Module 15: Comprehensive STEM Practice and Review

Introduction

Learning science requires more than reading explanations. True understanding develops through practice and repeated problem solving.

This final module provides a collection of review questions designed to help students apply concepts from the previous modules. These questions cover topics from mathematics, chemistry, physics, and earth science.

Students are encouraged to attempt each problem carefully and write out each step of their reasoning.

When solving problems, remember to:

- identify known quantities
- determine the unknown quantity
- choose the appropriate equation
- check units in your final answer

These strategies are essential for solving scientific problems successfully.

Section 1: Mathematical Foundations

1. Write the following numbers in scientific notation.

   a. 450000
   b. 0.00072
   c. 8200000

2. Convert the following values into decimal form.

   a. 3.4×10^{-3}
   b. 7.1×10^{4}
   c. 6.5×10^{-6}

3. Evaluate the following expressions.

   a. $4 + 3 \times 2^2$
   b. $(5 + 3) \times 4^2$
   c. $6^2 - 4 \times 3$

Section 2: Unit Conversions

1. Convert the following quantities.

   a. 5 kilometers to meters
   b. 200 centimeters to meters
   c. 3 kilograms to grams

2. Convert time units.

   a. 2 hours to seconds
   b. 45 minutes to seconds
   c. 1.5 hours to minutes

3. A car travels at 20 meters per second.
   Convert this speed to kilometers per hour.

Section 3: Chemistry Concepts

1. How many moles are in 36 grams of water (H_2O)?

2. Calculate the molar mass of carbon dioxide (CO_2).

3. If a reaction produces 2 moles of water, how many grams of water are formed?

4. Using the reaction:

   $$2H_2 + O_2 \rightarrow 2H_2O$$

   How many moles of water form from 6 moles of hydrogen?

5. Explain the difference between reactants and products.

Section 4: Physics – Motion

1. A car travels 120 meters in 10 seconds.
   Find the velocity.

2. A bicycle accelerates from 5 m/s to 15 m/s in 5 seconds.
   Find the acceleration.

3. A car starts from rest and accelerates at 3 m/s^2 for 6 seconds.
   Find the final velocity.

4. A ball falls freely for 4 seconds.
   Calculate the final velocity (use g = 9.8 m/s^2).

Section 5: Waves

1. A wave has frequency 400 Hz and wavelength 0.75 meters.
   Find the wave speed.
2. A wave travels at 300 m/s and has wavelength 2 meters.
   Find the frequency.
3. If the frequency of a wave is 5 Hz, what is the period?
4. Describe the difference between constructive interference and destructive interference.

Section 6: Electricity

1. What are the two types of electric charge?
2. Write the equation for Coulomb's Law.
3. If the distance between two charges doubles, how does the electric force change?
4. What is an electric field?
5. What does voltage represent in an electric circuit?

Section 7: Gas Laws

1. Write the equation for pressure.
2. State Boyle's Law.
3. State Charles's Law.
4. Write the Ideal Gas Law.
5. Explain why temperature must be measured in Kelvin when using gas laws.

Section 8: Earth Science

1. What are the steps of the scientific method?
2. What is a scientific hypothesis?
3. What is the difference between a hypothesis and a theory?
4. What are the four major Earth systems?
5. What causes earthquakes along plate boundaries?

Challenge Problems

1. Convert 15 m/s to km/hr.
2. How many molecules are in 1 mole of CO_2?
3. A gas occupies 10 liters at 2 atm.
   If the pressure increases to 4 atm, what is the new volume?
4. Light has wavelength 600 nm and frequency 5×10^{14} Hz.
   Find the speed of the wave.

Reflection Questions

1. Which STEM topic in this handbook did you find most challenging?
2. What strategies helped you solve difficult problems?
3. How can regular practice improve your understanding of science?

Reflecting on your learning process can help strengthen your study habits and improve future performance.