Lesson 1:
Water Rights: Managing the Colorado River System

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Standards and Benchmarks (see page 1.18)

Lesson Description

The class will participate in an activity simulating the Colorado River's trek to the sea. The goal is to try to sustain the river long enough for some water to exit into the Gulf of California. The challenge is to align the individual needs of consumers with the health of the river while an ever-changing set of conditions influences both supply and demand. If students have an understanding of supply and demand, conduct the fifth round of the simulation and an extension activity, which will allow them to illustrate their skills in shifting market curves for the Colorado River water as conditions change.

Grade Level

High school

Concepts

Allocation

Scarcity

Value

***Optional concepts*:** Changes in market price and quantity, shifts in demand, shifts in supply

Objectives

Students will be able to

- define allocation, scarce, and value;
- describe the water crisis affecting the western United States;
- describe the multiple parties using the Colorado River System;

- compare the results of different water allocation schemes; and
- (optional) express their understanding of market shifts as river conditions change.

Compelling Question

How should we allocate scarce resources?

Time Required

90-120 minutes

Materials

- PowerPoint Slides 1.1-1.14
- Handout 1-1A, one copy for all but 14 students
- Handout 1-1B, one copy, cut into strips
- Handout 1-2, one copy for each student (optional)
- Handout 1-3, one copy for each student
- Twelve 16-oz. clear plastic cups
- Two pitchers or containers (reservoirs) that will hold seven cups of water each
- One gallon of water
- A funnel (if the jug's opening is narrow)
- Blue painter's tape
- One permanent marker
- Two 1-c. measuring cups

Preparation

- Label the plastic cups using the blue painter's tape and permanent marker.
- Two cups should say "Power Plant," two should say "Fracking," two should say "Agriculture," two should say "Residential," two should say "Data Storage," and two should say "Marsh: Bay of California."
- Use a 1-c. measuring cup to pour eight ounces of water into one of the plastic cups. Tear off a small piece of blue tape and adhere it to the back of the cup (the side not labeled) at the water line. Do this for each of the consumer cups so that students will know where to stop pouring during the simulation. In the end, each cup should have the blue tape at the halfway mark.

- The two pitchers (reservoirs) should each be filled with seven cups (56 ounces) of water. Use the blue tape to mark the water level.
- Preview the following documentary: https://e360.yale.edu/features/video_colorado_river_running_near_empty.
- For additional background and depth of understanding, view the following series: https://e360.yale.edu/series/crisis-on-the-colorado.

Introduction

The Colorado River provides water for one out of every eight Americans for residential, industrial, mining, agricultural, and recreational needs. The river serves seven western U.S. states and Mexico, and water appropriation was established by an agreement forged in 1922. Senior water rights were given to the earliest (white) settlers and tended to be in the agriculture, ranching, and mining interests. Senior rights were also awarded to California after a series of Supreme Court cases throughout the twentieth century. Having senior water rights mandates that the same amount of water be allotted each year regardless of river totals. All others have junior rights and have to share the remainder. Ultimately, the federal government controls the water and has the final say in appropriation. The region was divided in half: the Upper Basin and Lower Basin. The boundary between the basins is at Lee's Ferry just below Glen Canyon Dam at the Utah/Arizona border. Each basin was apportioned 7.5 million acre-feet per year, but that agreement came on the heels of one of the wettest periods in western U.S. history. Though the river has been reliable, it has fallen victim in recent years to severe drought and growing demand. During the past 50 years, according to figures from the Reclamation Bureau, the population served by the river has grown from 12 million to 40 million. During that period, the average flow of the river has fallen from 15.5 million acre-feet to as low as 12 million acre-feet. (An acre-foot serves a family of five for a year.) As a result, the Colorado River has reached its historical rendezvous with the Gulf of California only once in nearly two decades (the result of an artificial surge of water orchestrated by environmentalists). Consequently, the marsh at the doorstep of the Gulf has been dramatically compromised with significant salt intrusion and the loss of ecosystems.

Procedure

1. If desired, introduce the Colorado River crisis to the students by showing the following short documentary before opening the PowerPoint slideshow: https://e360.yale.edu/features/video_colorado_river_running_near_empty.

2. Use the PowerPoint slides to indicate the numerous "straws" that draw water from the Colorado River. This will introduce the students to their roles in the subsequent simulation.

3. Display Slides 1.2-1.5 to introduce the students to the agreement made in 1922 among the states fed by the Colorado River.

4. Display Slide 1.6 and explain that there is an early draw on the supply of water to satisfy a thirsty eastern Colorado.

5. Display Slides 1.7-1.12 and review descriptions of the consumers depicted in this lesson's simulation.

6. Display Slide 1.13 that illustrates the anomalous pricing system in many rain-starved western cities.

7. Display Slide 1.14 and discuss the ecological impact that occurs because the river doesn't reach its natural terminus.

8. Explain that water is a **scarce** natural resource. It is scarce because many people want to use/consume it but there is a limited amount. Societies develop different **allocation** strategies—that is, ways in which to distribute the water.

9. Tell the students they are going to simulate the movement of the Colorado River water through the Lower Basin of the system from Glen Canyon Dam to the Gulf of Colorado. Ask for 14 student volunteers to participate in the simulation. Once selected, tell the rest of the class they will be economists who will monitor and **value** the use of the river's water in the simulation. Distribute a copy of *Handout 1-1A: The Valuation of Water in the Colorado River Simulation* to each economist.

10. Instruct the volunteers to create two lines of seven. Assign each student a role by giving them a reservoir or pre-labeled plastic cup. The two students representing the reservoirs will each stand at the heads of the lines with the pitchers of water. Arrange students in each line as follows:
    - Reservoir
    - Power Plant
    - Fracking
    - Agriculture
    - Residential
    - Data Storage
    - Marsh: Bay of California

11. Tell the students they will simulate the flow of the river by passing the reservoirs down the lines. Explain that during the simulation they represent the people described by their roles: Based on either the information in the PowerPoint slideshow or their own assumptions, they should make decisions as if they were the people described by the roles. For example, as someone in agriculture, that student should try to obtain water for their crops. Have each student in line suggest reasons they need water. (*Answers will vary.*) To simulate the flow of the river during the simulation, each student will take some water and then hand the pitcher

to the next student in line. (Alternatively, the reservoir student can fill the cups as requested by each person on the river as he or she moves down the river.) Tell the students the simulation will be repeated a number of times with different scenarios.

12. Instruct half the economists to observe one of the rivers and the other half the other river. (This simulation uses two rivers to get more students involved. If desired, only one river can be used with the rest of the class as economists. However, with two rivers, a wider variety of results—or errors—may occur, giving the class more information to discuss.)

13. Meet quietly with the economists to ensure that they understand how to use the table to record information and value the river based on the example provided on Handout 1-1A. (NOTE: The first round requires that the volunteers in the river lines not know the values, so clear up any questions without revealing the values to the volunteers.)

Round 1

14. Tell the volunteers that in this first round, they should take as much water as they would like because the price of the water is so low it is practically free. But to keep it simple, they should take either no water, half a plastic cup of water (to the blue tape), or a full plastic cup of water. Explain the following:
    - As the reservoirs are passed down the line, take all the water you think your designated consumer will need. Each student may shield the drawdown of the river—that is, hide from others how much water he or she is taking—before passing the reservoir to the next consumer.
    - Once a reservoir is passed to the next student, no more water can be acquired.
    - If there is spillage, that water is irretrievable as either evaporation or leakage.
    - A reservoir will be passed until either all the water is gone or the marsh, the river terminus, is reached.
    - Results will be determined by the individual choices made at each stop.

15. Instruct the students to begin the round. When each pitcher has reached the last student in a line, or reservoirs have been emptied, have the water consumers show the amount of water they drew by raising their cups or calling out the amount. Instruct the economists to record the amounts used by each consumer and value the water usage. Discuss the following:
    - In either line, did water reach the marsh at the end of the river? (*Answers will vary.*)
    - If the answer to the first question was "No," what were the obstacles that kept water from reaching the marsh? (*Answers may include that the individual consumers took more water than they actually needed, placing more value on their needs than the needs of those further down the river. There could have been a degree of spillage [evaporation,*

leakage] that wasted a great deal of water. The individual consumers had no idea how their drawdown would impact other consumers.)

- In this round, water was allocated on a first-come, first-served basis.

Round 2

16. Return the distributed water to the reservoirs so that they are back to prescribed levels. (Have the students representing the reservoirs use extra water to replenish if some was spilled.)

17. Explain to the volunteers that in the previous round, they had little guidance on how much water to take. Tell them you will now give them a slip, from *Handout 1-1B: Value Slips for River Simulation*, that tells them the water's value. Explain that this slip lists the value amount for the first eight ounces of water and another value amount for the second eight ounces; this is the marginal benefit for their use of water.

18. Explain to the volunteers that their goal is to maximize the total value for themselves. Note that the water is still provided at a cost that is so low they can consider it free.

19. Instruct the students to begin passing the reservoirs down the line, allowing students to take all the water they think their designated consumers will need. The same rules about spillage, etc., apply in this round. Students should continue passing their reservoir until either all the water is gone or the marsh, the river terminus, is reached.

20. Have the water consumers show or call out the amount they drew. Instruct the economists to record the amounts used by each consumer and value the water usage. Discuss the following:
    - In either line, did water reach the marsh at the end of the river? (*No, it is likely that all the water would have been gone by the time it reached data storage.*)
    - Ask the students representing data storage or the marsh if they are unhappy with this allocation. (*Yes, since they did not receive any water, they are likely to be unhappy.*)
    - On what basis was water allocated in this round? (*In this round, water was used as though it were a free resource—on a first-come, first-served basis.*)
    - Why was water allocated in this way? (*No one had an understanding of the cost; early consumers saw nothing but benefit and took as much as they could. This meant that residents would have no more than eight ounces available and data storage would have none.*)

21. Explain that in this round, consumers received varying levels of water values as they consumed second cups of water. This might be because the marginal or additional satisfaction from a second cup of water varied among consumers. In a residence, there are limits to how much water a family can consume. Over-production by a fracking or agricultural operation could

reduce the price of the commodity (oil, corn, wheat, or beef). Data storage provides a unique service that seems to have limitless demand, and power plants can sell excess product to utilities in other parts of the hemisphere.

Round 3

22. Return the distributed water to the reservoirs so that they are back to prescribed levels (using extra water to replenish if some was spilled).

23. Tell the students that some consumers have senior water rights. This means they have a claim to the water before anyone else can use the water. Explain that because some consumers—the power plant, agriculture, and residential consumers—have been here the longest, they have a right to a full 16-oz. cup of water.

24. Instruct the students to begin passing the reservoirs down the line, allowing students to take all the water they think their designated consumers will need. The same rules about spillage, etc., apply in this round.

25. As the reservoirs reach the fracking consumers, note that based on senior rights, they can only take eight ounces because there must be enough for agriculture and residents to have a full 16-oz. cup. Students should continue passing their reservoir until either all the water is gone or the marsh, the river terminus, is reached.

26. Have each water consumer show or call out the amount they drew. Ask the economists to record the amount used by each consumer and value the water usage. Discuss the following:
    - In either line, did water reach the marsh at the end of the river? (*No*)
    - What were the differences in distribution with these rights compared with the distribution in the previous round? (*The fracking consumers received only eight ounces and the residents received a full 16-oz. cup instead of only the eight ounces allotted them in the previous round.*)
    - On what basis was water allocated in this round? (*In this round, water was allocated based on arbitrarily assigned rights.*)

Round 4

27. Point out that up until this point, the price of water has been so low that price didn't influence consumption decisions.

28. Return the distributed water to the reservoirs so that they are back to prescribed levels (using extra water to replenish if some was spilled).

29. Set the price of water at $65 for each eight ounces. Tell the volunteers to think about how much water they should take by comparing the price of the water with the marginal benefit of the water—based on the slips of paper you gave them in Round 2. Tell the students representing the marsh that they do not have any money to purchase water, so they will only get any water that filters down to the end.

30. Instruct the students to begin passing the reservoirs down the line, allowing them to take all the water they think their designated consumers will need. The same rules about spillage, etc., apply in this round. Students should continue passing their reservoir until either all the water is gone or the marsh, the river terminus, is reached. Discuss the following:

    - Did the water reach the marsh at the end of the river? (*Yes, if the volunteers took the correct amount of water.*)
    - What were the differences in distribution with these rights compared with the distribution in the previous round? (*All the volunteers took only eight ounces of water—except for data storage—because the second eight ounces is worth less to them than the $65. Data storage values the second eight ounces highly, so they took a full 16-oz. cup of water.*)
    - On what basis was water allocated in this round? (*In this round, water was allocated based on price.*)
    - Do you like that the water was priced? (*No, because in previous rounds it was free. Consumers are not as well off as they were when the water was free.*)
    - Why might pricing water be a good idea? (*Answers will vary, but hopefully some students will note that only people who value the water highly will buy the water.*)

31. Ask the economists to report the total values of the water usage. Record their answers on the board. (*Round 1: will vary depending on how the students elected to distribute the water; Round 2: $550; Round 3: $500; Round 4: $750*) Discuss the following:

    - Which round resulted in the least value and which round resulted in the most value? (*The round with least value will be either Round 3, the rights round, or Round 1, in which students chose the allocation. The round with most value will be Round 4, in which a pricing system was used.*)
    - Which system should be used to allocate water? (*Most students will choose the pricing system because it provides the most value to society. However, some students will point out that in a water rights system, residents get more water and so may choose that system because of what they believe is fair. Some students may think more water should reach the marsh to preserve nature. Point out that other issues besides value may be used to allocate water.*)

    NOTE: If a shorter activity is desired, skip to the Closure section. If time permits, you may conduct the optional Round 5 and then the Closure. (Economics classes that have covered supply and demand concepts can do the optional Round 5 and subsequent supply and demand activity.)

Round 5 (optional)

32. Return the distributed water to the reservoirs so that they are back to prescribed levels (using extra water to replenish if some was spilled).

33. Explain that if using a pricing system, economists must be careful about pricing the water. If the price is too high or too low, it can result in low-value outcomes.

34. Tell the students that in this final round, there will be different prices for the two river lines. For one river, the price of water will be $55. For the other river, the price will be $80. (If there is only one river, then conduct two rounds.)

35. Instruct the students to begin passing the reservoirs down the line, allowing them to take all the water they think their designated consumers will need. The same rules about spillage, etc., apply in this round. Students should continue passing their reservoir until either all the water is gone or the marsh, the river terminus, is reached.

    NOTE: For the river with high-priced water, the marsh students will have a reservoir with 24 ounces of water and a cup that holds only 16 ounces. You can either instruct the student to keep pouring—creating eight ounces of spillage waste and a small mess—or just note to the class that some water is not used and is wasted.

36. Ask the economists to report the total value of water usage for each river. (*$710 for the price of $55; $625 for the price of $80*)

37. Discuss the following with the economists:

    - Why did the value for the high-priced water result in a lower value than that in Round 4? (*Too much water flowed through to the marsh, creating waste.*)
    - Why did the value for the low-priced water also result in a lower value? (*No water reached the marsh, which provides value to society—even if the marsh can't "pay" for water.*)

38. Tell the students that economists prefer pricing resources such as water for two reasons: One, as was shown in the first four rounds, pricing results in the highest-value usage for a resource, as opposed to a first-come, first-served basis or arbitrarily assigned rights. Two, a correctly determined price produces the best results for society.

39. Explain that one way the water could be allocated is to auction off the water to determine the price. Ask the students if they see a problem with this idea. (*Answers will vary. The marsh has no ability to pay, so the water will be bought by someone who values having the water less than society would value having the water in the marsh.*)

40. Ultimately, economists must try to value water based on the idea of supply and demand. Distribute a copy of *Handout 1-2: Pricing the Colorado River System* to each student. Tell the students to read the scenarios and decide what will happen to the equilibrium price and quantity when the change described in each scenario occurs. Tell the students that in the simulation the amount of water was fixed, but in reality the Colorado River system has reservoirs to store water; more water can be released if the price rises, or less water can be released if the price falls. The following are suggested answers for the handout:
    1. *Demand up; price up; quantity up*
    2. *Demand down; price down; quantity down*
    3. *Supply down; price up; quantity down*
    4. *Demand up; price up; quantity up*
    5. *Supply down; price up; quantity down*
    6. *Supply down; price up; quantity down*
    7. *Demand down; price down; quantity down*
    8. *Supply down; price up; quantity down*
    9. *Demand up; price up; quantity up*
    10. *Supply up; price down; quantity up*

41. Review the answers and note that when more water is demanded, the price of water should increase. When more water is supplied (by nature), the price should decrease.

Closure

42. Discuss the following to review the key content from the lesson:
    - Describe the water crisis affecting the western United States. (*Water is a scarce natural resource. Many people want to use water, but there is a limited amount of water available.*)
    - Give examples of consumers who use water from the Colorado River. (*Examples include agriculture, residents, power plants, data storage centers, fracking operations, and golf courses.*)
    - What is the current allocation strategy for the Colorado River? (*The current strategy is based on a 1922 agreement involving seven western U.S. states and Mexico. The region is divided in half; each half is allotted an equal amount of water, and some consumers have first right of usage, while others receive what remains.*)
    - Did the rivers always reach the marshes in the simulations? (*No*)

- What were the results of the different allocation schemes demonstrated in the simulation? (*In Round 1, water was allocated on a first-come, first-served basis and was randomly consumed; water likely didn't reach the marsh. In Round 2, each consumer understood the marginal benefit received from water consumption but had no information about cost, so again water was drawn on a first-come, first-served basis; water likely didn't reach the marsh. In Round 3, senior and junior rights were assigned to consumers, giving power plants, agriculture, and residents freedom to consume a full allotment of water, with fracking and data storage having to accept what was left. In Round 4, the consumers became aware of the marginal cost of each eight ounces of water and had to weigh that against the marginal benefit; if each consumer gauged that relationship accurately, water reached the marsh. In the optional Round 5, the water in the rivers was priced differently—one river above equilibrium and one river below. The results were that for the low-priced river, no water reached the marsh, and for the high-priced river, too much water reached the marsh.*)
- What happened to cause a river to fall short of the marsh? (*Answers may include that there was too much demand, not enough water in the reservoir, or too many consumers looking after themselves before considering others who use the river.*)
- If a river's water did reach the marsh, what factor(s) allowed for that to happen? (*Answers may include that the introduction of a meaningful price for the water made consumers more cautious about how much water they consumed.*)
- In which round was the most value generated for society? Why? (*Round 4, with the pricing of water: Consumers used water after comparing how much they valued it with what the cost was. This reduced waste.*)
- Why do economists recommend pricing as a means of allocating scarce natural resources? (*Pricing provides a uniform basis for consumers to measure costs versus benefits received from a resource. This allows for each consumer to accurately gauge the value he or she receives from each unit. It also establishes parameters on marginal utility received.*)
- What factors were behind the varying benefits consumers received from the purchase of water? (*Answers may include diminishing marginal utility existed after a certain amount of water was consumed, as was the case for residents; excessive fracking produced a surplus of product, reducing its profitability; data storage and power plants offered unique products and had sustained utility at higher output levels; or agriculture increased its revenue by producing less thirsty crops.*)
- What additional changes could consumers of the Colorado River water implement if they wanted to sustain its flow into the sea? Why might they decide do so? (*Answers may include homeowners could eliminate their lawns; data storage centers could turn to air cooling systems; or fracking could be changed to more renewable energy sources to eliminate its viability. Under a pricing system, these steps might be taken to avoid using precious and costly water.*)

Assessment

43. Distribute a copy of *Handout 1-3: Assessment* to each student. Allow time for the students to work and then review the answers as follows:

Multiple Choice

1. When consumers of river water are unaware of the price demanded for the commodity, which system of allocation is used to distribute water?
   a. Need
   b. Achievement based
   c. First come, first served
   d. Rationing
2. Why does putting a price on water drawn from the Colorado River result in a more conducive allocation of the commodity?
   a. It provides for a reliable supply of water each year.
   b. It aligns self-interest with efficiency when satisfying consumer demand.
   c. It allows for each consumer to always take as much water as they want.
   d. It validates the 1922 agreement as the best system for distributing water in the western United States.
3. How could the water crisis in the western United States be best described?
   a. The 1922 agreement is regularly violated, creating unpredictable shortages of water for consumers.
   b. The federal government is consuming most of the water to maintain federal lands.
   c. The problem is temporary and will be solved when normal quantities of rain return.
   d. Not enough value is placed on the water, and it is increasingly over-subscribed by the growing number of consumers.

Short Answer

4. In times when gasoline is in short supply (for instance, in periods before and after a hurricane), is it best policy for a government to cap the price of gasoline to make it affordable for every consumer? Why or why not?

   No, because people will likely hoard gasoline and take more than they will actually use, making it difficult for late-arriving consumers to acquire any. By allowing the price to reflect the shortage, people will make better decisions about how much they consume, making it possible for more people to have access.

Handout 1-1A: The Valuation of Water in the Colorado River Simulation

As an economist, you are to estimate the total value generated by the water that flows down the Colorado River. You will observe the water usage in each round of the simulation. You will record the usage in 8-oz. units, which is equal to half the 16-oz. cups used in the simulation. For example, if the power plant fills its cup halfway, it is one unit. If it fills it to the top, it is two units. Circle the appropriate number. Do not circle any numbers if water is not used. You will then calculate the total value of the water usage with the values listed below. For example, if the power plant fills its cup to the top and the rest of the entities fill their cups halfway, then the total value, with the power plant in parenthesis, would be:

($150 + $50) + $115 + $75 + $75 + $135 + $100 = $700

	Value of first 8 oz.	Value of second 8 oz.	Round 1 quantity	Round 2 quantity	Round 3 quantity	Round 4 quantity	Round 5 quantity
Power plant	$150	$50	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
Fracking	$115	$60	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
Agriculture	$75	$25	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
Residential	$75	$10	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
Data storage	$135	$100	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
Marsh	$100	$25	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2

Round 1 total value: _____

Round 2 total value: _____

Round 3 total value: _____

Round 4 total value: _____

Round 5 total value: _____

Handout 1-1B: Value Slips for River Simulation

POWER PLANT	Value of first 8 oz.	Value of second 8 oz.
	$150	$50
FRACKING	Value of first 8 oz.	Value of second 8 oz.
	$115	$60
AGRICULTURE	Value of first 8 oz.	Value of second 8 oz.
	$75	$25
RESIDENTIAL	Value of first 8 oz.	Value of second 8 oz.
	$75	$10
DATA STORAGE	Value of first 8 oz.	Value of second 8 oz.
	$135	$100
POWER PLANT	Value of first 8 oz.	Value of second 8 oz.
	$150	$50
FRACKING	Value of first 8 oz.	Value of second 8 oz.
	$115	$60
AGRICULTURE	Value of first 8 oz.	Value of second 8 oz.
	$75	$25
RESIDENTIAL	Value of first 8 oz.	Value of second 8 oz.
	$75	$10
DATA STORAGE	Value of first 8 oz.	Value of second 8 oz.
	$135	$100

Handout 1-2: Pricing the Colorado River System (page 1 of 2)

There are 10 market changes listed below. Each one will result in the shift of a curve and the formation of a new equilibrium price and quantity.

The following page has 10 supply and demand diagrams with numbers that correspond to the 10 market changes.

After reading each market change, illustrate its consequences on the accompanying diagram by shifting the appropriate curve (using up or down arrows) to describe the changes to market price and quantity.

1. Residential development expands rapidly in Las Vegas as the economy strengthens.

2. Data storage centers begin experiments with air cooling systems to relieve their mega-server complexes.

3. A dry winter translates to a disappointing snow melt in the spring.

4. The world price of oil spikes, leading to a number of new fracking operations opening.

5. The U.S. Forest Service fences off several water sources to protect endangered thistle.

6. The lining of a diversion canal in central Arizona has been compromised, and significant quantities of water have been lost.

7. Homeowners in southern California are responding eagerly to a lawn buyback program.

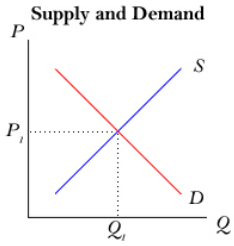
8. The federal government orders a reallocation of river water to both basins, reducing the annual drawdown from 7.5 million acre-feet to 7.05 million acre-feet.

9. New hotels are constructed at an unprecedented rate on the Las Vegas Strip.

10. A 16-year drought officially ends after two very extensive monsoon seasons.

Handout 1-2: Pricing the Colorado River System (page 2 of 2)

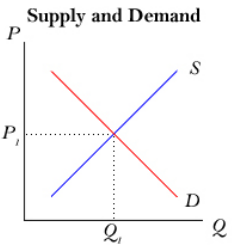
1. Las Vegas



Price _____

Quantity _____

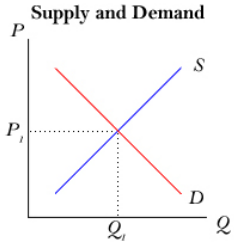
6. Diverson canal



Price _____

Quantity _____

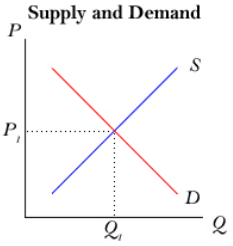
2. Data storage centers



Price _____

Quantity _____

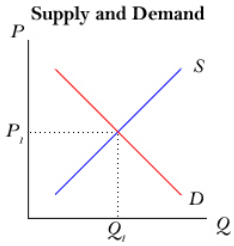
7. Lawn buyback



Price _____

Quantity _____

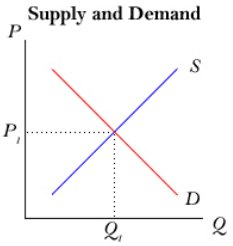
3. Dry winter



Price _____

Quantity _____

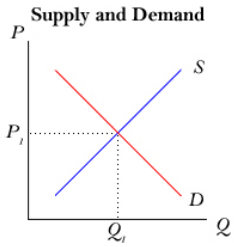
8. Reallocation



Price _____

Quantity _____

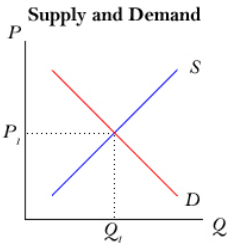
4. Price of oil



Price _____

Quantity _____

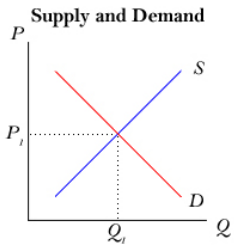
9. New hotels



Price _____

Quantity _____

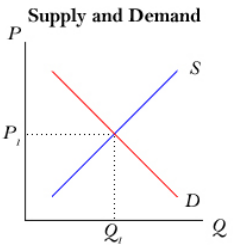
5. Endangered thistle



Price _____

Quantity _____

10. Monsoon season



Price _____

Quantity _____

Handout 1-3: Assessment

Multiple Choice

Select the best answer for each of the following questions.

1. When consumers of river water are unaware of the price demanded for the commodity, which system of allocation is used to distribute water?
   a. Need
   b. Achievement based
   c. First come, first served
   d. Rationing
2. Why does putting a price on water drawn from the Colorado River result in a more conducive allocation of the commodity?
   a. It provides for a reliable supply of water each year.
   b. It aligns self-interest with efficiency when satisfying consumer demand.
   c. It allows for each consumer to always take as much water as they want.
   d. It validates the 1922 agreement as the best system for distributing water in the western United States.
3. How could the water crisis in the western United States be best described?
   a. The 1922 agreement is regularly violated, creating unpredictable shortages of water for consumers.
   b. The federal government is consuming most of the water to maintain federal lands.
   c. The problem is temporary and will be solved when normal quantities of rain return.
   d. Not enough value is placed on the water, and it is increasingly over-subscribed by the growing number of consumers.

Short Answer

Write a response to the following prompt using complete sentences and correct grammar and punctuation.

4. In times when gasoline is in short supply (for instance, in periods before and after a hurricane), is it best policy for a government to cap the price of gasoline to make it affordable for every consumer? Why or why not?

Standards and Benchmarks

Voluntary National Content Standards in Economics

Standard 3: Allocation

Different methods can be used to allocate goods and services. People acting individually or collectively must choose which methods to use to allocate different kinds of goods and services.

- **Benchmark: Grade 12**

    1. Comparing the benefits and costs of different allocation methods in order to choose the method that is most appropriate for some specific problem can result in more effective allocations and a more effective overall allocation system.

Standard 4: Incentives

People usually respond predictably to positive and negative incentives.

- **Benchmark: Grade 12**

    1. Acting as consumers, producers, workers, savers, investors, and citizens, people respond to incentives in order to allocate their scarce resources in ways that provide them the highest possible net benefits.

Standard 8: Role of Prices

Prices send signals and provide incentives to buyers and sellers. When supply or demand changes, market prices adjust, affecting incentives.

- **Benchmark: Grade 12**

    3. Changes in supply or demand cause relative prices to change; in turn, buyers and sellers adjust their purchase and sales decisions.