

d. Means of genome expression. Describe the different gene expression strategies used by HIV-1 to translate its genome.

e. Major steps in replication cycle. What host molecule serves as the primer for replication? What features of the HIV-1 replication are unique?

Question 2. 25 points. Write yes or no in each space

Characteristic	Present or absent in			
	Retrotransposon	HIV-1	CaMV	Hepatitis B
a) RNA genome				
b) DNA genome				
c) usually integrates into host				
d) contains LTRs				
e) enveloped particles				
f) reverse transcriptase				

Question 3. 10 points. Write T or F

True or False

- _____ Retrotransposons make virus-like particles, but they are generally not infectious
- _____ Reverse transcriptase is required for frameshifting
- _____ Hepatitis C virus uses RNA dependent RNA polymerase for its replication
- _____ Recombination occurs in DNA viruses, but not RNA viruses
- _____ Lentivirus particles contain a round core in the middle.
- _____ Ribosomal frameshifting is a translation mechanism used by retrotransposons.
- _____ Retroviral DNA is transcribed by cellular RNA polymerase.
- _____ Cauliflower mosaic virus requires both cytoplasm and nucleus to complete its replication.
- _____ Hepatitis B virus is the most important cause of acute hepatitis in the U.S.
- _____ The genome of Hepatitis B is the largest of any of the reverse-transcribing viruses

Question 4. 10 points.

What are the general features of retroviruses that form tumors and how are they different from HIV-1?

Question 5. 20 points. To the left of each number representing each phrase in the column on the left, write the letter of the corresponding term from the column on the right. Each letter should be used exactly once.

1. RNA dependent RNA polymerase	A. HIV-1
2. Discovery of reverse transcriptase	B. Hepatitis C virus
3. Contains an oncogene	C. Reverse transcriptase
4. A virus that uses a cap structure for translation	D. Temin and Baltimore
5. RNase H activity	E. Rous sarcoma virus
6. A virus that uses suppression of termination	F. Rev protein
7. Contains primer binding site	G. Tat protein
8. Transport of partially spliced RNA	H. LTR
9. Required for retroviral transcription	I. Retrovirus

Question 6. 10 points. Your smart friend who is a biologist but not a virologist asks you to explain succinctly the main differences between Hepatitis B and Hepatitis C viruses. Give her an answer in two sentences containing no more than 60 words total. (e.g., 30+30, 40+20, 45+15, or less. I'LL TAKE A POINT OFF FOR EVERY EXTRA WORD!)

Note to students about question 6:

It turns out I really like this question. You'll see at least one and probably two like it again. Of course, the point of the question is in a sense the point of the course - to teach us all to understand information well enough to be able to synthesize what we know so that we can use it in our daily lives and be able to communicate the essence of it to others. Knowing detail is great, but if you start communicating with someone who is intelligent, but not knowledgeable in a specific area, through detail, and then try to broaden a conversation from there, you're likely to lose the person from the beginning. Before I graded this question, I wrote my own answer as I would approach the question given the constraints I imposed. I imagined talking to my smart premed daughter who has taken biology, chemistry through organic, genetics, neuroscience, and anatomy, but not biochemistry, molecular biology, or virology. I gave myself five minutes to answer the question. My first answer, which I wrote in a little more than three minutes, was 74 words. I identified a couple of concepts that had to be jettisoned (illegitimate integration of the "X" protein gene as a factor in HepB causing cancer and HepC being related to *Yellow fever virus*) and was left with two sentences comprising 58 words within my self-imposed 5 minute time constraint:

Hepatitis B, a DNA-containing pararetrovirus, replicates by reverse transcription in particles in cytoplasm, transcribes in the nucleus, causes acute or chronic liver disease, sometimes cancer, and is preventable by vaccination. Hepatitis C, an RNA-containing flavivirus, replicates in the cytoplasm through an RNA intermediate, is the leading cause of chronic liver disease, and is currently not preventable by vaccine.

I'm not saying this is the ideal answer - there were some very good answers that were different in content from mine. The best ones, however, addressed both aspects of the viruses and the diseases they cause. Obviously, short answers such as these would still require some follow-up conversation - but you get the point.