

CHEM 108

Organization of Matter

Physical & Chemical Properties

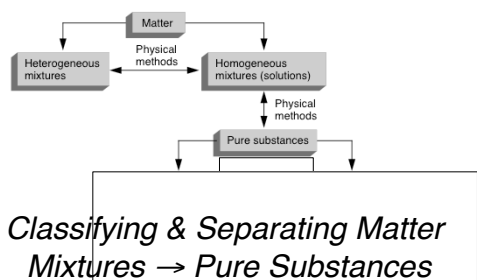
Atoms and The Periodic Table

Except where otherwise noted, content on this site is licensed under a Creative Commons Attribution 4.0 International license.

Chemistry & Matter

Organization of matter

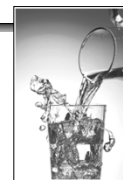
- Physical vs. Chemical Properties
- Physical States:
Solid (s), Liquid (l), Gas (g)
- Homogeneous vs. Heterogeneous Mixtures



QUESTION

Which of the following would NOT be considered matter?

- A. Water
- B. Sugar
- C. Light
- D. Gasoline
- E. Sand

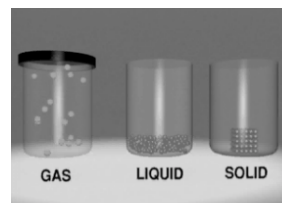


QUESTION

Which of the following is a pure substance?

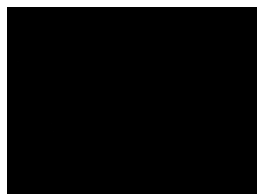
- A. Sodium (Element # 11)
- B. Milk
- C. Blood
- D. Saline solution
- E. Stainless steel

Physical States of Matter



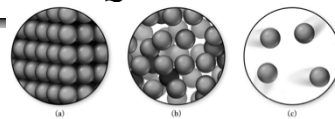
<http://chemconnections.org/general/movies/States-of-Matter.mov>

Physical States of Matter



<http://chemconnections.org/general/movies/States-of-Matter.mov>

QUESTION

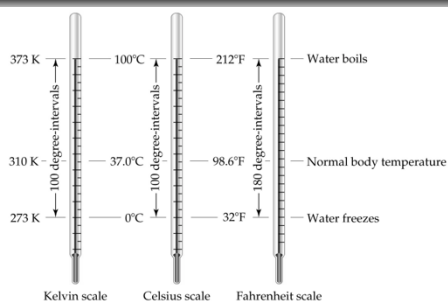


The kinetic energy of physical states increases in the following order: Solid (s) < Liquid (l) < Gas (g).

- Correctly match the illustrations of the molecule above and its physical state.

- A) a = solid, b = gas, c = liquid
 B) a = liquid, b = solid, c = gas
 C) a = solid, b = liquid, c = gas
 D) a = liquid, b = gas, c = solid
 E) a = gas, b = liquid, c = solid

Physical States of Water



Chemistry & Matter Properties & Physical States

- Physical vs. Chemical Properties
- Solid (s) \rightleftharpoons Liquid (l) \rightleftharpoons Gas (g)
- Homogeneous vs. Heterogeneous Mixtures
- Extensive vs. Intensive Properties
 Varies with amount (extensive) or does not vary with amount (intensive)
 Heat of chemical reaction is extensive (Chemical Property), density is intensive (Physical Property)

QUESTION

Extensive properties of a pure substance depend on sample size whereas intensive properties are characteristic of that substance. Which of these properties are intensive?

- I) Color
 II) Mass
 III) Density

- A) I and II B) I and III C) II and III D) I, II and III

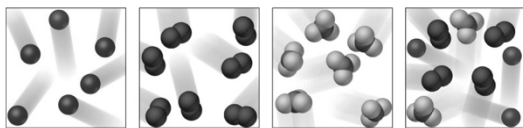
Chemistry & Matter

- Organization of atoms & molecules:
 atoms/elements \rightarrow molecules/compounds
- Physical vs. Chemical Properties
- Chemical Reactions: atoms combine to form molecules, which chemically react further.



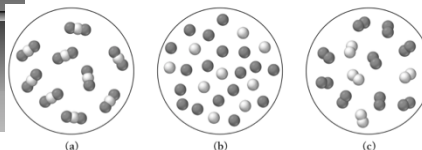
Chemical Visualization: Atoms & Molecules

Atomic Force Microscopy / Molecular Modeling
Experimental / Mathematical



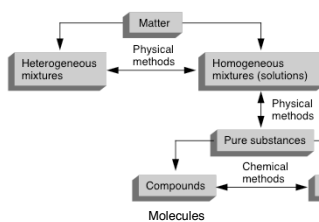
Solid (s) \rightleftharpoons Liquid (l) \rightleftharpoons Gas (g)

QUESTION



- Which drawing(s) illustrate(s) a pure substance and not a mixture.

A) a, b, and c
B) a and b
C) a only
D) b only
E) c only



Atoms / Elements & Compounds/ Molecules

QUESTION

Which of the following is an element?

- A. Sugar
- B. Salt (Sodium chloride, NaCl)
- C. Brass
- D. Chlorine (Cl_2)
- E. Air

CHEMISTRY of Atoms

The Periodic Table

Mendeleev's Table 1868-1871

Mural at St. Petersburg University, Russia

Periodic Table

Los Alamos National Lab

<http://periodic.lanl.gov/index.shtml>

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H																	
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg											Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
32																		
33																		
34																		
35																		
36																		
37																		
38																		
39																		
40																		
41																		
42																		
43																		
44																		
45																		
46																		
47																		
48																		
49																		
50																		
51																		
52																		
53																		
54																		
55																		
56																		
57																		
58																		
59																		
60																		
61																		
62																		
63																		
64																		
65																		
66																		
67																		
68																		
69																		
70																		
71																		
72																		
73																		
74																		
75																		
76																		
77																		
78																		
79																		
80																		
81																		
82																		
83																		
84																		
85																		
86																		
87																		
88																		
89																		
90																		
91																		
92																		
93																		
94																		
95																		
96																		
97																		
98																		
99																		
100																		
101																		
102																		
103																		
104																		
105																		
106																		
107																		
108																		
109																		
110																		
111																		
112																		
113																		
114																		
115																		
116																		
117																		
118																		

Chemistry & Matter

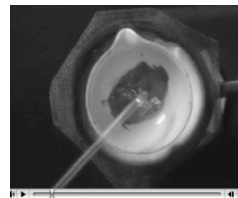
- How many different chemicals (atoms + molecules) do you think have been reported in the scientific literature?

- A) 100,000
- B) 1,000,000
- C) 10,000,000
- D) 100,000,000
- E) 1,000,000,000

CAS Registry : ~12,000 in 1907

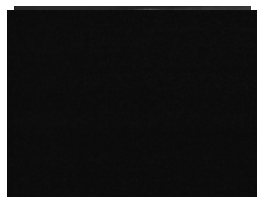
~ 500 new molecules are currently added / hr

Observations of Physical & Chemical Properties



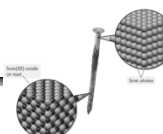
<http://chemconnections.org/general/movies/phys-chem-prop.mov>

Observations of Physical & Chemical Properties



<http://chemconnections.org/general/movies/phys-chem-prop.mov>

QUESTION



Which of these are chemical properties of matter?



- I) Rust/Corrosion
- II) Density = Mass / Volume
- III) Flammability
- IV) Boiling point (Temperature: Liquid \rightleftharpoons Gas)

- A) I and II
- B) I and III
- C) II and IV
- D) III and IV

QUESTION



If you hold in your hand a solid piece of pure gallium, symbol Ga / element number 31 in the Periodic Table, this silvery metal, which has been used in certain types of thermometers, will melt into a liquid by absorbing your body's heat.

Which term best describes this observation?

- A) boiling point
- B) physical change
- C) chemical change
- D) metaphysical property
- E) heat of reaction