

- Which compound is most soluble in water?
(A) silver acetate (C) silver nitrate
(B) silver chloride (D) silver sulfate
- According to Reference Table F, which compound is most soluble in water?
(A) BaCO_3
(B) BaSO_4
(C) ZnCO_3
(D) ZnSO_4
- In an aqueous solution of potassium chloride, the solute is
(A) Cl
(B) K
(C) KCl
(D) H_2O
- The attraction between water molecules and an Na^+ ion or a Cl^- ion occurs because water molecules are
(A) linear (C) polar
(B) symmetrical (D) nonpolar
- Based on Reference Table F, which of the following saturated solutions would be the *least* concentrated?
(A) sodium sulfate (C) copper (II) sulfate
(B) potassium sulfate (D) barium sulfate
- Based on Reference Table F, which salt is *least* soluble?
(A) FeCO_3
(B) Na_2CO_3
(C) BaCl_2
(D) CaCl_2
- Based on Reference Table F, which of the following compounds is *least* soluble in water?
(A) NaCl
(B) Pb_2ClO_3
(C) Na_2CrO_4
(D) PbCrO_4
- According to Reference Table F, which substance is most soluble?
(A) AgI
(B) CaSO_4
(C) PbCl_2
(D) $(\text{NH}_4)_2\text{CO}_3$
- According to Reference Table F, which of these compounds is most soluble at 298 K and 1 atm?
(A) PbCl_2
(B) AgCl
(C) PbCrO_4
(D) PbCO_3
- Based on Reference Table F, which of these saturated solutions has the lowest concentration of dissolved ions?
(A) $\text{NaCl}(\text{aq})$
(B) $\text{MgCl}_2(\text{aq})$
(C) $\text{NiCl}_2(\text{aq})$
(D) $\text{AgCl}(\text{aq})$
- Which ion, when combined with chloride ions, Cl^- , forms an insoluble substance in water?
(A) Fe^{2+} (C) Pb^{2+}
(B) Mg^{2+} (D) Zn^{2+}
- Which compound is insoluble in water?
(A) BaSO_4
(B) CaCrO_4
(C) KClO_3
(D) Na_2S
- When $\text{PbI}_2(\text{s})$ is added to $\text{Na}_2\text{CO}_3(\text{aq})$, a white precipitate is formed. According to Reference Table F, the white precipitate most likely is
(A) KNO_3
(B) PbCO_3
(C) NaI
(D) Na_2CO_3
- Based on Reference Table G, when 100 grams of water saturated with KNO_3 at 70°C is cooled to 25°C , the total number of grams of KNO_3 that will precipitate is
(A) 40 (C) 80
(B) 45 (D) 95

Practice Problems: Solubility Rules

15. By which process is a precipitate most easily separated from the liquid in which it is suspended?

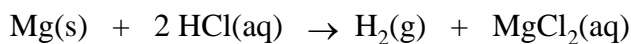
- (A) neutralization (C) condensation
(B) distillation (D) filtration

16. Diethyl ether is historically used as an anesthetic. It is insoluble in water but mixes with many organic solvents and is widely used as a solvent itself, e.g., for fats and oils.

a) Write the molecular formula and draw the structural formula of diethyl ether.

b) Based upon its structural formula. Why is diethyl ether such a good solvent of fats and oils?

17. Hydrogen can be made by the reaction of magnesium with a strong acid such as hydrochloric acid, HCl, or sulfuric acid, H₂SO₄. The reaction with hydrochloric acid is shown below:



Since hydrogen gas is almost insoluble in water, it can be collected by displacement of water using an inverted bottle.

a Draw the Lewis electron-dot structure for a molecule of hydrogen gas.

b Based upon your knowledge of molecular structure, explain why hydrogen does not dissolve in water.

c Write a balanced chemical equation for the reaction of magnesium solid with sulfuric acid to form hydrogen gas and magnesium sulfate.

Practice Problems: Solubility Rules

18. Base your answers to the following questions on the information below.

Many consumer products are packaged in containers made of a plastic called polypropylene.

Polypropylene is a polymer made from a biproduct of oil and widely used because it is inexpensive, durable, insoluble in water and non-toxic. The molecule used as the building block to synthesize this long chain hydrocarbon is propene. Polypropylene can not be used as source of nutrients by bacteria.

a) What is the molecular formula of propene? _____

b) Draw the structural formula of propene.

c) Based upon your knowledge of why substances will dissolve in some substances but not others, explain why polypropylene does not dissolve in water.

d) Explain in a sentence or two why would the use of paper packaging would be better for the environment than polypropylene plastic.

19. An unknown solid was tested and showed the properties listed below:

Properties

low melting point
nearly insoluble in water
non-conductor of electricity
relatively soft solid

a) State the type of bonding you would expect of this substance.

b) Explain why this substance is insoluble in water.

c) Explain why it is soft.

20. An unknown substance, liquid X, is tested in the laboratory. The chemical and physical test results are listed below.

- Nonconductor of electricity
- Insoluble in water
- Soluble in hexane
- Low melting point as a solid
- Combustion produces only CO_2 and H_2O

Based on these results, a student should conclude that liquid X is

- (A) ionic and organic
 - (B) ionic and inorganic
 - (C) covalent and organic
 - (D) covalent and inorganic
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Practice Problems: Solubility Rules

21. Base your answers to the following questions on the information given below.

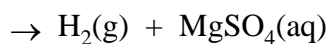
Testing of an unknown solid shows that it has the properties listed below.

- (1) low melting point
- (2) nearly insoluble in water
- (3) electricity
- (4) relatively soft solid

- a* State the type of bonding that would be expected in the particles of this substance.]
- b* Explain in terms of attractions between particles why the unknown solid has a low melting point.
- c* Explain why the particles of this substance are nonconductors of electricity.

**Practice Problems: Solubility Rules
Answer Key**

1. C



2. D

18. a) C₃H₆ b) drawing c) non-polar will not dissolve in polar solvents
d) Paper is biodegradable.

3. C

4. C

5. D

19. a) covalent b) The substance must not have any polarity since polar molecules or ionic substances would dissolve in polar water. c) It must be a molecular substance with very little attraction between its molecules. These weak attractions makes the molecules easy to move apart and thus are soft.

6. A

7. D

8. D

9. B

10. D

11. C

20. C

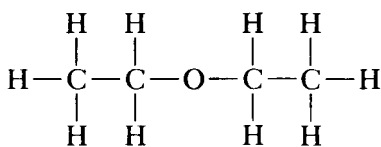
12. A

13. B

14. D

15. D

16.



- c Example: -There are no freely moving charged particles

- a) C₂H₅OC₂H₅ or C₄H₁₀
O b) It is a non-polar molecule.

17. **H•H**

- b) Hydrogen is a non-polar molecule and cannot dissolve in a polar substance like water.
c) Mg(s) + H₂SO₄(aq)