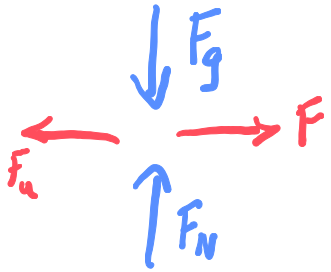
Thinking about Forces

- Make a list of “Real Physical Forces”
  - Normal (push)
  - Frictional
  - Tension
  - Spring (complex case)
  - Gravitational
  - Electric, magnetic
  - …

Think about:

- What causes the force
- How is the force applied

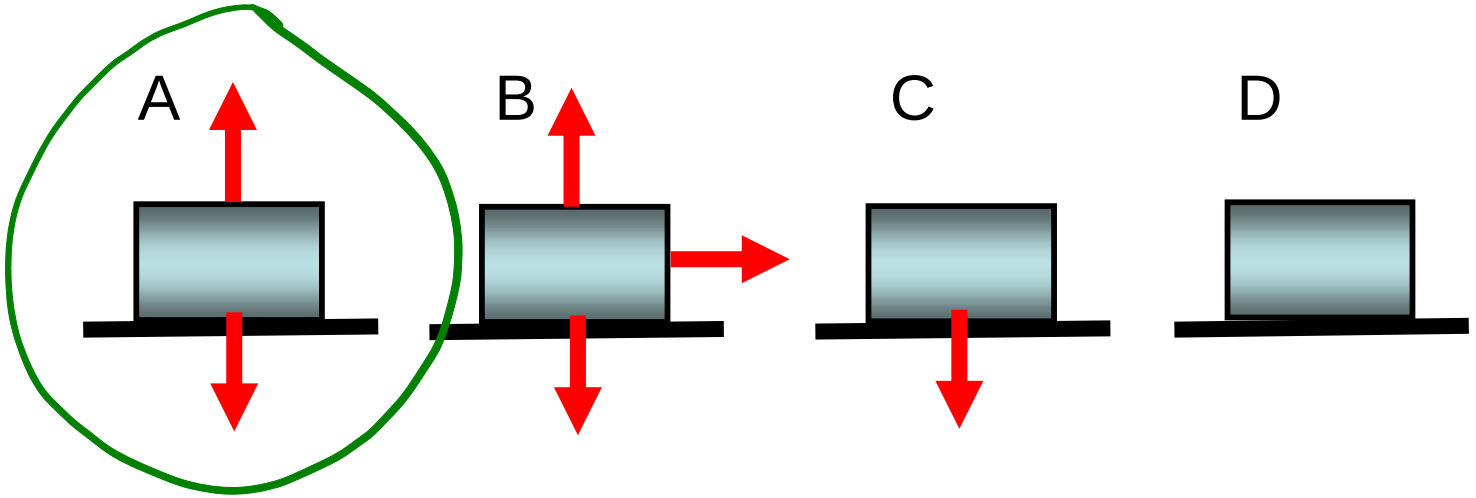


Thinking about Forces

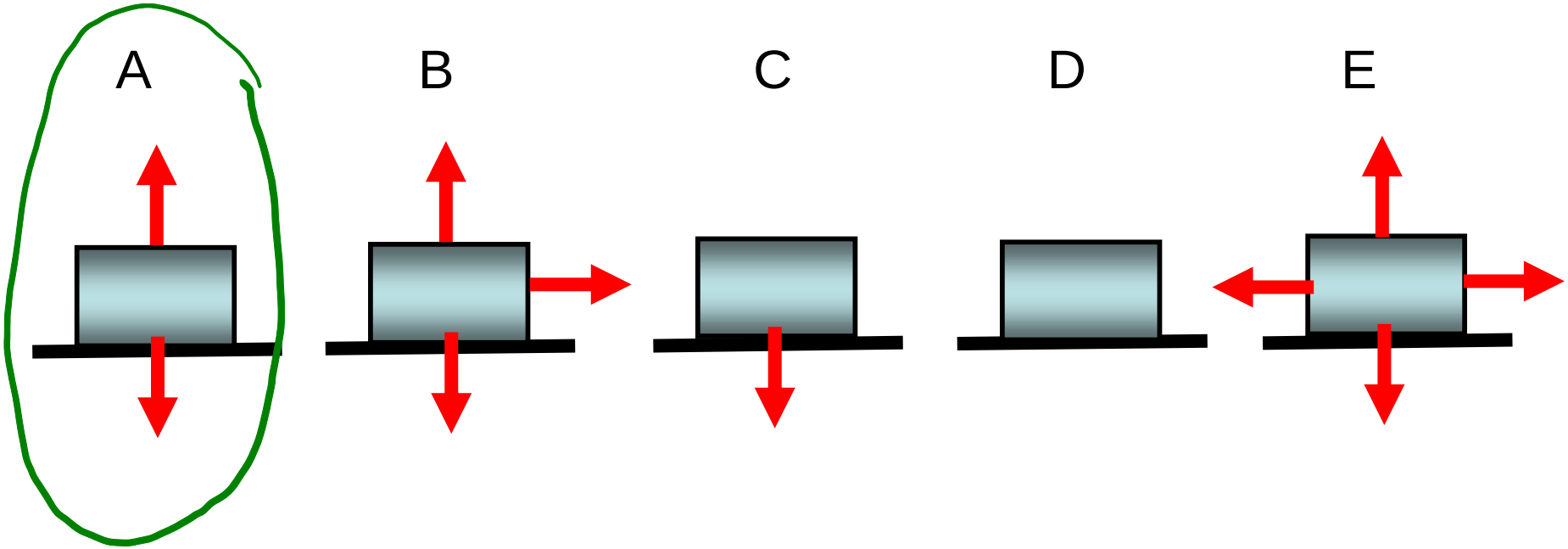
- Categories of forces
  - Contact
    - Normal
    - Frictional
    - Tension
  - Non-contact
    - Gravitational force
    - Electric and magnetic
    - Many others

Think about:
- What causes the force
- How is the force applied

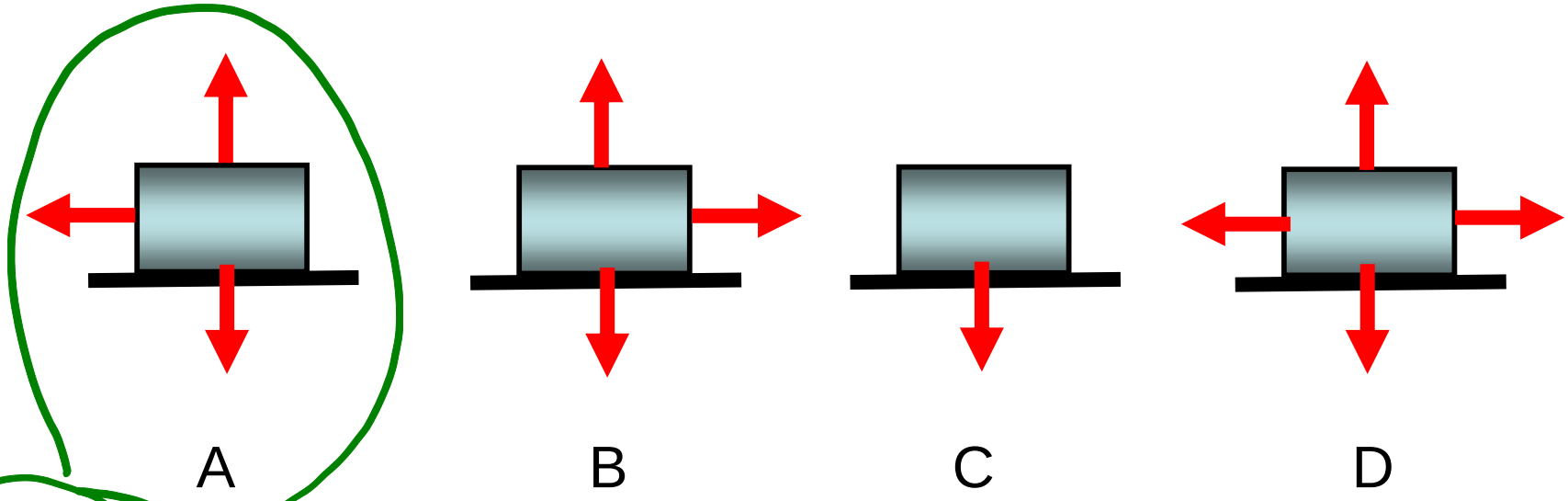
A block sits ***at rest*** on a frictionless surface. Which of the following sketches most closely resembles the correct freebody diagram for all forces acting on the block? Each red arrow represents a force. Observe their number and direction, but **ignore their lengths**.



Now, the same block moves with a **constant velocity to *the right on the frictionless surface***. Which of the following most closely resembles the correct freebody diagram for all forces acting on the block?



Now, the block moves with a **constant** velocity ***to the right*** on a surface ***that has friction***. Which of the following most closely resembles the correct freebody diagram for all forces acting on the block?



1. A
2. B
3. C
4. D
5. None of the above

Newton's Laws

- Newton's 1st Law. A body in motion tends to remain in motion. Or, the velocity of an object doesn't change if there is no net force on that object.
- Some types of forces:
  - Gravitational
  - Tension
  - Spring (later)
  - Normal
  - Friction

If Net Force = 0,
Object will keep original state

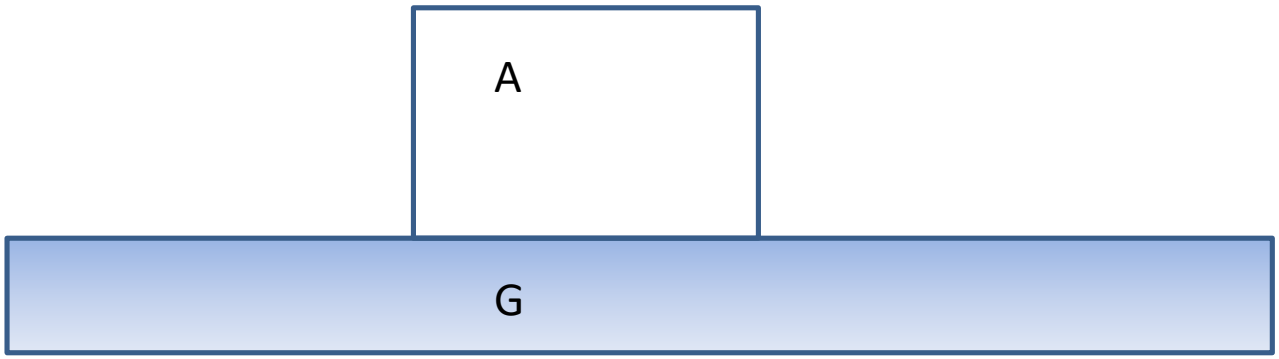
- Newton's 2nd Law: $\vec{a} = \frac{\vec{F}_{net}}{m}$ $\vec{F}_{net} = m\vec{a}$
- Newton's 3rd Law: For every action there is an equal and opposite reaction
- Freebody diagrams. Very important. Do it with every problem.

Analyzing Forces

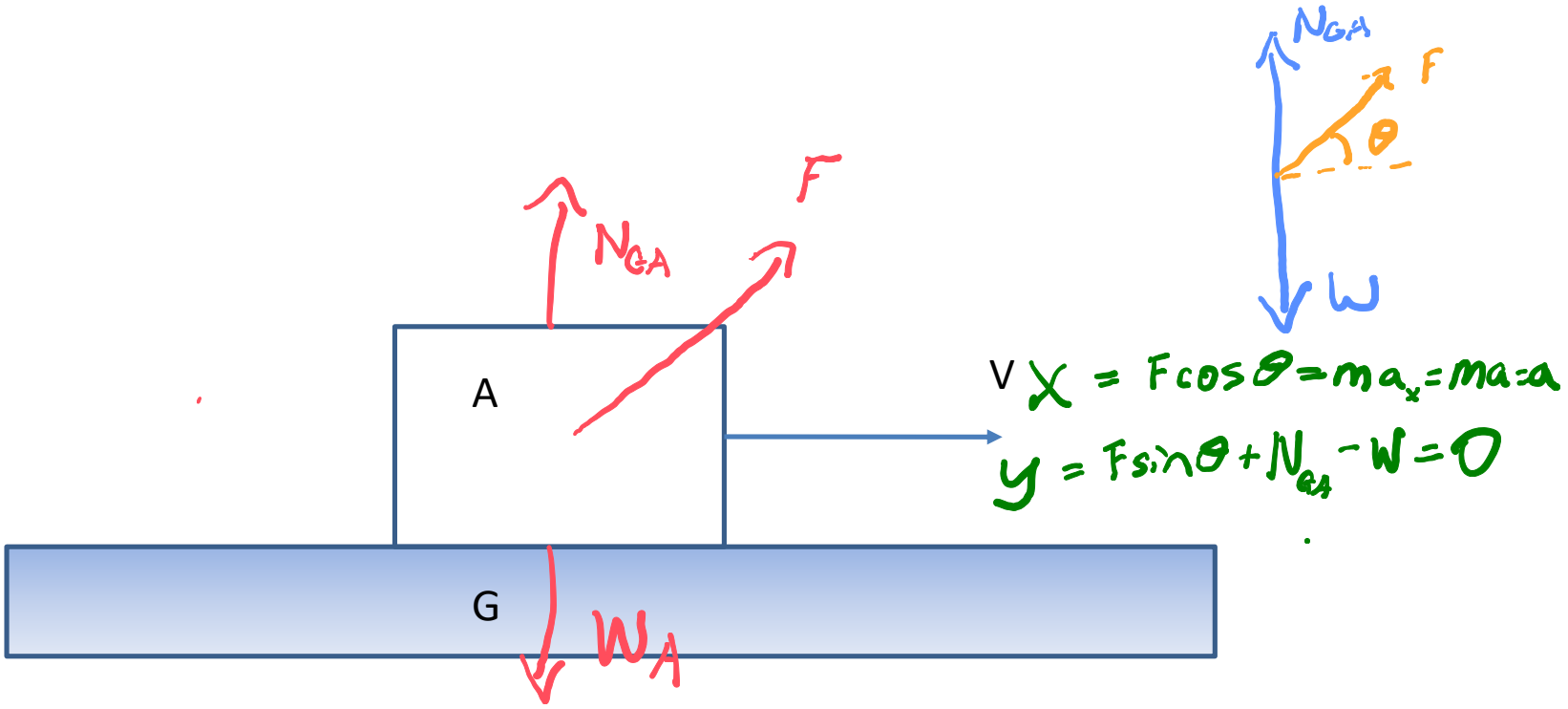
- Free Body Diagram
  - Identify a single object
  - Set up a reference frame
  - Find all real physical forces that the object is receiving
  - Then sum all physical forces. The result of the summation (sum of all forces) is called:
    The Net Force

$$\vec{a} = \frac{\vec{F}_{net}}{m}$$

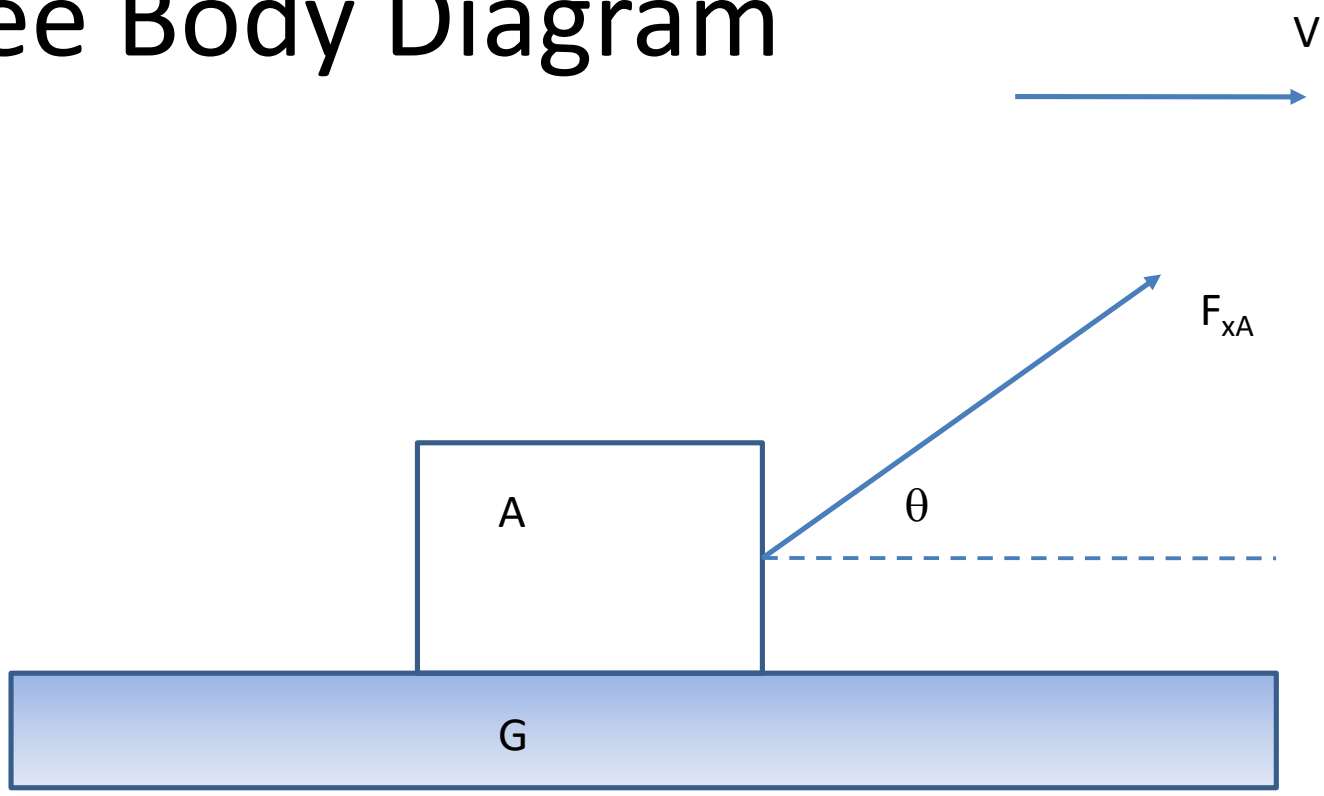
Free Body Diagram



Free Body Diagram

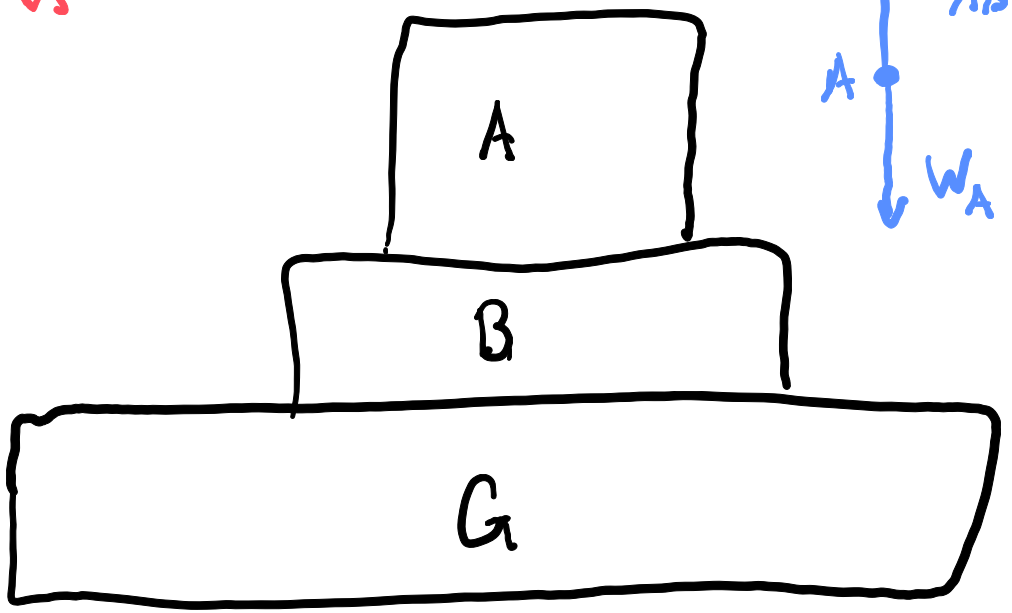


Free Body Diagram



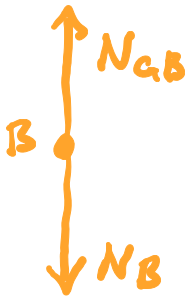
$F = ma$

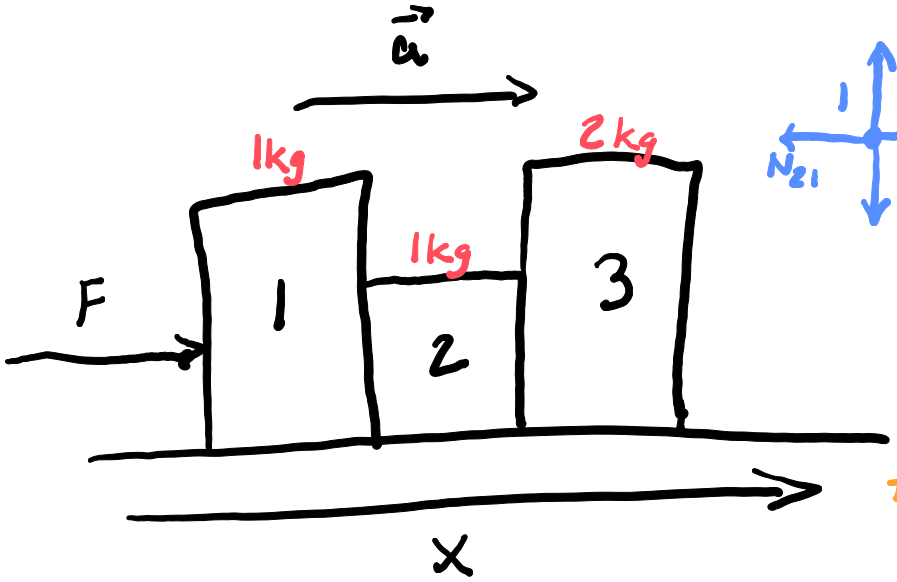
$1N = 1kg \times 1m/s$

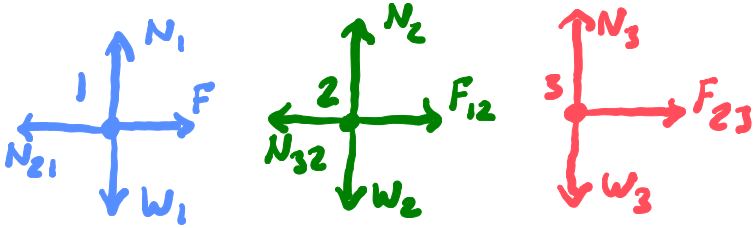


$N_{AB} = W_A$

$N_{GB} = N_B$







$F - N_{21} = m_1 a \rightarrow N_{21} = F - m_1 a$

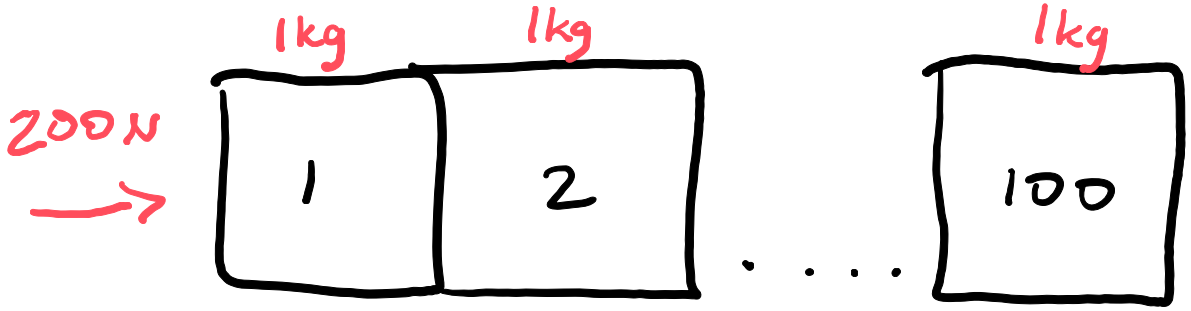
$N_{12} - N_{32} = m_2 a$

$+ \quad N_{23} = m_3 a$

$F = (m_1 + m_2 + m_3) a$

Midterm Question

Find Normal Force of any given block



$F = (m_1 + m_2 + \ldots + m_{100})\, a = 100 \times 1 \times a$

$a = 2\ m/s^2$

$N_{100} = m_{100}\, a$

$N_{100} = 1 \times 2 = 2N$

$200 - N = 1 \times 2$

$N_1 = 198N$