



Teaching Guide

For

UPS Staffing Module

**Illinois Problem Based Learning
Math and Science Project**

2008

Table of Contents

Acknowledgements

We would like to recognize the following people for their contribution to this module:

Mark Korba, UPS, Addison, IL

Carolyn Presley, UPS, Addison, IL

Problem Solving Activity

Overview of Module

- Scenario Focus (Pathway, Job Titles, Related Subject Matter)
- Description of the Problem to be solved
- TDL Cluster Knowledge and Skills and Performance Elements Addressed
- Illinois Learning Standards Addressed
- Objectives
- Measurement Criteria
- Teacher Notes
- Time Required to Complete Problem
- Support Materials and Resources Necessary for Completion of Scenario

Lesson 1 with Handout 1, 2, 3, and 4

Lesson 2 with Handout 5, 6, and 7

Lesson 3 with Handout 8, 9, 10, 11, and 12

Lesson 4 with Handout 13 and 14

Lesson 5 with Handouts 15 and 16

Lesson 6 with Handouts 17 and 18

Lesson 7 with Handout 19 and 20

Teacher Assessment Materials

- Final Evaluation
- Solution Checker
- UPS Hub Solution (separate PowerPoint file)

Appendix

Glossary of Terms

Scenario Focus

Career Cluster: Business Management and Administration

Primary Career Pathway: Human Resources

Occupation/JobTitles Related to this Scenario: Human Resources Manager

Recommended Teaching Subject Areas: Math, Science, Engineering and Business

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Scenario Problem Statement and Performance Elements

As the Human Resources department we are in charge of calculating the amount of people needed to operate one of UPS's major hub sorts. Your total sort volume for this problem will be 220,000 pieces. How many employees should be planned on the payroll to support this operation?

Cluster Knowledge and Skills and Performance Elements

- Use writing and organizational skills to construct reports, graphs and tables.
- Use technology to design and develop multimedia materials.
- Use description of audience and purpose to prepare written documents.
- Develop and deliver formal and informal presentations relating to a broad range of business topics.

Illinois Learning Standards:

Math

- Solve problems that involve percents, including percent increase and decrease, regardless of the piece of information that is missing.(H - 6D.2)

- Solve simple problems involving rates and other derived measurements such as velocity and density.(H - 7C.1)
- Construct, read, interpret, infer, predict, draw conclusions, and evaluate data from various displays, including histograms and scatter plots.(H - 10A.1)

Science:

- Apply scientific inquiries or technological designs to explain the chemical nature of biological processes, describing photosynthesis in terms of basic requirements and products, correlating respiration, or diagramming the nitrogen, water, oxygen, and carbon cycles with reference to ecosystem-to-molecular levels.(H - 12A.1)
- Apply scientific inquiries or technological designs to examine the conservation of matter and energy, quantifying conservation of mass, diagramming conservation of energy in common examples, or relating the concepts of force, momentum, power, motion, and work to the concepts of mass, distance, and velocity and their applicable constants, laws, and equations.(H - 12C.4)

What I Want Students to Know	What I Want Students to be Able to Do
<ul style="list-style-type: none"> • Define the duties of a Human Resources Manager • Define the qualifications needed to become a Human Resources Manager • Relationship of rates and percentage increases and decreases to solving employee resource problems • Define the concepts of work, energy, force and power • Relationship of work, energy, force and power to employee output 	<ul style="list-style-type: none"> • Apply calculations of rates to employee resource problem • Apply calculations of percentage increases and decreases to employee resource problem • Use formulas to calculate work, energy, force and power • Calculate employees needed under constraints given • Use the internet to research the career of a Human Resource Manager • Make a presentation with visuals

Objectives:

- Define and recognize conveyors, pallet trucks, parcel delivery vehicles, and truck freight carriers.
- Plan, create, and design a written business report with details and a PowerPoint presentation.
- Explain, summarize, and recommend a solution to the UPS staffing problem using PowerPoint.

Measurement Criteria for an acceptable solution:

1. Determine the appropriate number of employees needed at the UPS's major sorting hub to handle 220,000 pieces.
2. Determine the amount of time needed to sort the 220,000.
3. Determine the average pieces per hour for the average UPS employee in an 8 hour day.
4. Determine the average absenteeism for peak vacation seasons.
5. Presentation presented the information with visual aids and/or handouts.
6. The presentation met the 7 requirements of effective business presentations:
 - Evidence of preparedness and practice
 - Started on time
 - Dressed appropriately
 - Showed enthusiasm and confidence
 - Maintained eye contact, showed friendliness and respect
 - Spoke slowly and distinctly without grammatical errors or slang
 - Welcomed questions and answered completely; accepted reactions without being defensive.

Teacher Notes:

Students should have a good working knowledge of math and the use of formulas. Additional content on the use and applications of rates, percentage increases and decreases, data analysis may be necessary for some students. This can be done congruently with the scenario or prior to working on the scenario.

Students will need a brief discussion on "Brainstorming" and its use, along with the work and characteristics of "Cooperative Groups". A resource to review these techniques is "Super Teaching" by Eric Jensen, ISBN #9781890460020.

Please review the materials needed prior to starting the problem solving activity so that you can make copies or obtain items needed. Notify students of the date that presentations will be made; stick to the time limits. Give the students the opportunity to make their own cause and effect connections as various consequences present it.

Time Required to Complete Problem: 12 hours

Types of Materials included in this Module:

1. Lesson plans for each topic with discussion questions and student activities.
2. Copy of student handouts with activities for duplication.
3. Copy of material describing problem for students.
4. Evaluation with measurement criteria and scoring guide.
5. Teacher materials to assist in evaluation of problem and possible solution steps.
6. Sample student product "UPS Hub Solution" in separate PowerPoint file.

Support Materials and Resources Necessary for Completion of Scenario:

- Computer Lab
- LCD Projector
- Chalk Board
- Internet
- Student Handouts

Lesson 1

TOPIC	Overview of UPS Staffing Problem	TIME ESTIMATE	1 hour
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OBJECTIVES	
<ul style="list-style-type: none"> • Students will be able to clearly define the problem statement. • Students will be able to define the PBL concept. 	

MATERIALS & RESOURCES	
<ul style="list-style-type: none"> • Handout #1, Pre-Test • Handout #2, UPS Problem Statement • Handout #3, Brainstorming Worksheet • Handout #4, Journal Entry worksheet 	

LESSON DESCRIPTION & ACTIVITIES		
Steps	No. of Minutes	ACTIVITIES
1	35	- Introduction to Project <ul style="list-style-type: none"> • Distribute copies of Handout 1, the Pretest. • Allow students 30 minutes to complete.
2	15	- Distribute Handout 2, the UPS Problem Statement. - After students have reviewed the problems, distribute Handout 3 and have students brain storm their ideas about the problem.
3	15	- Discuss the PBL concepts and procedures. - Have students brain storm the PBL Concepts.
4	5	- Distribute Handout 4, Journal Entry worksheet and have students record their responses.

Pre-Test

Easy Ride Van Company finds that about 40 percent of the time a person who makes an advance reservation for transportation does not keep the reservation. Therefore, for each of their 10-passenger vans, the Easy Ride Van Company schedules 13 persons on the basis of advance reservations.

1) Based on the information above, about how many riders out of the 13 scheduled would not keep their reservations?

- a) 1
- b) 3
- c) 5
- d) 7
- e) 9

2) Ken bought a used car for \$5,375. He had to pay an additional 15 percent of the purchase price to cover both sales tax and extra fees. Of the following, which is closest to the total amount Ken paid?

- a) \$806
- b) \$5,510
- c) \$5,760
- d) \$5,940
- e) \$6,180

3) A certain machine produces 300 nails per minute. At this rate, how long will it take the machine to produce enough nails to fill 5 boxes of nails if each box will contain 250 nails?

- a) 4 min
- b) 4 min 10 sec
- c) 4 min 30 sec
- d) 4 min 50 sec
- e) 5 min

4) What percent of 175 is 7?

- a) 4%
- b) 12.25%
- c) 25%
- d) 32%
- e) 40%

5) There were 90 employees in a company last year. This year the number of employees increased by 10 percent. How many employees are in the company this year?

- a) 9
- b) 81
- c) 91
- d) 99
- e) 100

6) Ms. Thierry and 3 friends ate dinner at a restaurant. The bill was \$67. In addition, they left a \$13 tip. Approximately what percent of the total bill did they leave as a tip?

- a) 10%
- b) 13%
- c) 15%
- d) 20%
- e) 25%

7) Last year there were 80 students enrolled in the eighth-grade class. This year the number of students enrolled in the eighth-grade class increased by 10%.

- a) 8
- b) 18
- c) 81
- d) 88
- e) 90

8) This year, 75% of the graduating class of Harriet Tubman High School had taken at least 8 math courses. Of the remaining class members, 60% had taken 6 or 7 math courses. What percent of the graduating class had taken fewer than 6 math courses?

- a) 0%
- b) 10%
- c) 15%
- d) 30%
- e) 45%

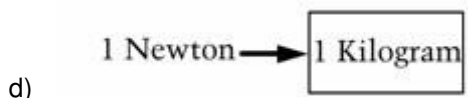
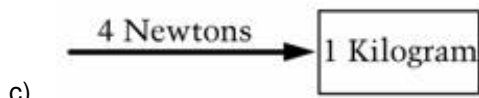
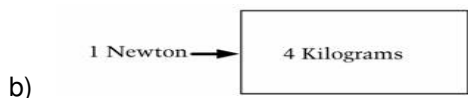
9) On a math test, 12 students earned an A. This number is exactly 25% of the total number of students in the class. How many students are in the class?

- a) 15
- b) 16
- c) 21
- d) 30
- e) 48

10) Victor's van travels at a rate of 8 miles every 10 minutes. Sharon's sedan travels at a rate of 20 miles every 25 minutes. What is difference between their two rates?

- a) 0 miles per minute
- b) 0.45 miles per minute
- c) 0.5 miles per minute
- d) 1 mile per minute
- e) 10 miles per minute

11) Each figure below shows a force measured in Newton's pushing on a block. If there are no other forces pushing on the block, in which case is the acceleration of the block greatest?



12) Household appliances convert electricity into one or more different forms of energy. An electric fan can best be described as converting electricity into:

- a) heat energy only
- b) heat energy and sound energy only
- c) heat energy, sound energy, and mechanical energy only
- d) heat energy, sound energy, mechanical energy, and chemical energy

13) Beans and coal both have stored energy. Where did the energy come from that is stored in beans and coal?

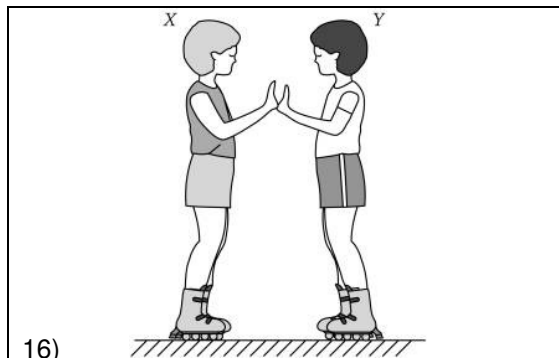
- a) From the Sun's light
- b) From the Earth's gravity
- c) From the heat in the Earth's core
- d) From the air's carbon dioxide

14) To keep a heavy box sliding across a carpeted floor at constant speed, a person must continually exert a force on the box. This force is used primarily to overcome which of the following forces?

- a) Air resistance
- b) The frictional force exerted by the floor on the box
- c) The weight of the box
- d) The gravitational force exerted by the Earth on the box

15) Which of the following is designed to convert energy into mechanical work?

- a) Electric fan
- b) Kerosene heater
- c) Flashlight
- d) Baking oven



- 16) Two girls wearing in-line skates are standing on a smooth surface with the palms of their hands touching and their arms bent, as shown above. If Girl X pushes by straightening his arms out while Girl Y holds his arms in the original position, what is the motion of the two girls?
- Girl X does not move and Girl Y moves backward
 - Girl Y does not move and Girl X moves backward
 - The motion depends on how hard Girl Y pushes
 - Girl X and Girl Y both move backward

- 17) Most of the chemical energy of the gasoline burned in a car is not used to move the car but is changed into
- Electricity
 - Heat
 - Magnet
 - Sound

- 18) Applying the brakes on a bicycle causes it to slow down because the brake...
- produce friction
 - use gravity to slow down the bicycle
 - add energy to the bicycle
 - help cool the bicycle tires

- 19) A red ball weighs more than a blue ball. This requires that...
- The red ball is larger than the blue ball
 - In direct sunlight the red ball is larger than the blue ball
 - Earth's gravitation pull is greater on the red ball than on the blue ball
 - Earth's gravitation pull is greater on the blue ball than on the red ball

- 20) Two companies make golf balls, and each claim that its ball goes farther. Which would provide the **best** scientific evidence to help determine which ball goes farther?
- The best golfer in the world hits each ball 100 times, and we measure how far each goes.
 - A machine hits each ball with exactly the same force, and we measure how far each goes.
 - We read results of test conducted on the two balls by each company.
 - We ask the best 100 golfers in the world the world which ball goes further.



UPS Staffing Logistics

150 S. Lombard
Addison, IL 60101

Interoffice Memorandum

To: Human Resources Manager

From: Mark Korba, Manager

Problem:

As the Human Resources department you are in charge of calculating the amount of people needed to operate one of UPS's major hub sorts. Your total sort volume for this problem will be 220,000 pieces. How many employees should be planned on the payroll to support this operation?

Brain Storming Work Sheet

Name: _____

Date: _____

1. List all words processed from the brainstorming exercise.

2. Write down all questions from the brainstorming exercise. (Use the back of the paper if necessary!)

Lesson 2

TOPIC	Researching UPS Careers	TIME ESTIMATE	1 hour
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OBJECTIVES

- Students will be able to research and summarize two careers with UPS.

MATERIALS & RESOURCES

- Handout #5, Human Resource Manager Work Sheet
- Handout #6, Journal Entry Sheet
- Handout #7, Peer Evaluation Sheet
- Access to Computer with internet

LESSON DESCRIPTION & ACTIVITIES

Steps	No. of Minutes	ACTIVITIES
1	10	- Assign students into groups. Use Pre-Test scores to create the cooperative groups. Re-visit the roles needed for cooperative groups and the characteristics of a cooperative group.
2	40	- Distribute Handout 5, Worksheets for Human Resource Manager to begin research on the internet. Instruct students to keep detailed notes.
3	5	- Distribute Handout 6, Journal Entry Lesson 2 and Handout 7, Peer Evaluation Sheet. Have students complete each and collect the Peer Evaluation Sheets.

Research Work Sheet - UPS Job

Name: _____

Date: _____

List the websites that your group used to find the job availability at a UPS hub. Do not be shy about your research!!

1. _____
 2. _____
 3. _____
 4. _____
 5. _____
 6. _____
-

Research Work Sheet - UPS Job

Name: _____

Date: _____

List the websites that your group used to find the job availability at a UPS hub. Do not be shy about your research!!

1. _____
 2. _____
 3. _____
 4. _____
 5. _____
 6. _____
-

Research Work Sheet - UPS Job

Name: _____

Date: _____

List the websites that your group used to find the job availability at a UPS hub. Do not be shy about your research!!

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Research Work Sheet - UPS Job

List the different types of jobs you found available at a UPS hub. Use specific titles for each different job.

1. _____
 2. _____
 3. _____
 4. _____
 5. _____
 6. _____
-

Research Work Sheet - UPS Job

List the different types of jobs you found available at a UPS hub. Use specific titles for each different job.

1. _____
 2. _____
 3. _____
 4. _____
 5. _____
 6. _____
-

Research Work Sheet - UPS Job

List the different types of jobs you found available at a UPS hub. Use specific titles for each different job.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Peer Evaluation Sheet

Date _____

Rank your participation and your group member's participation on a scale of 1(low) and 5(high). Write in your name at the number 1 spot and each of the other member's names after yours. Circle the number that best fits the effort that each of you have put forth. Remember, Honesty and Integrity!

- | | | | | | |
|----------|---|---|---|---|---|
| 1. _____ | 1 | 2 | 3 | 4 | 5 |
| 2. _____ | 1 | 2 | 3 | 4 | 5 |
| 3. _____ | 1 | 2 | 3 | 4 | 5 |
| 4. _____ | 1 | 2 | 3 | 4 | 5 |

Lesson 3

TOPIC	Percents and Rates	TIME ESTIMATE	1 hour
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OBJECTIVES

- Students will be able to define and calculate percents and rates.
- Students will be able to apply percent and rate concepts to the UPS Staffing problem.

MATERIALS & RESOURCES

Handout #8, Mathematic Concepts Sheet 1 (Define and Calculate Percents and Rates)
 Handout #9, Mathematic Concepts Sheet 2 (Apply Percents and Rates)
 Handout #10, Revised UPS Staffing Problem Sheet (with Problem Constraints)
 Handout #11, Journal Entry Sheet
 Handout #12, Peer Evaluation Sheet

RESOURCES

- www.wikipedia.org

LESSON DESCRIPTION & ACTIVITIES

Steps	No. of Minutes	ACTIVITIES
1	30	<ul style="list-style-type: none"> - Distribute Handout 8, Mathematic Concepts Sheet 1. Have students work independently on defining percent and rate. - Teacher will provide an example of a rate problem and a percent problem. Students will then work in their assigned groups calculating various percents and rates using Mathematic Concepts Sheet 1.
2	15	<ul style="list-style-type: none"> - Distribute Handout 9, Mathematic Concepts Sheet 2. - Students will work in their assigned groups applying their knowledge of rates and percents to the UPS staffing problem using Mathematic Concepts Sheet 2.
3	10	<ul style="list-style-type: none"> - Distribute Handout 10, Revised UPS Staffing Problem Sheet and facilitate a classroom discussion regarding the constraints added to the original problem.

4	5	- Handout Journal Entry, Lesson 3 and Peer Evaluation Sheet (Handouts 11 and 12). Have students complete each and collect the Peer Evaluation Sheets.
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Mathematic Concepts Sheet 1

Name _____

Go to www.wikipedia.org to define **percent**, and then rewrite the definition in your own words.

<p><u>Definition:</u></p>	<p>In my words...</p>
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1.) Explain two ways to change a percent into a decimal.

1

2

Convert the following percents into decimals

2.) $34\% = \underline{\hspace{2cm}}$

3.) $99\% = \underline{\hspace{2cm}}$

4.) $12\% = \underline{\hspace{2cm}}$

5.) $80\% = \underline{\hspace{2cm}}$

6.) $8\% = \underline{\hspace{2cm}}$

7.) $3\% = \underline{\hspace{2cm}}$

8.) $30\% = \underline{\hspace{2cm}}$

9.) $\begin{array}{r} 124\% \\ = \end{array} \underline{\hspace{2cm}}$

Sample Problem:

Donquell shovels snow in his neighborhood before school for money. On a normal morning he can shovel 20 porches before he goes to school. This morning he was only able to shovel 40% of his normal work load. How many porches was he able to shovel?

10.) What is 12% of 32?

11.) What is 60% of \$3.50

12.) What is 8% of 8?

- 13.) Keisha earns \$68 a week at her part-time job. She puts 25% into her savings account. How much does she put into her savings every week?

Go to www.wikipedia.org to define **rate**, then rewrite the definition in your own words.

<p><u>Definition:</u></p>	<p>In my words...</p>
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Sample Problem:

Jerome drove his car from Chicago, IL to Springfield, IL in 3 hours. Suppose that the cities are 200 miles apart. What is Jerome's rate during this trip?

- 14.) Dante drove his motorcycle from St. Louis, MS to Chicago, IL in 4 hours. Suppose that the cities are 296 miles apart. What is Dante's rate during this trip?

- 15.) What is the rate if you drive
550 miles in 10 hours?

- 16.) What is the rate if in 5 hours
you travel 450 miles?

- 17.) John can read 400 words in 4 minutes.
What is the rate of John's reading?
(Use words per minute)

- 18.) Using words per minute. What is your rate if you
can read 750 words in 8 minutes?

- 19.) Mercedes' car can hold 24 gallons of gasoline. She can take a 360 mile trip on one full tank. What is the rate of her car's miles per gallon?
- 20.) What is your gas mileage if you can travel 490 miles on a 16 gallon tank?

Mathematic Concepts Sheet 2

Name _____

Rates at UPS

- 1.) A sorter at UPS has 588 packages to sort. Today she only has 6 hours to complete the task. What is the rate of packages she must sort per hour?



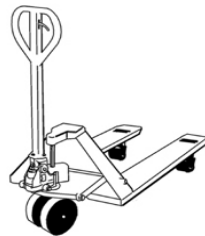
- 2.) A supervisor of the UPS dock over sees the unloading of UPS freight carriers. They are expected to unload an average of 214 freight carriers in a 5 day work week. What is the rate of trucks unloaded per day?



- 3.) The driver of a UPS parcel delivery vehicle normally picks up 168 packages in one day. Suppose he works a seven hour day. What is the rate of packages picked up per hour?



- 4.) Jerome moves pallets onto the UPS freight carriers using a pallet jack. On any given 6.5 hour day he must move 221 pallets onto different freight carriers. What is the rate of pallets moved per hour by Jerome?



- 5.) Kenya is the payroll clerk at a local UPS distribution center. UPS employees are distributed pay checks every two weeks. Each work week consists of five work days. The average employee works a 7.5 hour day. Before taxes the average paycheck for a UPS employee is \$930. What is the average hourly rate for a UPS employee?



Percents at UPS

- 6.) Drivers of UPS freight carriers are required by the company to rest 9% of their work day. If a driver worked an 8 hour day how much of that time was spent resting? (Hint: It must be in minutes)
- 7.) It is very difficult for someone to work at 100% productivity for the entire day. Suppose most workers at UPS work at 82.3% productivity over the course of a day. The driver of a UPS parcel delivery vehicle is expected to pick up 24 parcels a day. Realistically how many parcels do they actually pick up day?
- 8.) LaTonya was a package sorter at UPS. Unfortunately she was fired because she only worked at 17% of her work productivity capacity. If she was expected to sort 187 packages, how many packages did she actually sort?
- 9.) Dante moves pallets onto the UPS freight carriers using a pallet jack. Last week he broke his hand which has lowered his work productivity. He can now only work at 65% of his work productivity. Before he could move 41 pallets in an hour. Now how many pallets can Dante move in an hour?

- 10.) On the 4th of July 25% of the UPS workers took the day off. Normally at the distribution center there are 564 employees during the day. How many employees took the day off on the 4th of July?

CHALLENGE: A particular UPS distribution center employs 400 people. Over the winter holiday 12% of the workforce did not come into work. How many UPS employees **came into work** over the winter holiday?



UPS Staffing Logistics

150 S. Lombard
Addison, IL 60101

Interoffice Memorandum

To: Human Resources Manager

From: Mark Korba, Manager

Problem:

As the Human Resources department you are in charge of calculating the amount of people needed to operate one of UPS's major hub sorts. Your total sort volume for this problem will be 220,000 pieces. How many employees should be planned on the payroll to support this operation?

Constraints:

1. Each sorter can sort at most 112 pieces per hour (PPH)
2. The average hours worked per employee (average paid day or APD) is 3.61 hours

Once you have arrived at your solution, please prepare a written business report with details and a PowerPoint presentation and present it at our next management team meeting.

If you have any questions, please let me know.

Peer Evaluation Sheet
Date _____

Rank your participation and your group member's participation on a scale of 1(low) and 5(high). Write in your name at the number 1 spot and each of the other member's names after yours. Circle the number that best fits the effort that each of you have put forth. Remember, Honesty and Integrity!

- | | | | | | |
|----------|---|---|---|---|---|
| 1. _____ | 1 | 2 | 3 | 4 | 5 |
| 2. _____ | 1 | 2 | 3 | 4 | 5 |
| 3. _____ | 1 | 2 | 3 | 4 | 5 |
| 4. _____ | 1 | 2 | 3 | 4 | 5 |

Lesson 4

TOPIC	Concepts of Force, Work, Energy and Power	TIME ESTIMATE	1 hour
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OBJECTIVES	
<ul style="list-style-type: none"> • Students will be able to define the concepts of Force, Work, Energy, and Power. • Students will be able to define the concept of Calories. • Students will be able to calculate force exerted. • Students will be able to calculate work done. • Students will be able to calculate energy used. 	

MATERIALS & RESOURCES	
<ul style="list-style-type: none"> • Handout #13, Science Concepts • Handout #14, Journal Entry • Access to Computers • Calculators 	

LESSON DESCRIPTION & ACTIVITIES		
Steps	No. of Minutes	ACTIVITIES
1	10	<ul style="list-style-type: none"> - Distribute Handout 13, Science Concepts work sheet. Post the objectives on the chalk board and review these with the students. - As a class discuss the major points in the handout. - Go over the student responses to this handout.
2	35	<ul style="list-style-type: none"> - Students will use the internet to research the concepts of Force, Work, Energy, Power, and Calories. - Students will present solutions to problems #6, #7, and #8.
3	10	<ul style="list-style-type: none"> - Distribute Handout 14, Journal Entry Sheets and allow time for students to complete.

Science Concepts

Name: _____

Date: _____

1. **Define Force.** Be specific and describe the calculation of force.
2. **Define Work.** Give an example of a formula being used to calculate work done. Know the units being used.
3. **Define Energy.** Give an example of a formula being used to calculate energy used/consumed/created.
4. **Define Power.** Give an example of a formula being used to calculate power.
5. **Define Calories.** How are calories burned calculated? How might the concept of calories affect the performance of an employee?

- 6. Calculate the force exerted on a box that has a mass of 4 kg and has an acceleration of 4 m/s².**

- 7. Find the work done to lift a box with a mass of 10 kg, an acceleration of 5 m/s², and through a distance of 3 m.**

- 8. How much Kinetic Energy is used to move a box with a mass of 8 kg at a velocity of 2 m/s?**

- 9. How are the concepts of Force, Work, Energy, and Power related? Be specific in the details and the links between concepts.**

Lesson 5

TOPIC	Field Trip to UPS	TIME ESTIMATE	4 hours
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OBJECTIVES

- Students will define and recognize conveyors, pallet trucks, parcel delivery vehicles, and truck freight carriers.

MATERIALS & RESOURCES

- Handout #15, Field Trip Questions Worksheet
- Handout #16, Journal Entry

LESSON DESCRIPTION & ACTIVITIES

Steps	No. of Minutes	ACTIVITIES
1	225	- Distribute Handout 15, Field Trip Questions. - Students will take a field trip to the UPS hub sorting facility.
2	15	- Distribute Handout 16 Journal Entry and have students complete.

Field Trip Questions



Name _____

Interview

Find a UPS employee and politely ask them the following questions. Make sure to record their answers.

- 1.) What is your job at UPS?

- 2.) What types of training did you need to do your job?

- 3.) Do you use any math during the work day? (If “yes” give an example)

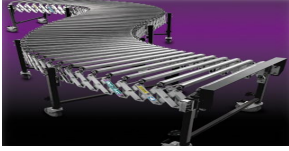
- 4.) Do you use any science during the work day? (If “yes” give an example)

- 5.) What types of problems do you have on the job?

To Student: Make sure to say, “Thank you” when the interview is over.

On the floor

- 1.) Take a tally of how many different conveyors you see:



- 2.) Take a tally of how many pallet trucks you see:



- 3.) Take a tally of how many UPS parcel delivery vehicles you see:



- 4.) Take a tally of how many UPS truck freight carriers you see:



- 5.) Make a quantitative observation about anything you see.
(**Quantitative Observation:** An observation with a number in it)

Journal Entry - Lesson 5

Name: _____

Date: _____

A. In your own words, describe the experience at the UPS hub. Include 2 questions that you asked and had answered. Also include your observations of the work done, the flow of the work, etc.

B. Define the four vocabulary words and describe their function at the UPS facility.

1. conveyors
2. pallet trucks
3. parcel delivery vehicles
4. truck freight carriers

Lesson 6

TOPIC	Preparing and Presenting Reports	TIME ESTIMATE	2-3 hours
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OBJECTIVES
<ul style="list-style-type: none"> • Students will plan, create, and design a written business report with details. • Students will complete a PowerPoint presentation with recommendations for their solution to problem.

MATERIALS & RESOURCES
<ul style="list-style-type: none"> • Handout #17, Presentation Rubric • Handout #18, Journal Entry • Copy of Handout #10, Revised UPS Staffing Problem Sheet (with Problem Constraints) • Completed worksheets from previous lessons • Access to Computers with Internet • LCD Projector

LESSON DESCRIPTION & ACTIVITIES		
Steps	No. of Minutes	ACTIVITIES
1	5	- Review the Handout 10, UPS Problem and discuss any questions students may have.
2	10	- Distribute Handout 16, Rubric for Evaluating Student Presentation. - Discuss and answer any questions that students may have.
3	70	- Allow time for student to work on preparing reports and presentations.
4	60	- Have students make 10 minute presentations to the class. - Discuss the things students learned while working on the presentation.
5	10	- Distribute Handout 18, Journal Entry for Lesson 6 and have students complete.

Presentation Rubric

Presentation Components	Below Expectations (Score 5)	Meets Expectations (Score 15)	Exceeds Expectations (Score 25)	Score (0 – 25)
Content	<ul style="list-style-type: none"> ▪ Provides inconsistent information for solution ▪ Has no apparent application of critical thinking ▪ Has no clear goal ▪ Is pulled from less than two sources ▪ Has significant factual errors, misconceptions, or misinterpretations 	<ul style="list-style-type: none"> ▪ Supports the solution ▪ Has application of critical thinking that is apparent ▪ Has no clear goal ▪ Is pulled from exactly two sources ▪ Has some factual errors and inconsistencies 	<ul style="list-style-type: none"> ▪ Is well thought out and supports the solution ▪ Reflects application of critical thinking ▪ Has clear goal that is related to the topic ▪ Has used more than two sources ▪ Is accurate 	
Professionalism	<ul style="list-style-type: none"> ▪ More than 5 spelling, grammatical, or punctuation errors ▪ Poor use of vocabulary and word choice 	<ul style="list-style-type: none"> ▪ Minimal (1 to 5) spelling, grammatical, or punctuation error ▪ Low-level use of vocabulary and word choice 	<ul style="list-style-type: none"> ▪ No spelling, grammatical, or punctuation errors ▪ High-level use of vocabulary and word choice 	
Organization	<ul style="list-style-type: none"> ▪ Content is unfocused and haphazard ▪ Information does not support the solution to the challenge or question ▪ Information has no apparent pattern 	<ul style="list-style-type: none"> ▪ Project has a focus but might stray from it at times ▪ Information appears to have a pattern, but the pattern is not consistently carried out in the project ▪ Information loosely supports the solution 	<ul style="list-style-type: none"> ▪ Information is clearly focused in an organized and thoughtful manner ▪ Information is constructed in a logical pattern to support the solution 	
Slide Show	<ul style="list-style-type: none"> ▪ Presentation appears sloppy and/or unfinished ▪ Multimedia is overused or underused ▪ Format does not enhance content ▪ Presentation has no clear organization 	<ul style="list-style-type: none"> ▪ Multimedia loosely illustrates the main points ▪ Format does not suit the content ▪ Presentation does not capture audience attention ▪ Presentation is loosely organized 	<ul style="list-style-type: none"> ▪ Multimedia is used to clarify and illustrate the main points ▪ Format is appropriate for the content ▪ Presentation captures audience attention ▪ Presentation is well organized 	

Name

Total

100

Journal Entry - Lesson 6

Name: _____

Date: _____

Describe the work your group accomplished while preparing the presentation. Be specific and focus on the details of the work.

Lesson 7

TOPIC	Post Test	TIME ESTIMATE	1 hour
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OBJECTIVES
<ul style="list-style-type: none"> Students will be able to apply prior knowledge gained during this unit to solve more challenging problems.

MATERIALS & RESOURCES
<ul style="list-style-type: none"> Handout #19, Post Test Handout #20, Bonus question (Optional)

LESSON DESCRIPTION & ACTIVITIES		
Steps	No. of Minutes	ACTIVITIES
1	35	- Distribute Handout 19, Post Test and allow students 30 minutes to complete.
2	45	<ul style="list-style-type: none"> - Distribute Handout 20, Bonus Question and allow students time to complete if desired. - Discuss and answer any questions that students may have.

Post Test

Easy Ride Van Company finds that about 40 percent of the time a person who makes an advance reservation for transportation does not keep the reservation. Therefore, for each of their 10-passenger vans, the Easy Ride Van Company schedules 13 persons on the basis of advance reservations.

1) Based on the information above, about how many riders out of the 13 scheduled would not keep their reservations?

- a) 1
- b) 3
- c) 5
- d) 7
- e) 9

2) Ken bought a used car for \$5,375. He had to pay an additional 15 percent of the purchase price to cover both sales tax and extra fees. Of the following, which is closest to the total amount Ken paid?

- a) \$806
- b) \$5,510
- c) \$5,760
- d) \$5,940
- e) \$6,180

3) A certain machine produces 300 nails per minute. At this rate, how long will it take the machine to produce enough nails to fill 5 boxes of nails if each box will contain 250 nails?

- a) 4 min
- b) 4 min 10 sec
- c) 4 min 30 sec
- d) 4 min 50 sec
- e) 5 min

4) What percent of 175 is 7?

- a) 4%
- b) 12.25%
- c) 25%
- d) 32%
- e) 40%

5) There were 90 employees in a company last year. This year the number of employees increased by 10 percent. How many employees are in the company this year?

- a) 9
- b) 81
- c) 91
- d) 99
- e) 100

6) Ms. Thierry and 3 friends ate dinner at a restaurant. The bill was \$67. In addition, they left a \$13 tip. Approximately what percent of the total bill did they leave as a tip?

- a) 10%
- b) 13%
- c) 15%
- d) 20%
- e) 25%

7) Last year there were 80 students enrolled in the eighth-grade class. This year the number of students enrolled in the eighth-grade class increased by 10%.

- a) 8
- b) 18
- c) 81
- d) 88
- e) 90

8) This year, 75% of the graduating class of Harriet Tubman High School had taken at least 8 math courses. Of the remaining class members, 60% had taken 6 or 7 math courses. What percent of the graduating class had taken fewer than 6 math courses?

- a) 0%
- b) 10%
- c) 15%
- d) 30%
- e) 45%

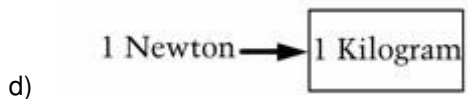
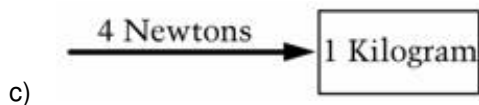
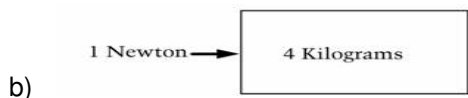
9) On a math test, 12 students earned an A. This number is exactly 25% of the total number of students in the class. How many students are in the class?

- a) 15
- b) 16
- c) 21
- d) 30
- e) 48

10) Victor's van travels at a rate of 8 miles every 10 minutes. Sharon's sedan travels at a rate of 20 miles every 25 minutes. What is difference between their two rates?

- a) 0 miles per minute
- b) 0.45 miles per minute
- c) 0.5 miles per minute
- d) 1 mile per minute
- e) 10 miles per minute

11) Each figure below shows a force measured in Newton's pushing on a block. If there are no other forces pushing on the block, in which case is the acceleration of the block greatest?



12) Household appliances convert electricity into one or more different forms of energy. An electric fan can best be described as converting electricity into:

- a) heat energy only
- b) heat energy and sound energy only
- c) heat energy, sound energy, and mechanical energy only
- d) heat energy, sound energy, mechanical energy, and chemical energy

13) Beans and coal both have stored energy. Where did the energy come from that is stored in beans and coal?

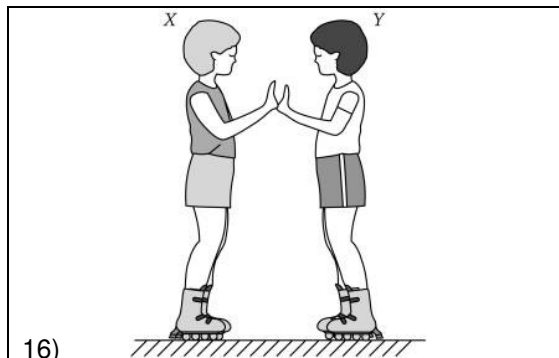
- a) From the Sun's light
- b) From the Earth's gravity
- c) From the heat in the Earth's core
- d) From the air's carbon dioxide

14) To keep a heavy box sliding across a carpeted floor at constant speed, a person must continually exert a force on the box. This force is used primarily to overcome which of the following forces?

- a) Air resistance
- b) The frictional force exerted by the floor on the box
- c) The weight of the box
- d) The gravitational force exerted by the Earth on the box

15) Which of the following is designed to convert energy into mechanical work?

- a) Electric fan
- b) Kerosene heater
- c) Flashlight
- d) Baking oven



- 16) Two girls wearing in-line skates are standing on a smooth surface with the palms of their hands touching and their arms bent, as shown above. If Girl X pushes by straightening his arms out while Girl Y holds his arms in the original position, what is the motion of the two girls?
- a) Girl X does not move and Girl Y moves backward
 - b) Girl Y does not move and Girl X moves backward
 - c) The motion depends on how hard Girl Y pushes
 - d) Girl X and Girl Y both move backward

- 17) Most of the chemical energy of the gasoline burned in a car is not used to move the car but is changed into
- a) Electricity
 - b) Heat
 - c) Magnet
 - d) Sound

- 18) Applying the brakes on a bicycle causes it to slow down because the brake...
- a) produce friction
 - b) use gravity to slow down the bicycle
 - c) add energy to the bicycle
 - d) help cool the bicycle tires

Challenge Problem



UPS Staffing Logistics

150 S. Lombard
Addison, IL 60101

Interoffice Memorandum

To: Human Resources Manager
From: Mark Korba, Manager

Problem:

As the Human Resources department you are in charge of calculating the amount of people needed to operate one of UPS's major hub sorts. Your total sort volume for this problem will be 220,000 pieces. How many employees should be planned on the payroll to support this operation?

Constraints:

1. Each sorter can sort at most 112 pieces per hour (PPH)
2. The average hours worked per employee (average paid day or APD) is 3.61 hours

Solution:

545 employees need to be on the payroll to support this operation.

BONUS QUESTION:

It is assumed that the union allows 10% of the workforce to be off on vacation at any given time. Furthermore, your sort is averaging a 5% absenteeism rate on any given day. How many employees should be planned on the payroll to support this operation?

Show your work on the back of this paper.

Teacher

Assessment Materials

FINAL EVALUATION

Problem Statement to be Solved:

As the Human Resources department you are in charge of calculating the amount of people needed to operate one of UPS's major hub sorts. Your total sort volume for this problem will be 220,000 pieces. How many employees should be planned on the payroll to support this operation?

Constraints:

1. Each sorter can sort at most 112 pieces per hour (PPH)
2. The average hours worked per employee (average paid day or APD) is 3.61 hours

Once you have arrived at your solution, please prepare a written business report with details and a PowerPoint presentation and present it at our next management team meeting.

Measurement Criteria that would describe an acceptable solution

1. Determined the appropriate number of employees needed at the UPS's major sorting hub to handle 220,000 pieces.
2. Determined the amount of time needed to sort the 220,000.
3. Determined the average pieces per hour for the average UPS employee in an 8 hour day.
4. Determine the average absenteeism for peak vacation seasons.
5. All calculations were correct.
6. Business report included a cover letter, introduction stating the purpose of the report, documentation to support recommendations, a detailed explanation with charts and spreadsheets to more clearly communicate recommended distribution plan.
7. Presentation presented the information with visual aids and/or handouts.
8. The presentation met the 7 requirements of effective business presentations:
 - Evidence of preparedness and practice
 - Started on time
 - Dressed appropriately
 - Showed enthusiasm and confidence
 - Maintained eye contact, showed friendliness and respect
 - Spoke slowly and distinctly without grammatical errors or slang
 - Welcomed questions and answered completely; accepted reactions without being defensive.

Presentation Rubric

Presentation Components	Below Expectations (Score 5)	Meets Expectations (Score 15)	Exceeds Expectations (Score 25)	Score (0 – 25)
Content	<ul style="list-style-type: none"> ▪ Provides inconsistent information for solution ▪ Has no apparent application of critical thinking ▪ Has no clear goal ▪ Is pulled from less than two sources ▪ Has significant factual errors, misconceptions, or misinterpretations 	<ul style="list-style-type: none"> ▪ Supports the solution ▪ Has application of critical thinking that is apparent ▪ Has no clear goal ▪ Is pulled from exactly two sources ▪ Has some factual errors and inconsistencies 	<ul style="list-style-type: none"> ▪ Is well thought out and supports the solution ▪ Reflects application of critical thinking ▪ Has clear goal that is related to the topic ▪ Has used more than two sources ▪ Is accurate 	
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Master solution for problem

Assumptions

Absenteeism is to be treated statistically. Typically students would collect information about absences over a time frame and extract the necessary statistics. For the purposes of this solution the statistical information was constructed artificially. In order to keep the mathematical complexity low frequencies were assigned only to whole number percentages of absences between 0 and 10. In addition the number of plant employees was treated as a continuous variable. Once the mathematical principles behind the solution are understood by the students the fact that this number is an integer can easily be incorporated in the attached spreadsheet.

It is assumed that all full time employees on the payroll carry a fixed cost (**RS**) and that when there are not enough employees in the plant to operate it at the theoretical capacity working their regular shifts the necessary additional work hrs. are paid at the overtime rate (**OT**).

The goal is to determine the staffing level that minimizes the total cost (**CST**) of the operation. Higher staffing levels produce higher fixed costs and lower overtime costs. The calculation is illustrated below and performed in the attached spreadsheet.

Notation

TC = # of employees needed to operate plant at the theoretical capacity.

AC = percentage of staffing above TC.

AR = absenteeism rate.

P(AR) = frequency of absenteeism rate. $\sum_{AR} P(AR) = 1.$

N = number of hub employees = $(1+AC/100) \times TC.$

NP = number of employees present = $(1-AR/100) \times N = (1-AR/100) \times (1+AC/100) \times TC.$

ARM = maximum absenteeism rate that does not cause understaffing.

{ $NP \geq TC \Rightarrow (1-AR/100) \times (1+AC/100) \times TC \geq TC \Rightarrow ARM = AC/(1+AC/100)$ }

Parameters used in spreadsheet

TC = $220000/(112 \times 3.61) = 544$

RS = 30000(US\$/year)
OT = 30(US\$/hr.)
APD (Average Paid Day) = 3.61
DOP (Days of Operation/ year) = 365

Calculations

The understaffing(US) at the hub is: **US = 0** when **NP ≥ TC** and **TC-NP** when **TC > NP**.

Its expected level(USA) is given by the statistical average:

$$USA = \sum_{US} P(US) \times US = \sum_{TC > NP} P(NP) \times (TC - NP) = \sum_{AR > ARM} P(AR) \times (TC - (1 - AR/100) \times N).$$

OTC = expected total overtime cost = USA x APD x DOP x OT.

RSC = total fixed cost = N x RS.

Both **OTC** and **RSC** are functions of **AC**. The solution to the problem is the **AC** that minimizes **CST = OTC + RSC**.

For the specific set of parameters used in this example the attached spreadsheet indicates that a staffing level of 3% above **TC** (**N = 560** employees) minimizes **CST**.

AC	ARM	Sum P(AR)xAR, AR>ARM	Sum P(AR), AR>ARM	USA	OTC	RSC	CST
0	0	0.938507877	0.988507877	27.2	1075202	16320000	17395202
1	0.990099	0.938507877	0.988507877	22.09451715	873385.2	16483200	17356585
2	1.960784	0.911782348	0.961512394	17.13295262	677257.1	16646400	17323657
3	2.912621	0.848318727	0.896753596	12.50400723	494277.2	16809600	17303877
4	3.846154	0.730962925	0.775768233	8.468334488	334749	16972800	17307549
5	4.761905	0.561971568	0.59973557	5.257990326	207845.7	17136000	17343846
6	5.660377	0.372473985	0.40026443	2.960451096	117025.2	17299200	17416225
7	6.542056	0.207003282	0.224231767	1.489610877	58883.57	17462400	17521284
8	7.407407	0.094486895	0.103246404	0.653103588	25816.86	17625600	17651417
9	8.256881	0.034908801	0.038487606	0.237735482	9397.565	17788800	17798198

Solution Checker

Step 1: Take the number of pieces that need to be sorted and divide it by the number of pieces sorted per hour by a single employee.

$$220,000 \text{ pieces} \div 112 \text{ pieces per hour} = 1,964.2857 \text{ hours}$$

Step 2: Take the total amount of hours divide it by the average hours worker per employee.

$$1,964.2857 \text{ hours} \div 3.61 \text{ hours} = 544.123 \text{ employees}$$

Step 3: Since we cannot use a decimal to represent the number of employees we must round up to 545 employees need to be on the payroll to support this operation.

Solution to the Bonus problem

It is assumed that the union allows 10% of the workforce to be off on vacation at any given time. Furthermore, your sort is averaging a 5% absenteeism rate on any given day.

Step 4: Take the sum of the percents, and subtract the sum from 100.

$$10\% + 5\% = 15\%$$

$$100\% - 15\% = 85\%$$

This means 85% of the workforce is present. To find the total amount of the workforce needed we divide the number of employees present by the 85%.

$$545 \text{ employees} \div 85\% = 641.176 \text{ employees}$$

Step 5: Since we cannot use a decimal to represent the number of employees we must round up to 642 employees need to be on the payroll to support this operation.

See UPS Hub Solution as separate PowerPoint file for example of student solution.

Answers to Pre/Post Test: (Including learning Illinois Learning Standards)

1) C	Math H-7C.1	11) C	Science H-12C.4
2) E	Math H-7C.1	12) B	Science H-12C.4
3) B	Math H-6D.2	13) A	Science H-12C.4
4) A	Math H-7C.1	14) B	Science H-12C.4
5) D	Math H-7C.1	15) A	Science H-12C.4
6) D	Math H-7C.1	16) D	Science H-12C.4
7) D	Math H-7C.1	17) B	Science H-12C.4
8) B	Math H-7C.1	18) A	Science H-12C.4
9) E	Math H-7C.1	19) C	Science H-12C.4
10) A	Math H-6D.2	20) B	Science H-12C.4

A P P E N D I X

GLOSSARY of TERMS Related to this Scenario

Have each group of students generate their own set of glossary terms in the brainstorming exercise.