1. **Which droplet size (large or small) carries the most fungal spores or bacterial cells?  Explain why.**

Large droplets will carry the most fungal or bacterial cells. Rain droplets in general are significantly larger than fungal spores or bacterial cells so all droplets will carry a significant number of spores or cells. As you increase in droplet size, the droplets will impact the plant at a faster speed and with more energy which causes the droplet to collect and disperse more spores farther than a smaller droplet would.

1. **What presentation angle for a sticky slide captures the most airborne pathogen spores?  Why?**

At high wind speeds, the 90° angle is the most efficient. At lower wind speeds, any presentation angle but 180° is viable, but the 45° angle is the most efficient. At the 180° angle, the wind will just blow the spores off of your slide and you won’t get an accurate reading. At 45° and 90°, you avoid some of the wind turbulence that would blow your spores off of your slide trap.

1. **Explain how conidia are forcibly discharged under the influence of electrostatic forces.**

In the proper conditions, charges build up in conidia that aid in their dispersal from the leaf. When relative humidity increases, decreases, or the fungus is exposed to red-infrared radiation, these charges build up between the spores which causes them to separate from each other and violently shoot off of the plant leaf and into the air.

1. **During spore discharge, does the larger diameter spore (ie. 100 microns) travel further or the smaller diameter spore (ie. 5 microns)?  Explain.**

The larger diameter spore will travel farther than the smaller diameter spore. Spore diameter increases faster than drag increases, meaning that the deceleration is less on a larger diameter pore.

1. **Why is the National Atmospheric Deposition Program (NADP) important to plant pathology?**

The NADP weather stations can be outfitted with fungal spore traps to collect data on fungal deposition. The weather stations also provide data on water deposition and precipitation totals. This can be used to help determine at what point in the year a plant pathogen will move to a certain stage of its life cycle.

1. **Describe 6 practices for controlling virus infection in potato**

In order to control virus infections in potato, you should ensure using clean tubers, controlling the virus vectors, breed in virus resistance into the plant host, using cross protection, using gene silencing, and inactivating the virus using heat. Nurseries that sell tubers have their products routinely indexed to ensure the product they are producing is pathogen free. This helps control virus populations by not allowing the virus into the field to begin with. In controlling virus vectors, insecticides, though ineffective, can be used to control insect populations. If the plant virus is vectored by nematodes, the soil can be fumigated to lower nematode populations and thus lower viral populations. In breeding virus resistance into the plant host, you must first find a plant resistance gene to bread into the host. Breeding host resistance can often be challenging as finding a resistance gene for a host can be difficult. Cross protection makes use of a less severe strain of your plant virus. If you infect your plants with the less severe strain of your plant virus, this prevents the more severe strain from infecting your plant which will help mitigate losses. Gene silencing is the use of small inhibitory RNAs that silence the viral genes. In order to inactivate viral particles, propagative organs are dipped in 35-54°C water for a few minutes or hours and actively growing plkants are kept in growth chambers at temperatures between 35 and 40°C. This will inactivate some viruses and allow the plant to grow normally.

1. **What mechanism causes the basidiospores of a rust fungus to be actively discharged? Describe the process.**

Basidiospores make use of surface tension in order to be actively discharged. The spores have an asymmetric shape with a bulge (hilar appendix) at their base. Before discharging, fluid begins to build up at the hilar appendix and at the apex of the adjacent spore. The fluid at the appendix forms a drop (Buller’s drop) which increases to a critical size. When the drop reaches critical size, it makes contact with the fluid at the apex of the adjacent spore and the drop moves. When this movement occurs, momentum is released into the spore allowing it to shoot off of the sterigma.

1. **Compare & contrast the similarities and differences between biotrophic and necrotrophic pathogens.**

A biotrophic pathogen is an obligate pathogen. They have a highly evolved interation with their host and do no normally kill their host. These pathogens are not able to be cultured as they cannot survive without their host. Examples of biotrophic pathogens are viruses and certain types of fungi including rusts, smuts, and downy mildews.

Necrotrophic pathogens are facultative pathogens. These pathogens can survive outside their hosts, typically as saprohpytes. These pathogens will opportunistically attack a host and will cause severe disease or death of the host. Also known as non-obligate pathogens, examples of necrotrophic pathogens include many bacterial and fungal strains.

1. **Compare & contrast similarities and differences between monocyclic and polycyclic disease cycles. Which type of disease cycle does each of your 3 selected pathosystems have?**

In a monocyclic disease cycle, a pathogen produces a primary inoculum. When the primary inoculum comes in contact with a host, it causes a primary infection. The disease. At the end of the growing season, the pathogen goes into an overwintering stage and lies dormant until the next growing season. During the next growing cycle, the overwintering structures produce a primary inoculum and the cycle starts again. During a polycyclic disease cycle, primary inoculum comes into contact with a plant surface causing a primary infection. This primary infection produces a secondary inoculum which, upon dispersal, produces a secondary infection. This secondary infection cycle can be repeated many times over a growing season before the pathogen produces overwintering structures. Once the pathogen enters its overwintering stage, it waits for proper conditions before releasing the primary inoculum and restarting the cycle. Fusarium of palms has a monocyclic disease cycle, panama disease of bananas exhibits a monocyclic disease cycle, and mango malformation disease has a polycyclic disease cycle.