Transcription Overview

A Level

Part A Transcription & Translation

A [ ] is a region of DNA that "codes for" a protein. The production of a protein happens in two main steps: transcription and translation.

Transcription is the process by which [ ] is produced from [ ]. In eukaryotic cells, this process happens inside [ ].

Translation is the process by which [ ] is produced from [ ]. This process happens inside [ ].

Items:

DNA **gene** **the nucleus** **a polypeptide chain** **messenger RNA (mRNA)** **a ribosome**

Part B The process of transcription

Transcription begins when transcription factors and the enzyme [ ] bind to the promoter region of a gene. The enzyme then moves along the DNA, unwinding and unzipping it as it does so. The enzyme facilitates the binding of complementary RNA nucleotides to the [ ] strand (in the $5'$ to $3'$ direction), forming an mRNA strand that has the same base sequence as the [ ] strand of DNA (except that the [ ] DNA bases are replaced by [ ] RNA bases).

Items:

RNA polymerase **adenine** **antisense/template** **thymine** **uracil** **lagging** **sense/coding**

DNA polymerase **leading** **guanine** **cytosine**

Part C Pre-mRNA to mRNA

The RNA strand produced by transcription is often called "pre-mRNA", and must undergo certain modifications in order to become mature mRNA.

A $5'$ cap is added to the [ ] end of the strand. This consists of a modified [ ] nucleotide. A poly(A) tail is added to the [ ] end of the strand. This consists of 100 to 250 [ ] nucleotides. These features allow the cell to identify the RNA as mRNA, which ensures that it will be exported from the nucleus (in eukaryotic cells) and bind to a ribosome.

Pre-mRNA also undergoes a process called splicing, during which the [ ] (non-coding regions) are removed so that only the [ ] (coding regions) remain.

Once the pre-mRNA has been capped, polyadenylated, and spliced, it is now a mature mRNA that can be translated.

Items:

uracil | $5'$ | **introns** | **guanine** | $3'$ | **adenine** | **exons** | **cytosine**

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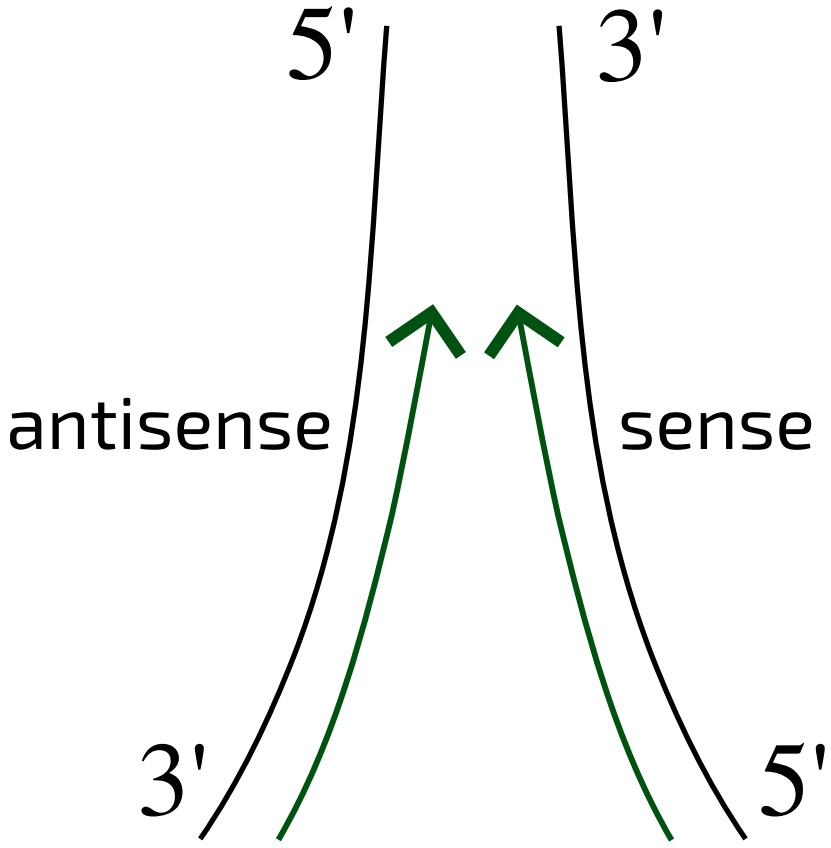
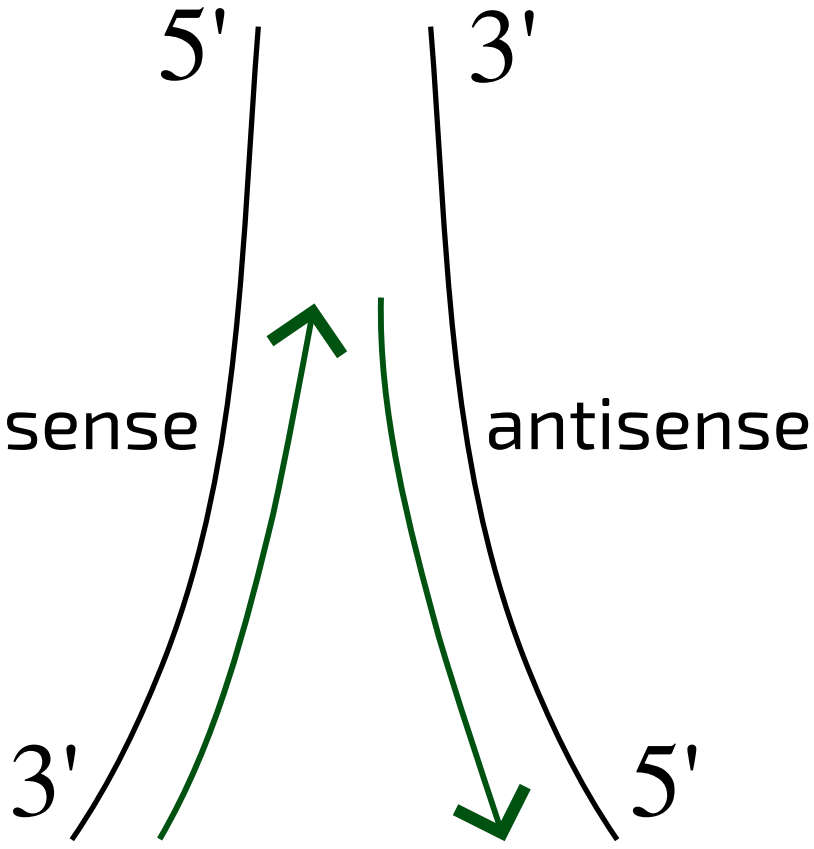
Transcription Diagrams

A Level

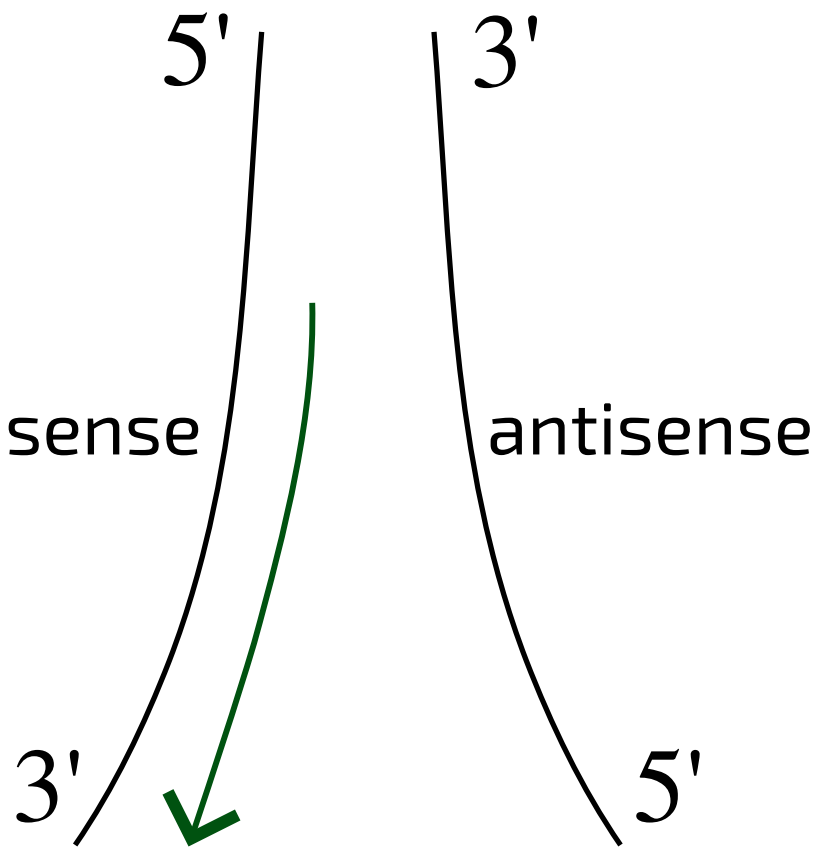
The images below represent DNA transcription. The labels ($5'$ and $3'$) refer to the DNA strands (black). The DNA molecule is unzipping from bottom to top. The green arrows represent possible directions of nucleotide addition by RNA polymerase.



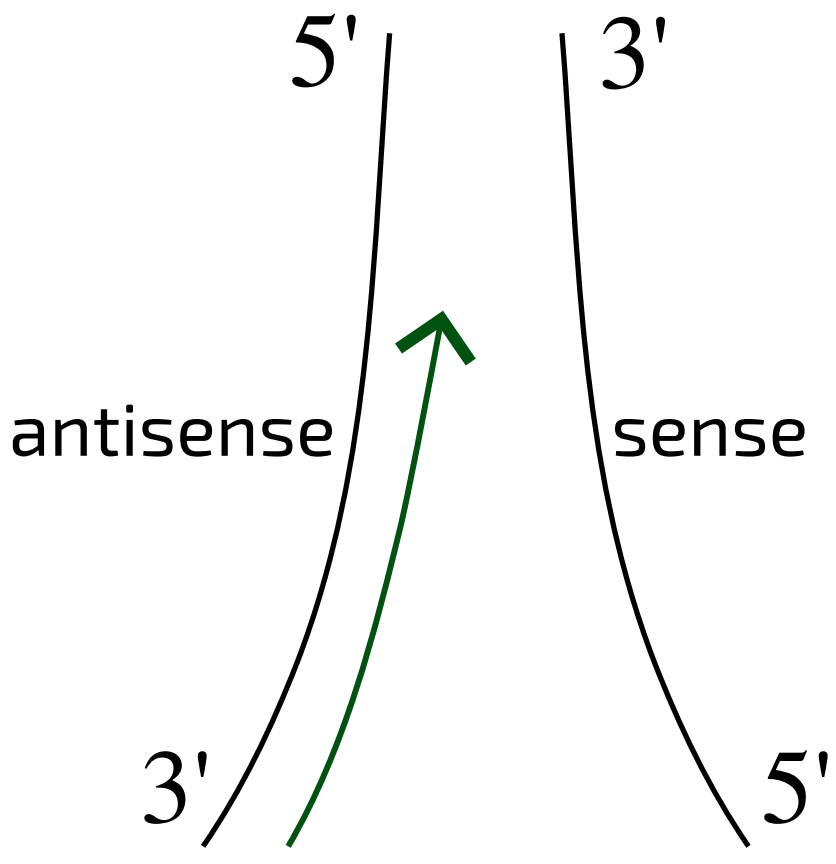
A



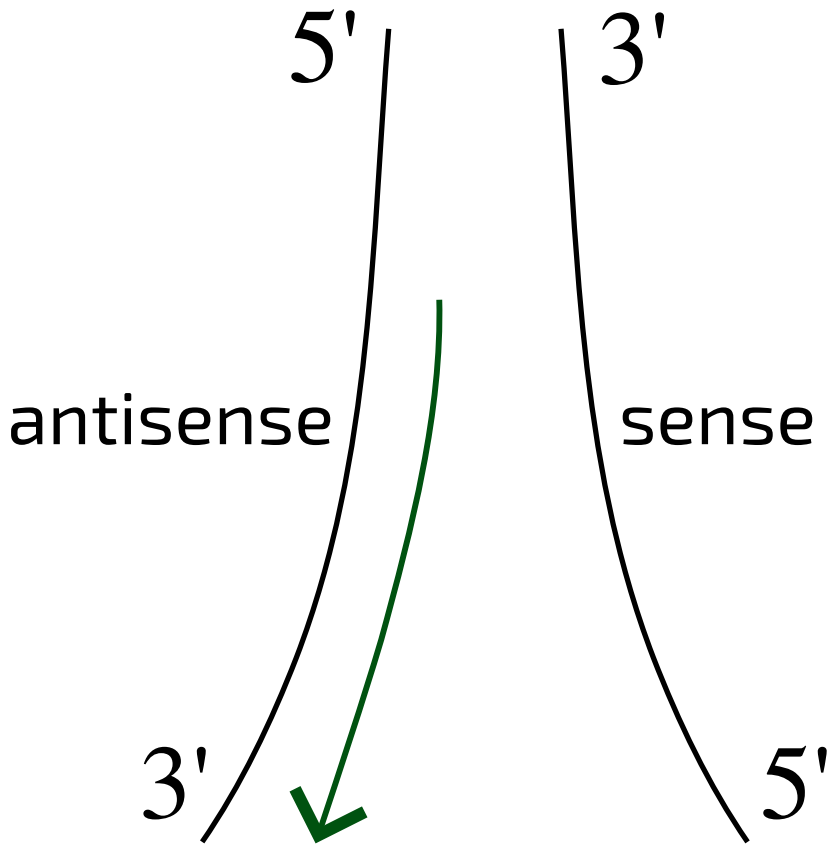
B



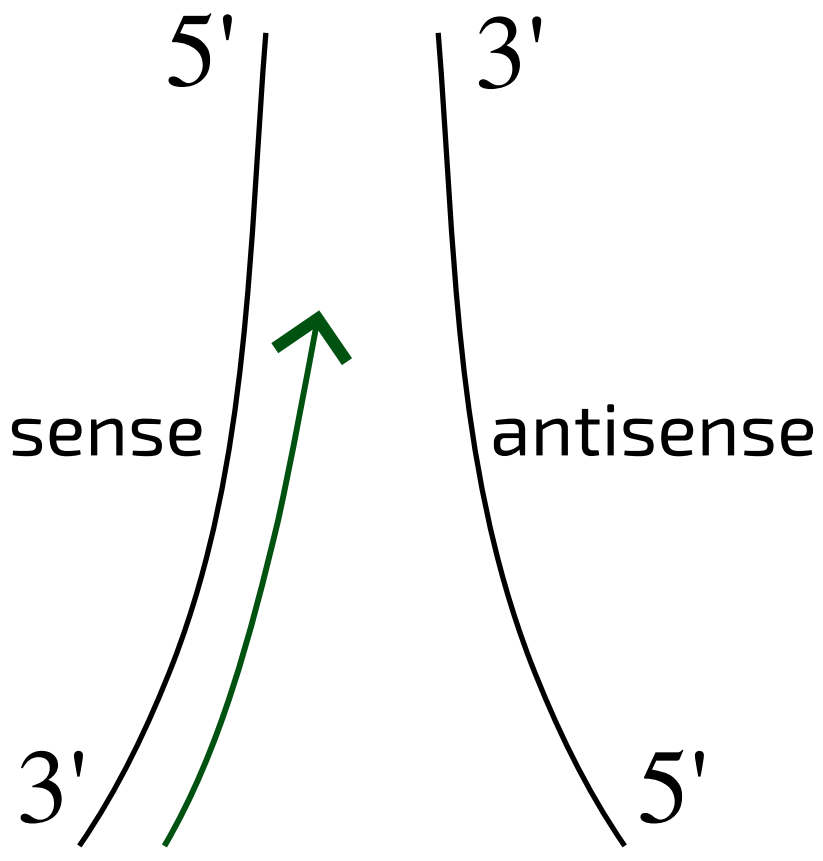
C



D



E



F

Which image above correctly illustrates the process of DNA transcription?

- A
- B
- C
- D
- E
- F

DNA vs RNA

A Level

Part A DNA

Which of the following are true of DNA?

- [ ] is single-stranded in eukaryotic cells
- [ ] is double-stranded in eukaryotic cells
- [ ] contains thymine
- [ ] contains uracil
- [ ] contains ribose
- [ ] contains deoxyribose

Part B RNA

Which of the following are true of RNA?

- [ ] is single-stranded in eukaryotic cells
- [ ] is double-stranded in eukaryotic cells
- [ ] contains thymine
- [ ] contains uracil
- [ ] contains ribose
- [ ] contains deoxyribose

Transcription vs Replication

A Level

In the table below, identify which statements about transcription and DNA replication are correct, and which are incorrect. Fill in every box with either a tick (correct) or a cross (incorrect).

	Transcription	Replication
free nucleotides bind to both DNA strands		
two new DNA molecules are produced		
hydrogen bonds are broken between the two DNA strands		
uracil nucleotides bind to adenine nucleotides		
the process occurs along the entire length of the chromosome		
the process only occurs at specific regions of the chromosome(s)		

Items:

✔ ✖

Adapted with permission from OCR A Level January 2003, Biology Foundation, Question 4

Gameboard:

STEM SMART Biology Week 7

Transcribe the Sequences

A Level

C C C

Part A Sense to RNA

A region of the sense/coding DNA strand contains the following base sequence (from $5'$ to $3'$):

ATGCCGCAGTTC

Enter the sequence of the mRNA that would be transcribed from this gene region (from $5'$ to $3'$). Enter your answer in all caps and without spaces.

Part B Antisense to RNA

A region of the antisense/template DNA strand contains the following base sequence (from $3'$ to $5'$):

TACAGTCAGTCA

Enter the sequence of the mRNA that would be transcribed from this gene region (from $5'$ to $3'$). Enter your answer in all caps and without spaces.

Part C RNA to sense

A region of mRNA contains the following base sequence (from $5'$ to $3'$):

CAUGUCAAAUGG

Enter the sense/coding strand sequence of DNA (from $5'$ to $3'$) that produced this mRNA sequence. Enter your answer in all caps and without spaces.

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Post-transcriptional Modifications

A Level

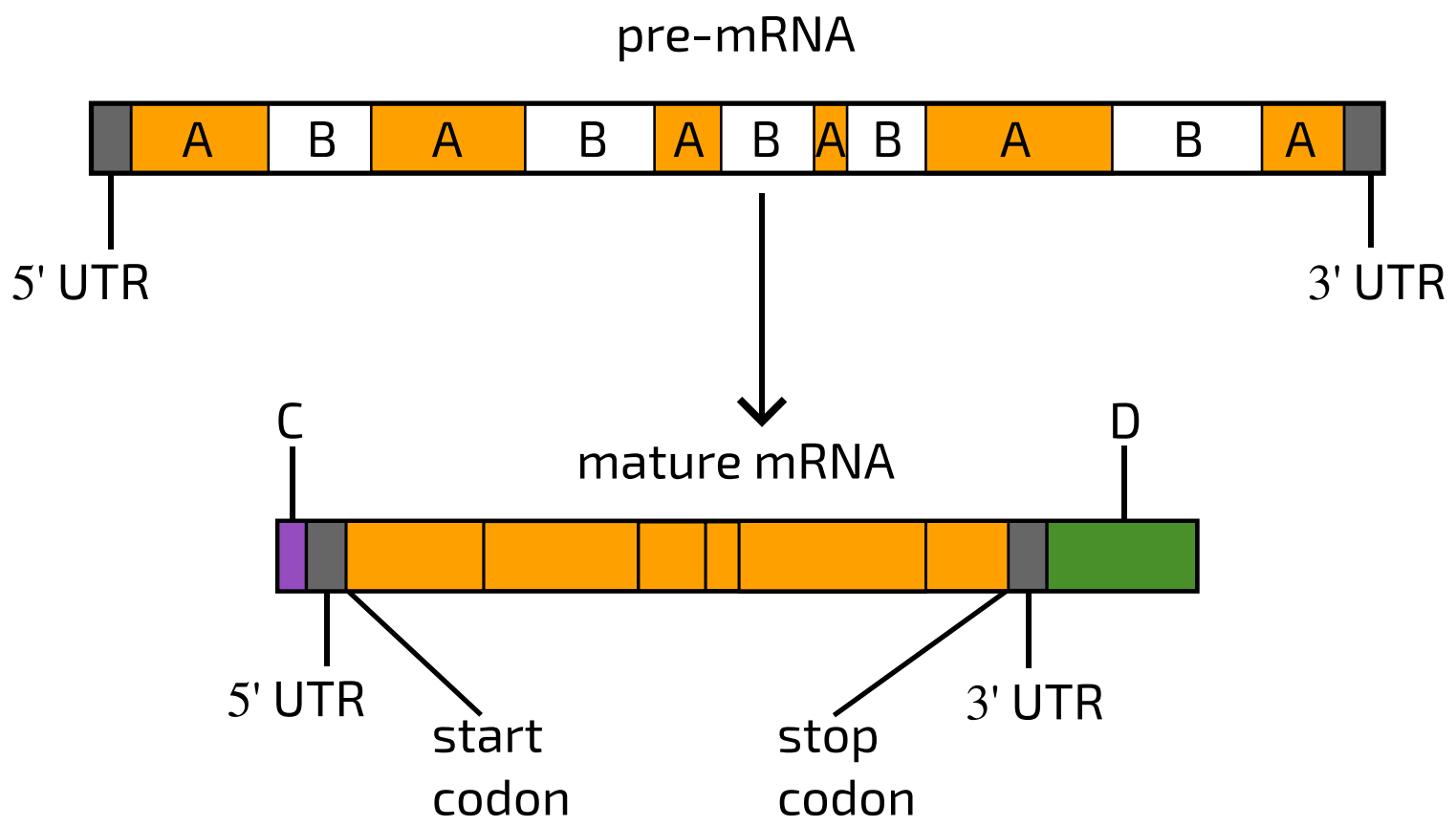

Figure 1: Post-transcriptional modification. A pre-mRNA transcript is modified to become a mature RNA through splicing, capping, and polyadenylation. UTR = untranslated region.

Match the labels from Figure 1 to the mRNA regions in the table below.

Label	Region
A	
B	
C	
D	

Items:

$5'$ cap **intron** **$3'$ cap** **C-terminus** **N-terminus** **exon** **poly(A) tail**

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