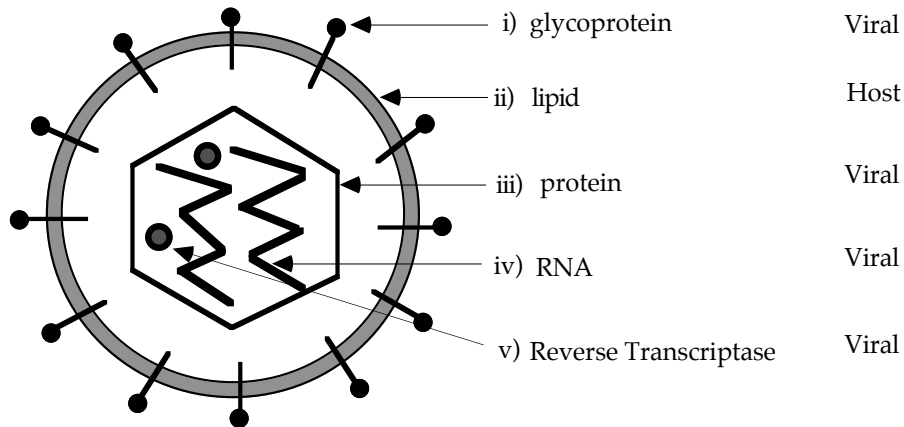


7.014 Section Solutions: AIDS

a)



b) *The gp120 protein on the surface of the HIV envelope binds to the CD4 receptor, and this ligand-receptor binding event is the first step in infection.*

c) i)

1. *Synthesis of single (-) strand of DNA using the single (+) strand RNA genome as the template.*
2. *Degradation of the single (+) strand RNA template.*
3. *Synthesis of the complementary (+) strand of DNA using the single (-) strand of DNA as the template to form double stranded DNA.*

- ii)
1. *RNA-directed DNA polymerase activity.*
 2. *RNase activity.*
 3. *DNA-directed DNA polymerase activity.*

d) *While AZT will inhibit DNA synthesis mediated by reverse transcriptase, it will also inhibit nucleic acid synthesis in other cells of the body, mediated by DNA polymerases and thus kill cells which are dividing. All bodily cells that are actively replicating (e.g.: red blood cell precursors, skin cells, etc.) can be affected by these nucleotide analogs. However, HIV reverse transcriptase will use AZT and thymidine interchangeably while host cell DNA polymerase prefers thymidine over AZT. Therefore, AZT may be used at concentrations that inhibit HIV replication but are not yet toxic to host cell polymerases.*

e) *It would be effective to target the integration of the double-stranded DNA into the host cell genome. Not only is the integrase enzyme a retroviral-specific enzyme, but developing therapies to disrupt this enzyme's activity won't likely affect other cellular properties, because we do not possess any enzymes which have this type of activity.*

Additionally, viral protease inhibitors will affect the processing of the viral polyprotein into active proteins. The host proteins are not synthesized as polyproteins.

f) *The mutations are most likely to be in the viral gene coding for reverse transcriptase (the pol gene) because mutations in this gene may directly cause the mutated reverse transcriptase not to prefer AZT during replication and thus become resistant to AZT.*

g) *Order of steps: B D C A F E G*