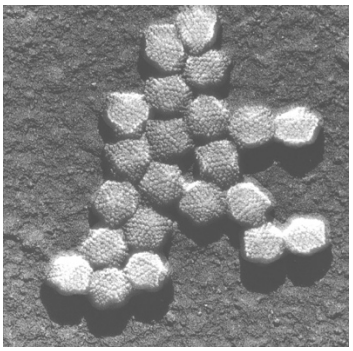
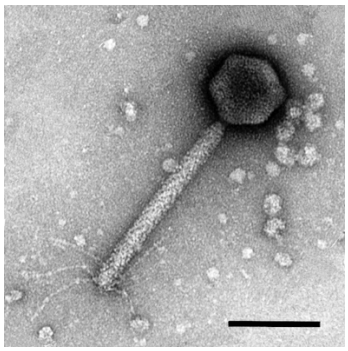
Name: _____
Hour: _____

Socratic Seminar – Viruses

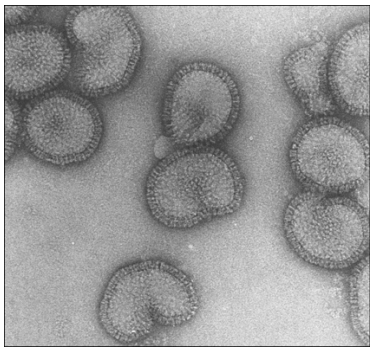
Introduction:
A virus is a tiny bundle of genetic material-- either DNA or RNA-- Carried in a protein shell called a capsid. Some viruses have an additional layer around this coat called an envelope. The envelope is made of a lipid. Three examples of viruses can be seen in Figure 1.



Adenovirus



Bacteriophage



Influenza Virus

Figure 1. sizes vary between 45 and 200 nanometers (10^{-9} meters)

When a virus enters a cell, the information carried in a virus's genetic material enables the virus to force the infected cell to make more copies of the virus. The poliovirus, for example, can make over one million copies of itself inside a single human intestinal cell. A virus is usually very, very small compared to the size of the cell it infects.

Viruses can infect the cells of plants, animals, fungi, protists, and even prokaryotes. Any individual species of organism may be infected by hundreds of different types of viruses, which can infect that specific species alone. There are viruses that infect only humans (for example, smallpox), viruses that infect humans and a few other species (for example, influenza), viruses that infect only one kind of plant (for example, the tobacco mosaic virus), and some viruses that infect only a particular species of bacteria (for example, various bacteriophages that only infect *E. coli*).

These unique traits of viruses have made many scientists wonder: **Should a virus be classified as a living thing?**

Develop one question about a virus being a living thing. Present evidence that answers your question. Be thorough and thoughtful about your question and evidence

Question:

_____

_____

Evidence:

_____

_____

_____

Develop one question about a virus *not* being a living thing. Present evidence that answers your question. Be thorough and thoughtful about your question and evidence

Question:

_____

_____

Evidence:

_____

_____

_____

Name: _____
Hour: _____

Socratic Seminar: Guided Questions

Directions: Use the class website to help research the following questions (you may use other websites) – be detailed in your responses. You will be discussing these with your classmates soon.

1. What is life? Describe attributes of life that make it distinctive from other parts of the Earth system, such as minerals, water, or light.

_____

_____

_____

_____

_____

2. What is a virus, what qualities do viruses possess that are characteristics of life (from above question), what qualities set them apart from the classic definitions of life?

_____

_____

_____

_____

_____

3. Is a virus a living entity? Why or why not? Support your answer with ideas from the previous questions.

_____

_____

_____

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_____

4. If you define a virus as a living entity, what are the limits of life? How does a virus die? Discuss what qualities must be present for something to be considered alive.

_____

_____

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5. If a virus is not defined as living, what is it? How does it reproduce? How have viruses evolved through time?

_____

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Name: _____
Hour: _____

Socratic Seminar: Claim, Evidence, Reasoning

Directions: Based off of your research to the question "Should viruses be classified as a living thing?" make a claim as to what you believe. You will then use evidence to back up your claim and reasoning to defend your evidence and back up your claim. As you write your argument, remember to do the following:

- State the claim you are trying to support
- Include genuine evidence (data, analysis, and interpretation)
- Provide a justification of your evidence that explains why the evidence is relevant and why it provides adequate support for the claim.
- Organize your argument in a way that aides readability.
- Use a broad range of words including relevant vocabulary.
- Correct grammar, punctuation, and spelling errors.

The Research Question: _____

Your Claim: _____

Your Evidence: _____

Your Reasoning:_____

Once your argument is written, are you able to answer the following questions?

- Why does your evidence support your claim?
- Why did you decide to use that evidence? Why is your evidence important?
- How do you know your analysis of the data is free from errors?
- How did you analyze or interpret your data? Why did you decide to do it that way?
- How does your justification of your evidence fit with accepted scientific ideas?
- Why did you reject another claim?

Name: _____
Hour: _____

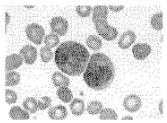
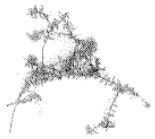
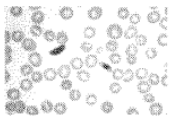
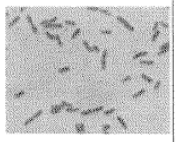
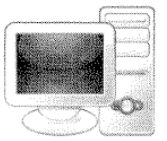
Reference Information:

Table 1 – Information about Viruses and other objects found on Earth.

Object and Size[1]	Appearance	Functional "Life" Span	Energy Source	Carbon Source	Waste Production	Responds to External Stimuli	Biomolecules[2] Present in the Object	Form of Reproduction	Genetic Material[3]	Growth?
Influenza Virus 130 nanometers in diameter		10 Years	None	None	None	No	Nucleic Acid Protein	Replication; Requires a host	RNA	No
Adenovirus 220 nanometers in diameter		10 Years	None	None	None	No	Nucleic Acid Protein Lipids	Replication; Requires a host	DNA	No
Coriander Seeds 3 millimeters in diameter		1–10 Years	Organic Compounds[4]	Carbon Dioxide	None	Yes	Nucleic Acid Protein Lipids Carbohydrates	Sexual[5]	DNA and RNA	Yes
Amoeba 500 micrometers in diameter		1–3 Months	Organic Compounds	Carbohydrates	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	Asexual[6]	DNA and RNA	Yes
Human Red Blood Cell 8 micrometers in diameter		3–4 Months	Organic Compounds	Carbohydrates	No	No	Nucleic Acid Protein Lipids Carbohydrates	None	None	No

1. 1 meter = 100 centimeters = 1000 millimeters = 1,000,000 micrometers = 1,000,000,000 nanometers
2. A biomolecule is any molecule that performs an important function in living organisms. Biomolecules are usually composed of hydrogen, carbon, oxygen, nitrogen, prosperous, or sulfur atoms and they are organized into one of four main groups (carbohydrates, proteins, lipids, and nucleic acids).
3. The genetic material of an object is the molecule(s) that play the fundamental role in determining the nature and structure of an organism or cell.
4. Organic compounds are molecules that are composed of carbon such as sugar (which is a type of carbohydrate)
5. *Sexual* refers to a form of reproduction in which two parents give rise to an offspring.
6. *Asexual* refers to a form of reproduction that involves only one parent that produces genetically identical offspring by budding or by the division of a single cell or the entire organism into two parts.

Name: _____
Hour: _____

Object and Size	Appearance	Functional "Life" Span	Energy Source	Carbon Source	Waste Production	Responds to External Stimuli	Biomolecules Present in the Object	Form of Reproduction	Genetic Material	Growth?
Human White Blood Cell 10 micrometers in diameter		1 Month	Organic Compounds	Carbohydrates	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	None	DNA and RNA	No
Sponge 100 centimeters in diameter		100–200 Years	Organic Compounds	Carbohydrates	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	Sexual and asexual	DNA and RNA	Yes
Elodea 40 centimeters in length		2–4 Weeks	Sunlight	Carbon Dioxide	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	Sexual and asexual	DNA and RNA	Yes
Plasmodium Falciparum 15 micrometers in length		1–2 Months	Organic Compounds	Carbohydrates	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	Sexual and asexual but only occurs inside a host	DNA and RNA	Yes
E. Coli 3 micrometers in length		1–3 Months	Organic Compounds	Carbohydrates	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	Asexual	DNA and RNA	Yes
Tube Worms 1.5 meters in length		100–200 Years	Inorganic Compounds	Carbohydrates	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	Sexual	DNA and RNA	Yes
Dog 0.75 meters in height		15–20 Years	Organic Compounds	Carbohydrates	Yes	Yes	Nucleic Acid Protein Lipids Carbohydrates	Sexual	DNA and RNA	Yes
Computer 45 centimeters in height		10–20 years	Electricity	None	Yes	Yes	None	None	None	No