

CHAPTER 1
AN INTRODUCTION TO CHEMISTRY
SOLUTIONS TO REVIEW QUESTIONS

1. (a) A hypothesis is a tentative explanation of certain facts to provide a basis for further experimentation. A theory is an explanation of the general principles of certain phenomena with considerable evidence to support it.
(b) A theory is an explanation of the general principles of certain phenomena with considerable evidence to support it. A scientific law is a simple statement of natural phenomena to which no exceptions are known under the given conditions.
2. (a) hypothesis
(b) hypothesis
(c) observation
(d) theory
(e) observation
(f) scientific law
3. (a) A liquid has a definite volume but not a definite shape.
(b) A gas has an indefinite volume and high compressibility.
(c) A solid has a definite shape.
(d) A liquid has an indefinite shape and slight compressibility.
4. A crystalline solid has a regular, repeating, three-dimensional, geometric pattern. An amorphous solid does not
(a) A solid that has a regular, repeating pattern is a crystalline solid.
(b) A plastic solid is amorphous.
(c) A solid that has no regular repeating pattern is amorphous.
(d) Glass is an amorphous solid.
(e) Gold is a crystalline solid.
5. A phase is a homogeneous part of a system separated from other parts by a physical boundary.
6. There are six phases present.
7. Another name for a homogeneous mixture is solution.
8. Alcohol, mercury, and water are the only liquids in the table which are not mixtures. Mercury is an element; alcohol and water are compounds.
9. Air is the only gas mixture found in the table. The other gases are elements or compounds.
10. Three phases are present within the bottle; solid and liquid are observed visually, while gas is detected by the immediate odor.
11. The system is heterogeneous as three phases are present.

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12. A system containing only one substance is not necessarily homogeneous. Two phases may be present. Example: ice in water.
13. A system containing two or more substances is not necessarily heterogeneous. In a solution only one phase is present. Examples: sugar dissolved in water, dilute sulfuric acid.
14. Homogeneous mixtures contain only one phase, while heterogeneous mixtures contain two or more phases.
15. (a) sugar, a compound and (c) gold, an element
16. Using the steps of the scientific method to help determine why your cell phone has stopped working.
 - (a) Observation: My cell phone has stopped working.
 - (b) Hypothesis: I think that the battery needs to be recharged.
 - (c) Experiment: Plug in the phone to recharge the battery and allow sufficient time for the battery to fully recharge. Turn the phone back on. The phone now works again.
 - (d) Theory: The battery in the phone has a limited charge time and needs to be recharged on a regular basis in order to keep it in working order.

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SOLUTIONS TO EXERCISES

1. Two states are present; solid and gas.
2. Two states are present; solid and liquid.
3. The photo represents a heterogeneous mixture.
4. The maple leaf represents a heterogeneous mixture.
5. (a) homogeneous
(b) heterogeneous
(c) heterogeneous
(d) heterogeneous
6. (a) homogeneous
(b) homogeneous
(c) heterogeneous
(d) heterogeneous

7. Typical answers could be

<u>Substance</u>	<u>Main or Active Ingredient</u>
chocolate syrup	high fructose corn syrup
margarine	vegetable oil blend
non-dairy creamer	corn syrup solids
beef bouillon	salt
toothpaste	sodium fluoride
antibacterial soap	triclocarban
first aid spray	lidocaine HCl
sunblock lotion	ethylhexyl p-methoxycinnamate

8. The steps of the scientific method can be used to predict the outcome of the semester in the following way:
 - (a) Collect the facts or data. They include the number of classes you have enrolled in, the amount of time you will give to each class, the number of hours required for your off campus job, and the amount of time for social activities.
 - (b) Formulate a hypotheses. You predict that the amount of time you have allocated each week for class work will be sufficient to result in good grades at the end of the semester.
 - (c) Plan and do additional experiments to test the hypothesis. In the first two weeks of the semester keep a record of your performance in each class, including grades on homework, quizzes, and exams.
 - (d) Modify the hypothesis. If your grades in any class are not good, your hypothesis was incorrect. It will be necessary to increase the amount of time allocated to that class.
9. (a) water, a pure substance
(b) chicken stock, a mixture
(c) salt, a pure substance
(d) mustard flour, a mixture

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10. Hypothesis – The soup is a not a good source of nutrition because it contains 12 grams of fat per serving.

Test – Search for the number of grams of fat per day recommended for an adult. Compare this number to the grams per fat on the label.

11. Observations –

Calcite crystals have the ability to reflect light around an object rendering it “unseeable.”

“Invisibility cloaks” work only with laser light aimed directly at the crystal.

Hypotheses –

If larger crystals were used, larger objects could be hidden.

These “invisibility cloaks” will improve in the future.

12. (a), (b), Picture (2) best represents a homogeneous mixture. Pictures (1) and (c) (3) show heterogeneous mixtures, and picture (4) does not show a mixture, as only one species is present.

Picture (1) likely shows a compound, as one of the components of the mixture is made up of more than one type of “ball.” Picture (2) shows a component with more than one part, but the parts seem identical, and therefore it could be representing a diatomic molecule.

13. (a) two phases, solid and gas
(b) two phases, liquid and gas
(c) two phases, solid and liquid