1) Hand draw and label a non-enveloped virion. (4 pts)

![Non-enveloped virion diagram]

2) What is the difference between a non-enveloped virion and an enveloped virion? (4 pts)

**Enveloped virus:** Many viruses (e.g. influenza and many animal viruses) have viral envelopes covering their protein capsids.[1] The envelopes typically are derived from portions of the host cell membranes (phospholipids and proteins), but include some viral glycoproteins.

**Non-Enveloped virus:** as pictured in question one above - without a host's membrane structure.

3) How large is the biggest virion compared to how small is the tiniest virion? (2 pts)

10nm to 400nm

4) What are the criteria used in classifying virions? (4 pts)

**Nucleic acid, presence or absence of envelope, shape, size and host of attack**
5) How many orders of virions have been classified to date? (1 pts)


6) Sketch and briefly describe the 5 different stages that a T₄ lytic type virion uses for replication within an *E. coli* bacteria. (10 pts)
7) Draw and annotate a diagram for a virion replication graph. (14 pts)

See text book for explanation:

**Attachment** The tail fibers attach to host cell. Attachment is dependent on the chemical attraction and precise fit between attachment proteins.

Entry T4 releases enzymes to weaken the peptidoglycan of the cell wall and the phage genome moves through the cell wall and into the bacterium

**Burst** the bacteriophages synthesizing in its own molecules and genes synthesizing new viruses under control of the viral genome. Translation in the host cell's ribosomes results in viral proteins.

**Assembly** the viral proteins spontaneously attach to each other to form new virions.

**Release** newly assembled virions are released from the cell as helicases completes its work on the cell wall and the bacterium digests.
8) A. During Lysogenic conversion phage lambda virus becomes integrated into an *E. coli* host’s genomic structure. What is the resulting integrated virus now called ___Prophage_______________? (1 pt)

Lysogenic conversion is responsible for ___Tox_______________ genes being incorporated into the bacterial genome evoking potential disease. (1 pt)

B. During the process of viral excision (called ___Induction______) from the *E. coli* host a ___Prophage________________ now becomes follows a lytic process. (2 pt)

C. What are 3 agents that may cause the events in question B? (3 pts)

___U.V. light________________

___X-ray____________________

___Carcinogenic chemicals____

9) In what part of Eukaryotic cell animal type: (4 pts):

RNA virus replicated

_____Cytoplasm___________________________________________

DNA virus replicated

_____Nucleus _____________________________________________

RNA retrovirus

_____Cytoplasm & Nucleus_________________________________

10) Describe the three mechanisms by which animal viruses make entry into an animal cell. (6 pts)

___Endocytosis___________________________________________

___Direct penetration_____________________________________

___Membrane Fushion_______________________________________
11) How does a virus exit an animal cell? (3 pts)

Virus are released from the host cell either by **lysis** of the host cell or by **budding** where virus are assembled, they are extruded through one of the cells membranes (the nuclear membrane for DNA type virus, the endoplasmic reticulum for cytoplasmic membrane for RNA type virus). Naked animal virus may be released by **exocytosis** which is a process similar to budding.

12) Draw and label the 3 models of by which (-)RNA, (+)RNA, (ds)RNA type virus replicate occurs within Eukaryotic cells. (12 pts)
A) Positive single-stranded RNA viruses (picornaviruses)

\[ +\text{RNA} \rightarrow \text{Proteins (after processing by host and virus-coded proteinase)} \]
\[ \text{Viral replicases} \rightarrow \pm \text{RNA} \rightarrow +\text{RNA (virion)} \]

B) Double-stranded RNA viruses (reoviruses)

\[ \pm\text{NRA} \rightarrow +\text{RNA} \rightarrow \text{Protein} \]
\[ \text{Replicase} \rightarrow \pm \text{RNA (viron)} \]

C) Negative single-stranded RNA viruses (paramyxoviruses - mumps and measles orthomyxoviruses — influenza)

\[ \text{RNA-dependent RNA polymerase} \]
\[ -\text{RNA} \rightarrow +\text{RNA} \rightarrow \text{Proteins} \]
\[ \text{viral replicase} \rightarrow \pm \text{RNA (replicative form)} \rightarrow -\text{RNA} \]

D) Retroviruses (Rous sarcoma virus, HIV)

\[ \text{RNA-dependent DNA polymerase} \]
\[ \text{Reverse transcriptase} \]
\[ \text{Ribonuclease H} \]
\[ +\text{RNA} \rightarrow +\text{RNA/-DNA} \rightarrow -\text{DNA} \rightarrow \pm\text{DNA} \]

RNA Reproductive Strategies

13) Now, in summary, describe 3 ways that a virus can be damaging to a Eukaryotic cell. (6 pts)

1. **Active infections** caused by DNA viruses include hepatitis, infectious mononucleosis, Burkitt’s lymphoma, chicken pox, and small pox.

2. **Latent infections** caused by DNA viruses include genital herpes and pharyngitis cause by adenoviruses.

3. **Lytic burst** cells kill by lytic action of virus such as lip cold sore Herpes simplex 1 virus
   Or simplex 2 genital virus.

4. **Oncogenic** (cancer-causing) and potentially oncogenic DNA viruses are common; such viruses cause cancer of the liver and genitourinary tract, as well as lymphoma and papilloma.