Power and Transportation

8444 18 weeks

8445 36 weeks

Table of Contents

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Course Description

Suggested Grade Level: 9 or 10 or 11

This course explores the ways that energy is converted to power and the ways power is transmitted, controlled, and used through mechanical, fluid, and electrical devices. Students will

explore transportation systems, research career opportunities in the power and transportation fields, conduct experiments, and design and build products.

As noted in Superintendent's Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

Task Essentials Table

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

Task Number	8445	8444	Tasks/Competencies
Introducing Energy, Power, and Transportation			
39	⊕	⊕	Differentiate between energy, power, and transportation.
40	⊕	⊕	Use instruments to collect quantitative data related to power systems.
41	⊕	⊕	Demonstrate safe work practices while participating in lab activities.
Exploring Energy and Power			
42	⊕	⊕	Compare and contrast energy sources.
43	⊕	⊕	Differentiate among the methods of generating power.
44	⊕	⊕	Identify types of energy conversion systems.
45	⊕	○	Identify the input, process, output, and feedback for each conversion method.
46	⊕	⊕	Describe the design process.
47	⊕	○	Design a power transmission system, using the systems approach.
Exploring Mechanical Power			

48	⊕	⊕	Identify components of mechanical systems.
49	⊕	⊕	Calculate mechanical power.
50	⊕	⊕	Demonstrate principles of mechanical systems as they relate to power transmission.
51	⊕	⊕	Explain basic mechanical systems, to include simple machines.
52	⊕	○	Troubleshoot mechanical systems.
Exploring Fluid Power			
53	⊕	⊕	Identify components of fluid power systems.
54	⊕	⊕	Calculate fluid power.
55	⊕	○	Utilize hydraulic and pneumatic fluid systems to transmit power.
56	⊕	○	Explain basic fluid systems, to include flow and pressures.
57	⊕	○	Troubleshoot fluid systems.
Exploring Electrical Power			
58	⊕	⊕	Identify components of electrical systems.
59	⊕	⊕	Calculate electrical power.
60	⊕	○	Utilize electricity to transmit power.
61	⊕	○	Troubleshoot electrical systems.
Exploring Power Transmission and Control			
62	⊕	⊕	Identify components of power-transmission systems.
63	⊕	○	Measure the performance of power-transmission systems.
64	⊕	⊕	Describe engine construction and principles of operation.
Exploring Transportation Systems			
65	⊕	⊕	Identify types of transportation systems.
66	⊕	○	Differentiate between modes of transportation, including their effects on society.

67	⊕	⊕	Describe components of transportation systems.
68	⊕	○	Explain current and basic regulations related to transportation.
69	⊕	⊕	Evaluate the environmental impacts associated with different modes of transportation.
Modeling Transportation Systems			
70	⊕	○	Research the history of different energies and their use in powering transportation systems.
71	⊕	⊕	Explain how the components of transportation systems interact.
72	⊕	⊕	Evaluate transportation system devices.
73	⊕	⊕	Evaluate transportation control systems.
74	⊕	⊕	Evaluate overall system design.
75	⊕	⊕	Design a transportation subsystem.
76	⊕	○	Construct a subsystem, or model of a subsystem, based on your design.
77	⊕	○	Evaluate subsystem/model.
Exploring Careers in Power and Transportation			
78	⊕	○	Research careers related to power and transportation and their educational requirements.
79	⊕	○	Prepare a résumé for a chosen career.
80	⊕	○	Present research on a chosen career.

Legend: ⊕Essential ○Non-essential ⊖Omitted

Curriculum Framework

Introducing Energy, Power, and Transportation

Task Number 39

Differentiate between energy, power, and transportation.

Definition

Differentiation should include

- definition of energy as the capacity to do work
- definition of power as the rate at which work is performed or energy is expended (motive force)
- definition of transportation as the movement of people or goods from one place to another (using motive force).

Process/Skill Questions

- What is energy?
- What is work?
- What is force?
- How does rate of work affect power?
- How do we move people and products?
- Why do we need to move people or products?

ITEEA National Standards

1. The Characteristics and Scope of Technology

18. Transportation Technologies

2. The Core Concepts of Technology

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

TSA Competitive Events

Animatronics

Flight Endurance

Transportation Modeling

Task Number 40

Use instruments to collect quantitative data related to power systems.

Definition

Use of instruments could include

- selection of instruments
- diagnostic software
- diagnostic tools
- measuring tools
- computer simulations.

Process/Skill Questions

- What are the advantages of running simulations?
- How can a computer be used to troubleshoot a power system?
- What types of problems can be diagnosed in power and transportation systems?
- What diagnostic tools can aid in troubleshooting?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

16. Energy and Power Technologies

18. Transportation Technologies

TSA Competitive Events

Animatronics

Dragster Design

Flight Endurance

System Control Technology

Transportation Modeling

Task Number 41

Demonstrate safe work practices while participating in lab activities.

Definition

Demonstration should include adherence to government and industry standards, lab safety procedures, and classroom rules.

Process/Skill Questions

- Why should lab safety be important to everyone?
- How does your attitude about safety affect others in the lab?
- What organizations determine the safety standards?
- What safety concerns should be considered when dealing with mechanical systems? Fluid systems? Electrical systems?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

TSA Competitive Events

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Engineering Design

Flight Endurance

System Control Technology

Transportation Modeling

Exploring Energy and Power

Task Number 42

Compare and contrast energy sources.

Definition

Comparison should include similarities and differences between renewable, nonrenewable, and inexhaustible energy sources.

Process/Skill Questions

- What are the sources of energy?
- What are the advantages and disadvantages of different sources of energy?
- What are the impacts of different energy sources (social, economic, cultural, political, and environmental)?

ITEEA National Standards

16. Energy and Power Technologies

4. The Cultural, Social, Economic, and Political Effects of Technology

5. The Effects of Technology on the Environment

TSA Competitive Events

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System Control Technology

Task Number 43

Differentiate among the methods of generating power.

Definition

Differentiation may include comparison/contrast of different methods of power generation (e.g., fossil fuels, human/animal power, nuclear, geothermal, wind, solar, chemical).

Process/Skill Questions

- What are the different methods of generating power?
- How have power-generation methods changed over time?
- How are some power-generation methods more efficient than others?
- How is efficiency measured for each power-generation method?

ITEEA National Standards

16. Energy and Power Technologies

18. Transportation Technologies

2. The Core Concepts of Technology

5. The Effects of Technology on the Environment

7. The Influence of Technology on History

TSA Competitive Events

Animatronics

Flight Endurance

Transportation Modeling

Task Number 44

Identify types of energy conversion systems.

Definition

Identification should include, but not be limited to

- electrical conversion systems
- fluid conversion systems
- mechanical conversion systems.

Process/Skill Questions

- How is energy converted?
- What are the other types of energy conversion (e.g., thermal, radiant, chemical)?

ITEEA National Standards

16. Energy and Power Technologies

18. Transportation Technologies

TSA Competitive Events

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Flight Endurance

Transportation Modeling

Task Number 45

Identify the input, process, output, and feedback for each conversion method.

Definition

Identification should include the following conversion methods:

- Mechanical to electrical
- Electrical to mechanical
- Chemical to electrical
- Electrical to chemical
- Chemical to thermal
- Thermal to mechanical
- Electrical to radiant
- Radiant to electrical

Process/Skill Questions

- What are advantages and disadvantages of different conversion methods?
- What is an example of an electrical-to-mechanical conversion? Fluid-to-mechanical? Electrical-to-fluid?
- What method does a battery utilize? A wind turbine? A light bulb?

ITEEA National Standards

16. Energy and Power Technologies

18. Transportation Technologies

2. The Core Concepts of Technology

Task Number 46

Describe the design process.

Definition

Description should include that the design process is a systematic, creative process for turning ideas into real objects, products, systems, and environments.

Process/Skill Questions

- What are the advantages of using the design process?
- How can the design process be documented?

Task Number 47

Design a power transmission system, using the systems approach.

Definition

Design should use the design process and include the essential components of a power transmission system.

Process/Skill Questions

- What are the steps of the design process?
- What are the essential components of a power transmission system?
- What are the advantages to working with a design team instead of working individually?
- What are the qualities of a productive team member?

TSA Competitive Events

Engineering Design

System Control Technology

Exploring Mechanical Power

Task Number 48

Identify components of mechanical systems.

Definition

Identification should include

- power sources
- inputs
- processes

- outputs
- feedback
- mechanisms
- controllers.

Process/Skill Questions

- What scientific principles govern mechanical systems?
- What is the difference between a complex machine and a simple machine?
- What are sensors?
- How do mechanical systems use feedback to maintain performance?
- What are devices that modify mechanical power called?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

Task Number 49

Calculate mechanical power.

Definition

Calculation should include

- force
- ratios
- units of measurement
- mechanical advantage.

Process/Skill Questions

- What is mechanical advantage?
- What is horsepower?
- What is torque?
- What are the conversion equations?

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 50

Demonstrate principles of mechanical systems as they relate to power transmission.

Definition

Demonstration should include construction of mechanical systems.

Process/Skill Questions

- What tools and equipment do you need to construct the mechanical system?
- What is the purpose of the system?
- What materials are appropriate for your chosen system?
- How do you evaluate the success of power transmission?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

18. Transportation Technologies

TSA Competitive Events

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Transportation Modeling

Task Number 51

Explain basic mechanical systems, to include simple machines.

Definition

Explanation should include how the simple machine achieves mechanical advantage.

Process/Skill Questions

- How did you achieve a mechanical advantage?
- What would you do to improve the device/system?
- What process did you use to achieve your outcome?

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 52

Troubleshoot mechanical systems.

Definition

Troubleshooting should include

- diagnosis
- repair
- documentation of findings.

Process/Skill Questions

- How is the malfunctioning system identified?
- Are specific tools needed to repair the system?
- What is necessary to achieve safe, functional operation?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

Exploring Fluid Power

Task Number 53

Identify components of fluid power systems.

Definition

Identification should include

- power sources
- inputs
- processes
- outputs
- feedback
- mechanisms
- controllers.

Process/Skill Questions

- How does a fluid system transmit power?
- What are the advantages of using fluid power over mechanical power?
- What is the difference between pneumatic and hydraulic power?
- How would you determine which fluid power to use?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

Task Number 54

Calculate fluid power.

Definition

Calculation should include

- force
- ratios
- viscosity
- compressibility
- units of measurement
- mechanical advantage.

Process/Skill Questions

- How do you measure fluid power?
- What is Pascal's law?
- How do you match the size of the system to the task?

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 55

Utilize hydraulic and pneumatic fluid systems to transmit power.

Definition

Utilization should include the construction of a fluid system.

Process/Skill Questions

- What components do you need to build a fluid system?
- What tools and equipment do you need to construct a fluid power system?
- What is the purpose of your system?
- What materials are appropriate for your chosen system?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

18. Transportation Technologies

9. Engineering Design

TSA Competitive Events

Animatronics

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Engineering Design

Flight Endurance

Transportation Modeling

Task Number 56

Explain basic fluid systems, to include flow and pressures.

Definition

Explanation should include how fluid is moved, compressed, and regulated.

Process/Skill Questions

- What controllers can be used to regulate flow?
- Why would you want to increase or decrease the flow? Pressure?
- What causes a pressure drop in a fluid power system?

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 57

Troubleshoot fluid systems.

Definition

Troubleshooting should include

- diagnosis
- repair
- documentation of findings.

Process/Skill Questions

- How is the malfunctioning system identified?
- Are there specific tools needed to repair the system?
- What is necessary to achieve safe, functional operation?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

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Exploring Electrical Power

Task Number 58

Identify components of electrical systems.

Definition

Identification should include

- power sources
- inputs
- processes
- outputs
- feedback
- control devices

- conductors.

Process/Skill Questions

- How does an electrical system transmit power?
- What materials make the best conductors? Insulators?
- What are the advantages of using an electrical system over a mechanical or fluid system?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

Task Number 59

Calculate electrical power.

Definition

Calculation should include

- units of measurement
- mechanical advantage.

Process/Skill Questions

- What types of electronic test equipment would you use to measure electrical power (e.g., multimeter)?
- What safety equipment might you use when measuring electrical power?
- What are the conversion equations?
- What is Ohm's law?
- What is Watt's law?

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 60

Utilize electricity to transmit power.

Definition

Utilization should include construction of a

- series circuit
- parallel circuit
- compound circuit.

Process/Skill Questions

- What are similarities/differences between series and parallel circuits?
- What are the advantages and disadvantages of using a series circuit? Parallel circuit?
- What are the four primary components of a circuit?

TSA Competitive Events

Animatronics

Engineering Design

System Control Technology

Transportation Modeling

Task Number 61

Troubleshoot electrical systems.

Definition

Troubleshooting should include

- diagnosis
- repair
- documentation of findings.

Process/Skill Questions

- How is the malfunctioning system identified?
- Are there specific tools needed to repair the system?
- What is necessary to achieve safe, functional operation?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

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Exploring Power Transmission and Control

Task Number 62

Identify components of power-transmission systems.

Definition

Identification may include

- energy source
- conversion method
- transmission path
- storage medium
- protection devices
- mechanical advantage
- control devices
- measuring devices.

Process/Skill Questions

- What are some examples of power-transmission protection devices?
- What power-transmission systems require a storage medium? Why?
- Which conversion method is appropriate for a given application?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

Task Number 63

Measure the performance of power-transmission systems.

Definition

Measurement may include

- torque
- horsepower
- time
- watts
- volts
- amps
- ohms
- capacity
- pressure
- vacuum
- compression.

Process/Skill Questions

- What is the appropriate measuring device for each?
- How do you record measurements?
- What are the appropriate units of measurement for each?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

16. Energy and Power Technologies

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 64

Describe engine construction and principles of operation.

Definition

Description should include

- fuel delivery system
- mechanical system
- electrical system.

Process/Skill Questions

- What are different classifications of engines (e.g., combustion, ignition, strokes, cylinder design, shaft orientation, cooling system)?
- What are the advantages/disadvantages of each type of engine?
- What are the five events that take place during engine operation?

Exploring Transportation Systems

Task Number 65

Identify types of transportation systems.

Definition

Identification should include

- land
- water
- air
- space
- intermodal.

Process/Skill Questions

- What are examples of each type of transportation system?
- How do you determine which transportation system to use?
- What are advantages and disadvantages of each transportation system?
- Why is transportation important to developing new technologies?

ITEEA National Standards

18. Transportation Technologies

Task Number 66

Differentiate between modes of transportation, including their effects on society.

Definition

Differentiation should include land, air, marine, and space transportation and their societal impacts, including social, cultural, economic, political, and environmental aspects.

Process/Skill Questions

- What are the modes of transportation?
- How are transportation impacts monitored and controlled?
- What agencies govern each mode of transportation?
- Which modes of transportation use fixed routes?
- What impacts (positive and negative) does transportation have on society?
- How do different technologies affect transportation?
- What are trade-offs of using one transportation system over another?

ITEEA National Standards

18. Transportation Technologies

4. The Cultural, Social, Economic, and Political Effects of Technology

5. The Effects of Technology on the Environment

6. The Role of Society in the Development and Use of Technology

TSA Competitive Events

Engineering Design

Flight Endurance

Transportation Modeling

Task Number 67

Describe components of transportation systems.

Definition

Description should include

- input
- process
- output
- feedback.

Process/Skill Questions

- What are inputs for various transportation systems? Processes? Outputs?
- Why is feedback important?
- How does maglev differ from light rail?
- What are some emerging technologies in transportation systems?

ITEEA National Standards

2. The Core Concepts of Technology

Task Number 68

Explain current and basic regulations related to transportation.

Definition

Explanation should include, but not be limited to

- speed limits
- rules of the road/sky/water
- age restrictions
- hazardous material regulations
- license requirements.

Process/Skill Questions

- Who decides maximum gross weights on the roadways?
- How many hours is a pilot allowed to fly at one time? A truck driver to drive?
- What license(s) are you eligible for at your current age?

ITEEA National Standards

18. Transportation Technologies

Task Number 69

Evaluate the environmental impacts associated with different modes of transportation.

Definition

Evaluation should include effects on

- air pollution
- water pollution
- noise pollution
- land acquisition
- traffic congestion.

Process/Skill Questions

- What are the local regulations regarding emissions?
- What organization(s) should you contact if you have questions about regulations?
- How might a new highway affect your area?
- What could pose a potential threat to your local water supply?

ITEEA National Standards

5. The Effects of Technology on the Environment

Modeling Transportation Systems

Task Number 70

Research the history of different energies and their use in powering transportation systems.

Definition

Research should include, but not be limited to, the history of the use of the following in transportation systems:

- oil
- coal
- wood
- natural gas
- wind power
- electricity/solar power.

Process/Skill Questions

- What types of energy have been used to power automobiles? Trains? Ships? Airplanes? Spacecraft? Intermodal transportation?
- What are the reasons for transitioning from one fuel type to another?

ITEEA National Standards

18. Transportation Technologies

4. The Cultural, Social, Economic, and Political Effects of Technology

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Task Number 71

Explain how the components of transportation systems interact.

Definition

Explanation should include

- structural subsystems
- control subsystems
- propulsion subsystems.

Process/Skill Questions

- What transportation systems do not rely on a moving vehicle (e.g., conveyor belt, pipeline, escalator)?
- What is the purpose of a structural subsystem?

- How do the subsystems affect one another?
- What are some examples of propulsion subsystems?
- What advancements have been made in each of the subsystems?

ITEEA National Standards

18. Transportation Technologies

Task Number 72

Evaluate transportation system devices.

Definition

Evaluation should include major components of each system.

Process/Skill Questions

- What are potential sources of information in regard to transportation devices?
- Where do you look for information on a particular product?
- How can material selection affect performance?

ITEEA National Standards

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

18. Transportation Technologies

Task Number 73

Evaluate transportation control systems.

Definition

Evaluation should be based on system performance, economy, efficiency, and reliability.

Process/Skill Questions

- What components of the system provide control?
- How do you evaluate the performance of a control system?
- What outside factors would affect control performance?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

12. Use and Maintain Technological Products and Systems

13. Assess the Impact of Products and Systems

18. Transportation Technologies

TSA Competitive Events

Dragster Design

Flight Endurance

System Control Technology

Transportation Modeling

Task Number 74

Evaluate overall system design.

Definition

Evaluation should include ergonomics, safety, efficiency, and capacity.

Process/Skill Questions

- What is ergonomics?
- What are the safety issues related to system design?
- How does the intended purpose of the system affect its design?
- How is the efficiency of a system determined?
- What factors influence system efficiency?

ITEEA National Standards

10. The Role of Troubleshooting, Research and Development, Invention and Innovation, and Experimentation in Problem Solving

13. Assess the Impact of Products and Systems

18. Transportation Technologies

2. The Core Concepts of Technology

9. Engineering Design

Task Number 75

Design a transportation subsystem.

Definition

Design should

- include scale drawing
- use appropriate material selection
- accomplish its purpose (e.g., carrying cargo or people)
- include a process flowchart
- meet specifications.

Process/Skill Questions

- What is scale?
- What determines appropriate material selection (e.g., economy, safety)?
- Why must a design meet specifications?
- Why should a design be replicable?

TSA Competitive Events

Dragster Design

Engineering Design

Flight Endurance

System Control Technology

Transportation Modeling

Task Number 76

Construct a subsystem, or model of a subsystem, based on your design.

Definition

Construction should include

- proper selection of tools and materials
- safe use of tools and equipment
- accurate proportions
- adherence to specifications.

Process/Skill Questions

- What tools should be used? Why?
- What materials should be used? Why?
- How do you determine accurate proportions?

TSA Competitive Events

Dragster Design

Engineering Design

Flight Endurance

System Control Technology

Transportation Modeling

Task Number 77

Evaluate subsystem/model.

Definition

Evaluation should include

- performance
- adherence to specifications/plans
- efficient use of materials
- achievement of purpose.

Process/Skill Questions

- What elements of your design would you change? Why?
- What elements of your process would you change? Why?
- What other materials might be used?
- What challenges did you encounter during the design/construction process? How did you solve them?

ITEEA National Standards

18. Transportation Technologies

9. Engineering Design

Exploring Careers in Power and Transportation

Task Number 78

Research careers related to power and transportation and their educational requirements.

Definition

Research should include the career description as well as the methods to meet the educational requirements.

Process/Skill Questions

- What is the difference between a job and a career?
- What are the educational requirements?
- How can the educational requirements of the career(s) be met?
- What skills are required for your particular career interest?
- What are the opportunities for career growth?
- What potential obstacles might you encounter?
- What kind of working conditions (environmental, job hazards, physical demands) can you expect?
- How are the required skills transferable to other careers?
- Who is a person important in the development of your chosen field?

TSA Competitive Events

Career Preparation

Transportation Modeling

Task Number 79

Prepare a résumé for a chosen career.

Definition

Preparation of a résumé should include

- cover letter
- education
- training
- certifications
- work experience
- references.

Process/Skill Questions

- What is the purpose of a résumé?
- What is the appropriate length of a résumé?
- How do you select the proper format for your résumé?
- What criteria should you use in selecting references?
- Why should you tailor your résumé for each position to which you apply?

ITEEA National Standards

3. The Relationships Among Technologies and the Connections Between Technology and Other Fields

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Task Number 80

Present research on a chosen career.

Definition

Presentation should include, but not be limited to

- description of career
- salary range
- educational requirements
- working conditions
- future outlook
- related and crossover careers.

Process/Skill Questions

- What are the elements of an effective presentation?
- How do you prepare for different types of audiences?

TSA Competitive Events

Career Preparation

Engineering Design

Extemporaneous Presentation

Prepared Presentation

SOL Correlation by Task

39	Differentiate between energy, power, and transportation.	
40	Use instruments to collect quantitative data related to power systems.	

41	Demonstrate safe work practices while participating in lab activities.	English: 9.5, 10.5, 11.5 Science: CH.1
42	Compare and contrast energy sources.	English: 9.5, 10.5, 11.5 History and Social Science: WG.1, WG.4
43	Differentiate among the methods of generating power.	English: 9.5, 10.5, 11.5
44	Identify types of energy conversion systems.	English: 9.5, 10.5, 11.5
45	Identify the input, process, output, and feedback for each conversion method.	English: 9.5, 10.5, 11.5
46	Describe the design process.	English: 9.5, 10.5, 11.5
47	Design a power transmission system, using the systems approach.	
48	Identify components of mechanical systems.	
49	Calculate mechanical power.	Mathematics: A.4, AII.3
50	Demonstrate principles of mechanical systems as they relate to power transmission.	History and Social Science: WG.1
51	Explain basic mechanical systems, to include simple machines.	
52	Troubleshoot mechanical systems.	Mathematics: COM.18
53	Identify components of fluid power systems.	
54	Calculate fluid power.	Mathematics: A.4, AII.3
55	Utilize hydraulic and pneumatic fluid systems to transmit power.	
56	Explain basic fluid systems, to include flow and pressures.	
57	Troubleshoot fluid systems.	Mathematics: COM.18
58	Identify components of electrical systems.	
59	Calculate electrical power.	Mathematics: A.4, A.8, AII.3
60	Utilize electricity to transmit power.	
61	Troubleshoot electrical systems.	
62	Identify components of power-transmission systems.	
63	Measure the performance of power-transmission systems.	
64	Describe engine construction and principles of operation.	

65	Identify types of transportation systems.	
66	Differentiate between modes of transportation, including their effects on society.	English: 9.5, 10.5, 11.5 History and Social Science: WHII.4
67	Describe components of transportation systems.	
68	Explain current and basic regulations related to transportation.	
69	Evaluate the environmental impacts associated with different modes of transportation.	English: 9.5, 10.5, 11.5 History and Social Science: GOVT.9, GOVT.15, VUS.2, VUS.6, VUS.8, VUS.10, VUS.13, VUS.14, WG.1, WG.14, WG.15, WG.16, WG.17, WHII.4, WHII.13, WHII.14
70	Research the history of different energies and their use in powering transportation systems.	English: 9.8, 10.8, 11.8 History and Social Science: GOVT.9, GOVT.15, VUS.2, VUS.6, VUS.8, VUS.10, VUS.13, VUS.14, WHII.4, WHII.13, WHII.14
71	Explain how the components of transportation systems interact.	
72	Evaluate transportation system devices.	History and Social Science: VUS.1, WHII.1
73	Evaluate transportation control systems.	English: 9.5, 10.5, 11.5
74	Evaluate overall system design.	English: 9.5, 10.5, 11.5 History and Social Science: VUS.1, WHII.1
75	Design a transportation subsystem.	
76	Construct a subsystem, or model of a subsystem, based on your design.	
77	Evaluate subsystem/model.	
78	Research careers related to power and transportation and their educational requirements.	English: 9.5, 9.8, 10.5, 10.8, 11.5, 11.8 Science: PH.4
79	Prepare a résumé for a chosen career.	English: 9.6, 9.7, 10.6, 10.7, 11.6, 11.7
80	Present research on a chosen career.	English: 9.1, 10.1, 11.1

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked “optional.”

Appendix: Credentials, Course Sequences, and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- College and Work Readiness Assessment (CWRA+)
- National Career Readiness Certificate Assessment
- Workplace Readiness Skills for the Commonwealth Examination

Concentration sequences: *A combination of this course and those below, equivalent to two 36-week courses, is a concentration sequence. Students wishing to complete a specialization may take additional courses based on their career pathways. A program completer is a student who has met the requirements for a CTE concentration sequence and all other requirements for high school graduation or an approved alternative education program.*

- Electronics Systems I (8416/36 weeks)
- Electronics Systems I (8417/18 weeks)
- Energy and Power (8448/36 weeks)
- Energy and Power (8495/18 weeks)
- Renewable Energy (8408/36 weeks)
- Sustainability and Renewable Technologies (8414/36 weeks)

Career Cluster: Science, Technology, Engineering and Mathematics	
Pathway	**Occupations**
Engineering and Technology	**Aerospace Engineer** **Aerospace Engineering Technician** **Electrical Engineer** **Electrical Engineering Technician** **Electro-Mechanical Technician** **Marine Engineer** **Mechanical Engineer** **Mechanical Engineering Technician** **Power Systems Engineer**

Career Cluster: Transportation, Distribution and Logistics	
Pathway	**Occupations**
Facility and Mobile Equipment Maintenance	**Aircraft Mechanic and Service Technician** **Automotive Service Technician, Mechanic Service Technician**

Career Cluster: Transportation, Distribution and Logistics	
Pathway	**Occupations**
Health, Safety and Environmental Management	**Health, Safety, and Environment Manager**