

**Multiple Choice.** Circle the one alternative that best completes the statement or answers the question.

1. What is the first step in the Scientific Method? (2 pts.)

- (a) formulate a theory
- (b) formulate a hypothesis
- (c) test hypothesis
- (d) find trends or patterns
- \*(e) make observations or do experiments**

**SHORT ANSWER.** Write the word, phrase, or number with units that best completes each statement or answers the question.

2. Isotopes are atoms with the same number of **protons** but with different numbers of **neutrons**. (2 pts.)

3. How many protons and how many neutrons are in an atom of:  $^{118}\text{I}$  ? (2 pts.)

**53 protons, 65 neutrons**

4. What is the atomic number of platinum— 170 (1 pts.)

**78**

5. What is the complete element symbol for an atom that has 36 protons and 40 neutrons? (3 pts.)

**$^{76}_{36}\text{Kr}$**

6. What is the best answer for the following problem? (Follow Significant Figure Rules.) (2 pts.)

$$\frac{3.112}{273.15 + 26.1} = \frac{3.112}{299.25} = 0.01039933 = 0.01040$$

7. What is the best answer for the following problem? (2 pts.)

$$4.21 + 38.44 + 3278 = 3320.65 = 3321$$

8. Write the following numbers to 3 significant figures. (1 pt. each)

a) 7 **7.00**

b) 454,811 **455,000**

9. What is the best answer for the following problem? (2 pts.)

$$(4.184)(18.2)(29.1-25.1) = (4.184)(18.2)(4.0) = 304.5952 = 300$$

10. Give the correct chemical symbols for the following elements. (1 pt. each)

a) radium \_\_\_\_\_ **Ra** \_\_\_\_\_      b) arsenic \_\_\_\_\_ **As** \_\_\_\_\_

c) manganese \_\_\_\_\_ **Mn** \_\_\_\_\_      d) barium \_\_\_\_\_ **Ba** \_\_\_\_\_

11. Give the names of the elements that corresponds to the symbols below. (1 pt. each)

a) Ti \_\_\_\_\_ **titanium** \_\_\_\_\_      b) Au \_\_\_\_\_ **gold** \_\_\_\_\_

c) Xe \_\_\_\_\_ **xenon** \_\_\_\_\_      d) P \_\_\_\_\_ **phosphorus** \_\_\_\_\_

12. Classify the following elements as **metal, nonmetal, or metalloid**. (1 pt. each)

a) sodium \_\_\_\_\_ **metal** \_\_\_\_\_      b) sulfur \_\_\_\_\_ **nonmetal** \_\_\_\_\_

b) mercury \_\_\_\_\_ **metal** \_\_\_\_\_      d) germanium \_\_\_\_\_ **metalloid** \_\_\_\_\_

13. The name of the group of elements containing sodium and lithium is

\_\_\_\_\_ **alkali metals** \_\_\_\_\_. (1 pt.)

14. The name of the group of elements containing krypton and argon are called

\_\_\_\_\_ **noble gases** \_\_\_\_\_. (1 pt.)

15. How many significant figures do each of the following values below have? (1 pt. each)

a) 5,320 \_\_\_\_\_ **3** \_\_\_\_\_      b) 0.00780 \_\_\_\_\_ **3** \_\_\_\_\_

16. The group of elements containing cadmium, chromium, and platinum is called the

\_\_\_\_\_ **transition metals** \_\_\_\_\_. (1 pt.)

17. What is the definition of an extensive property? (2 pts.)

a property that does depend on the amount of substance, for example: mass or volume

18. What is the definition of a homogeneous mixture? (2 pts.)

a mixture = 2 or more elements or compounds "mixed" together

homogeneous mixture = a mixture that is uniform throughout

19. What ion does calcium form? (Give symbol and charge.) (2 pts.)

$\text{Ca}^{+2}$

20. What ion does sulfur form? (Give symbol and charge.) (2 pts.)

$\text{S}^{-2}$

**PROBLEMS. MUST show ALL work, units, and answers with correct significant figures.**

21. The density of copper is 8.96 g/mL at 20°C. What is the mass of 25.0 mL of copper at 20°C? Show work. (4 pts.)

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

$$\text{volume} * \text{density} = \frac{\text{mass} * \text{volume}}{\text{volume}}$$

$$\text{mass} = \text{volume} * \text{density} = 25.0 \text{ mL} \left( \frac{8.96 \text{ g}}{\text{mL}} \right) = 224 \text{ g}$$

22. The density of mercury is  $13.6 \text{ g/cm}^3$  at  $20^\circ\text{C}$ . What is the volume of  $21.3 \text{ g}$  of mercury? Show work. (4 pts.)

$$\text{density} = \frac{\text{mass}}{\text{volume}}, \quad \text{volume} * \text{density} = \frac{\text{mass} * \text{volume}}{\text{volume}}, \quad \text{volume} * \text{density} = \text{mass},$$

$$\frac{\text{volume} * \text{density}}{\text{density}} = \frac{\text{mass}}{\text{density}}, \quad \text{volume} = \frac{\text{mass}}{\text{density}} = 21.3 \text{ g} \left( \frac{\text{cm}^3}{13.6 \text{ g}} \right) = 1.57 \text{ cm}^3$$

23. Convert  $0.025 \text{ g}$  into  $\text{mg}$ . Show work. (3 pts.)

$$0.025 \text{ g} \left( \frac{1000 \text{ mg}}{1 \text{ g}} \right) = 25 \text{ mg}$$

24. Convert  $38.2 \text{ cm}$  into decimeters. Show work. (4 pts.)

$$38.2 \text{ cm} \left( \frac{1 \text{ m}}{100 \text{ cm}} \right) \left( \frac{1 \text{ dm}}{0.1 \text{ m}} \right) = 3.82 \text{ dm}$$

25. Convert  $25.1 \mu\text{m}$  into  $\text{nm}$ . Show work. (4 pts.)

$$25.1 \mu\text{m} \left( \frac{1 \times 10^{-6} \text{ m}}{1 \mu\text{m}} \right) \left( \frac{1 \text{ nm}}{1 \times 10^{-9} \text{ m}} \right) = 25,100 \text{ nm}$$

26. What is  $35^\circ\text{C}$  in Kelvin? Show work. (2 pts.)

$$35^\circ\text{C} + 273.15 = 308.15 = 308 \text{ K}$$

27. What is  $-11.4\text{ }^{\circ}\text{C}$  in degrees Fahrenheit? Show work. (3 pts.)

$$\frac{9}{5}(-11.4\text{ }^{\circ}\text{C}) + 32 = 11.48 = 11.5\text{ }^{\circ}\text{F}$$

28. Convert 5.61 feet into centimeters. Use only exact conversion factors. Show work. (3 pts.)

$$5.61\text{ ft} \left( \frac{12\text{ in.}}{1\text{ ft.}} \right) \left( \frac{2.54\text{ cm}}{1\text{ in.}} \right) = 171\text{ cm}$$

29. The density of lead is  $11.3\text{ g/mL}$ . What is this density in pounds/liter? ( $1\text{ kg} = 2.20\text{ pounds}$ ) (5 pts.)

$$\frac{11.3\text{ g}}{\text{mL}} \left( \frac{1000\text{ mL}}{1\text{ L}} \right) \left( \frac{1\text{ kg}}{1000\text{ g}} \right) \left( \frac{2.20\text{ lbs.}}{1\text{ kg}} \right) = \frac{24.9\text{ lbs.}}{\text{L}}$$

30. How many moles of nickel atoms are in  $7.38 \times 10^{24}$  nickel atoms? Show work. (3 pts.)

$$7.38 \times 10^{24}\text{ Ni atoms} \left( \frac{1\text{ mole Ni}}{6.022 \times 10^{23}\text{ atoms}} \right) = 12.3\text{ moles Ni}$$

31. The volume of a large fish tank is measured to be 2.82 cubic feet. What is the volume of the fish tank in gallons? Show work. (1 gallon = 3.7854 L) (6 pts.)

$$2.82 \text{ ft.}^3 \left( \frac{12 \text{ in.}}{1 \text{ ft.}} \right) \left( \frac{12 \text{ in.}}{1 \text{ ft.}} \right) \left( \frac{12 \text{ in.}}{1 \text{ ft.}} \right) \left( \frac{2.54^3 \text{ cm}^3}{1^3 \text{ in.}^3} \right) \left( \frac{1 \text{ mL}}{1 \text{ cm}^3} \right) \left( \frac{1 \text{ L}}{1000 \text{ mL}} \right) \left( \frac{1 \text{ gallon}}{3.7854 \text{ L}} \right) = 21.1 \text{ gallons}$$

For the first conversion, I wrote it all out and the second conversion I used the shortcut.

32. How many grams of potassium are in 4.31 moles of potassium? (3 pts.)

$$4.31 \text{ mole K} \left( \frac{39.0983 \text{ g}}{1 \text{ mole K}} \right) = 169 \text{ g of potassium}$$

33. How many moles of zinc are in 48.3 grams of zinc? Show work. (3 pts.)

$$48.3 \text{ g Zn} \left( \frac{1 \text{ mole Zn}}{65.39 \text{ g}} \right) = 0.739 \text{ mole Zn}$$

34. Silver consists of two isotopes:  $^{107}\text{Ag}$  (51.84%) with an atomic mass of 106.9051 amu and  $^{109}\text{Ag}$  (48.16%) with an atomic mass of 108.9048 amu. What is the average atomic mass of silver? MUST show ALL work. Report answer to 4 significant figures. (4 pts.)

$$= (0.5184)(106.9051 \text{ amu}) + (0.4816)(108.9048 \text{ amu})$$

$$= 107.8681555$$

$$= 107.9 \text{ amu}$$

35. What is the mass of  $5.22 \times 10^{22}$  atoms of iron? Show work. (4 pts.)

$$5.22 \times 10^{22} \text{ Fe atoms} \left( \frac{1 \text{ mole Fe}}{6.022 \times 10^{23} \text{ atoms}} \right) \left( \frac{55.845 \text{ g}}{1 \text{ mole Fe}} \right) =$$

$$= 4.840765526$$

$$= 4.84 \text{ g Fe}$$