

Chapter 2

Matter matters.

Describe the *physical* properties of the items on your desk using both your observational skills and the tools available.

A	B	C	D

Quantitative (B, D)

- using numbers
- actual measurements

Qualitative (A, C)

- no numbers
- description

A	B	C	D

Quantitative (B, D)

- using numbers
- actual measurements

Qualitative (A, C)

- no numbers
- description

A

B

C

D

Intensive (A, B)

Extensive (C, D)

- does *not* vary with the quantity of material present.

- varies with the amount of material present.

Physical & Chemical Changes

Chapter 2

Which of the following are chemical changes? *Select all that apply.*

1. breaking glass
2. building a birdhouse
3. rusting bicycle
4. melting butter
5. hardening cement
6. spoiling food
7. mixing lemonade
8. mowing the lawn.

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2. building a birdhouse
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4. melting butter
5. hardening cement
6. spoiling food
7. mixing lemonade
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Which of the following are physical changes? *Select all that apply.*

1. corroding metal
2. bleaching hair
3. fireworks exploding
4. squeezing oranges to make OJ
5. frying an egg
6. making salt water to gargle your sore throat.

Which of the following are physical changes? *Select all that apply.*

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4. squeezing oranges to make OJ
5. frying an egg
6. making salt water to gargle your sore throat.

Properties

Chapter 2

Which properties below are extensive qualitative, physical properties?

1. yellow

2. hot

3. heavy

4. explosive

5. long

6. 35°C

7. hard

8. very dense

9. 5 cm

Which properties below are extensive qualitative, physical properties?

- | | |
|--------------|---------------|
| 1. yellow | 6. 35°C |
| 2. hot | 7. hard |
| 3. heavy | 8. very dense |
| 4. explosive | 9. 5 cm |
| 5. long | |

- #9 is extensive, but not qualitative
- #4 is a chemical property
- #1, 2, 6, 7, 8 are qualitative, but they are intensive, not extensive

Which properties below are intensive quantitative, physical properties?

1. large

2. 35°C

3. 26.2 g

4. 3.7 cm

5. green

6. cold

7. 2.5 g/ml

8. 450 ml

Which properties below are intensive quantitative, physical properties?

- | | |
|-----------|------------------|
| 1. large | 6. cold |
| 2. 35°C | 7. 2.5 g/ml |
| 3. 26.2 g | 8. 85 miles/hour |
| 4. 3.7 cm | 9. 450 ml |
| 5. green | |

- #1, 5, 6 are intensive, but they are qualitative not quantitative
- #3, 4, 9 are quantitative but they are extensive, not intensive

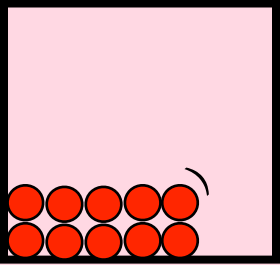
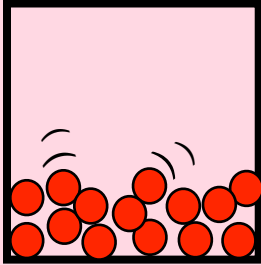
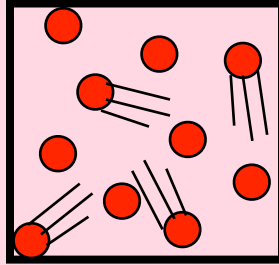
Water, it's an amazing substance.

- Earth is the only place in the universe that we know of that has the right conditions for water to exist as **solid**, **liquid**, and **gas** in the same place at the same time.

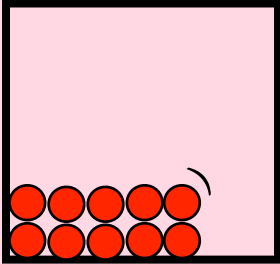
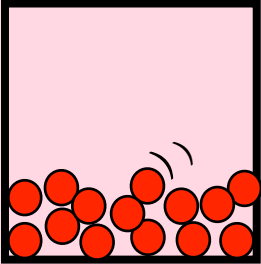
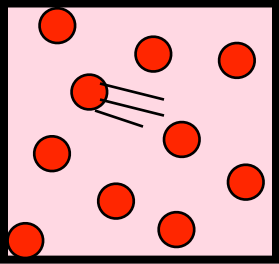


△ to slide view

Explaining the Macroscopic by Describing the Nanoscopic

	Solid	Liquid	Gas
Macroscopic property: Compressible or not?	<input type="text"/>		<input type="text"/>
Nanosopic explanantion	<input type="text"/>		<input type="text"/>
Macroscopic property: Fluid or not?	<input type="text"/>	<input type="text"/>	
Nanosopic explanantion	<input type="text"/>	<input type="text"/>	
Diagram of the nanoscopic. Add some wiggle and speed lines as appropriate			

Explaining the Macroscopic by Describing the Nanoscopic

	Solid	Liquid	Gas
Macroscopic property: Compressible or not?	NOT compressible		compressible
Nanosopic explanantion	Particles are touching		Particles are far apart
Macroscopic property: Fluid or not?	rigid	fluid	
Nanosopic explanantion	Particles are stuck	Particles are NOT stuck together	
Diagram of the nanoscopic. Add some wiggle and speed lines as appropriate (Δ to slide view)			

Select the statement below that gives the *best* nanoscopic explanation (particle theory) as to why solids are *rigid (hard)*. (Choose only one.)

1. the particles are very small.
2. the particles are stuck together.
3. the particles are touching each other.
4. the particles are aligned in a regular and repeating pattern.
5. the particles are polar, so they are “sticky”

Select the statement below that gives the best nanoscopic explanation as to why solids are *rigid (hard)*.

1. the particles are very small.

2. the particles are stuck together.

3. the particles are touching each other.

✓ Of course to be stuck, the particles would need to be touching, but it is not the act of touching that makes them rigid. After all, liquid water molecules are touching each other, yet liquid water is not rigid

4. the particles are aligned in a regular and repeating pattern.

✓ While choice #2 is the *best* response, it does make sense that for any substance to be regular and repeating, the particles would need to be stuck to one another, but not all solids are arranged in a repeating pattern (glass, rubber, wax, cotton candy). Yet, to be a solid, the particles *must* be stuck together.

5. the particles are polar, so they are “sticky”

✓ It does make sense that for particles to be stuck to one another, being polar and “sticky” may be why they are stuck, but some molecules that are non polar are solids (moth balls, bacon fat).

△ to slide view

Select the statement below that gives the best nanoscopic explanation as to why liquids and solids are *incompressible*.

1. the particles are very small.
2. the particles are stuck together.
3. the particles are touching each other.
4. the particles are aligned in a regular and repeating pattern.
5. the particles are polar so they are “sticky”

Select the statement(s) below that gives the best nanoscopic explanation as to why liquids and solids are *incompressible*.

1. the particles are very small.
2. the particles are stuck together.
3. the particles are touching each other.
 - ✓ incompressibility does not occur because the particles are stuck, they simple need to be touching, so there is no room to push them any closer together.
4. the particles are aligned in a regular and repeating pattern.
5. the particles are polar so they are “sticky”

Select the statement(s) below that gives the best nanoscopic explanation as to *why* liquids or gases are *fluid*.

1. most of the particles are very small.
2. most of the particles are NOT stuck together.
3. most of the particles are touching each other.
4. most of the particles are NOT aligned in a regular and repeating pattern.
5. the particles are polar, so they are “sticky”

Select the statement(s) below that gives the best nanoscopic explanation as to *why* liquids or gases are *fluid*.

1. most of the particles are very small.
2. most of the particles are NOT stuck together.
3. most of the particles are touching each other.
4. most of the particles are NOT aligned in a regular and repeating pattern.
 - ✓ Again, while this is a true statement, but is not the *reason* that the liquid and gas are fluid.
5. the particles are polar, so they are “sticky”

Particles

Understanding the words:

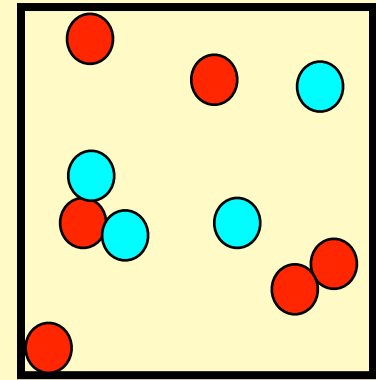
Pure or Mixture

Elements or Compounds?

Atoms or Molecules?

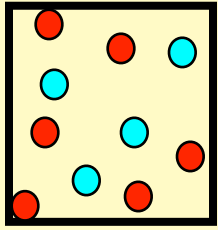


In the following slides, the boxes represent containers with “stuff” in them.

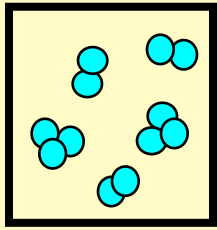


1. Atoms are represented by circles.
2. Different colored circles will represent different elements.
3. If the circles are touching, assume they are bonded together.

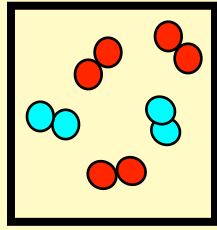
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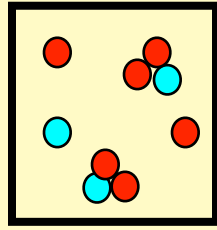
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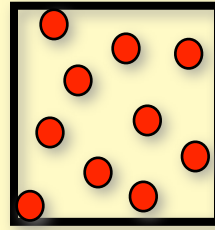
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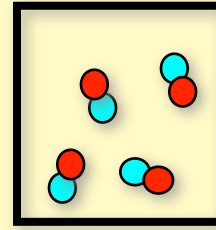
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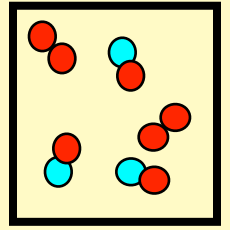
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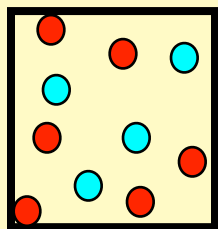
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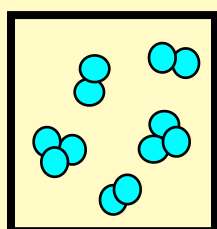
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- Which box(es) contain a pure substance ?
- Enter 0 for none of the above

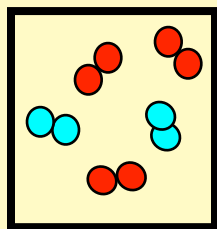
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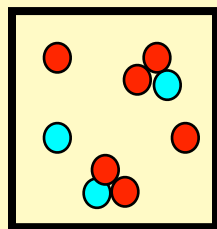
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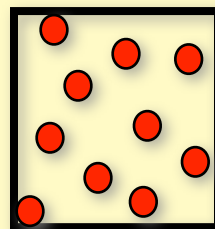
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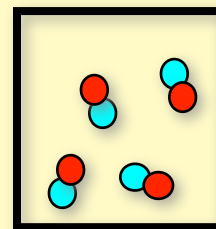
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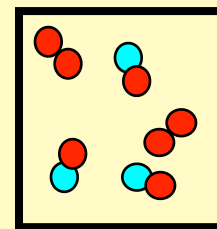
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6



7

ANSWER

- Which box(es) contain a pure substance?
- Enter 0 for none of the above
- #2 is a mixture of *allotropes* of the same element.

Allotropes of oxygen

We are an
allotrope of the
element
oxygen, O_3 .



We are another
allotrope of
oxygen, O_2

We are all
oxygen atoms

Allotropes

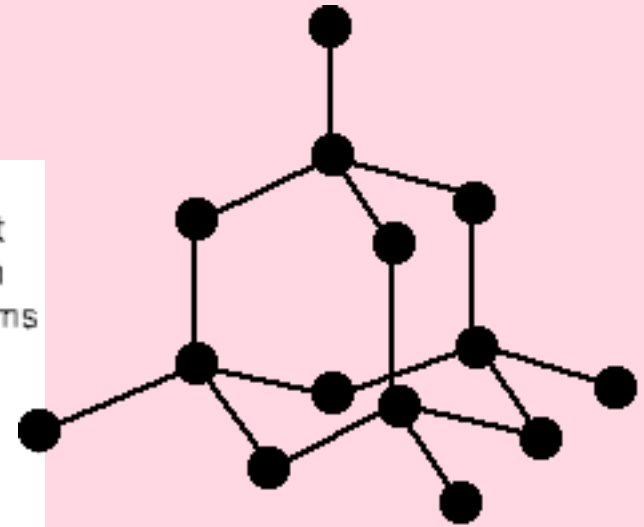
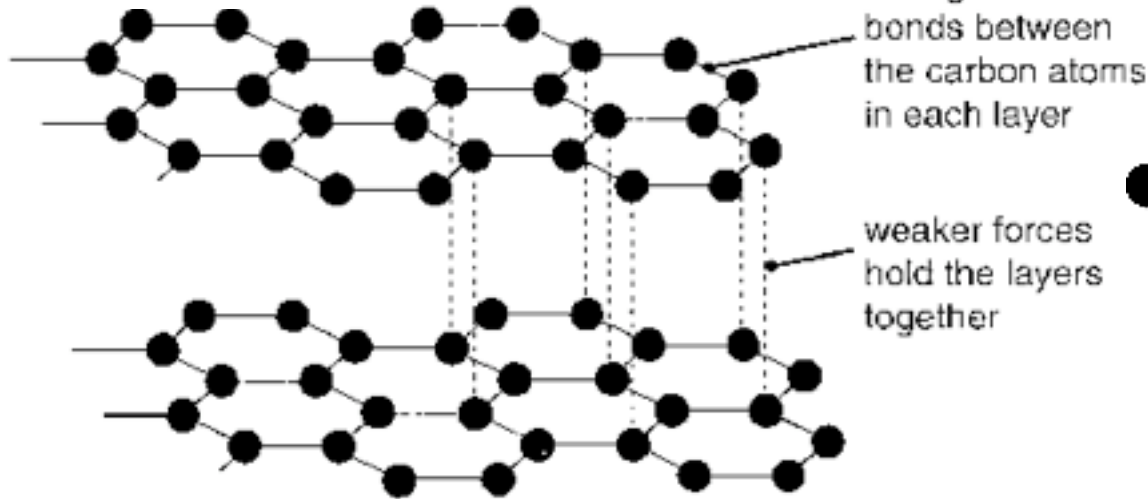
Different forms of the same element, caused by a different arrangement of the atoms of that element.

Allotropes of carbon



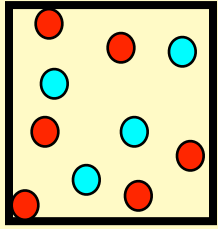
Buckminsterfullerene
aka Buckyballs

Graphite

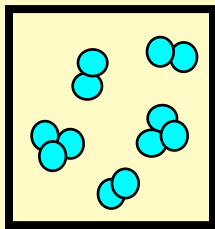


Diamonds

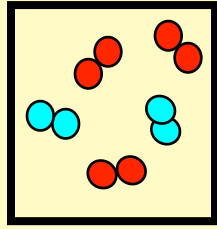
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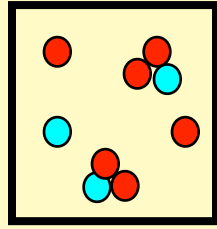
1



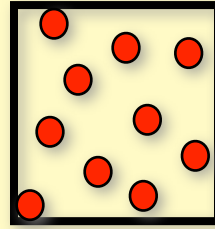
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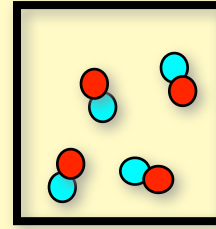
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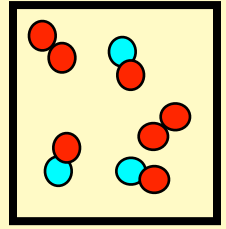
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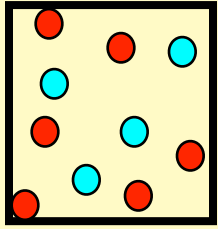
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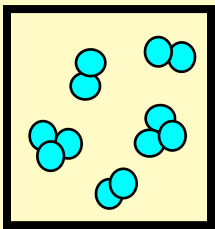
7

- Which box(es) contain a mixture?
- Enter 0 for none of the above

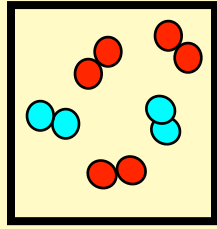
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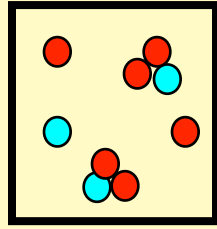
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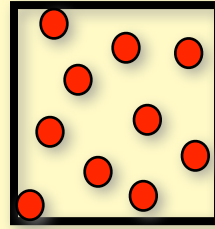
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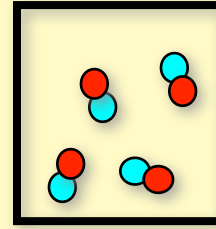
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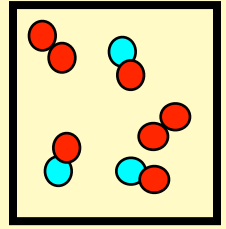
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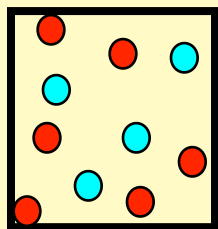


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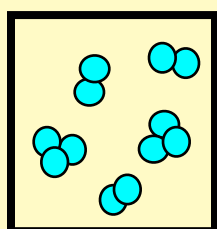
ANSWER

- Which box(es) contain a mixture?
- Enter 0 for none of the above
- #5 is a pure element
- #6 is a pure compound

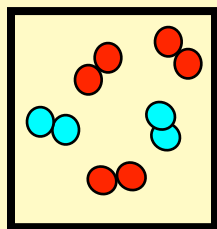
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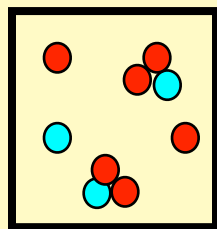
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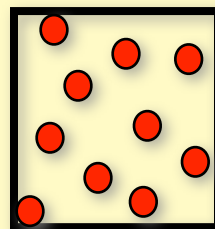
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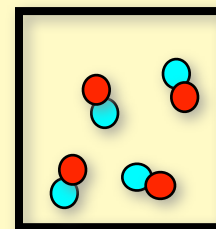
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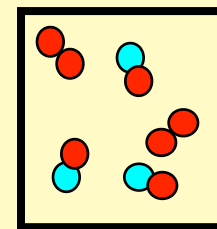
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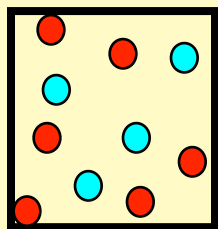
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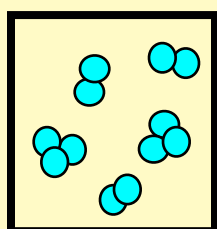
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- Which box(es) contain(s) a compound?
- Enter 0 for none of the above

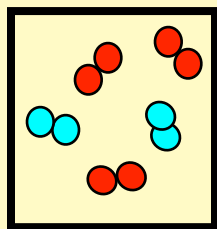
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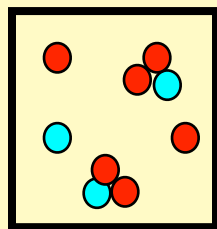
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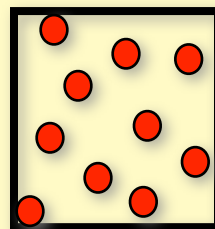
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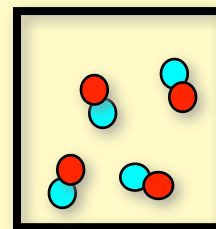
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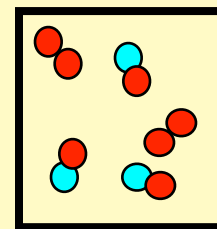
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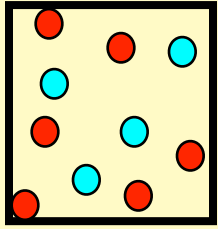


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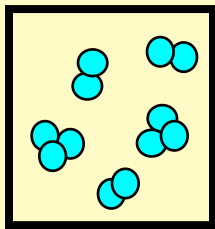
ANSWER

- Which box(es) contain(s) a compound?
- Enter 0 for none of the above
- #1 and 3 have two different elements in the box
- #2 and 5 have only one kind of element in the box

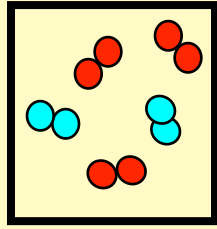
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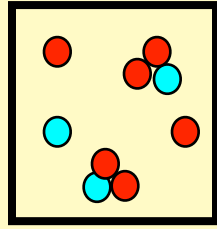
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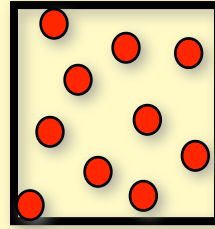
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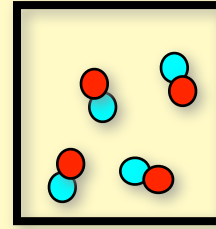
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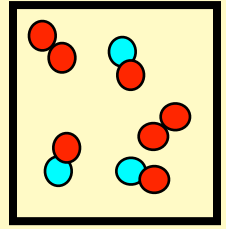
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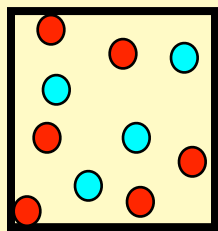
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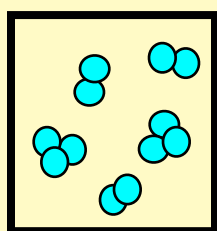
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- In which box(es) are the particles *only* molecules?
- Enter 0 for none of the above

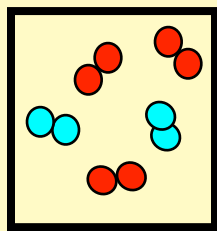
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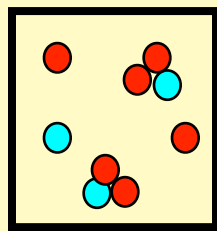
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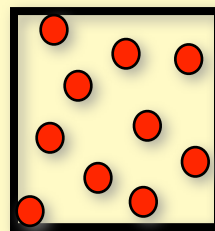
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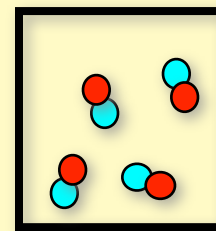
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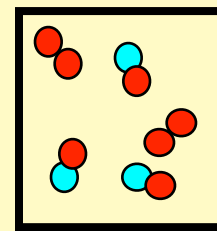
4



5



6

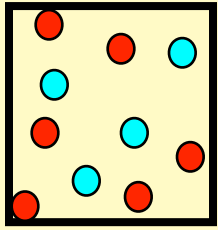


7

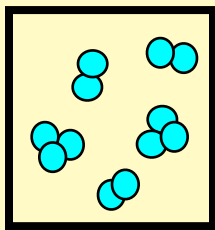
ANSWER

- In which box(es) are the particles *only* molecules?
- Enter 0 for none of the above
- #1 and 5 have only atoms in the box
- #4 has atoms as well as molecules in the box

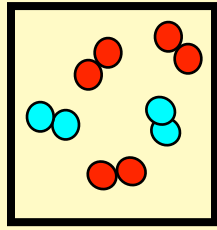
The boxes below represent containers with “stuff” in them.



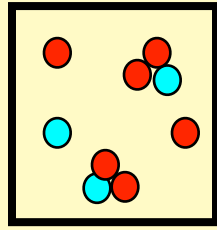
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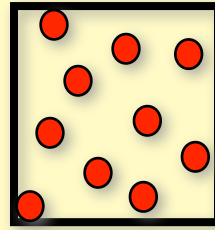
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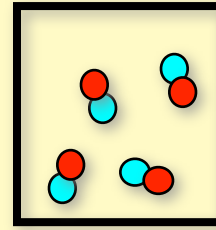
3



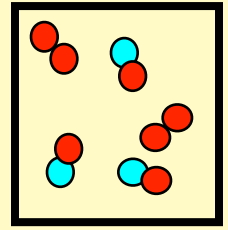
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5



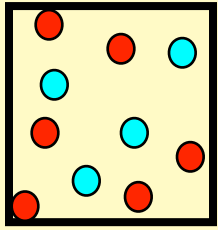
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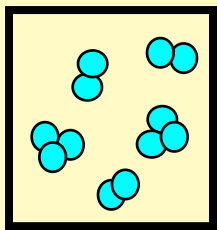
7

- Which box(es) contain *only a single* element?
- Enter 0 for none of the above

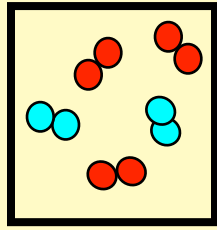
The boxes below represent containers with “stuff” in them.



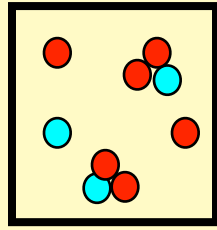
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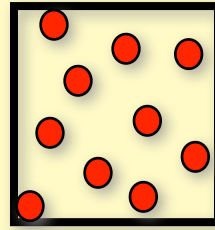
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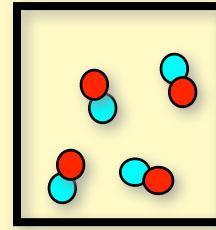
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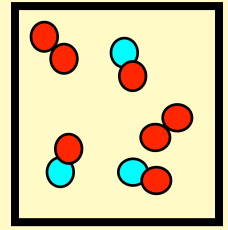
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6

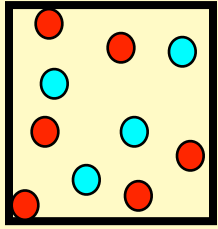


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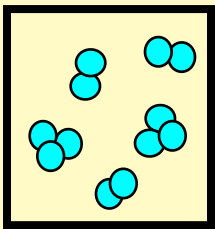
ANSWER

- Which box(es) contain *only a single* element?
- Enter 0 for none of the above
- #1 and 3 have a mixture of two different elements in the box

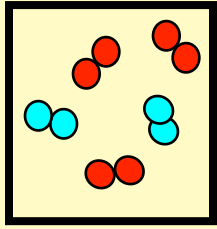
The boxes below represent containers with “stuff” in them.



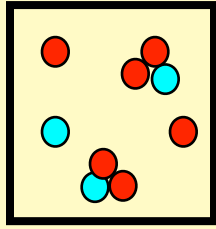
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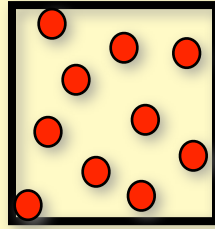
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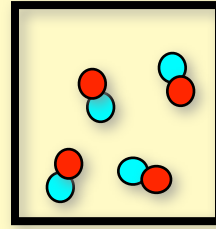
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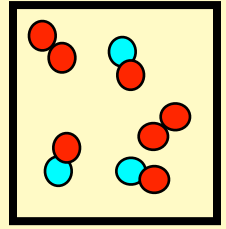
4



5



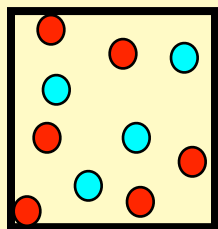
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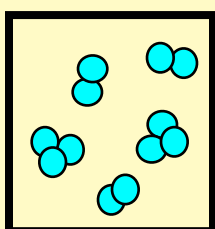
7

- Which box(es) contain(s) a mixture whose particles are atoms *and* molecules.
- Enter 0 for none of the above

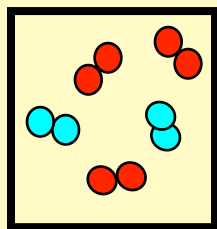
The boxes below represent containers with “stuff” in them.



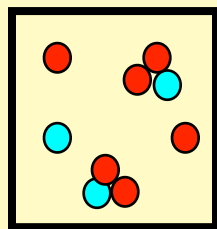
1



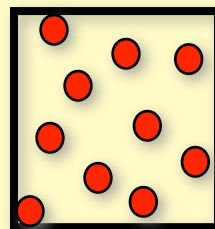
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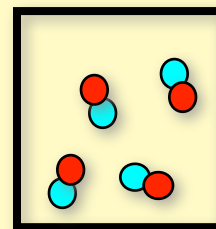
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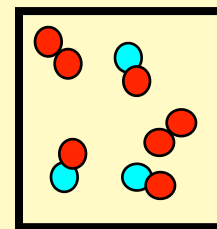
4



5



6



7

ANSWER

- Which box(es) contain(s) a mixture whose particles are atoms *and* molecules.
- Enter 0 for none of the above
- #1 and 5 are only atoms
- #2, 3, 6, and 7 are only molecules

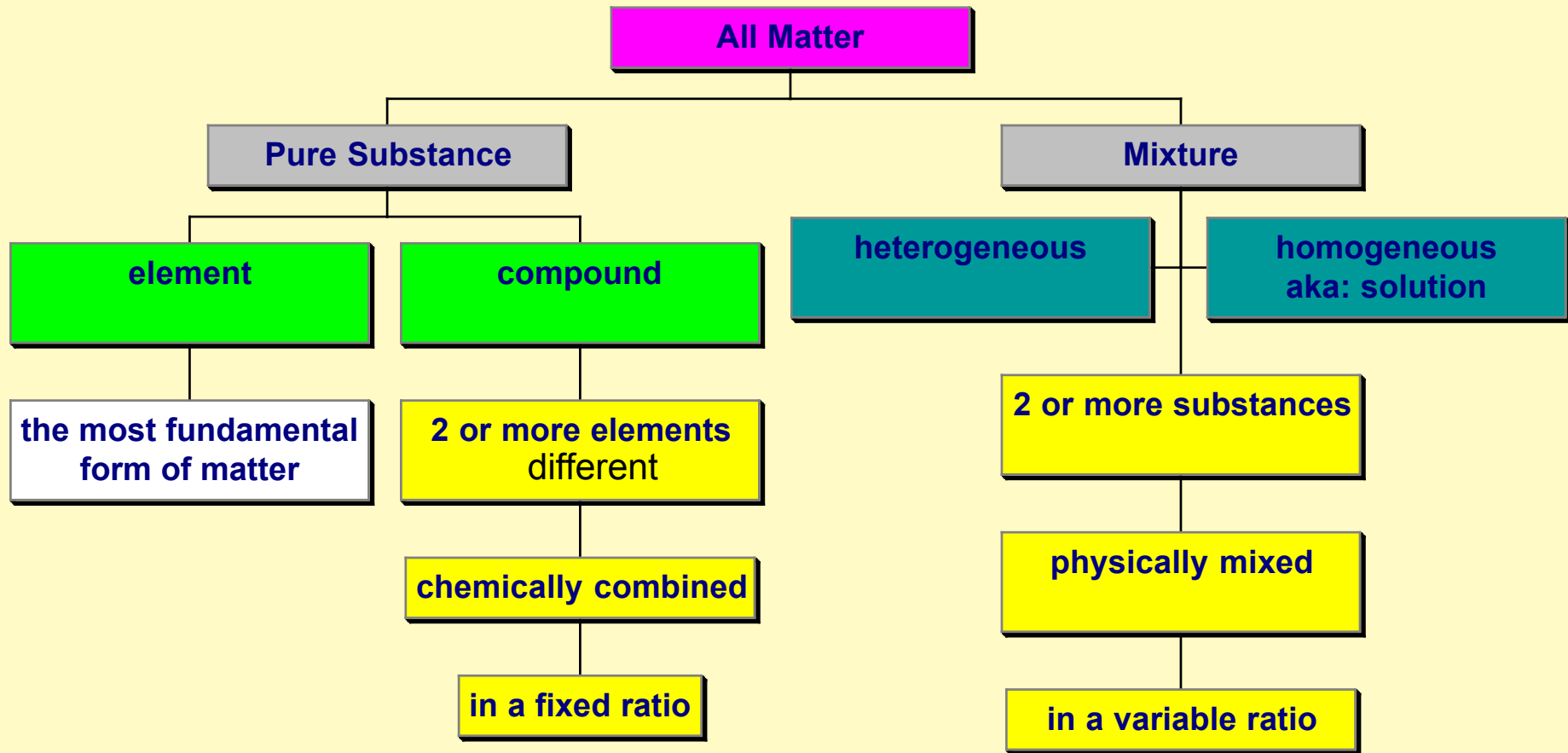
How are you feeling about the use of the terms:
pure substance - mixture
molecules - atoms
elements - compounds

1. I think I can use all of these terms correctly most of the time.
2. I think I will be able to use these terms correctly with a little more practice tonight.
3. I am feeling unsure about them, but I will work on them tonight, then ask for help tomorrow if I am still not clear.
4. I am feeling fuzzy about them, but have no intentions of trying to figure it out.

Types of Mixtures

slide show

Classification of Matter



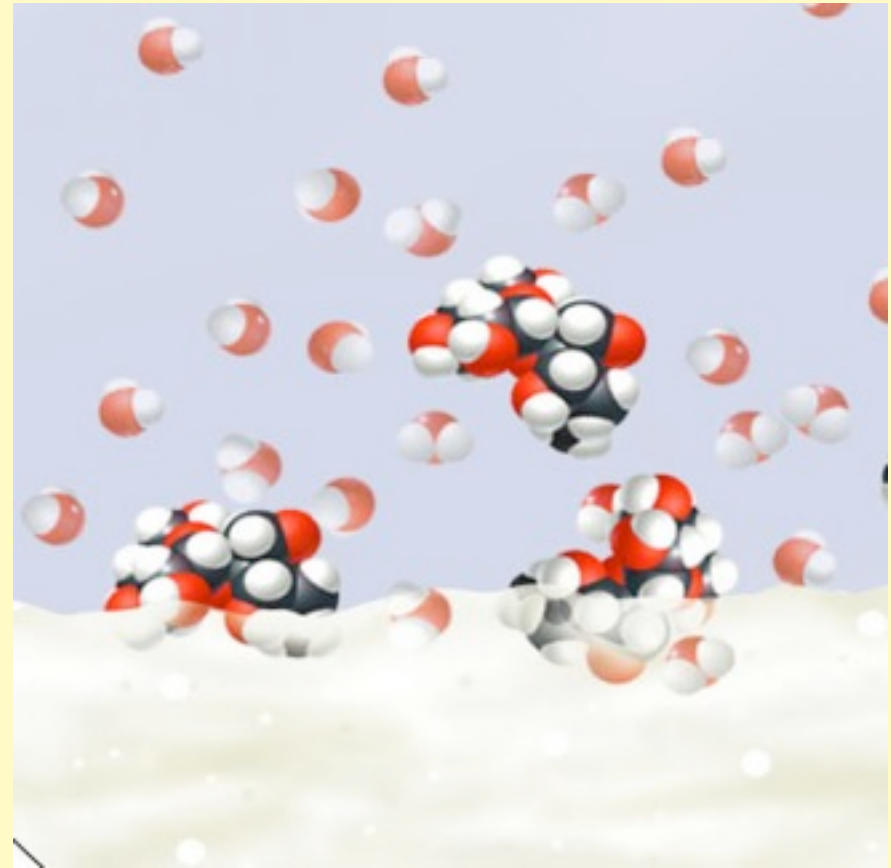
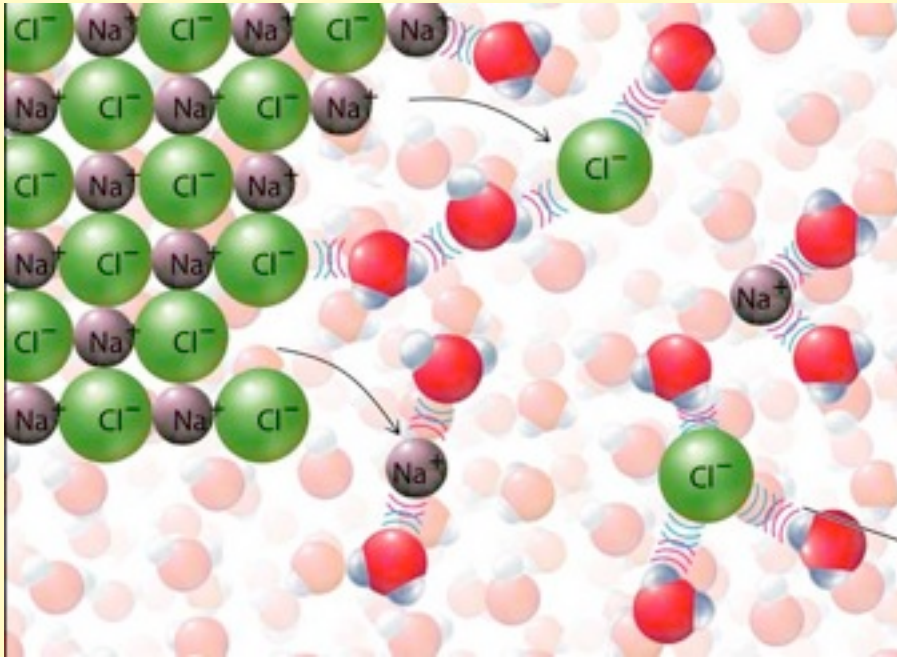
Definitions

- Heterogeneous mixtures
 - ✓ With your eyes: you can see the different parts
 - ✓ May not be mixed uniformly throughout
- Homogeneous mixture: aka solution
 - ✓ With your eyes: looks the same all over
 - ✓ Mixed uniformly throughout
 - ▶ For instance: Sugar in water has same sweetness throughout
 - ✓ Specific types of solutions:

* Solid in Liquid	* Solid in Gas	* Solid in Solid
* Liquid in Liquid	* Liquid in Gas	* Liquid in Solid ??
* Gas in Liquid	* Gas in Gas	* Gas in Solid

Solution: Solid in Liquid

- Salt in water - separate into ions
- Sugar in water - stays together as molecules



Solution: Liquid in Liquid

- Shirley Temple
 - ✓ Pomegranate juice and ginger ale
- Juice and Seltzer
 - ✓ cranberry juice and seltzer
- Mixed drink: Rum and Coke
 - ✓ Alcohol and soda



Solution: Gas in Liquid

- Seltzer
 - ✓ CO_2 and water
- “Air” for fish
 - ✓ O_2 in water



Solution: Solid in Gas

(perhaps this is actually a suspension)

- Dust
 - ✓ Dirt in air
- Pollen
 - ✓ Pollen in air



Solution: Liquid in Gas

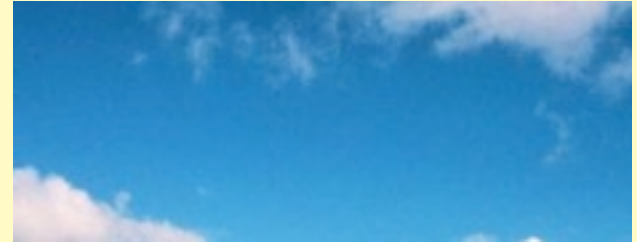
(perhaps this is also a suspension)

- Fog
 - ✓ Water in air



Solution: Gas in Gas

- Air
 - ✓ nitrogen and oxygen



Solution: Solid in Solid

- Alloys

- ✓ Brass
- ✓ Stainless steel



- Gems

- ✓ Ruby: red chromium compounds in aluminum oxide
- ✓ Sapphire: blue titanium in aluminum oxide



Solution: Liquid in Solid

- ????

Solution: Gas in Solid

- Marshmallows
 - ✓ air in sugar puff
- Canned whip cream
 - ✓ N_2O in cream

