

CH 121

General Chemistry Final Examination April 29, 2002

Name: _____
(please print)

SSN: * * * - * * - _____
(last 4 digits)

There are 40 Questions. Each question is worth 1 point.
Circle your answer **clearly**; otherwise no credit will be given.
Circle only **one** answer. If you circle two or more, you will receive no credit.

$R = 0.082057 \text{ L}\cdot\text{atm}/\text{K}\cdot\text{mol}$

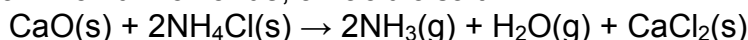
- The value seven hundred fifty million with four significant figures is written as
 - 7500×10^6
 - 7.500×10^8
 - 750×10^6
 - 750,000,000
 - 7500×10^8
- Which of the following is **NOT** an element of the fourth period in the periodic table?
 - Co
 - V
 - Mg
 - Ca
 - Kr
- To obtain 5.66×10^{21} atoms of nickel, you would weigh
 - 0.552 g.
 - 1.81 g.
 - 106 g.
 - 9.64×10^{19} g.
 - 1.04×10^{-20} g.
- How many grams of magnesium contain the same number of atoms as 20.04 g of calcium?
 - 12.16 g
 - 20.04 g
 - 24.30 g
 - 40.08 g
 - 48.60 g
- Which of the following series represents only known stable metal ions?
 - Fe^{2+} , Fe^{3+} , K^{2+}
 - Mg^{2+} , Ba^{3+} , Na^+
 - Li^{2+} , Na^+ , Al^{3+}
 - Fe^{2+} , Sr^{2+} , Mg^{2+}
 - Li^{2+} , Ca^{2+} , Al^{3+}

6. Which formula represents the binary compound formed by sodium and tellurium?
- Na_2Te
 - NaTe
 - Na_3Te
 - Na_3Te_2
 - NaTe_2
7. What is the correct name of KClO_4 ?
- potassium chlorate
 - potassium perchlorite
 - potassium perchlorate
 - potassium hypochlorate
 - potassium hypochlorite
8. Which of the following compounds is 36.4% oxygen by mass?
- N_2O
 - NO
 - N_2O_3
 - N_2O_4
 - N_2O_5
9. The molar mass of barium nitrate is
- 199.21 g/mol.
 - 229.32 g/mol.
 - 261.35 g/mol.
 - 336.61 g/mol.
 - 398.62 g/mol.
10. When 8.00 g of hydrogen reacts with 32.0 g of oxygen, the final mixture will contain
- H_2 , H_2O , O_2 .
 - H_2 , H_2O .
 - O , H_2O .
 - H_2 , O_2 .
 - pure H_2O .

11. A 27.0 g sample of an unknown carbon-hydrogen compound was burned in excess oxygen to form 88.0 g of CO₂ and 27.0 g H₂O. What is a possible molecular formula of the hydrocarbon?

- a. CH₄
- b. C₂H₆
- c. C₄H₆
- d. C₄H₈
- e. C₄H₁₀

12. Ammonia gas can be prepared by the reaction of a basic oxide like calcium oxide with ammonium chloride, an acidic salt.



If you isolate exactly 100. g of NH₃, but should have isolated 136 g in theory, what is the percentage yield of ammonia?

- a. 36.8%
- b. 71.2%
- c. 73.5%
- d. 81.2%
- e. 90.0%

13. Which pairs of reagents (if any) could be used in an aqueous solution to prepare pure manganese(II) sulfide by a precipitation reaction?

- a. MnCO₃ and Ag₂S
- b. MnCl₂ and Na₂S
- c. MnCl₂ and Na₂SO₄
- d. MnSO₄ and PbS
- e. none of these reagents will produce pure manganese(II) sulfide

14. Consider the equation -- $2\text{NaI(aq)} + \text{Cl}_2\text{(g)} \rightarrow \text{I}_2\text{(aq)} + 2\text{NaCl(aq)}$. The species undergoing reduction is

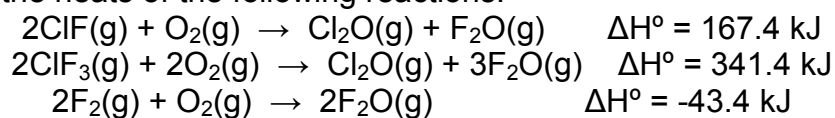
- a. sodium.
- b. iodide.
- c. chlorine.
- d. iodine.
- e. water.

15. The oxidation number of sulfur in $\text{S}_2\text{O}_3^{2-}$
- +8.
 - +6.
 - +4.
 - +3.
 - +2.
16. A solution of sodium carbonate is treated with a solution of nitric acid. Bubbles are observed in the colorless solution. The balanced equation is
- $\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g}) + 2\text{NaNO}_3(\text{aq})$
 - $\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{H}_2\text{CO}_3(\text{aq}) + 2\text{NaNO}_4(\text{aq})$
 - $\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{H}_2(\text{g}) + \text{CO}_2(\text{g}) + 3 \text{O}_2(\text{g}) + \text{N}_2(\text{g}) + \text{Na}_2\text{O}(\text{aq})$
 - $2\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + 2\text{CO}(\text{g}) + 3 \text{O}_2(\text{g}) + \text{NaNO}_3(\text{aq})$
 - $2\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{HNO}_3(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + 2\text{CO}_2(\text{g}) + \text{N}_2(\text{g}) + 2\text{NaNO}_3(\text{aq})$
17. If 15.0 g water at 28.0 °C is added to 125.0 g water at 20.0 °C, what is the final temperature of the resulting mixture?
- 20.9 °C
 - 22.6 °C
 - 23.1 °C
 - 24.0 °C
 - 27.3 °C
18. Consider the thermal energy transfer during a chemical process. When heat is transferred to the system, the process is said to be _____ and the sign of q is _____.
- exothermic, positive
 - exothermic, negative
 - endothermic, positive
 - endothermic, negative
 - enthalpic, negative

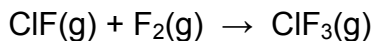
19. Which of the following particles has the largest radius?

- a. He
- b. F^-
- c. O^{2-}
- d. Mg^{2+}
- e. N^{3-}

20. Given the heats of the following reactions:



Calculate the heat of the reaction of chlorine monofluoride with F_2 according to the equation:



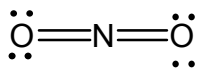
- a. -217.5 kJ
 - b. -130.2 kJ
 - c. -108.7 kJ
 - d. 130.2 kJ
 - e. 217.5 kJ
21. Which of the following electronic transitions in a hydrogen atom would have the highest energy?
- a. $n = 4$ to $n = 1$
 - b. $n = 4$ to $n = 2$
 - c. $n = 2$ to $n = 1$
 - d. $n = 4$ to $n = 3$
 - e. $n = 1$ to $n = 0$

22. When $l = 3$, what set of orbitals is designated?

- a. g
- b. p
- c. f
- d. d
- e. s

23. What element has the electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6$?
- O
 - S
 - Se
 - Si
 - Ge
24. A measure of the ability of a gaseous atom to acquire an electron to become negatively charged is called its
- ionization energy.
 - polarizability.
 - electron affinity.
 - electronegativity.
 - electron density.
25. Which of the following elements has the highest electron affinity?
- Cl
 - N
 - C
 - P
 - Na
26. Which of the following diatomic molecules has the greatest bond strength?
- F_2
 - O_2
 - N_2
 - HF
 - HCl
27. A straight-chain alkene has six carbon atoms. Its molecular formula is
- C_6H_6
 - C_6H_8
 - C_6H_{10}
 - C_6H_{12}
 - C_6H_{14}

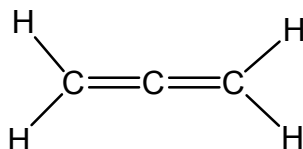
28. The Lewis structure



represents

- a. NO_2^-
 - b. NO_2^+
 - c. NO_2
 - d. both NO_2^+ and NO_2^-
 - e. NO_2^+ , NO_2^+ , and NO_2^-
29. In the combustion of methane, CH_4 , what change in hybridization (if any) occurs to the carbon atom?

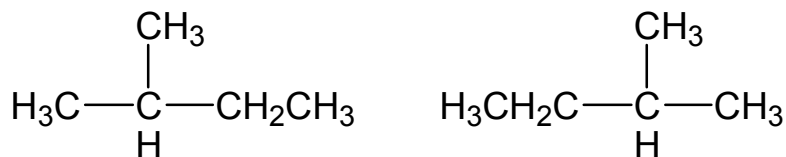
- a. sp^3 to sp^4
 - b. sp^2 to sp^3
 - c. sp^2 to sp
 - d. sp^3 to sp
 - e. no change in hybridization occurs
30. What hybrid orbital set is used by the terminal carbon atoms in the following molecule?



- a. sp
 - b. sp^2
 - c. sp^3
 - d. sp^3d
 - e. sp^3d^2
31. Which functional group does **not** contain an oxygen atom?
- a. ester
 - b. amide
 - c. alkene
 - d. aldehyde
 - e. alcohol

32. Which of the following pairs are isomers?

- a. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{CHO}$
- b. $\text{CH}_3\text{CH}_2\text{OCH}_3$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- c. CH_3COOH and CH_3CHO
- d.



- e. $\text{CH}_3\text{CH}=\text{CH}_2$ and $\text{CH}_2=\text{CHCH}_3$

33. What volume will a mixture of 0.200 mole N_2 and 0.500 mole He occupy at 0.944 atm and 15.0 °C?

- a. 0.913 liters
- b. 5.00 liters
- c. 12.5 liters
- d. 15.7 liters
- e. 17.5 liters

34. What is the density of CH_4 at 200 °C and 0.115 atm?

- a. 0.0475 g/L
- b. 0.0716 g/L
- c. 0.542 g/L
- d. 0.870 g/L
- e. 2.09 g/L

35. What is the chemical formula of a gas if it has a pressure of 1.40 atm and a density of 1.82 g/L at 27 °C?

- a. CO_2
- b. CO
- c. CH_4
- d. O_2
- e. N_2

36. When NaBr dissolves in water, what types of intermolecular forces must be broken?

- a. ion-ion forces
- b. H-bonds
- c. ion-dipole forces
- d. ion-ion forces and H-bonds
- e. dipole-dipole

37. A metal fluoride crystallizes such that the fluoride ions occupy cubic lattice positions at the corners and on the faces while the 4 metal atoms occupy positions within the body of the unit cells. The formula of the metal fluoride is

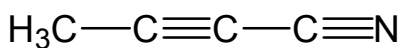
- a. MF
- b. MF₂
- c. MF₃
- d. M₄F₁₄
- e. MF₈

The following questions pertain to lead (atomic mass of 207.2 g/mol) which crystallizes in a face-centered cubic arrangements. Lead has an atomic radius of 1.75×10^{-8} cm.

38. What is the density of lead in g/cm³?

- a. 19.7 g/cm³
- b. 14.7 g/cm³
- c. 13.2 g/cm³
- d. 11.4 g/cm³
- e. 9.85 g/cm³

39. How many pi (π) bonds are in the following molecule?



- a. 2
- b. 4
- c. 6
- d. 7
- e. 10

40. Which group of compounds includes an aldehyde, an acid, and an alcohol (in any order)?

- a. HCO_2H , $\text{CH}_3\text{CO}_2\text{CH}_3$, $\text{CH}_3\text{CH}_2\text{OH}$
- b. H_2CO , $\text{CH}_3\text{CH}_2\text{OH}$, $\text{CH}_3\text{CO}_2\text{CH}_3$
- c. $\text{CH}_3\text{CO}_2\text{H}$, CH_3OH , $\text{CH}_3\text{CH}_2\text{OCH}_3$
- d. H_2CO , $\text{CH}_3\text{CO}_2\text{H}$, CH_3CHO
- e. H_2CO , $\text{CH}_3\text{CO}_2\text{H}$, $\text{CH}_3\text{CH}_2\text{OH}$