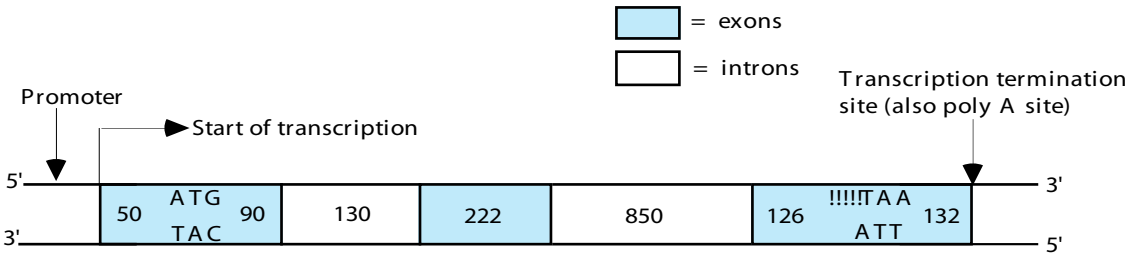
SOLUTION KEY- SECTION 7

1. Shown below is the genomic structure of the human b-globin gene. The numbers within the boxes indicate the length (in nucleotides) of each region. The DNA sequences corresponding to the start codon and the stop codon are indicated.



What is the length (in nucleotides) of the mature, processed b-globin mRNA?
It is 620bp long. Note: But if you consider the alternative splicing of introns then there are other possibilities too i.e. 398bp.

2. The mature mRNA sequence has some nucleotides that are not represented in the template strand of the genomic DNA sequence.

iii. What nucleotide is added to the 5' end of the mature mRNA? Why is it important?
7 methyl guanine is added to the 5'end of mature mRNA. It protects the mRNA from degradation by exonucleases and also promotes ribosomal binding.

iv. What nucleotides are added to the 3'end of the mature mRNA? Why are they important?
A poly A tail, comprised of approximately 200 adenine nucleotides is added to the 3'end of the mature mRNA. It provides stability to the mature mRNA and prevents its degradation by exonucleases. It may also promote export of the mRNA from the nucleus into the cytosol.

3. How does the chromatin structure of a stem cell/ progenitor cell cell differ from that of a highly differentiated cell?
The dividing cells express a greater fraction of genes compared to highly differentiated cells such as muscle and nerve cells. Gene expression requires chromatin modification, which promotes the unpacking of chromosomes so that the genes are accessible to the transcription factors and available for transcription. The most common chromatin modifications that promote DNA unpacking are an increase in histone acetylation and a decrease in DNA methylation.

7.013 Introductory Biology
Spring 2013