Closed Economy (No International Trade) with No Government Intervention

Find the equilibrium price and quantity. Consumers pay the equilibrium price so the consumer surplus is the area above the equilibrium price and below the demand curve. The total surplus is simply the consumer surplus plus the producer surplus.
Closed Economy with Price Floor

A price floor is a legal limit on how low the price of a good or service can be. Remember, a price floor must be above the equilibrium for it to affect the market. If it is above equilibrium, it creates a surplus, because at that price $Q_s > Q_d$. To find the price floor that gives a surplus of $X$, set up the equation $Q_s - Q_d = X$. You can then solve your supply and demand equations for $Q$, plug them into $Q_s - Q_d = X$, and solve for $P$.

The consumer surplus is above the price line and below the demand curve. The producer surplus is slightly different than usual. While it is still below the price line and above the supply curve, it stops at the quantity bought by consumers. This is because the producers farther to the right have no one to sell to (even though they would like to sell at this price) and therefore cannot get any surplus from this market.
Closed Economy with Price Ceiling

A price ceiling is a legal limit on how high the price of a good or service can be. Remember, a price ceiling must be below the equilibrium for it to affect the market. If it is below equilibrium, it creates a shortage, because at that price $Q_0 > Q_s$. To find the price ceiling that gives a shortage of $X$, set up the equation $Q_0 - Q_s = X$. You can then solve your supply and demand equations for $Q$, plug them into $Q_0 - Q_s = X$, and solve for $P$.

The producer surplus is below the price line and above the supply curve. The consumer surplus is slightly different than usual. While it is still above the price line and below the demand curve, it stops at the quantity sold by producers. This is because the consumers farther to the right have no one to buy from (even though they would like to buy at this price) and therefore cannot get any surplus from this market.
The next two policies are aimed at ensuring producers receive a certain price for the good or service they produce. Historically, this has been used for farm goods so that farmers receive what the government considers a “fair” price, but the policies can be used in any market. You will not be asked to apply these concepts to an open economy (one with international trade).
Closed Economy with Price Support Program

One way the government can raise the price of a good or service is by buying the good, so that both the government and consumers are demanding the product. With a price support program, the government does this until the price increases to the desired level.

![Diagram of price support program]

We start with a price above the equilibrium as the government’s goal (if it were below the equilibrium, the government wouldn’t need to do anything). We can see that at that price, producers will produce more than consumers will want to buy (look at points A and B). Therefore, the government must buy the difference in these quantities.

In this case, consumers pay the price the government chose so the consumer surplus is above that price line and below the demand curve. Producers receive this same price so the producer surplus is the area below that price line and above the supply curve. And finally, as we said, the government must buy the difference between the quantity produced and the quantity demanded at that price, and they must pay the same price as everyone else. So the cost to the government is the vertical rectangle.

Note 1: We will not ask you to calculate dead weight loss for this situation.

Note 2: The government can either destroy, give away, or store the goods it buys (it can’t sell them because that would change the price in the market and mess up the original goal of the program). If the government is storing the good it buys (like cheese in caves), then it might have to pay for that, too. That cost isn’t on the graph above and doesn’t affect the market, but you can still calculate it (for example storing 100,000 blocks of cheese at a storage cost of $2/block would cost the government $200,000). The government would have to pay this in addition to the cost of buying the good in the market. If we don’t tell you there’s a storage cost, then you can just assume the government is destroying or giving away the good at no additional cost.
Closed Economy with Price Guarantee (Subsidy) Program

Another way the government can raise the price of a good or service is by adding some money to the amount the consumer pays for 1 unit. For instance, if the consumer paid $2 for a block of cheese, the government could add $1 so that the producer receives $3. If the consumer bought 10 blocks of cheese, then the government would give the producer $10. So even though the consumer is paying $2/block, the producer is getting $3/block.

We start with a price above the equilibrium as the government’s goal (if it were below the equilibrium, the government wouldn’t need to do anything). At that price, producers are producing at point A. In this case, the government is not buying anything. Therefore, the consumers must be buying all of this quantity produced. We can see that the price must be lower for consumers to buy that quantity (point B). So the government must pay the difference between these two prices.

Consumers are paying the low price so the consumer surplus is the triangle above this low price line and below the demand curve. The producers are still receiving the high price so the producer surplus is the area below that high price line and above the supply curve. (The two surpluses overlap.) And now the government is paying that price difference for every single unit bought, so they pay the price difference times the quantity bought/sold (which is the area of the horizontal rectangle).

Note: We will not ask you to calculate dead weight loss for this situation.
Closed Economy with Production Quota

A production quota is a legal limit on the quantity produced in a market. The government institutes this policy by selling quota licenses. Each license gives permission to produce 1 unit. So if the government wants there to be 5 units produced, for example, then they would sell 5 licenses. Of course, if the quota quantity is more than the equilibrium quantity, the government wouldn’t need to do anything.

![Diagram of a production quota]

With a production quota, consumers must buy everything producers make (the government isn’t buying anything here) so $Q_s = Q_o = \text{Quota Quantity}$. We can draw a vertical line at the quota quantity to represent this. We can see that consumers need to pay a higher price than producers receive for these quantities to be equal. That means the government can charge the difference as a license fee. As an example, consumers might pay $10 for one unit, and if the license fee is $3, then the producer will receive only $7 ($10 - $3). That’s how the government gets the quantity produced below the equilibrium.

Consumers pay the higher price (that includes the license fee) so the consumer surplus is the area above that price line and below the demand curve. The producers receive what the consumers pay minus the license fee, so the producer surplus is the area below the lower price line and above the supply curve. The government sells the quota licenses at the fee we just calculated and, as we said, in the amount of the quota. So the government revenue is the rectangle between the consumer and producer surpluses (this is also called the quota rent). The total surplus is the sum of the consumer surplus, producer surplus, and government revenue. We can see that the area that was originally in the total surplus, but is not now, is the tip of the large triangle. This is the dead weight loss.

*Note: You will not be asked to apply a production quota to an open economy (one with trade international trade).*
Open Economy (International Trade) with No Government Intervention

When an economy opens to international trade, consumers have a choice of buying from the world market and buying from domestic producers. Domestic producers can also sell to the world market or to domestic consumers. No matter how much they buy or sell, we assume the world price stays the same. There are three possible results of opening to trade. First, the world price might be exactly the same as the domestic equilibrium price. In that case, nothing happens since buying from or selling to the world market doesn't give anyone a better price.

If the world price is above the domestic equilibrium, then producers will want to sell to the world market (export). Domestic consumers will still want to buy some but will have to pay the higher world price (no producer will sell to consumers below the world price when it's just as easy to get the world price) and will consequently demand less. Producers will produce more since the world price is higher. The difference between those quantities will be the quantity exported: \( Q_s - Q_d = Q_{\text{Export}} \).
If the world price is below the domestic equilibrium, then consumers will want to buy from the world market (import). Domestic producers will still want to produce some but will have to sell at the lower world price (no consumer will buy above the world price when they can just as easily buy at the world price) and will consequently produce less. Consumers will demand more since the world price is lower. The difference between those quantities will be the quantity imported: $Q_D - Q_S = Q_{\text{import}}$.

In both cases, consumer surplus is above the world price line and below the demand curve, producer surplus is below the world price line and above the supply curve, and the total surplus is the sum of these. Notice that the total surplus is now bigger than when there was no trade.
The following two policies are intended to reduce the quantity imported, so we'll be looking at cases when the world price is below the domestic equilibrium price (so that there are imports to reduce).
Open Economy (International Trade) with Tariff

The government can reduce imports by simply making the world price higher. The amount the government adds to the world price is called a tariff (it's like a tax on imports). So now consumers have to pay the world price plus the tariff. On the graph, we move the world price up by the tariff amount.

Now, consumers pay the higher price so the consumer surplus is above the higher price line and below the demand curve. The producers can now raise their prices to the world + tariff price (but no higher) so the producer surplus is below the higher price line and above the supply curve. The government makes money from the tariff. That amount is the quantity imported (that's how many units the tariff is charged on) times the tariff amount (how much per unit the government is charging). This government revenue is just the area of the rectangle shown below. The total surplus is consumer surplus plus producer surplus plus government revenue. If we compare this to our previous open economy graph, we can see the two small triangles on either side of the government revenue used to be part of the total surplus but aren't in this case. The area of those triangles is our dead weight loss.
Open Economy (International Trade) with Import Quota

The government can also reduce imports by putting a legal limit on the quantity imported. Remember this is different from putting a legal limit the quantity produced. In this case, the government doesn't care how much is produced, only how much is imported. The policy is very similar to a tariff since the world is increased by the price of an import license. One import license gives permission to import one unit. So the price of one unit becomes the world price plus whatever the fee is for one import license. To know how much licenses should cost, we need to know what world price would cause the imports to equal the government's goal. One method is to simply guess prices above the world price and plug them into the domestic supply and demand equations until you find a price when the imports are exactly where the government wants them.

If guessing looks like it might take too much time, you can always calculate the price directly. Let's say the government's import quota is some number called \( Q_x \). We need to find a price where \( Q_0 - Q_x = Q_x \). We can plug our domestic supply and demand equations into this equation and solve for \( P \) (like we did for a shortage). Alternatively, we can rewrite \( Q_0 - Q_x = Q_x \) as \( Q_0 + Q_x = Q_0 \). This is the same as finding the intersection between the demand curve and the supply curve shifted right by \( Q_x \). We've practiced shifting lines left and right and finding intersections. So using a point on the supply curve and its slope, we can find a new supply curve with the quota shift. Then we can find its intersection with the demand curve.

The new price you find with whichever of these methods you prefer is the price that gives the import level the government wants (plug it in to check!). That price is the world price plus the license fee (so just subtract the world price to find the license fee). It's the price that consumers pay and the price domestic producers receive. Consumer surplus, producer surplus, and dead weight loss are identical to the tariff case. The money made from the import quota licenses (also called quota rent) is just like the money made from the tariff.

![Diagram](image)

Note: If the import licenses are given away by the government, then whoever receives them from the government earn the quota rent rather than the government. But who own these licenses will not affect your answers to questions about surpluses, so you might as well as assume the government sells them (even though in real life this isn't always the case).
Excise Tax

An excise tax is a per-unit tax levied on a good or service by the government. Here, the tax will be levied on producers, but in terms of the effects on the market, it does not matter if the tax is levied on consumers or producers.

The tax can be added to the graph by shifting the supply curve up vertically by the amount of the tax. This can be done by finding two points on the original supply curve and adding the tax to the price at both points. The two new points can then be used to find a new line. If you have the equation for the original supply curve, you can increase the intercept by the amount of the tax and keep the slope the same. This will also give the new supply curve.

The intersection of the new supply curve and the demand curve gives the quantity produced/consumed. The price at this intersection is the price consumers pay. The consumer surplus is above this price and below the demand curve. The government takes the tax from what the consumer pays so the producer receives the price the consumer pays minus the tax. The producer surplus is below this price and above the supply curve.

The government earns the tax times the quantity sold, which makes the center box the government revenue. We can divide this into two parts, one that comes from the old consumer surplus (this is called the Consumer Tax Incidence) and one that comes from the old producer surplus (this is called the Producer Tax Incidence). Since this depends on the old surpluses, we use the old equilibrium price to divide the government revenue. The dead weight loss is the remaining amount that was in the original surpluses but is earned by no one when the tax is in place.