

3.11: Exercises

3.1: What is Matter?

1. What is matter?

Answer

Matter is anything that has mass and takes up space.

2. Atoms are the building blocks of all matter in the universe. As of 2011, scientists only know of 118 different types of atoms. How do you think it's possible to generate so many different forms of matter using only 118 types of building blocks?

Answer

Atoms can combine in many different ways to form compounds.

3. Which do you think has more matter, a cup of water or a cup of mercury? Explain.

Answer

A cup of mercury. Both have the same volume. However, the cup of mercury will weigh more so it should have more matter in it.

3.2: Physical States of Matter

4. Give an example of matter in each phase: solid, liquid, or gas.

Answer

Answers will vary. Solid = steel; liquid = water; gas = air.

3.3: Composition of Matter

5. Distinguish between an element and a compound. About how many of each are known?

Answer

Elements cannot be broken down to chemically simpler components. Compounds can because they are made up of more than one element. There are 118 known elements. There are millions of known compounds.

6. What is the difference between a homogeneous mixture and a heterogeneous mixture?

Answer

A homogeneous mixture is uniform throughout. A heterogeneous mixture is not uniform throughout.

7. Identify each as a heterogeneous mixture or a homogeneous mixture.
 - a. Salt is mixed with pepper.
 - b. Sugar is dissolved in water.
 - c. Pasta is cooked in boiling water.

Answer

- a. heterogeneous
- b. homogeneous
- c. heterogeneous

8. Identify each as a heterogeneous mixture or a homogeneous mixture.

- a. air
- b. dirt
- c. a big screen television

Answer

- a. homogeneous
- b. heterogeneous
- c. heterogeneous

9. In [Exercise 7](#), which choices are also solutions?

Answer

- b, sugar dissolved in water

10. In [Exercise 8](#), which choices are also solutions?

Answer

- a, air

11. Identify each of the following as an element, compound, homogeneous mixture, or heterogeneous mixture.

- a. apple juice
- b. copper
- c. carbon dioxide, a 1:2 combination of carbon and oxygen
- d. ham and cheese sandwich

Answer

- a. homogeneous mixture
- b. element
- c. compound
- d. heterogeneous mixture

12. Identify each of the following as an element, compound, homogeneous mixture, or heterogeneous mixture.

- a. chocolate chip ice cream
- b. magnesium nitride, a 3:2 combination of magnesium and nitrogen
- c. gasoline
- d. fluorine

Answer

- a. heterogeneous mixture
- b. compound
- c. homogeneous mixture
- d. element

3.4: Physical and Chemical Properties

13. Does each statement represent a physical property or a chemical property?

- a. Sulfur is yellow.
- b. Steel wool burns when ignited by a flame.
- c. A gallon of milk weighs over eight pounds.

Answer

- a. physical
- b. chemical
- c. physical

14. Does each statement represent a physical property or a chemical property?

- a. A pile of leaves slowly rots in the backyard.
- b. In the presence of oxygen, hydrogen can interact to make water.
- c. Gold can be stretched into very thin wires.

Answer

- a. chemical
- b. chemical
- c. physical

3.5: Physical and Chemical Changes

15. Does each statement represent a physical change or a chemical change?

- a. Water boils and becomes steam.
- b. Food is converted into usable form by the digestive system.
- c. The alcohol in many thermometers freezes at about -40 degrees Fahrenheit.

Answer

- a. physical
- b. chemical
- c. physical

16. Does each statement represent a physical change or a chemical change?

- a. Plants use photosynthesis to convert carbon dioxide into glucose.
- b. The house across the street has been painted a new color.
- c. The elements sodium and chlorine come together to make a new substance called sodium chloride.

Answer

- a. chemical
- b. physical
- c. chemical

3.6: Conservation of Mass

17. Octane is a major component of gasoline. When octane is burned by your car engine, the octane reacts with oxygen to form carbon dioxide and water. If 100.0 g of octane reacts with 350.2 g of oxygen to make 142.0 g of water, how many grams of

carbon dioxide are produced.

Answer

308.2 g

18. Baking soda (NaHCO_3) decomposes over time to form sodium carbonate, water, and carbon dioxide. How many grams of baking soda must decompose to form 250.0 g of sodium carbonate? In addition to the sodium carbonate, 42.5 g of water and 103.8 g of carbon dioxide will also form.

Answer

396.3 g

3.7: Energy

19. Classify each of the following as energy primarily transferred as heat, or energy primarily transferred as work:

- The energy transferred from your body to a shopping cart as you push the shopping cart down the aisle.
- The energy transferred from a wave to your board when you go surfing.
- The energy transferred from the flames to your hotdog when you cook your hotdog over a campfire.

Answer

- work
- work
- heat

20. Decide whether each of the following statements is true or false:

- When heat is transferred to an object, the object cools down.
- Any time you raise the temperature of an object, you have done work.
- Any time you move an object by applying force, you have done work.
- Any time you apply force to an object, you have done work.

Answer

- false, it heats up
- false, you have added heat
- true
- false, it must be moved to do the work

21. Classify each of the following energies as kinetic energy or potential energy:

- The energy in a chocolate bar.
- The energy of rushing water used to turn a turbine or a water wheel.
- The energy of a skater gliding on the ice.
- The energy in a stretched rubber band.

Answer

- potential
- kinetic
- kinetic
- potential

3.8: Energy and Chemical and Physical Change

22. A pot of water is set on a hot burner of a stove. What is the direction of heat flow?

Answer

Heat flows into the pot of water.

23. Some uncooked macaroni is added to a pot of boiling water. What is the direction of heat flow?

Answer

Heat flows from the water to the macaroni.

24. Label each of the following processes as endothermic or exothermic.

- a. an ice cube melts in a cup
- b. a chemical ice pack is activated by breaking the inner pouch and shaking

Answer

- a. endothermic (the ice must be heated to melt so it absorbs energy)
- b. endothermic (the ice pack feels cold)

25. Label each of the following processes as endothermic or exothermic.

- a. sweat evaporates from your skin
- b. a bonfire

Answer

- a. endothermic (the liquid must be heated to evaporate so it absorbs energy)
- b. exothermic (the fire feels warm so it gives off heat)

3.9: Temperature

26. Perform the following conversions.

- a. 255°F to degrees Celsius
- b. -255°F to degrees Celsius
- c. 50.0°C to degrees Fahrenheit
- d. -50.0°C to degrees Fahrenheit

Answer

- a. 124°C
- b. -159°C
- c. 122.0°F
- d. -58.0°F

27. Perform the following conversions.

- a. 1,065°C to degrees Fahrenheit
- b. -222°C to degrees Fahrenheit
- c. 400.0°F to degrees Celsius

d. 200.0°F to degrees Celsius

Answer

- a. 1949°F
- b. -368°F
- c. 204.4°C
- d. 93.3°C

28. Perform the following conversions.

- a. 100.0°C to kelvins
- b. -100.0°C to kelvins
- c. 100. K to degrees Celsius
- d. 300. K to degrees Celsius

Answer

- a. 373.2 K
- b. 173.2 K
- c. -173°C
- d. 27°C

29. Perform the following conversions.

- a. 1,000.0 K to degrees Celsius
- b. 50.0 K to degrees Celsius
- c. 37.0°C to kelvins
- d. -37.0°C to kelvins

Answer

- a. 726.9°C
- b. -223.2°C
- c. 310.2 K
- d. 236.2 K

30. Convert 0 K to degrees Celsius.

Answer

-273°C

31. Convert 0 K to degrees Fahrenheit.

Answer

-460°F

32. The hottest temperature ever recorded on the surface of the earth was 136°F in Libya in 1922. What is the temperature in degrees Celsius and in kelvins?

Answer

57.8°C , 330.9 K

33. The coldest temperature ever recorded on the surface of the earth was -128.6°F in Vostok, Antarctica, in 1983. What is the temperature in degrees Celsius and in kelvins?

Answer

-89.2°C , 183.9 K

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