

DIAGNOSTIC TEST IN GENERAL CHEMISTRY I
SY 2022-2023

Instructions: Read each question carefully and shade the correct answer in the answer sheet provided to you. Do not write anything on this test questionnaire.

1. Which of the following properties can be classified as an intensive property of matter?
A. Color
B. Mass
C. Volume
D. Weight
2. How could you separate a mixture of sand and iron fillings?
A. Decantation
B. Distillation
C. Evaporation
D. Magnetism
3. Table salt is a compound with the chemical name, Sodium Chloride. What is its chemical formula?
A. CaCO_3
B. $\text{Mg}(\text{OH})_2$
C. NaBr
D. NaCl
4. Illustrate the formula for the compound that forms between the element sodium and bromine.
A. NaBr
B. NaBr_2
C. Na_2Br
D. SBr_2
5. Which of the following household cleaning materials should not be mixed with an acid to avoid the release of toxic chlorine gas?
A. Commercial soap
B. Sodium hydroxide
C. Hydrogen peroxide
D. Sodium hypochlorite

6. Which of the following can be separated using this method as shown in figure 1?

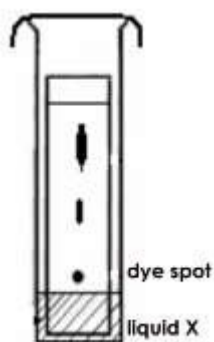


Figure 1. Thin Liquid Chromatography Sample

(Source: https://msfinneganssciencewebsite.weebly.com/uploads/1/4/1/3/14133966/separating_mixtures_exam_questions.pdf)

- A. Colors in black dyes
 - B. Mixture of salt and water
 - C. Mixture of Sand and iron fillings
 - D. Mixture of ethyl alcohol and water
7. An atom X contains 33 protons, 35 neutrons and 33 electrons. Which of the following is the correct isotopic symbol for this atom?
- A. $^{68}_{33}\text{X}$
 - B. $^{68}_{35}\text{X}$
 - C. $^{66}_{33}\text{X}$
 - D. $^{66}_{35}\text{X}$
8. Which of the following formulas represent the figure below?

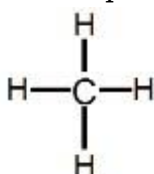


Figure 2. Chemical Structure of Methane

(Illustrated by: Myra Joy B. Montero)

- A. Empirical formula
- B. Molecular formula
- C. Structural formula
- D. Condensed formula

9. Examine what compound the figure below represents.

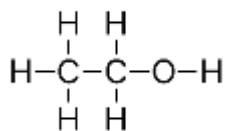


Figure 3. Chemical Structure of an alcohol

(Illustrated by: Myra Joy B. Montero)

- A. **Ethanol**
B. Butanol
C. Propanol
D. Methanol
10. A science student read $(\text{NH}_4)_2\text{SO}_4$ in a bottle. What is the name of this compound?
A. **Ammonium sulfate**
B. Ammonium disulfate
C. Diammonium sulfate
D. Diammonium disulfate
11. Which of the following is the correct formula for the ionic compound containing Fe^{3+} and SO_4^{2-} ?
A. FeSO_4
B. Fe_2SO_4
C. **$\text{Fe}_2(\text{SO}_4)_3$**
D. $\text{Fe}_3(\text{SO}_4)_2$
12. A 0.500 g sample of a compound containing only antimony and oxygen was found to contain 0.418 g of antimony and 0.082 g of oxygen. What is the simplest formula for the compound?
A. SbO
B. SbO_2
C. Sb_3O_4
D. **Sb_2O_3**
13. A compound contains, by mass, 40.0% carbon, 6.71% hydrogen, and 53.3% oxygen. A 0.320 mole sample of this compound weighs 28.8 g. Calculate the molecular formula of this compound.
A. CH_2O
B. $\text{C}_2\text{H}_4\text{O}$
C. $\text{C}_2\text{H}_4\text{O}_2$
D. **$\text{C}_3\text{H}_6\text{O}_3$**

14. Epinephrine (adrenaline) is a hormone secreted into the bloodstream in times of stress. It contains 59.0% C, 7.15% H, 26.20% O, and 7.65% N and has a molar mass of 183 g/mol. Calculate the molecular formula using the given components previously mentioned.
- CH_2NO
 - $\text{C}_2\text{H}_4\text{NO}$
 - $\text{C}_8\text{H}_6\text{NO}_2$
 - $\text{C}_9\text{H}_{13}\text{NO}_3$
15. Diagram I in Figure 1 represents the reactant mixture for a chemical reaction. Compare diagrams II through IV, then find out the product mixture that is consistent with both diagram I and the concepts associated with a balanced chemical equation.

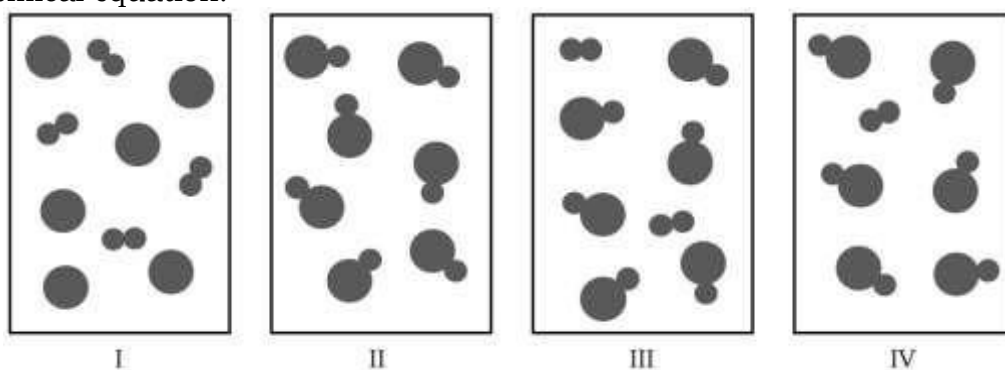


Figure 4. Reactant (I) and Product (II-IV) of a Chemical Reaction
(Illustrated by: Ryan Paul M. Vales)

- II only
 - III only
 - IV only**
 - III and IV
16. Evaluate the following chemical equations. Select the equation that is correctly written and follows the concepts associated with a balanced chemical equation.
- $4\text{NH}_3 + 5\text{O}_2 \longrightarrow 4\text{NO} + 6\text{H}_2\text{O}$
 - $4\text{Al} + 12\text{HCl} \longrightarrow 4\text{AlCl}_3 + 6\text{H}_2$
 - $2\text{Mg} + 2\text{HCl}_2 \longrightarrow 2\text{MgCl}_2 + \text{H}_2$
 - $3\text{Cu} + 3\text{Ag}(\text{NO}_3)_3 \longrightarrow 3\text{Cu}(\text{NO}_3)_3 + 3\text{Ag}$
17. Given the following chemical reaction, $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \longrightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$, how many moles of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, can be "burned" biologically when 15.0 mol of oxygen is available?
- 0.400 mol
 - 1.67 mol
 - 2.50 mol**
 - 90.0 mol

18. The table 1 below shows the production of companies manufacturing hydrogen gas out of the decomposition of hydrogen peroxide.

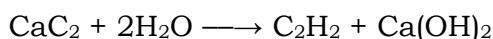
Table 1. Production of Hydrogen Gas (*hypothetical data only*)

Company	Amount of H ₂ O ₂ Used (g)	Amount of H ₂ Produced (g)
A	30	1.5
B	40	1.8
C	50	1.8
D	60	2.2

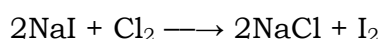
(Tabulated by: Ryan Paul M. Vales)

In terms of production, which company would be best for investment?

- A. **Company A**
 - B. Company B
 - C. Company C
 - D. Company D
19. A laboratory is manufacturing acetylene (C₂H₂) at 94.5% efficiency. At this rate, a lab aide reported that 338 g of C₂H₂ was produced from 358 g of H₂O and an excess of CaC₂. Is the lab aide telling the truth?



- A. Yes, the personnel reported truthfully.
 - B. No, at that efficiency, 489 g of C₂H₂ should have been produced.
 - C. **No, at that efficiency, only 244 g of C₂H₂ could have been produced.**
 - D. No, C₂H₂ cannot be produced since there is only one reactant given.
20. A personnel in a laboratory manufacturing iodine (I₂) predicted that 0.791 grams of molecular chlorine will be required to completely react with 0.0223 moles of sodium iodide according to the following chemical reaction,



Is the personnel's prediction correct?

- A. **Yes, the prediction is correct.**
 - B. No, 3.16 grams will be required to ensure complete reaction of the reactants.
 - C. No, only 0.112 grams will be required to ensure complete reaction of the reactants.
 - D. No, no matter how much chlorine will be added, the reaction won't be completed since NaI is the limiting reactant.
21. Pressure is equal to which of the following?
- A. A/F, where A is area and F is force
 - B. **F/A, where F is force and A is area**
 - C. d/F, where d is distance and F is force
 - D. F/d, where F is force and d is displacement

22. The following figure represents one mole of an ideal gas in a container fit with a movable piston.

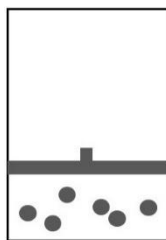
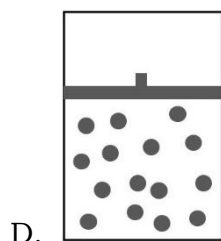
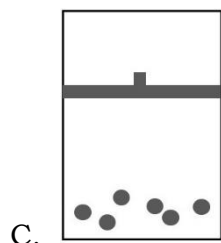
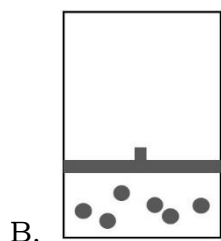
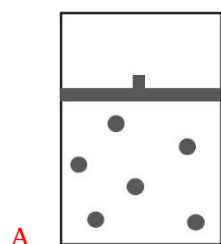


Figure 5. *One Mole of Ideal Gas in a Container with Movable Piston*
(Illustrated by: Ryan Paul M. Vales)

Which figure shows the change, if any, that would take place if the Kelvin temperature is doubled under constant pressure?



23. A laboratory assistant predicted that their laboratory would need at least a 45-liter container to hold 2.00 mol of oxygen gas at Standard Temperature and Pressure (STP). Is the laboratory assistant correct?
- A. Yes, using Avogadro's Law, 2.00 mol O₂ would occupy 45 liters at STP.
 - B. Yes, using the Ideal Gas Equation, 2.00 mol O₂ would occupy 45 liters at STP.
 - C. No, stoichiometric calculations would tell that at least 90-liter container must be prepared.
 - D. No, stoichiometric calculations would tell that a 5-liter container could already contain the said amount of gas.
24. A mixture of 0.50 mol H₂(g) and 0.50 mol N₂(g) is introduced into a 15.0-liter container having a pinhole leak at 30°C. Evaluate which of the following situations would be true after a period of time.
- A. The partial pressure of H₂ would exceed that of N₂ in the container.
 - B. The partial pressure of N₂ would exceed that of H₂ in the container.
 - C. The partial pressures of both gases would increase above their initial values.
 - D. The partial pressure of H₂ in the container would increase above the initial value.
25. Which of the following is an SI unit that can be used in stoichiometric calculations?
- A. Ω
 - B. mol
 - C. km
 - D. Hz
26. Evaluate the following statements to determine which of them is a **FALSE** assumption about the following chemical reaction.
- $$\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$$
- A. If 16.0 g of methane react with 64.0 g of oxygen, the combined masses of the products will be 80.0 g.
 - B. If 11.2 liters of methane react with an excess of oxygen, the volume of carbon dioxide produced at STP is 11.2 liters.
 - C. If 32.0 g of oxygen reacts with excess methane, the maximum amount of carbon dioxide produced will be 22.0 g.
 - D. If 22.4 liters of methane at STP react with 64.0 g of oxygen, 22.4 liters of carbon dioxide at STP can be produced.
27. Infer as to which gas will diffuse most rapidly.
- A. N₂
 - B. He
 - C. Cl₂
 - D. CO₂

28. Which principal energy level will contain electrons with the lowest energy?

- A. **First**
- B. Second
- C. Third
- D. Fourth

29. Evaluate the orbital diagrams below. Which element will likely exhibit magnetic moments?

Element A



Element B



Element C

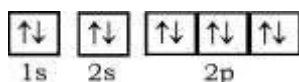


- A. Element A
- B. **Element B**
- C. Element A and C
- D. Element B and C

30. Which of the following is the correct orbital diagram for Nitrogen?

- A.
- B.
- C.
- D.

31. Study the orbital diagram below, which of the following statements concerning orbital diagrams is correct?



- I. There are six electrons in the outermost shell.
 - II. There are eight electrons in the outermost shell.
 - III. The orbital diagram implies that the element is diamagnetic.
 - IV. The orbital diagram implies that the element is paramagnetic.
- A. I and III
 - B. II and IV
 - C. I and IV
 - D. **II and III**

32. What will happen when an atom gains an electron?

- A. It will become a cation with a positive charge.
- B. It will become a cation with a negative charge.
- C. It will become an anion with a positive charge.
- D. **It will become an anion with a negative charge.**

33. Which of the following statements best explains why nitrogen has a higher ionization energy than oxygen?

- A. Ionization energy increases from right to left in a period.
- B. Ionization energy increases from left to right in a period.
- C. It has three electrons in each of the three *p* orbital making it more stable.
- D. It has 3 pairs of electrons in each of the three *p* orbital making it more stable.

34. Given their electron configurations, why do He, Ne and Ar do not form chemical bonds with other elements?

He - $1s^2$

Ne - $1s^2 2s^2 2p^6$

Ar - $1s^2 2s^2 2p^6 3s^2 3p^6$

- A. They have even numbers of electrons in their outermost shell.
- B. They are stable because their valence shell is completely filled.
- C. They are the last group in the periodic table that is why they are chemically inert.
- D. They are stable because they have eight valence electrons in their outermost shell.

35. Which type of chemical bonds involves equal sharing of electrons?

- A. Ionic bond
- B. Metallic bond
- C. Polar covalent bond
- D. Nonpolar covalent bond

36. Which of the following compounds has a Lewis structure which violates the octet rule?

- A. CCl_4
- B. ClF_3
- C. PCl_3
- D. SO_3

37. What is the O—C—O bond angle in CO_2 ?

- A. 90°
- B. 109.5°
- C. 120°
- D. 180°

38. What is the electron-group geometry of the compound shown below?

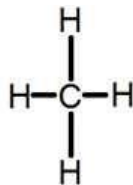






Figure 6. Chemical Structure of Methane
(Illustrated by: Pamela Lou C. Suazo)

- A. Bent
- B. Linear
- C. **Tetrahedral**
- D. Trigonal Planar

39. A polar covalent bond will form between which two atoms?

- A. beryllium and fluorine
- B. **hydrogen and chlorine**
- C. sodium and oxygen
- D. fluorine and fluorine

40. In which of the following bonds is the bond polarity **INCORRECT**?

- A. 
- B. 
- C. 
- D. 

41. In the homologous series below, what compound is next to pentane?
propane, butane, pentane, _____

- A. decane
- B. **hexane**
- C. methane
- D. octane

42. To what class of organic compound does the following substance belong?

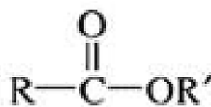


Figure 7. Chemical Structure of an Organic Compound
(Illustrated by: Cristobert C. Ayaton)

- A. **ester**
- B. ether
- C. ketone
- D. carboxylic acid

43. Which of the following statements about isomers is/are **TRUE**?

- I. Cyclohexane and methyl cyclopentane are isomers.
 - II. When compounds have the same molecular formula but different structures, they are called isomers.
 - III. A molecule has one carbon-carbon double bond. All isomers of this molecule must also have one carbon-carbon double bond.
- A. I only
B. II only
C. **I and II**
D. II and III

44. Which of the following is **NOT** a product of combustion of organic fuels?

- A. heat
B. water
C. **oxygen**
D. carbon dioxide

45. Predict the product of hydrogenation reaction of pent-2-ene.

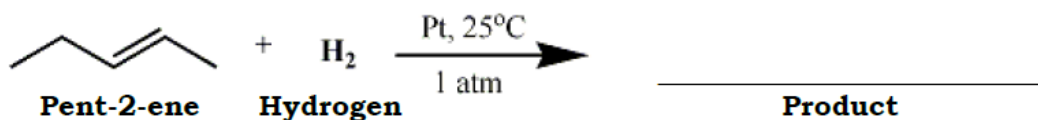

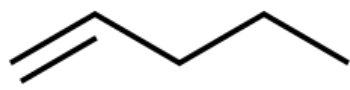
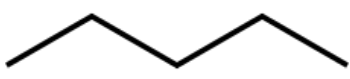
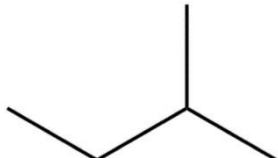


Figure 8. Hydrogenation reaction of pent-2-ene

(Source: <https://www.chegg.com/homework-help/fundamentals-of-general-organic-and-biological-chemistry-7thedition-chapter-13-problem-58ap-solution-9780321776143>)

-  A. Pent-2-yne (or 2-pentyne)
-  B. Pent-1-ene (or 1-pentene)
-  C. **Pentane**
-  D. 2-Methylpentane

46. It is a reaction in which polymers are synthesized.
- synthesis
 - polymerization**
 - decomposition
 - single displacement
47. A condensation polymer is formed when _____
- polymers are converted from gas to liquid.
 - successive monomers are repeatedly joined together.
 - monomers are joined together to make a high-density polymer.
 - monomers are combined to produce water or some other small molecule.**
48. Select the best current option for decreasing the amount of plastic waste in the environment.
- recycling**
 - incineration
 - automated sorting of the types of plastic
 - development of new environmentally friendly materials
49. Which of the following are best matched options?
- | I | II |
|-----------------------|--------------------------|
| (1) Starch | (W) Energy storage |
| (2) Collagen | (X) Transport protein |
| (3) Glycogen | (Y) Structural protein |
| (4) Hemoglobin | (Z) Essential fatty acid |
| (5) Omega-3 & Omega-6 | |
- 1-W, 3-X, 2-Z, 5-Y, 4-W
 - 1-W, 4-Z, 3-Y, 5-Z, 2-Y
 - 1-W, 5-Z, 2-Y, 4-X, 3-W**
 - 1-Z, 2, X, 3-W, 4-Z, 5-Y
50. Refer to the following statements to answer the following item.
- Assertion (A):** DNA and RNA molecules are found in the nucleus of the cell.
- Reason (R):** There are two types of nitrogenous bases, purines and pyrimidines. Adenine (A) and Guanine (G) are substituted purines; Cytosine (C), Thymine (T), and Uracil (U) are substituted pyrimidines.
- Choose the correct answer out of the following choices.
- Assertion (A) is a correct statement, but Reason (R) is a wrong statement.
 - Assertion (A) is a wrong statement, but Reason (R) is a correct statement.**
 - Assertion (A) and Reason (R) are both correct statements, and Reason (R) is a correct explanation for Assertion (A).
 - Assertion (A) and Reason (R) are both correct statements, but Reason (R) is not a correct explanation for Assertion (A).

**DIAGNOSTIC TEST IN GENERAL CHEMISTRY I
SY 2022-2023**

ANSWER KEY

1. A	11. C	21. B	31. D	41. B
2. D	12. D	22. A	32. D	42. A
3. D	13. D	23. B	33. C	43. C
4. A	14. D	24. B	34. B	44. C
5. D	15. C	25. B	35. D	45. C
6. A	16. A	26. B	36. B	46. B
7. A	17. C	27. B	37. D	47. D
8. C	18. A	28. A	38. C	48. A
9. A	19. C	29. B	39. B	49. C
10. A	20. A	30. D	40. D	50. B