1. Refer to the Figure 1 below to answer the following questions.

![Figure 1](image)

a. State what molecule is represented.
   - deoxyribose sugar

b. State whether the molecule would be found in DNA or RNA.
   - DNA

c. State the part of the molecule to which phosphates bind.
   - \( V \), \( III \)

d. Identify the part of the molecule that refers to the 3’ end.
   - \( III \)

2. Describe the structure of DNA.
   - double stranded
   - helix
   - strands are anti-parallel
   - complementary bases hold the two strands together by 3 hydrogen bonds between cytosine + guanine + two hydrogen bonds between adenine and thymine
   - covalent bonds form between sugar + phosphate groups of adjacent nucleotides

3. Describe 3 differences in RNA when compared to DNA.
   - DNA
     - sugar: contains deoxyribose
     - bases: adenine, cytosine, guanine, thymine
     - strands: 2
     - location: found in nucleus
   - RNA
     - sugar: contains ribose
     - bases: adenine, cytosine, guanine, uracil
     - strands: 1
     - location: found in nucleus + cytoplasm
4. Outline the steps of replication.
- Helix is unwound; the two strands separate
- Helicase is the enzyme involved in the unwinding & separation of the 2 strands
- Hydrogen bonds between complementary bases break
- New DNA nucleotides will join to the template strands by hydrogen bonds forming between complementary bases (A + T; C + G)
- DNA polymerase catalyzes the joining of adjacent nucleotides by covalent bond formation between the phosphate group of one nucleotide & the sugar group of the adjacent nucleotide

5. Refer to figure 2 to answer the following questions.

![Diagram of DNA structure]

**Figure 2**

a. What part of the nucleotide is labeled A?
   - phosphate group

b. What kind of bonds forms between the structures labeled B?
   - hydrogen

c. What kind of bond is indicated by label C?
   - covalent

d. What subunit is indicated by label D?
   - deoxyribose sugar

e. Which end of the molecule is indicated by label E?
   - 3'
6. Figure 3 shows a short section of DNA before and after replication. If the nucleotides used to replicate the DNA were radioactive, which strands in the replicated molecule would be radioactive? II, III

![DNA Replication Diagram]

Figure 3

7. In which process is transfer RNA (tRNA) involved in?
   \[\text{translation}\]

8. Which two processes involve the unwinding of the DNA double helix and its separation into two strands of nucleotides?
   \[\text{replication} \quad \text{and} \quad \text{transcription}\]

9. Where is an intron found?
   \[\text{in immature mRNA}\]

10. A certain gene codes for a polypeptide that is 120 amino acids long. Approximately how many nucleotides long is the mRNA that codes for this polypeptide likely to be?
    \[120 \cdot 3 = 360\]

11. Explain the terms universal and degenerate as they relate to the genetic code.
    \[\text{universal - in all living organisms, the same codons code for the same amino acids}\]
    \[\text{degenerate - more than one codon codes for an amino acid}\]
12. Compare transcription to translation.

**Transcription**
- produces RNA
- occurs in nucleus
- DNA is the template from which mRNA is produced

**Translation**
- produces proteins
- occurs in cytoplasm on ribosomes
- mRNA is the template which determines the amino acid sequence

13. Determine two possible DNA sequences that could code for Phe-Ile-Val-Leu.

<table>
<thead>
<tr>
<th>Amino Acid</th>
<th>mRNA</th>
<th>DNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phe- Ile- Val- Leu</td>
<td>uuu - Auu - Guu - Cuu</td>
<td>AAATAACAAAGAA</td>
</tr>
<tr>
<td></td>
<td>uuc - Auc - Guc - Cuc</td>
<td>AAATAGCAGGAG</td>
</tr>
<tr>
<td></td>
<td>Aua - Gua - Cua</td>
<td>AAATAGCAGGAG</td>
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<tr>
<td></td>
<td>- Gug - CUG</td>
<td>AAGTAACAGGAA</td>
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<td></td>
<td>- Uua</td>
<td>AAA TAA CAG GAA</td>
</tr>
<tr>
<td></td>
<td>- Uug</td>
<td>AAA TAA CAU GAA</td>
</tr>
</tbody>
</table>

There are many possibilities for the DNA sequence since there are multiple codons for each amino acid in the sequence.