



Review

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About this slideshow ...

I am not out to give you more to study! So:

- There's really nothing new in this slide show.
- I've added in some divider slides with huge blue ovals and large red lettering.



- I added in some red arrows to point things out. 
- I added a few slides that are just pictures of things already in non-slideshow materials. I marked those with a green star. 

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Also: The "Destination Earth"
film screengrabs at the end are
new.



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PHYSICS

7.6 Conservation of Energy

13. Consider the following scenario. A car for which friction is not negligible accelerates from rest down a hill, running out of gasoline after a short distance. The driver lets the car coast farther down the hill, then up and over a small crest. He then coasts down that hill into a gas station, where he brakes to a stop and fills the tank with gasoline. Identify the forms of energy the car has, and how they are changed and transferred in this series of events. (See Figure 7.34.)

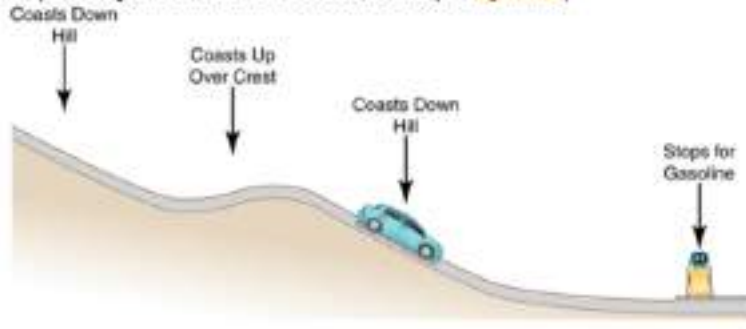


Figure 7.34 A car experiencing non-negligible friction coasts down a hill, over a small crest, then downhill again, and comes to a stop at a gas station.

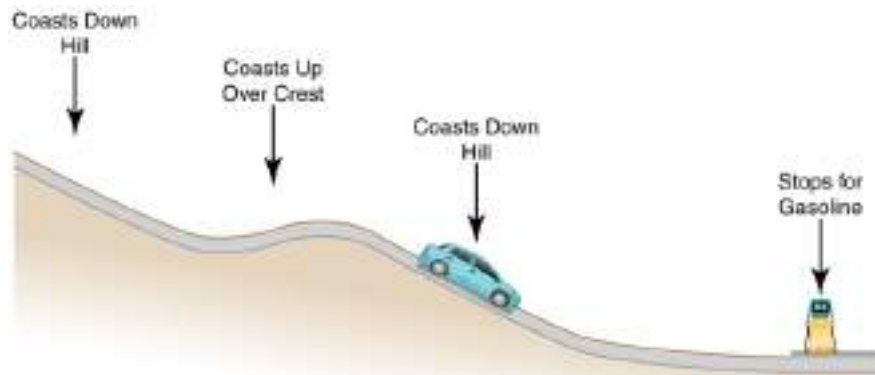
14. Describe the energy transfers and transformations for a javelin, starting from the point at which an athlete picks up the javelin and ending when the javelin is stuck into the ground after being thrown.

15. Do devices with efficiencies of less than one violate the law of conservation of energy? Explain.

16. List four different forms or types of energy. Give one example of a conversion from each of these forms to another form.

17. List the energy conversions that occur when riding a bicycle.

Figure 7.34



- A car experiencing non-negligible friction coasts down a hill, over a small crest, then downhill again, and comes to a stop at a gas station.



World Energy Use

What is the difference between energy conservation and the law of conservation of energy? Give some examples of each.

26. If the efficiency of a coal-fired electrical generating plant is 35%, then what do we mean when we say that energy is a conserved quantity?

S1-1. It is not atypical in the North Dakota Bakken Formation for an oil well to produce about 100 barrels per day from a depth of 1,500 meters. What is the change in potential gravitational energy in joules for a change in height of 100 barrels oil from 1,500 m below ground to the surface? Assume that a barrel of oil has a mass of 139 kg.

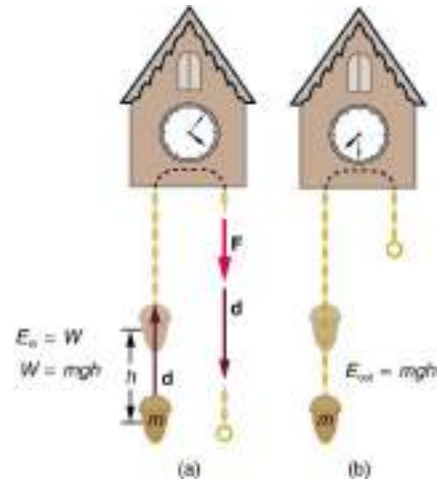
S1-2. (a) A pumpjack is a type of pump used to lift oil from an oil well to the surface. Assuming a pumpjack were 100% efficient in turning inputted energy into useful work (which it couldn't be, of course), how much energy would it take to lift 100 barrels from 1,500 m below ground to the surface?

(b) Is potential gravitational energy gained or lost in this pumping?



Figure 7.5

- (a) The work done to lift the weight is stored in the mass-Earth system as gravitational potential energy.
- (b) As the weight moves downward, this gravitational potential energy is transferred to the cuckoo clock.



HYDROCARBON CHEMISTRY

Hydrocarbons

Hydrocarbons are molecules composed entirely of carbon atoms and hydrogen atoms.

A carbon atom is capable of bonding not only to hydrogen atoms but also to other carbon atoms, so there are essentially limitless varieties of hydrocarbons.

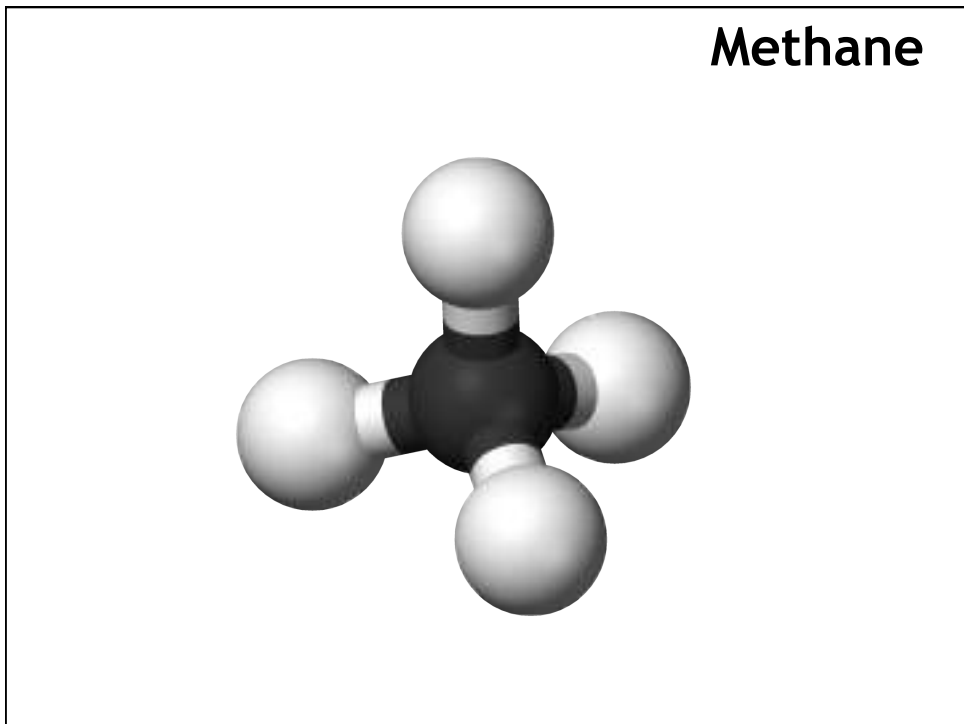
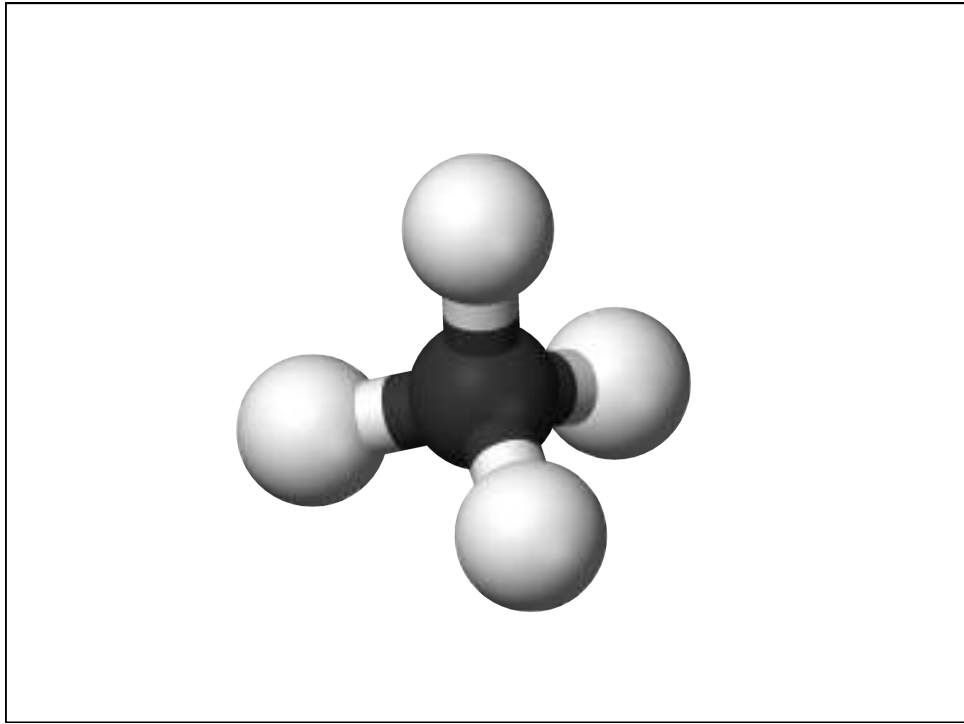
Some types of hydrocarbons by chemical bonds

Alkanes - only single bonds, no rings

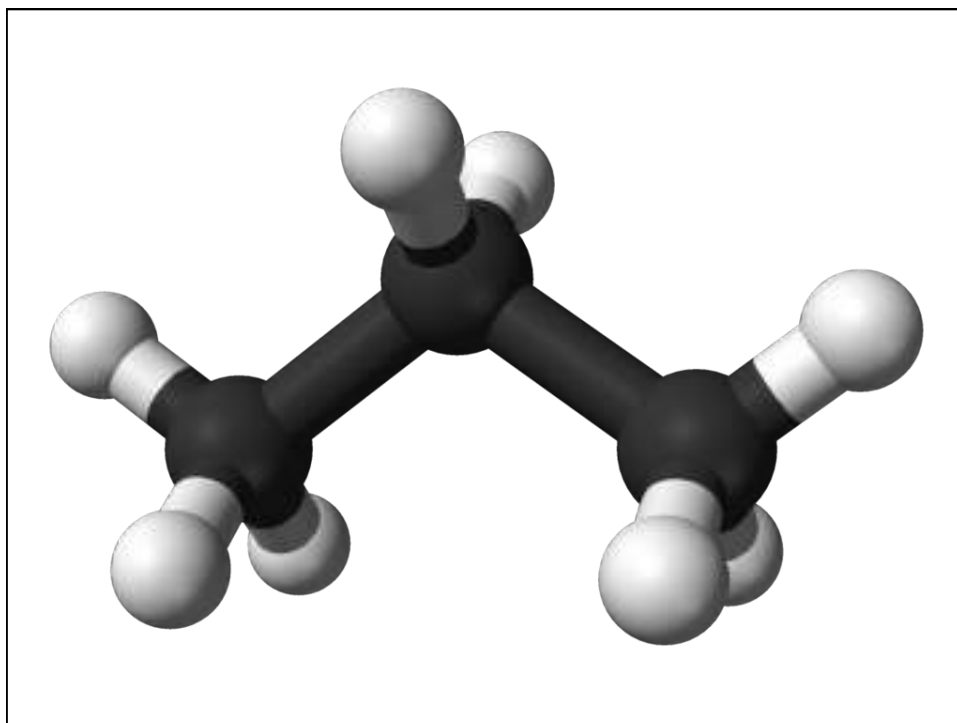
Cycloalkanes - online single bonds, 1 ring

Alkenes - at least one carbon-carbon double bond

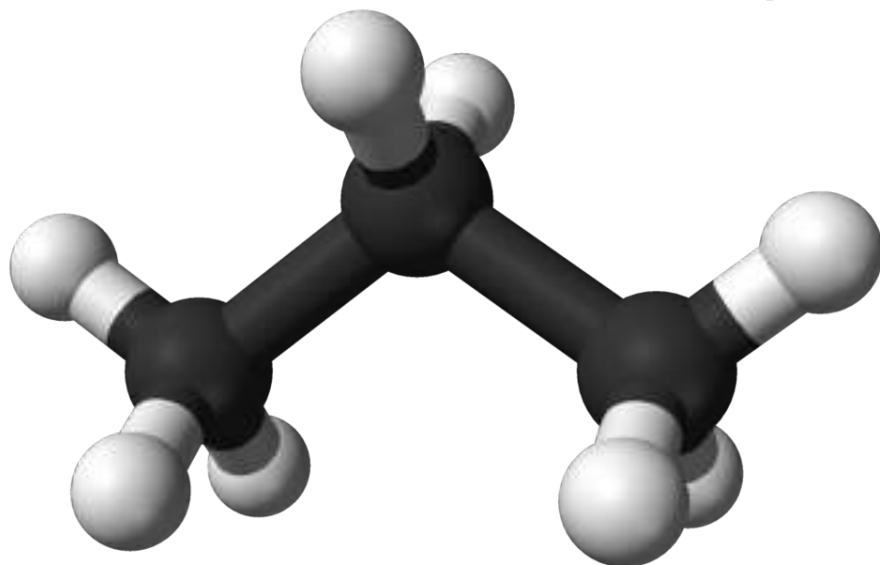
Alkynes - at least one carbon-carbon triple bond



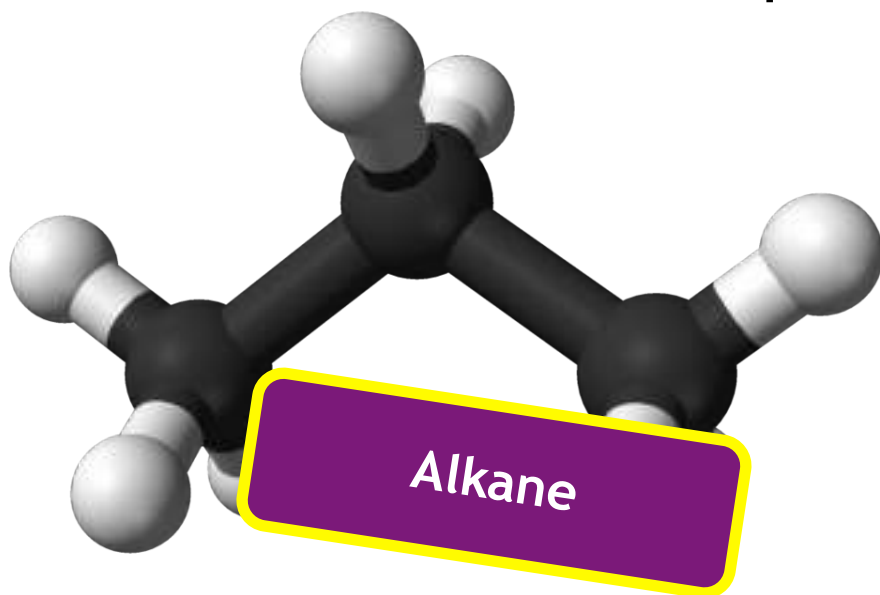
Methane

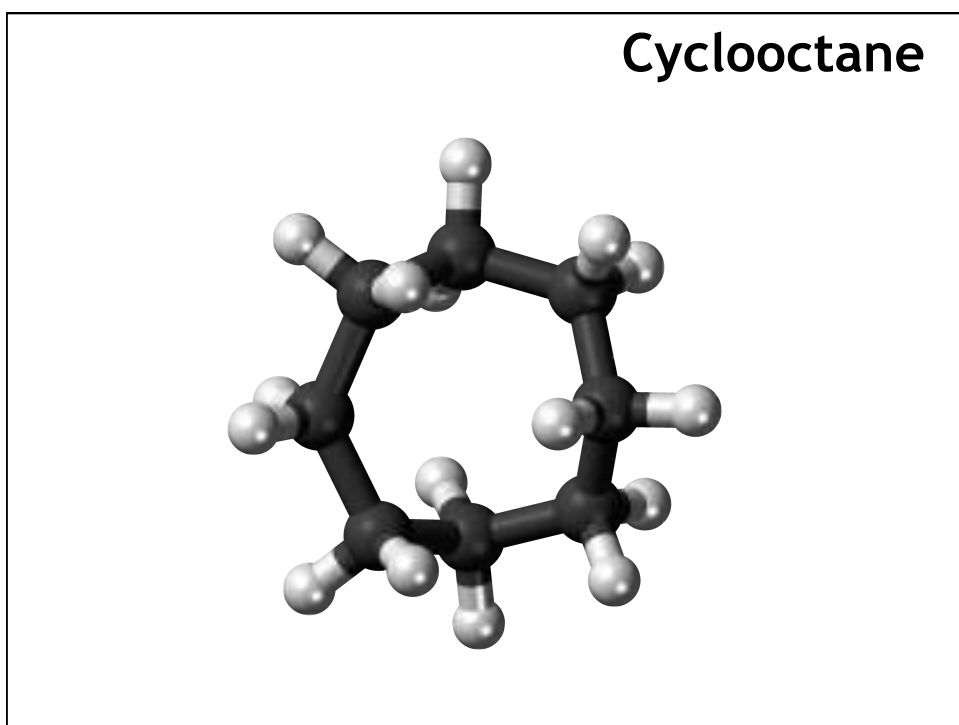
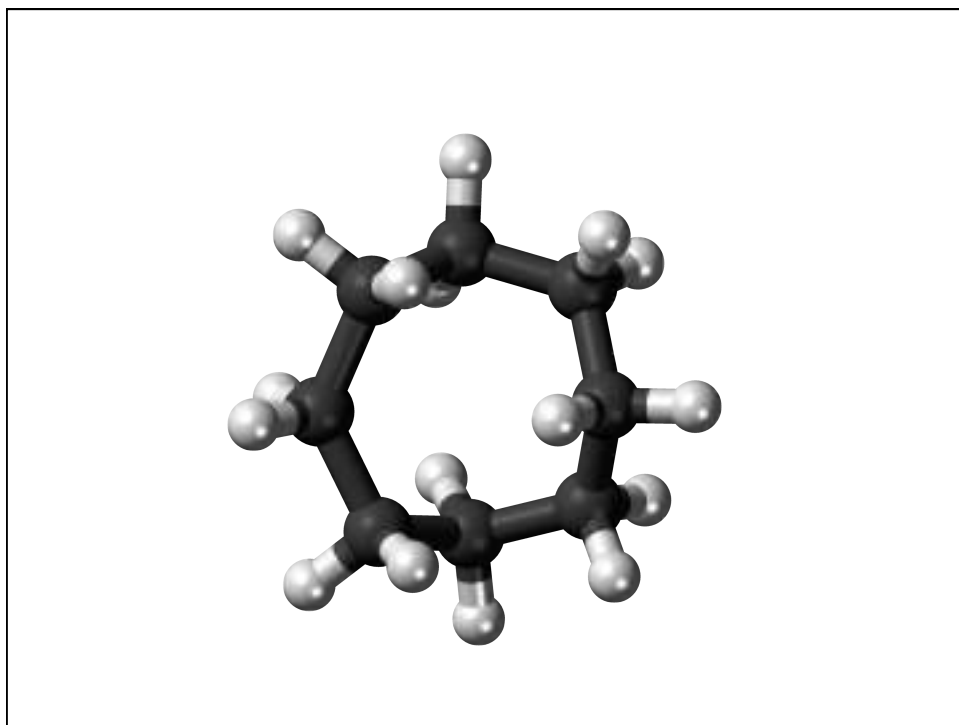


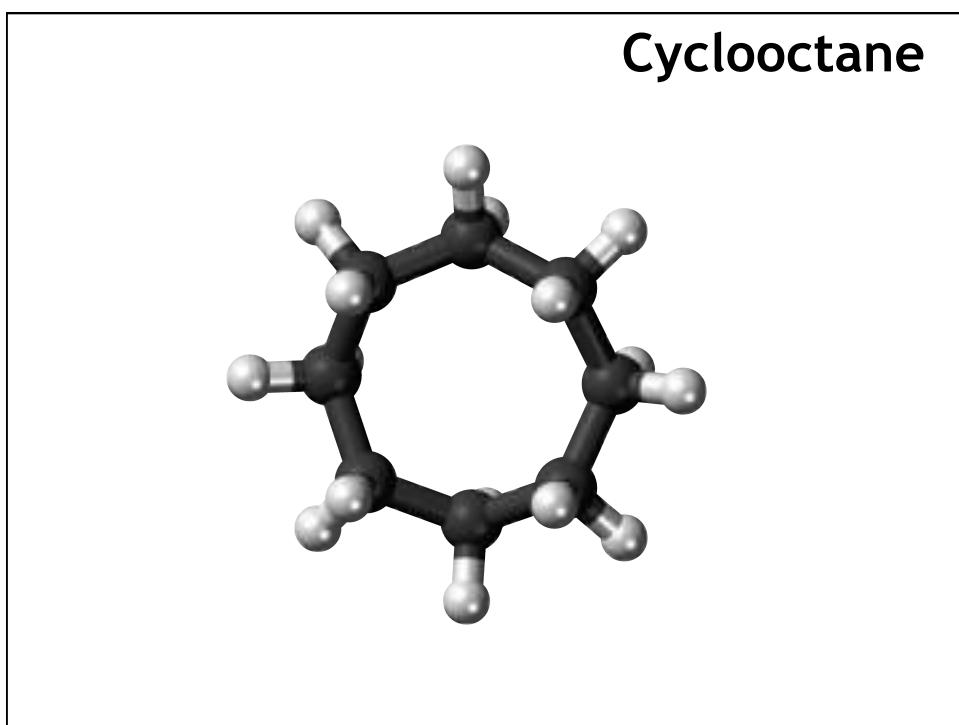
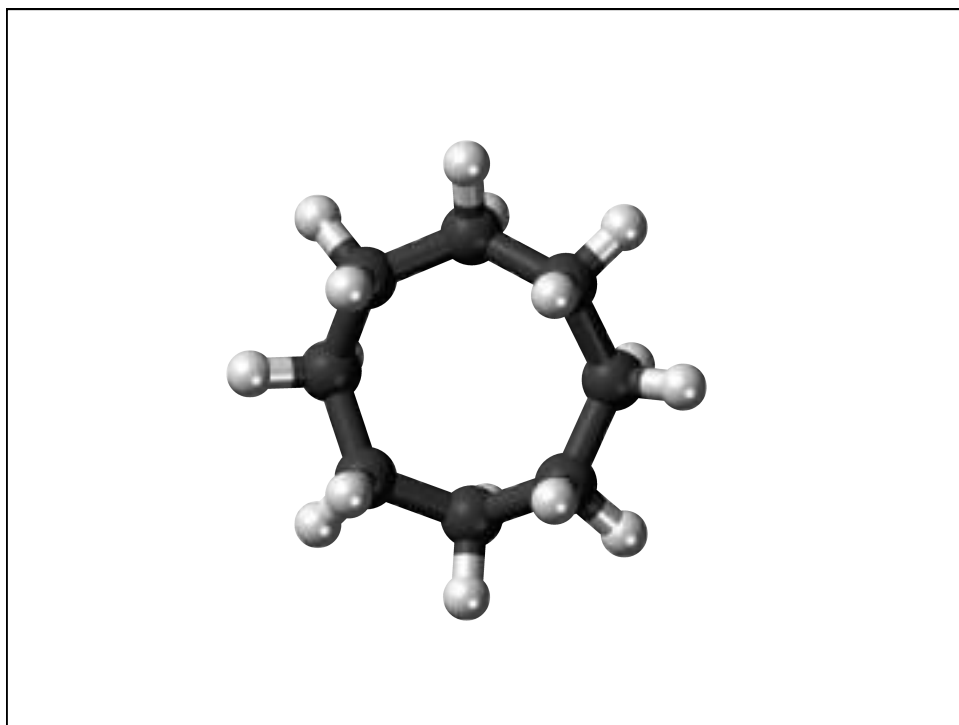
Propane



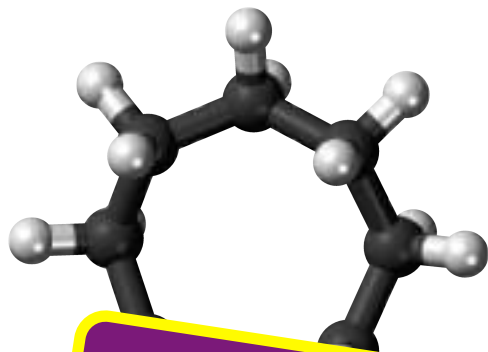
Propane



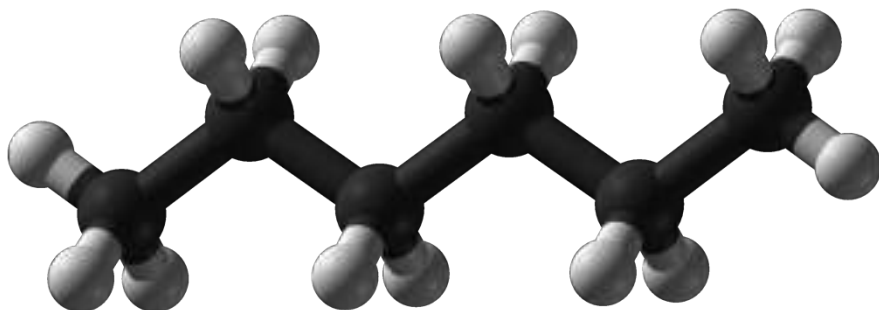




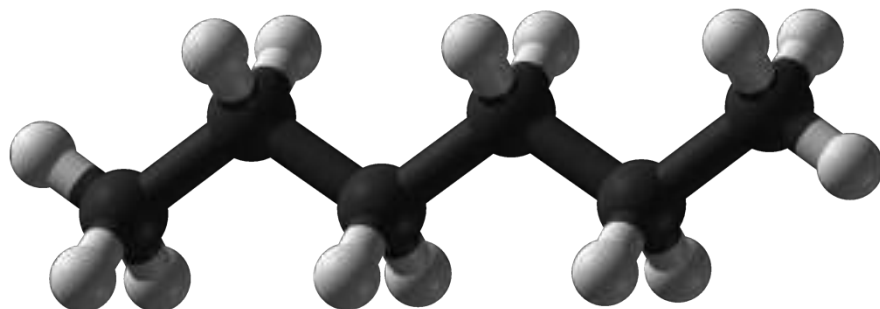
Cyclooctane



Cycloalkane



Hexane



Hexane



Alkane

Some types of alkanes by melting, boiling point

Gas - e.g., methane, propane

Liquid - e.g., hexane, heptane, octane

Wax - e.g., triacontane, pentacosane,
heptatriacontane



1 CH₄ methane
2 C₂H₆ ethane
3 C₃H₈ propane
4 C₄H₁₀ butane

GASES



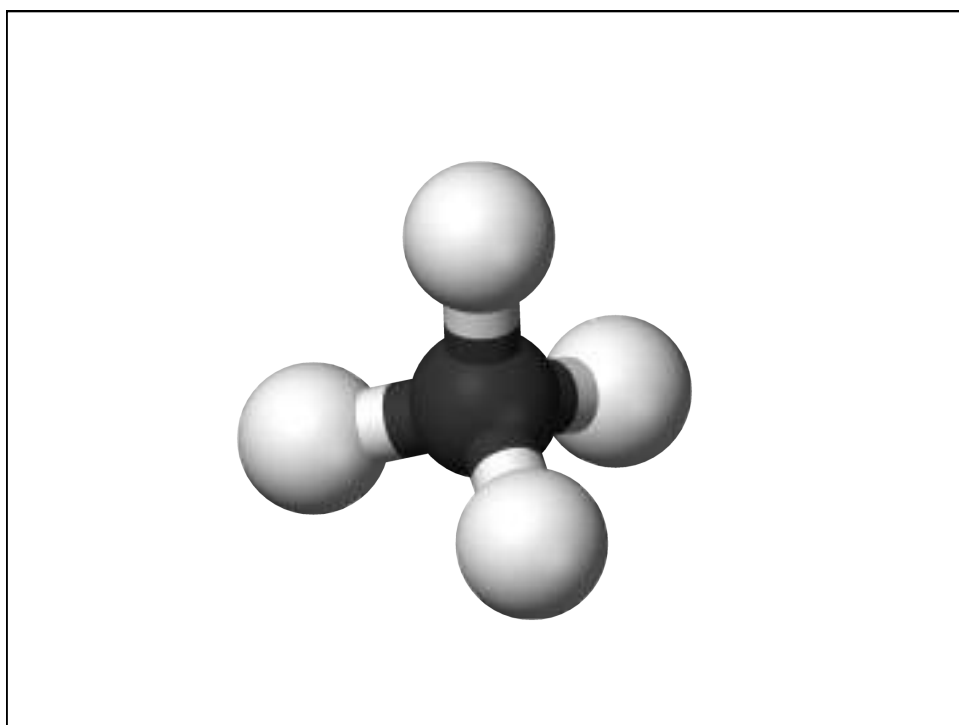
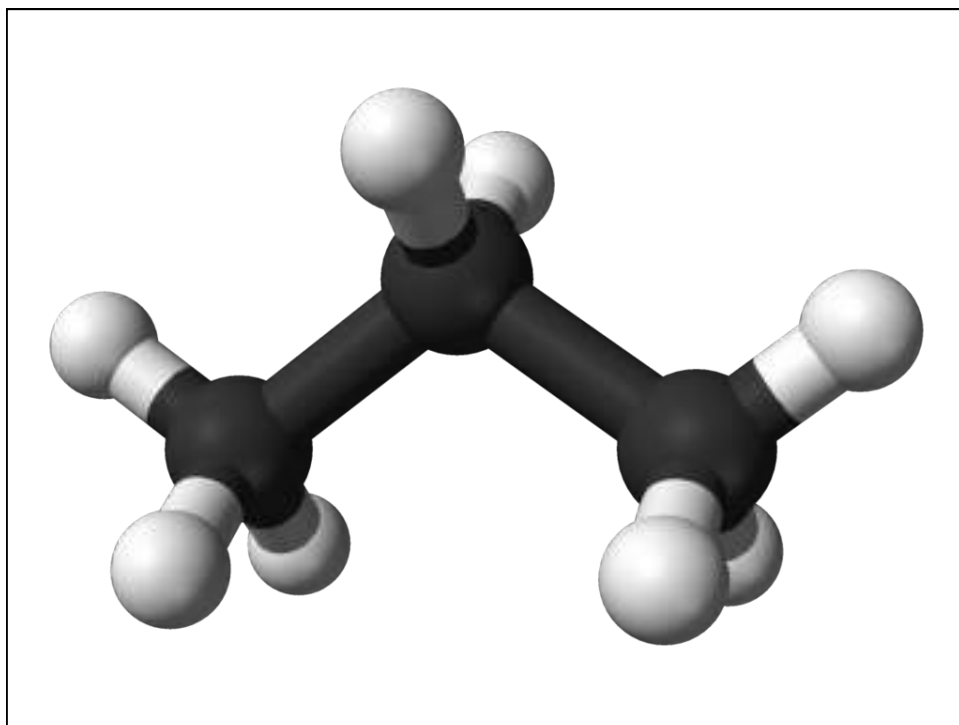
5 C₅H₁₂ pentane
6 C₆H₁₄ hexane
7 C₇H₁₆ heptane
8 C₈H₁₈ octane

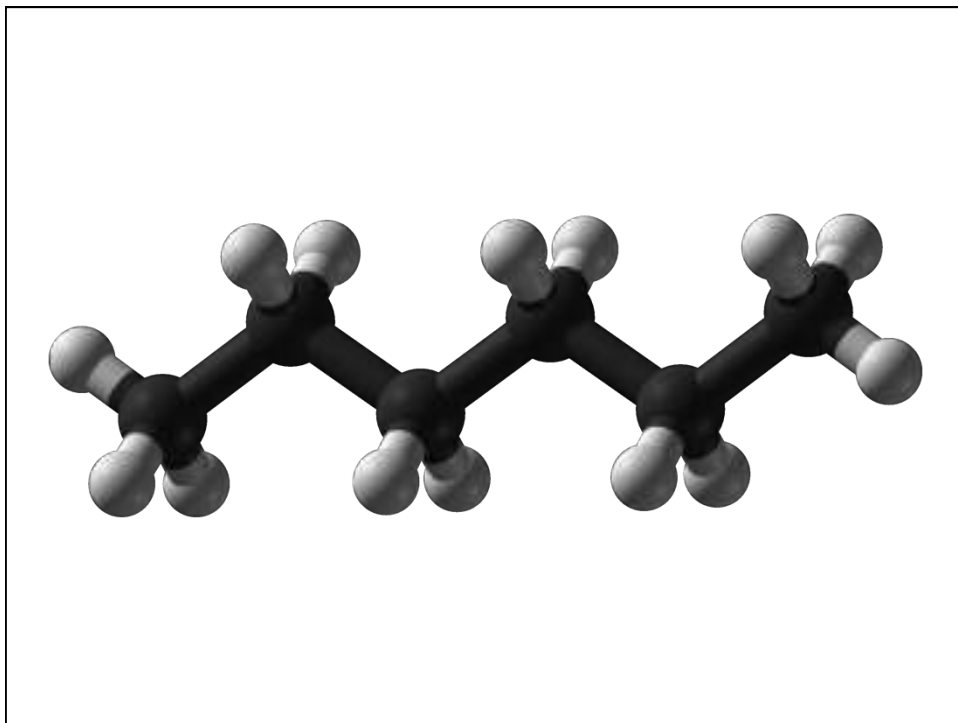
LIQUIDS



9 C₉H₂₀ decane
20 C₂₀H₄₂ icosane
30 C₃₀H₆₂ triacontane
40 C₄₀H₈₂ tetracontane

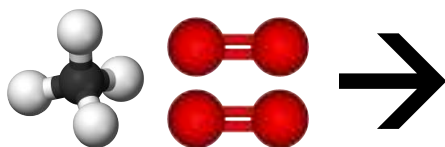
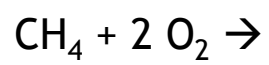
WAXES





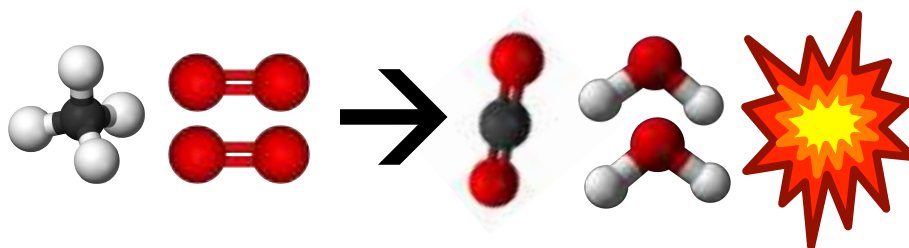
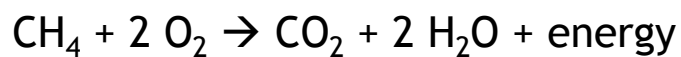
Combustion of hydrocarbons

Combustion of methane:



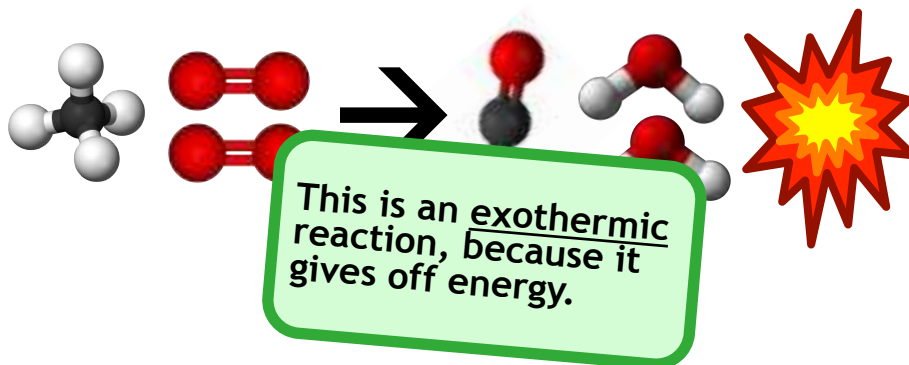
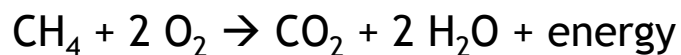
Combustion of hydrocarbons

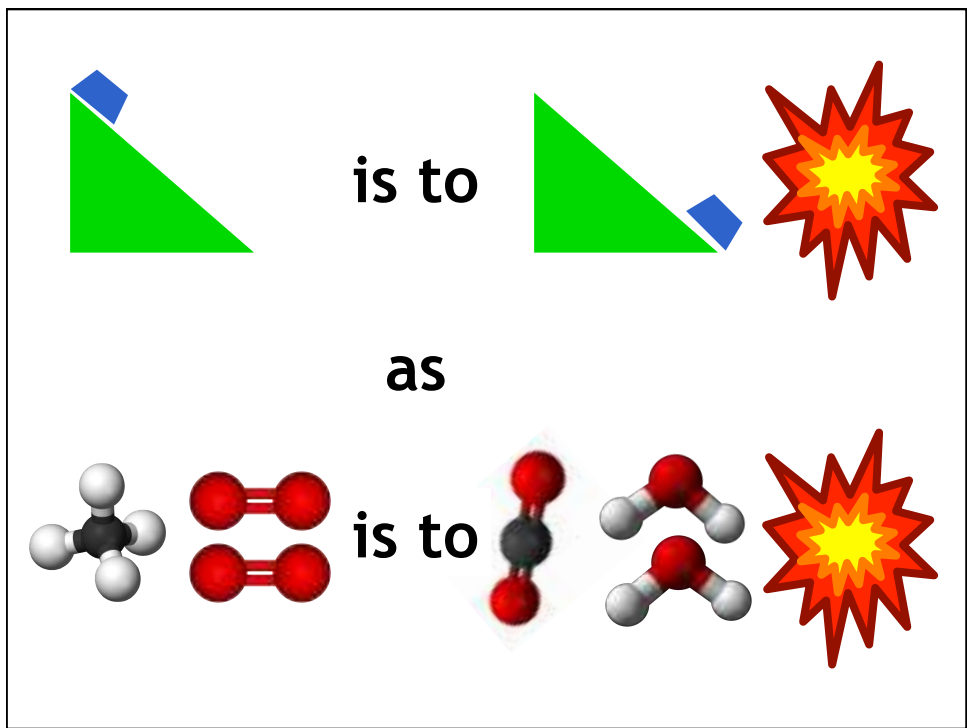
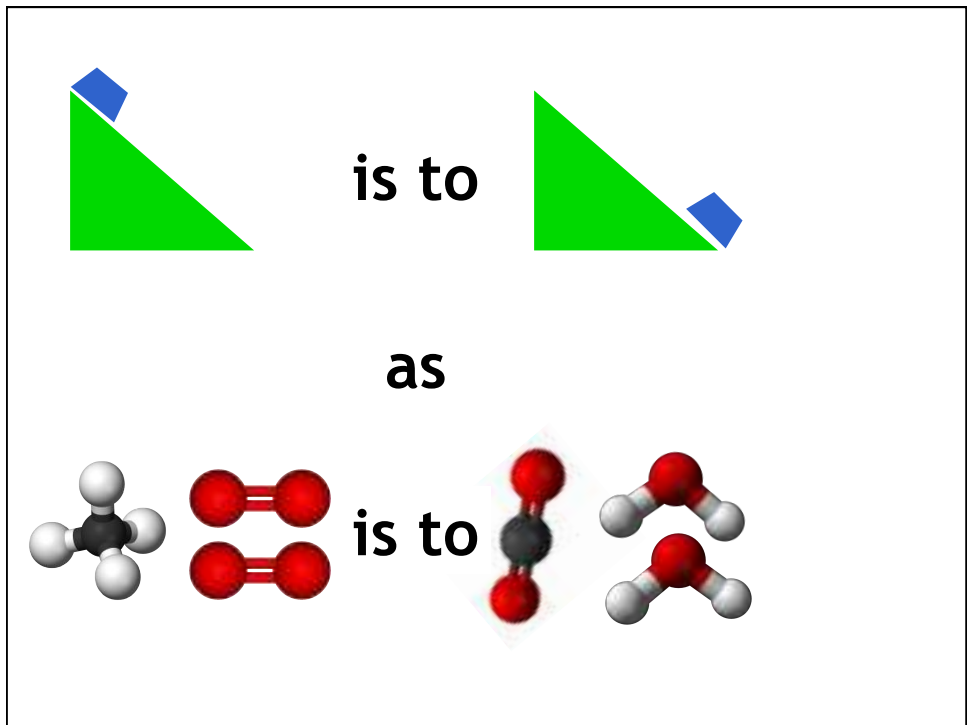
Combustion of methane:



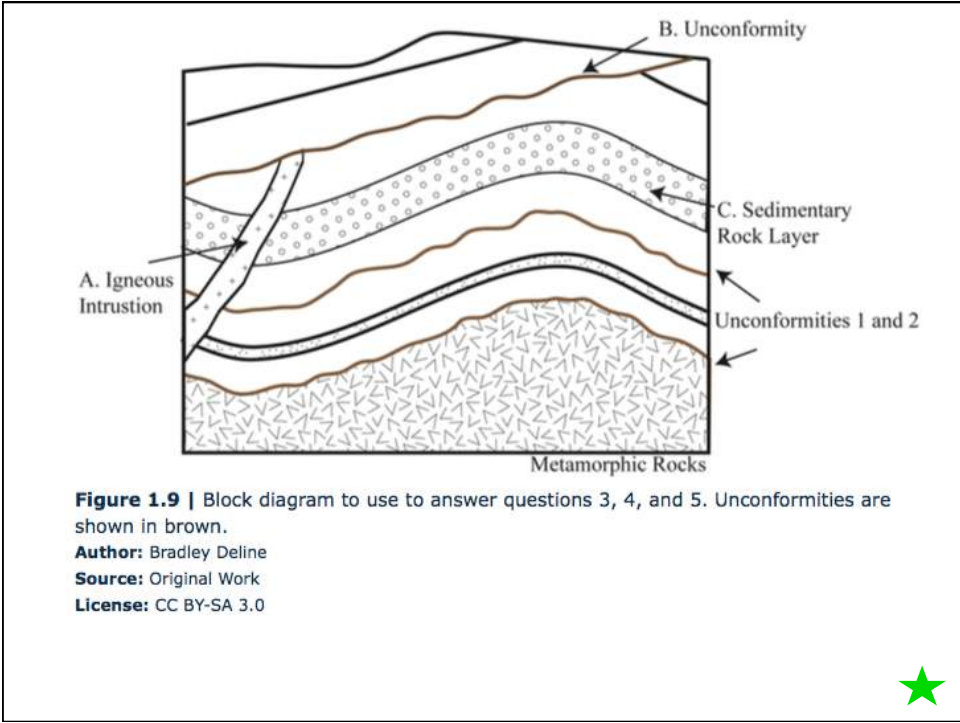
Combustion of hydrocarbons

Combustion of methane:





GEOLOGY



3. In Figure 1.9, which of the following geologic structures is the **youngest**?

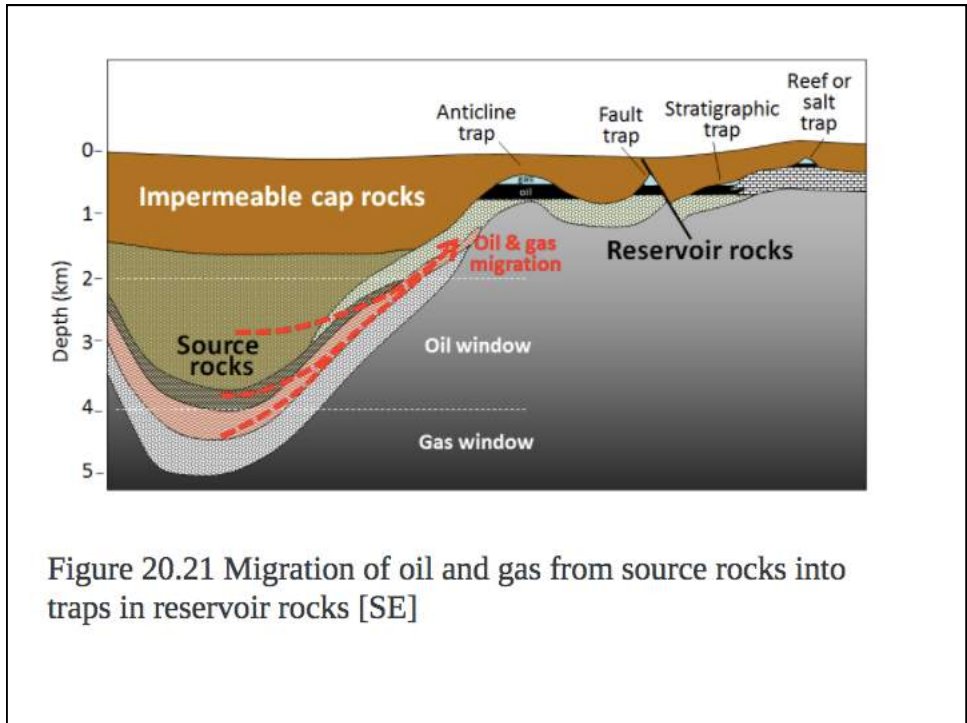
a. A b. B c. C

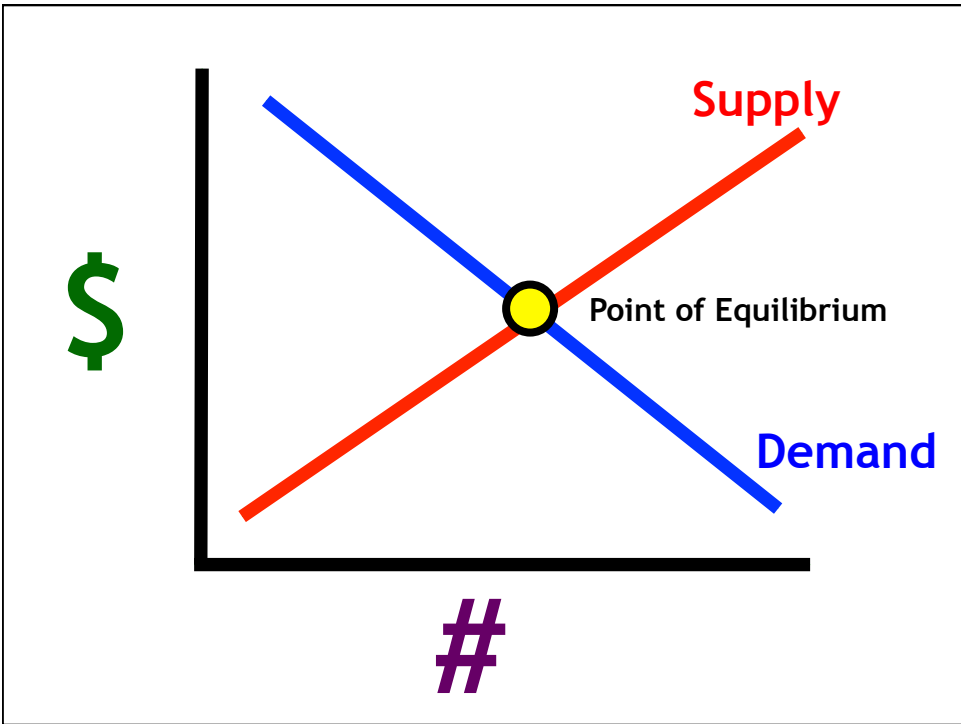
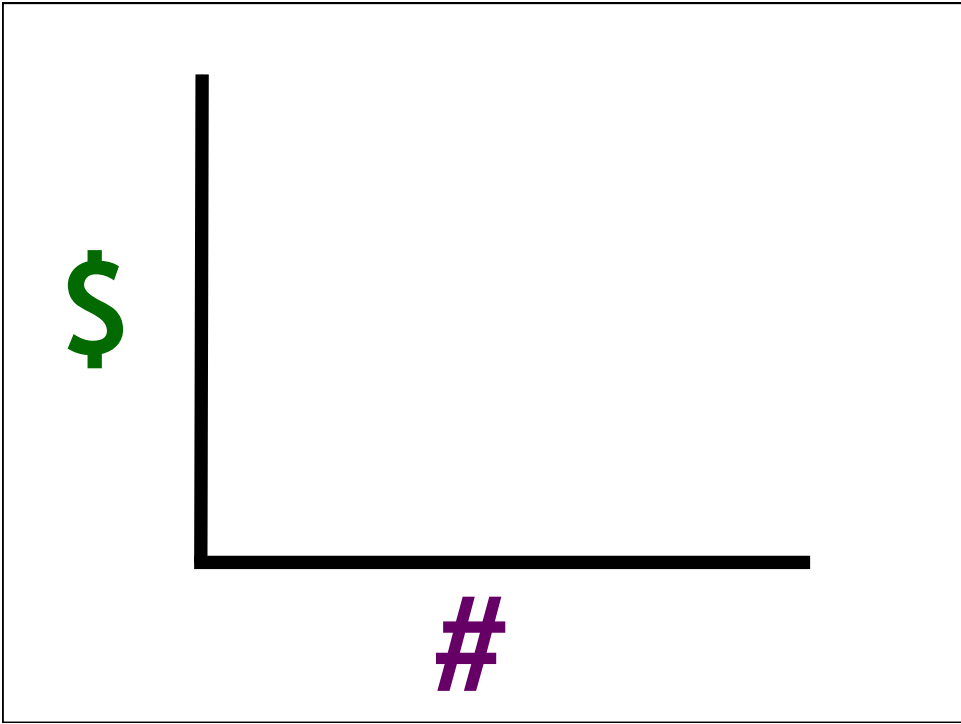
★

4. Which Geologic Law did you use to come to the conclusion you made in the previous question?

a. The Law of Superposition b. The Law of Cross-Cutting
c. The Law of Original Horizontality d. Unconformities

★



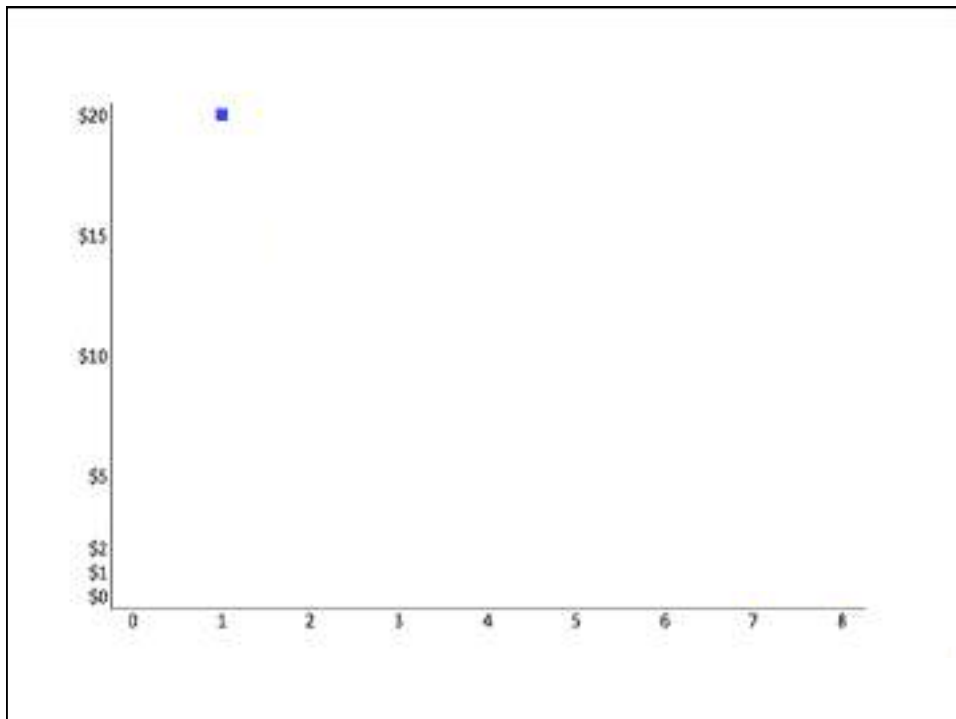


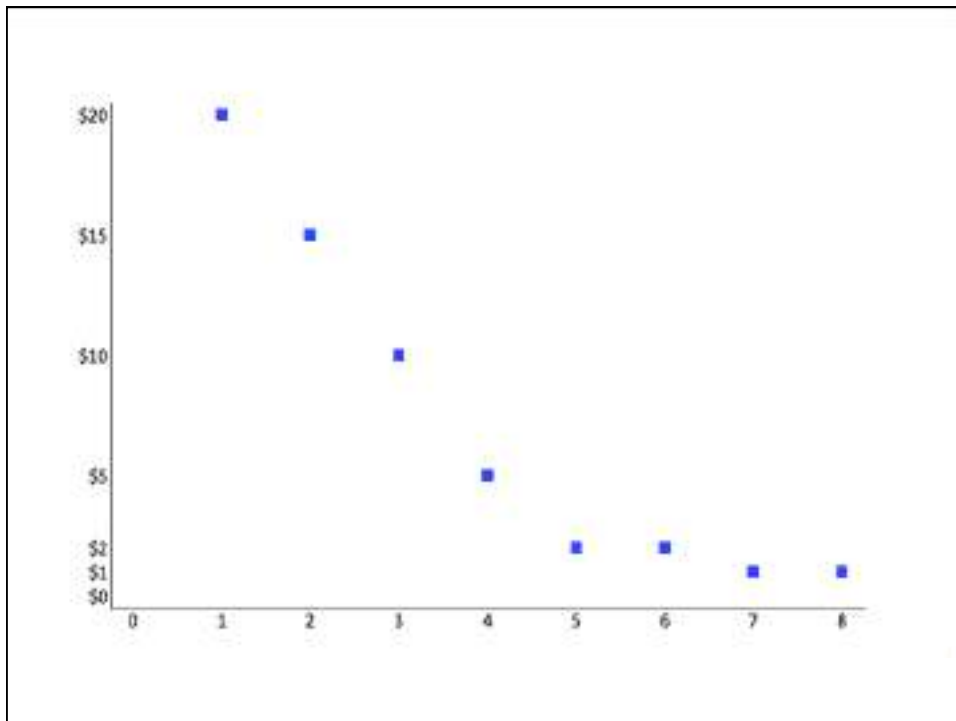
Example: Windchimes in Wendover on Wednesday

An economy with just eight people and one day:

- Allen, who adores windchimes and would pay \$20 for one.
- Bonnie, who thinks windchimes are okay, and would pay \$15 for one.
- Chuck, finds windchimes uncharming, but he would buy one at \$10 just to have the option of annoying his neighbor, Darla, if Darla's incense burning was annoying him.
- Darla hates windchimes and she would only pay \$5 for one, which she could use for smashing with a hammer to let off steam. If the price were \$2, she'd buy two. For \$1, she'd get up to 5 and smash them all.
- Wendy, loves making wind chimes, and she's good at it. She can churn out two out for \$5 each.
- Xavier likes making things out of metal and clay. It would be worth it for him to make one set of windchimes if it could fetch \$10.
- Yvonne like playing video games and not working. It would only be worth it for her to make one set of windchimes if she got \$15 for it.
- Zendaya is a successful celebrity actor and singer. For it to be worth it to her to make windchimes, she'd have to be paid \$20 each, and even then she'd mostly do it for Instagram value. But she's a fast worker, so she could make four.

What is the efficient number of windchimes for this society to produce?



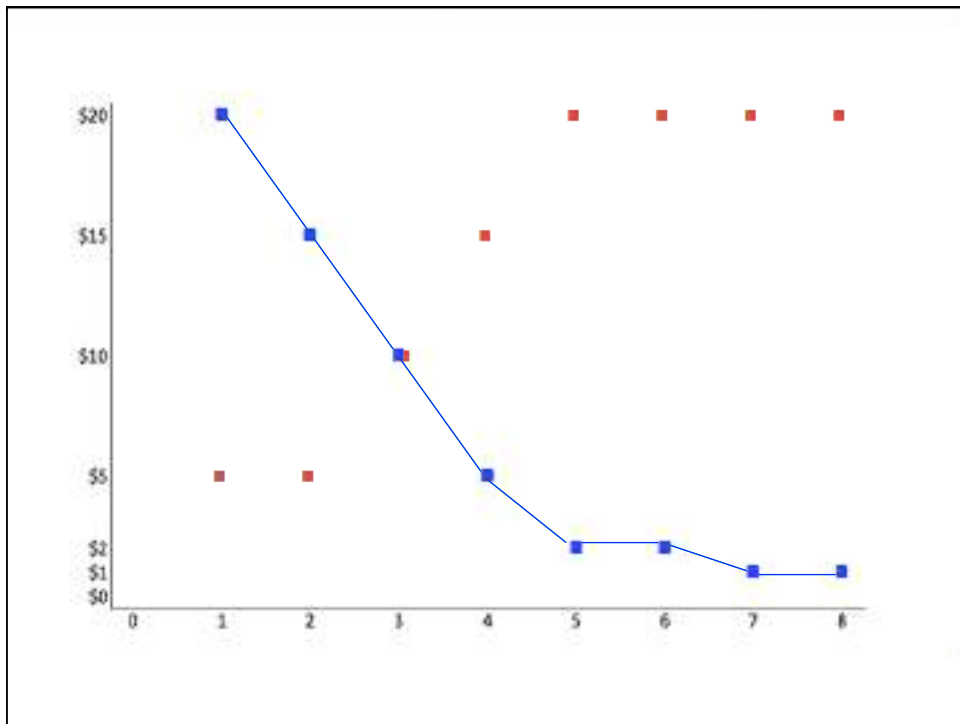
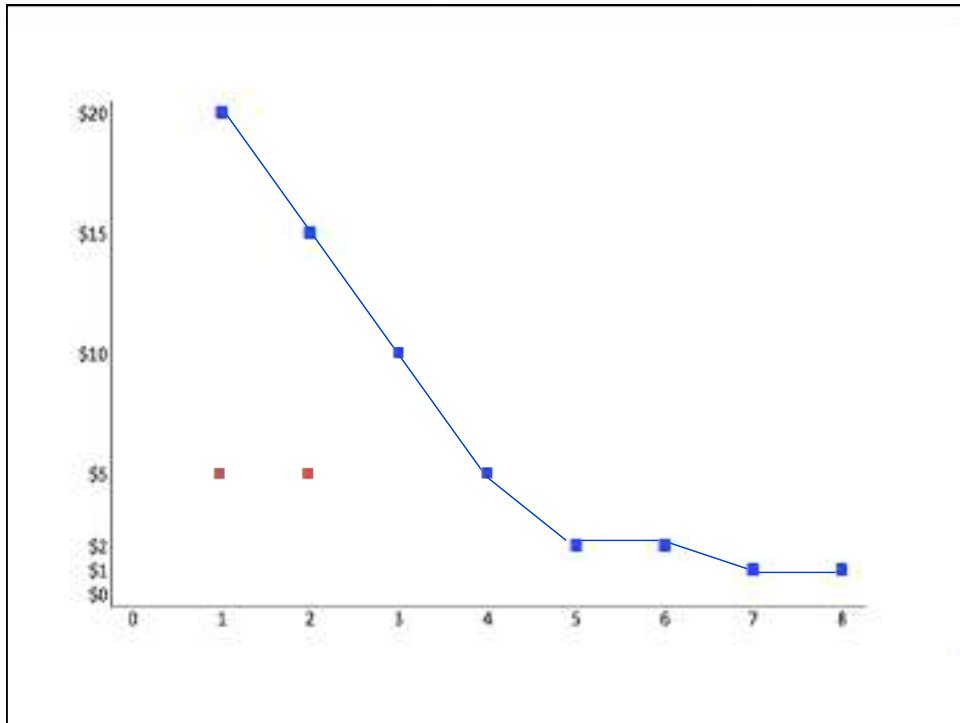


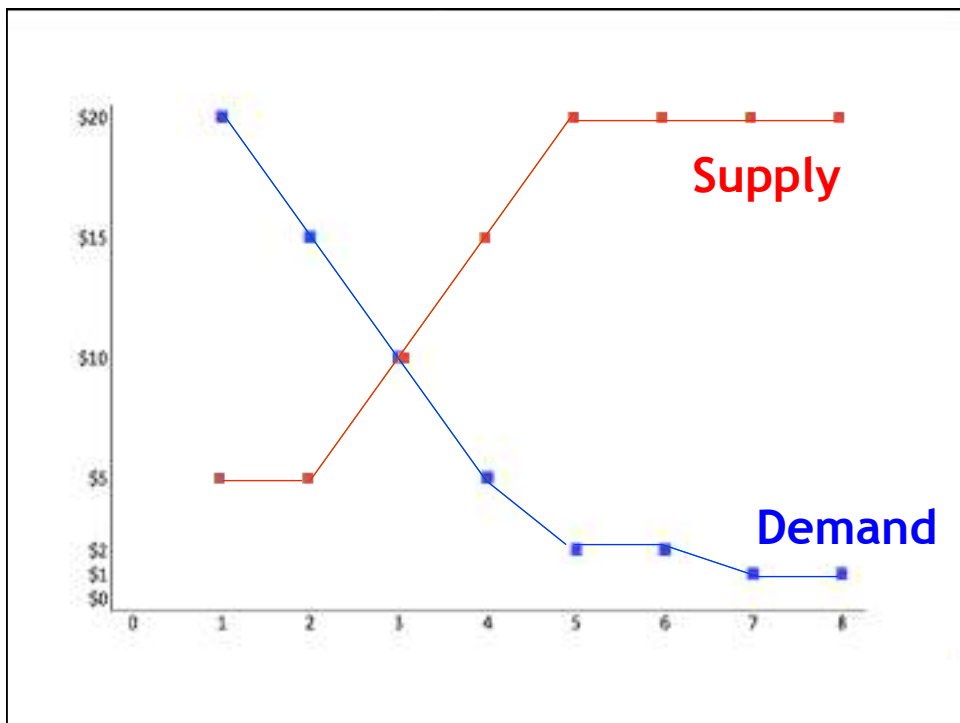
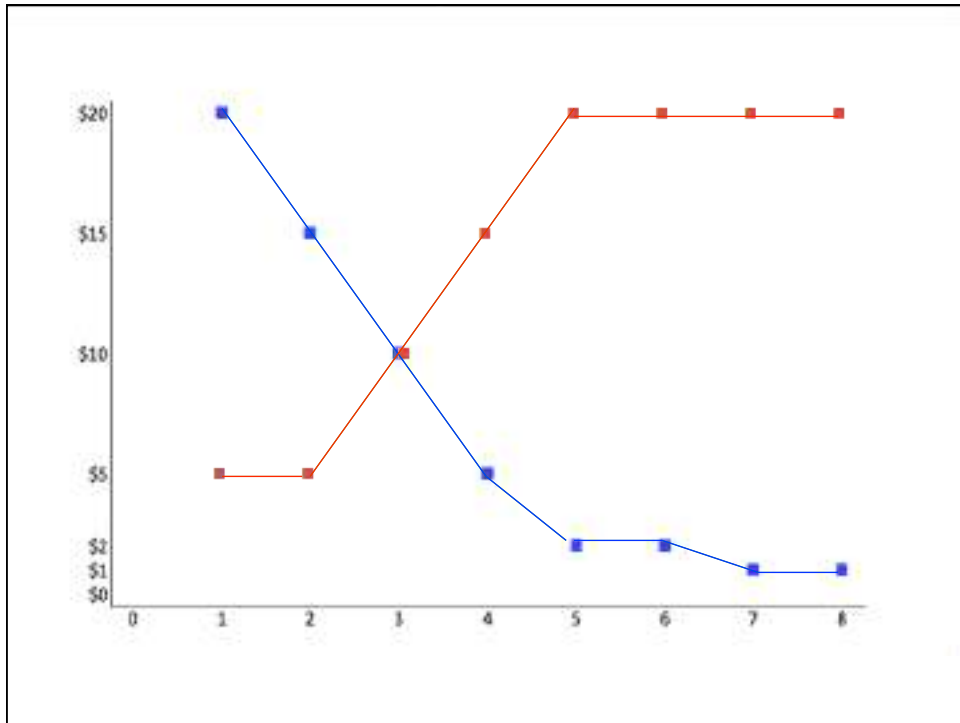
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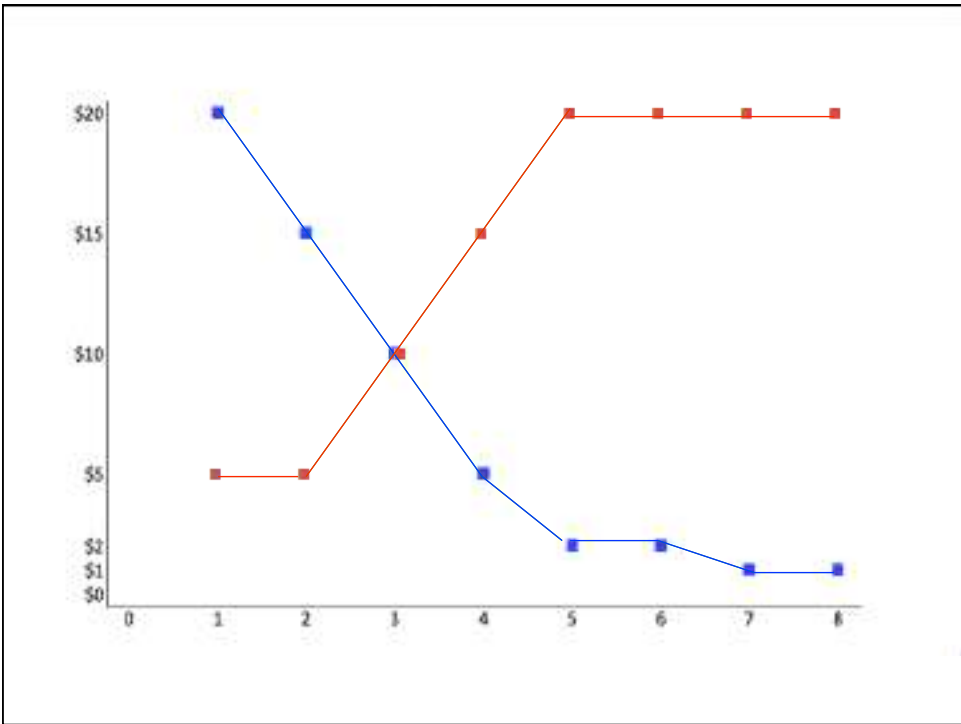
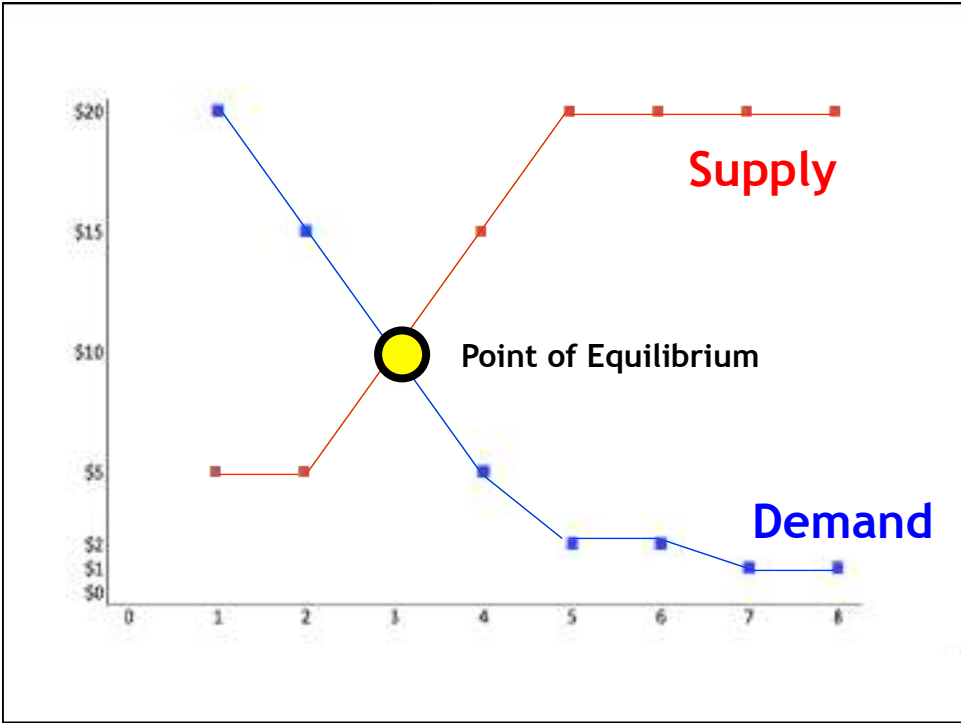
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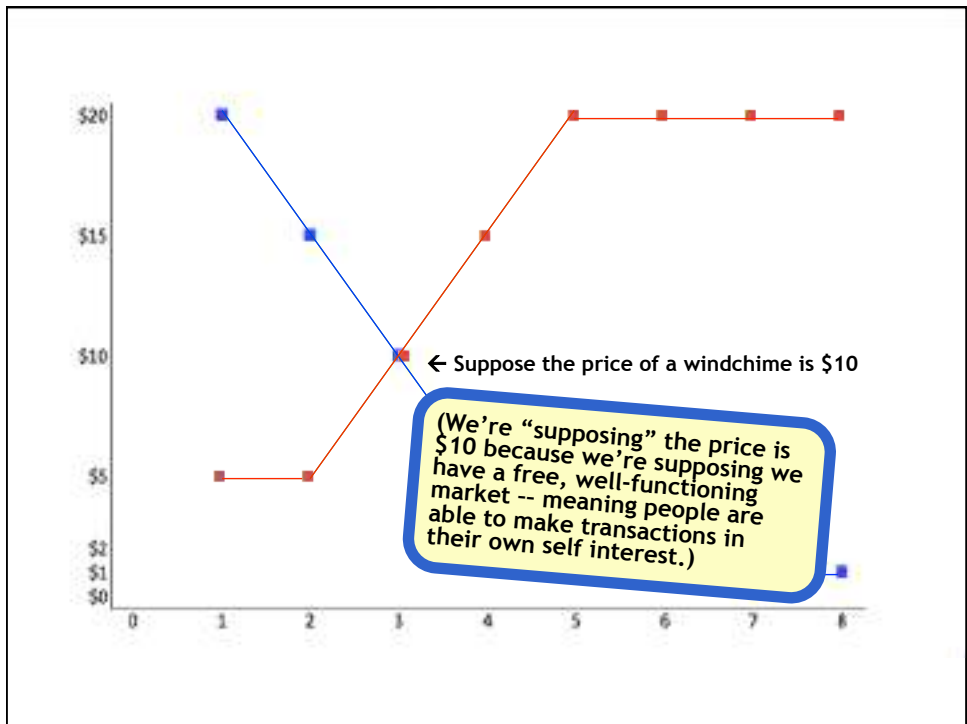
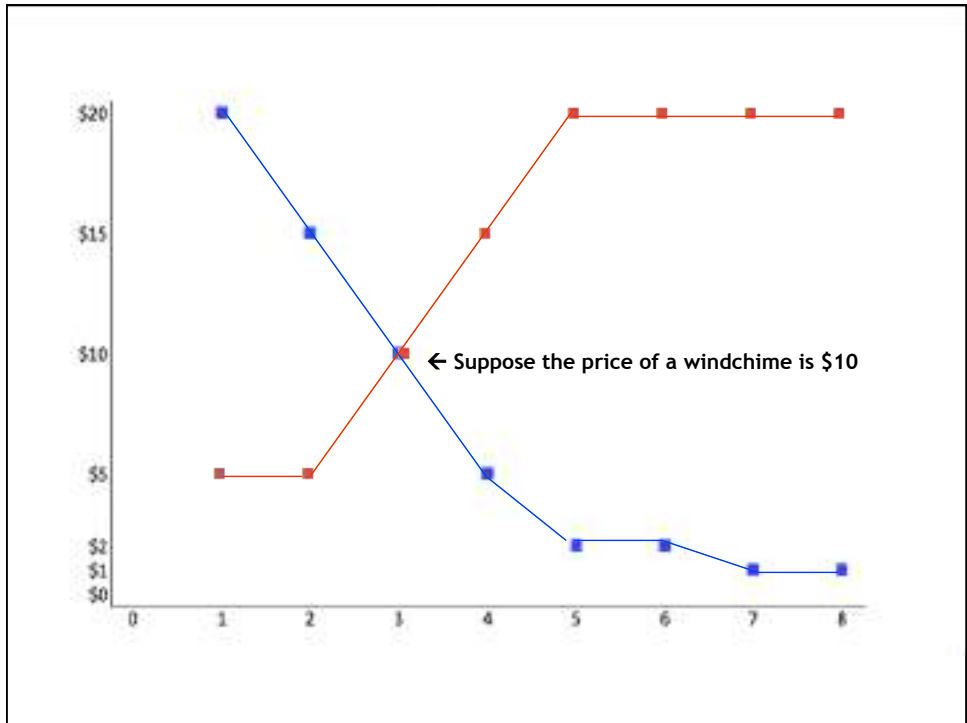
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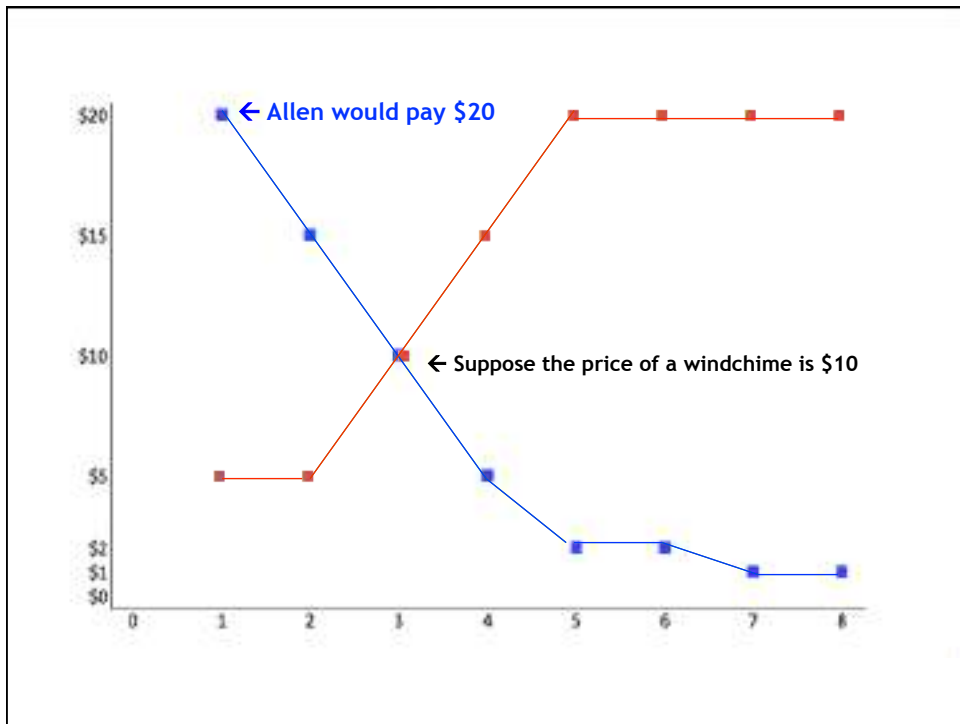
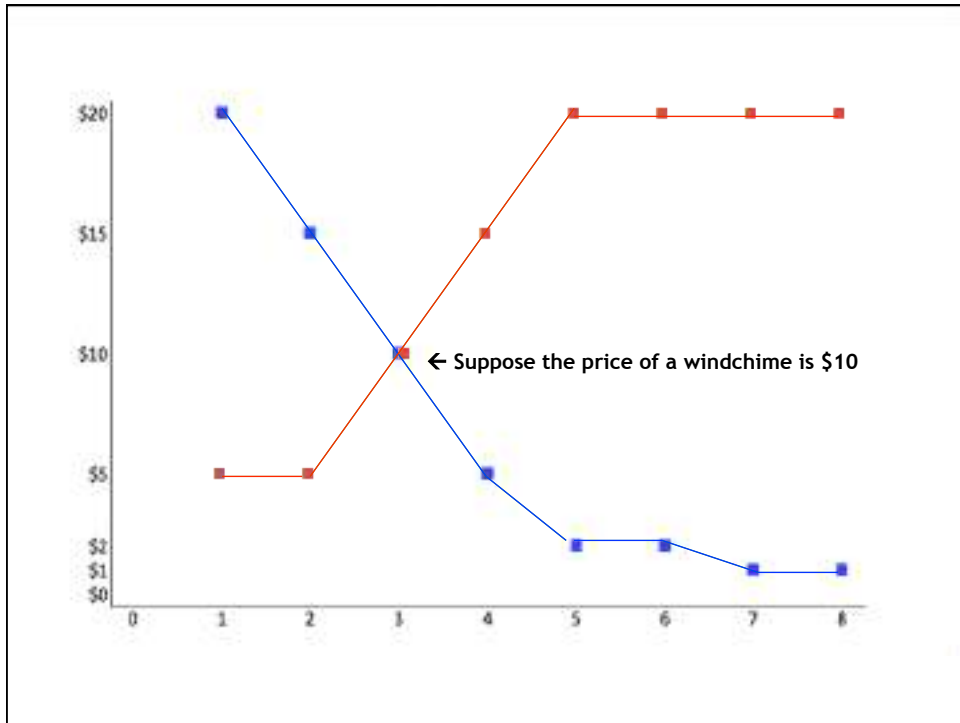
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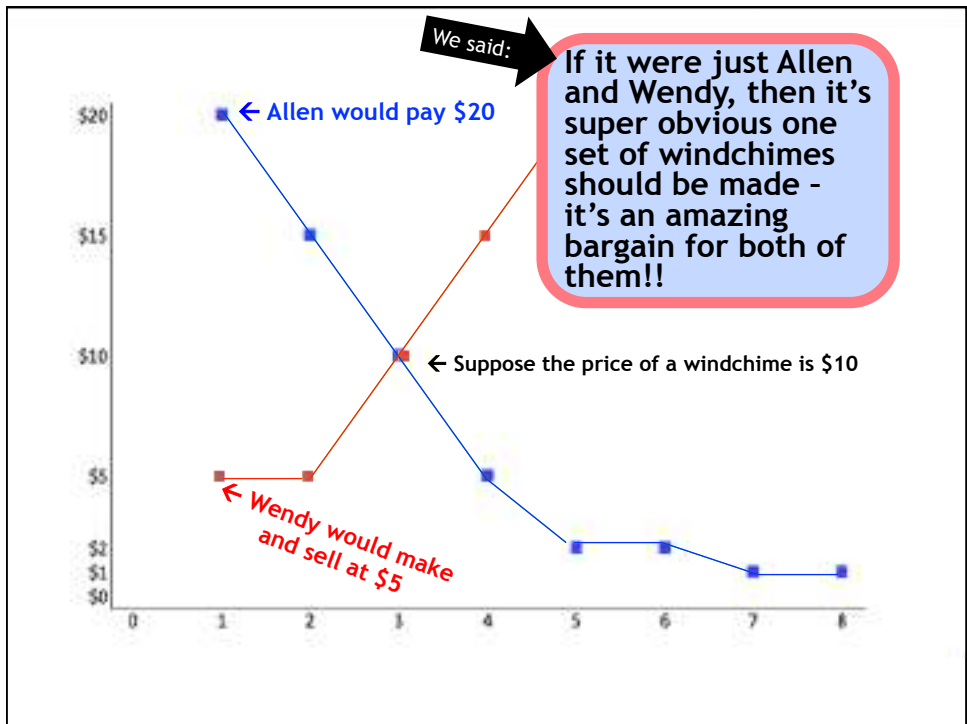
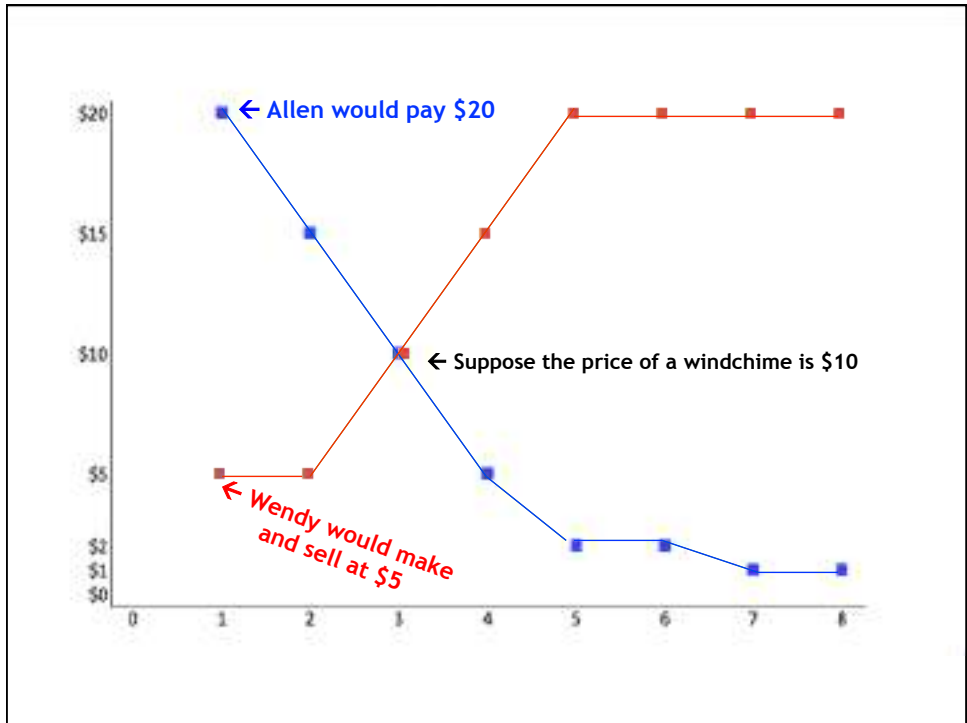


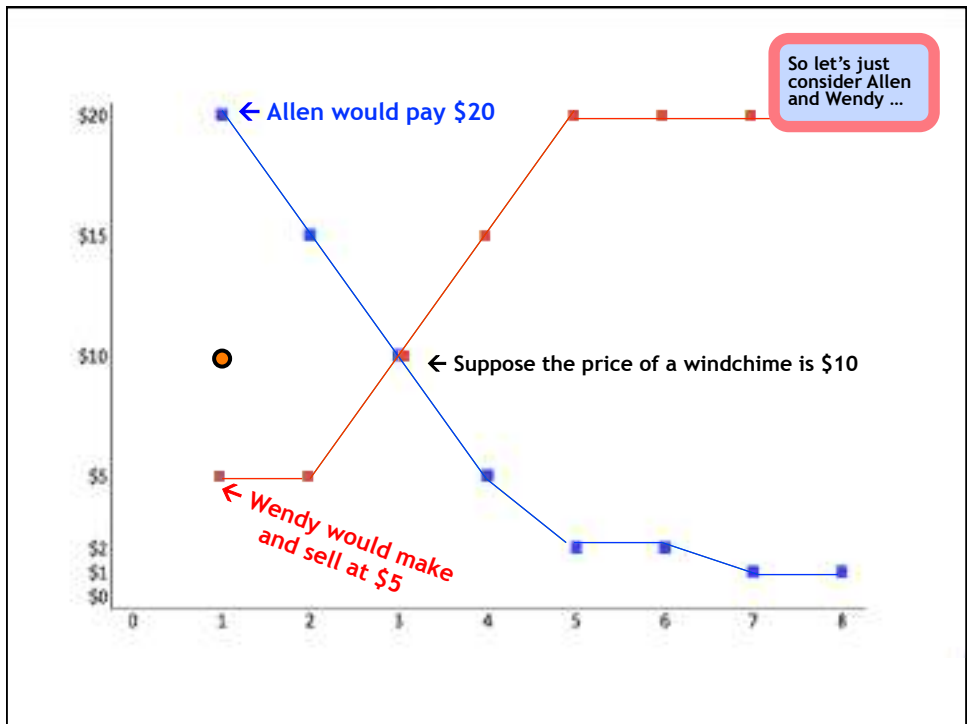
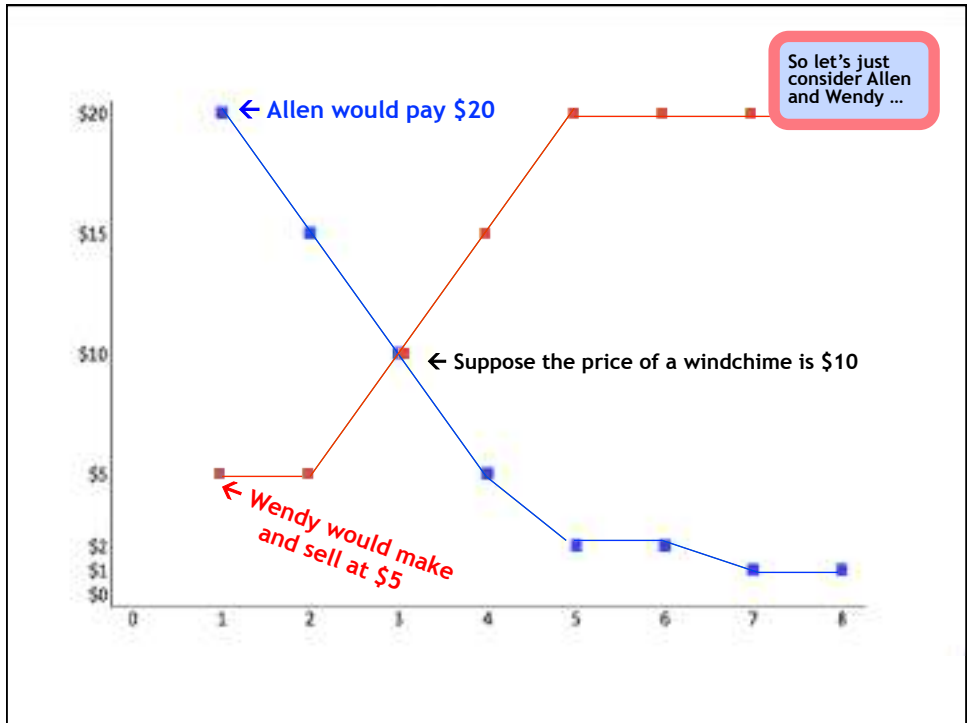


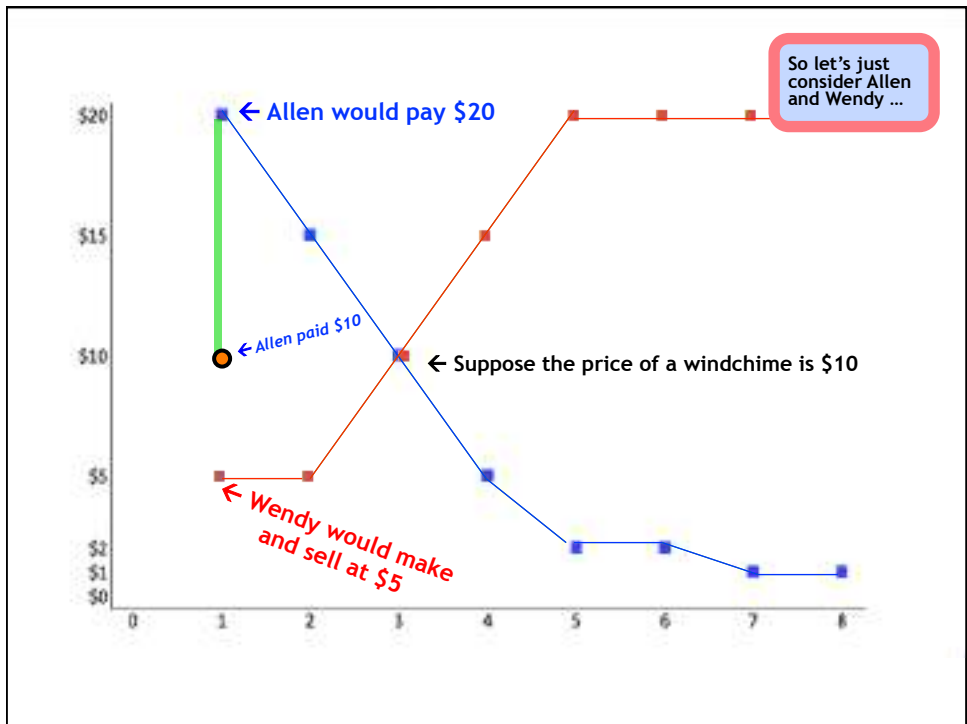
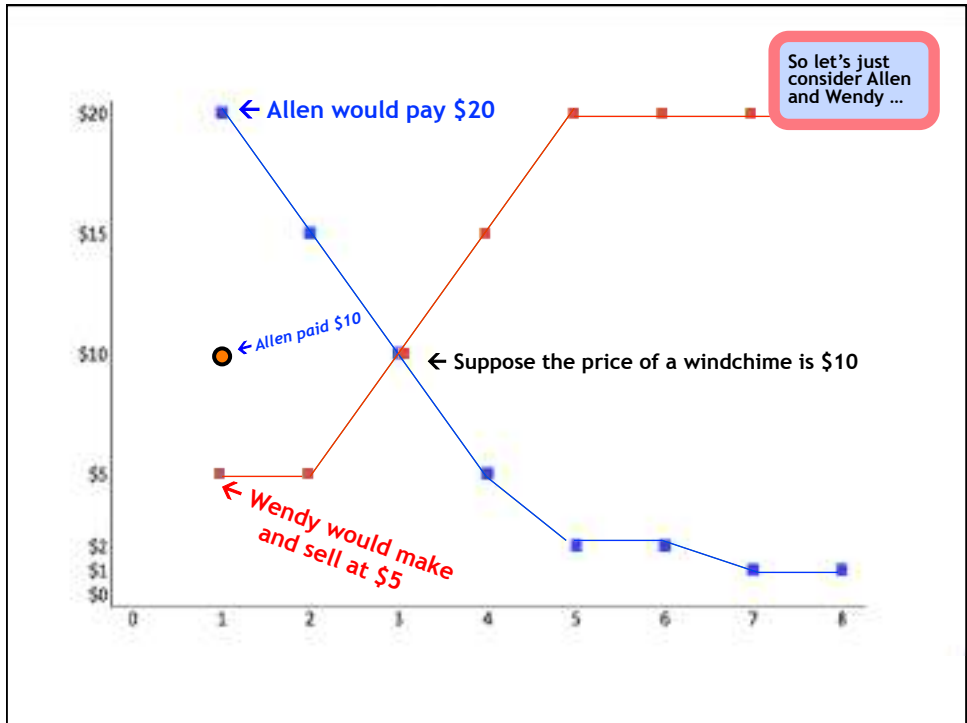


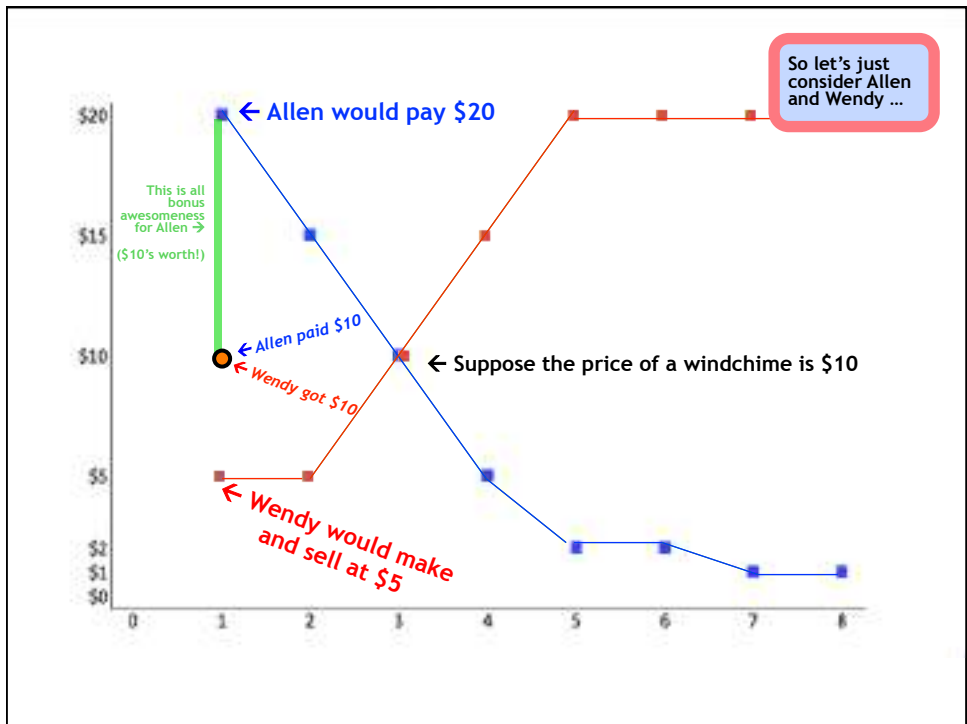
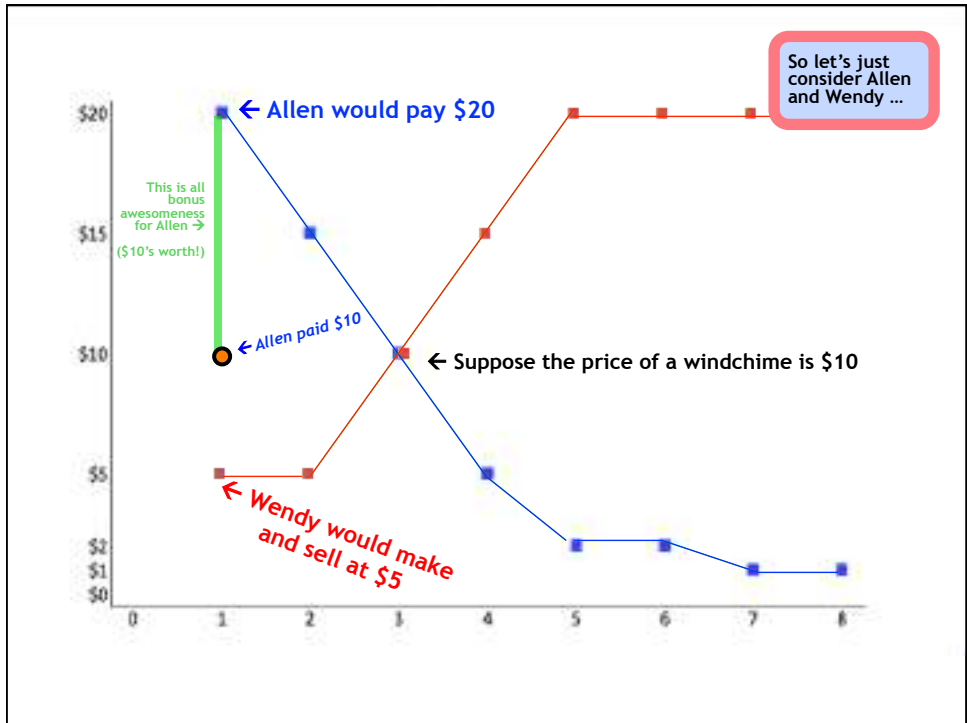


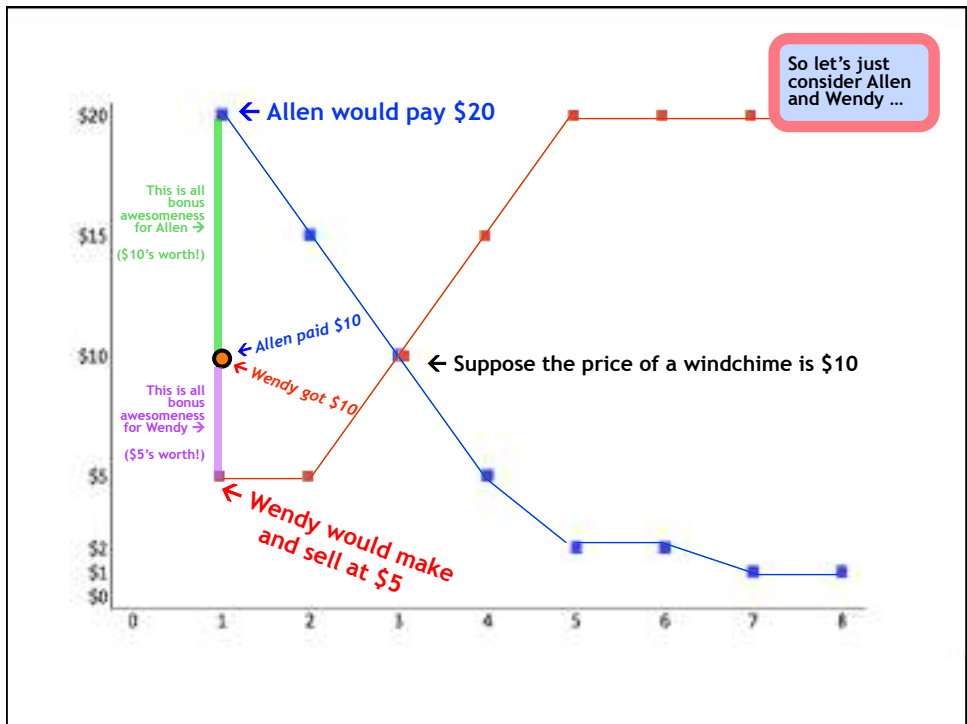
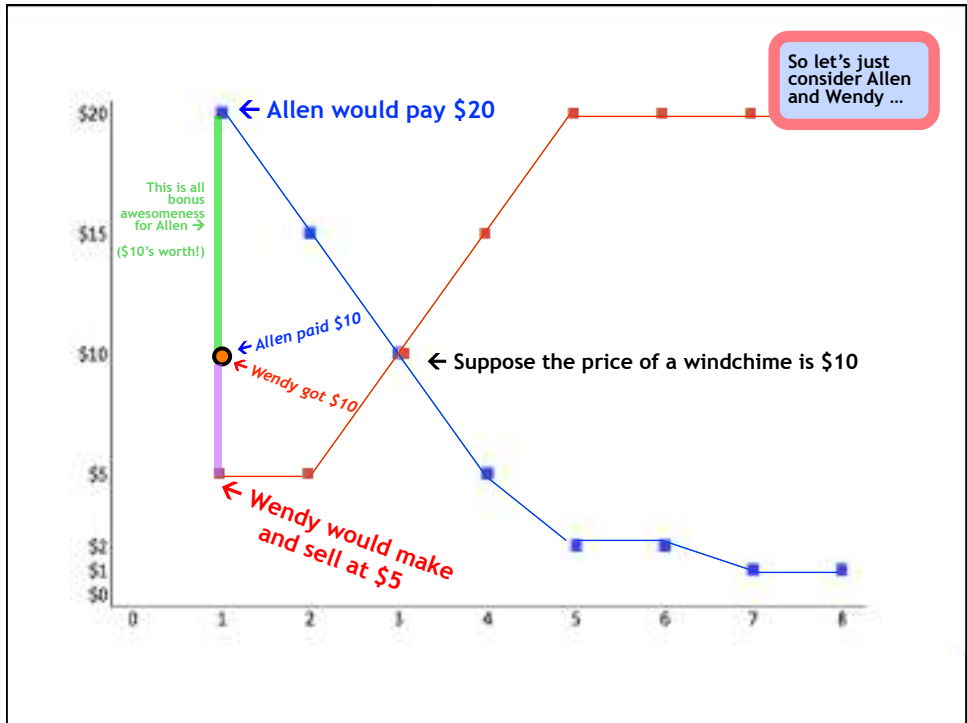


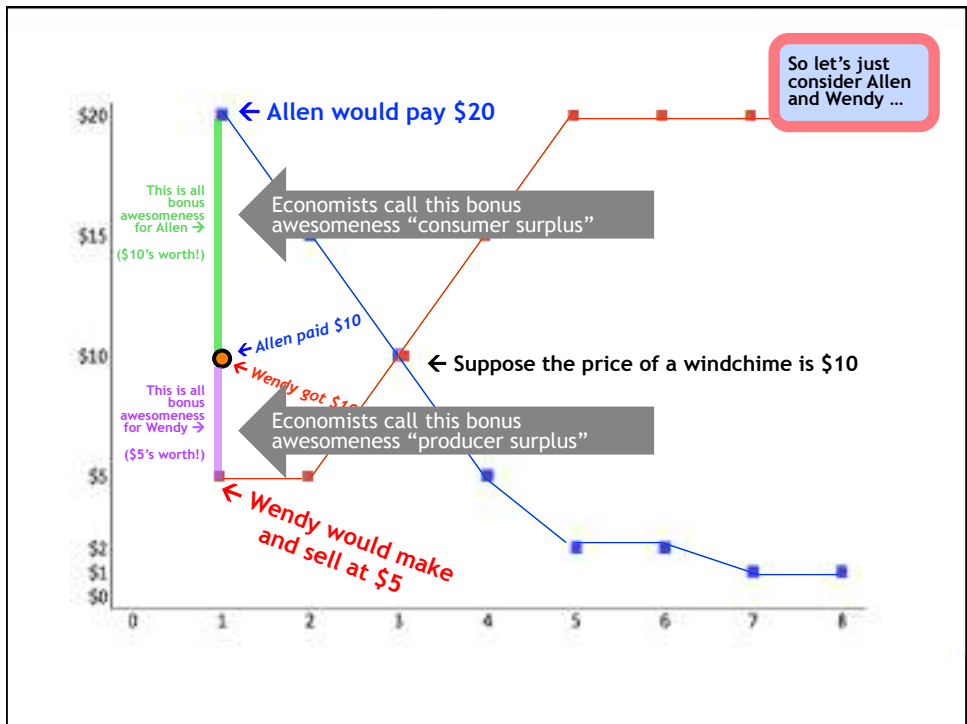
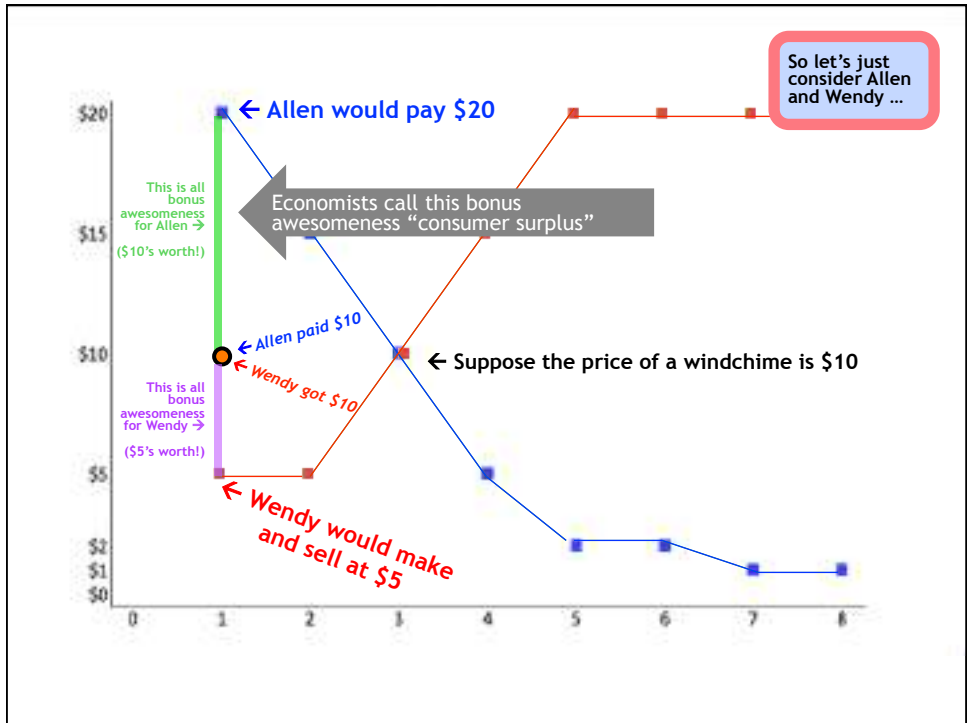


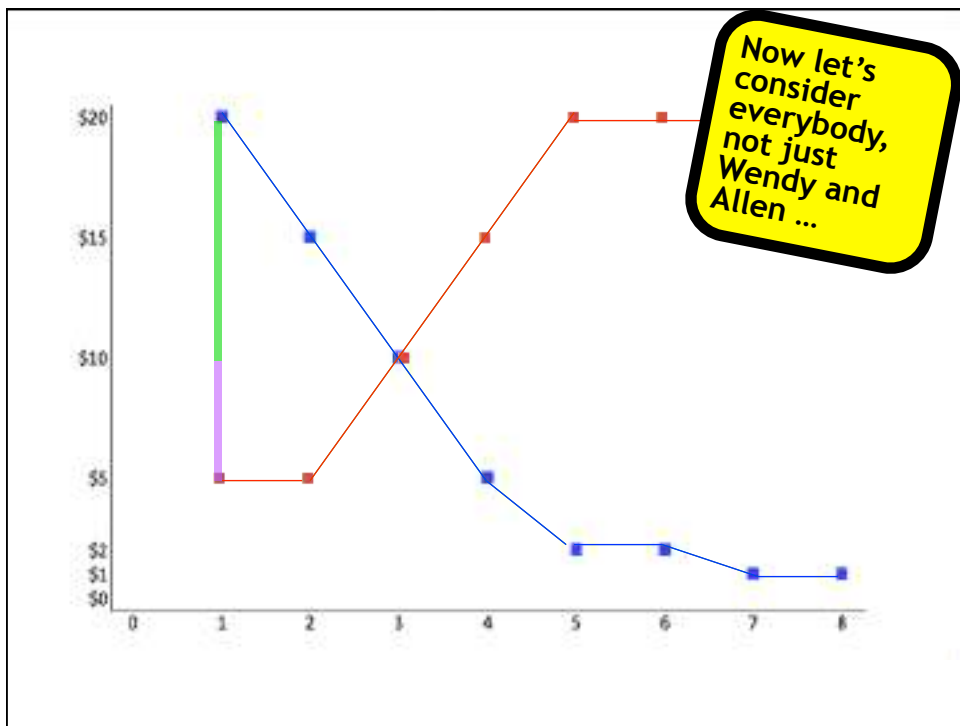
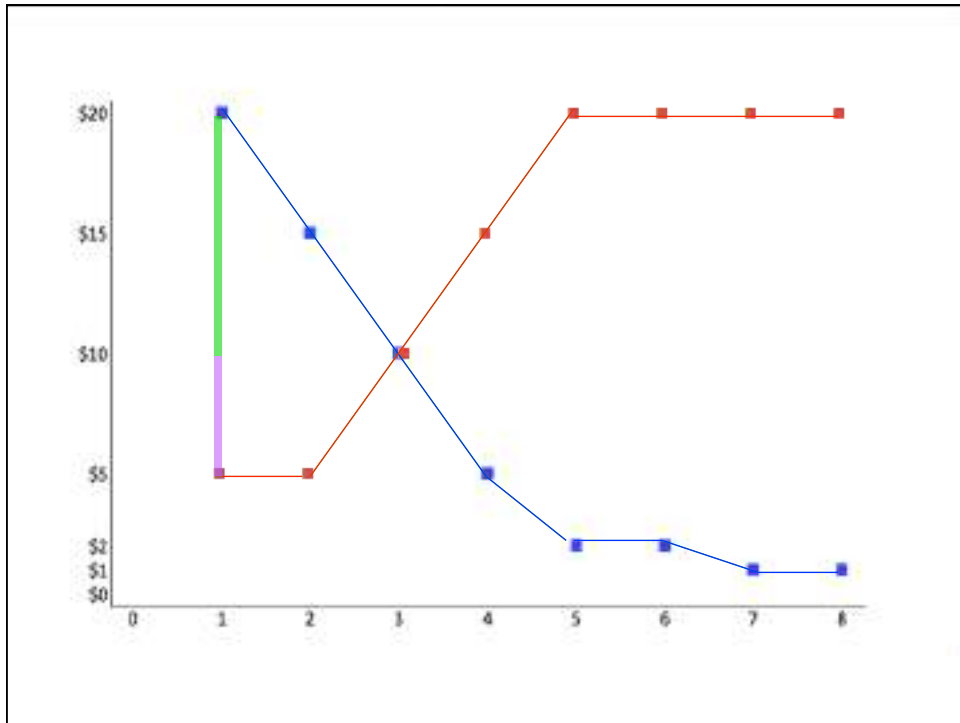


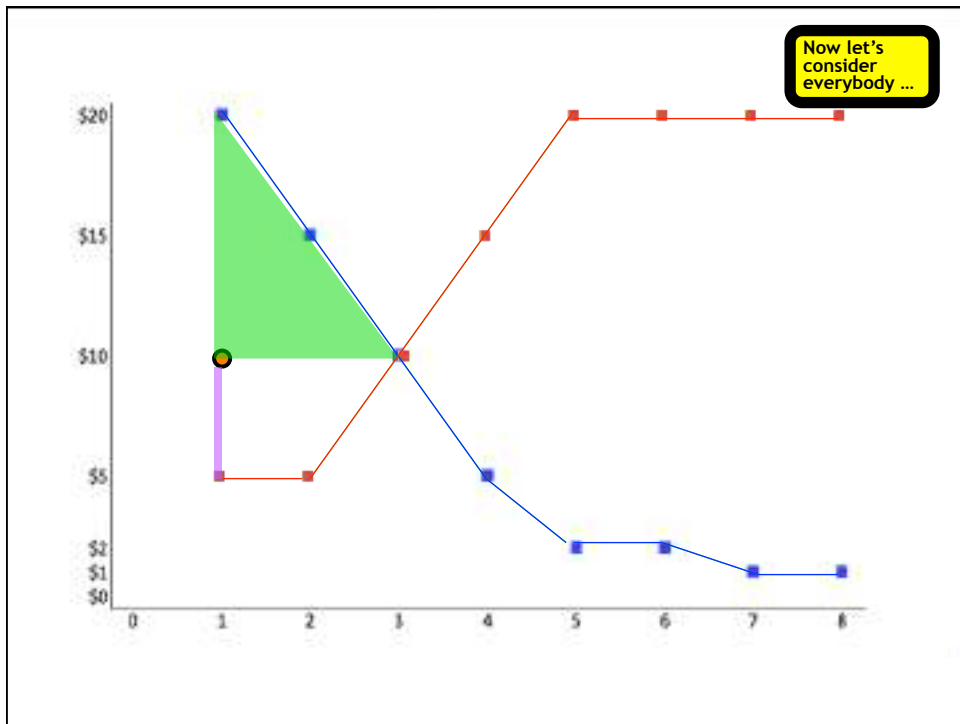
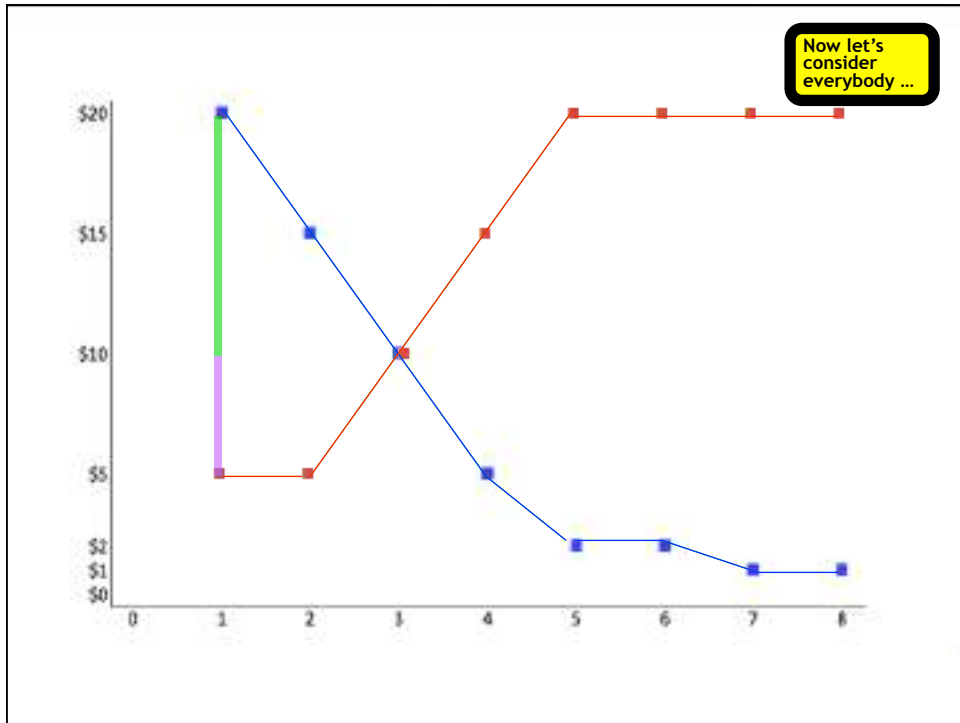


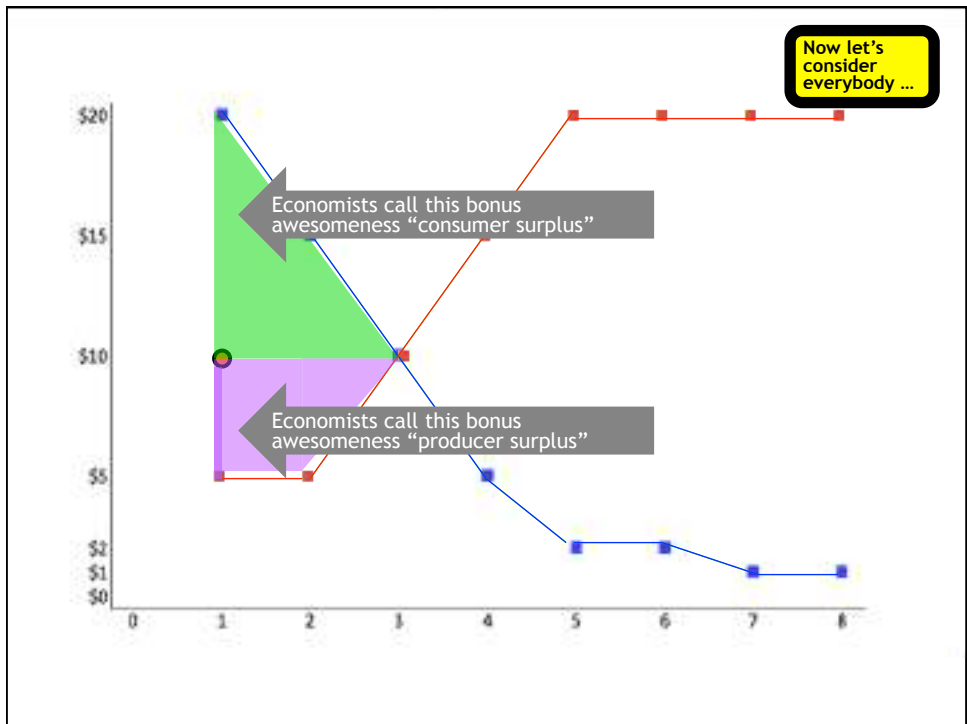
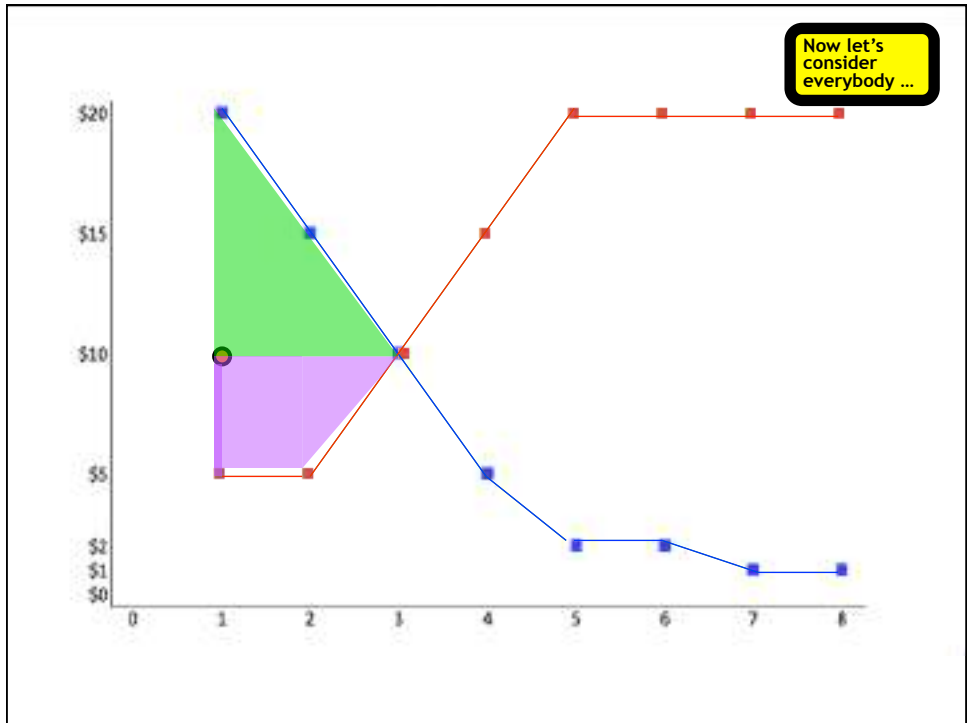


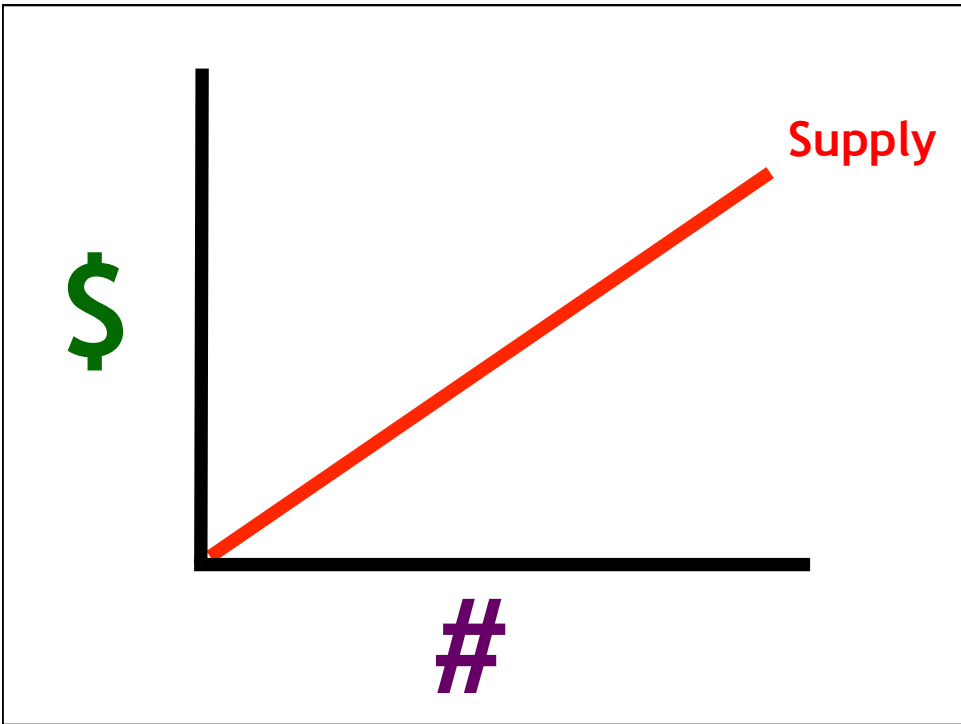
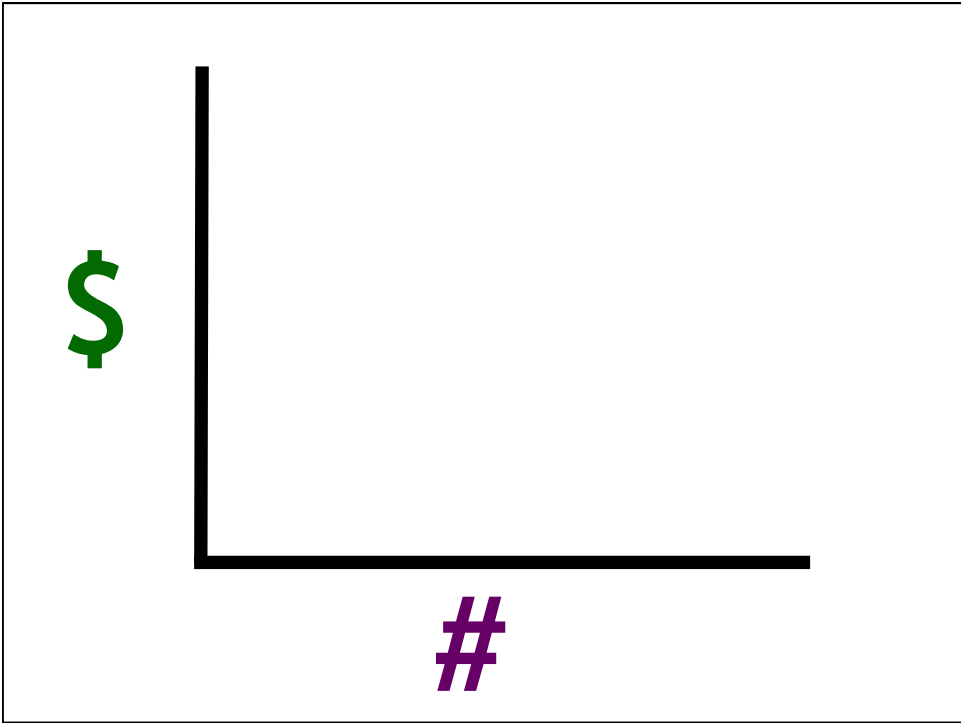


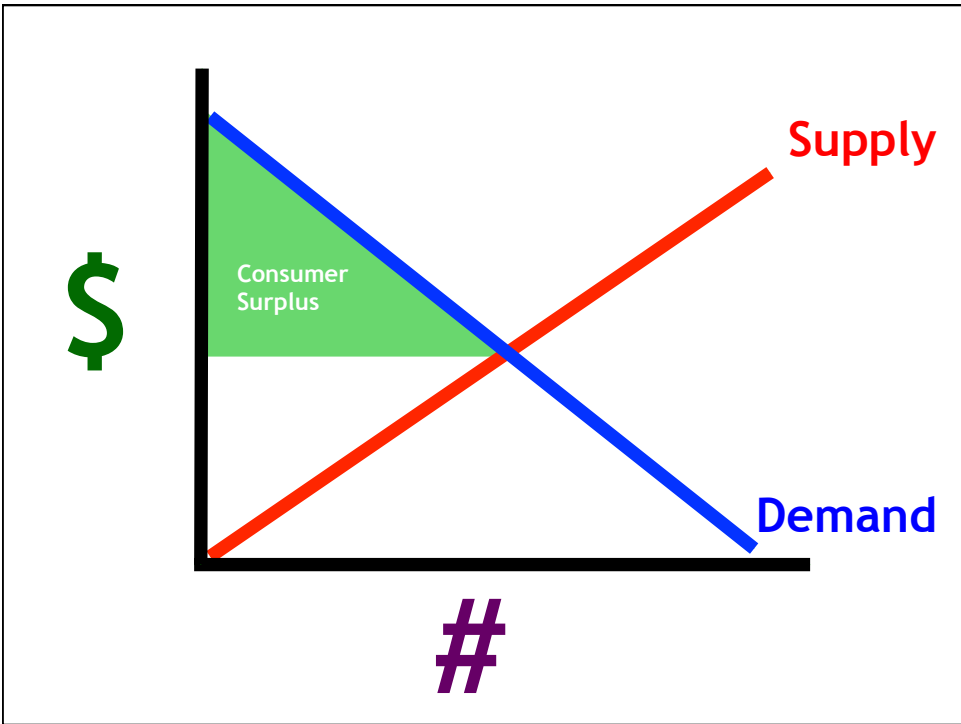
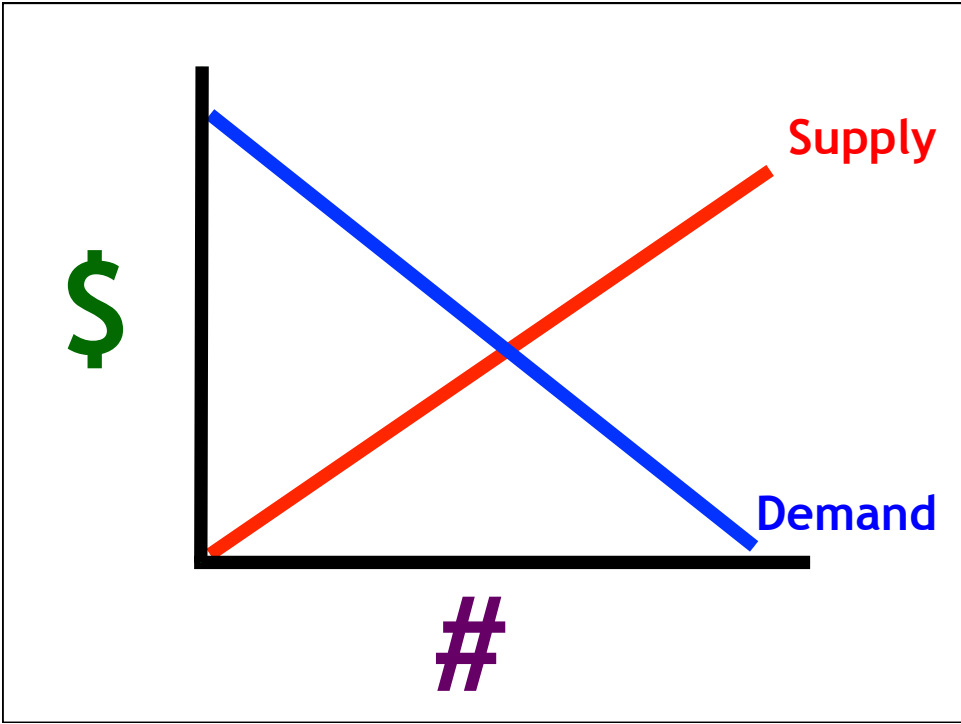


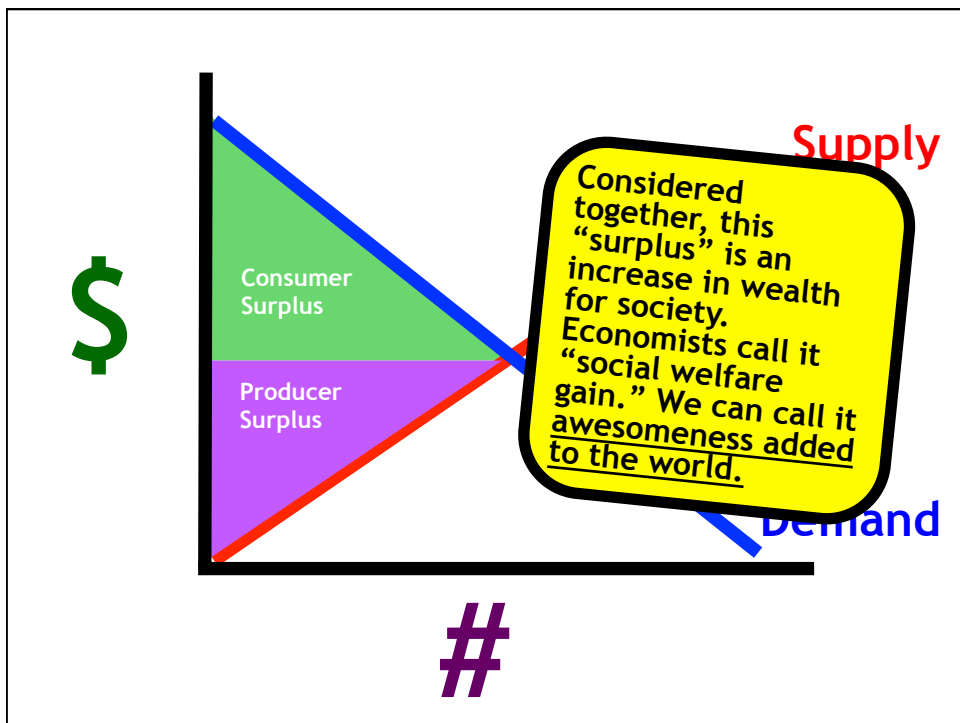
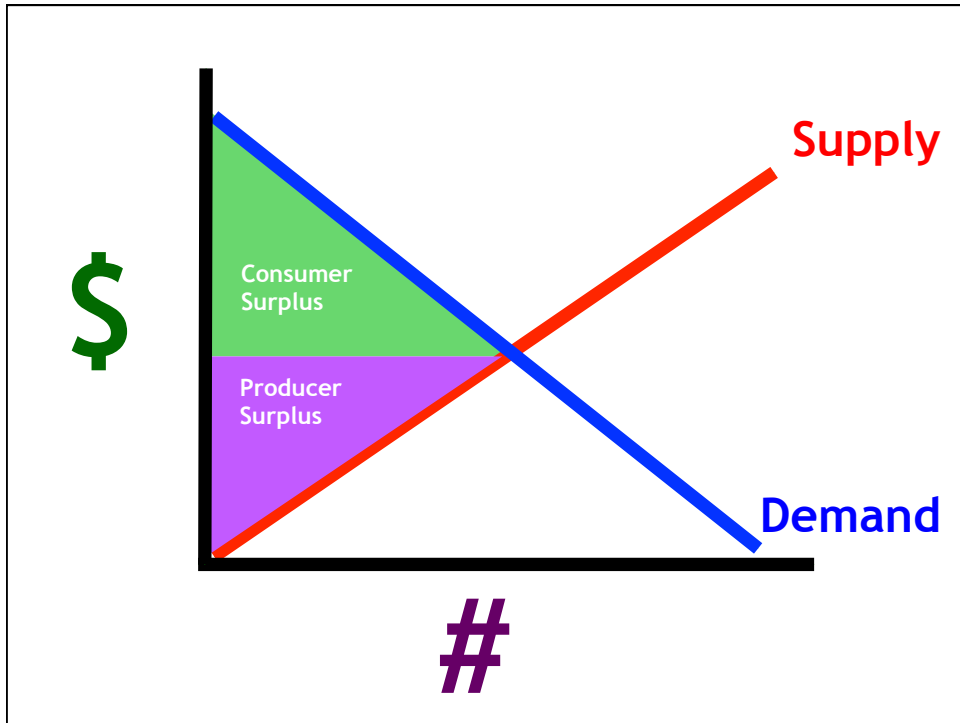


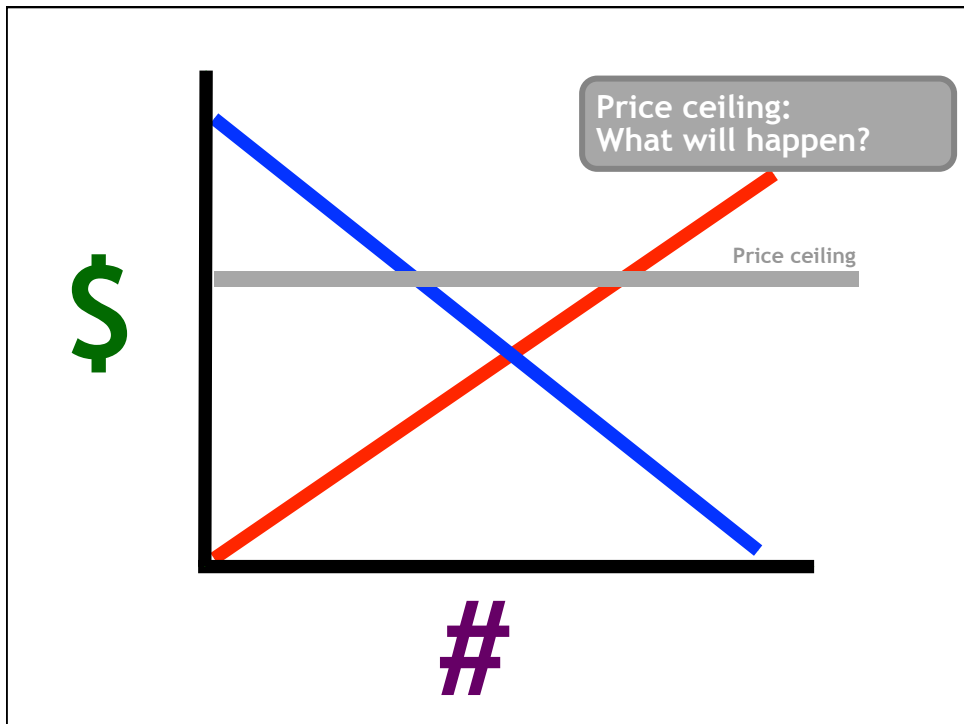
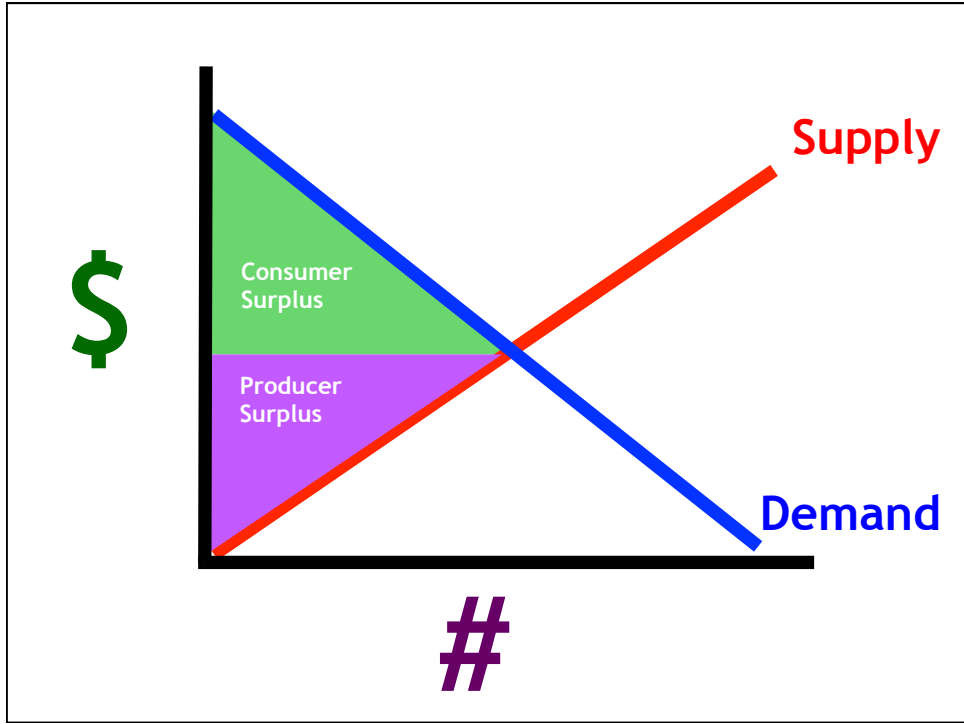


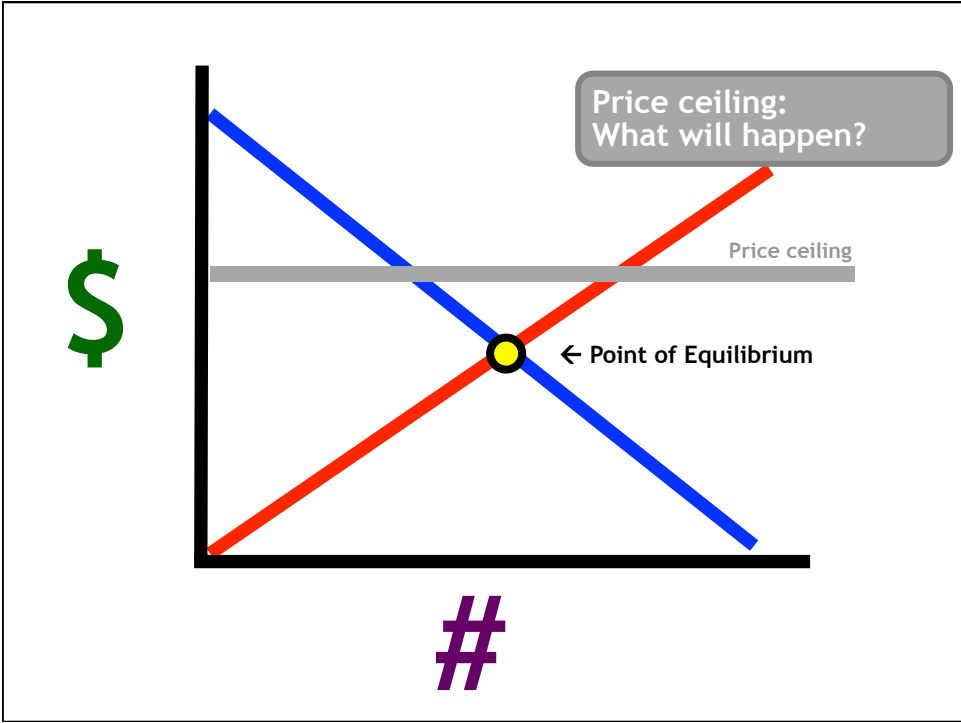
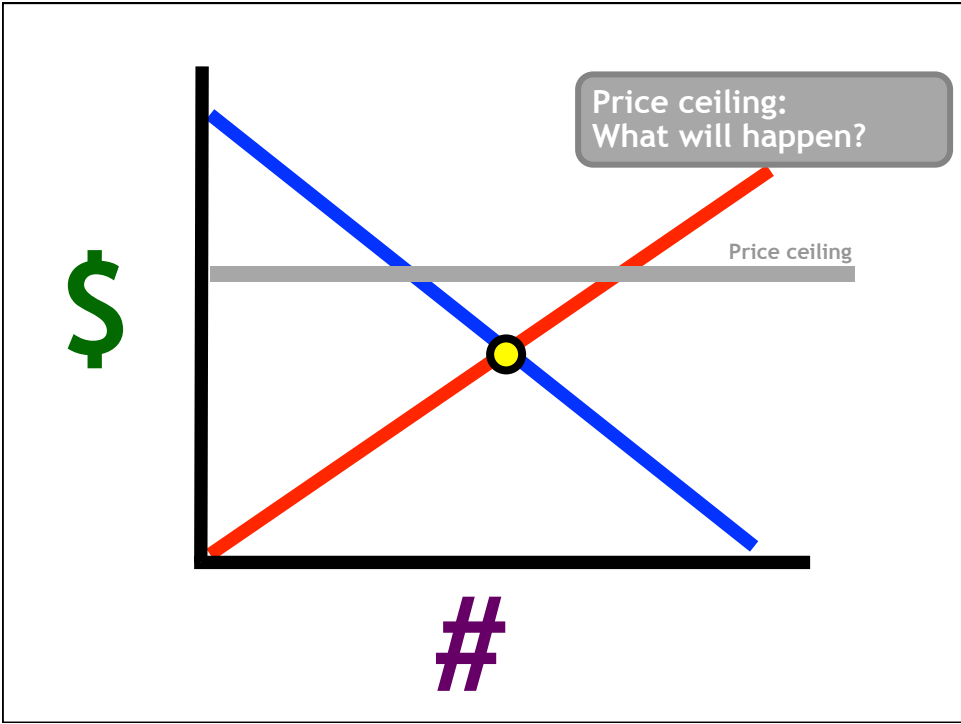


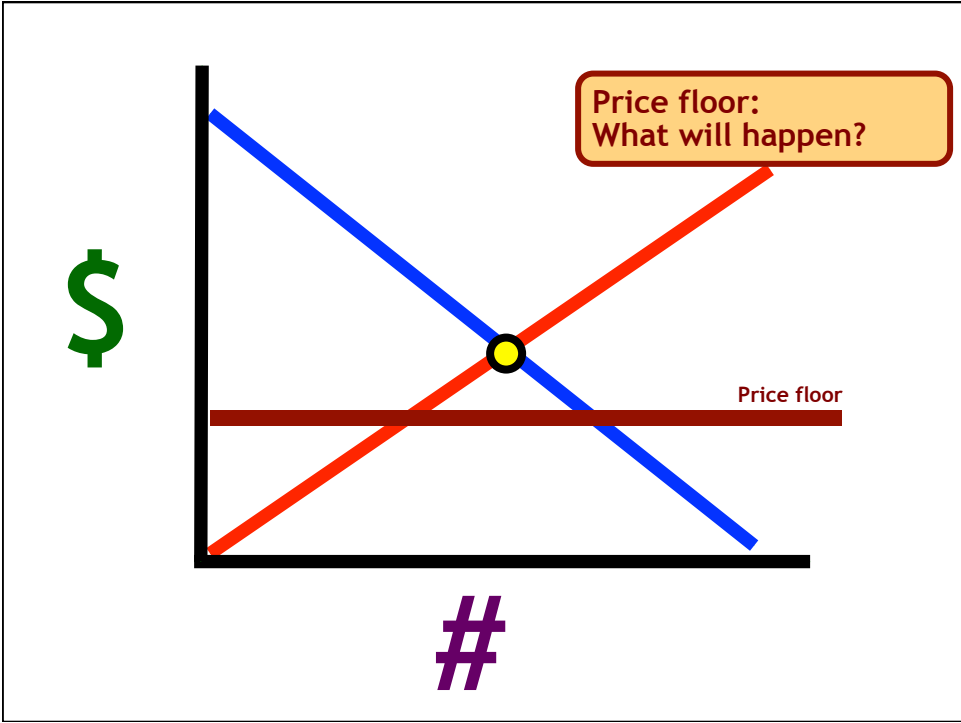
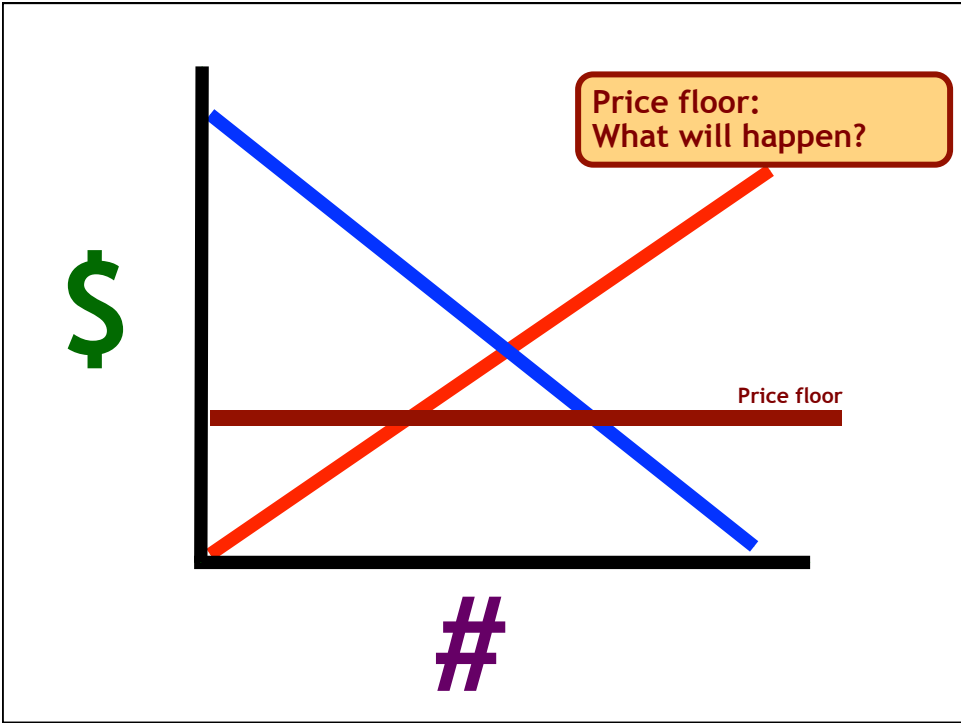


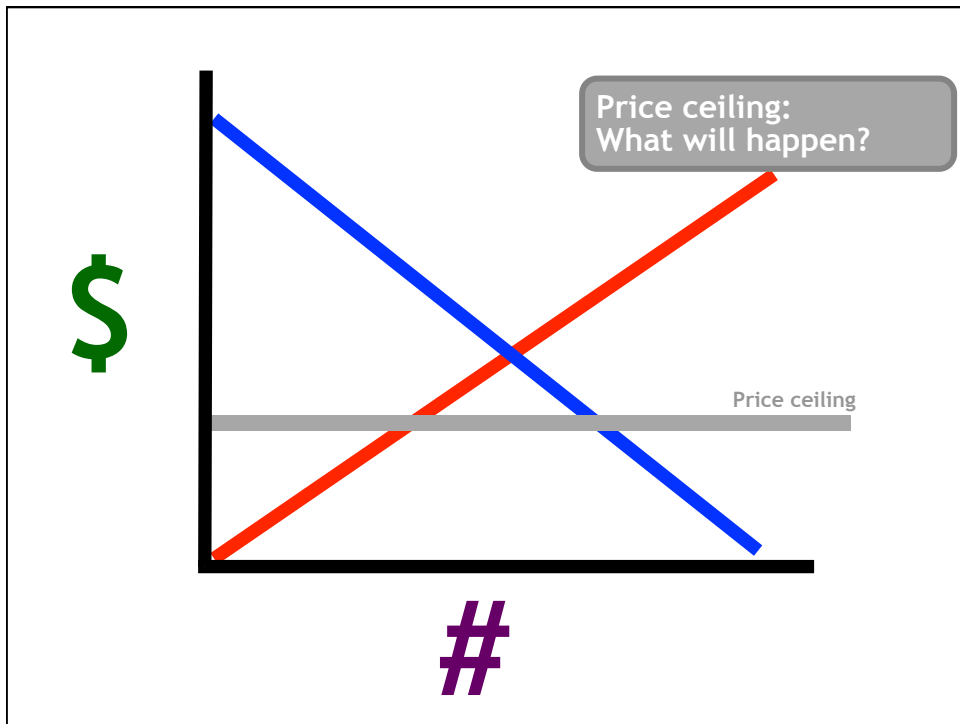
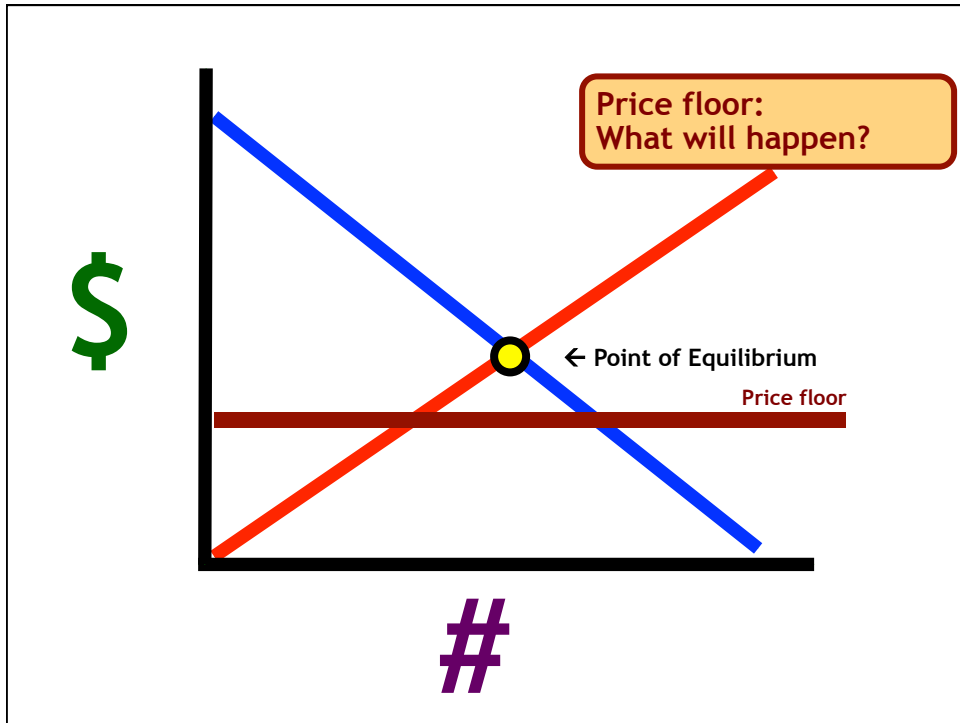


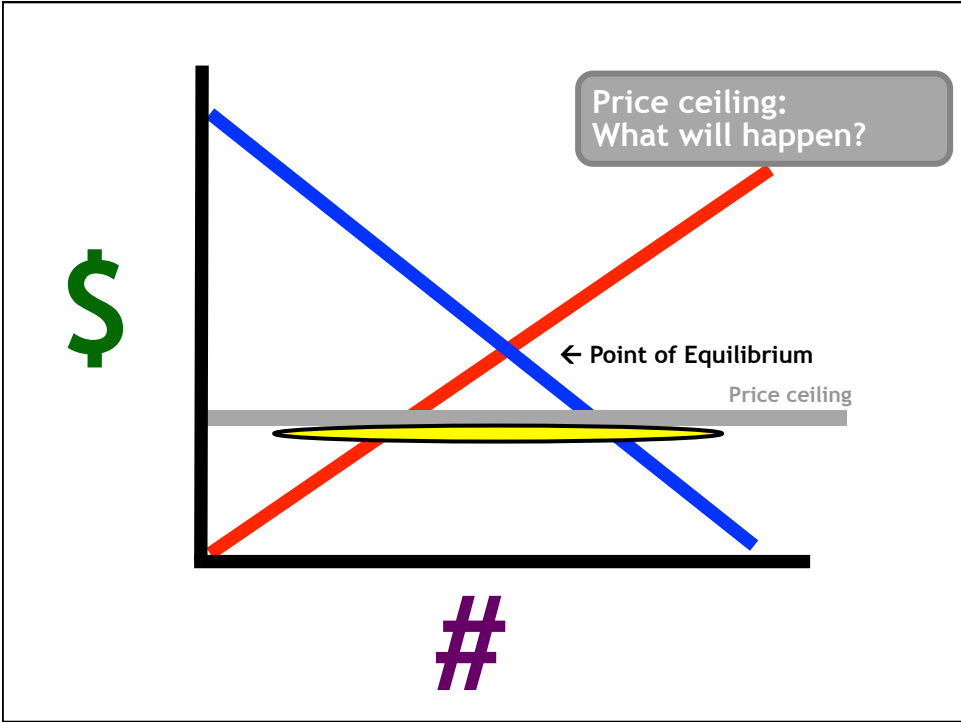
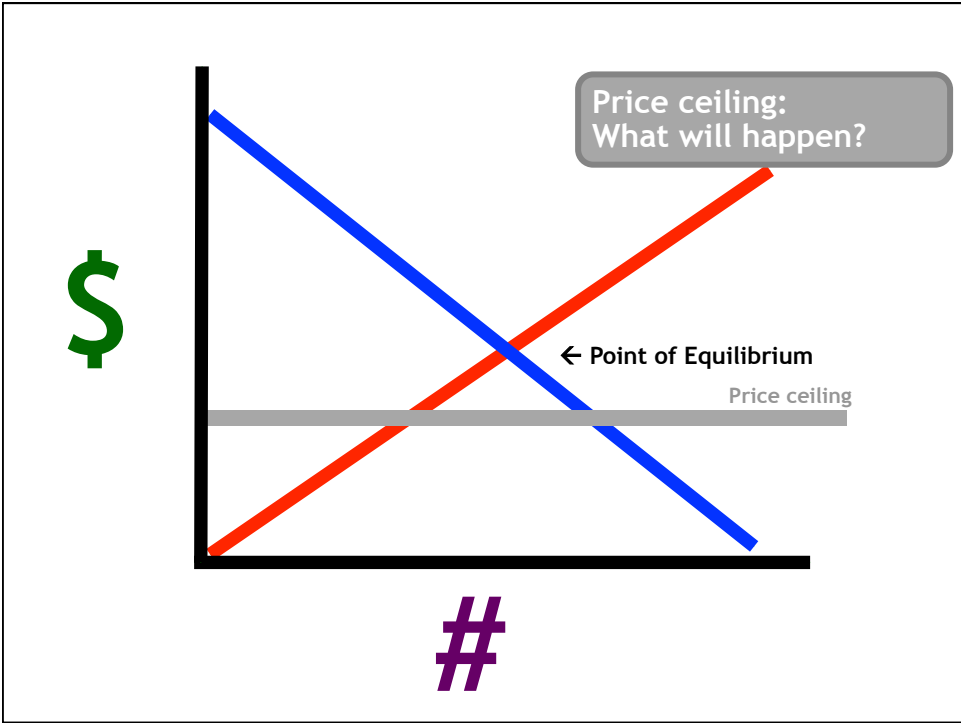


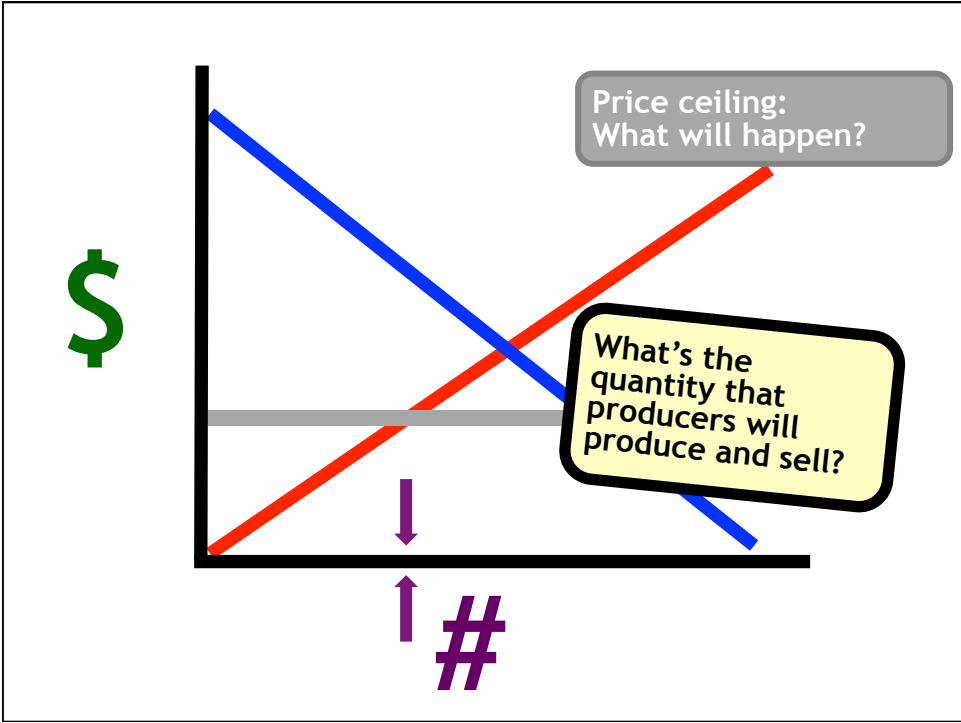
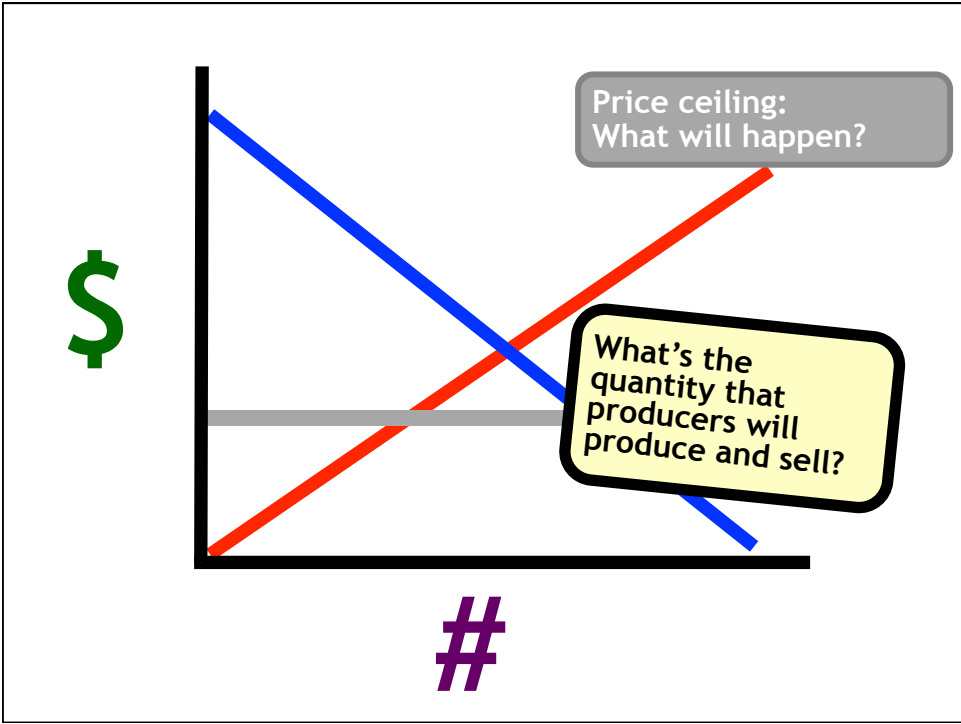


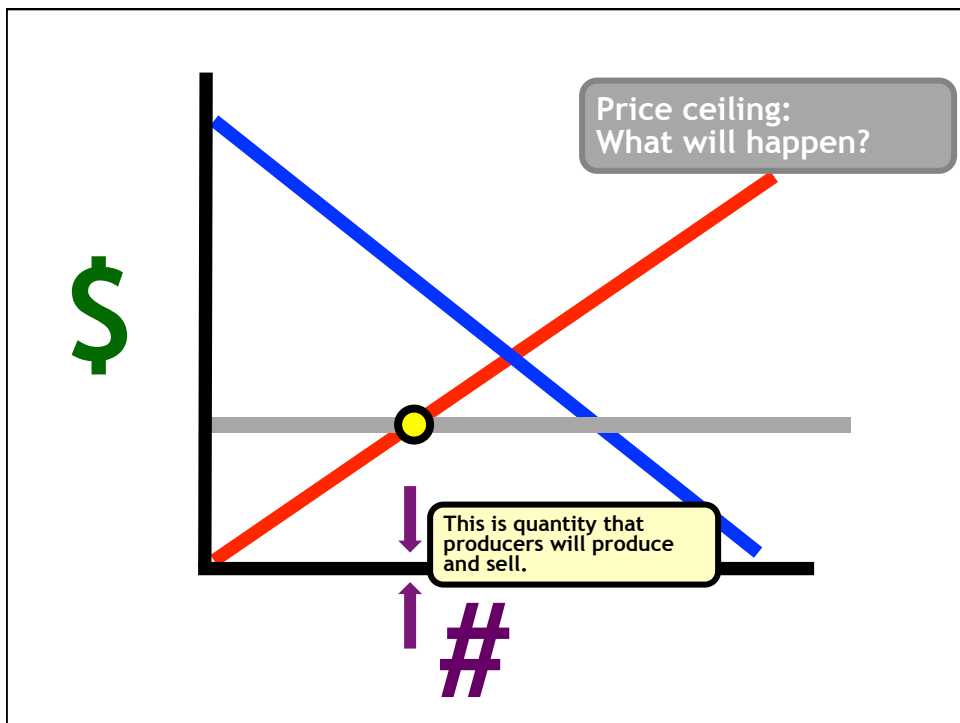
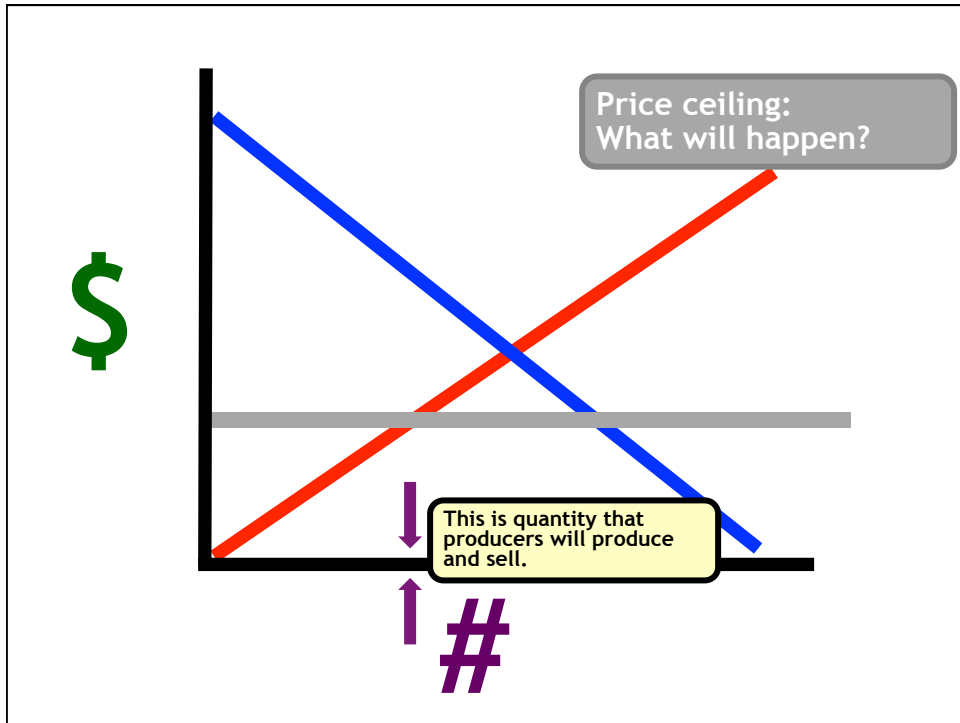


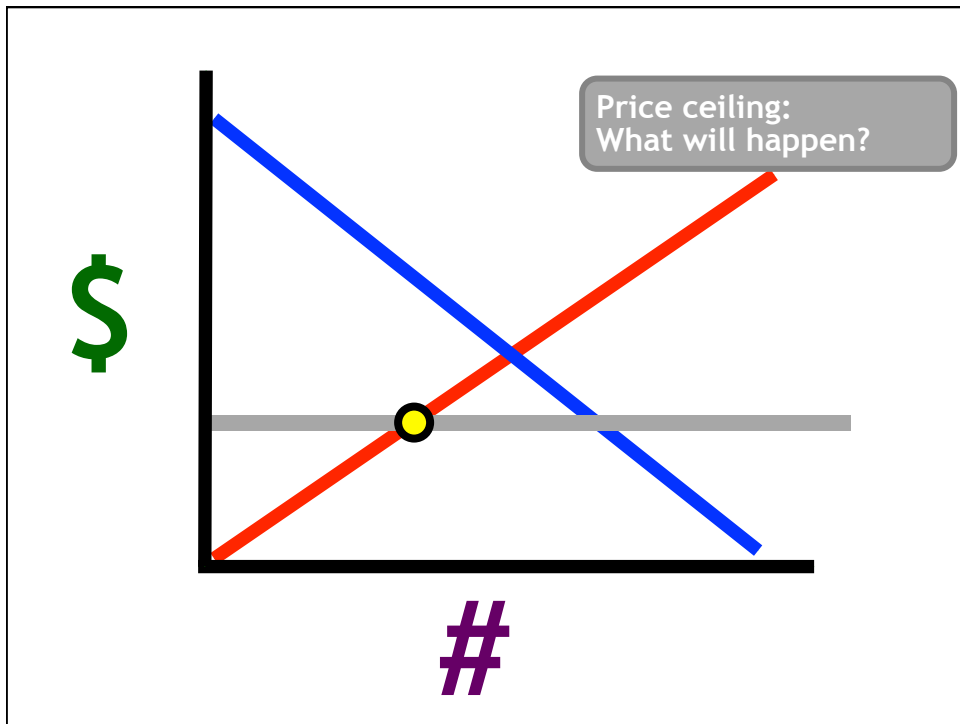
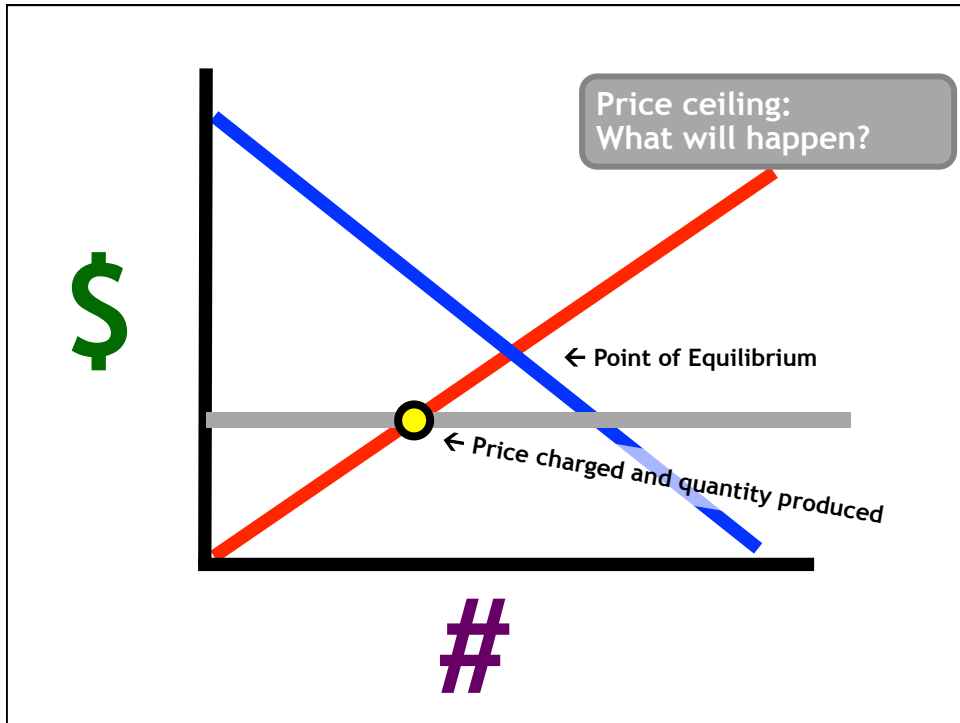


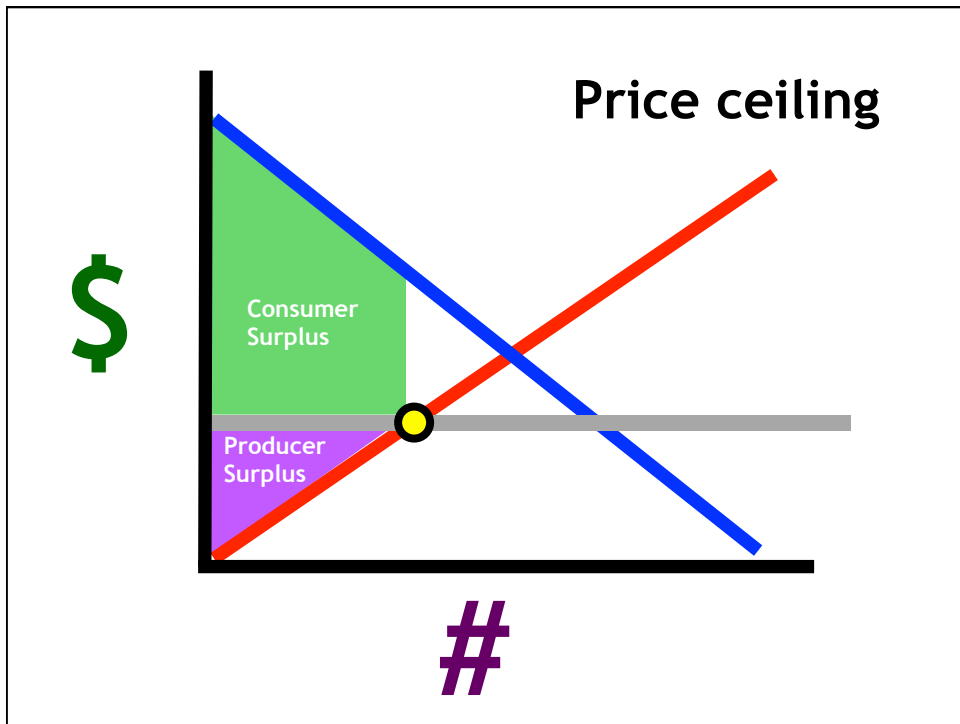
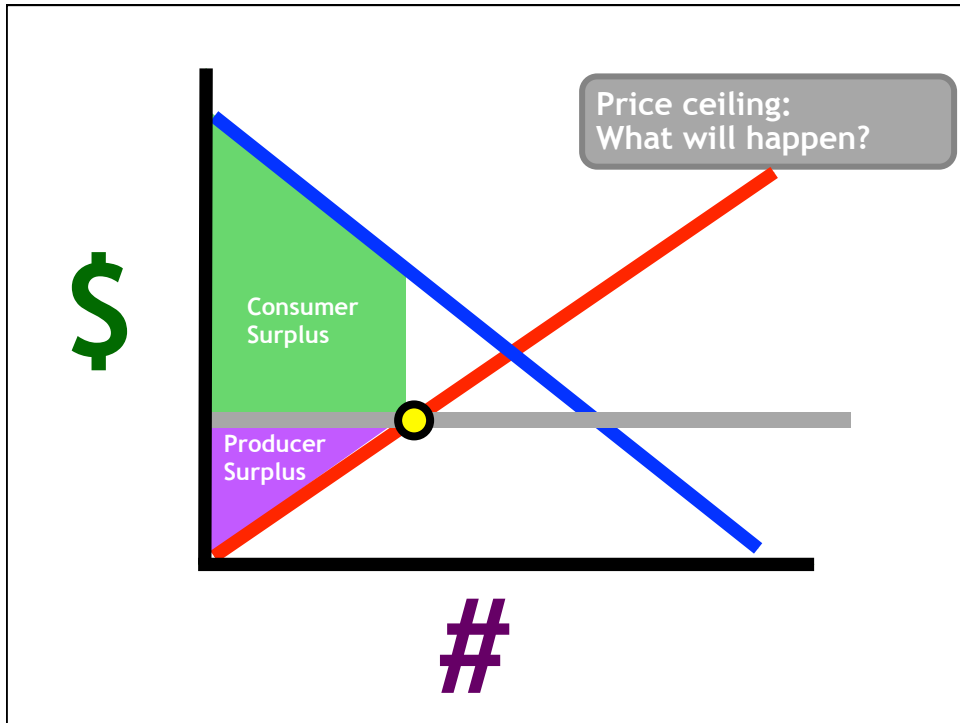


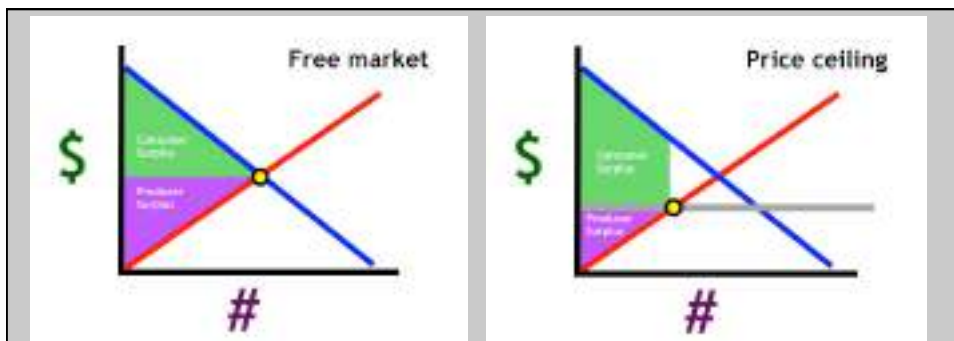
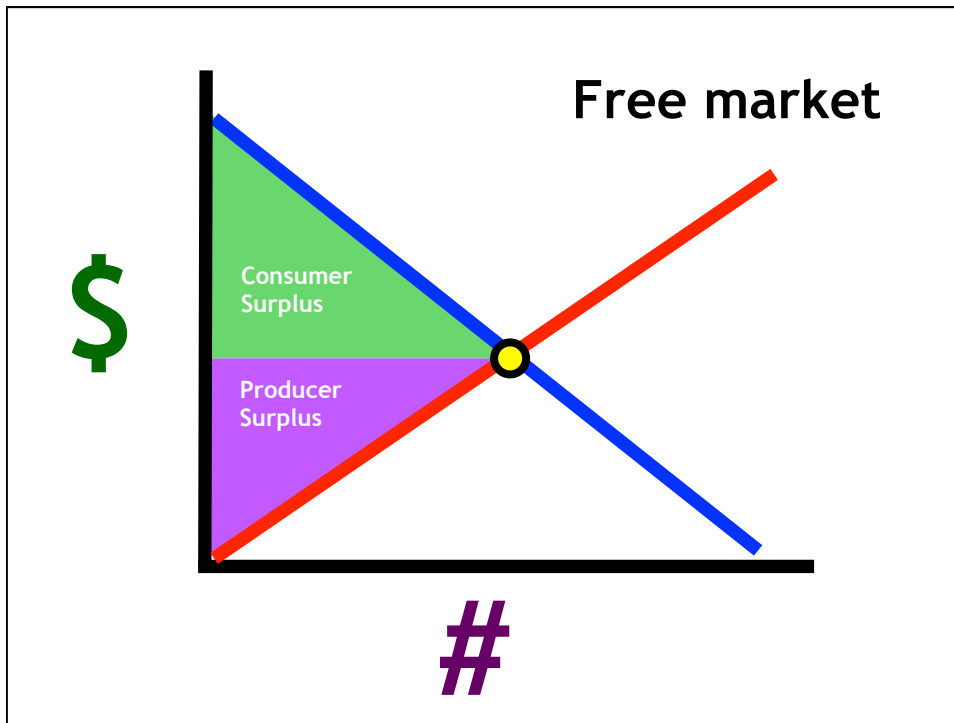






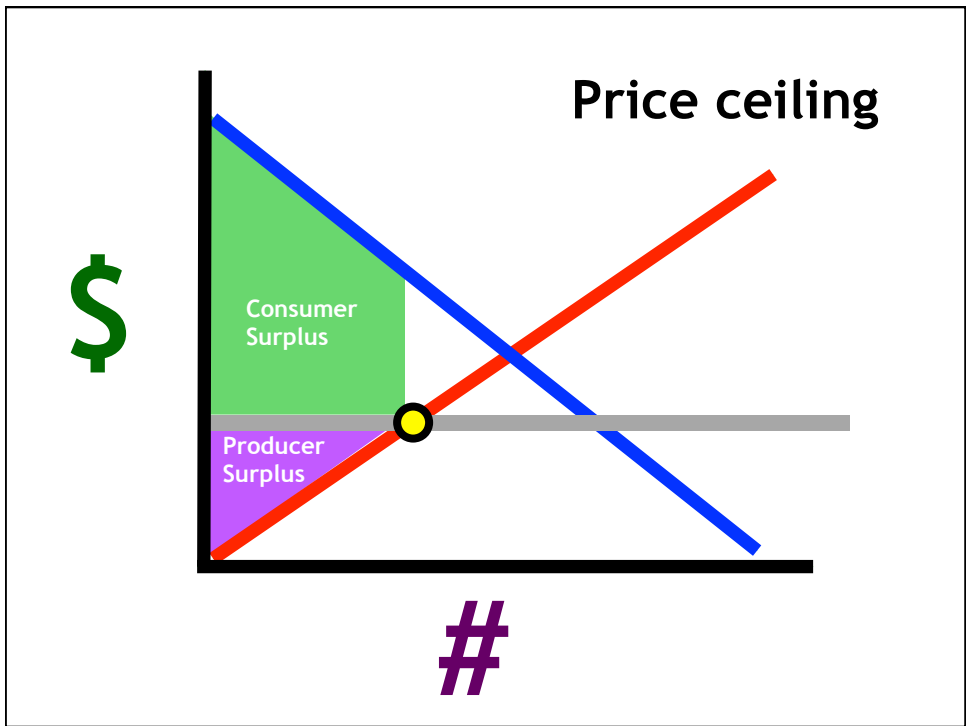
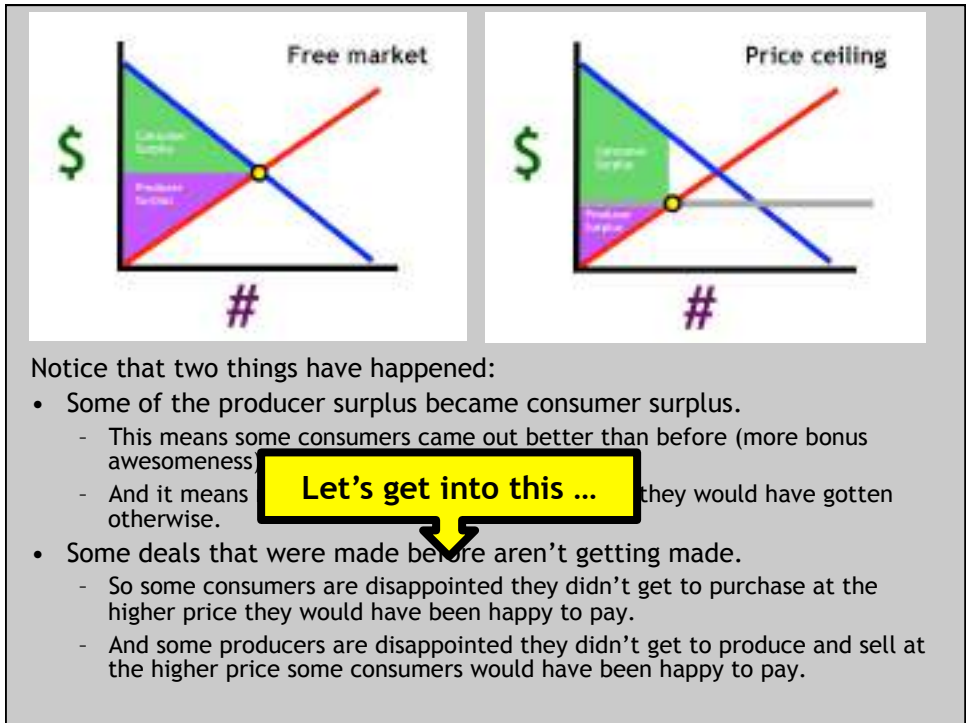


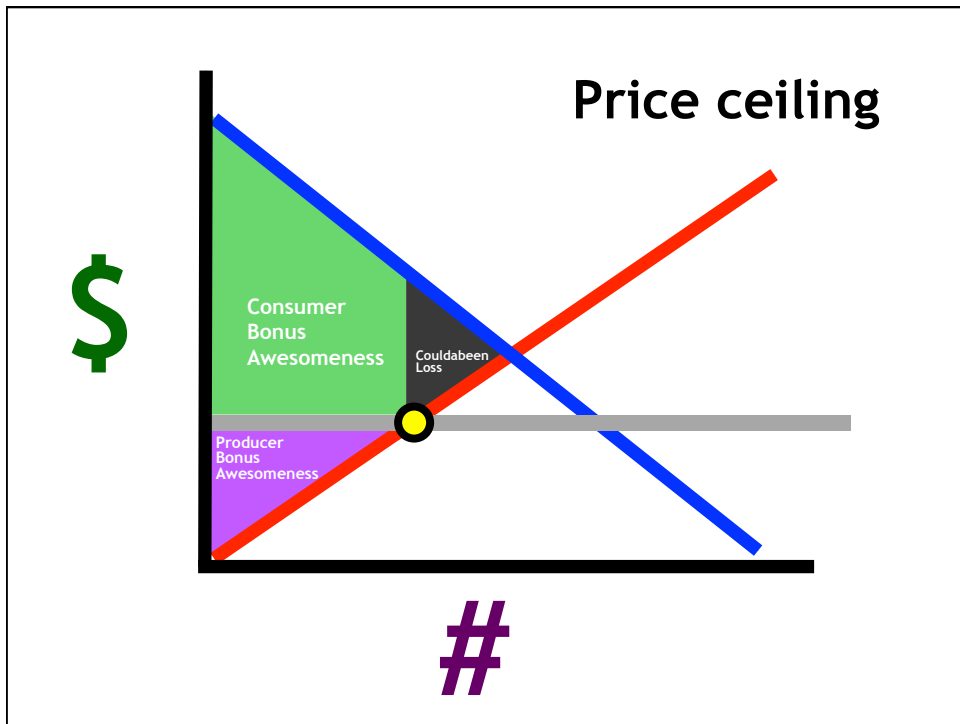
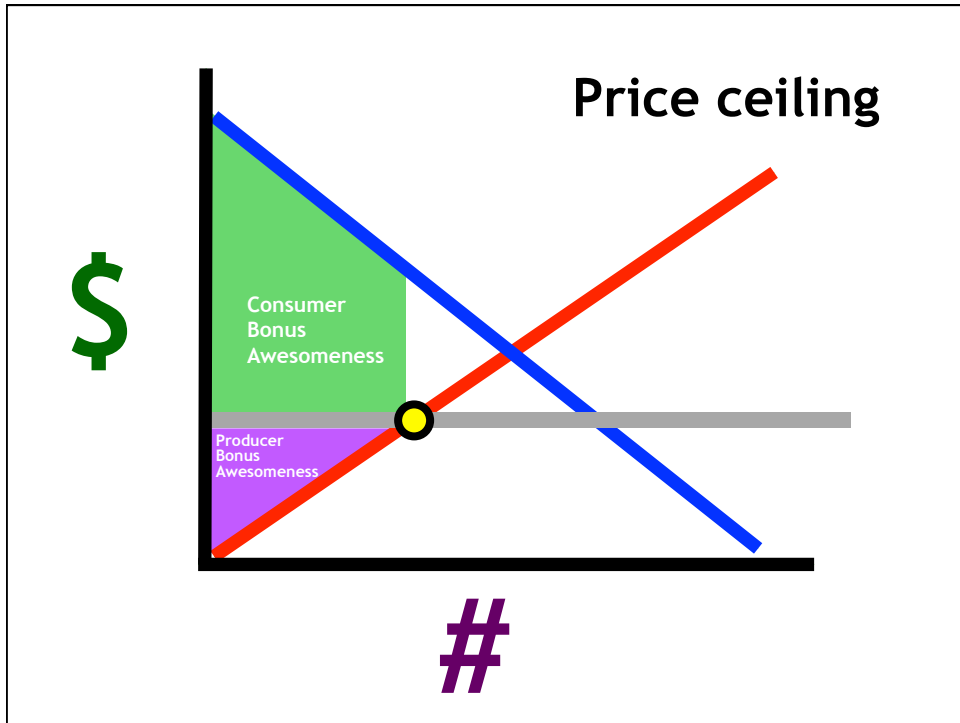


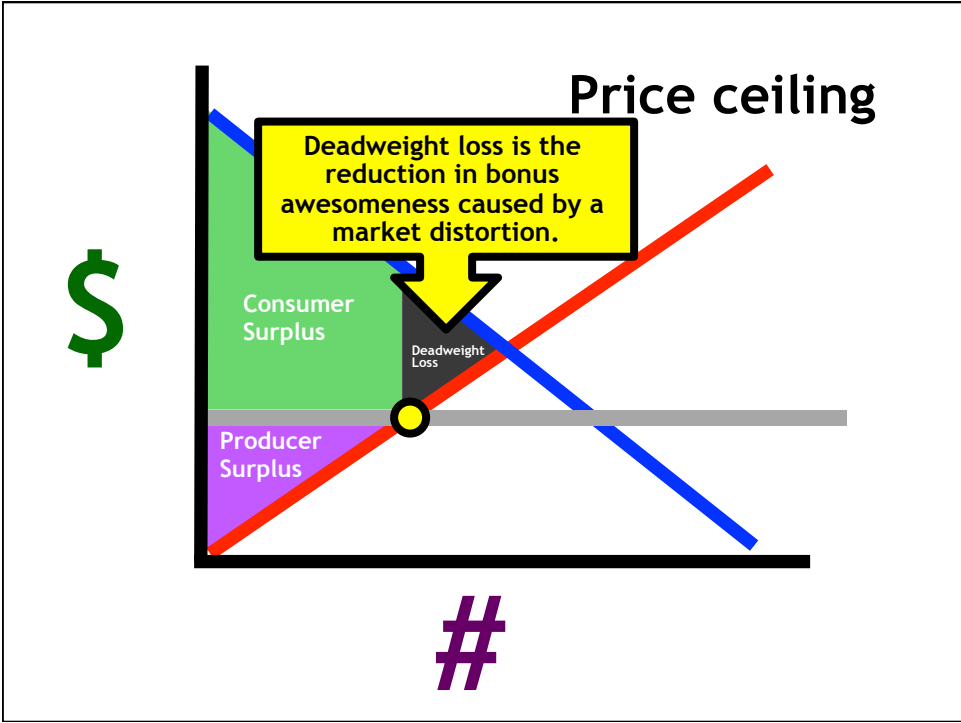
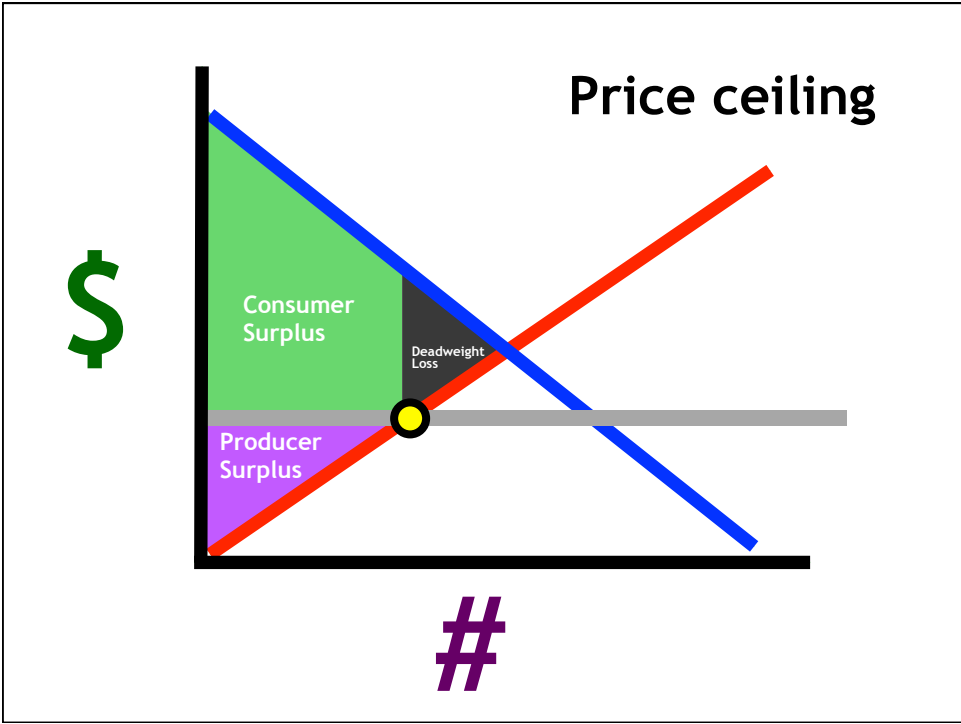


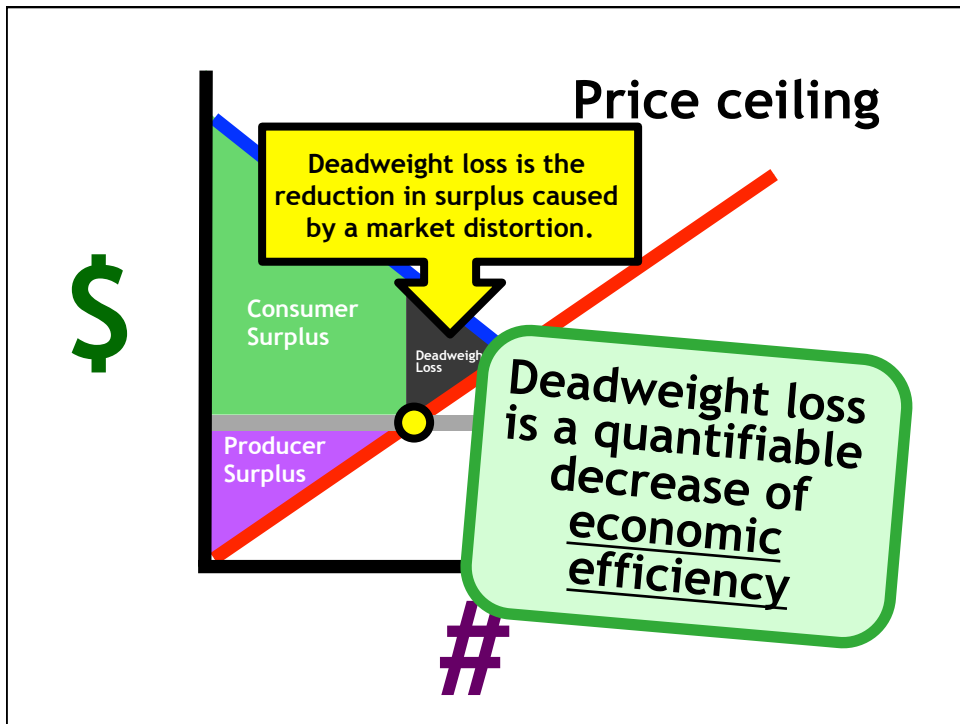
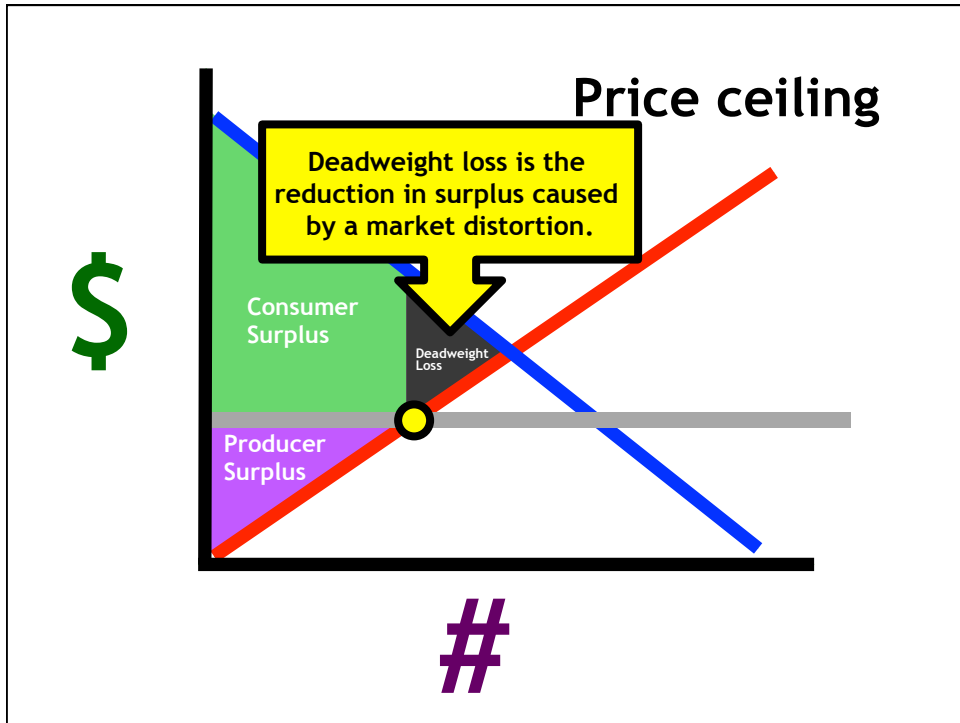
Notice that two things have happened:

- Some of the producer surplus became consumer surplus.
 - This means some consumers came out better than before (more bonus awesomeness).
 - And it means many producers lost out on surplus they would have gotten otherwise.
- Some deals that were made before aren't getting made.
 - So some consumers are disappointed they didn't get to purchase at the higher price they would have been happy to pay.
 - And some producers are disappointed they didn't get to produce and sell at the higher price some consumers would have been happy to pay.











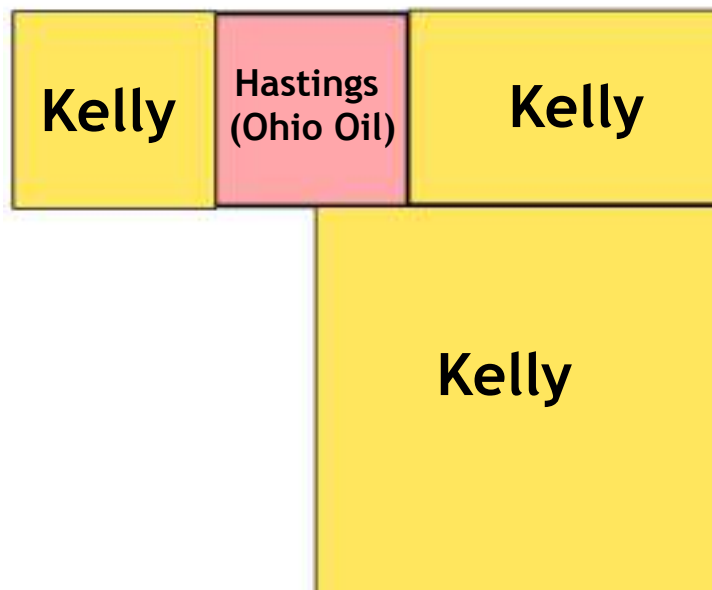
Ad Coelum Doctrine

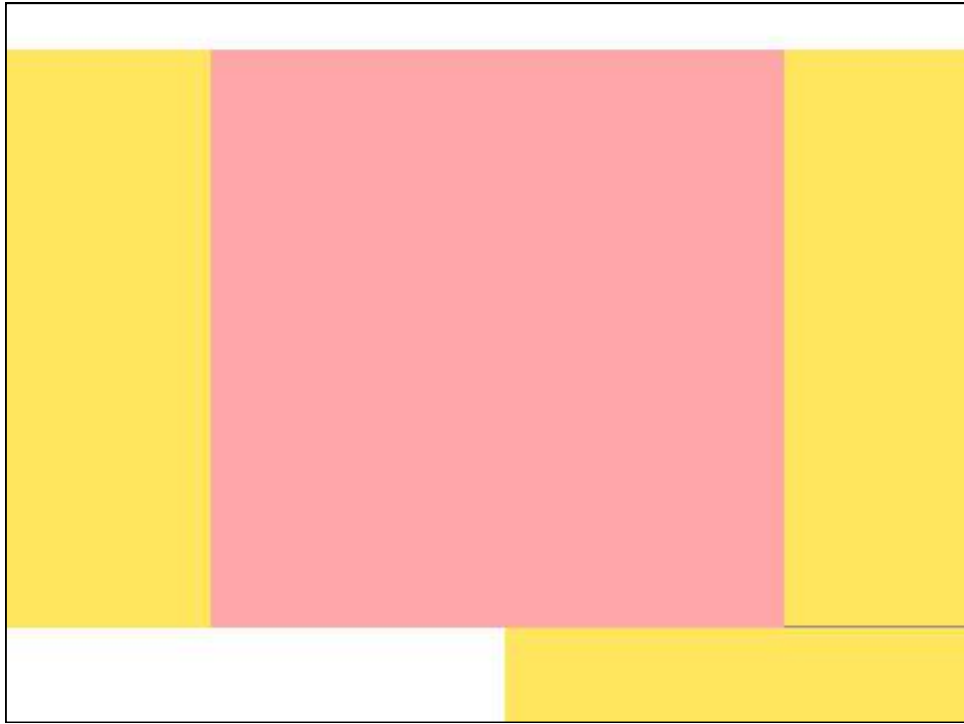
- The ad coelum doctrine provides that a real property owner owns the surface and the subsurface all the way to the center of the Earth bounded on sides extending from the surface boundaries to the center.
- “The owner of the surface own[s] all beneath.” - *Del Monte Mining & Milling v. Last Chance Mining & Milling*
- If you tunnel under the property line into my subsurface and take my minerals, I can sue to get them back.

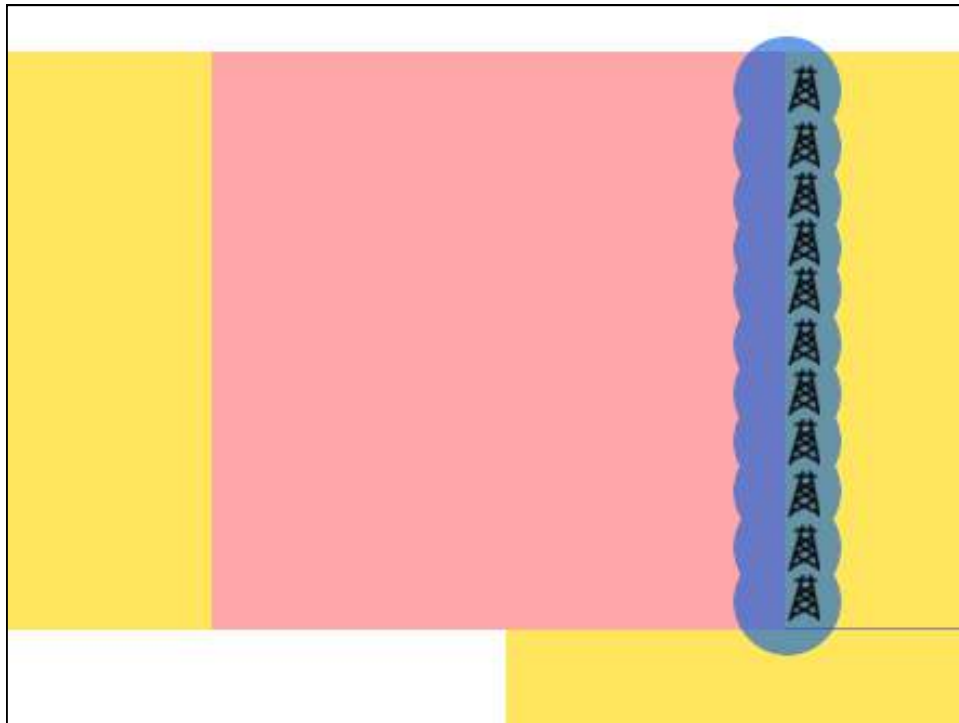
Rule of Capture

- The rule of capture modifies the ad coelum doctrine by providing that the landowner acquires ownership to the oil and gas extracted from the landowner's subsurface even if the oil and gas came from a neighboring property.
- “Whatever gets into the well belongs to the owner of the well, no matter where it came from.” - Kelly v. Ohio Oil

Kelly v. Ohio Oil







Doctrine of Correlative Rights

- The doctrine of correlative rights modifies the rule of capture by providing that a capturer is liable for waste or negligence that damages the common source of oil and gas.
- “due to the harsh consequences to neighboring land owners, Ohio law has evolved on this issue and the ‘rule of capture’ has been limited by the doctrine of correlative rights’ - Barnes v. Res. Energy Expl. (Ohio App. 2016)

Conservation Laws

- Conservation laws use the state's police power to regulate drilling and production.
 - Examples:
 - Well-spacing rules
 - Well-spacing exceptions
 - Production regulation
 - Forced pooling
 - In Texas, this regulation is done by the Railroad Commission.

Conservation Laws

“Petroleum conservation laws work hand in hand with the correlative-rights doctrine to limit the rule of capture, transforming it to a ‘fair share’ doctrine; each owner is entitled to a fair chance to capture the oil and gas under his or her property.” ” - John S. Lowe, Oil & Gas Law in a Nutshell, 6th Ed.

Fair-Share Principle

- The fair-share principle modifies the rule of capture by providing that each mineral-rights holder must have a fair opportunity to get the oil and gas under the owner's surface.
- “The right to have a reasonable opportunity to produce one's just and equitable share of oil in a pool is [a] common-law right ... ” *Wronski v. Sun Oil* (Mich. App. 1979)
- Drilling too close to the property line “deprived plaintiff of the opportunity of claiming and taking the oil that was rightfully hers; and defendants must respond in damages for such conversion.” *Ross v. Damm* (Mich. 1936)

Fair-Share Principle

“Within reasonable limits, each operator should have an opportunity equal to that afforded other operators to recover the equivalent of the amount of recoverable oil (and gas) underlying his property. The aim should be to prevent reasonably avoidable drainage of oil and gas across property lines that is not offset by counter drainage. ... This fair-share rule does not do away with the rule of capture, but rather acts to place limits on its proper application.” - *Wronski v. Sun Oil Co.*, (Mich. App. 1979) (quoting American Petroleum Institute)

Ad Coelum Doctrine

Rule of Capture

**Correlative
Rights**

**Conservation
Laws**

**Fair Share
Principle**



**AMERICAN
PETROLEUM
INSTITUTE**
presents





