. Uni-body &quot;body-frame combination&quot;</td>
</tr>
<tr>
<td>R1/239</td>
<td>2. Air</td>
</tr>
<tr>
<td>R1/140</td>
<td>a. General information (parts of plane's structure: rudder, fuselage, ailerons and their purpose)</td>
</tr>
<tr>
<td>R1/239</td>
<td>b. Monocoque (means one shell)</td>
</tr>
<tr>
<td>R1/239</td>
<td>1. Provides for more storage space than Truss frame</td>
</tr>
</tbody>
</table>

29
OUTLINE

3. Water
   a. Hulls
      1. General information
         a. Delta shape provides stability and makes it easier to
            "plane" the boat
         b. Chine reduces splashing, increases stability
         c. Displacement hulls carry greater weight
         d. Bulkheads reduce the possibility of sinking
      b. Types of hulls
         1. Round
         2. Flat
         3. V-hull
         4. Catamaran
         5. Tri-hull
         6. Hydrofoil
      c. Flotation tanks - Hull types
   b. Types of hulls
      1. Round
      2. Flat
      3. V-hull
      4. Catamaran
      5. Tri-hull
      6. Hydrofoil
   c. Flotation tanks - Hull types

4. Space (Rockets)
   General Information
   a. Single or multiple stages
   b. Main structural components
      1. Fuselage
      2. Crew compartment (if manned)
      3. Vertical stabilizer
   c. Space shuttle uses ceramic tiles to protect against excessive heat
don' during re-entry

RESOURCES

R1/138
R1/238
R1/228
R2/82
R2/82
R2/82
R1/242
R1/229
R1/243
R1/243
COURSE: Transportation Systems

UNIT: Vehicular systems and sub-systems

COMPETENCY: 006.00: Design, build, and evaluate a simple land transportation vehicle model.

OBJECTIVE: 006.01: Explain the fundamental concepts and principles used in the design and fabrication of actual and model land transportation vehicles.

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Propulsion</td>
<td>R1/173-190</td>
</tr>
<tr>
<td>General Information</td>
<td></td>
</tr>
<tr>
<td>1. Solar powered vehicles greatly reduce air pollution</td>
<td></td>
</tr>
<tr>
<td>2. Gearing (Increases/decreases speed and torque)</td>
<td></td>
</tr>
<tr>
<td>3. Reduced friction on bearings increases speed</td>
<td>R2/288</td>
</tr>
<tr>
<td>4. Horsepower = Foot/pound of torque x rpm/5252</td>
<td>R2/288</td>
</tr>
<tr>
<td>B. Guidance</td>
<td>R1/191-202</td>
</tr>
<tr>
<td>C. Control</td>
<td>R1/203-218</td>
</tr>
<tr>
<td>D. Suspension</td>
<td>R1/219-232</td>
</tr>
<tr>
<td>General Information</td>
<td></td>
</tr>
<tr>
<td>1. Maglev vehicles ride on magnetic force fields</td>
<td>R2/384</td>
</tr>
<tr>
<td>2. Maglev transportation systems have magnets on both the train and the rail system</td>
<td>R2/385</td>
</tr>
<tr>
<td>3. Active suspension refers to computerized controlled systems</td>
<td>R2/384</td>
</tr>
<tr>
<td>E. Structural</td>
<td>R1/233-246</td>
</tr>
<tr>
<td>General Information</td>
<td></td>
</tr>
<tr>
<td>1. Small fins placed on the body of a car can reduce air turbulence</td>
<td>R2/381</td>
</tr>
<tr>
<td>2. Coefficient of drag (the lower the better)</td>
<td>R2/381</td>
</tr>
<tr>
<td>3. Vehicles wind resistance (drag) may be tested in a wind tunnel</td>
<td>R2/381</td>
</tr>
<tr>
<td>4. Lighter materials, computers, and vortex generators increase fuel efficiency</td>
<td>R2/381</td>
</tr>
</tbody>
</table>
COURSE: Transportation Systems

UNIT: Vehicular systems and sub-systems

COMPETENCY: 006.00: Design, build, and evaluate a simple land transportation vehicle model.

OBJECTIVE: 006.02: Design, build, and evaluate a simple land transportation vehicle model.

OUTLINE

PERFORMANCE:

See Performance Item 006.02.01 for designing, building and evaluating a simple land transportation vehicle

RESOURCES

CG
COURSE: Transportation Systems

UNIT: Vehicular systems and sub-systems

COMPETENCY: 007.00: Design, build, and evaluate a simple water transportation vehicle model

OBJECTIVE: 007.01: Explain the fundamental concepts and principles used in the design and fabrication of actual and model water transportation vehicles.

OUTLINE

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Propulsion</td>
<td></td>
</tr>
<tr>
<td>1. Pitch (Of propeller blade) The angle of the blades measured by the distance a propeller moves forward for each revolution (assuming no slippage)</td>
<td>R2/83</td>
</tr>
<tr>
<td>2. Sails</td>
<td></td>
</tr>
<tr>
<td>a) Similar to wings of airplane (Both are airfoils)</td>
<td>R2/99</td>
</tr>
<tr>
<td>b) High pressure on windward side of sail</td>
<td>R2/99</td>
</tr>
<tr>
<td>B. Guidance</td>
<td></td>
</tr>
<tr>
<td>C. Control</td>
<td></td>
</tr>
<tr>
<td>D. Suspension</td>
<td></td>
</tr>
<tr>
<td>E. Structural</td>
<td></td>
</tr>
<tr>
<td>1. Chines (Reduce splashing and rolling of boat or ship)</td>
<td>R2/82</td>
</tr>
<tr>
<td>2. Hydrofoils offer much less drag than conventional hulls</td>
<td>R1/130</td>
</tr>
<tr>
<td>3. Generally, the greater a boat's draft, the more drag (Slower it goes)</td>
<td>R1/127</td>
</tr>
<tr>
<td>4. The greater &quot;surface to water area&quot; a hull has, the greater the drag</td>
<td>CR</td>
</tr>
<tr>
<td>5. Deep hull have greater stability</td>
<td>R1/230</td>
</tr>
<tr>
<td>6. Displacement (measured in cubic feet or weight of water displaced)</td>
<td>R1/127</td>
</tr>
<tr>
<td>a. The greater the displacement, the more it can carry</td>
<td></td>
</tr>
<tr>
<td>7. Double hulls lessen the likelihood of sinking</td>
<td>R1/242</td>
</tr>
<tr>
<td>8. Pointed bows offer less resistance than rounded or squared bows</td>
<td>CR</td>
</tr>
<tr>
<td>9. Wide, flat hulls are designed to carry heavy loads</td>
<td>R1/128</td>
</tr>
</tbody>
</table>
COURSE: Transportation Systems

UNIT: Vehicular systems and sub-systems

COMPETENCY: 007.00: Design, build, and evaluate a simple water transportation vehicle model

OBJECTIVE: 007.02: Design, build, and evaluate a simple water transportation vehicle model.

OUTLINE

PERFORMANCE

See Performance Item 007.02.01 and accompanying directions for the designing, building and evaluating of a simple water transportation vehicle.
COURSE: Transportation Systems

UNIT: Vehicular systems and sub-systems

COMPETENCY: 008.00: Design, build, and evaluate a simple air or space transportation vehicle model.

OBJECTIVE: 008.01: Explain the fundamental concepts and principles used in the design and fabrication of actual and model air and space transportation vehicles.

OUTLINE

A. Propulsion
   1. Converting pounds of thrust to newtons 1 pound = 4.48 newtons
   2. Wind propels hot air balloons
   3. Gliders propelled by wind currents
   4. Model rockets use solid fuel engines

B. Guidance

C. Control

D. Suspension
   1. Airfoils (Wings)
      a. Chamber (upper and lower part of wing)
      b. Excessive turbulence on top of an airfoil can call stall
      c. Aspect ration (Span/cord)
         1. The higher the ratio the greater the wing's efficiency.
      d. Winglets can reduce wing vortices
      e. Wing types and characteristics
         1. Straight - Excellent stall characteristics and economical to build
         2. Tapered
         3. Elliptical - Most efficient
         4. Sweptback and delta (Jet fighters)
   2. Balloons
      Supported by hot air (float in a sea of air)

RESOURCES

R2/396
R1/137
CG
R1/184
R2/116
R2/117
R2/118
R2/118
R2/118
R1/138
E. Structural

RESOURCES

R1/233-246
COURSE: Transportation Systems

UNIT: Vehicular systems and sub-systems

COMPETENCY: 008.00: Design, build, and evaluate a simple air or space transportation vehicle model.

OBJECTIVE: 008.02: Design, build, and evaluate a simple air or space transportation vehicle model.

OUTLINE

PERFORMANCE

See Performance Item 008.02.01 and accompanying directions for designing, building, and evaluating a simple air/space vehicle.  

RESOURCES

CG
Unit E

Transportation

Occupational Opportunities
COURSE: Transportation Systems

UNIT: Transportation Occupational Opportunities

COMPETENCY: 009.00: Assess personal career goals with respect to transportation occupations.

OBJECTIVE: 009.01: Identify occupational opportunities and trends within transportation systems.

OUTLINE

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. General</td>
<td></td>
</tr>
<tr>
<td>1. Occupational Outlook Handbook (Excellent source of information pertaining to occupations)</td>
<td>CG</td>
</tr>
<tr>
<td>2. Aptitude refers to how quickly one is able to learn a skill and grasp its concepts</td>
<td></td>
</tr>
<tr>
<td>B. Land transportation occupations</td>
<td></td>
</tr>
<tr>
<td>1. Changes in the economy generally have small effect upon mechanics</td>
<td>CG</td>
</tr>
<tr>
<td>2. Automotive mechanics need good analytical, communication, mathematical, and scientific skills</td>
<td></td>
</tr>
<tr>
<td>C. Water transportation occupations</td>
<td>CG</td>
</tr>
<tr>
<td>D. Air transportation occupations</td>
<td>CG</td>
</tr>
<tr>
<td>1. Ground controllers direct planes on the ground and preparing for take-off</td>
<td></td>
</tr>
<tr>
<td>2. Control of aircraft in the air is directed by air traffic controllers</td>
<td></td>
</tr>
<tr>
<td>3. Aerospace engineers help design, develop, build, and test military and commercial aircraft</td>
<td></td>
</tr>
<tr>
<td>4. Generally, air traffic controllers are not likely to be unemployed</td>
<td></td>
</tr>
<tr>
<td>5. Aircraft mechanics can expect excellent job opportunities in the future</td>
<td></td>
</tr>
<tr>
<td>E. Space transportation occupations</td>
<td>CG</td>
</tr>
</tbody>
</table>
**COURSE:** Transportation Systems  

**UNIT:** Transportation Occupational Opportunities  

**COMPETENCY:** 009.00: Assess personal career goals with respect to transportation occupations.  

**OBJECTIVE:** 009.02: Evaluate personal interests and attributes in relation to transportation occupations.  

<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>RESOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Review and update his/her CDP (Career Development Plan) with respect to transportation occupational skills.</td>
<td>CG</td>
</tr>
<tr>
<td>B. Research a transportation occupation of interest. Write and deliver a report to the class.</td>
<td>CG</td>
</tr>
<tr>
<td>C. See Performance Item 009.02.01 for detail instructions</td>
<td>CG</td>
</tr>
</tbody>
</table>
Section III

Appendices
Appendix A

Bibliography/References
Appendix A
Bibliography

REFERENCES:

R-1b Instructors Manual-Exploring Transportation
R-1c Student Activity Manual-Exploring Transportation
R-2b Instructors Guide-Transportation, Energy and Power Technology
R-3b Instructor's Resource Guide-Energy Technology, Power and Transportation
R-3c Student Workbook-Energy Technology, Power and Transportation


R* Primary References-All test-item questions are taken from primary references or former references. Each test-item gives the specific reference text and page used for writing the item. Within the Transportation Test-item Bank under the "attribute" section of each test-item, will be found the exact text and page number of the information used to write the test-item.

FR** Former References-These are media used in a previous course(s).

SR*** Secondary References-These are materials which provides additional and/or in depth information regarding the content in question. While no test-items are derived from this material it is never-the-less strongly recommended that this media be purchased to provide both the teacher and the student additional resource information.
Appendix B

Vendor's Addresses for Texts, Literature, Films, and Software
Technology Education
Vendor's Addresses for Texts, Literature, Film, and Software
Addendum, July 26, 1995

To request taping of the Exploring Technology Education tapes contact your Regional TAC or NC Dept. of Public Instruction
Division of Media and Technology.

AAAS Books
Dept. 2061, P.O. Box 753
Waldorf, Md. 20604
(301) 645-5643

Agency for Instructional Technology
Box A
Bloomington, Indiana 47402
(800) 457-4509

Career Publishing, Inc.
910 N. Main Street
Orange, CA 92613
(800) 854-4014

Creative Learning Systems
16510 Via Esprillo
San Diego, Ca. 92127
(800) 458-2880

Delmar Publishing Inc.
Computer Drive West
Albany, N.Y. 12212
(800) 347-7707
Rep. Patrick Delaney
704-567-8911

Glencoe/McGraw Hill
3305 Donner Trail
Wake Forest, N.C. 27587
Rep. Laurie Merlo
(919) 556-8453

Goal/QPC
13 Branch Street
Methuen, Ma. 01844-1953
(800) 643-4316

Goodheart-Willcox Co., Inc.
123 West Taft Drive
South Holland, Ill. 60473
1-800-323-0440
Rep. Gwen Willis
(704) 333-9247

Harcourt, Brace, Jovanovich, Pub.
2602 Kings Mill Rd.
Greensboro, N.C. 27407
Rep. Frank Wypasck
(919) 299-5489

Mid-America Vocational Curriculum Consortium
1500 West Seventh Avenue
Stillwater, Oklahoma 74074
(800) 654-3988

NC Dept. of Public Instruction
Division of Media and Technology
Education Building
301 North Wilmington Street
Raleigh, N.C. 27601-1714
919-715-1706

Oxford University Press
2001 Evans Road
Cary, N.C. 27513
(919) 677-0977

Pitsco
1004 East Adams
P.O. Box 1328
Pittsburg, Ks. 66762
(800) 835-0686

Regents/Prentice Hall
416 Bay Run
Newport, N.C. 28570
Rep. Sandra Ivey
(919) 247-2647

San Diego Technical Books, Inc.
4598 Convoy Street
San Diego, Ca. 92111
Rep. Amy
(800) 346-0071

Small World Technologies
P.O. Box 607
Hillsboro, Oregon, 97123
Rep. Gene Small
(800) 542-3555 or (503) 640-1729

TSA (Technology Student Association)
1914 Association Drive
Reston, Va. 22091
(703) 860-9000

West Educational Publishing
620 Opperman Drive
P.O. 64779
St. Paul, Mn. 55164-0779
Rep. Carl Holm (301) 916-9817
Appendix C

Equipment List
### Transportation Systems Equipment List

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind-tunnel</td>
<td>1</td>
</tr>
<tr>
<td>CO₂ Vehicle Start and Finish Gate</td>
<td>1</td>
</tr>
<tr>
<td>CO₂ Track Software</td>
<td>1</td>
</tr>
<tr>
<td>Model Steam Engine</td>
<td>1</td>
</tr>
<tr>
<td>Model Stirling Engine</td>
<td>1</td>
</tr>
<tr>
<td>Maglev Vehicle Rail Systems and Controls</td>
<td>1</td>
</tr>
<tr>
<td>Vane Anemometer/Thermometer</td>
<td>1</td>
</tr>
<tr>
<td>Hot Air Balloon Launcher (Propane)</td>
<td>1</td>
</tr>
<tr>
<td>Model Rocket Fin Aligner</td>
<td>12</td>
</tr>
<tr>
<td>Model Rocket Digital Launcher</td>
<td>1</td>
</tr>
<tr>
<td>Model Rock Launch Pad</td>
<td>1</td>
</tr>
<tr>
<td>Model Rocket Locator</td>
<td>1</td>
</tr>
<tr>
<td>Gyroscope</td>
<td>1</td>
</tr>
<tr>
<td>Testing-tank (For water transportation)</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix D

Software and Video
## Transportation Systems
### Software and Video

<table>
<thead>
<tr>
<th>Software/Video</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Technology: Principles of Flight Video Part 1 (Or comparable)</td>
<td>1</td>
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Appendix D-1
Appendix E

VoCATS
Transportation Systems Test-item Bank
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1. Transportation consumes:
A. 50% of the typical American's freetime.
B. Less energy than the residential sector.
C. 5% of all the energy consumed in the United States.
D. 25% of all the energy consumed in the United States.

2. The cost of transportation makes a large economic impact on people's lives. What percentage of personal income do average American adults spend on transportation?
A. 9%
B. 15%
C. 28%
D. 42%

3. All land transportation systems (highway, rail, and pipeline) share one major environmental and economic impact:
A. Very high air pollution.
B. High rates of fatal accidents.
C. The consumption of large amounts of land.
D. Noise pollution.

4. Technology used to move people and products is one definition of:
A. Communication.
B. Manufacturing.
C. Structural Systems.
D. Transportation.

5. Out of all the energy used in transportation systems, over half is used by:
A. Railroads.
B. Airplanes.
C. Automobiles.
D. Pipelines.

6. Which of the following have caused the greatest increase in automobile accidents?
A. Foreign imports
B. Travel speeds
C. Vehicle systems failures
D. Poorly maintained roads

7. Transportation systems produce more of this than any other industry:
A. Methane gas.
B. Carbon dioxide.
C. Carbon monoxide.
D. Ozone.
Generally, North Carolina's transportation systems:
A. Improve our quality of life.
B. Make people poorer.
C. Have little affect upon the environment.
D. Are a very small portion of the state budget.

An efficient transportation system contributes to which of the following?
A. Social needs
B. Economic needs
C. Strategic defense
D. All of the above

A combination of parts or subsystems working together for a common purpose defines:
A. Transportation.
B. System.
C. Process.
D. Knowledge.

Anticipating the results of a new transportation technology allows us to:
A. Control or eliminate all negative effects.
B. Eliminate all change that might have a negative impact.
C. Make responsible decisions about the use of the new technology.
D. Foresee all impacts of the new technology.

In intermodal transportation, carrying truck trailers on railroad flatcars is called:
A. Containerization.
B. Piggyback.
C. Hauling.
D. Container ship.

A water vessel that rides on a cushion of air is a:
A. Hydrofoil.
B. Hovercraft.
C. Jet ski
D. Gunwale.

Freight, transported to a harbor by rail, is taken by boat to another destination. This product movement is an example of:
A. Interim transportation.
B. Multi-method transportation.
C. Intermodal transportation.
D. Intracoastal transportation.

At the present usage rates, which of the following methods of transporting freight consumes as much energy as all of the other three combined?
A. Pipeline
B. Railroad
C. Waterway
D. Truck
16 Using more than one form of transportation to move freight or products is called:
A. Interstitial transportation.
B. Interurban transportation.
C. Interim transportation.
D. Intermodal transportation.

17 In intermodal transportation COFC stands for:
A. Container on Flat Car.
B. Conveyor onto Freight Carrier.
C. Crane onto Flat Car.
D. Cargo on Freight Carrier.

18 In air transportation, an example of a vertical take-off vehicle is a:
A. Helicopter.
B. Rocket.
C. Glider.
D. Piper Cub.

19 A dirigible is a rigid lighter-than-air ship kept afloat by:
A. Hot air.
B. Propane.
C. Nitrogen.
D. Helium.

20 Low noise output, low theft rate, and no traffic congestion are special advantages of:
A. Highway trucking systems.
B. Pipeline systems.
C. Railroad systems.
D. Intercoastal waterways.

21 Using more than one form of transportation mode to move freight or products is called:
A. Intermodal shipping.
B. Intracoastal shipping.
C. Intercoastal shipping.
D. International shipping.

22 The type of transportation that operates in the earth's atmosphere is:
A. Air transportation.
B. Space transportation.
C. Suspension transportation.
D. Take-off transportation.

23 Because of its cost effectiveness and relative slowness, most water transportation business involves the movement of:
A. People.
B. Coal.
C. Cargo.
D. None of the above.
24. An example of a heavier-than-air craft is a:
   A. Glider.
   B. Balloon.
   C. Dirigible.
   D. Blimp.

25. The aircraft which can lift and transport the heaviest loads is a:
   A. Dirigible.
   B. Helicopter.
   C. Hovercraft.
   D. Commercial plane.

26. When compared to commuter trains, the private automobile has the following advantage:
   A. Reduced pollution.
   B. Reduced traffic congestion.
   C. Increased flexibility.
   D. Reduced accidents.

27. Which of the following is a disadvantage of shipping cargo by water?
   A. Slow travel
   B. Limited access to much of the world
   C. Subject to weather conditions
   D. All of the above

28. Which of the following is an advantage of shipping cargo by water?
   A. Relatively low cost
   B. Ability to move large volumes and bulky materials
   C. Movement between continents
   D. All of the above

29. Ability to carry large and heavy loads at a low cost per mile and low pollution are special advantages of:
   A. Highway trucking systems.
   B. Railroad systems.
   C. Air freight systems.
   D. Hovercraft.

30. Cargo, lifted onto a flat car by a crane, is transported by rail to another destination. This product movement is an example of:
   A. Interim transportation.
   B. Intercoastal transportation.
   C. Intermodal transportation.
   D. Intracoastal transportation.

31. One mode of lighter-than-air transportation is:
   A. Hydrofoils.
   B. Hovercrafts.
   C. Airfoils.
   D. Dirigible.
32 You are in charge of creating a transportation system for moving water from a lake to the city. Which of the following would probably be the most efficient means of moving the water?
A. Truck
B. Train
C. Buses
D. Pipeline

33 In intermodal transportation TOFC stands for:
A. Truck on Freight Carrier.
B. Tugboat onto Flat Car.
C. Trailer on Flat Car.
D. Tramp onto Freight Carrier.

34 Intermodal transportation requires a significant amount of:
A. Time and money.
B. Planning and coordination.
C. Goods and services.
D. Advertising.

35 Of the following, which is the most important current limitation preventing travel to other planets?
A. The time it would take to get there
B. Communication over such great distances
C. The great amounts of power needed after leaving Earth's gravity
D. Navigation, it would be very hard to keep from getting lost in space

36 You have a very large cargo to transport from Raleigh, NC to Atlanta, GA. Which of the following modes of transportation will be the most efficient?
A. Car
B. Bus
C. Airplane
D. Railroad

37 Sails, jet engines, and electric motors are examples of:
A. Propulsion systems.
B. Guidance systems.
C. Control systems.
D. Suspension systems.

38 The parts of a vehicle that hold the things to be carried and the rest of the vehicle's systems are called its:
A. Suspension system.
B. Control system.
C. Structural system.
D. Storage system.

39 The parts of a vehicle that support the vehicle in its environment (such as the wings on an airplane) are called:
A. Control system.
B. Suspension system.
C. Guidance system.
D. Conversion system.
40 Stabilizer bars, springs, and tires are all parts of a car's:
   A. Control system.
   B. Guidance system.
   C. Suspension system.
   D. Conversion system.

41 The parts of a vehicle that are used to change a vehicle's direction and speed are part of the vehicle's:
   A. Propulsion system.
   B. Suspension system.
   C. Guidance system.
   D. Control system.

42 The system of a vehicle, that converts energy to produce power, that moves the vehicle is called its:
   A. Control system.
   B. Suspension system.
   C. Conversion system.
   D. Propulsion system.

43 No transportation vehicle could move without a source of:
   A. Compression.
   B. Combustion.
   C. Traction.
   D. Propulsion.

44 A car's body is an example of a:
   A. Suspension system.
   B. Control system.
   C. Storage system.
   D. Structural system.

45 Engines, magnetic levitation and nuclear energy are used in which system?
   A. Propulsion system
   B. Combustion system
   C. Exhaustion system
   D. Conversion system

46 Information required by a vehicle to follow a particular path or to perform a certain task is provided by a(n):
   A. Coordinate.
   B. Operator manual.
   C. Guidance system.
   D. Control system.

47 While riding her bicycle to the store, Gina sees a sign indicating road construction ahead. The sign is an example of which system?
   A. Propulsion system
   B. Suspension system
   C. Guidance system
   D. Control system
# Test Name: TRNSYCO1

## Scan Form:
GPFORMS

## Test Label:

### Subtest Name | Number of Items | Number of Objectives | Starting Item Number
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TRANS SYS COMPETENCY ONE | 47 | 3 | 1

### Answer Key for TRANS SYS COMPETENCY ONE

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### Objective Labels for TRANS SYS COMPETENCY ONE

1) 1.01A EXP TRAN SYS IMPORTANCE
2) 1.02A IDENT/DEF MODES OF TRANS
3) 1.03A IDENT/DEF VEHICULAR SYS

### Objective Codes for TRANS SYS COMPETENCY ONE

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### Number of Items Measuring each TRANS SYS COMPETENCY ONE Objective

1) 11 in 1.01A EXP TRAN SYS IMPORTANCE
2) 25 in 1.02A IDENT/DEF MODES OF TRANS
3) 11 in 1.03A IDENT/DEF VEHICULAR SYS
Test Name: TRNSYCO1
Scan Form: GPFORMS
Test Label:

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Items Measuring TRANS SYS COMPETENCY ONE 1.02A IDENT/DEF MODES OF TRANS
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25) 36

Items Measuring TRANS SYS COMPETENCY ONE 1.03A IDENT/DEF VEHICULAR SYS
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9) 45 10) 46 11) 47

Mastery Level for TRANS SYS COMPETENCY ONE Objectives
1) 8 out of 11 for 1.01A EXP TRAN SYS IMPORTANCE
2) 19 out of 25 for 1.02A IDENT/DEF MODES OF TRANS
3) 8 out of 11 for 1.03A IDENT/DEF VEHICULAR SYS

Partial Level for TRANS SYS COMPETENCY ONE Objectives
1) 7 out of 11 for 1.01A EXP TRAN SYS IMPORTANCE
2) 15 out of 25 for 1.02A IDENT/DEF MODES OF TRANS
3) 7 out of 11 for 1.03A IDENT/DEF VEHICULAR SYS
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1. The reference source for the operational procedures of most organizations is:
   A. Lovejoy's Guide.
   B. Robert's Rules of Order.
   C. Webster's Business Guide.

2. The number of members that must be present for business to be conducted is called a:
   A. Voting block.
   B. Parliament.
   C. Quorum.
   D. Committee.

3. The quality tool used to determine the "Driving Forces" and "Restraining Forces" for a problem or issue is the:
   A. Cause and Effect Diagram Method.
   B. Force Field Analysis Method.
   C. Nominal Group Technique.
   D. Run Chart.

4. What is the fifth step of the IDEAL Problem Solving Method?
   A. Learn perceptual patterns
   B. Listen to other people's ideas
   C. Look back and learn from the effects of your activities
   D. List all possible solutions to the problem

5. The quality tool which is designed to give everyone in the group an equal voice is the:
   A. Cause and Effect Process.
   B. Force Field Analysis Method.
   C. Nominal Group Technique.
   D. Equal Interaction Method.

6. What is the second component of the IDEAL approach to problem solving?
   A. Dealing with the problem
   B. Defining the problem
   C. Determining solutions to existing problems
   D. Describing possible strategies

7. The first component in the IDEAL approach to problem solving is:
   A. Identifying the problem.
   B. Inventing solutions to existing problems.
   C. Illustrating potential solutions to problems.
   D. Itemizing potential problem areas.
8  What is the fifth step of the IDEAL approach to problem solving?  
   A. Learn some perceptual patterns  
   B. Listen to other people's ideas  
   C. Look back and evaluate the effects of your activities  
   D. List all possible solutions to the problem

9  A motion can be changed by a motion to:  
   A. Table.  
   B. Resign.  
   C. Rescind.  
   D. Amend.

10 What is the fourth component of the IDEAL approach to problem solving?  
    A. Approaching the problem  
    B. Activating concepts  
    C. Acting upon strategies  
    D. Analyzing the problem

11 What is the third component of the IDEAL approach to problem solving?  
   A. Exploring alternative approaches to the problem  
   B. External representation of the problem  
   C. Explaining details of the problem  
   D. Extracting data concerning the problem

12 When finished working with sharp-pointed or sharp-edged tools put them:  
   A. In any available drawer.  
   B. On the edge of your work table.  
   C. On the floor next to your feet.  
   D. In their proper storage area.

13 Before using tools or machines which can cause injury you should always:  
   A. Review the appropriate safety manual.  
   B. Ask a friend for help.  
   C. Ask your teacher for permission.  
   D. Check the condition of all circuit-breakers connected to the equipment.

14 Safety glasses must be worn:  
   A. Only when operating a machine.  
   B. Only when one is producing dust or metal particles.  
   C. Only when grinding metals.  
   D. Whenever one is in the technology lab.

15 Which of the following is the most important safety consideration to observe while launching model rockets?  
   A. The launch team should wear leather gloves  
   B. Everyone should wear safety glasses  
   C. The launch pad must be made of asbestos  
   D. There must be at least an 8-mile-per-hour wind to prevent rockets from landing on the observation team
16 When refueling a fuel tank it should:
   A. Be filled to the very top.
   B. Have space left for fuel expansion.
   C. Never be touched on the spout.
   D. Be filled quickly.

17 In a technology laboratory, slipping tools can cause injury and:
   A. Ruin a nut or bolt.
   B. Loosen stuck bolts easily.
   C. Prevent hand injuries.
   D. Reduce working time.

18 If you are not sure how to use a laboratory machine you should:
   A. Ask your teacher for help.
   B. Experiment with the machine by yourself until it works.
   C. Take the machine apart to see how it works.
   D. Ask someone else to work the machine for you.

19 When working around machinery or electrical equipment one must:
   A. Remove all jewelry.
   B. Tie back long hair.
   C. Wear safety glasses.
   D. Do all the above.

20 Charged batteries should be kept:
   A. In well ventilated areas.
   B. In sealed containers.
   C. Near a heat source.
   D. Near welding stations.

21 When loosening a stuck bolt or nut, you should push the wrench with:
   A. All fingers wrapped tightly around the handle.
   B. A slightly larger wrench.
   C. An open hand.
   D. A hammer, screwdriver, or lever.

22 A hot engine should:
   A. Only be touched safely on the cylinders.
   B. Not be covered with rags.
   C. Only be touched safely on the exhaust system.
   D. Be covered with plastic sheets.

23 When operating equipment with rotating parts, long hair and loose clothing
   should be:
   A. Removed.
   B. Tied back or covered.
   C. Uncovered and hanging freely.
   D. Pushed loosely out of the operator's way.
24. In a technology lab, when should both safety glasses AND face shields be worn?
   A. When performing any type of lab work
   B. When working with motors or engines
   C. When working with sharp-pointed or sharp-edged tools
   D. When working with grinders

25. Engine parts should be cleaned with:
   A. Gasoline.
   B. Kerosene.
   C. Neoprene.
   D. Ethylene.

26. A headache, nausea, ringing in the ears, and tiredness are symptoms of:
   A. Carbon monoxide poisoning.
   B. Food poisoning.
   C. Electrical shock.
   D. None of the above.

DIRECTIONS FOR PERFORMANCE ITEMS See your teacher or test administrator for instructions on completing the following performance item(s).

27. As a member of a team complete the following:
   1) Effectively participate as a member of a team.
   2) Appropriately and effectively use one or more of the following "quality" tools: Fishbone Diagram, Force Field Analysis, Nominal Group Technique, and Run Chart.
   3) Correctly use supporting graphics for the above tools.

Your work will be assessed using the following criteria:

- Participate effectively as a team member by demonstrating appropriate behavior, being considerate of others, communicating well, demonstrating leadership skills, and keeping a customer focus when appropriate.
- Effectively use one or more quality tools
- Effectively use appropriate graphics
- Clearly communicated essential information

Total Score Possible 0-100 points

Scoring

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28 Demonstrate a safety conscious attitude in the technology classroom and lab. This includes the proper use of hand tools and equipment. Your teacher will provide you with a more detailed explanation of what is expected. You will be assessed using the following criteria:

- Demonstrates a safety conscience attitude and behaves in a safe manner
- Demonstrates proper use of handtools and equipment

**Scoring**

- 0-50 points
- 0-50 points
- Total Possible Score: 0-100 points

STOP HERE
Directions for Item 27

During this course, have each student use one or more quality tools (Fishbone Diagram, Force Field Analysis, Nominal Group Technique, or other appropriate tool) to analyze data or to solve a problem. Stress the utility and power of the various tools in solving problems.

Directions for Item 28

The students are expected to behave in a safe manner at all times, in the classroom as well as the laboratory. They are also expected to use all tools (simple and complex) appropriately.
Scoring Directions for Test Item 27 Unit I Key 27

Each student is expected to effectively participate as a team member and apply the listed "quality" tools appropriately. Working to solve a specific problem and as a team member each student must use one or more of the following tools:

- Fishbone Diagram
- Force Field Analysis
- Nominal Group Technique
- Rune Chart

Observe the interaction of the team and assess each student using the following criteria:

Scoring

- Participated effectively as a team member by demonstrating appropriate behavior, was considerate of others, communicated well, demonstrated leadership skills, and kept a customer focus when appropriate
- Effectively used one or more of the above tools
- Effectively used appropriate graphics with quality tools which clearly communicated essential information

Total Possible Score 100

Scoring Directions for Test Item 28 Unit I Key 28

Assess each student for proper safety procedures, attitude, and proper tool and equipment usage. Give the students a detailed explanation of the correct behaviors and procedures and your expectations of them. Assess each student using the following criteria:

Scoring

- Demonstrates safe behavior and attitude in classroom and laboratory
- Uses tools and equipment appropriately

Total Possible Score 100
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Scan Form: GPFORMS
Test Label:

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Answer Key for TRANS SYS COMPETENCY TWO


Item Codes for TRANS SYS COMPETENCY TWO

1) 002.01.02  2) 002.01.01  3) 002.01.04  4) 002.01.03  5) 002.01.05  6) 002.01.08  7) 002.01.07  8) 002.01.11  9) 002.01.06  10) 002.01.10  11) 002.01.09  12) 002.03.08 13) 002.03.02  14) 002.03.03  15) 002.03.06  16) 002.03.11 17) 002.03.14  18) 002.03.12  19) 002.03.04  20) 002.03.09 21) 002.03.13  22) 002.03.10  23) 002.03.07  24) 002.03.01 25) 002.03.15  26) 002.03.05  27) 002.02.01  28) 002.04.01

Objective Labels for TRANS SYS COMPETENCY TWO

1) 2.01A EXP MANAGEMENT SKILLS
2) 1.01A EXP TRAN SYS IMPORTANCE
3) 2.03A EXP SAFETY PROCEDURES
4) APPLY MANAGEMENT SKILLS
5) APPLY SAFETY PROCEDURES

Objective Codes for TRANS SYS COMPETENCY TWO

1) 002.01A  for 2.01A EXP MANAGEMENT SKILLS
2) 001.01  for 1.01A EXP TRAN SYS IMPORTANCE
3) 002.03A  for 2.03A EXP SAFETY PROCEDURES
4) 002.02  for APPLY MANAGEMENT SKILLS
5) 002.04  for APPLY SAFETY PROCEDURES

Number of Items Measuring each TRANS SYS COMPETENCY TWO Objective

1) 10 in 2.01A EXP MANAGEMENT SKILLS
2) 1 in 1.01A EXP TRAN SYS IMPORTANCE
3) 15 in 2.03A EXP SAFETY PROCEDURES
4) 1 in APPLY MANAGEMENT SKILLS
5) 1 in APPLY SAFETY PROCEDURES
Test Name: TRNSYCO2
Scan Form: GPFORMS
Test Label:

Items Measuring TRANS SYS COMPETENCY TWO 2.01A EXP MANAGEMENT SKILLS
1) 1  2) 2  3) 3  4) 4  5) 5  6) 6  7) 8  8) 9
9) 10  10) 11

Items Measuring TRANS SYS COMPETENCY TWO 1.01A EXP TRAN SYS IMPORTANCE
1) 7

Items Measuring TRANS SYS COMPETENCY TWO 2.03A EXP SAFETY PROCEDURES
1) 12  2) 13  3) 14  4) 15  5) 16  6) 17  7) 18  8) 19
9) 20  10) 21  11) 22  12) 23  13) 24  14) 25  15) 26

Items Measuring TRANS SYS COMPETENCY TWO APPLY MANAGEMENT SKILLS
1) 27

Items Measuring TRANS SYS COMPETENCY TWO APPLY SAFETY PROCEDURES
1) 28

Mastery Level for TRANS SYS COMPETENCY TWO Objectives
1) 8 out of 10 for 2.01A EXP MANAGEMENT SKILLS
2) 1 out of 1 for 1.01A EXP TRAN SYS IMPORTANCE
3) 11 out of 15 for 2.03A EXP SAFETY PROCEDURES
4) 1 out of 1 for APPLY MANAGEMENT SKILLS
5) 1 out of 1 for APPLY SAFETY PROCEDURES

Partial Level for TRANS SYS COMPETENCY TWO Objectives
1) 6 out of 10 for 2.01A EXP MANAGEMENT SKILLS
2) 1 out of 1 for 1.01A EXP TRAN SYS IMPORTANCE
3) 9 out of 15 for 2.03A EXP SAFETY PROCEDURES
4) 1 out of 1 for APPLY MANAGEMENT SKILLS
5) 1 out of 1 for APPLY SAFETY PROCEDURES
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1. The depth a vessel sits in the water is referred to as its:
   A. Ballast.
   B. Displacement.
   C. Draft.
   D. Lift.

2. Hydraulic systems control and transmit energy through:
   A. Fluids.
   B. Gases.
   C. Solids.
   D. Hydrometers.

3. The three axes upon which an aircraft rotates are: roll, pitch, and:
   A. Rise.
   B. Wave.
   C. Lift.
   D. Yaw.

4. Large amounts of energy are lost in machinery because of:
   A. Displacement.
   B. Drag.
   C. Friction.
   D. Efficiency.

5. Air that slows down a speeding automobile, forcing the driver to accelerate to maintain a steady speed is called:
   A. Planetary force.
   B. Residual friction.
   C. Aerodynamic drag.
   D. Acceleration constant.

6. A vessel is guided through its designated sea-lane by using techniques of:
   A. Waterways.
   B. Navigation.
   C. Drafting.
   D. Barging.

7. If a boat is moving 32 miles per hour, its speed in knots is approximately:
   A. 3 knots.
   B. 36.8 knots.
   C. 64 knots.
   D. 72.6 knots.
8 The equator is located at:
A. 180° latitude.
B. 180° longitude.
C. 0° longitude.
D. 0° latitude.

9 A good example of how torque can be multiplied is a:
A. Drum brake.
B. "Maglev" train.
C. Door knob.
D. Latch.

10 If a boat is moving 32 miles per hour (mph), its speed in knots is:
A. 36.8 knots.
B. 27.82 knots.
C. 0.03 knots.
D. 33.15 knots.

11 Power can be measured using the following formula:
A. \( P = w \times t \).
B. \( P = t/w \).
C. \( P = w/t \).
D. \( P = t + w \).

12 If 80 units of work are applied to a mechanical system that lifts 20 units of weight, the system is said to be:
A. 4% efficient.
B. 25% efficient.
C. 40% efficient.
D. 100% efficient.

13 The greater the amount of water displaced by the hull of a ship the greater the vessel's:
A. Buoyancy.
B. Speed.
C. Floatation
D. Draft.

14 The formula for calculating the actual mechanical advantage is:
A. Output / input.
B. Productivity \times\ efficiency.
C. Input / output.
D. Efficiency / productivity.

15 The upward force that an airplane's wings produce to keep it in the air is called:
A. Lift.
B. Pressure.
C. Thrust.
D. Suspension.
16. "The amount of work accomplished in a given period of time" is a good definition of:
   A. Effort.
   B. Energy.
   C. Power.
   D. Torque.

17. Wind and water currents can force a ship to stray from its intended path. This is called:
   A. Yawing.
   B. Rolling.
   C. Pitching.
   D. Keeling.

18. The equation for force is:
   A. Length x distance.
   B. Length x weight.
   C. Pressure x distance.
   D. Pressure x area.

19. A satellite put into orbit will continue to orbit at a constant speed, unless acted upon by another force. The satellite's orbit is an example of:
   A. Newton's first law of motion.
   B. Newton's second law of motion.
   C. Newton's third law of motion.
   D. Newton's fourth law of motion.

20. The spinning movement in an engine is called:
   A. Reciprocating motion.
   B. Rotary motion.
   C. Linear motion.
   D. Torque motion.

21. A book sitting on the edge of a desk is an example of:
   A. Mechanical energy.
   B. Gravitational energy.
   C. Kinetic energy.
   D. Potential energy.

22. The side to side movement on a boat is called:
   A. Pitch.
   B. Keel.
   C. Tramp.
   D. Roll.

23. The two forces which an aircraft must overcome in order to fly are:
   A. Gravity and thrust.
   B. Drag and gravity.
   C. Thrust and lift.
   D. Drag and lift.
24. The energy from a car's engine drives a crankshaft which spins and produces power in the form of:
   A. Effort.
   B. Friction.
   C. Torque.
   D. Pressure.

25. Which of the following vessels displaces the LEAST amount of water?
   A. Barge
   B. Kayak
   C. Oil tanker "with full shipment of oil"
   D. Tugboat

26. Which force keeps water in a bucket when it is whirled around rapidly?
   A. Coefficient of drag
   B. Centrifugal force
   C. Centripetal force
   D. Geosynchronous orbit

27. The force produced by a plane's propulsion system is called:
   A. Lift.
   B. Acceleration.
   C. Thrust.
   D. Suspension.

28. A twisting or turning force is called:
   A. Centripetal force.
   B. Diametric force.
   C. Torque.
   D. Distortion.

29. Lines of latitude and longitude are used to locate a fixed position on a map. When used together these lines are called:
   A. Coordinates.
   B. Meridians.
   C. Sextants.
   D. Intersections.

30. 0° longitude is commonly referred to as the:
   A. Equator.
   B. Prime meridian.
   C. International dateline.
   D. Navigational marker.

31. The force exerted by a piston having 80 psi and a 14 inch diameter is approximately:
   A. 12,320 pounds.
   B. 234 pounds.
   C. 129 pounds.
   D. 25,120 pounds.
32 In a space vehicle's orbit around the earth, the point at which the vehicle is farthest from the earth is called the:
A. Perigee.
B. Apogee.
C. Exosphere.
D. Mesosphere.

33 A solid object placed in a fluid less dense than itself will:
A. Sink.
B. Float.
C. Condense.
D. None of the above.

34 Which law of motion states that an unbalance of force on a body tends to produce an acceleration in the direction of force?
A. Newton's first law of motion
B. Newton's second law of motion
C. Newton's third law of motion
D. Newton's fourth law of motion

35 Which one of the following would best show a simple chronological outline of a transportation device?
A. Flow chart
B. Bar chart
C. Force field analysis
D. Flow chart

36 The basic unit of measure for power in a transportation device is:
A. Ergs.
B. Horsepower.
C. Watts.
D. Amperes.

37 The straight line motion produced in certain types of heat engines is called:
A. Reciprocating motion.
B. Traverse motion.
C. Linear motion.
D. Alternating motion.

38 The energy required to lift 33,000 pounds exactly 1 foot in 1 minute is:
A. 1/3 Hp.
B. 1 Hp.
C. 3 Hp.
D. 33 Hp.

39 Ailerons control the roll of an aircraft. Roll is rotation along its:
A. Wing-tip to wing-tip axis.
B. Nose to tail axis.
C. Center, top to bottom.
D. Wings.
40 The depth a vessel sits in the water is referred to as:
   A. Draft.
   B. Lift.
   C. Displacement.
   D. Ballast.

41 The force that resists the forward motion of an aircraft is called:
   A. Gravity.
   B. Thrust.
   C. Drag.
   D. Lift.

42 During flight, an aircraft can keep increasing its angle of attack until it:
   A. Ices.
   B. Stalls.
   C. Turns over.
   D. Crashes.

43 The natural force that tries to pull a plane to the ground is called:
   A. Weight.
   B. Gravity.
   C. Pressure.
   D. Drag.

44 Torque is measured in:
   A. Watts.
   B. Amperes.
   C. Foot-pounds.
   D. Pounds per square inch.

45 Steering a ship in a zig-zag course to go up wind is a navigational technique known as:
   A. Lateen.
   B. Rigging.
   C. Fore-and-aft.
   D. Tacking.

46 The amount of energy a machine or engine successfully converts into usable energy is expressed in terms of the machine or engine's:
   A. Motion.
   B. Combustion.
   C. Power.
   D. Efficiency.

47 A crane operator lifts a 1000 pound barrel of nails 40 feet to a second story window in 30 seconds. How much power is used?
   A. 40,000 Hp
   B. 1333 ft-lb/sec
   C. 33.33 lbs/sec
   D. .003 Hp
The force produced by a plane or rocket's propulsion system is called:
A. Thrust.
B. Lift.
C. Longitudinal.
D. Reciprocating.

Which law of motion states that a body or mass in motion tends to remain in motion, unless acted upon by another force?
A. Newton's first law of motion
B. Newton's second law of motion
C. Newton's third law of motion
D. Newton's fourth law of motion

The production of electricity through the use of magnets is called electromagnetic:
A. Induction.
B. Radiation.
C. Valence.
D. Flux.

The back-and-forth motion used in heat engines is called:
A. Reciprocating motion.
B. Rotary motion.
C. Linear motion.
D. Alternating motion.

The device used to measure how much work an engine can produce in a unit of time is called a:
A. Dynamometer.
B. Hydrometer.
C. Tachometer.
D. Torque wrench.

Which law of motion states that for every acting force there is an equal and opposite reacting force?
A. Newton's first law of motion
B. Newton's second law of motion
C. Newton's third law of motion
D. Newton's fourth law of motion

When north poles of two magnets are brought together, the magnets:
A. Attract each other.
B. Repel each other.
C. Produce a strong electrical current.
D. Produce less magnetic flux.

In a space vehicle's orbit around the earth, the point at which the vehicle is closest to the earth is called the:
A. Perigee.
B. Apogee.
C. Exosphere.
D. Mesosphere.
56 In order to operate clutch and brake devices rely on:
A. Magnetism.
B. Friction.
C. Gravity.
D. Torque.

57 On a ship's propeller the angle of its blades is referred to as its:
A. Pitch.
B. Law.
C. Center.
D. Roll.

58 One knot is equal to approximately:
A. 1.15 miles per hour.
B. 5.5 miles per hour.
C. 10.15 miles per hour.
D. 15.15 miles per hour.

59 A household furnace consumes 50,000 BTUs each hour. The furnace actually outputs 42,000 BTUs into the home during this time. The efficiency of the furnace:
A. 84%.
B. 19%.
C. 92%.
D. 8%.

60 A falling rock is an example of:
A. Mechanical energy.
B. Gravitational energy.
C. Kinetic energy.
D. Potential energy.

61 If a boat is moving 17.25 knots per hour, its speed in miles per hour (mph) is:
A. 15 miles per hour.
B. 5 miles per hour.
C. 25 miles per hour.
D. 45 miles per hour.

62 The lines of force that run between the poles of a magnet are called:
A. Coordinates.
B. Valence lines.
C. Induction waves.
D. Flux.

63 Pneumatic Systems control and transmit energy through:
A. Fluids such as water or oil.
B. Gases such as air.
C. Solids such as copper.
D. Pneumatism.
DIRECTIONS FOR PERFORMANCE ITEMS See your teacher or test administrator for instructions on completing the following performance item(s).

64 The purpose of this activity is to design, conduct, and evaluate lab experiments relating to scientific and technical principles found in transportation systems in such a way that the information gathered will help you improve the performance of the vehicular systems under study.

Individually or as a member of a team:

I. Design an experiment(s) dealing with an essential transportation vehicle subsystem which directly affects the performance of the vehicular system under study.

II. Conduct the experiment (changing key variables) and collect useful data using appropriate quality tools.

III. Evaluate and draw conclusions using your knowledge of appropriate scientific and technical concepts.

IV. Report your findings in a brief written and oral report to the class.

Your work will be assessed using the following criteria:

<table>
<thead>
<tr>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Experiment well designed. Key variables identified. Procedures and tool appropriate. 0-25</td>
</tr>
<tr>
<td>II. Experiment conducted professionally. Measurements accurately measured and recorded. 0-25</td>
</tr>
<tr>
<td>III. Evaluation through and well thought out. Scientific and technical terms accurate and applied appropriately. 0-25</td>
</tr>
<tr>
<td>IV. Written report clear and to the point. Conclusions are logical and follow from evidence. Oral presentation clear, interesting, and instructive. 0-25</td>
</tr>
</tbody>
</table>

Total Possible Score 0-100 points

STOP HERE
**Directions for Item 64**

For this activity help the students identify key scientific and technical concepts and principles directly related to the performance of the transportation vehicular systems under study.

For instance, to study concepts and principles of maglev vehicles, the students could design experiments showing how like magnetic poles repel, while unlike poles attract and changing the polarity can cause a vehicle to move. Or students may wish to experiment with superconductors.

All experiments should be designed to help the student better understand the underlying principles upon which the vehicular system under study operates and hopefully lead to vehicles which perform better when the student applies what he or she has learned, whether studying magnetic phenomena to improve a maglev vehicle's performance or the drag of different shaped block in a water trough.
Scoring Directions for Test Item 64 Unit 1 Key 64

The student or student teams should be evaluated by their performance in four areas: Design of the experiment, execution of experiment, experiment evaluation, and the written and oral report. Please keep in mind that the process is purposeful and designed to help the student understand basic scientific and technological concepts and principles related to transportation vehicular systems. The student(s) should understand (and be able to apply) what they learn. You may evaluate using the following formula or modify appropriately:

| Points | 
|--------|---|
| I. Experiment well designed. Key variable identified. Procedures and quality tools used appropriately. | 0-25 |
| II. Experiment conducted professionally. Measurements accurately measured and recorded. | 0-25 |
| III. Evaluation through and well thought out. Scientific and technical terms accurate and applied appropriately. | 0-25 |
| IV. Written report clear and to the point. Conclusions are logical and follow from the evidence. Oral presentation clear, interesting, and instructive. | 0-25 |
| Total Possible Score | 0-100 points |
**Test Name:** TRNSYCO3  
**Scan Form:** GPFORMS  
**Test Label:**

<table>
<thead>
<tr>
<th>Subtest Name</th>
<th>Number of Items</th>
<th>Number of Objectives</th>
<th>Starting Item Number</th>
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<tr>
<td>TRANS SYS COMPETENCY THREE</td>
<td>64</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Answer Key for TRANS SYS COMPETENCY THREE**

1) C  
2) A  
3) D  
4) C  
5) C  
6) B  
7) B  
8) D  
9) C  
10) A  
11) C  
12) B  
13) A  
14) A  
15) A  
16) C  
17) A  
18) D  
19) A  
20) A  
21) D  
22) D  
23) B  
24) C  
25) B  
26) B  
27) C  
28) C  
29) A  
30) B  
31) A  
32) B  
33) B  
34) B  
35) D  
36) C  
37) C  
38) B  
39) B  
40) A  
41) C  
42) B  
43) B  
44) C  
45) D  
46) D  
47) B  
48) A  
49) A  
50) A  
51) A  
52) A  
53) C  
54) B  
55) A  
56) B  
57) A  
58) A  
59) A  
60) C  
61) A  
62) D  
63) A  
64) S

**Item Codes for TRANS SYS COMPETENCY THREE**

1) 003.01.09  
2) 003.01.02  
3) 003.01.05  
4) 003.01.61  
5) 003.01.16  
6) 003.01.38  
7) 003.01.07  
8) 003.01.36  
9) 003.01.18  
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18) 003.01.31  
19) 003.01.54  
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29) 003.01.01  
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32) 003.01.56  
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61) 003.01.34  
62) 003.01.49  
63) 003.01.46  
64) 003.02.01

**Objective Labels for TRANS SYS COMPETENCY THREE**

1) 3.01A DEFINE SCI CONCEPTS  
2) DESIGN AND CONDUCT EXPERIMENTS

**Objective Codes for TRANS SYS COMPETENCY THREE**

1) 003.01A for 3.01A DEFINE SCI CONCEPTS  
2) 003.02.01 for DESIGN AND CONDUCT EXPERIMENTS
Number of Items Measuring each TRANS SYS COMPETENCY THREE Objective

1) 63 in 3.01A DEFINE SCI CONCEPTS  
2) 1 in DESIGN AND CONDUCT EXPERIMENTS

Items Measuring TRANS SYS COMPETENCY THREE 3.01A DEFINE SCI CONCEPTS

1) 1  2) 2  3) 3  4) 4  5) 5  6) 6  7) 7  8) 8
9) 9  10) 10  11) 11  12) 12  13) 13  14) 14  15) 15  16) 16
17) 17  18) 18  19) 19  20) 20  21) 21  22) 22  23) 23  24) 24
25) 25  26) 26  27) 27  28) 28  29) 29  30) 30  31) 31  32) 32
33) 33  34) 34  35) 35  36) 36  37) 37  38) 38  39) 39  40) 40
41) 41  42) 42  43) 43  44) 44  45) 45  46) 46  47) 47  48) 48
49) 49  50) 50  51) 51  52) 52  53) 53  54) 54  55) 55  56) 56
57) 57  58) 58  59) 59  60) 60  61) 61  62) 62  63) 63

Items Measuring TRANS SYS COMPETENCY THREE DESIGN AND CONDUCT EXPERIMENTS

1) 64

Mastery Level for TRANS SYS COMPETENCY THREE Objectives

1) 47 out of 63 for 3.01A DEFINE SCI CONCEPTS  
2) 1 out of 1 for DESIGN AND CONDUCT EXPERIMENTS

Partial Level for TRANS SYS COMPETENCY THREE Objectives

1) 38 out of 63 for 3.01A DEFINE SCI CONCEPTS  
2) 1 out of 1 for DESIGN AND CONDUCT EXPERIMENTS
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1. Subways did not become common until:
   A. Steam engines were developed.
   B. Steel track was perfected.
   C. Electric power was used for propulsion.
   D. Switching systems were developed allowing for faster trains.

2. On April 12, 1961 the Russians succeeded in:
   A. Testing the first hydrogen bomb.
   B. Launching their first nuclear submarine.
   C. Successfully orbiting the first man (Yuri Gagarin) in space.
   D. Successfully completing the first Lunar non-manned space flight.

3. By the year 1900, the U.S. had about 200,000 miles of railroads being used. The principal advantage(s) of rail verses horse-drawn wagons is that rail transportation is:
   A. More expensive, but faster.
   B. More expensive, but more reliable.
   C. Less expensive, more reliable, and faster.
   D. None of the above.

4. Setting the stage for advanced communication technology, on October 4, 1957:
   A. Sputnik 1 was launched into orbit.
   B. The communication satellite system for Star Wars went into operation.
   C. The first Trans-Atlantic fiber cable was completed.
   D. The first micro-wave communication system went into operation.

5. It is generally agreed that the first transportation device was the:
   A. Camel
   B. Dugout boat.
   C. Horse.
   D. Wheelbarrow.

6. This device greatly improved the efficiency and freedom of movement of sailboats:
   A. The forward beam rudder.
   B. Solid ballast.
   C. The square-rigged sail.
   D. The lateen sail.

7. On July 21, 1969 Neil Armstrong and Edwin Aldrin became the first men to:
   A. Join the Soviet Union in a joint space operation.
   B. Travel faster than the speed of sound.
   C. Dive more than one mile beneath the Atlantic Ocean's surface.
   D. Walk on the moon.
8. Space flights such as the Mariner, and Pioneer series allow:
   A. Information to be gathered from distances which today are too far for manned flight.
   B. Weapons to be dropped in the event of a nuclear war.
   C. For joint space missions between the U.S. and Russia.
   D. Astronauts to remain in space for over three months.

9. When people used animals for transportation, the fastest they could go was about 40 miles (64 kilometers) per hour. Today, modern jet aircraft such as the 500-seat Boeing 747 travel up to:
   A. 100 miles per hour.
   B. 150 miles per hour.
   C. 300 miles per hour.
   D. 600 miles per hour.

10. One of the most important navigational tools for early sailors helped determine a ship's latitude through the sighting of the sun or a star. This instrument was the:
    A. Compass.
    B. Load stone.
    C. Quadrant.
    D. Log.

11. In 1903 one of the most important events in the history of man took place when the Wright brothers:
    A. Powered the first steamboat.
    B. Traveled across the Atlantic in a hot-air balloon.
    C. Produced the first internal combustion engine.
    D. Flew the first successful engine-powered airplane.

12. One of the great advantages of using pack animals such as the camel to carry goods is that:
    A. Camels have an excellent sense of direction.
    B. Pack animals need no water during trips across deserts.
    C. Camels can carry much more (over 1000 lbs) than a human can carry.
    D. All the above.

13. The invention of the compass helped sailors:
    A. Identify their latitude.
    B. Identify their longitude.
    C. Maintain a constant speed.
    D. Maintain a constant course.

14. The Model-T Ford is of historical importance because:
    A. It represents the first relatively inexpensive car available to millions.
    B. It was the first mass produced car to be built using standardized parts.
    C. It gave millions freedom of movement never before known to the average citizen.
    D. All the above.
15 Sailing ships gave way to steamships mainly because:
A. Sailing ships were more expensive to operate because of the greater number of men required to operate them.
B. Sailing ships were more limited in size than steamships.
C. Steamships had a more reliable power source.
D. All the above.

16 Which type of engine was a central feature of the Industrial Revolution?
A. Reaction engine
B. Diesel engine
C. Steam engine
D. Rotary engine

17 The major effect of roads such as the ones built by the Romans and the modern roads and highways which followed, is that they greatly:
A. Increased trade.
B. Quickened communication.
C. Improved the movement of armies and supplies.
D. All the above.

DIRECTIONS FOR PERFORMANCE ITEMS See your teacher or test administrator for instructions on completing the following performance item(s).

18 As an individual or member of a team, first conduct research, then design, conduct, and evaluate laboratory experiments relating to the evolution of a transportation vehicular system or subsystem. Write a brief report, include sketches and technical drawings, and your research resources. Report your findings to your class.

The purpose of this activity is for you to develop a better understanding of the evolution of transportation systems and how the specific system or subsystem under study improved the performance of previously existing systems or subsystems.

Use the skills and insights learned from your previous experimentation on scientific and technical principles related to transportation vehicular systems.

You will be assessed using the following criteria:

<table>
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<th>Points</th>
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<tr>
<td>I. Research (Well researched and focused)</td>
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<tr>
<td>II. Experiment (Well designed and conducted)</td>
</tr>
<tr>
<td>III. Report (Well written, complete, and technically correct)</td>
</tr>
<tr>
<td>IV. Presentation (Clear, well organized and interesting)</td>
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</tbody>
</table>

Total Possible Score 0-100 points
Directions for Item 18

Using the knowledge and insights gained from their previous experiments, the students should research an important transportation historical development. The students should conduct and evaluate laboratory experiments related to this development and present their finds to the class.
Scoring Directions for Test Item 18 Unit 1 Key 18

Have the students working individually or in small teams conduct research, design, conduct, and evaluate laboratory experiments related to the evolution of a transportation vehicle system as well as develop a report which includes sketches, drawings and a bibliography of research text. Finally have the students present their finds to the rest of the class.

Encourage the students to use the skills they have already learned from the previous laboratory experiments. An example of an activity could be experimental inquiry into the different levels of force (lift) created by different type sails. Does the latteen sail work more efficiently at different angles to the wind than other designs?

Assess the students using the following criteria or modify appropriately:

<table>
<thead>
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<th>Points</th>
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<tbody>
<tr>
<td>I. Research is through and focused</td>
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<tr>
<td>II. Experiment has been well thought out and conducted. Measurements are accurate and recorded correctly using appropriate quality tools.</td>
</tr>
<tr>
<td>III. Report is well written, complete, and technically correct. Bibliography, sketches and appropriate drawings are included.</td>
</tr>
<tr>
<td>IV. Presentation is clear, well organized, interesting with necessary supporting graphics.</td>
</tr>
<tr>
<td>Total Possible Score</td>
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</tbody>
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Test Name: TRNSYCO4
Scan Form: GPFORMS
Test Label:

<table>
<thead>
<tr>
<th>Subtest Name</th>
<th>Number of Items</th>
<th>Number of Objectives</th>
<th>Starting Item Number</th>
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<tbody>
<tr>
<td>TRANS SYS COMPETENCY FOUR</td>
<td>18</td>
<td>2</td>
<td>1</td>
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</tbody>
</table>

Answer Key for TRANS SYS COMPETENCY FOUR


Item Codes for TRANS SYS COMPETENCY FOUR

1) 004.01.11 2) 004.01.07 3) 004.01.16 4) 004.01.09
5) 004.01.02 6) 004.01.04 7) 004.01.08 8) 004.01.10
9) 004.01.06 10) 004.01.01 11) 004.01.03 12) 004.01.12
13) 004.01.14 14) 004.01.05 15) 004.01.15 16) 004.01.17
17) 004.01.13 18) 004.02.01

Objective Labels for TRANS SYS COMPETENCY FOUR

1) 4.01A EXP TRANS SYS DEVELOPMENT 2) CONDUCT HISTORICAL EXPERIMENTS

Objective Codes for TRANS SYS COMPETENCY FOUR

1) 004.01A for 4.01A EXP TRANS SYS DEVELOPMENT
2) 004.02 for CONDUCT HISTORICAL EXPERIMENTS

Number of Items Measuring each TRANS SYS COMPETENCY FOUR Objective

1) 17 in 4.01A EXP TRANS SYS DEVELOPMENT 2) 1 in CONDUCT HISTORICAL EXPERIMENTS

Items Measuring TRANS SYS COMPETENCY FOUR 4.01A EXP TRANS SYS DEVELOPMENT

1) 1 2) 2 3) 3 4) 4 5) 5 6) 6 7) 7 8) 8
9) 9 10) 10 11) 11 12) 12 13) 13 14) 14 15) 15 16) 16
17) 17

Items Measuring TRANS SYS COMPETENCY FOUR CONDUCT HISTORICAL EXPERIMENTS

1) 18
Mastery Level for TRANS SYS COMPETENCY FOUR Objectives

1) 13 out of 17 for 4.01A EXP TRAN SYS DEVELOPMENT
2) 1 out of 1 for CONDUCT HISTORICAL EXPERIMENTS

Partial Level for TRANS SYS COMPETENCY FOUR Objectives

1) 10 out of 17 for 4.01A EXP TRAN SYS DEVELOPMENT
2) 1 out of 1 for CONDUCT HISTORICAL EXPERIMENTS
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1. With the exception of steam-powered ships, most transportation devices are powered by:
   A. External combustion engines.
   B. Stirling engines.
   C. Internal combustion engines.
   D. Reciprocating engines.

2. Most ships are propelled by:
   A. Rotary engines.
   B. Stirling engines.
   C. Diesel engines.
   D. Reaction engines.

3. On a sailboat, which sail is placed opposite or alongside the mainsail?
   A. Jib
   B. Spinnaker
   C. Airfoil
   D. Lateen

4. Which type of steam engine passes a heated gas back and forth between two cylinders?
   A. Reciprocating
   B. Steam turbine
   C. Piston
   D. Stirling

5. Which of the following is/are an example of an "internal combustion engine"?
   A. Universal-induction engine
   B. Stirling engine
   C. Ramjet engine
   D. All the above

6. The major source of energy for transportation systems is:
   A. Nuclear energy.
   B. Electricity.
   C. Solar energy.
   D. Petroleum.

7. Which of the following engines is an example of an external combustion engine?
   A. Diesel engine
   B. Steam engine
   C. Wankel engine
   D. Rocket engine
8 Which of the following is an advantage of liquid-propellant engines?
A. Power output can be regulated
B. Fuel is not pumped to a combustion chamber
C. Engine design determines power output and duration
D. Engine design is simple enough to be used in model rockets

9 A device that uses steam to produce rotary motion is called a(n):
A. Auxiliary steam engine.
B. Stirling cycle engine.
C. Steam turbine engine.
D. Reciprocating engine.

10 Transportation companies have been experimenting with new vehicles that use electromagnetic principles for propulsion and suspension. These systems are generally called:
A. Third rail systems.
B. Maglevs.
C. Electroprops.
D. Polarization Modules.

11 In internal combustion engines, pistons produce a:
A. Reciprocating motion.
B. Rotary motion.
C. Circular motion.
D. Linear motion.

12 The output of a linear-motion engine, such as a jet engine, is measured as:
A. Velocity.
B. Distance.
C. Torque.
D. Thrust.

13 The output of a reciprocating or rotary engine is always measured as:
A. Velocity.
B. Distance.
C. Torque.
D. Thrust.

14 The four separate piston strokes in a four-stroke cycle engine are compression, exhaust, power, and:
A. Intake.
B. Ignition.
C. Combustion.
D. Consumption.

15 Most large trucks are propelled by:
A. Diesel engines.
B. Ramjet engines.
C. Turbine engines.
D. Rotary engines.
16 Which type of sail improved the maneuverability of ships and encouraged increased exploration of uncharted land?
A. Square-rigged
B. Lateen
C. Dhow
D. Slant-rigged

17 All nuclear-fueled ships in the United States Navy are powered by:
A. Reciprocating engines.
B. Steam turbine engines.
C. Piston engines.
D. Stirling engines.

18 Turboprop engines are mainly used to power:
A. Guided missiles.
B. Military aircraft.
C. Commercial airliners.
D. Small business planes.

19 An example of an external combustion engine is the:
A. Reaction engine.
B. Diesel engine.
C. Steam engine.
D. Rotary engine.

20 Diesel-electric propulsion systems are most commonly found in:
A. Ship engines.
B. Aircraft engines.
C. Truck engines.
D. Train engines.

21 Many aircraft are propelled by:
A. Stirling engines.
B. Piston engines.
C. Steam engines.
D. Rotary engines.

22 The most powerful internal combustion engines are:
A. Rotary engines.
B. Rocket engines.
C. Jet engines.
D. Diesel engines.

23 Friction and centrifugal are two common types of:
A. Clutches.
B. Step pulleys.
C. Gear teeth.
D. Drive shafts.
24 Fuel is ignited by the intense heat of compression in:
   A. Rotary engines.
   B. Gasoline engines.
   C. Diesel engines.
   D. Four-stroke cycle engines.

25 Gas turbine engines are exposed to:
   A. Extreme cold.
   B. High temperatures.
   C. Heavy moisture.
   D. Heavy vibration.

26 The most powerful internal combustion engine is the:
   A. Steam engine.
   B. Diesel engine.
   C. Jet engine.
   D. Rocket engine.

27 The main difference between solid rocket engines and liquid rocket engines is:
   A. The amount of thrust produced is greater in a solid rocket.
   B. Liquid rockets are heavier.
   C. Solid rockets are no longer used.
   D. A liquid rocket engine may be throttled to control thrust.

28 On a sailboat the majority of the wind is captured by the:
   A. Mainsail.
   B. Lateen.
   C. Jib.
   D. Spinnaker.

29 Nearly all automobiles are powered by:
   A. Wankel engines.
   B. Stirling engines.
   C. Gasoline engines.
   D. Two-stroke cycle engines.

30 What do many automobiles use to transfer power from the engine to the differential?
   A. Pistons
   B. Step pulleys
   C. Gear teeth
   D. Drive shafts

31 The action in a jet engine is:
   A. Continuous.
   B. Non-continuous.
   C. Reciprocating.
   D. In the form of torque.
32 Jet engines are:
   A. Open at both ends.
   B. Closed at both ends.
   C. Open for intake only.
   D. Open for exhaust only.

33 On a ship's propeller, a lower pitch causes:
   A. Greater speed.
   B. Greater pulling power.
   C. Lower pulling power.
   D. Greater slip ratio.

34 On a ship's propeller a pitch of 17 means that the propeller will:
   A. Turn at 17 RPM's.
   B. Be at 17° to the ship shaft.
   C. Push at 17 ft/lbs.
   D. Move forward 17" with each revolution.

35 Wankel engines produce a:
   A. Linear motion.
   B. Rotary motion.
   C. Reciprocating motion.
   D. Alternating motion.

36 About what percentage of energy produced by burning diesel oil in a diesel engine is converted into motion?
   A. 40%
   B. 5%
   C. 50%
   D. 70%

37 Motion that produces a desired outcome including the factors force times distance is:
   A. Effort.
   B. Energy.
   C. Power.
   D. Work.

38 How energy efficient are heat engines?
   A. Less than 50% efficient
   B. Between 50 and 70% efficient
   C. Between 70 and 90% efficient
   D. Approximately 95% efficient

39 One of the least efficient but most widely used energy conversion devices for transportation is the:
   A. External rotary combustion engine.
   B. Internal combustion engine.
   C. Automatic transmission.
   D. Electric motor.
40. The greatest advantage of the diesel engine is its:
   A. Large size.
   B. Heavy structure.
   C. Durable casing.
   D. Fuel economy.

41. On turbofan engines, the fans provide an additional source of:
   A. Exhaust.
   B. Torque.
   C. Thrust.
   D. Lift.

42. Two-stroke cycle and four-stroke cycle are types of:
   A. Turbojet engines.
   B. Gasoline piston engines.
   C. Jet engines.
   D. Rotary engines.

43. In a turboprop engine nearly all of the energy produced by burning fuel is used to operate the:
   A. Compressor and propeller.
   B. Propeller and forward thrust.
   C. Compressor and reverse thrust.
   D. Forward and reverse thrust.

44. The "Stirling" engine is:
   A. A theoretical device.
   B. A steam engine.
   C. Two times less efficient than a gasoline engine.
   D. Used in many of today's automobiles.

45. Rocket engines such as those used on the space shuttle are:
   A. External combustion engines.
   B. Internal combustion engines.
   C. Rotary engines.
   D. Adapted jet engines.

46. On a sailboat, which sail is set forward of the mainsail?
   A. Jib
   B. Spinnaker
   C. Airfoil
   D. Lateen

47. Diesel engines are known for:
   A. Low weight.
   B. Power and dependability.
   C. High operating costs.
   D. Maintenance problems.
48. Which of the following is NOT an internal combustion engine?
   A. Diesel
   B. Steam
   C. Wankel
   D. Rocket

49. The ramjet engine is the simplest of all reaction engines and is basically a(n):
   A. Hollow tube.
   B. Exhaust system.
   C. Compressor turbine.
   D. Hollow sphere.

50. Gas turbine engines are used to power:
   A. Small business airplanes.
   B. Commercial airliners.
   C. Lawn mowers.
   D. Ships.

51. The force that propels an inflated balloon around a room demonstrates the same principles as a:
   A. Diesel engine.
   B. Piston engine.
   C. Wankel engine.
   D. Jet engine.

52. The action in a jet engine is:
   A. Reciprocating.
   B. Torque.
   C. Continuous.
   D. Not continuous.

53. An example of an internal combustion engine which produces a linear motion is a:
   A. Turbojet engine.
   B. Gasoline piston engine.
   C. Jet engine.
   D. Rotary engine.

54. Which of the following is an advantage of solid-propellant engines?
   A. Fuel and oxygen are ignited in a combustion chamber
   B. Power output can be regulated
   C. Fuel is not pumped to a combustion chamber
   D. Kerosene is the primary source of fuel

55. The diesel fuel in modern locomotive engines is burned in an engine which is used to:
   A. Turn a generator to make electricity.
   B. Turn a large, multi-speed transmission to power the wheels.
   C. Power the compressor section of the turbine drive engine.
   D. Power the wheels through a special fluid turbine transmission.
56 Turbofan engines are used to power:
   A. Guided missiles.
   B. Military aircraft.
   C. Commercial airliners.
   D. Small business planes.

57 Liquid-propellant and solid-propellant are types of:
   A. Rotary engines.
   B. Rocket engines.
   C. Jet engines.
   D. Diesel engines.

58 Ramjet engines are used mainly to power:
   A. Missiles.
   B. Military helicopters.
   C. Commercial airlines.
   D. Small business planes.

59 The Wankel engine is:
   A. A type of internal combustion engine.
   B. A type of external combustion engine.
   C. Obsolete.
   D. A type of rocket engine.

60 Steering wheels, brakes, and automatic pilots are all examples of transportation:
   A. Control systems.
   B. Support systems.
   C. Suspension systems.
   D. Structural systems.

61 The positioning of a wheel such that it contacts the road behind the centerline of the steering axis is referred to as:
   A. Caster.
   B. Mono-steering.
   C. Multi-directional.
   D. Positive axle steering.

62 Most modern automobiles have a positive camber which:
   A. Can dramatically increase the speed of the car.
   B. Can dramatically increase the braking distance of the car.
   C. Can reduce the wear on bearings and axles.
   D. Make them more dangerous to drive.

63 An airplane relies on:
   A. An elevator to change pitch.
   B. An aileron to change pitch.
   C. A rudder to change pitch.
   D. An fuselage to change pitch.
64 Mechanical devices that control the separation and joining of power to drive systems are:
   A. Differentials.
   B. Drive shafts.
   C. Clutches.
   D. Brakes.

65 If one aileron were lowered and the other raised, the plane would:
   A. Dive.
   B. Climb.
   C. Roll.
   D. Stall.

66 Tanks and bulldozers can change direction by:
   A. Engaging truckers.
   B. Engaging directional control wheels.
   C. Making one track go faster than another.
   D. Reversing their transmission.

67 How many degrees of freedom does a train have?
   A. One
   B. Two
   C. Three
   D. Four

68 Systems which provide for multiplying, dividing, or reversing the mechanical power coming from engines or motors are called:
   A. Transmission systems.
   B. Suspension systems.
   C. Hydraulic systems.
   D. Pneumatic systems.

69 Caster is desired in a steering system because it:
   A. Is considerably less expensive.
   B. Is easier to maintain.
   C. Is considerably stronger than conventional methods.
   D. Makes it much easier to steer the vehicle.

70 The small rotor on the rear of a helicopter is used to offset what forces caused by the main rotor?
   A. Pitch
   B. List
   C. Roll
   D. Torque

71 To control direction, which vehicles use a fixed rail system?
   A. Cars
   B. Trucks
   C. Planes
   D. Trains
72 Rockets use which of the following to change direction?
A. Rudder
B. Aileron
C. Nozzle direction
D. All the above

73 The "camber" of a wheel refers to:
A. The amount of traction it has.
B. The wheels suspension properties.
C. The angle it is to the road.
D. The number of "layers" or "belts" it has.

74 How many degrees of freedom does a helicopter have?
A. One
B. Two
C. Three
D. Four

75 Hot air balloons:
A. Control direction by using rudders.
B. Control speed by propellers.
C. Control altitude by the amount of hot air in the balloon.
D. Control altitude and direction through the use of thrusters and ballast.

76 Control systems are designed to control a vehicles position in space, and:
A. Speed and direction.
B. Support it in its environment.
C. Determine danger.
D. Protect passengers from the surrounding environment.

77 Which of the following gear systems would provide the most pushing power for a towtruck?
A. A motor turning a small gear driving a small gear driving the rear wheels
B. A motor turning a small gear driving a large gear driving the rear wheels
C. A motor turning a large gear driving a large gear driving the rear wheels
D. A motor turning a large gear driving a small gear driving the rear wheels

78 To change direction, one changes the cyclical pitch on a:
A. Car.
B. Boat.
C. Airplane.
D. Helicopter.

79 Drum and disc are two types of:
A. Suspension systems.
B. Propulsion systems.
C. Transmission systems.
D. Brake systems.
To increase the speed of different types of vehicles one may:
A. Increase the fuel consumption of the engine.
B. Change sail position.
C. Change the pitch or speed of the propeller.
D. Do any of the above.

To steer a boat one must turn the:
A. Elevator.
B. Stabilizer.
C. Keel.
D. Rudder.

In control systems, the number of changes in direction a vehicle can make is called:
A. Degrees of freedom.
B. Directional degrees.
C. Mobility.
D. Maneuverability.

On aircraft, the longitudinal axis, "roll" is controlled by the:
A. Fuselage.
B. Elevators.
C. Rudder.
D. Ailerons.

Which device allows an airplane to change its compass heading?
A. Ailerons
B. Fuselage
C. Rudder
D. Tail

Pneumatic tires are filled with:
A. Oil.
B. Air.
C. Water.
D. Pneumatium.

A boat that rises above the surface of the water on "wings" that remain in the water is called a/n:
A. Planer.
B. Jet-ski.
C. Hydrofoil.
D. Air-boat.

Both balloons and boats are kept afloat by the:
A. Gravitational forces acting on them.
B. Trust created by their engines.
C. Buoyancy of their vehicles.
D. Lift created by their foils.
88 Lift on a helicopter is created by the:
A. Props.
B. Elevators.
C. Rotor blades.
D. Airfoils.

89 An aircraft is suspended in air by its wings. This is made possible by the lift which is made by:
A. The air moving more quickly under its wings.
B. The air moving more quickly over the top of its wings.
C. The buoyancy of the vehicle in relation to the air around it.
D. The coefficient of drag created by the thrust of its engines.

90 What is used to give blimps lift?
A. Hot air
B. Hydrogen
C. Oxygen
D. Helium

91 A stabilizer bar prevents:
A. An aircraft from bumps caused by erratic winds.
B. Ships from excessive roll.
C. Trains from leaving the track at high speeds.
D. Cars from leaning out too far when turning.

92 Flat, round, catamaran, and hydrofoils are all types of:
A. Boat.
B. Wing designs.
C. Hull designs.
D. Plenum chambers.

93 Pneumatic tires provide a cushioning effect because:
A. Air compresses.
B. Oil compresses.
C. Water compresses.
D. Pneumatium compresses.

94 Annular jets and plenum chambers are found on:
A. Boats.
B. Air cushioned vehicles.
C. Military rockets.
D. Nuclear submarines.

95 All heavier-than-air aircraft rely on:
A. Propellers to provide thrust.
B. Rotors to provide lift.
C. Wings to fly.
D. Airfoils to provide lift.
Hydroplaning may cause a vehicle to:
A. Increase its speed.
B. Loose altitude.
C. Go out of control.
D. Decrease its angle of attack.

Which type of boat hull is designed to skim on the surface of the water once the boat reaches its optimum speed?
A. Displacement
B. Planeing
C. Hydrofoil
D. Air cushioned

The four forces affecting a plane in flight are the lift, weight (gravity), thrust, and:
A. Propulsion.
B. Compression.
C. Combustion.
D. Drag.

Land suspension systems are made up of tires, springs, shock absorbers, and:
A. T-props.
B. Steering cables.
C. Stabilizer bars.
D. Centering drivers.

The buoyancy of submarines are controlled by:
A. Its rudder.
B. Speed.
C. Inflation tubes.
D. Flotation tanks.

Which of the following hulls is the most stable?
A. Round bottom
B. Flat bottom
C. Semi-Vee bottom
D. Catamarans and tri-hulls

The boats which tend to be the LEAST stable have:
A. Round hulls.
B. Flat bottom hulls.
C. Tri-hulls.
D. Semi-Vee bottom hulls.

A hydrofoil is lifted out of the water by:
A. Thrusters.
B. A cushion of air.
C. The lift created by its foils.
D. Its propellers.
104 The main purpose of a shock absorber is to:
A. Reduce damage resulting from a head-on collision.
B. Reduce spring oscillation.
C. Reduce torque forces of an engine.
D. Reduce the braking forces of air brakes.

105 The major advantage of air cushion vehicles such as Hovercraft is that they:
A. Can travel over land and water.
B. Can go very fast.
C. Can go very high.
D. Are extremely stable in storms.

106 The body of an airplane is called a:
A. Chamber.
B. Compartment.
C. Fuselage.
D. Cabin.

107 A conning tower is found:
A. At airports.
B. On tugboats.
C. Most catamarans.
D. On submarines.

108 In marine vessels, the hull designed to carry heavy loads is called a:
A. Displacement hull.
B. Planing hull.
C. Delta hull.
D. Conical hull.

109 What part of a marine vessel's hull improves ride during roll and reduces splashing over the bow?
A. Fore
B. Conical contour
C. Delta shape
D. Chine

110 Bulkheads serve to:
A. Isolate sections of the ship to prevent sinking.
B. Store fuel and other fluids.
C. Store bulk materials such as coal and grains.
D. Tie cargo down to prevent it from moving during storms.

111 Ailerons, flaps, elevators, and rudders cause the plane to move by:
A. Increasing or decreasing drag.
B. Increasing or decreasing lift.
C. Increasing or decreasing the plane's center of weight.
D. Increasing or decreasing the plane's center of effort.
The pilot and other operators of large planes are located in the planes:
A. Cockpit.
B. Pilothouse.
C. Conning tower.
D. Control tower.

The empennage of a plane is its:
A. Wing(s).
B. Nose section.
C. Tail section.
D. Fuselage.

The primary purpose of a plane's tail section is to provide:
A. Baggage space.
B. Fuel Storage.
C. Control and stability.
D. Added lift.

The two main parts of a hot air balloon are the:
A. Fuselage and cabin.
B. Fuselage and cockpit.
C. Envelope and car (basket).
D. Car (basket) and shroud.

Stages are parts of:
A. Luxury cars.
B. Buses.
C. Rockets.
D. Trains.

Larger cars generally have conventional frames, tend to be safer, and:
A. Tend to rattle more.
B. Tend to be quieter.
C. Tend to be more fuel efficient.
D. Tend to be less expensive because of conventional rather than unibody construction.

The main body of a marine vessel is called a/n:
A. Conical.
B. Cabin.
C. Deck.
D. Hull.

The main two parts of an automobile structure are the:
A. Truss and frame.
B. Body and wheels.
C. Body and chassis.
D. Cab and engine compartment.
Ceramic tiles are used on the space shuttle to:
A. Reduce friction.
B. Reduce drag.
C. Protect against heat.
D. Increase the lift during the re-entry process.

In marine vessels, the hull designed to ride on top of the water for increased speed is called a:
A. Displacement hull.
B. Planing hull.
C. Delta hull.
D. Conical hull.

What part of a marine vessel's hull is designed to provide clean cutting through the water for optimum water flow and minimum drag?
A. Fore
B. Conical contour
C. Delta shape
D. Chine

The term monocoque means:
A. Hollow.
B. Strong.
C. One shell.
D. Many chambers.

What part of a marine vessel's hull provides stability and makes it easier to plane the boat?
A. Fore
B. Conical contour
C. Delta shape
D. Chine

The main advantage of monocoque design for plane fuselages is that this design:
A. Provides considerably more storage space than truss design.
B. Is much less expensive to build than truss design.
C. Is much less in weight than truss design.
D. None of the above.

One of the major disadvantages of plastics verses steel in car construction, is that plastics:
A. Do not withstand impact as well as steel.
B. Tend to weight more than steel.
C. Have a higher coefficient of drag.
D. All the above.

Unibody, truss system, and monocoque all refer to:
A. Suspension systems.
B. Control systems.
C. Structural systems.
D. Bridge designs.
128  A jet fighter is most likely to have a:
   A. Straight wing.
   B. Tapered wing.
   C. Elliptical wing.
   D. Sweptback or delta wing.

129  Straight, tapered, elliptical, and sweptback refer to:
   A. Hulls.
   B. Car bodies.
   C. Train designs.
   D. Wings.

130  The location of radio transmitters can be seen on:
   A. Aeronautical charts
   B. Nautical charts.
   C. Road maps.
   D. Tourist maps.

131  This method uses a compass to read the bearings of visible landmarks and a chart to determine the vehicle's location:
   A. Dead reckoning.
   B. Piloting.
   C. Circumnavigation.
   D. VOR.

132  A method for determining a vehicle's position by estimating how far and in what direction it has come from its last known position is called:
   A. Radio sextant application.
   B. Piloting.
   C. Gyro-compassing method.
   D. Dead reckoning.

133  This device continuously measures radio waves given off by the sun to determine the position of the vehicle:
   A. Gyrocompass.
   B. VOR.
   C. IEC (Integrated Electronic Compass).
   D. Radio sextant.

134  On average, magnetic north differs from true north by approximately:
   A. 1000 miles north.
   B. 1000 miles south.
   C. 11 miles north.
   D. 11 miles south.

135  Church steeples and water towers can frequently be seen on:
   A. Aeronautical charts.
   B. Nautical charts.
   C. Road maps.
   D. Tourist maps.
136 This guidance system sends out radio waves which bounce off objects and return to a receiver which then determines how far away the objects are:
A. Sonar.
B. Radar.
C. Loran.
D. Omega.

137 The device attached to the drive train of land transportation vehicles that measures speed in miles or kilometers is called a:
A. Log.
B. Sextant.
C. Speedometer.
D. Altimeter.

138 The navigational system that employs up to five satellites is:
A. VOR.
B. Loran.
C. Omega.
D. NAVSAT.

139 On a scaled map, what decreases as the denominator in the ratio increases?
A. Detail
B. Land Area
C. Numerator
D. Chart size

140 A map that is shaped like a sphere is called a/n:
A. Log.
B. Nautical chart.
C. Globe.
D. VOR

141 What guidance device would the average person use to travel across the United States in a car?
A. Compass
B. Light
C. Map
D. Radio

142 How many longitudinal degrees are measured on the globe?
A. 66
B. 90
C. 180
D. 360

143 The development of what instrument allowed early ocean navigators to cross wide bodies of water without having to rely on landmarks?
A. The sundial
B. The telescope
C. The compass
D. The hydrometer
144 Which of the following is an example of a guidance system?
A. Jib
B. Wheel
C. Road sign
D. Rudder

145 A ship would use which of the following to determine the waters depth?
A. Sonar
B. Radar
C. Loran
D. Omega

146 Radio transmitting stations are usually land-based and controlled by the:
A. City or town government.
B. County government.
C. State government.
D. Federal government.

147 What navigational device is designed to point to true north?
A. Sextant
B. Compass
C. Gyrocompass
D. Sonar

148 The relationship of large land masses such as the North American Continent, can be seen on a:
A. Globe.
B. Aeronautical chart.
C. Nautical chart.
D. Sextant.

149 The navigational system having a very high frequency omnidirectional range is:
A. VOR.
B. Loran.
C. Omega.
D. NAVSAT.

150 Guidance systems give a vehicle's operator warning signals, direction, and:
A. Location.
B. Pressure.
C. Speed.
D. All the above.

151 Stop lights, lighthouses, and buoys are all parts of:
A. Suspension systems.
B. Control systems.
C. Guidance systems.
D. Structural systems.
152 Air and marine maps that are designed for navigation purposes are called:
A. Coordinates.
B. Sextants.
C. Charts.
D. Buoys.

153 On a scaled map, what increases as the denominator in the ratio increases?
A. Detail
B. Land area
C. Numerator
D. Chart size

154 The navigational system that is widely used worldwide to guide ships and planes that are approaching the coast is:
A. VOR.
B. Loran.
C. Omega.
D. NAVSAT.
Test Name: TRNSYCO5
Scan Form: GPFORMS
Test Label: TRANS SYS COMPETENCY FIVE

Number of Items: 154
Number of Objectives: 5
Starting Item Number: 1

Answer Key for TRANS SYS COMPETENCY FIVE

1) C 2) C 3) B 4) D 5) C 6) D 7) B 8) A
57) B 58) A 59) A 60) A 61) A 62) C 63) A 64) C
89) B 90) D 91) D 92) C 93) A 94) B 95) D 96) C
153) B 154) C
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Scan Form: GPFORMS  
Test Label: Item Codes for TRANS SYS COMPETENCY FIVE

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Objective Labels for TRANS SYS COMPETENCY FIVE

1) 5.01A EXP PROPULSION CONCEPTS
2) 5.03A EXP CONTROL CONCEPTS
3) 5.04A EXP SUSPENSION CONCEPTS
4) 5.05A EXP STRUCTURAL CONCEPTS
5) 5.02A EXP GUIDANCE CONCEPTS
Test Name: TRNSYCO5  
Scan Form: GPFORMS  
Test Label:

Objective Codes for TRANS SYS COMPETENCY FIVE

1) 005.01A  for 5.01A EXP PROPULSION CONCEPTS  
2) 005.03A  for 5.03A EXP CONTROL CONCEPTS  
3) 005.04A  for 5.04A EXP SUSPENSION CONCEPTS  
4) 005.05A  for 5.05A EXP STRUCTURAL CONCEPTS  
5) 005.02A  for 5.02A EXP GUIDANCE CONCEPTS

Number of Items Measuring each TRANS SYS COMPETENCY FIVE Objective

1) 59 in 5.01A EXP PROPULSION CONCEPTS  
2) 25 in 5.03A EXP CONTROL CONCEPTS  
3) 23 in 5.04A EXP SUSPENSION CONCEPTS  
4) 22 in 5.05A EXP STRUCTURAL CONCEPTS  
5) 25 in 5.02A EXP GUIDANCE CONCEPTS

Items Measuring TRANS SYS COMPETENCY FIVE 5.01A EXP PROPULSION CONCEPTS

1) 1  
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Items Measuring TRANS SYS COMPETENCY FIVE 5.03A EXP CONTROL CONCEPTS

1) 60  
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Items Measuring TRANS SYS COMPETENCY FIVE 5.04A EXP SUSPENSION CONCEPTS

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Items Measuring TRANS SYS COMPETENCY FIVE 5.05A EXP STRUCTURAL CONCEPTS

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100
Test Name: TRNSYCO5
Scan Form: GPFORMS
Test Label:

Items Measuring TRANS SYS COMPETENCY FIVE 5.02A EXP GUIDANCE CONCEPTS

1) 130  2) 131  3) 132  4) 133  5) 134  6) 135  7) 136  8) 137
9) 138 10) 139 11) 140 12) 141 13) 142 14) 143 15) 144 16) 145
17) 146 18) 147 19) 148 20) 149 21) 150 22) 151 23) 152 24) 153
25) 154

Mastery Level for TRANS SYS COMPETENCY FIVE Objectives

1) 44 out of 59 for 5.01A EXP PROPULSION CONCEPTS
2) 19 out of 25 for 5.03A EXP CONTROL CONCEPTS
3) 17 out of 23 for 5.04A EXP SUSPENSION CONCEPTS
4) 17 out of 22 for 5.05A EXP STRUCTURAL CONCEPTS
5) 19 out of 25 for 5.02A EXP GUIDANCE CONCEPTS

Partial Level for TRANS SYS COMPETENCY FIVE Objectives

1) 35 out of 59 for 5.01A EXP PROPULSION CONCEPTS
2) 15 out of 25 for 5.03A EXP CONTROL CONCEPTS
3) 14 out of 23 for 5.04A EXP SUSPENSION CONCEPTS
4) 13 out of 22 for 5.05A EXP STRUCTURAL CONCEPTS
5) 15 out of 25 for 5.02A EXP GUIDANCE CONCEPTS
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1 Which of the following is used to increase the fuel efficiency of automobiles?
   A. Lighter materials
   B. Computers
   C. Vortex generators
   D. All of the above

2 You are designing a CO$_2$ powered race car. Generally, which of the following will most directly effect its speed?
   A. Weight
   B. Shape
   C. Finish
   D. Type wheels

3 Which one of the following design concepts would NOT be considered when building and evaluating a land transportation vehicle?
   A. Drag
   B. Weight
   C. Buoyancy
   D. Shape

4 You are riding your 10 speed (2 front sprockets, 5 back sprockets) bike on level ground, which combination of sprockets would enable you to go the fastest?
   A. Small front, smallest back
   B. Small front, largest back
   C. Large front, smallest back
   D. Large front, largest back

5 MagLev vehicles are suspended by:
   A. Rails.
   B. Electrical current traveling through the third track.
   C. Magnetic force fields.
   D. Magnetic wheels.

6 The propulsion system of a CO$_2$ car consists of a/n:
   A. Electro-magnetic computerized launching system.
   B. CO$_2$ cartridge.
   C. String and screw-eye.
   D. Axles and wheels.

7 When 40 foot-pounds of torque are produced at 3,200 r/min, how many horsepower are being produced?
   A. 24.37
   B. 48.70
   C. 80
   D. 128,000
8. For a vehicle driven by a motor turning at a constant rpm, which of the following would result in the greatest pulling power?
   A. A driving wheel attached to a small gear driven by a large gear directly connected to the motor
   B. A driving wheel attached to a large gear driven by a small gear directly connected to the motor
   C. A driving wheel attached to a small gear driven by a small gear directly connected to the motor
   D. A driving wheel attached to a large gear driven by a large gear directly connected to the motor

9. For a vehicle driven by a motor turning a constant rpm, which of the following would result in the fastest speed?
   A. A drive wheel directly connected to a small gear driven by a large gear connected to the motor
   B. A drive wheel directly connected to a large gear driven by a small gear connected to the motor
   C. A drive wheel directly connected to a large gear driven by one of the same size connected to the motor
   D. A drive wheel directly connected to a small gear driven by one of the same size connected to the motor

10. The guidance system for CO2 cars being raced consists of a/n:
    A. CO2 cartridge.
    B. String and screw-eye.
    C. Track.
    D. Electro-magnetic computerized launcher.

11. To direct the airflow around a car to increase its efficiency, what may be placed on the roof of the car?
    A. Bearings
    B. Small fins
    C. Vortexes
    D. Thermal shields

12. The term active suspension refers to:
    A. Fuel suspension processes.
    B. Vehicle body designs.
    C. Computer controlled suspension systems.
    D. High tech shock absorbers.

13. Magnetic levitation vehicles are suspended on a magnetic field and propelled by:
    A. Electric motors.
    B. Diesel engines.
    C. Jet turbines.
    D. Propulsion magnets.

14. To increase efficiency in automobiles, it is best to design car bodies which have:
    A. High drag indexes.
    B. Low drag indexes.
    C. A low coefficient of drag.
    D. A high coefficient of drag.
15 The suspension system of a CO\textsuperscript{2} car consists of:
A. A car body.
B. Two screw-eyes.
C. A CO\textsuperscript{2} cartridge.
D. Axles and wheels.

16 When designing a CO\textsuperscript{2} powered race car, one should polish the axles to:
A. Reduce wheel wear.
B. Reduce friction caused by the axles rubbing against the bearings.
C. Make the look more professional.
D. Decrease the coefficient of drag on the car.

17 You are riding your 10 speed (2 front sprockets. 5 back sprockets) bike up a long hill. Which combination of sprockets would allow you do go the slowest?
A. Small front, smallest back
B. Small front, largest back
C. Large front, smallest back
D. Large front, largest back

18 The structural system of a CO\textsuperscript{2} car consists of:
A. A car body.
B. CO\textsuperscript{2} Cartridge.
C. Wheels and axles.
D. Screw-eyes.

19 Solar-powered vehicles are being required in some cities because they:
A. Are more fuel efficient.
B. Are faster.
C. Result in less air pollution.
D. Are safer.

20 In the design of automobiles, it is best to design cars which generate:
A. No vortex.
B. A vortex.
C. A high degree of drag.
D. Minimum torque.

21 Maglev rail systems contain magnets:
A. Located on the train only.
B. Located on the track (guideway) only.
C. Located on both the train and the track (guideway).
D. Which have north poles only.

22 A vehicle's operation through wind at high speeds may be simulated in a:
A. Speed chamber.
B. Highway environment simulator.
C. Wind tunnel.
D. Pressurized reactor.
DIRECTIONS FOR PERFORMANCE ITEMS See your teacher or test administrator for instructions on completing the following performance item(s).

23 The purpose of this activity is to design and build the highest quality simple land transportation vehicle model you are capable of developing by applying the skills, knowledge, and insights learned through your research, experimentation, and evaluation.

Individually or as a member of a team, design, build, and evaluate a simple land transportation vehicle model. Using information previously learned from your research and experimentation, including any necessary addition research, design a simple land transportation vehicle then build the model (graphical, physical, or computer generated) to the appropriate scale and specifications as indicated in your design criteria. Finally evaluate and test your model to see that it functions appropriately. Use the specific guidelines provided by your teacher throughout the process. Demonstrate your model to the class.

You will be assessed using the following criteria:

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<tr>
<td>I. Design (Well researched and thought out) (Includes necessary drawings, specifications, and design criteria). 0-25</td>
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<tr>
<td>II. Model Artisanship (Quality and appropriateness of construction) 0-25 Efficacy (Works well and as planned, efficient) 0-25</td>
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<td>III. Evaluation (Thorough and well thought out, discusses relevant aspects of model's performance) 0-15</td>
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<td>IV. Demonstration (Model performs as expected, presenter gives clear description and explanation of model's functions) 0-10</td>
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<td>Total Possible Score 0-100 points</td>
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STOP HERE
**Directions for Item 23**

For this activity help the students develop the highest quality simple land transportation project they can design and execute. Work to ensure that they use their skills, knowledge, and insights gained from their previous experimentation and research in the design of their model. The model does not have to be physical such as a CO$_2$, maglev, or mouse-trap car or other device. It may be graphical, electronic, or computer generated. Ask yourself the purpose of the activity. Does it demand the use of the students' analytical and creative skills as well as allow them to apply the technical and scientific information they have already learned about transportation systems and subsystems? Does the activity add to a more complex understanding of transportation systems? Finally, if the student(s) are going on to Advanced Transportation Systems, will this activity lead in this direction? Is what they will learn here fundamental and essential to what they will need to know to be successful with a more complicated and demanding study?
Scoring Directions for Test Item 23 Unit 1 Key 23

The purpose of this activity is to have the students continue their research into appropriate land transportation vehicular systems, and design, build, and evaluate a simple land transportation model. Note that the model may be graphical, computer generated, or physical. The student(s) should demonstrate his/her model to the rest of the class. Evaluation should focus on the application of scientific and technical skills as well as the efficacy of their models. As noted below the students will also be assessed on the quality of their demonstration.

Assess the students using the following criteria or modify appropriately:

I. Design (Well researched and thought out) (Includes the necessary drawings with correct specifications and design criteria) 0-25

II. Model Artisanship (Quality and appropriateness of construction) 0-25
    Efficacy (Works well and as planned) 0-25

III. Evaluation (Thorough and well thought out, discusses relevant aspects of model's performance and uses scientific and technical terms correctly) 0-15

IV. Demonstration (Model performs as expected, presenter gives clear description and explanation of model's performance and functions) 0-10

Total Possible Score 0-100 points
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Scan Form: GPFORMS
Test Label:

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Answer Key for TRANS SYS COMPETENCY SIX


Item Codes for TRANS SYS COMPETENCY SIX

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5) 006.01.22  6) 006.01.19  7) 006.01.02  8) 006.01.12
9) 006.01.11  10) 006.01.17  11) 006.01.04  12) 006.01.10
13) 006.01.08  14) 006.01.07  15) 006.01.20  16) 006.01.16
17) 006.01.14  18) 006.01.21  19) 006.01.09  20) 006.01.06
21) 006.01.18  22) 006.01.03  23) 006.02.01

Objective Labels for TRANS SYS COMPETENCY SIX

1) 6.01A EXP LAND TRANS DESIGN  2) DESIGN/BUILD LAND TRANS MODEL

Objective Codes for TRANS SYS COMPETENCY SIX

1) 006.01A for 6.01A EXP LAND TRANS DESIGN
2) 006.02 for DESIGN/BUILD LAND TRANS MODEL

Number of Items Measuring each TRANS SYS COMPETENCY SIX Objective

1) 22 in 6.01A EXP LAND TRANS DESIGN  2) 1 in DESIGN/BUILD LAND TRANS MODEL

Items Measuring TRANS SYS COMPETENCY SIX 6.01A EXP LAND TRANS DESIGN

1) 1  2) 2  3) 3  4) 4  5) 5  6) 6  7) 7  8) 8
9) 9  10) 10  11) 11  12) 12  13) 13  14) 14  15) 15  16) 16
17) 17  18) 18  19) 19  20) 20  21) 21  22) 22

133
Test Name: TRNSYCO6
Scan Form: GPFORMS
Test Label:

Items Measuring TRANS SYS COMPETENCY SIX DESIGN/BUILD LAND TRANS MODEL

1) 23

Mastery Level for TRANS SYS COMPETENCY SIX Objectives

1) 17 out of 22 for 6.01A EXP LAND TRANS DESIGN
2) 1 out of 1 for DESIGN/BUILD LAND TRANS MODEL

Partial Level for TRANS SYS COMPETENCY SIX Objectives

1) 13 out of 22 for 6.01A EXP LAND TRANS DESIGN
2) 1 out of 1 for DESIGN/BUILD LAND TRANS MODEL
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1. The advantage of hydrofoils in hull design is that:
   A. They have great stability in storms and are nearly impossible to sink.
   B. They offer great control at low speeds and large cargo storage.
   C. Fishermen find them excellent for trolling.
   D. The foils offer much less drag than conventional hulls.

2. Assuming 100% efficiency with no drag or friction, if a propeller on a boat turns 3,800 rpm's, and the boat moves forward at 57,000 inches per minute, what is the propeller's pitch?
   A. .06
   B. 9
   C. 15
   D. 21

3. All else being equal, the greater a sailboat's draft, the:
   A. Faster it will go.
   B. Slower it will go.
   C. More it can carry.
   D. Less it can carry.

4. A marine vessel's propeller has a pitch of 17 and turns at 4,200 rpm. Assuming 100% efficiency, approximately how far would the boat move in one minute?
   A. 100 ft
   B. 100 yds
   C. 1/2 mile
   D. 1 mile

5. Generally, the greater the surface area to water of a boat, the:
   A. Greater the drag.
   B. The less the drag.
   C. The less buoyancy.
   D. The greater its speed.

6. Sailboats designed with deep hulls help:
   A. Increase the boats speed.
   B. Increase the boats turning radius.
   C. Stabilize the boat in rough seas.
   D. Reduce the boat's buoyancy.

7. A small boat displaces 10 cubic feet of water. Four people, together weighing 650 lbs, want to row across the sound. What will happen? (Note the water weighs approximately 64 lbs. per cubic feet).
   A. The boat will sink.
   B. The boat will not sink.
   C. The boat will be more stable with four people than one person.
   D. Displacement has nothing to do with whether they will make it across the sound.
8 The advantage of double-hull design on ships is that it:
   A. Increases buoyancy.
   B. Helps increase the ships speed.
   C. Lessens the drag on the hull.
   D. Lessens the likelihood of sinking.

9 The sail of a sailboat works much like a/n:
   A. Rocket engine.
   B. Hot air balloon.
   C. Wing on an airplane.
   D. Internal combustion engine.

10 When designing a sailboat, to increase its buoyancy, one would:
   A. Increase its weight.
   B. Increase its displacement.
   C. Increase the square feet area of the sail(s).
   D. Increase its ballast.

11 When building a water transportation vehicle, which one of the following would be considered during the design stage?
   A. Thrust
   B. Lift
   C. Moor
   D. Draft

12 A cruising sailboat will have:
   A. Low pressure on the windward side of its main sail.
   B. Low pressure on the windward side of its spinnaker.
   C. High pressure on the windward side of its main sail.
   D. High pressure on its starboard side.

13 Generally, a boat built for speed will have a:
   A. Flat bow.
   B. Round bow.
   C. Square bow.
   D. Pointed bow.

14 If you wished to design a small fresh water fishing boat, which hull shape would most likely meet your needs?
   A. Round
   B. Flat
   C. Square
   D. Triangular

15 A solid steel ball will sink in water because:
   A. It is harder than water.
   B. It is a solid, not a liquid.
   C. It displaces less water than it weighs.
   D. It displace more water than it weighs.
16 Generally, wide flat hulls are:
   A. Designed for speed and to carry great weight.
   B. Designed to carry great weight but tend to generate great drag.
   C. Designed for speed and light cargos.
   D. Designed to carry great weight but tend to be unstable.

17 A chine is designed to:
   A. Increase the speed of a boat.
   B. Pull in nets on a fishing boat.
   C. Secure a vessel to a mooring.
   D. Reduce the rolling and splashing of a boat.

DIRECTIONS FOR PERFORMANCE ITEMS See your teacher or test administrator for instructions on completing the following performance item(s).

18 The purpose of this activity is to design and build the highest quality simple water transportation vehicle model you are capable of developing by applying the skills, knowledge, and insights learned through your research, experimentation, and evaluation.

   Individually or as a member of a team, design, build, and evaluate a simple water transportation vehicle model. Using information previously learned from your research and experimentation, including any necessary addition research, design a simple water transportation vehicle. Then build the model (graphical, physical, or computer generated) to the appropriate scale and specifications as indicated in your design criteria. Finally evaluate and test your model to see that it functions appropriately. Use the specific guidelines provided by your teacher throughout the process. Demonstrate your model to the class.

You will be assessed using the following criteria:

   Points

I. Design (Well researched and thought out. Includes necessary drawings, specifications, and design criteria.) 0-25

II. Model
   Artisanship (Quality and appropriateness of construction) 0-25
   Efficacy (Works well and as planned) 0-25

III. Evaluation (Thorough and well thought out, discusses relevant aspects of model's design, construction, and performance) 0-15

IV. Demonstration (Model performs as expected, presenter gives clear description and explanation of model's development and functions) 0-10

Total Possible Score 0-100 points

STOP HERE
Directions for Item 18

For this activity you are to help the students develop the highest quality simple water transportation vehicular model they can design and execute. Work to ensure that they use their skills, knowledge, and insights gained from their previous experimentation and research in the design of their model. The model does not have to be physical such as a motor or sail boat or other device. It may be graphical, electronic, or computer generated. To help determine the worth of a student(s)' project, ask yourself the purpose of the activity. Does it demand the use of the student(s') analytical and creative skills as well as allow them to apply the technical and scientific information they have already learned related to transportation systems and subsystems? Does the activity add to a more complex and thorough understanding of transportation systems? Finally, if the student(s) are going on to Advanced Transportation Systems, will this activity lead in this direction? In other words, is what they will learn here fundamental and essential to what they will need to know to be successful with a more complicated and demanding study?
Scoring Directions for Test Item 18 Unit 1 Key 18

The purpose of this activity is to have the students continue their research into appropriate water transportation systems and design, build, and evaluate a simple water transportation vehicular model. This model may be graphical, computer generated or physical. The students should demonstrate their model to the rest of the class. Evaluation should focus on the application of scientific and technical skills as well as the artisanship of the students and the efficacy of their models. As noted below the students will also receive credit for their demonstration.

Assess the students using the following criteria or modify appropriately:

I. Design (Well researched and thought out. Includes the necessary drawings, with correct specifications and design criteria) 0-25

II. Model Artisanship (Quality and appropriateness of construction) 0-25
   Efficacy (Works well and as planned) 0-25

III. Evaluation (Thorough and well thought out. Discusses relevant aspects of model's performance and uses scientific and technical terms correctly) 0-15

IV. Demonstration (Model performs as expected, presenter gives clear description and explanation of model's performance and functions) 0-10

Total Possible Score 0-100 points
Subtest Name: TRANS SYS COMPETENCY SEVEN

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<th>Number of Objectives</th>
<th>Starting Item Number</th>
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Answer Key for TRANS SYS COMPETENCY SEVEN


Item Codes for TRANS SYS COMPETENCY SEVEN

1) 007.01.09  2) 007.01.02  3) 007.01.13  4) 007.01.03
5) 007.01.05  6) 007.01.15  7) 007.01.06  8) 007.01.16
9) 007.01.11  10) 007.01.12 11) 007.01.01  12) 007.01.10
13) 007.01.17 14) 007.01.14 15) 007.01.07  16) 007.01.08
17) 007.01.04 18) 007.02.01

Objective Labels for TRANS SYS COMPETENCY SEVEN

1) 7.01A EXP WATER TRAN DESIGN  2) DESIGN/BUILD WATER TRANS MODEL

Objective Codes for TRANS SYS COMPETENCY SEVEN

1) 007.01A  for 7.01A EXP WATER TRAN DESIGN
2) 007.02  for DESIGN/BUILD WATER TRANS MODEL

Number of Items Measuring each TRANS SYS COMPETENCY SEVEN Objective

1) 17 in 7.01A EXP WATER TRAN DESIGN  2) 1 in DESIGN/BUILD WATER TRANS MODEL

Items Measuring TRANS SYS COMPETENCY SEVEN 7.01A EXP WATER TRAN DESIGN

1) 1  2) 2  3) 3  4) 4  5) 5  6) 6  7) 7  8) 8
9) 9  10) 10 11) 11 12) 12 13) 13 14) 14 15) 15 16) 16
17) 17

Items Measuring TRANS SYS COMPETENCY SEVEN DESIGN/BUILD WATER TRANS MODEL

1) 18

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Mastery Level for TRANS SYS COMPETENCY SEVEN Objectives

1) 13 out of 17 for 7.01A EXP WATER TRAN DESIGN
2) 1 out of 1 for DESIGN/BUILD WATER TRANS MODEL

Partial Level for TRANS SYS COMPETENCY SEVEN Objectives

1) 10 out of 17 for 7.01A EXP WATER TRAN DESIGN
2) 1 out of 1 for DESIGN/BUILD WATER TRANS MODEL
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1 When turbulence on the top of an airfoil reduces lift to such a degree that the lift can no longer support the craft:
   A. A state of stall has been reached.
   B. Aerodynamic balance has been reached.
   C. Drag has been eliminated.
   D. Mach one has been reached.

2 For a plane to bank, it will use its:
   A. Landing gear.
   B. Flaps and elevators.
   C. Rudder and ailerons.
   D. Emergency evacuation chute.

3 A wing having a span of 30 feet and a cord of 5 feet would have an aspect ratio of:
   A. 3.
   B. 6.
   C. 10.
   D. 150.

4 To design a plane which has excellent stall characteristics, one would choose:
   A. Straight wing.
   B. Tapered wing.
   C. Elliptical wing.
   D. Sweptback or delta wing.

5 The aspect ratio refers to the:
   A. Angle a plane cuts through the air compared to its thrust.
   B. Ratio of a wings span to its chord.
   C. Ratio of a ships weight to what it can carry.
   D. Ratio of a rockets angle of re-entry to its loss of altitude.

6 Hot air balloons float in air much like boats in water. What is the primary propulsion for hot air balloons?
   A. Released hot air
   B. Propeller(s)
   C. Aileron(s)
   D. Wind

7 A hot air balloon floats because:
   A. Heat always goes up.
   B. The unequal pressure on the bottom of the balloon forces it up.
   C. The air on the outside of the balloon is more dense than the air on the inside.
   D. The helium used is lighter than air.
Gliders are powered by:
A. Wankel or two-stoke engines.
B. Diesel engines.
C. Solar powered motors.
D. Wind currents and gravity.

The higher the aspect ratio the:
A. Higher the plane's drag.
B. Greater the wing's efficiency.
C. Greater the tonnage the ship can carry.
D. Faster the rockets re-entry speed.

The most efficient wing is the:
A. Elliptical wing.
B. Straight wing.
C. Sweptback wing.
D. Tapered wing.

One method for reducing wing vortices is to:
A. Lower the aspect ratio.
B. Decrease fuel consumption.
C. Use a larger tail section.
D. Use winglets.

The upper chamber must have more curvature, and therefore more surface area
than the lower chamber in order to:
A. Provide lift on the top of the wing.
B. Provide thrust during initial take-off.
C. Provide better ballast and less drag.
D. Decrease the fuel pressure as the fuel leaves the lower chamber of the
engine.

The wing having excellent stall characteristics and economical to build is
the:
A. Elliptical wing.
B. Straight wing.
C. Sweptback wing.
D. Tapered wing.

Model rockets are powered by:
A. Inert gas jets.
B. Solid-fuel engines.
C. Liquid-fuel engines.
D. Pneumatic engines.

Flaps are designed to:
A. Increase the buoyancy of boats.
B. Increase the lift of a wing.
C. Apply drag to a rocket.
D. Apply directional thrust on a rocket.
Kites and planes can fall from the sky when the angle of attack becomes so steep that they:
A. Dive.
B. Break apart.
C. Stall.
D. Decline.

If your model rocket engine produces 8.896 newtons of force, how many pounds of thrust are produced?
A. 1
B. 2
C. 20
D. 100

The design and making of a space vehicle's propulsion system apply which of the following laws?
A. Newton's First, Second, and Third Laws of Motion
B. Ohm's Laws of Thrust and Pressure
C. Nelson's Laws of Stability
D. Bernoulli's Theorems of Motion and Propulsion

The plane which is most efficient from structural, weight, and drag standpoints would have:
A. Straight wings.
B. Tapered wings.
C. Elliptical wings.
D. Sweptback or delta wings.

The Voyager had a wing span of more than 110 feet and a chord of about 3 feet. This plane had an excellent:
A. Camber.
B. Chord line
C. Aspect ratio.
D. Differential.

The upper chamber and lower chamber refers to:
A. Parts of a ship hull.
B. Parts of a Wankel engine.
C. Parts of a rocket engine.
D. Parts of a wing.
DIRECTIONS FOR PERFORMANCE ITEMS See your teacher or test administrator for instructions on completing the following performance item(s).

22 The purpose of this activity is to design and build the highest quality simple air or space transportation model you are capable of developing by applying the skills, knowledge, and insights learned through your research, experimentation, and evaluation.

Individually or as a member of a team, design, build, and evaluate a simple air or space transportation model. Using information previously learned from your research and experimentation, including any necessary addition research, design a simple air or space transportation model, then build the model (graphical, physical, or computer generated) to the appropriate scale and specifications as dictated by your design criteria. Finally evaluate and test your model to see that it functions appropriately. Use the specific guidelines provided by your teacher throughout the process. Demonstrate your model to the class.

You will be assessed using the following criteria:

I. Design (Well researched and thought out. Includes necessary drawings, specifications, and design criteria).
   Points: 0-25

II. Model Artisanship (Quality and appropriateness of construction)
    Efficacy (Works well and as planned, efficient)
   Points: 0-25

III. Evaluation (Thorough and well thought out, discusses relevant aspects of model's design, construction, and performance)
   Points: 0-15

IV. Demonstration (Model performs as expected, presenter gives clear description and explanation of models development and functions)
   Points: 0-10

Total Possible Score 0-100 points
Directions for Item 22

Help the students develop the highest quality simple air or space transportation vehicle model they can design and execute. Work to ensure that they use their skills, knowledge, and insights gained from their previous experimentation and research in the design of their model. The model does not have to be physical such as a glider or simple model rocket. It may be graphical, electronic, or computer generated. Ask yourself the purpose of the activity. Does it demand the use of the students' analytical and creative skills as well as allow them to apply the technical and scientific information they have already learned about transportation systems and subsystems? Finally, if the student(s) are going on to Advanced Transportation Systems, will this activity lead in this direction? Is what they will learn here fundamental and essential to what they will need to know to be successful in a more complicated and demanding study?
Scoring Directions for Test Item 22 Unit 1 Key 22

The purpose of this activity is to have the students continue their research into appropriate air or space transportation systems and design, build, and evaluate a simple air or space transportation vehicular model. This model may be graphical, computer generated or physical. The students should demonstrate their model to the rest of the class. Evaluation should focus on the application of scientific and technical skills as well as the artisanship of the students and the efficacy of their models. As noted below the students will also be assessed on the quality of their demonstration.

Assess the students using the following criteria or modify appropriately:

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<tbody>
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<tr>
<td>I. Design (Well researched and thought out. Includes the necessary drawings with correct specifications and design criteria)</td>
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<tr>
<td>II. Model</td>
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<tr>
<td>Artisanship (Quality and appropriateness of construction)</td>
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<tr>
<td>Efficacy (Works well and as planned)</td>
</tr>
<tr>
<td>III. Evaluation (Thorough and well though out, discusses relevant aspects of model's design, construction, and performance)</td>
</tr>
<tr>
<td>IV. Demonstration (Model performs as expected, presenter gives clear description and explanation of model's functions)</td>
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**Scan Form:** GPFORMS  
**Test Label:**

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<td>TRANS SYS COMPETENCY EIGHT</td>
<td>22</td>
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**Answer Key for TRANS SYS COMPETENCY EIGHT**

1) A  
2) C  
3) B  
4) A  
5) B  
6) D  
7) C  
8) D  
9) B  
10) A  
11) D  
12) A  
13) B  
14) B  
15) B  
16) C

**Item Codes for TRANS SYS COMPETENCY EIGHT**

1) 008.01.17  
2) 008.01.12  
3) 008.01.20  
4) 008.01.18  
5) 008.01.05  
6) 008.01.13  
7) 008.01.11  
8) 008.01.14  
9) 008.01.06  
10) 008.01.08  
11) 008.01.09  
12) 008.01.03  
13) 008.01.07  
14) 008.01.15  
15) 008.01.10  
16) 008.01.16  
17) 008.01.04  
18) 008.01.01  
19) 008.01.19  
20) 008.01.21  
21) 008.01.02  
22) 008.02.01

**Objective Labels for TRANS SYS COMPETENCY EIGHT**

1) 8.01A EXP AIR/SPACE TRAN DESIG  
2) BUILD AIR OR SPACE MODEL

**Objective Codes for TRANS SYS COMPETENCY EIGHT**

1) 008.01A  for 8.01A EXP AIR/SPACE TRAN DESIG  
2) 008.02  for BUILD AIR OR SPACE MODEL

**Number of Items Measuring each TRANS SYS COMPETENCY EIGHT Objective**

1) 21 in 8.01A EXP AIR/SPACE TRAN DESIG  
2) 1 in BUILD AIR OR SPACE MODEL

**Items Measuring TRANS SYS COMPETENCY EIGHT 8.01A EXP AIR/SPACE TRAN DESIG**

1) 1  
2) 2  
3) 3  
4) 4  
5) 5  
6) 6  
7) 7  
8) 8

9) 9  
10) 10  
11) 11  
12) 12  
13) 13  
14) 14  
15) 15  
16) 16

17) 17  
18) 18  
19) 19  
20) 20  
21) 21  
22) 22
Test Name: TRNSYCOB
Scan Form: GPFORMS
Test Label:

Items Measuring TRANS SYS COMPETENCY EIGHT BUILD AIR OR SPACE MODEL
1) 22

Mastery Level for TRANS SYS COMPETENCY EIGHT Objectives
1) 16 out of 21 for 8.01A EXP AIR/SPACE TRAN DESIG
2) 1 out of 1 for BUILD AIR OR SPACE MODEL

Partial Level for TRANS SYS COMPETENCY EIGHT Objectives
1) 13 out of 21 for 8.01A EXP AIR/SPACE TRAN DESIG
2) 1 out of 1 for BUILD AIR OR SPACE MODEL
DIRECTIONS FOR MULTIPLE-CHOICE ITEMS: Read each of the following multiple-choice items and the possible answers carefully. Mark the letter of the correct answer on your answer sheet or as instructed by your teacher. REMEMBER: MAKE NO MARKS ON THIS TEST.

1 Aircraft preparing for take-off or just after landing are directed by:
   A. Guidance personnel.
   B. Traffic directors.
   C. Air traffic controllers.
   D. Ground controllers.

2 Aircraft mechanics and engine specialist need the following skills:
   A. Analytical, artistic, communication, mathematical.
   B. Scientific, artistic, communication, mathematical.
   C. Analytical, artistic, mathematical, scientific.
   D. Analytical, communication, mathematical, scientific.

3 Diesel mechanics need the following skills:
   A. Analytical, mathematical, artistic, and great strength.
   B. Analytical, mathematical, artistic, and scientific.
   C. Analytical, mathematical, scientific, and communication.
   D. Analytical, mathematical, scientific, and great strength.

4 The control of aircraft through the airways is done by:
   A. The U.S. Airforce.
   B. Air traffic controllers.
   C. TWS operators.
   D. ERIN in the United States.

5 Your aptitude towards a particular occupational field refers to:
   A. How quickly you are able to learn a skill and grasp its concepts.
   B. Those things that you are successful at doing.
   C. The amount of formal and informal education you have obtained.
   D. Whether or not you like or dislike a particular occupational area.

6 Aerospace engineers help produce commercial and military aircraft and have additional responsibilities of:
   A. Designing.
   B. Developing.
   C. Testing.
   D. All the above.

7 Skilled automotive mechanics can expect changes in the economy to:
   A. Have little affect on employment opportunities.
   B. Have a large affect on employment opportunities.
   C. Decrease their salaries greatly.
   D. Decrease automobile repair cost.
8 During a recession air traffic controllers are:
   A. Always laid off.
   B. Never laid off.
   C. Seldom laid off.
   D. The most affected occupation.

9 An excellent place to learn more about transportation careers is the:
   A. Newspaper.
   D. Robert's Inventories.

10 Aircraft mechanics with experience can expect:
   A. Limited job opportunities due to the decrease in airlines.
   B. Fair job opportunities in the future.
   C. Good job opportunities in the future.
   D. Excellent job opportunities in the future.
DIRECTIONS FOR PERFORMANCE ITEMS See your teacher or test administrator for instructions on completing the following performance item(s).

The purpose of this activity is to assess your interest and abilities in relation to existing or emerging occupations within any area of the transportation industries.

As part of your Career Development Plan, review your interests, attributes, academic success, and your course of study in relation to the things you have done in this class. Research relevant career opportunities.

You may wish to reference the TSA Career and Personal Planning Activity found in the TSA Curricular Resource Guide.

Finally, prepare a brief written report on your findings and report these to the rest of your class. You will be evaluated using the following criteria:

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<thead>
<tr>
<th>Points</th>
<th>Written Report</th>
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<tbody>
<tr>
<td>0-25</td>
<td>Occupational Information (Includes occupation(s) of interest, responsibilities, characteristics, salary range, number of openings, and required skills).</td>
</tr>
<tr>
<td>0-25</td>
<td>Educational Requirement (Accurate and clear description of needed education and training).</td>
</tr>
<tr>
<td>0-25</td>
<td>Student's Interest (Explains persuasively how his/her talents and interest match the occupation under study).</td>
</tr>
</tbody>
</table>

| 0-25   | Presentation (Clearly, persuasively, and interestingly presents the above information). |

| Total Possible Points | 0-100 |

STOP HERE
Directions for Item 11

Have each student assess their interest and abilities in relation to an occupation within the transportation system industry. Have each student research an occupation of interest, assessing themselves in relation to their interest, attributes, past academic performance, and their present career development plan.
Scoring Directions for Test Item 11 Unit 1 Key 11

Assess each student on how well he or she evaluates themselves (their aptitude, academic performance, interests, and course of study) in relationship to the transportation system careers he or she investigates. Is their assessment serious and honest? Does he or she have a good understanding of what is required in relation to their past performance and interests?

Assess each student using the following criteria or modify appropriately:

Points

I. Written Report

Occupational Information
(Includes occupation(s) of interest, responsibilities, characteristics, salary range, number of openings, and required skills) 0-25

Educational Requirements
(Accurate and clear description of needed education and training) 0-25

Student's Interest
(Explains persuasively how his/her talents and interest match the occupation under study) 0-25

II. Presentation
(Clearly, persuasively, and interestingly, presents the above information) 0-25

Total Possible Points 0-100
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Scan Form: GPFORMS
Test Label:

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Answer Key for TRANS SYS COMPETENCY NINE


Item Codes for TRANS SYS COMPETENCY NINE

1)009.01.01  2)009.01.07  3)009.01.03  4)009.01.06
5)009.01.05  6)009.01.02  7)009.01.10  8)009.01.08
9)009.01.04  10)009.01.09 11)009.02.01

Objective Labels for TRANS SYS COMPETENCY NINE

1)9.01A IDENT TRANS OCCUP OPPORT  2)ASSESS CAREER GOALS

Objective Codes for TRANS SYS COMPETENCY NINE

1)009.01A  for 9.01A IDENT TRANS OCCUP OPPORT
2)009.02  for ASSESS CAREER GOALS

Number of Items Measuring each TRANS SYS COMPETENCY NINE Objective

1) 10 in 9.01A IDENT TRANS OCCUP OPPORT  2) 1 in ASSESS CAREER GOALS

Items Measuring TRANS SYS COMPETENCY NINE 9.01A IDENT TRANS OCCUP OPPORT

1) 1  2) 2  3) 3  4) 4  5) 5  6) 6  7) 7  8) 8
9) 9  10) 10

Items Measuring TRANS SYS COMPETENCY NINE ASSESS CAREER GOALS

1) 11

160
Test Name: TRNSYCO9
Scan Form: GPFORMS
Test Label:

Mastery Level for TRANS SYS COMPETENCY NINE Objectives

1) 8 out of 10 for 9.01A IDENT TRANS OCCUP OPPORT
2) 1 out of 1 for ASSESS CAREER GOALS

Partial Level for TRANS SYS COMPETENCY NINE Objectives

1) 6 out of 10 for 9.01A IDENT TRANS OCCUP OPPORT
2) 1 out of 1 for ASSESS CAREER GOALS
PITCH: The measure (in inches) of distance a propeller moves forward during each revolution

One newton = .224 pounds of force

One pound of force = 4.448 newtons

1 Hp = the energy needed to lift 33,000 lbs. 1 foot in 1 minute

1 knot = 1.151 land miles

\[
\text{Horsepower} = \frac{\text{Torque} \times \text{rpm}}{5252}
\]

1 mile = 5280 feet

\[
\text{Efficiency} = \frac{\text{Energy out}}{\text{Energy in}} \times 100\%
\]