

# CHEMISTRY I – CH-1211

## EXTRA PRACTICE

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## Exam 1 Review: Measurements, Derived Units, Significant Figures

1. How many significant figures are in each number?

- A. 554 km
- B. 7 pennies
- C.  $1.01 \times 10^5$  m
- D. 0.00099 s
- E. 1.4500 km
- F. 21,000 m

3;  $\infty$  (obtained via counting); 3; 2; 5; (ambiguous but considered to be 2 for this class)

sec01-q0001-01.tex

Keyword:significant figures

2. What is the volume (in  $\text{cm}^3$ ) of a 2.50 gram block of metal whose density is 6.72 grams per cubic centimeter?

A:  $0.372 \text{ cm}^3$

$$\rho = \frac{m}{V} \rightarrow$$
$$V = \frac{m}{\rho} = \frac{2.50 \text{ g}}{6.72 \text{ g cm}^{-3}} = 0.372 \text{ cm}^3$$

sec01-q0002-01.tex

Keyword:density

3. A cube of 1.2 inches on the side has a mass of 36 grams. What is the density (in  $\text{g mL}^{-1}$ )?

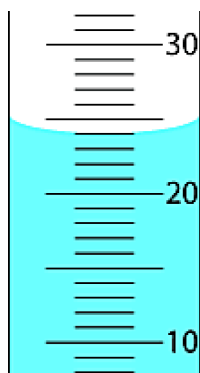
A:  $1.3 \text{ g mL}^{-1}$

$$l = 1.2 \text{ in} \left( \frac{2.54 \text{ cm}}{1 \text{ in}} \right) = 3.048 \text{ cm}$$
$$V = l^3 = (3.048 \text{ cm})^3 = 28.32 \text{ cm}^3$$
$$\rho = \frac{m}{V} = \frac{36 \text{ g}}{28.32 \text{ cm}^3} \left( \frac{\text{cm}^3}{\text{mL}} \right) = 1.27 \text{ g mL}^{-1} = 1.3 \text{ g mL}^{-1}$$

sec01-q0003-01.tex

Keyword:density

4. A student is using a graduated cylinder to measure the volume of a liquid. What reading should be recorded?



24.0 mL; the zero in the tenth-place is the uncertain (estimated) number.

sec01-q0007-01.tex

Keyword:uncertainty; measurement

5. A student performs an experiment to determine the density of a sugar solution. She obtains the following results:  $1.11 \text{ g mL}^{-1}$ ,  $1.81 \text{ g mL}^{-1}$ ,  $1.95 \text{ g mL}^{-1}$ ,  $1.75 \text{ g mL}^{-1}$ . The actual value for the density of the sugar solution is  $1.75 \text{ g mL}^{-1}$ . Determine if the following statements are true or false.
- A. Her results are precise.  
B. Her results are accurate.

**A is false. B is false.**

sec01-q0010-01.tex

Keyword:accuracy; precision

6. What answer should be reported, unambiguously, with the correct number of significant figures, for the following calculation?

$$(433.621 - 333.9) \times 11.900$$

**A:  $1.19 \times 10^3$**

$$\begin{aligned} (433.621 - 333.9) \times 11.900 &= \\ (99.721) \times 11.900 &= 1186.7 \\ &= 1,190 \\ &= 1.19 \times 10^3 \end{aligned}$$

sec01-q0011-01.tex

Keyword:significant figures

7. What is the length (in mm) of 3.20 cm?

A: 32.0 mm

$$3.20 \text{ cm} \left( \frac{\text{m}}{10^2 \text{ cm}} \right) \left( \frac{10^3 \text{ mm}}{\text{m}} \right) = 32.0 \text{ mm}$$

sec01-q0012-01.tex

Keyword:metric; conversions

8. If the walls in a room are 955 ft<sup>2</sup> in area, and a gallon of paint covers 15 yd<sup>2</sup>, how many gallons of paint are needed for the room? (3 ft = 1 yd)

A: 7.1 gal

$$955 \text{ ft}^2 \left( \frac{\text{gal}}{15 \text{ yd}^2} \right) = 7.074 \text{ gal} = 7.1 \text{ gal}$$

sec01-q0013-01.tex

Keyword:imperial; conversions

9. What symbol is used to represent the factor 10<sup>9</sup>?

G (giga)

sec01-q0014-01.tex

Keyword:metric

10. A piece of metal ore has a mass of 9.25 g. When a student places it into a graduated cylinder containing water, the liquid level rises from 21.25 mL to 26.47 mL. What is the density (in g mL<sup>-1</sup>) of the ore?

A: 1.77 g mL<sup>-1</sup>

$$\begin{aligned} V(\text{ore}) &= V_f - V_i \\ &= 26.47 \text{ mL} - 21.25 \text{ mL} = 5.22 \text{ mL} \end{aligned}$$

$$\begin{aligned} \rho(\text{ore}) &= \frac{m}{V} \\ &= \frac{9.25 \text{ g}}{5.22 \text{ mL}} \\ &= 1.7720 \text{ g mL}^{-1} = 1.77 \text{ g mL}^{-1} \end{aligned}$$

sec01-q0015-01.tex

Keyword:density; volume displacement

11. How many significant figures are in the answer to the following calculation?

$$12.011 \text{ g} - 11.11 \text{ g} + 2.412 \text{ g} =$$

3

sec01-q0027-01.tex

Keyword: significant figures

12. How many significant figures are in the answer to the following calculation?

$$(29.0025 + 0.2) (6.134 - 6.101) / 5.196 \times 10^{-2}$$

2

$$\begin{aligned} (29.0025 + 0.2)(6.134 - 6.101) / 5.196 \times 10^{-2} &= \\ (29.202)(0.0330) / 5.196 \times 10^{-2} &= \\ (0.9636) / 5.196 \times 10^{-2} &= 18.546 \\ &= 19 \end{aligned}$$

sec01-q0028-01.tex

Keyword: significant figures

13. Nitric acid is a very important industrial chemical and  $1.612 \times 10^{10}$  lb were produced in 1992. If the density of nitric acid is  $12.53 \text{ lb gal}^{-1}$ , what is the volume (in L)?  $1 \text{ gal} = 3.7854 \text{ L}$

A:  $4.870 \times 10^9 \text{ L}$

$$\begin{aligned} 1.612 \times 10^{10} \text{ lb} \left( \frac{1 \text{ gal}}{12.53 \text{ lb}} \right) \left( \frac{3.7854 \text{ L}}{1 \text{ gal}} \right) &= 4.86996 \times 10^9 \text{ L} \\ &= 4.870 \times 10^9 \text{ L} \end{aligned}$$

sec01-q0029-01.tex

Keyword: conversions



14. A rectangular block has the following dimensions:  $2.9 \text{ cm} \times 3.5 \text{ cm} \times 10.0 \text{ cm}$ . The mass of the block is  $615.0 \text{ g}$ . What is the volume (in  $\text{cm}^3$ ) and density (in  $\text{kg m}^{-3}$ ) of the block?

A:  $1.0 \times 10^2 \text{ cm}^3$ ;  $6.1 \times 10^3 \text{ kg m}^{-3}$

$$\begin{aligned} V &= l \times w \times h \\ &= 2.9 \text{ cm} \times 3.5 \text{ cm} \times 10.0 \text{ cm} \\ &= 101.5 \text{ cm}^3 = 1.0 \times 10^2 \text{ cm}^3 \\ \rho &= \frac{m}{V} \\ &= \frac{615.0 \text{ g}}{101.5 \text{ cm}^3} \left( \frac{\text{kg}}{10^3 \text{ g}} \right) \left( \frac{10^2 \text{ cm}}{\text{m}} \right)^3 \\ &= 6059 \text{ kg m}^{-3} = 6.1 \times 10^3 \text{ kg m}^{-3} \end{aligned}$$

sec01-q0030-01.tex

Keyword: volume; density

15. The average daytime temperatures on Earth and Jupiter are  $72^\circ\text{F}$  and  $313 \text{ K}$ , respectively. Which planet is hotter, on average, and by how much (in  $^\circ\text{C}$ )?

A: Jupiter;  $18^\circ\text{C}$

$$\begin{aligned} T_{\text{Earth}} (^\circ\text{C}) &= \frac{[T_{\text{Earth}} (^\circ\text{F}) - 32]}{1.8} \\ &= \frac{(72^\circ\text{F} - 32)}{1.8} \\ &= 22.22^\circ\text{C} \\ T_{\text{Jupiter}} (^\circ\text{C}) &= T_{\text{Jupiter}} (\text{K}) - 273.15 \\ &= 313 \text{ K} - 273.15 \\ &= 39.85^\circ\text{C} \\ \Delta T &= T_{\text{Jupiter}} (^\circ\text{C}) - T_{\text{Earth}} (^\circ\text{C}) \\ &= 39.85^\circ\text{C} - 22.22^\circ\text{C} \\ &= 17.63^\circ\text{C} = 18^\circ\text{C} \end{aligned}$$

Jupiter is hotter than Earth by  $18^\circ\text{C}$  on average.

sec01-q0031-01.tex

Keyword: temperature

16. At room temperature, elemental bromine ( $\text{Br}_2$ ) is a liquid with a density of  $3.12 \text{ g cm}^{-3}$ . What is the mass (in g) of 125 mL of bromine and what volume (in mL) does 85.0 g of bromine occupy?

A: 390. g; 27.2 mL

$$\begin{aligned}\rho &= \frac{m}{V} \longrightarrow \\ m &= V\rho \\ &= 125 \text{ mL} \left( \frac{3.12 \text{ g}}{\text{cm}^3} \right) \left( \frac{\text{cm}^3}{\text{mL}} \right) \\ &= 390. \text{ g}\end{aligned}$$

$$\begin{aligned}\rho &= \frac{m}{V} \longrightarrow \\ V &= \frac{m}{\rho} \\ &= \frac{85.0 \text{ g}}{3.12 \text{ g cm}^{-3}} \left( \frac{\text{mL}}{\text{cm}^3} \right) \\ &= 27.243 \text{ mL} = 27.2 \text{ mL}\end{aligned}$$

sec01-q0032-01.tex

Keyword: volume; density

17. A sample containing 33.42 g of metal pellets is poured into a graduated cylinder that initially contains 12.7 mL of water. The final water level in the cylinder is 21.6 mL. What is the density (in  $\text{g mL}^{-1}$ ) of the metal?

A:  $3.8 \text{ g mL}^{-1}$

$$\begin{aligned}\Delta V &= V_{\text{final}} - V_{\text{initial}} \\ &= 21.6 \text{ mL} - 12.7 \text{ mL} \\ &= 8.9 \text{ mL} \\ \rho &= \frac{m}{V} \\ &= \frac{33.42 \text{ g}}{8.9 \text{ mL}} \\ &= 3.755 \text{ g mL}^{-1} = 3.8 \text{ g mL}^{-1}\end{aligned}$$

sec01-q0033-01.tex

Keyword: volume; density; volume displacement

18. Which of the following has three significant figures?

- A.  $6.070 \times 10^{-15}$
- B.  $0.053 \times 10^2$
- C. 700
- D.  $3.00 \times 10^2$
- E. 8650.

**D**

sec01-q0034-01.tex

Keyword: significant figures

19. Which of the following is a chemical change?

- A. forging of metal
- B. boiling water
- C. shattering glass
- D. rust forming on a bike
- E. melting ice

**D**

sec01-q0035-01.tex

Keyword: chemical changes

20. Write the following numbers in normalized scientific notation to three significant figures.

- A. 0.00046701
- B. 8973.002
- C. 0.0279020
- D. 32.4513
- E. 0.000090999

- A.  $4.67 \times 10^{-4}$
- B.  $8.97 \times 10^3$
- C.  $2.79 \times 10^{-2}$
- D.  $3.25 \times 10^1$
- E.  $9.10 \times 10^{-5}$

sec01-q0036-01.tex

Keyword: significant figures; scientific notation

21. A student goes to the lab and is tasked with measuring the mass of a block of nickel metal that has a known mass of 15.00 g. The student takes three different measurements in which they collect the following masses: 13.29 g, 13.28 g, and 13.29 g. What statement best describes their results?
- Their measurements are both precise and accurate
  - Their measurements are precise, but not accurate
  - Their measurements are accurate, but not precise
  - Their measurements are neither precise or accurate

**B**

sec01-q0039-01.tex

Keyword:accuracy; precision

22. Perform the following conversions below. Report your answers in normalized scientific notation to the appropriate number of significant figures.

A:  $1.4521 \times 10^8$  mg;  $4.50 \times 10^{-10}$  m;  $4.21 \times 10^{-2}$  L;  $1.73 \times 10^{11}$  cm<sup>3</sup>

- 145.21 kg to mg
- 0.490 nm to m
- 42.1 cm<sup>3</sup> to L
- $1.73 \times 10^5$  m<sup>3</sup> to cm<sup>3</sup>

$$\text{A. } 145.21 \text{ kg} \left( \frac{10^3 \text{ g}}{\text{kg}} \right) \left( \frac{10^3 \text{ mg}}{\text{g}} \right) = 1.4521 \times 10^8 \text{ mg}$$

$$\text{B. } 0.490 \text{ nm} \left( \frac{\text{m}}{10^9 \text{ nm}} \right) = 4.90 \times 10^{-10} \text{ m}$$

$$\text{C. } 42.1 \text{ cm}^3 \left( \frac{\text{mL}}{\text{cm}^3} \right) \left( \frac{\text{L}}{10^3 \text{ mL}} \right) = 4.21 \times 10^{-2} \text{ L}$$

$$\text{D. } 1.73 \times 10^5 \text{ m}^3 \left( \frac{10^2 \text{ cm}}{\text{m}} \right)^3 = 1.73 \times 10^{11} \text{ cm}^3$$

sec01-q0040-01.tex

Keyword:conversions; scientific notation

23. Determine the number of significant figures for each of the following values.

A: 2; 4; ∞; 4; 5; 8

- A. 4700
- B. 0.4700
- C. 4700 pencils
- D. 00.4700
- E. 4700.0 g
- F. 4700.0100

sec01-q0041-01.tex

Keyword:significant figures

24. Evaluate each expression and report your answer to the appropriate number of significant figures.

A: 1.050;  $2.9 \times 10^8$ ; 12.79; 5;  $2.36 \times 10^4$ ; 108.3;  $4.30 \times 10^4$

- A.  $0.5000 \times 21.000000 =$
- B.  $29.1 \times (8.31 \times 10^4) \times 120 =$
- C.  $0.459 + 12.33 - 0.001 =$
- D.  $14.010 - 13.99 + 5 =$
- E.  $\frac{(2.36 \times 10^3)(2.360 \times 10^2)}{2.3600 \times 10^1} =$
- F.  $(41.540 \times 2.715) - 4.513 =$
- G.  $\frac{(2.83 \times 10^3)(0.2100 + 312.12)}{20.55} =$

sec01-q0042-01.tex

Keyword:significant figures

25. Which of the following options is at the highest temperature?

- A. 71.4 °F
- B. 22.1 °C
- C. 294.65 K

**B;** This solution converts all temperatures to °C.

$$\begin{aligned} \text{A. } T(^{\circ}\text{C}) &= \frac{[T(^{\circ}\text{F}) - 32]}{1.8} \\ &= \frac{(71.4^{\circ}\text{F} - 32)}{1.8} \\ &= 21.88^{\circ}\text{C} = 21.9^{\circ}\text{C} \end{aligned}$$

$$\text{B. } T(^{\circ}\text{C}) = 22.1^{\circ}\text{C}$$

$$\begin{aligned} \text{C. } T(^{\circ}\text{C}) &= T(\text{K}) - 273.15 \\ &= 294.65 \text{ K} - 273.15 \\ &= 21.50^{\circ}\text{C} \end{aligned}$$

sec01-q0043-01.tex

Keyword: temperature

26. Zirconium metal has a density of 6.49 g cm<sup>-3</sup>. What volume (in L) of zirconium are present in 5.41 lb of this metal? (1 lb = 453.59 g)

**A: 0.378 L**

$$\begin{aligned} 5.41 \text{ lb} \left( \frac{453.59 \text{ g}}{1 \text{ lb}} \right) \left( \frac{\text{cm}^3}{6.49 \text{ g}} \right) \left( \frac{\text{mL}}{\text{cm}^3} \right) \left( \frac{\text{L}}{10^3 \text{ mL}} \right) &= 0.3781 \text{ L} \\ &= 0.378 \text{ L} \end{aligned}$$

sec01-q0044-01.tex

Keyword: density

27. A student fills a graduated cylinder with deionized water up to the 35.50 mL line. They then carefully place a copper rod into the cylinder and note that the new volume reading is 36.51 mL. If the density of copper is  $8.96 \text{ g cm}^{-3}$ , what was the mass (in g) of the copper rod?

A: 9.05 g

$$\begin{aligned}\Delta V &= V_{\text{final}} - V_{\text{initial}} \\ &= 36.51 \text{ mL} - 35.50 \text{ mL} \\ &= 1.01 \text{ mL}\end{aligned}$$

$$\begin{aligned}\rho &= \frac{m}{V} \longrightarrow \\ m &= V\rho \\ &= 1.01 \text{ mL} \left( \frac{8.96 \text{ g}}{\text{cm}^3} \right) \\ &= 9.0496 \text{ g} = 9.05 \text{ g}\end{aligned}$$

sec01-q0045-01.tex

Keyword:density; volume displacement

28. A student obtains a silver rod that has a mass of 23.99 g and carefully places it in a graduated cylinder filled with deionized water. They note the new volume reading in the graduated cylinder is 110.25 mL. Unfortunately, the student forgot to take an initial reading of the volume in the cylinder prior to adding the silver rod. If the density of silver is  $10.49 \text{ g cm}^{-3}$ , what was the initial volume (in mL) of the water?

A: 107.96 mL

$$\begin{aligned}\rho &= \frac{m}{V} \longrightarrow \\ V &= \frac{m}{\rho} \\ &= \frac{23.99 \text{ g}}{10.49 \text{ g cm}^{-3}} \\ &= 2.28693 \text{ mL}\end{aligned}$$

$$\begin{aligned}\Delta V &= V_{\text{final}} - V_{\text{initial}} \longrightarrow \\ V_{\text{initial}} &= V_{\text{final}} - \Delta V \\ &= 110.25 \text{ mL} - 2.28693 \text{ mL} \\ &= 107.9630 \text{ mL} = 107.96 \text{ mL}\end{aligned}$$

sec01-q0046-01.tex

Keyword:density; volume displacement

29. 750. mL of ethanol weighs 570. g. What is the density (in  $\text{g mL}^{-1}$ ) of ethanol?

A:  $0.760 \text{ g mL}^{-1}$

$$\begin{aligned}\rho &= \frac{m}{V} \\ &= \frac{570. \text{ g}}{750. \text{ mL}} \\ &= 0.760 \text{ g mL}^{-1}\end{aligned}$$

sec01-q0047-01.tex

Keyword:density

30. Which of the following is the same as one milliliter?

- A. 1,000 L
- B. 0.01 L
- C. 0.001 L
- D. 0.000001 L
- E. 0.000000001 L

C

sec01-q0048-01.tex

Keyword:metric

31. 1.00 L of helium gas has a mass of 0.178 g. What is the mass (in g) of 2.4 L of helium gas?

A: 0.43 g

$$\begin{aligned}\rho &= \frac{m}{V} \\ &= \frac{0.178 \text{ g}}{1.00 \text{ L}} \\ &= 0.178 \text{ g L}^{-1}\end{aligned}$$

$$\begin{aligned}\rho = \frac{m}{V} &\longrightarrow m = V\rho \\ &= 2.4 \text{ L} \left( \frac{0.178 \text{ g}}{\text{L}} \right) \\ &= 0.4272 \text{ g} = 0.43 \text{ g}\end{aligned}$$

sec01-q0049-01.tex

Keyword:density



32. The Hindenburg contained  $7.062 \times 10^6 \text{ ft}^3$  of a gas. If the gas was helium ( $\rho(\text{He}) = 1.78 \times 10^{-4} \text{ g mL}^{-1}$ ), how much lighter (in kg) would it be than if the gas was air ( $\rho(\text{air}) = 1.293 \times 10^{-3} \text{ g mL}^{-1}$ )? (1 ft = 0.3048 m)

A:  $2.23 \times 10^5 \text{ kg}$

$$V = 7.062 \times 10^6 \text{ ft}^3 \left( \frac{0.3048 \text{ m}}{\text{ft}} \right)^3 \left( \frac{10^2 \text{ cm}}{\text{m}} \right)^3 \left( \frac{\text{mL}}{\text{cm}^3} \right)$$

$$= 2.000 \times 10^{11} \text{ mL}$$

$$\rho = \frac{m}{V} \rightarrow$$

$$m(\text{He}) = V\rho(\text{He})$$

$$= 2.000 \times 10^{11} \text{ mL} \left( \frac{1.78 \times 10^{-4} \text{ g}}{\text{mL}} \right) \left( \frac{\text{kg}}{10^3 \text{ g}} \right)$$

$$= 3.560 \times 10^4 \text{ kg}$$

$$m(\text{air}) = V\rho(\text{air})$$

$$= 2.000 \times 10^{11} \text{ mL} \left( \frac{1.293 \times 10^{-3} \text{ g}}{\text{mL}} \right) \left( \frac{\text{kg}}{10^3 \text{ g}} \right)$$

$$= 2.5860 \times 10^5 \text{ kg}$$

$$\Delta m = m(\text{air}) - m(\text{He})$$

$$= 2.5860 \times 10^5 \text{ kg} - 3.56 \times 10^4 \text{ kg}$$

$$= 25.860 \times 10^4 \text{ kg} - 3.56 \times 10^4 \text{ kg}$$

$$= (25.860 - 3.56) \times 10^4$$

$$= 22.30 \times 10^4 \text{ kg} = 2.23 \times 10^5 \text{ kg}$$

sec01-q0050-01.tex

Keyword: density



## Exam 1 Review: Scientific Method, Properties, Classification of Matter

1. Classify each statement as being either qualitative or quantitative.
  - A. This recitation worksheet took a good amount of time to complete
  - B. This recitation worksheet took 50 minutes to complete
  - C. The University of Georgia is a very large school

**A. qualitative; B. quantitative; C. qualitative**

sec01-q0038-01.tex

Keyword: classifying data

2. Identify the incorrect statement.
  - A. Helium in a balloon is an element
  - B. Paint is a mixture
  - C. Tap water is a compound
  - D. Mercury in a barometer is an element

**C. Tap water is not a compound as it is a mixture/solution that contains many other dissolved particles such as  $O_2(g)$ , Mg, Fe, Ca, etc. Pure water,  $H_2O(l)$ , would be a compound.**

sec01-q0004-01.tex

Keyword: classification of matter

3. Which answer includes all the following that are chemical changes and not physical changes?
  - I. freezing of water
  - II. rusting of iron
  - III. dropping a piece of iron into hydrochloric acid where  $H_2(g)$  is produced
  - IV. burning of a piece of wood
  - V. emission of light by a kerosene oil lamp
  - A. III and IV
  - B. II and V
  - C. I, II, III, IV, and V
  - D. II, III, and V
  - E. II, III, IV, and V

**E**

sec01-q0005-01.tex

Keyword: chemical changes; physical changes

4. Which answer includes all of the following properties of sulfur that are physical properties and not other properties?

- I. It reacts with hydrogen when heated
- II. It is a yellow solid at room temperature
- III. It is soluble in carbon disulfide
- IV. It has a density of  $2.97 \text{ g cm}^{-3}$
- V. It melts at  $112^\circ\text{C}$

- A. II, III, IV, and V
- B. II, IV, and V
- C. I
- D. II, III, and IV
- E. III, IV, and V

**A**

sec01-q0006-01.tex

Keyword:chemical properties; physical properties

5. Molecules can be described as

- A. mixtures of two or more pure substances
- B. mixtures of two or more elements that has a specific ratio between components
- C. two or more atoms chemically joined together
- D. heterogeneous mixtures
- E. homogeneous mixtures

**C**

sec01-q0009-01.tex

Keyword:classification of matter

6. Which statement best explains the difference between a law and a theory?

- A. A law is truth whereas a theory is mere speculation.
- B. A law summarizes a series of related observations, while a theory gives the underlying reasons for them.
- C. A theory describes what nature does; a law explains why nature does it.

**B. A law is the "what" and a theory is the "why".**

sec01-q0016-01.tex

Keyword:scientific method

7. Inks and food coloring are typically composed of many different dyes which can be separated by paper chromatography. Which of these terms apply to inks?
- A. substance
  - B. homogeneous mixture
  - C. compound
  - D. element
  - E. heterogeneous mixture

**B**

sec01-q0017-01.tex

Keyword:separation of mixtures

8. Which of these separations cannot be achieved using a physical process and, therefore, requires a chemical process?
- A. salt from sea water
  - B. water from honey
  - C. hydrogen from water
  - D. ice from water
  - E. fish from water

**C. H<sub>2</sub>O is a molecule and each hydrogen atom is chemically bonded to an oxygen atom. A, D, and E can be separated via filtration. B is separated via distillation.**

sec01-q0018-01.tex

Keyword:separation of mixtures

9. All of the following will lead to a heterogeneous mixture except (select all that apply)
- A. sugar and coffee
  - B. mud and water
  - C. salt and water
  - D. tea and no-pulp lemonade
  - E. vinegar and water

**A, C, D, E**

sec01-q0008-01.tex

Keyword:mixtures

10. All of these will lead to a homogeneous mixture except

- A. sugar and coffee
- B. mud and water
- C. salt and water
- D. tea and no-pulp lemonade
- E. vinegar and water

**B**

sec01-q0019-01.tex

Keyword:mixtures

11. How are gases different from solids and liquids?

- A. Gases can only be made up of atoms
- B. Particles in a gas attract each other more strongly than in solids and liquids
- C. Gases are compressible
- D. Only gases can take the shape of their container
- E. Gases are colorless

**C**

sec01-q0020-01.tex

Keyword:states of matter

12. A scientific law...

- A. is a statement that summarizes past observations and makes predictions.
- B. is subject to change via legal action.
- C. contains an explanation of observations.
- D. must have a mathematical formula.
- E. cannot be modified.

**A**

sec01-q0021-01.tex

Keyword:scientific method

13. All statements about scientific theories are true except

- A. they explain why nature behaves the way it does.
- B. they must have the ability to make predictions on future behavior.
- C. they should use observations to test the theory.
- D. they are derived from hypothesis.
- E. they are speculation.

**E**

sec01-q0022-01.tex

Keyword:scientific method

14. Which of these represents a hypothesis?
- A. Sodium reacts with water to form sodium hydroxide and hydrogen gas.
  - B. Nitrogen gas is a fairly inert substance.
  - C. Nickel has a silvery sheen.
  - D. When a substance combusts, it combines with air.
  - E. When wood burns, heat is given off.

**D** is a hypothesis because it is a tentative explanation that is testable and falsifiable.

**A** is an observed chemical reaction and a statement of fact. **B** is a general property of nitrogen and a descriptive statement. **C** is a physical property of nickel and a statement of observation. **E** is a description of an observed phenomenon and not a testable explanation.

sec01-q0023-01.tex

Keyword:scientific method

15. Which of the following is a homogeneous mixture?
- A. wine
  - B. mud
  - C. salad
  - D. salsa

**A**

sec01-q0024-01.tex

Keyword:mixtures

16. Which of the following is an element?
- A. sodium chloride
  - B. water
  - C. carbon monoxide
  - D. argon
  - E. rust

**D**

sec01-q0025-01.tex

Keyword:elements

17. Which of the following is a heterogeneous mixture?
- A. sports drink
  - B. chlorine gas
  - C. black coffee
  - D. bowl of cereal
  - E. carbon (graphite)

**D**

sec01-q0026-01.tex

Keyword:mixtures

18. Which of the following is not an example of a homogeneous mixture?

- A. air
- B. rain
- C. steel
- D. blood
- E. coffee

**D**

sec01-q0037-01.tex

Keyword:mixtures

19. Which of the following would you expect to have the highest density?

- A. oxygen
- B. lead
- C. water
- D. helium

**B. Oxygen and helium are gasses and water is a liquid at room temperature. States of matter with less order are more likely to be less dense (although not always).**

sec01-q0051-01.tex

Keyword:density



## Exam 1 Review: Atoms and Atomic Theory

1. Complete the empty cells.

Symbol	# of p	# of n	# of e <sup>-</sup>	Z	A
<sup>51</sup> V		18	18		34

Symbol	# of p	# of n	# of e <sup>-</sup>	Z	A
<sup>51</sup> V	23	28	23	23	51
<sup>34</sup> S <sup>2-</sup>	16	18	18	16	34

sec02-q0001-01.tex

Keyword:atomic structure

2. Which of the statements about two isotopes is false?

- A. They will have the same charge on the nucleus.
- B. They will have different numbers of neutrons.
- C. They will have essentially the same chemical reactivity.
- D. They will have the same atomic numbers.
- E. They will have the same atomic weights.

**E**

sec02-q0002-01.tex

Keyword:isotopes

3. An unused flashbulb contains magnesium and oxygen. After use, the contents are changed to magnesium oxide but the total mass does not change. This observation can best be explained by the...

- A. Law of Constant Composition
- B. Law of Multiple Proportions
- C. Avogadro's Law
- D. Law of Conservation of Mass

**D**

sec02-q0003-01.tex

Keyword:laws

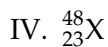
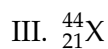
4. What is the mass number for  $^{25}\text{Mg}$ ?

25

sec02-q0005-01.tex

Keyword: isotopes

5. Which of the following represents isotopes?



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

B

sec02-q0006-01.tex

Keyword: isotopes

6. Complete the empty cells.

Symbol	# of p	# of n	# of e <sup>-</sup>	Z	A
$^{93}\text{Nb}$					
	88		86		226
		76	52		128

Symbol	# of p	# of n	# of e <sup>-</sup>	Z	A
$^{93}\text{Nb}$	41	52	41	41	93
$^{226}\text{Ra}^{2+}$	88	138	86	88	226
$^{128}\text{Te}$	52	76	52	52	128

sec02-q0001-02.tex

Keyword: atomic structure

7. Write the group number for each of the following elements.

- A. Ba
- B. Sb
- C. Zr
- D. Tl
- E. Rn

**A. group 2 (or 2A); B. group 15 (or 5A); C. group 4 (or 4B); D. group 13 (or 3A); E. group 18 (or 8A)**

sec02-q0007-01.tex

Keyword:elements; periodic table

8. Write the period number for each of the following elements.

- A. Hf
- B. Am
- C. Ga
- D. Si
- E. He

**A. 6; B. 7; C. 4; D. 3; E. 1**

sec02-q0008-01.tex

Keyword:elements; periodic table

9. Which of the following elements is a metal?

- A. Ge
- B. Sb
- C. H
- D. Sn
- E. Cl

**D**

sec02-q0009-01.tex

Keyword:elements; periodic table

10. Which of the following elements is a nonmetal?

- A. Ca
- B. Si
- C. Mo
- D. Cs
- E. Se

**E**

sec02-q0010-01.tex

Keyword:elements; periodic table

11. What quantity did J. J. Thompson determine using a cathode ray tube?
- A. the mass of an electron
  - B. the charge-to-mass ratio of an electron
  - C. the density of a proton
  - D. the charge of a neutron
  - E. the charge-to-mass ratio of a proton

**B**

sec02-q0011-01.tex

Keyword:famous experiments

12. Which of the following is found in the nucleus?
- A. cations
  - B. neutrons
  - C. electrons
  - D. anions
  - E. none of these

**B**

sec02-q0012-01.tex

Keyword:atomic structure

13. Which of these is not found in an atom?
- A. electron
  - B. neutron
  - C. photon
  - D. proton
  - E. all of them are

**C**

sec02-q0013-01.tex

Keyword:atomic structure

14. True or False: an atom consists mostly of empty space.
- A. true
  - B. false, an atom consists primarily of electrons
  - C. false, an atom consists primarily of the nucleus
  - D. false, an atom consists primarily of neutrons
  - E. false, an atom consists primarily of protons

**A**

sec02-q0014-01.tex

Keyword:atomic structure

15. Which of the following contribute to the mass of an atom? (select all that apply)

- A. protons
- B. neutrons
- C. electrons
- D. electrons
- E. the nucleus
- F. atomic charge

**A and B**

sec02-q0015-01.tex

Keyword:atomic structure

16. What is the atomic mass (in amu) of a magnesium ion containing 12 protons, 13 neutrons, and 10 electrons?

**25 amu**

sec02-q0019-01.tex

Keyword:isotopes

17. An element consists of four naturally occurring isotopes. The percent abundance and isotope masses are given as:

- (a) 1.40 %; 203.973 u
- (b) 24.10 %; 205.9754 u
- (c) 22.10 %; 206.9759 u
- (d) 52.40 %; 207.9766 u

Find the standard atomic weight (in u) of the element.

**A: 207.2 u**

$$A_r^\circ(E) = \left(\frac{x(X_1)\%}{100\%}\right) [A_r(X_1)] + \left(\frac{x(X_2)\%}{100\%}\right) [A_r(X_2)] + \left(\frac{x(X_3)\%}{100\%}\right) [A_r(X_3)] + \left(\frac{x(X_4)\%}{100\%}\right) [A_r(X_4)]$$

$$\begin{aligned} A_r^\circ(B) &= \left(\frac{1.40\%}{100\%}\right) (203.973 \text{ u}) + \left(\frac{24.10\%}{100\%}\right) (205.9754 \text{ u}) + \left(\frac{22.10\%}{100\%}\right) (206.9759 \text{ u}) + \left(\frac{52.40\%}{100\%}\right) (207.9766 \text{ u}) \\ &= 207.21 \text{ u} \\ &= 207 \text{ u} \end{aligned}$$

sec02-q0058-01.tex

Keyword:percent abundance; isotopes

18. The element rhenium (Re) has a standard atomic weight of 186.207 and exists as two naturally occurring isotopes. Given the following percent abundance and isotope mass

- $^{185}\text{Re}$
- $^{187}\text{Re}$ : 62.60 %; 186.956

find the relative atomic weight of rhenium-185.

A: 185

$$\begin{aligned}
 A_r^\circ(\text{Re}) &= x(^{185}\text{Re}) A_r(^{185}\text{Re}) + x(^{187}\text{Re}) A_r(^{187}\text{Re}) \longrightarrow \\
 A_r(^{185}\text{Re}) &= \frac{A_r^\circ(\text{Re}) - \left[ x(^{187}\text{Re}) A_r(^{187}\text{Re}) \right]}{x(^{185}\text{Re})} \\
 &= \frac{186.207 - \left[ \left( \frac{62.60\%}{100\%} \right) (186.956) \right]}{\frac{(100\% - 62.60\%)}{100\%}} \\
 &= 184.953 \\
 &= 185
 \end{aligned}$$

sec02-q0059-01.tex

Keyword: percent abundance; isotopes

## Exam 1 Review: Ions, Ionic Compounds, Molecules, and Nomenclature

1. What is the correct charge of a sulfur atom with 16 protons, 16 neutrons, and 18 electrons?

2-

sec02-q0016-01.tex

Keyword: ions

2. What charge will most likely be formed by lithium?

1+

sec02-q0017-01.tex

Keyword: ions

3. Is iodine more likely to gain or lose an electron?

Gain an electron (to increase its stability)

sec02-q0018-01.tex

Keyword: ions

4. Fill out the missing information regarding a binary ionic compound.

A. Name: sodium chloride

B. Cation:

C. Anion:

D. Formula:

A. Name: sodium chloride

B. Cation:  $\text{Na}^+$

C. Anion:  $\text{Cl}^-$

D. Formula:  $\text{NaCl}$

sec02-q0021-01.tex

Keyword: ionic compounds

5. Fill out the missing information regarding a binary ionic compound.

- A. Name:
- B. Cation:  $\text{Mg}^{2+}$
- C. Anion:  $\text{O}^{2-}$
- D. Formula:

- A. Name: magnesium oxide
- B. Cation:  $\text{Mg}^{2+}$
- C. Anion:  $\text{O}^{2-}$
- D. Formula:  $\text{MgO}$

sec02-q0021-02.tex

Keyword: ionic compounds

6. Fill out the missing information regarding a binary ionic compound.

- A. Name:
- B. Cation:
- C. Anion:
- D. Formula:  $\text{Al}_2\text{S}_3$

- A. Name: aluminum sulfide
- B. Cation:  $\text{Al}^{3+}$
- C. Anion:  $\text{S}^{2-}$
- D. Formula:  $\text{Al}_2\text{S}_3$

sec02-q0021-03.tex

Keyword: ionic compounds

7. Fill out the missing information regarding a binary ionic compound.

- A. Name: iron(III) oxide
- B. Cation:
- C. Anion:
- D. Formula:

- A. Name: iron(III) oxide
- B. Cation:  $\text{Fe}^{3+}$
- C. Anion:  $\text{O}^{2-}$
- D. Formula:  $\text{Fe}_2\text{O}_3$

sec02-q0021-04.tex

Keyword: ionic compounds



8. Fill out the missing information regarding a binary ionic compound.

- A. Name:
- B. Cation:  $\text{Sn}^{2+}$
- C. Anion:  $\text{Cl}^-$
- D. Formula:

- A. Name: tin(II) chloride
- B. Cation:  $\text{Sn}^{2+}$
- C. Anion:  $\text{Cl}^-$
- D. Formula:  $\text{SnCl}_2$

sec02-q0021-05.tex

Keyword: ionic compounds

9. Fill out the missing information regarding a binary ionic compound.

- A. Name:
- B. Cation:
- C. Anion:
- D. Formula:  $\text{PbF}_4$

- A. Name: lead(IV) fluoride
- B. Cation:  $\text{Pb}^{4+}$
- C. Anion:  $\text{F}^-$
- D. Formula:  $\text{PbF}_4$

sec02-q0021-06.tex

Keyword: ionic compounds

10. Fill out the missing information regarding a binary ionic compound.

- A. Name: sodium hydroxide
- B. Cation:
- C. Anion:
- D. Formula:

- A. Name: sodium hydroxide
- B. Cation:  $\text{Na}^+$
- C. Anion:  $\text{OH}^-$
- D. Formula:  $\text{NaOH}$

sec02-q0021-07.tex

Keyword: ionic compounds

11. Fill out the missing information regarding a binary ionic compound.

A. Name:

B. Cation:  $\text{Mg}^{2+}$

C. Anion:  $\text{CO}_3^{2-}$

D. Formula:

A. Name: magnesium carbonate

B. Cation:  $\text{Mg}^{2+}$

C. Anion:  $\text{CO}_3^{2-}$

D. Formula:  $\text{MgCO}_3$

sec02-q0021-08.tex

Keyword: ionic compounds

12. Fill out the missing information regarding a binary ionic compound.

A. Name:

B. Cation:

C. Anion:

D. Formula:  $\text{Na}_2\text{SO}_3$

A. Name: sodium sulfite

B. Cation:  $\text{Na}^+$

C. Anion:  $\text{SO}_3^{2-}$

D. Formula:  $\text{Na}_2\text{SO}_3$

sec02-q0021-09.tex

Keyword: ionic compounds

13. Fill out the missing information regarding a binary ionic compound.

A. Name:

B. Cation:  $\text{Fe}^{2+}$

C. Anion:  $\text{OH}^-$

D. Formula:

A. Name: iron(II) hydroxide

B. Cation:  $\text{Fe}^{2+}$

C. Anion:  $\text{OH}^-$

D. Formula:  $\text{Fe}(\text{OH})_2$

sec02-q0021-10.tex

Keyword: ionic compounds

14. Fill out the missing information regarding a binary ionic compound.

- A. Name:
- B. Cation:
- C. Anion:
- D. Formula:  $\text{TiPO}_3$

- A. Name: titanium(III) phosphite
- B. Cation:  $\text{Ti}^{3+}$
- C. Anion:  $\text{PO}_3^{3-}$
- D. Formula:  $\text{TiPO}_3$

sec02-q0021-11.tex

Keyword: ionic compounds

15. Provide the names for the following compounds.

- A.  $\text{N}_2\text{O}$
- B.  $\text{P}_2\text{O}_5$
- C.  $\text{SF}_2$
- D.  $\text{S}_2\text{O}$
- E.  $\text{P}_2\text{I}_4$

- A. dinitrogen monoxide
- B. diphosphorous pentoxide
- C. sulfur difluoride
- D. disulfur monoxide
- E. diphosphorous tetraiodide

sec02-q0022-01.tex

Keyword: ionic compounds

16. What is the proper chemical formula for lithium hypoiodite?

- A.  $\text{LiIO}$
- B.  $\text{LiO}_2$
- C.  $\text{LiIO}_3$
- D.  $\text{LiIO}_4$

A

sec02-q0023-01.tex

Keyword: ionic compounds; nomenclature

17. Write the chemical formula for a compound formed between aluminum and sulfur.

$\text{Al}_2\text{S}_3$

sec02-q0024-01.tex

Keyword: ionic compounds

18. In which set do all elements tend to form cations in binary ionic compounds?

- A. Na, Al, S
- B. Ca, Mn, Sn
- C. P, As, Sb
- D. S, Cl, Br

**B**

sec02-q0025-01.tex

Keyword: ions

19. Which of the following contains both ionic and covalent bonds?

- A.  $\text{CaBr}_2$
- B. COS
- C.  $\text{BaSO}_4$
- D.  $\text{SF}_6$
- E. none of these

**C**

sec02-q0026-01.tex

Keyword: ionic compounds

20. What is the name of the  $\text{C}_3\text{H}_8$ ?

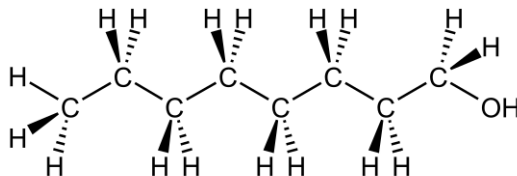
- A. hexane
- B. propane
- C. decane
- D. butane
- E. ethane

**B**

sec02-q0027-01.tex

Keyword: nomenclature; organic molecule

21. What is the name of this compound?



**octanol**

sec02-q0037-01.tex

Keyword: organic nomenclature; nomenclature

22. What is the name of  $\text{H}_3\text{P}$ ?

phosphine

sec02-q0038-01.tex

Keyword:nomenclature

23. What is the chemical formula for magnesium carbide?

$\text{Mg}_2\text{C}_3$

sec02-q0039-01.tex

Keyword:nomenclature

24. Write the empirical formulas for the following compounds.

- A. iron(II) sulfide
- B. iron(III) sulfide
- C. iron(II) sulfate
- D. iron(III) sulfate
- E. iron(II) sulfite

- A.  $\text{FeS}$
- B.  $\text{Fe}_2\text{S}_3$
- C.  $\text{FeSO}_4$
- D.  $\text{Fe}_2(\text{SO}_4)_3$
- E.  $\text{FeSO}_3$

sec02-q0046-01.tex

Keyword:nomenclature; ions

25. Provide the name for each of the following and identify it as a molecular or ionic compound

Formula	Name	Compound Type
$C_6H_{12}O_2$		
$Al_4C_3$		
$Ca_3P_2$		
$KC_2H_3O_2$		
$NaHCO_3$		
$FeCl_3$		

Formula	Name	Compound Type
$C_6H_{12}O_2$	hexanoic acid	molecular
$Al_4C_3$	aluminum carbide	ionic
$Ca_3P_2$	calcium phosphide	ionic
$KC_2H_3O_2$	potassium acetate	ionic
$NaHCO_3$	sodium hydrogen carbonate	ionic
$FeCl_3$	iron(III) chloride	ionic

sec02-q0049-01.tex

Keyword:nomenclature

26. Provide the name for each of the following and identify it as a molecular or ionic compound

Formula	Name	Compound Type
HNO <sub>2</sub> (aq)		
Hg <sub>2</sub> O		
CuSe		
Cl <sub>2</sub> O <sub>7</sub>		
H <sub>2</sub> O <sub>2</sub>		
Be(NO <sub>3</sub> ) <sub>2</sub> ·4H <sub>2</sub> O		

Formula	Name	Compound Type
HNO <sub>2</sub> (aq)	nitrous acid	molecular
Hg <sub>2</sub> O	mercury(I) oxide	ionic
CuSe	copper(II) selenide	ionic
Cl <sub>2</sub> O <sub>7</sub>	dichlorine heptaoxide	molecular
H <sub>2</sub> O <sub>2</sub>	hydrogen peroxide (dihydrogen dioxide)	molecular
Be(NO <sub>3</sub> ) <sub>2</sub> ·4H <sub>2</sub> O	beryllium nitrate tetrahydrate	ionic

sec02-q0050-01.tex

Keyword:nomenclature

27. Provide the name for each of the following and identify it as an alkane, alcohol, or carboxylic acid.

Formula	Name	Compound Type
$C_7H_{15}OH$		
$C_9H_{19}COOH$		
$C_4H_{10}$		
$C_6H_{14}$		
$C_4H_9COOH$		
$C_8H_{17}OH$		

Formula	Name	Compound Type
$C_7H_{15}OH$	heptanol	alcohol
$C_9H_{19}COOH$	decanoic acid	carboxylic acid
$C_4H_{10}$	butane	alkane
$C_6H_{14}$	hexane	alkane
$C_4H_9COOH$	pentanoic acid	carboxylic acid
$C_8H_{17}OH$	octanol	alcohol

sec02-q0051-01.tex

Keyword:nomenclature; organic nomenclature



28. Provide the chemical formulas and identify each as molecular or ionic compound. Include phase labels where necessary.

Name	Formula	Compound Type
sulfurous acid		
iron(II) bromide		
manganese(IV) thiocyanate		
cadmium phosphite		
dihydrogen monosulfide		
potassium permanganate		

Name	Formula	Compound Type
sulfurous acid	$\text{H}_2\text{SO}_3(\text{aq})$	molecular
iron(II) bromide	$\text{FeBr}_2$	ionic
manganese(IV) thiocyanate	$\text{Mn}(\text{SCN})_4$	ionic
cadmium phosphite	$\text{Cd}_3(\text{PO}_3)_2$	ionic
dihydrogen monosulfide	$\text{H}_2\text{S}$	molecular
potassium permanganate	$\text{KMnO}_4$	ionic

sec02-q0052-01.tex

Keyword:nomenclature

29. Provide the chemical formulas and identify each as molecular or ionic compound. Include phase labels where necessary.

Name	Formula	Compound Type
iron(II) oxalate		
sodium chromate		
beryllium dichromate		
perchloric acid		
nitric acid		
sodium carbonate decahydrate		

Name	Formula	Compound Type
iron(II) oxalate	$\text{FeC}_2\text{O}_4$	ionic
sodium chromate	$\text{Na}_2\text{CrO}_4$	ionic
beryllium dichromate	$\text{BeCr}_2\text{O}_7$	ionic
perchloric acid	$\text{HClO}_4(\text{aq})$	molecular
nitric acid	$\text{HNO}_3(\text{aq})$	molecular
sodium carbonate decahydrate	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$	ionic/molecular

sec02-q0053-01.tex

Keyword:nomenclature

30. Which of the following names is most appropriate for the molecule  $\text{CH}_3(\text{CH}_2)_2\text{COOH}$ ?
- dimethylene-acetic acid
  - propanoic acid
  - butanoic acid
  - oxobutylalcohol

sec02-q0056-01.tex

Keyword:nomenclature; organic nomenclature

31. Name the following compounds.

- A.  $\text{Si}_2\text{Br}_2$
- B.  $\text{Na}_2\text{CO}_3$
- C.  $\text{HClO}_4$
- D.  $\text{Zn}(\text{CN})_2$
- E.  $\text{OH}^-$
- F.  $\text{Ca}^{2+}$

- A. disilicon hexabromide
- B. sodium carbonate
- C. perchloric acid
- D. zinc cyanide
- E. hydroxide ion
- F. calcium ion

sec02-q0057-01.tex

Keyword:nomenclature



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