



Fundamental Physics for Food Technology and Innovation (4011106)

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Vectors and Scalars in Food Technology

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Overview of topics to be covered:

- A. Distinguish between vector and scalar quantities.
- B. Identify common vector and scalar quantities in food processing.
- C. Apply vector concepts to food technology applications.

What are Scalar Quantities?

- Single numerical value with unit
- Direction not required
- Examples in food technology:
 - *Temperature in ovens*
 - *Mass of ingredients*
 - *Volume of liquids*
 - *Pressure in autoclaves*

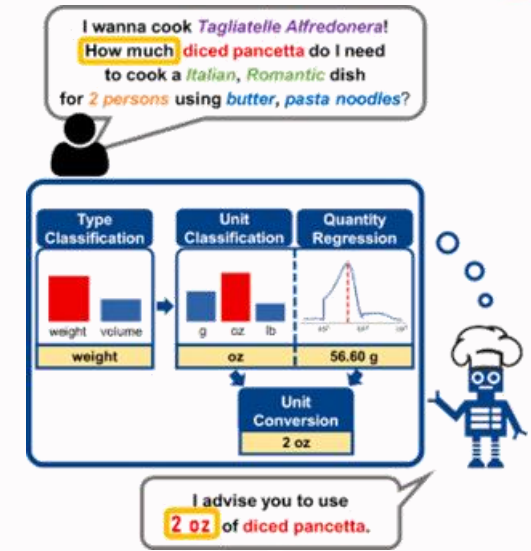


Figure 1: Scalar quantities in cooking

Common Scalar Quantities in Food Processing

Temperature

- *Cooking temperatures*
- *Storage temperatures*
- *Pasteurization temperatures*

Pressure

- *Pressure cooking*
- *Vacuum packaging*
- *Sterilization pressure*



Figure 2: Food processing temperature pressure gauges

What are Vector Quantities?

- Quantities with both magnitude and direction
- Important in food processing equipment
- Examples:
 - *Force in mixing operations*
 - *Velocity in fluid flow*
 - *Acceleration in centrifuges*



Figure 3: *Vectors in food machinery*

Vectors in Food Processing Equipment

Mixing Operations

- *Direction of mixer blades*
- *Force vectors in dough mixing*
- *Angular velocity in blenders*



Figure 4: *Industrial food mixer vectors*

Vector Applications in Fluid Flow

- Flow direction in pipes
- Velocity profiles in heat exchangers
- Force vectors in pumping systems



Figure 5: *Fluid flow vectors food industry*



Practice Problems

1. Identify vector and scalar quantities in a commercial mixer
2. Analyze force vectors in conveyor systems
3. Calculate resultant forces in fluid flow

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Summary

- Scalars: Temperature, pressure, mass, volume
- Vectors: Force, velocity, acceleration
- Applications in food processing equipment
- Importance in process design



Figure 6: *Physics food technology summary*



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