A. Answer the following short answer questions. (60 POINTS TOTAL)

1) Describe the mechanism by which poliovirus shuts off host cell translation (4 points).

2) What is cap snatching and why is it necessary for influenza replication (5 pts)?

3) For each virus family listed below, give the type and nature of the genome, number of genome segments, and whether it is an enveloped or nonenveloped virus (for example: Togavirus - enveloped plus sense RNA virus having one genome segment) (15 points).

   Filovirus

   Picornavirus
Flavivirus

Orthomyxovirus

Paramyxovirus

4) What is an ‘IRES’ and how would you experimentally identify one (10 points)?

5) What features or motifs are found on integral membrane proteins that are necessary for them to function in the plasma membrane? (4 points).
6) Draw the pathway, showing only nucleic acid intermediates, by which an alphavirus genome is replicated. Be sure to show all intermediates in replication (6 points).

7) In the blanks below, match the viruses on the left side with their corresponding families listed on the right side (6 pts).

- rabies virus
- yellow fever virus
- rhinovirus
- hepatitis C virus
- measles virus
- Hantaan virus

A. Rhabdoviridae
B. Bunyaviridae
C. Paramyxoviridae
D. Picornaviridae
E. Flaviviridae
F. Flaviviridae

8) Explain the process of low pH-mediated fusion of influenza virus. List the key molecules and their function. Describe in a stepwise manner these events (10 points).
B. Answer the following TRUE (T) OR FALSE (F). (2 points each, 20 POINTS TOTAL)

______ 9. Alphaviruses depend on host cell lysis for virus release.

______ 10. Antigenic shift in influenza virus is the major determinant for significant outbreaks of viral disease.

______ 11. A major difference between enveloped and non-enveloped viruses is the inability of enveloped viruses to form regular icosahedral structures.

______ 12. The canyon hypothesis of picornaviruses suggests that antibody molecules bind deeply into the depression found around the 5-fold axes of the virion.

______ 13. Cis-acting sequences required for alphavirus replication can be identified using defective-interfering RNAs.


______ 15. The flavivirus polyprotein is processed exclusively by viral proteases.

______ 16. Influenza virus replicates in the nucleus of cells and therefore does not require a viral polymerase to replicate its genome.

______ 17. The Sabin vaccine of poliovirus is a mixture of three attenuated poliovirus strains.

______ 18. Poliovirus VPg is necessary for the initiation of viral RNA replication.
C. Answer the following problem solving question (20 points)

19) An interesting paradox is faced by all viruses. On one hand the virus must form a stable particle so that it can withstand life in the "extracellular world" while on the other it still must be unstable enough to disassemble upon reaching a new host cell. The paradox is: ‘Why do incoming viruses disassemble, when progeny virus particles in the same cell a few hours later remain fully intact?’ Describe two models how a virus could solve this problem and provide an experiment that will allow you to discriminate between your two hypotheses.