A UoM model based on the VIM

with input from Ontolog UoM panel discussion

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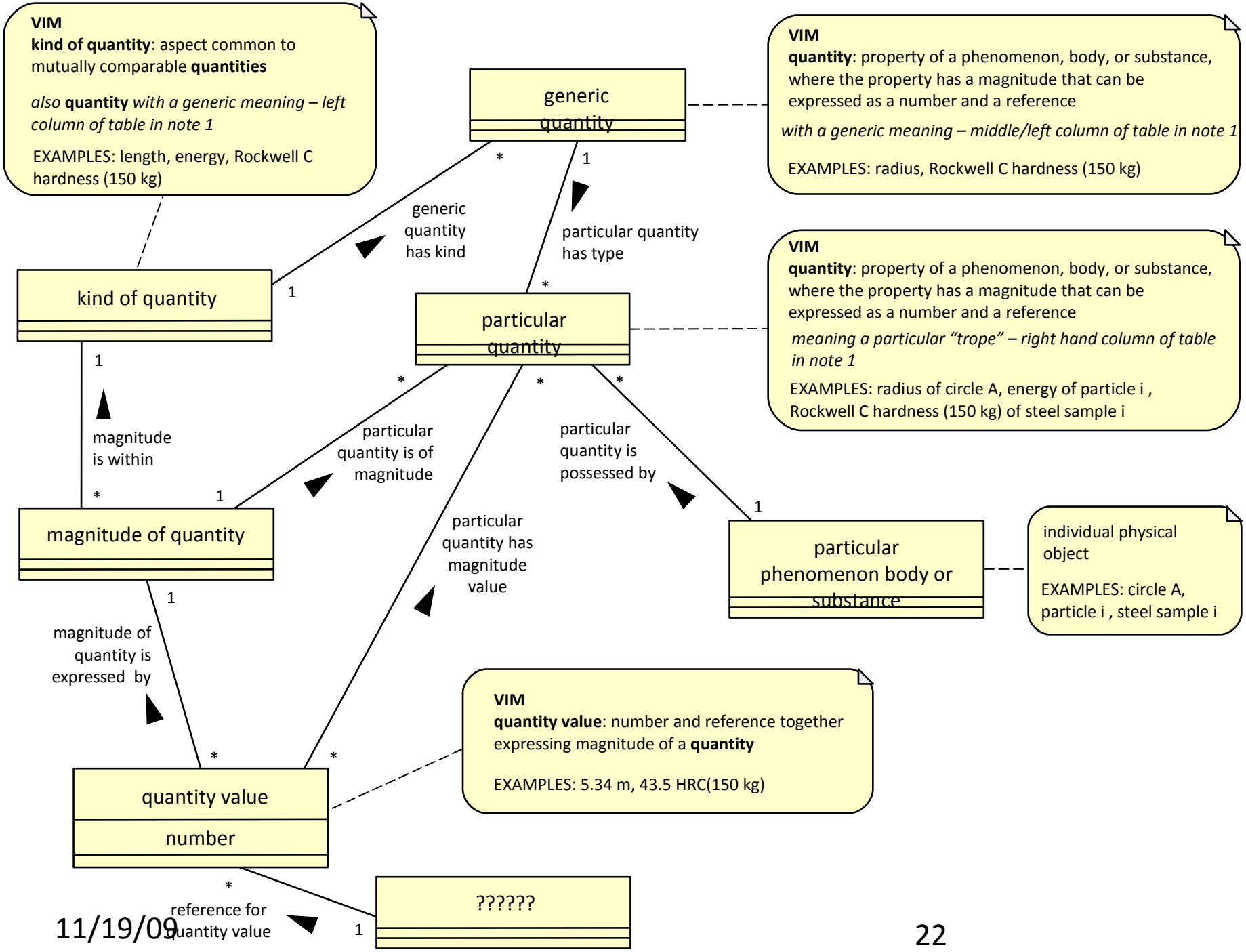
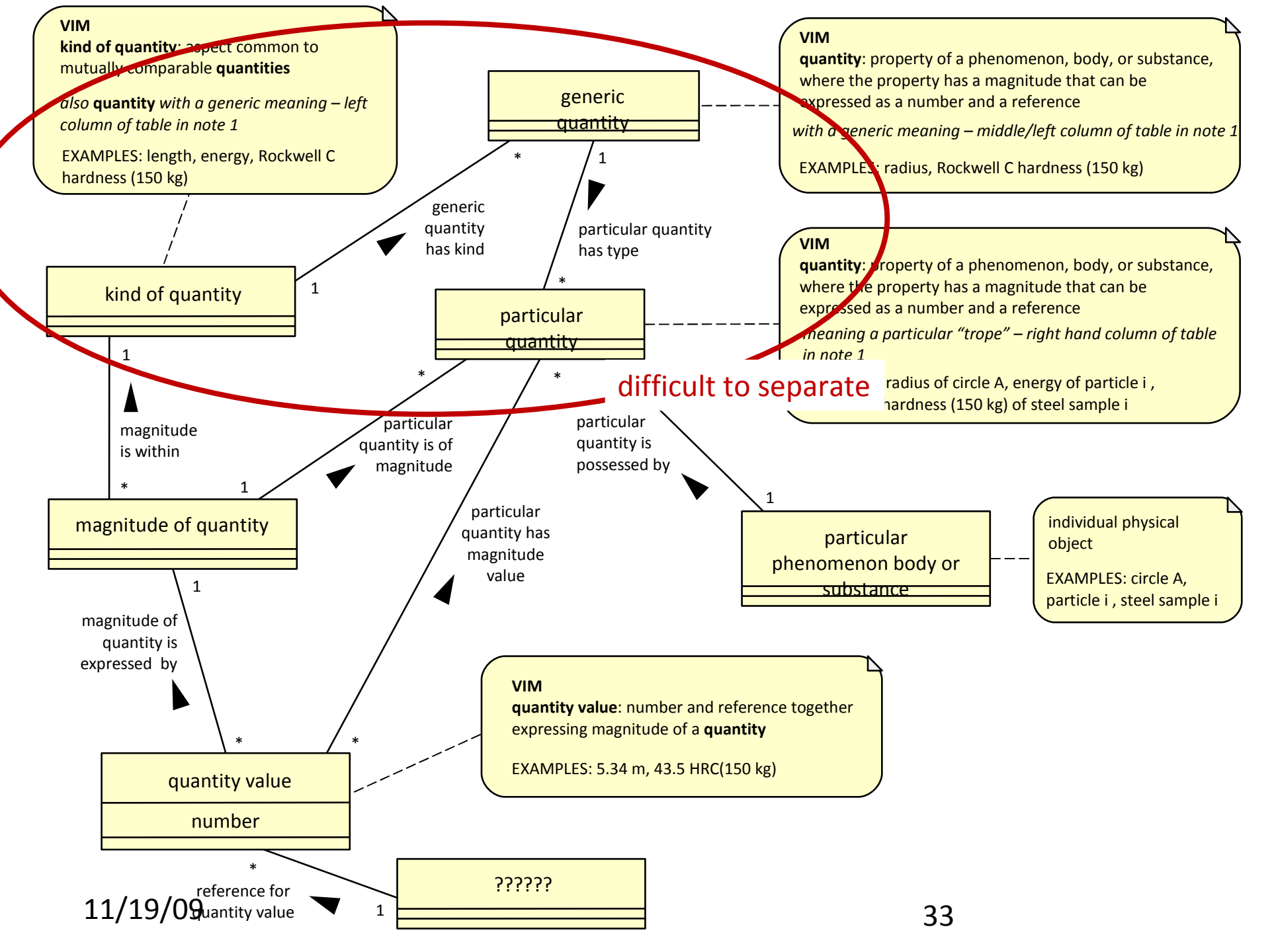
2009-11-18


VIM
kind of quantity: aspect common to mutually comparable quantities
also quantity with a generic meaning – left column of table in note 1
EXAMPLES: length, energy, Rockwell C hardness (150 kg)
generic quantity
VIM
quantity: property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference
with a generic meaning – middle/left column of table in note 1
EXAMPLES: radius, Rockwell C hardness (150 kg)
generic quantity has kind
particular quantity has type
kind of quantity
particular quantity
VIM
quantity: property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference
meaning a particular "trope" – right hand column of table in note 1
EXAMPLES: radius of circle A, energy of particle i , Rockwell C hardness (150 kg) of steel sample i
magnitude is within
particular quantity is of magnitude
particular quantity is possessed by
magnitude of quantity
particular quantity has magnitude value
particular phenomenon body or substance
individual physical object
EXAMPLES: circle A, particle i , steel sample i
magnitude of quantity is expressed by
VIM
quantity value: number and reference together expressing magnitude of a quantity
EXAMPLES: 5.34 m, 43.5 HRC(150 kg)
quantity value
number
reference for quantity value
??????


VIM
kind of quantity: aspect common to mutually comparable quantities
also quantity with a generic meaning – left column of table in note 1
EXAMPLES: length, energy, Rockwell C hardness (150 kg)
generic quantity
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generic quantity has kind
particular quantity has type
kind of quantity
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VIM
quantity: property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number and a reference
meaning a particular "trope" – right hand column of table in note 1
radius of circle A, energy of particle i , hardness (150 kg) of steel sample i
difficult to separate
magnitude is within
particular quantity is of magnitude
particular quantity is possessed by
magnitude of quantity
particular quantity has magnitude value
particular phenomenon body or substance
individual physical object
EXAMPLES: circle A, particle i , steel sample i
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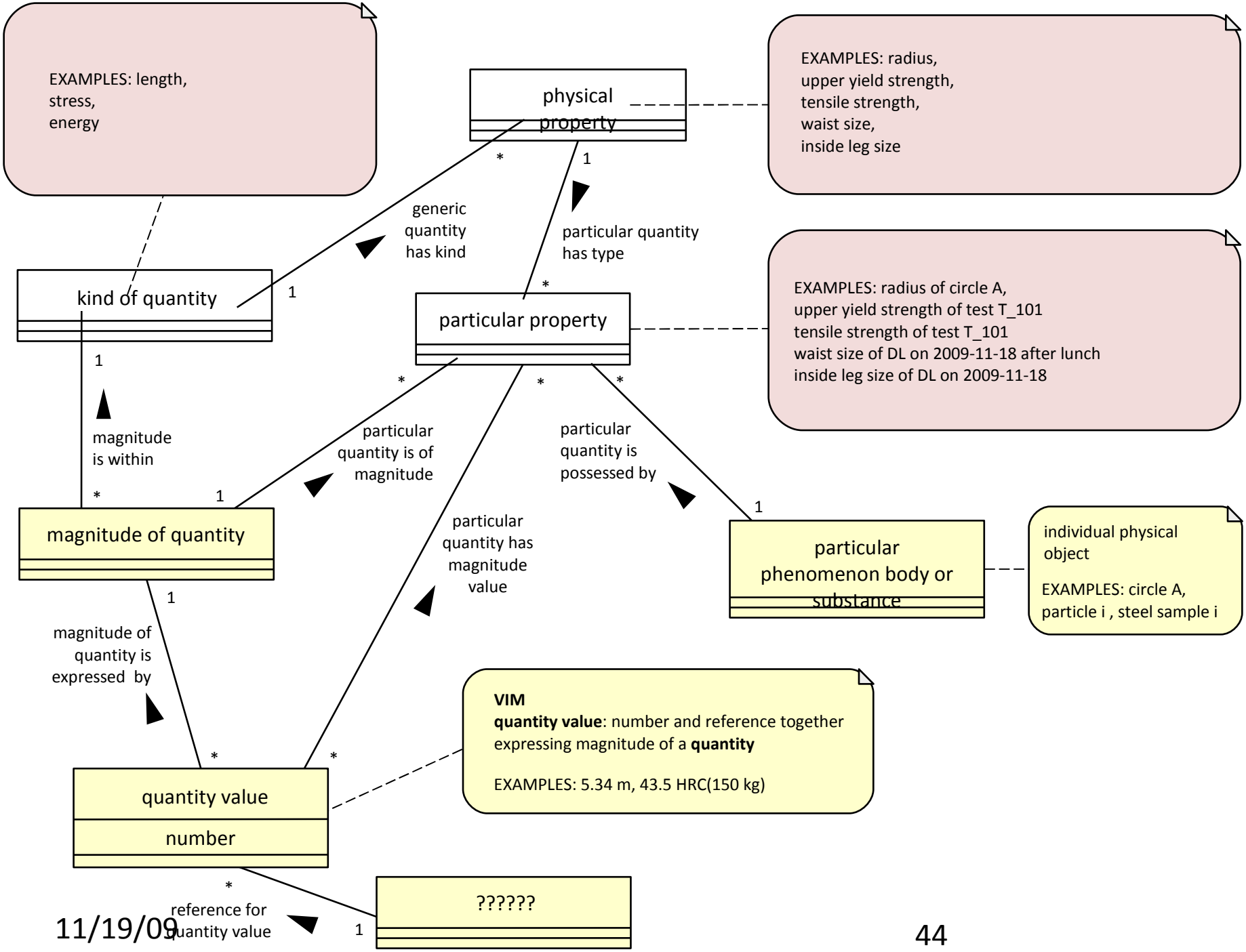

EXAMPLES: length,
stress,
energy
physical property
EXAMPLES: radius,
upper yield strength,
tensile strength,
waist size,
inside leg size
generic quantity has kind
particular quantity has type
kind of quantity
particular property
EXAMPLES: radius of circle A,
upper yield strength of test T_101
tensile strength of test T_101
waist size of DL on 2009-11-18 after lunch
inside leg size of DL on 2009-11-18
magnitude is within
particular quantity is of magnitude
particular quantity is possessed by
magnitude of quantity
particular quantity has magnitude value
particular phenomenon body or substance
individual physical object
EXAMPLES: circle A,
particle i , steel sample i
magnitude of quantity is expressed by
VIM
quantity value: number and reference together expressing magnitude of a quantity
EXAMPLES: 5.34 m, 43.5 HRC(150 kg)
quantity value
number
reference for quantity value
??????

An example

- Three measurements to ISO 6892-1:
  - T_101 has an upper yield strength of 531 MPa
  - T_101 has a lower yield strength of 517 MPa
  - T_101 has a tensile strength of 540 MPa
- Three “physical properties”:
  - ISO 6892-1 upper yield strength
  - ISO 6892-1 lower yield strength
  - ISO 6892-1 tensile strength
- One “kind of quantity” – stress
  - or three depending upon our understanding of “mutually comparable”

A possible view of physical properties

- Three different functions:
  - ISO 6892-1 upper yield strength
  - ISO 6892-1 lower yield strength
  - ISO 6892-1 tensile strength
- with domain “tensile test to ISO 6892-1”
- with range “stress”

- Two different functions:
  - waist size
  - inside leg size
- with domain “person (at instant)”
- with range “length”

Kind of quantity

as class of particular quantity

- of the same kind as “length”:
  - path around the waist of DL on 2009-11-18 after lunch
  - path along the inside leg size of DL on 2009-11-18
  - straight path from bow to stern of the Medway Queen

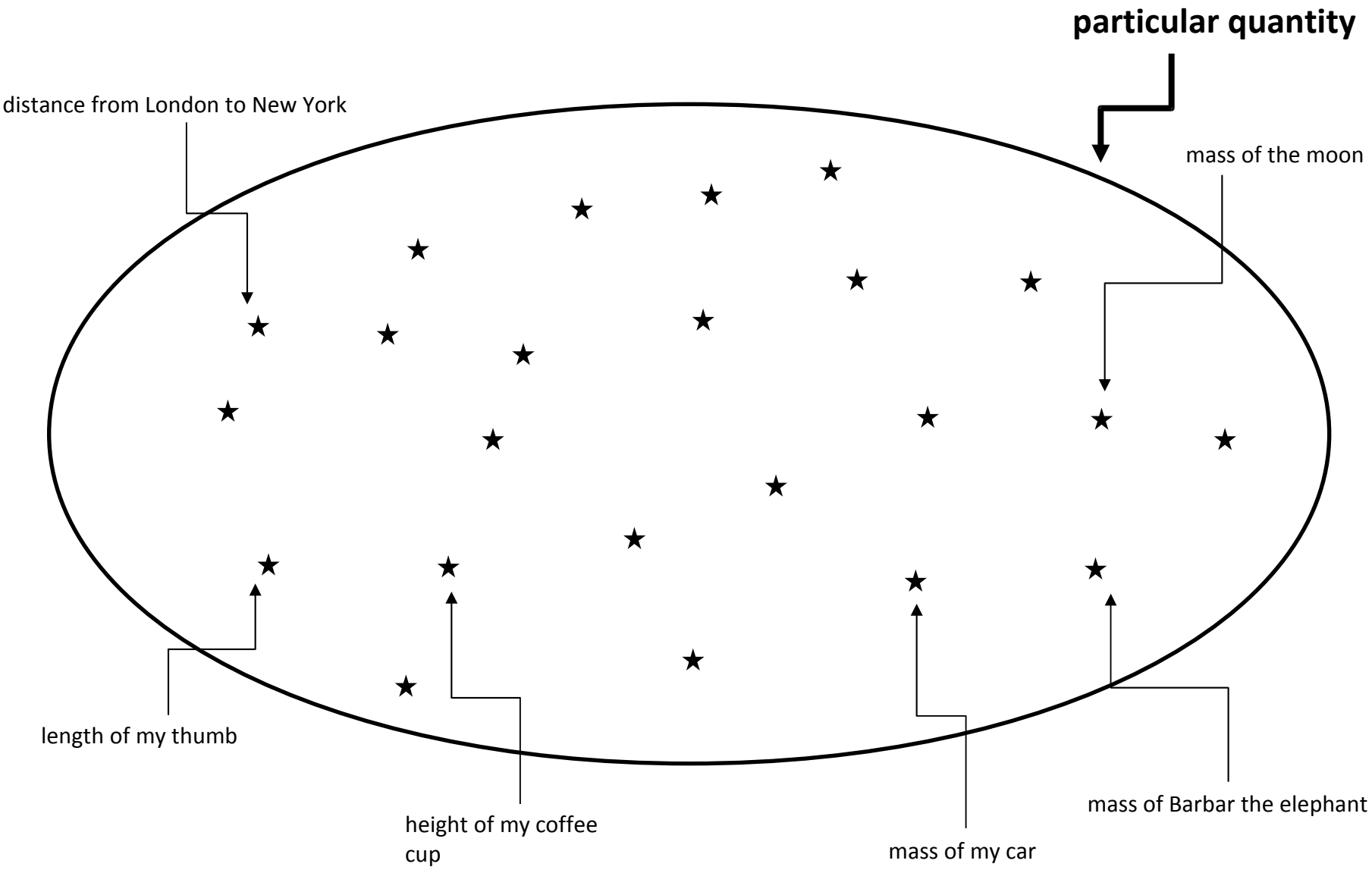
- of the same kind as “stress”:
  - surface across parallel part of specimen of T_101 at instant of upper yield
  - surface across parallel part of specimen of T_101 at instant of lower yield
  - surface across parallel part of specimen of T_101 at instant of maximum force

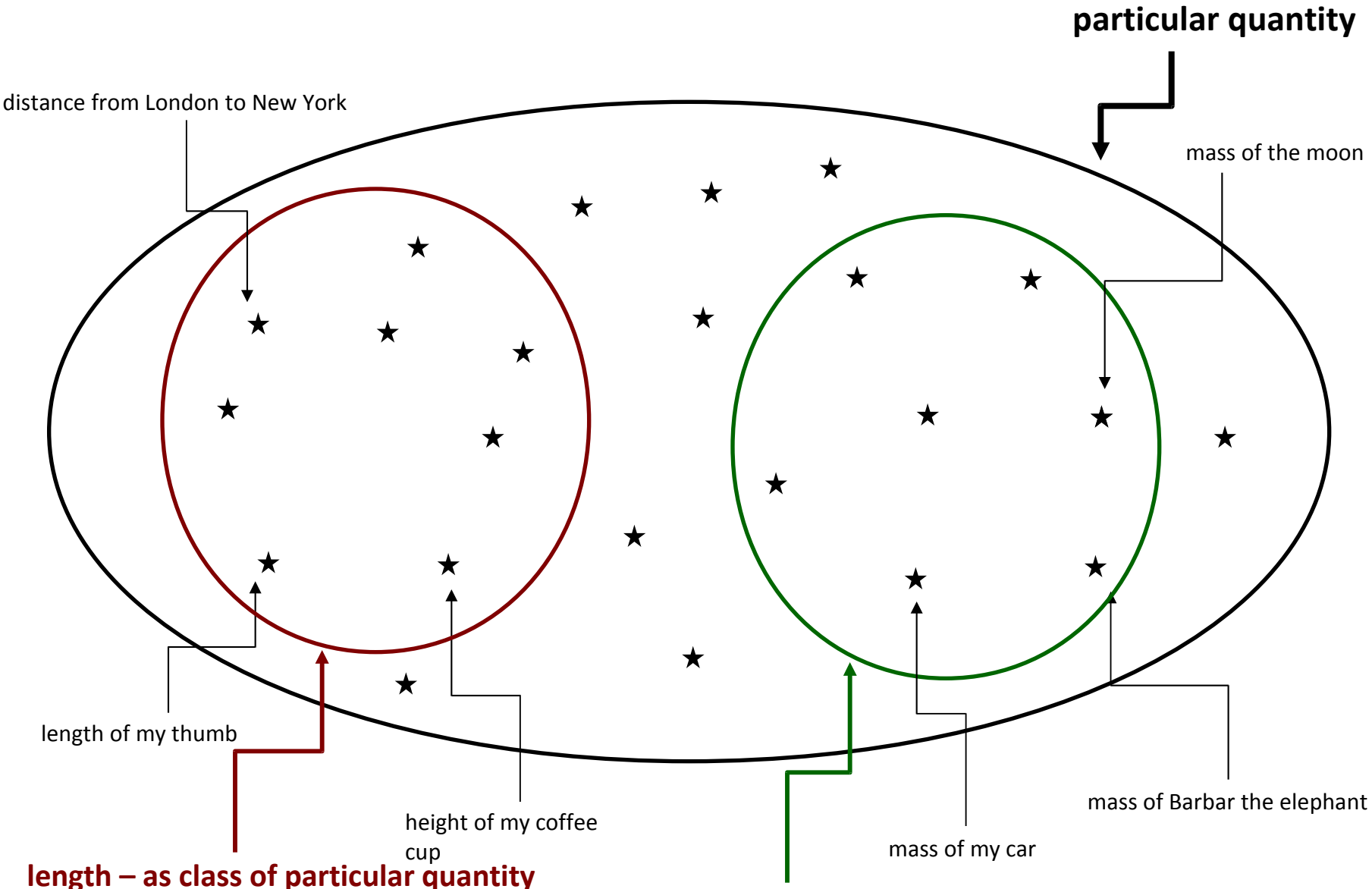
Kind of quantity

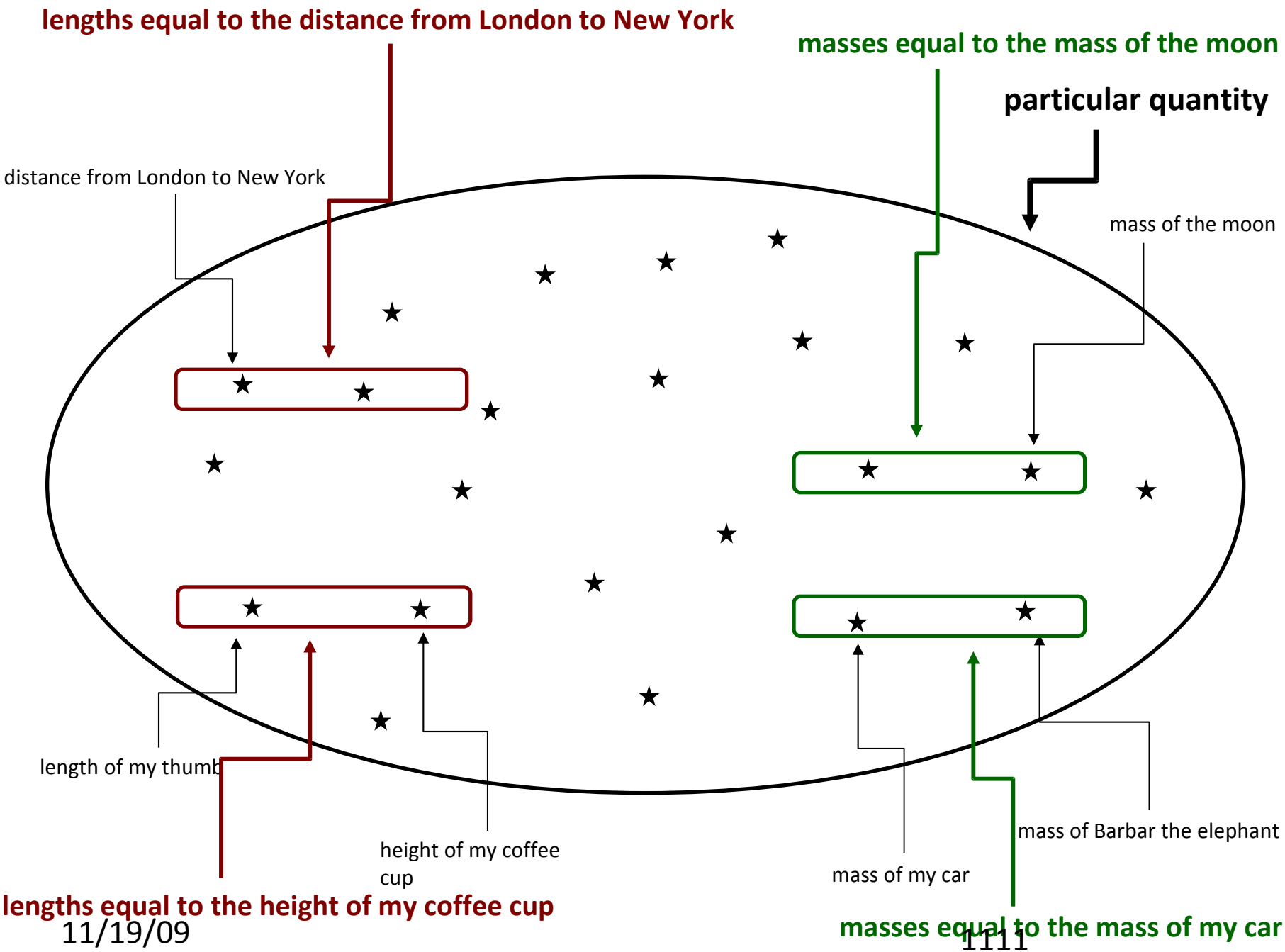
as class of magnitude of quantity

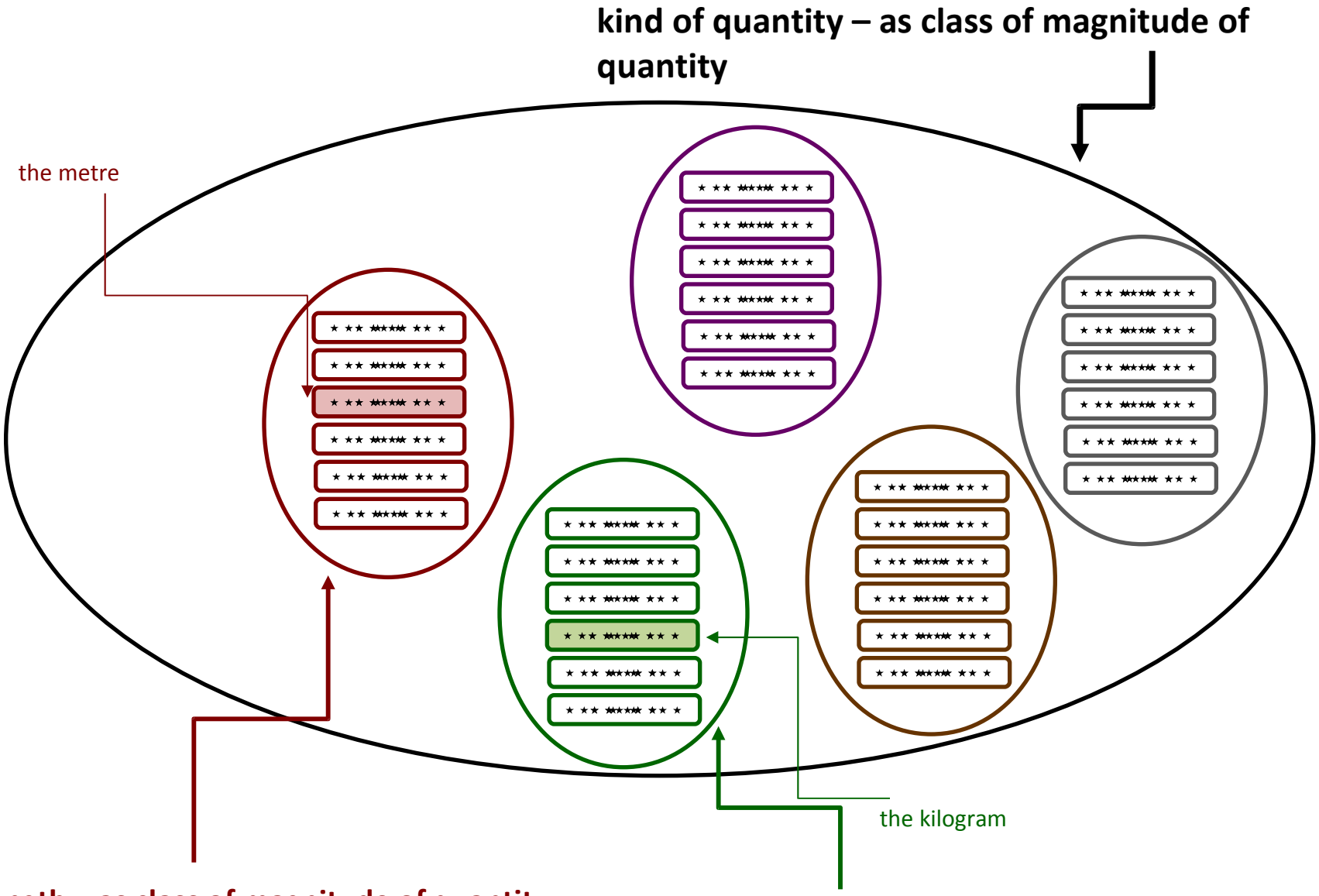
- of the same kind as “length”:
  - length magnitude that is expressed as “37 inches”
  - length magnitude that is expressed as “31 inches”
  - length magnitude that is expressed as “63 metres”

- of the same kind as “stress”:
  - stress magnitude that is expressed as “531 MPa”
  - stress magnitude that is expressed as “517 MPa”
  - stress magnitude that is expressed as “540 MPa”


particular quantity
distance from London to New York
mass of the moon
length of my thumb
height of my coffee cup
mass of my car
mass of Barbar the elephant


particular quantity
distance from London to New York
mass of the moon
length of my thumb
height of my coffee cup
mass of my car
mass of Barbar the elephant
length – as class of particular quantity
mass – as class of particular quantity


lengths equal to the distance from London to New York
masses equal to the mass of the moon
particular quantity
distance from London to New York
mass of the moon
length of my thumb
height of my coffee cup
mass of my car
mass of Barbar the elephant
lengths equal to the height of my coffee cup
masses equal to the mass of my car


kind of quantity – as class of magnitude of quantity
the metre
the kilogram
length – as class of magnitude of quantity
mass – as class of magnitude of quantity

Conclusions

- There is a distinction between a physical property (e.g. tensile strength) and a kind of quantity (e.g. stress)
  - The difference may be merely custom and practice, but is clearly there.
  - There are millions of physical properties specific to particular scientific and engineering domains, so we have to get them out of scope.

- There are two meanings for a “kind of quantity”
  - *The path around the waist of DL on 2009-11-18 after lunch* is of kind length – length as a class of particular quantity
  - *The magnitude expressed as “37 inches”* is of kind length – length as a class of magnitude of quantity