

## Chem 112 General Chemistry

## Exam 1

Fall 2022

## Multiple Choice

Identify the choice that best completes the statement or answers the question.

B

1. The correct IUPAC name for  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ .
- calcium nitrate hydrate
  - calcium(II) nitrate tetrahydrate
  - calcium dinitrate tetrahydrate
  - calcium dinitrate hydrate
  - calcium nitrate tetrahydrate

C

2. Which has the correct name-formula combination?
- Titanium(IV) phosphide -  $\text{Ti}_3\text{P}_4$
  - Nickel(II) oxide -  $\text{NiO}$
  - Manganese(II) sulfide -  $\text{MnS}$
  - Iron(II) nitride -  $\text{FeN}$
  - Copper(II) fluoride -  $\text{CuF}$

A

3. Which of the following is a chemical change?
- A diamond is heated in air to 800 °C, and forms CO and  $\text{CO}_2$
  - Light refracts through a brilliant-cut diamond
  - A small industrial diamond is used to cut glass.
  - An uncut diamond is chiseled out of its ore.
  - A diamond wheel is used to cut a gemstone

C

4. A temperature of 103°F or higher is considered a medical emergency. Patient A comes in with a temperature of 38°C. Patient B comes in with a temperature of 313 K. Is either patient having a medical emergency?
- Yes, both patients
  - No, neither patient
  - Yes, patient B only
  - Not enough information to determine
  - Yes, patient A only

A

5. Calculate the answer and report the correct number of significant figures, when dividing 1.030 g by 2.87 mL
- 0.359 g/mL
  - 0.3589 g/mL
  - 0.358 g/mL
  - 0.36 g/mL
  - 0.35 g/mL

D

6. A student is determining the density of an unknown metal with a mass of 32.56 g. The student partially fills a graduated cylinder with water and measures the volume of the water by itself as 14.78 mL. The student then adds the metal to the water and measures the new volume as 20.44 mL. What is the identity of the metal?
- Iron,  $d = 7.87 \text{ g/cm}^3$
  - Lead,  $d = 11.3 \text{ g/ml}$
  - Magnesium,  $d = 1.74 \text{ g/ml}$
  - Tin,  $d = 5.75 \text{ g/ml}$
  - Aluminium,  $d = 2.70 \text{ g/ml}$

E

7. How many protons (p) and electrons (e) are found in a  $\text{Se}^{2-}$  ion?
- $36\text{p}, 34\text{e}$  would be  $\text{Se}^{2+}$
  - $34\text{p}, 34\text{e}$  would be neutral
  - $32\text{p}, 34\text{e}$  would be  $\text{Ge}^{2-}$
  - $34\text{p}, 32\text{e}$  would be  $\text{Se}^{2+}$
  - $34\text{p}, 36\text{e}$  is actually  $\text{Se}^{2-}$
8. Classify the following compounds as ionic or covalent (molecular):  $\text{OF}_2$ ,  $\text{CuO}$ ,  $\text{SeO}_2$ .
- ionic, ionic, covalent
  - covalent, ionic, covalent
  - ionic, ionic, covalent
  - ionic, covalent, ionic
  - covalent, covalent, ionic

B

$\text{OF}_2$  has no metals  
 $\therefore$  covalent

$\text{SeO}_2$  also has  
no metals  
 $\therefore$  covalent

$\text{CuO}$  = Copper Oxide

Cu is a metal

O is a non-metal

$\therefore$  ionic

$4\text{H}_2\text{O} = 4$  hydiate

Ca = Calcium

$\text{NO}_3$  = nitrate  
 $\text{NO}_3^-$

$(\text{NO}_3)^2$  has 2-

Iron(II) nitride -  $\text{FeN}$   $\text{Fe}^{2+}\text{N}^{3-}$

Copper(II) fluoride -  $\text{CuF}$   $\text{Cu}^{2+}\text{F}^-$

$\text{Fe}_3\text{N}_2$

$\text{CuFe}_2$

chemical change  
optical  
mechanical  
mechanical  
mechanical

$$\begin{aligned} 313\text{K} - 273\text{K} &= 40^\circ\text{C} \\ 40^\circ\text{C} &= \frac{9}{5}(40) + 32 \\ 40^\circ\text{C} &= 54^\circ\text{F} \\ 38^\circ\text{C} &= \frac{9}{5}(38) + 32 \\ 38^\circ\text{C} &= 100.4^\circ\text{F} \end{aligned}$$

$$\begin{aligned} 1.030 \text{ g} &\div 2.87 \text{ mL} = 0.3588 \text{ g/mL} \\ 0.3588 \text{ g/mL} &\text{ has 3 sig figs} \\ \therefore 358 \text{ mg} &\text{ is in answer} \\ \text{A & C have 3 sig figs} &\rightarrow \text{rounding 0.3588 up to 0.3600} \end{aligned}$$

$$\begin{aligned} 32.56 \text{ g} &\div 5.66 \text{ mL} = 5.75 \text{ g/mL} \\ 5.75 \text{ g/mL} &- 14.78 \text{ mL} = 5.66 \text{ mL} \end{aligned}$$

$$\begin{aligned} 32.56 \text{ g} &\div 5.66 \text{ mL} = 5.75 \text{ g/mL} \\ 5.75 \text{ g/mL} &- 14.78 \text{ mL} = 5.66 \text{ mL} \\ \therefore 34 \text{ electrons} &\text{ in neutral} \\ + 2 \text{ electrons for charge} &\text{ } \\ 36 \text{ electrons in } \text{Se}^{2-} &\text{ } \end{aligned}$$

Group 2t  
- Group 1b 2-

9. Predict the chemical formula for the ionic compound formed by the elements Ba and S

  - a.  $\text{Ba}_2\text{S}$
  - b.  $\text{BaS}$
  - c.  $\text{Ba}_2\text{S}_3$
  - d.  $\text{Ba}_2\text{S}_2$
  - e.  $\text{BaS}_2$

- D 10. Which scientist is known for developing the Periodic Table of the Elements?

  - a. Ernest Rutherford
  - b. Albert Einstein
  - c. James Chadwick
  - d. Dmitri Mendeleev
  - e. J. J. Thomson

11. A chemist is trying to identify an unknown metal, and finds that  $25.0\text{ cm}^3$  of the substance has a mass of  $224.43\text{ g}$  at  $20^\circ\text{C}$ . Which of the following metals is it?

a. Silver, d = $10.5\text{ g/cm}^3$	d. Iron, d = $7.87\text{ g/cm}^3$	$\frac{224.43\text{ g}}{25.0\text{ cm}^3} = 8.9$
b. Copper, d = $8.98\text{ g/cm}^3$	e. Gold, d = $19.32\text{ g/cm}^3$	$8.9$
c. Aluminum, d = $2.70\text{ g/cm}^3$		

12. Which of the following elements would be chemically similar to oxygen ( $O$ ,  $Z = 8$ )? What is below  
in the Group 16  
Chalcogens

  - a. S,  $Z = 16$
  - b. As,  $Z = 33$
  - c. Ca,  $Z = 20$
  - d. Br,  $Z = 35$
  - e. Sc,  $Z = 21$

13. A race car has a maximum speed of 0.104 km/s. What is this speed in miles per hour?

  - a. 233 miles per hour
  - b. 388 miles per hour
  - c. 98.0 miles per hour
  - d. 602 miles per hour
  - e. 3.88 miles per hour

14. Which of the following numbers contains three significant figures?

  - a. 0.23 → 2 sig figs
  - b. 0.2303 → 4 sig figs
  - c. 0.00230 → 3 sig figs
  - d. 2.300 → 4 sig figs
  - e. 0.023 → 2 sig figs

15. Write the chemical formula for diarsenic trioxide  $\rightarrow$   $\text{As}_2\text{O}_3$

  - a.  $\text{As}_3\text{O}_2$
  - b.  $\text{As}_2\text{O}_3$
  - c.  $\text{AsO}_4$
  - d.  $\text{As}_2\text{S}_3$
  - e.  $\text{As}_2\text{O}_4$

16. Write the balanced equation for the reaction of solid potassium chlorate decomposing to form solid potassium chloride and oxygen gas.

O<sub>2</sub>(g)

O<sub>2</sub> gas → ClO<sub>3</sub><sup>-</sup>  
needs Bob

2(ClO<sub>3</sub><sup>-</sup>) → O<sub>2</sub> + 2KCl  
to balance

a.  $2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + \text{O}_6(\text{g})$

b.  $2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 6\text{O}(\text{g})$

c.  $2\text{KClO}_3(\text{s}) \rightarrow \text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$

d.  $2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$

e.  $\text{KClO}_3(\text{s}) \rightarrow \text{KCl}(\text{s}) + 3\text{O}(\text{g})$

17. The answer to the calculation below with the correct number of significant figures is

Addition goes to the fewest decimal places

Name: \_\_\_\_\_

$$\begin{array}{r} 197 \\ 79P^+ \quad - 79 \\ \hline 118n^0 \end{array}$$

79e ID: A  
(no charge)

B 18. An atom of the isotope  $^{197}\text{Au}$  contains how many protons (p), neutrons (n), and electrons (e)?

- a.  $79\text{p}, 197\text{n}, 79\text{e}$
- b.  $79\text{p}, 118\text{n}, 79\text{e}$
- c.  $197\text{p}, 118\text{n}, 79\text{e}$
- d.  $79\text{p}, 79\text{n}, 79\text{e}$  impossible
- e.  $197\text{p}, 197\text{n}, 197\text{e}$

$\hookrightarrow$  no element has  $> 118$  yet

E 19. Convert 32.1 in to centimeters. 1 in = 2.54 cm

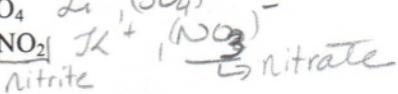
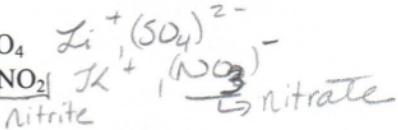
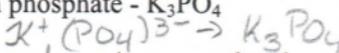
- a. 12.6 cm
- b. 0.815 cm
- c. 16.4 cm
- d. 1.95 cm
- e. 81.5 cm

$\hookrightarrow$  3 sig figs conversion by factors

$$32.1 \text{ in} \quad | \quad 2.54 \text{ cm} \\ \hline 1 \text{ in}$$

C 20. Which has the correct name-formula combination?

- a. Calcium phosphate -  $\text{Ca}_2(\text{PO}_4)_3$
- b. Barium sulfate -  $\text{Ba}(\text{SO}_4)_2$
- c. Potassium phosphate -  $\text{K}_3\text{PO}_4$
- d. Lithium sulfate -  $\text{LiSO}_4$
- e. Potassium nitrate -  $\text{KNO}_3$



nitrate

C 21. How many electrons are in a neutral carbon-14 atom?

- a. 8
- b. 4  $\rightarrow$  valence  $e^-$
- c. 6 Carbon is in group 4a or group 14
- d. 14
- e. 2

Carbon -14 is an isotope  $\therefore$   
the number of  $n^0$  is different,  
but  $p^+$  and  $e^-$  are the same

C 22. Which has the correct name-formula combination?

- a. Carbon tetraiodide -  $\text{CI}_4$
- b. Diphosphorus pentoxide -  $\text{P}_2\text{O}_5$
- c. Iodine heptafluoride -  $\text{IF}_7$
- d. Chlorine pentafluoride -  $\text{ClF}_5$
- e. Sulfur tetrafluoride -  $\text{SF}_4$

E 23. An unknown element X has the following isotopes:  $^{64}\text{X}$  (64.00 amu, 49.00% abundant),  $^{66}\text{X}$  (66.00 amu, 28.00% abundant),  $^{68}\text{X}$  (68.00 amu, 23.00% abundant). What is the average atomic mass in amu of X?

- a. 65.58 amu
- b. 65.5 amu
- c. 66.10 amu

$$\begin{array}{r} 64.00 \text{ amu} (0.49) \\ + 66.00 \text{ amu} (0.28) \\ + 68.00 \text{ amu} (0.23) \\ \hline 65.418 \text{ amu} \end{array}$$

A 24. Gasoline is composed of a variety of different liquid hydrocarbons, which do not separate as time passes.

Gasoline is an example of a:

homogeneous mixture = solution

- a. solution
- b. heterogeneous mixture
- c. element
- d. atom
- e. compound

B

25. Which of the following is the first step in the scientific method?

- a. analysis of results
- b. observation
- c. experimentation
- d. background research
- e. hypothesis formation

Science starts with  
Huh? That's interesting.  
or that's weird

A

26. What are the coefficients in front of the  $\text{H}_2$  and the Au if you balance the following unbalanced equation:



- a. 3, 2
- b. 1, 1
- c. 6, 2
- d. 6, 4
- e. 3, 6



$2 \text{Au}$

$3 \text{S}$

$6 \text{H}$

must  
equal

$2 \text{Au}$   
 $3 \text{S}$   
 $6 \text{H}$

$6 \text{H}$   $3 \text{S}$

B

27. Which will have a higher density: 1.00 g of pure gold or 1.00 kg of pure gold?
- There's no way to determine; it depends on the temperature of samples
  - Both will have the same density
  - There's no way to determine; it depends on the atmospheric pressure during measurements
  - 1.00 g of pure gold
  - 1.00 kg of pure gold

Density =  $\frac{\text{mass}}{\text{Volume}}$   
is intensive.  
Quantity independent

A

28. Which of the following is an intensive physical property of matter?

- density
  - reactivity
  - flammability
- $\begin{matrix} \text{d. volume} \\ \text{e. mass} \end{matrix}$
- extensive = mass dependent  
chemical properties

D

29. Which of the following quantities is equivalent to 3.7 cm?

- $3.7 \times 10^2 \text{ mm}$
  - $3.7 \times 10^5 \mu\text{m}$
  - $3.7 \times 10^{-2} \text{ mm}$
- $\begin{matrix} \text{d. } 3.7 \times 10^{-5} \text{ km} \\ \text{e. } 3.7 \times 10^{-3} \text{ m} \end{matrix}$
- $3.7 \text{ cm} \quad | \quad 3.7 \text{ km} \quad | \quad 0.37 \text{ cm}$   
 $| 10^3 \quad | \quad 1 \text{ km} \quad | \quad 1 \text{ m}$

B

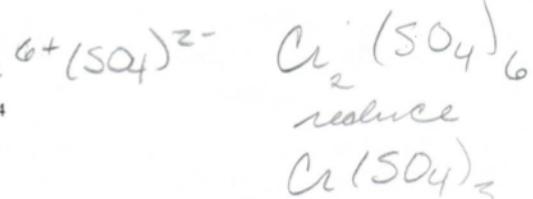
30. Glucose is an example of a(n) molecular covalent compound

- atom
  - compound
  - heterogeneous mixture
- $\begin{matrix} \text{d. element} \\ \text{e. homogeneous mixture} \end{matrix}$

B

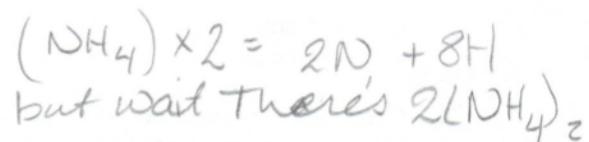
31. Write the chemical formula for chromium(VI) sulfate

- $\text{Cr}(\text{SO}_3)_3$
  - $\text{Cr}(\text{SO}_4)_3$
  - $\text{CrSO}_3$
- $\begin{matrix} \text{d. } \text{Cr}_6\text{SO}_4 \\ \text{e. } \text{CrSO}_4 \end{matrix}$

A

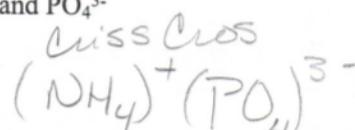
32. How many H atoms are in two formula unit of  $(\text{NH}_4)_2\text{SO}_4$ ?

- 16
  - 32
  - 4
- $\begin{matrix} \text{d. } 2 \\ \text{e. } 8 \end{matrix}$

D

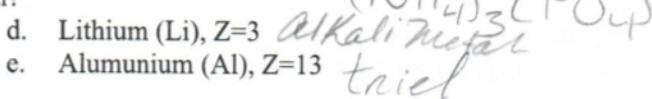
33. Predict the chemical formula for the ionic compound formed by  $\text{NH}_4^+$  and  $\text{PO}_4^{3-}$

- $\text{NH}_4\text{PO}_4$
  - $\text{NH}_{4,3}\text{PO}_4$
  - $\text{NH}_4(\text{PO}_4)_3$
- $\begin{matrix} \text{d. } (\text{NH}_4)_3\text{PO}_4 \\ \text{e. } (\text{NH}_4^+)_3\text{PO}_4^{3-} \end{matrix}$

C

34. Which element is classified as a transition metal?

- Xenon (Xe), Z=54
- Tellurium (Te), Z=52
- Zirconium (Zr), Z=40



Noble gas  
Chalcogen  
Transition metal  
in d-Block