This unit is about Newton's Laws, which constitute the *Dynamics and Net Force* model—in particular, the 2nd Law is its equation of change, the 1st Law defines an inertial coordinate system which is a condition of validity of the model, and the 3rd Law explains how physical interactions generate pairs of forces on different bodies. Here are the components of a Model:

**Components of a General Model**

1. Description of the model: its name and the situations, conditions, and idealizations under which the model applies

2. Knowledge and definitions prerequisite for understanding the model

3. Specification of the **allowed systems**: the types and number of objects allowed in the system for that model. This includes the particular state variables that characterize the system and which the model interrelates

4. The relevant **interactions** that are the agent of change for the state variable(s)

**Net Force and Dynamics**

1. The *Dynamics and Net Force* Model applies to a single particle when working in an inertial coordinate system

2. Prerequisite knowledge:
   - Origin and Type of Forces, Free Body Diagrams, Vectors, Coordinate Systems

3. Allowed System
   - **Objects**: Single Point Mass (or center of mass of rigid body)
   - **Motion Variable**: \( \dot{v}(t) \) (and its derivative, \( \ddot{a}(t) \))

4. Relevant **Interactions**:
   - Forces on body: gravity, spring, contact, drag,... combined into *Net Force*
5. The model's **mathematical Law of Change** that describes how the interactions change the state variables.

5. **Law of Change**:
   - usual form:
     \[ \sum \vec{F}(t) = m \frac{d\vec{v}(t)}{dt} \equiv ma(t) \]
   - equivalent integral form:
     \[ m\vec{v}(t_f) = m\vec{v}(t_i) + \int_{t_i}^{t_f} \sum \vec{F}(t)dt \]

6. **Cues** and suggestions for recognizing when the model applies.

6. **Cues**: The problem involves a single body, you only need to know the translational motion of that body, and it is possible to draw a force diagram for it. The problem asks for the acceleration.