

AI Model: ChatGPT 4.0

Task: Explain Newton's Second Law of Motion with a real-world example.

Zero-shot Prompt:

“Explain Newton's second law with a real-world example.”

Response :

Newton's Second Law of Motion states:


“The acceleration of an object depends on the net force acting on it and the mass of the object.”

This is usually written as the formula:

$$F = ma,$$

where:

- F is the net force (in newtons, N),
- m is the mass (in kilograms, kg),
- a is the acceleration (in meters per second squared, m/s^2).

 **Real-World Example:** Pushing a Shopping Cart Imagine you're pushing an empty shopping cart at a supermarket:

- The cart has little mass, so when you apply a small force, it accelerates quickly.
- If the cart is full of groceries (increased mass), you need to apply more force to get the same acceleration.
- Or, with the same force, the acceleration will be slower.

Breakdown:

- If mass increases and force stays the same → acceleration decreases.
- If you push harder (increase force) with the same cart mass → acceleration increases.



Conclusion:

Newton's Second Law shows how force and mass influence motion. It's why heavy trucks need more engine power to accelerate and why lightweight bicycles can speed up quickly with just a little pedaling effort.

Few-shot Prompt:

“What is gravity?”

“Gravity is a force that pulls objects toward the center of the Earth. It keeps us grounded and causes objects to fall.”

“What is inertia?”

“Inertia is an object's resistance to change in its motion. A stationary object stays still unless something pushes it.”

“Explain Newton’s second law with a real-world example.”

Response :

Newton’s Second Law says that the force acting on an object equals its mass times its acceleration ($F = ma$). This means the heavier something is, the more force you need to move it.

Example:

Imagine you’re riding a bicycle. If you’re going up a hill and carrying a heavy backpack, you’ll need to pedal harder (apply more force) to keep moving at the same speed. That’s because the greater the mass, the more force is needed to accelerate.

Chain-of-Thought (Zero-shot CoT)

“Explain Newton’s second law with a real-world example. Let’s think step by step.”

Response :



Step 1: Understand the Law

Newton’s Second Law says:

Force = Mass \times Acceleration

Or written as:

$$F = m \times a$$

- Force (F) is how hard you push or pull.
- Mass (m) is how heavy the object is.
- Acceleration (a) is how quickly the object speeds up or slows down.

Step 2: Pick a Real-World Example

Let's use the example of pushing a shopping cart.

Step 3: Think Step by Step

Situation 1: Light Cart

- The cart is empty (small mass).
 - You push it gently (small force).
- The cart speeds up quickly (large acceleration).

Situation 2: Heavy Cart

- Now the cart is full of groceries (big mass).
- You push with the same gentle force.
- This time, the cart moves slowly (small acceleration).

Step 4: Apply the Formula

If you want the full cart to move just as fast as the empty one:

- You need to increase your pushing force (F).
- Because $F = m \times a$, a bigger mass (m) needs more force (F) for the same acceleration (a).

Final Answer (Simple Summary):

Newton's Second Law means the more mass an object has, the more force you need to move it.

For example, it's easier to push an empty shopping cart than a full one—because the full cart is heavier and resists acceleration more.

Observations and Analysis:

- **Zero-shot Prompting**

The zero-shot prompt produced a concise and correct answer. It directly explained Newton's second law and gave a simple real-world example. However, it lacked deeper explanation or step-by-step reasoning.

- **Few-shot Prompting**

By providing examples of similar science questions and answers, the AI adapted its tone and structure to match the examples. The response was slightly more thoughtful and aligned with the desired educational style. It offered a clearer comparison to illustrate the law, but the reasoning still remained shallow. This technique improves consistency and style, especially for domain-specific outputs.

- **Chain-of-Thought (Zero-shot CoT)**

When prompted with "Let's think step by step," the AI naturally broke the answer into logical parts. It first defined the key concepts then applied them to a scenario. The explanation had a clear progression and was easier to follow for a learner. This simple addition encouraged deeper reasoning—even without examples.