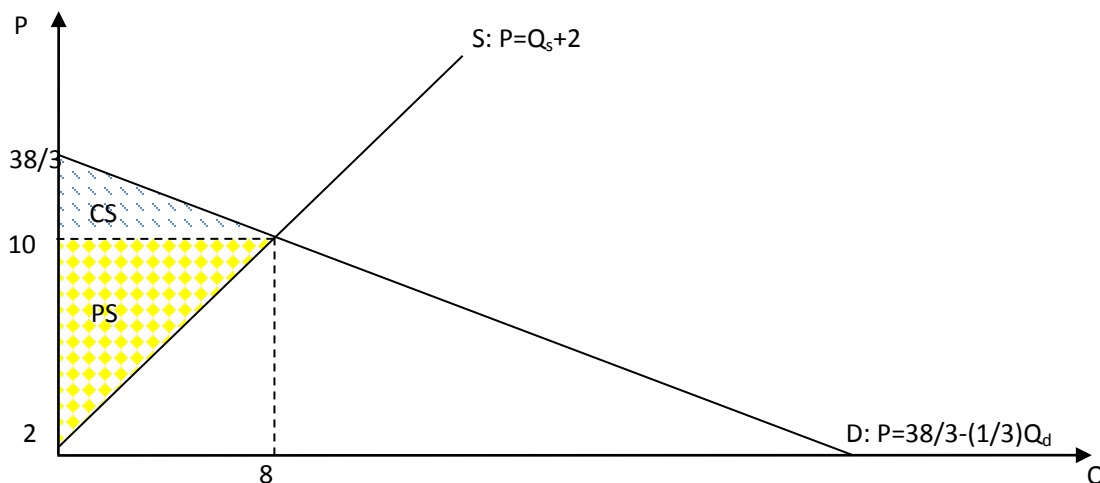


**Problem 1:** Suppose the market demand and supply curves for mead are given by the equations  $Q_D = 38 - 3P$  and  $Q_S = P - 2$ .

- (1) Solve for the equilibrium price and quantity. Graph your results. Shade in the areas that represent consumer and producer surplus.

Setting demand equal to supply, we find that:

$$38 - P = P - 2 \rightarrow P^* = \$10, Q^* = 8$$



- (2) Government officials fear that too much mead is being consumed at the market equilibrium, leading to concerns about health and safety of the populace. In response the government imposes an excise tax of \$2 on the producers of mead.

- a. Calculate the new equilibrium prices and quantity. Plot the new equilibrium on your graph and label consumer surplus, producer surplus, and tax revenues. Was the tax effective in reducing the quantity of mead consumed? What is the incidence of the tax on consumers and producers?

To solve for the new equilibrium price and quantity with the unit tax note that the price producers get ( $P_S$ ) is equal to the price consumers pay ( $P_D$ ) minus the amount of the tax (2). Thus,  $P_S = P_D - 2$ . Now we can sub in this expression for  $P_S$  into the demand curve and solve for  $P_D$  which will be the price of exchange

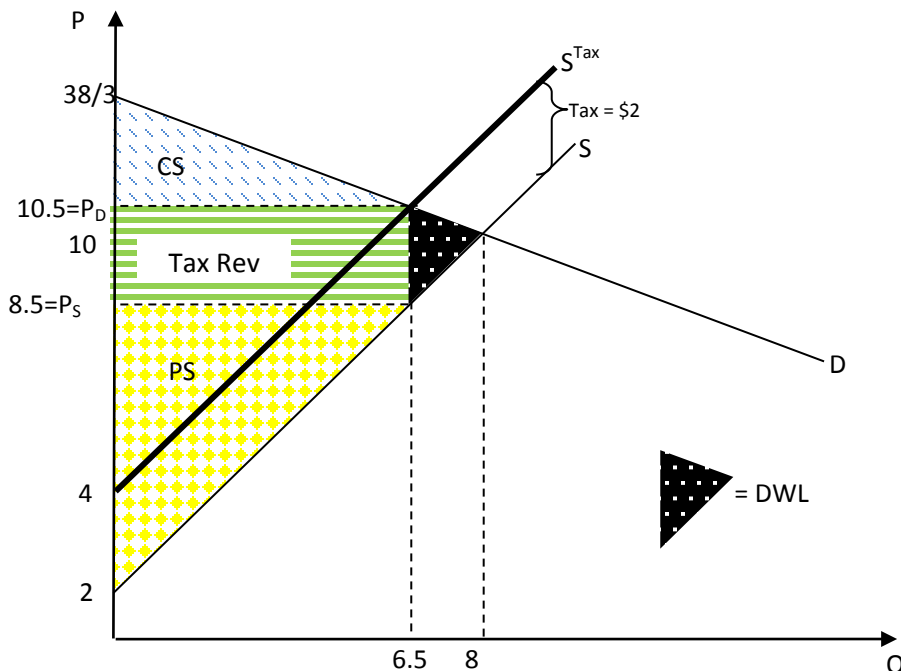
$$38 - 3P_D = P_D - 2 - 2 \Rightarrow P_D = \$10.5 \Rightarrow P_S = 8.5 \Rightarrow Q_D = Q_S = 6.5$$

The tax effective in reducing the quantity of mead consumed from 8 to 6.5.

$$\epsilon = |\text{Demand slope} / (Q_e / P_e)|; \theta = |\text{Supply slope} / (Q_e / P_e)|$$

Incidence of tax on consumers =  $\frac{\theta}{\theta + \epsilon} = \frac{\text{supply slope}}{\text{supply slope} + \text{demand slope}} = \frac{1}{1 + 3} = 1/4$  (the eqm quantity and price has been canceled)

Incidence of tax on producer =  $1 - 1/4 = 3/4$



b. Complete the following table with quantities:

	No Tax	\$2 Unit Tax	Change
Consumer Surplus	$0.5 \cdot 8 \cdot (\$38/3 - 10) = \$32/3$	$0.5 \cdot 6.5 \cdot (\$38/3 - 10.5) = \$7.042$	-\$3.625
Producer Surplus	$0.5 \cdot 8 \cdot (\$10 - \$2) = \$32$	$0.5 \cdot 6.5 \cdot (\$8.5 - \$2) = \$21.125$	-\$10.875
Tax Revenue	\$0	$\$2 \cdot 6.5 = \$13$	\$13
Total Welfare	$CS + PS = \$128/3$	\$41.167	-\$1.5

c. Suppose that the level of mead consumption at the no tax equilibrium really was a health and safety problem in that it required the government, or those other than mead producers or consumers, to spend more for healthcare, police, and corrections. Do these costs enter into the welfare calculations in your table in part b.? If not, should they?

The costs do not enter our deadweight loss calculation, but they should. Later in the semester we will learn that mead consumption-production (at least in this example) creates a negative externality which is a cost generated by production-consumption that doesn't fall on consumers or producers. When a consumption-production of particular good or service creates a negative externality, the competitive market lead to too low of a price with too much of the good being produced and consumed. In these instances an excise tax might aid in bringing about a more efficient allocation. This is one of the reasons we have excise taxes on goods like gasoline, tobacco, and alcohol. The other reason that these goods are taxes is that demand is pretty inelastic (at least in the short run) so these taxes end up raising a bunch of revenue.<sup>1,2</sup>

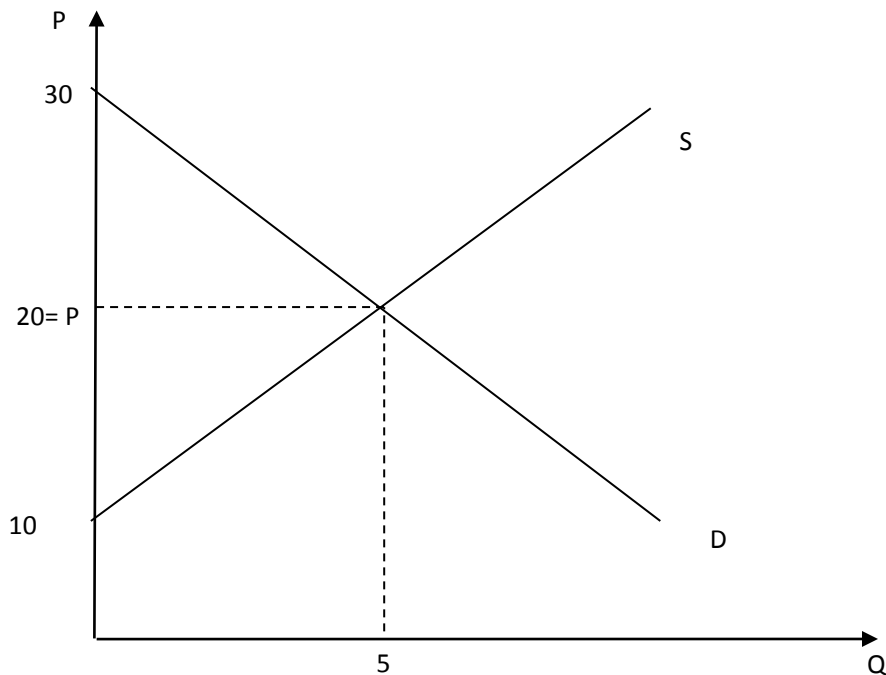
<sup>1</sup> Do you want to try mead? From the Wisconsin State Journal - [New Madison meadery plans to have bottles in stores soon](#). As the article points mead is a niche product. For a variety of reasons it isn't likely to be heavily abused in modern times. In the Ancient Greece and the Middle Ages it was a go-to beverage for village drunks though.

<sup>2</sup> There can be large differences between short- and long-run demand elasticity. An increase in the cigarette tax is unlikely to have a large impact on the smoking habits of adult smokers, but it will make it harder for young people to purchase cigarettes and start smoking. Overtime this will lead to a reduction of smokers. In the short run an increase in the gas tax is

**Problem 2:** Consider the market for potatoes with inverse demand given by  $P=30-2*Q_D$  and inverse supply given by  $P=10+2*Q_S$ . Now suppose the government implements a price subsidy program instead of the price support program. Let the government target price be \$24.

- (1) Calculate the equilibrium price and quantity. Draw a graph and label the equilibrium price and quantity.

Setting demand equal to supply, we find that:  
 $30-2*Q_D = 10+2*Q_S \rightarrow P^* = \$20, Q^* = 5$



- (2) The government is concerned about potato farmers’ ability to earn adequate income from farming potatoes and decides to implement a price support policy whereby a price floor of \$24 will be set in the market for potatoes and the government will purchase and destroy the surplus potatoes at a price of \$24.

- a. Calculate the price of exchange, quantity exchanged in the marketplace, and the amount of potatoes purchased and destroyed by the government.

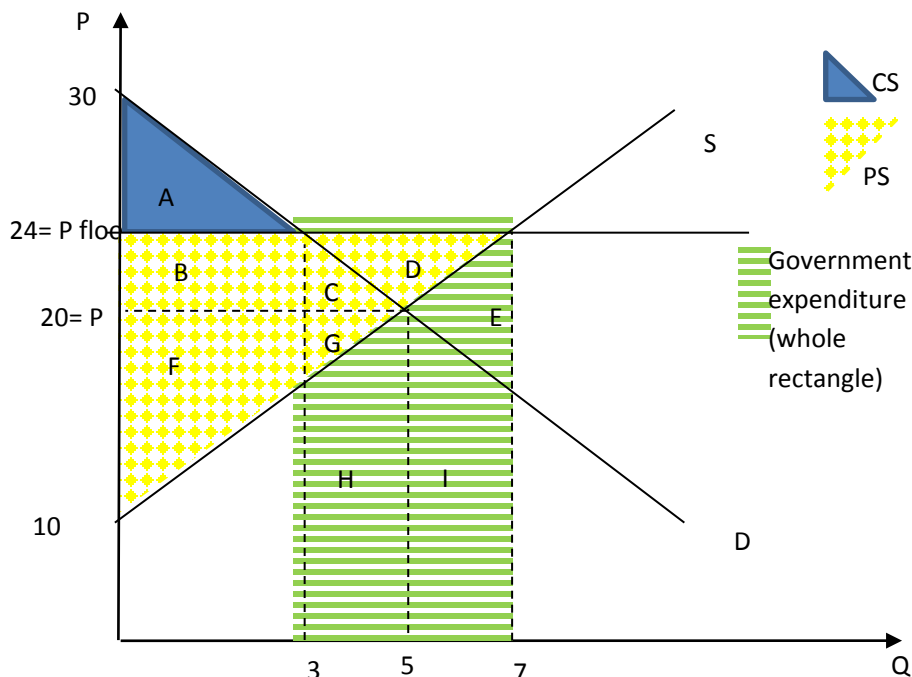
If  $P' = \$24$ , new demand for potato is  $Q'_D = 15 - P/2 = 15 - 24/2 = 3$ ; new supply for potato is  $Q'_S = -5 + P/2 = -5 + 24/2 = 7$ .

So the farmer will supply 7 potatoes and consumer will buy 3 potatoes. The government will purchased  $7-3=4$  potatoes and destroyed them.

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will not lead to a large reduction in gas use as the cars we drive and places we need to commute to and from are cannot be changed quickly. Overtime, however, the cars people drive and their commuting patterns will change in response to higher gas prices. There is a reason Hummers aren’t be sold anymore – and it is higher gas prices.

- b. On your graph from part (1) shade in and label areas that represent consumer surplus, producer surplus, and government expenditures under the price floor policy. Can you identify the deadweight loss (DWL)? (**Hint:** it isn't a triangle)



	No Price Floor	Price Floor of \$24	Change
Consumer Surplus	A+B+C	A	-B-C
Producer Surplus	F+G	B+C+D+F+G	B+C+D
Government Revenue		-C-D-E-G-H-I	-C-D-E-G-H-I
Total Welfare	A+B+C+F+G	A+B+F-E-H-I	-C-E-G-H-I

Thus DWL is the area C+E+G+H+I

- c. Complete the following table with quantities. What is the deadweight loss resulting from the price support?

	No Price Floor	Price Floor of \$24	Change
Consumer Surplus	\$25	\$9	-\$16
Producer Surplus	\$25	\$49	\$24
Government Revenue	\$0	-\$96	-\$96
Total Welfare	\$50	-\$38	-\$88

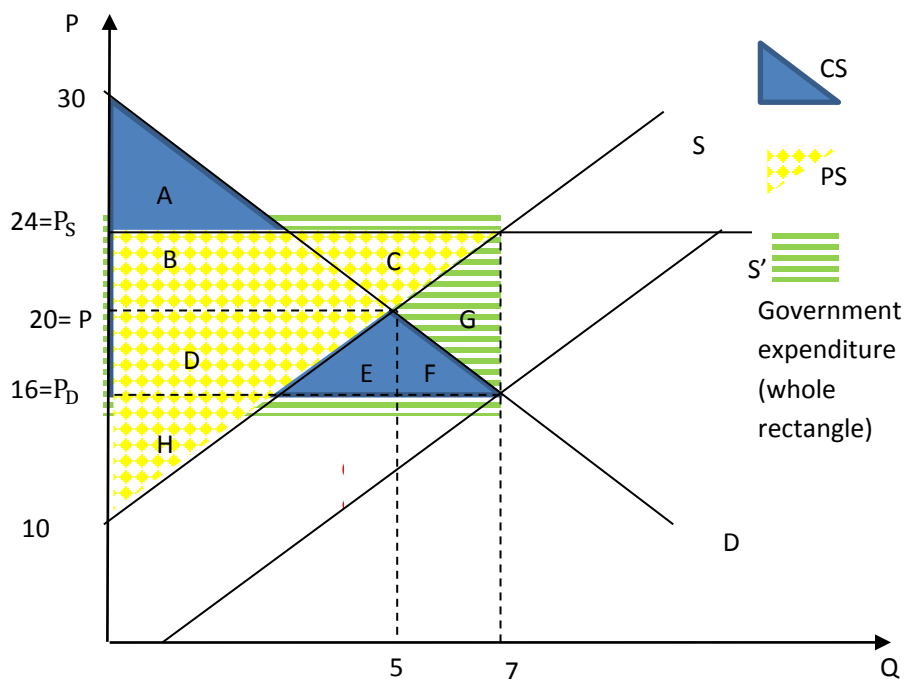
- (3) The government is concerned about high cost of the price support policy described in part (2) and is considering doing away with said policy and implementing a unit subsidy (paid to the farmers) that will ensure that farmers receive a price (after the subsidy) of \$24 for their potatoes.

- a. How large does the subsidy need to be? (**Hint:** the incidence formula applies to subsidies).  
Incidence for consumer=1/2=incidence for producers so

$$P_S = \$24 = P^* + \text{subsidy} * \frac{1}{2} = 20 + \text{subsidy} * \frac{1}{2} \rightarrow \text{subsidy} = \$8$$

- b. Under the subsidy from part (3)a. calculate the equilibrium prices and quantity. What is the price of exchange? On a new graph label the original equilibrium and the post subsidy equilibrium prices and quantities. Shade in the regions that represent consumer surplus, producer surplus, government expenditures, and DWL under the subsidy program.

In equilibrium, producer receives \$24 and consumer pay  $P_D = P^* - \text{subsidy} * \frac{1}{2} = \$20 - \frac{\$8}{2} = \$16$ .  
 So the quantity equilibrium is  $Q=7$



	No Subsidy	Subsidy	Change
Consumer Surplus	A+B	A+B+D+E+F	D+E+F
Producer Surplus	D+H	B+C+D+H	B+C
Government Revenue		-B-C-D-E-F-G	-B-C-D-E-F-G
Total Welfare	A+B+D+H	A+B+D+H-G	-G

Thus the DWL is the area G.

- c. Complete the following table with quantities. What is the deadweight loss resulting from the subsidy? Is the subsidy better than the price support?

	No Subsidy	Subsidy	Change
Consumer Surplus	\$25	\$49	\$24
Producer Surplus	\$25	\$49	\$24
Government Revenue	\$0	-\$56	-\$56
Total Welfare	\$50	\$42	-\$8

The Dead weight loss from subsidy is \$8, while the deadweight loss resulting from the price support is \$88. So, the subsidy is better than the support.