2) What is the difference between a template and a primer?

- DNA primase requires a DNA template and RNA nucleotides to initiate primer synthesis.
- Enzyme reverse transcriptase uses RNA as a template, it makes a DNA molecule.
- Telomerase uses an RNA template to synthesize new DNA.
- DNA primase synthesizes RNA primers using the single-strand DNA templates.
- DNA polymerases require template, primer, free 3 OH', & dNTP's for DNA replication.
- DNA synthesis during replication is initiated from RNA primers.

- **TEMPLATE**: Genetic material in DNA must have a mechanism to be copied accurately for reproduction. The double helix model of DNA suggested to Watson and Crick that DNA could be replicated by semiconservative replication. In this mechanism, the two strands of a parental molecule are separated, and each **parental strand** acts as a template to direct the synthesis of a new strand through complementary base pairing.

3) What is the difference between primase and polymerase?

POLYMERASE FACTS:

- All DNA polymerases synthesize new DNA by adding nucleotides to the 3' OH of the growing DNA chain.
- DNA polymerase I and DNA polymerase III both have 3′→5′ exonuclease activity but only DNA polymerase I has 5′→ 3′ exonuclease activity.
- DNA polymerases require template, primer, free 3 OH', & dNTP's for DNA replication.
- The proofreading function of DNA polymerases involves 3′ → 5′ exonuclease activity.
- DNA polymerases cannot synthesize a DNA from scratch without a primer. → Primase is responsible for making the primer

39) What does telomerase do?

- SUMMARY
- Expressing telomerase in somatic cells **causes cancer**
- Telomerase activity is most likely to be found in **germ line cells** in humans
- Telomerase uses an **RNA template** to synthesize new DNA
- HUGE EXPLANATION

- Telomerase allows for the ends of chromosomes to be replicated. In the absence of telomerase, the ends of chromosomes are clipped after each round of replication, causing the telomeres to be eventually lost and the ends of the chromosomes to become unstable. In order for the chromosomes to be maintained for use in the next generation, telomerase must be expressed in cells of the germ line.
- Most somatic cells normally do not express telomerase. Because of this, somatic cells normally can divide only a limited number of times before the telomeres are completely removed and the chromosomes become unstable. However, in most cancers, mutations occur that allow telomerase to be expressed. Because the telomeres are restored after replication, these cells are able to divide an unlimited number of times, allowing cancer cells to reproduce themselves without limit and allowing tumors to grow to large size and cancer to spread within the body.

45) Describe initiation of **Eukaryotic transcription** – the Binding of RNA polymerases to the promoter

- Promoter is the sequence of DNA where transcription is initiated
- Promoters are usually located upstream of the start site
- Promoters are required for transcription along with Ribonucleotides, DNA template, RNA polymerase
- RNA polymerase binds to a promoter to initiate transcription
- In eukaryotic transcription:
  (1) Eukaryotic transcription involves a core promoter and a regulatory promoter.
  (2) There is no one generic promoter.
  (3) Chromatin remodeling is necessary before certain genes are transcribed.
  (4) There are several different types of RNA polymerase.
- The TATA-binding protein (TBP) binds to the TATA box sequence in eukaryotic promoters its function in transcriptional initiation is to bend and partly unwind DNA at a promoter.
- In eukaryotic cells, the basal transcription apparatus binds at the core promoter

46) Transcribed DNA strands are repaired much more efficiently than non-transcribed strands (if damage is introduced into both). Which syndrome shows evidence that some type of transcription-specific DNA repair mechanism exists?

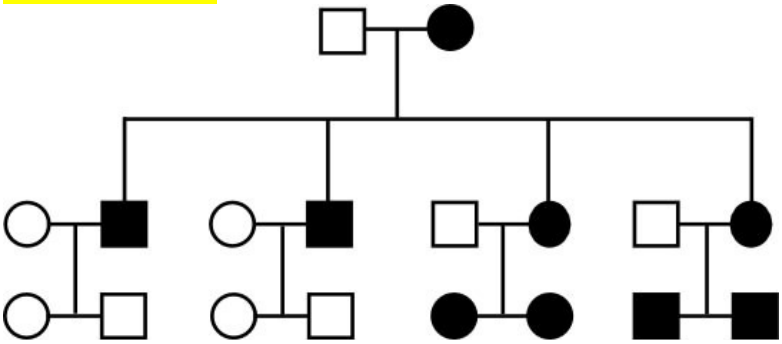
- DNA polymerase I "repairs" the RNA primers and replaces RNA with DNA.
- Some DNA polymerases have the ability to function in DNA repair mechanisms in eukaryotic cells.

- **More specifics below:**

(1) DNA polymerase α: initiation of nuclear DNA synthesis and DNA repair
(2) DNA polymerase γ: replication and repair of mitochondrial DNA
(3) Other eukaryotic DNA polymerases (ζ, η, and θ) allow DNA replication to proceed past damaged regions of DNA (DNA lesions), or to play various roles in DNA repair processes

- Most pedigrees showing the hypothetical human trait show the following characteristics for **Y-linked**:
  - Only males are affected.
  - Affected fathers always pass the trait to sons.

Mitochondrial



- Several members of a family have a very rare form of hearing disorder. You construct the following pedigree. The most likely mode of inheritance is **mitochondrial** since affected females pass the condition on to all their children and affected males do not.

Consanguinity

In pedigree analysis, consanguinity refers to **mating between two closely related parents.**

Twin studies

- Normally used to study the inheritance of human traits or disorders

Genetic influence

- EX. In an effort to identify the influence of genetic factors on both Type 1 diabetes and Type II diabetes, researchers calculated concordance rates for monozygotic twins. Concordance rates of 30–50% have been found for Type I diabetes with concordance rates of 80% for Type II. For both kinds of diabetes, dizygotic concordance rates were about 15%. What does this information suggest concerning the relative effect of genetic and environmental factors for each type of diabetes? **Genetic influences exert a larger role in Type II diabetes than in Type I diabetes.**