Phase 1: Project Familiarization and Setup (2 weeks)

1. **Task:** Understand PubChem API and Python Basics
    - **Duration:** 1 week
    - **Goal:** Familiarize with the PubChem API documentation and basic Python programming, focusing on handling JSON data.
    - **Resources:**
        - PubChem API Documentation
        - Python for Beginners
        - JSON in Python
2. **Task:** Install and Configure Python Environment
    - **Duration:** 1 week
    - **Goal:** Set up Python environment with necessary tools (install Python, pip, requests library, and a code editor).
    - **Output:** A working Python environment with the `requests` library installed.
    - **Resources:**
        - Installing Python
        - Installing Packages with pip
        - Python Requests Library

Phase 2: Script Development and Data Retrieval (6 weeks)

1. **Task:** Design Script Structure
    - **Duration:** 1 week
    - **Goal:** Outline the structure of the script, identifying key functions and data flow.
    - **Output:** A flowchart or diagram of the script's structure, including function descriptions.
    - **Resources:**
        - Python Script Structuring
        - Diagramming Tools
2. **Task:** Implement Basic API Request Function
    - **Duration:** 1 week

- **Goal:** Develop the function that takes a SMILES string as input and sends a request to PubChem.
- **Output:** A Python function that successfully sends a request and retrieves data.
- **Resources:**
    - Handling API Requests with Requests Library
    - SMILES Strings and Chemical Information

3. **Task:** Parse and Handle JSON Data
    - **Duration:** 1 week
    - **Goal:** Implement functionality to parse the JSON response from PubChem and extract relevant information.
    - **Output:** A Python script that outputs parsed JSON data in a readable format.
    - **Resources:**
        - Parsing JSON in Python
        - Working with JSON Responses
4. **Task:** Retrieve Specific Data Types from PubChem
    - **Duration:** 3 weeks
    - **Goal:** Retrieve the following specific data from PubChem using the API:
        - **Subtask 1:** Full description of the molecule.
        - **Subtask 2:** List of all names, identifiers, and synonyms.
        - **Subtask 3:** Commercial availability and suppliers.
        - **Subtask 4:** Computed properties (e.g., molecular weight, solubility).
        - **Subtask 5:** Toxicity or safety information.
    - **Output:** A Python script that retrieves and displays each type of data.
    - **Resources:**
        - PubChem Data Descriptions
        - Retrieving Names and Identifiers
        - Computed Properties Guide

Phase 3: Error Handling, Advanced Features, and Review (4 weeks)

1. **Task:** Handle Errors and Edge Cases
    - **Duration:** 1 week
    - **Goal:** Ensure the script handles invalid SMILES strings, network errors, and unexpected API

responses.
    - **Output:** A robust Python script with error-handling mechanisms.
    - **Resources:**
        - Error Handling in Python

2. **Task:** Implement Additional Features
    - **Duration:** 2 weeks
    - **Goal:** Add features like saving JSON output to a file, or retrieving multiple types of data (e.g., bioactivity, patents).
    - **Output:** An enhanced Python script with additional features.
    - **Resources:**
        - Saving JSON Data to a File
        - Exploring PubChem Data Types

3. **Task:** Write Detailed Documentation and Final Review
    - **Duration:** 1 week
    - **Goal:** Document the entire project, including how to use the script, code comments, and explanations of functions. Perform final testing and debugging to ensure all features work correctly.
    - **Output:** A comprehensive user guide, code documentation, and a fully functional, bug-free Python script.
    - **Resources:**
        - Documenting Python Code
        - Effective Software Testing

Phase 4: Final Submission and Wrap-up (2 weeks)

1. **Task:** Prepare Final Deliverables
    - **Duration:** 1 week
    - **Goal:** Compile the final script, documentation, and any other project materials.
    - **Output:** A project package ready for submission.

2. **Task:** Submit Final Project and Receive Feedback
    - **Duration:** 1 week
    - **Goal:** Submit the project for review and implement any final feedback.
    - **Output:** Finalized project, with feedback integrated (if necessary).