

Chemistry 121 exam practice test

- 1) Which of the following would be considered a chemical reaction?  
(A) Ice Melting (B) A log burning (C) Dissolving sugar in coffee (D) Boiling water  
(E) Superheated coffee foaming over when sugar added
- 2) Two moles of Neon gas at 20.0°C are heated to 350°C while the volume is kept constant. The density of the gas:  
(A) Increases (B) Decreases (C) Remains the same (D) Not enough information given
- 3) Which of the following atomic symbols is incorrect?  
(A)  ${}^{14}_6\text{C}$  (B)  ${}^{37}_{16}\text{Cl}$  (C)  ${}^{14}_7\text{N}$  (D)  ${}^{39}_{19}\text{K}$
- 4) What is the wavelength in nm of radiation with a frequency of  $5.75 \times 10^{14}$  Hz?  
(A) 522 (B) 425 (C) 575 (D) 325 (E) None of these
- 5) Consider the element mercury, atomic number 80, atomic mass 200.6 g. The nucleus of an atom of mercury-199 contains;  
(A) 80 protons, 119 neutrons, 80 electrons. (B) 80 protons, 119 neutrons. (C) 80 protons, 119 alpha particles. (D) 80 protons, 80 neutrons. (E) 80 protons, 120 neutrons
- 6) Which of the following sets of quantum numbers in the form (n,l,ml,ms) are not possible?  
(A) (5,2,3,-½) (B) (4,3,-2,+½) (C) (6,1,0,+½) (D) (2,0,0,-½) (E) (7,1,0,-½)
- 7) Consider four 1-L flasks at STP. Flask A contains NH<sub>3</sub> gas, flask B contains NO<sub>2</sub> gas, flask C contains NF<sub>3</sub> gas, and flask D contains N<sub>2</sub> gas. In which flask do the molecules have the highest average velocity?  
(A) NH<sub>3</sub> gas (B) NO<sub>2</sub> gas (C) NF<sub>3</sub> gas (D) N<sub>2</sub> gas (E) all are the same
- 8) Which of the following will have the largest atomic radius?  
(A) Rb (B) Sr (C) Te (D) Sn
- 9) Which of the following elements would be the easiest to ionize?  
(A) Mg (B) Cs (C) Na (D) Ca (E) Be
- 10) Which of the following frequencies corresponds to light with the longest wavelength?

- (A)  $3.00 \times 10^{13} \text{ s}^{-1}$  (B)  $4.12 \times 10^5 \text{ s}^{-1}$  (C)  $8.50 \times 10^{20} \text{ s}^{-1}$  (D)  $9.12 \times 10^{12} \text{ s}^{-1}$   
(E)  $1.20 \times 10^9 \text{ s}^{-1}$

11) Which of the following substances can't form hydrogen bonds with water?  
(A) H<sub>2</sub>S (B) H<sub>3</sub>C-NH<sub>2</sub> (C) PH<sub>3</sub> (D) H<sub>3</sub>C-CH<sub>3</sub>

12) In which case is the bond polarity incorrect?  
(A)  $\delta^+ \text{H}-\text{F}^{\delta-}$  (B)  $\delta^+ \text{K}-\text{O}^{\delta-}$  (C)  $\delta^+ \text{Mg}-\text{H}^{\delta-}$  (D)  $\delta^+ \text{Cl}-\text{I}^{\delta-}$  (E)  $\delta^+ \text{Si}-\text{S}^{\delta-}$

13) What type of structure does the XeOF<sub>2</sub> molecule have?  
(A) pyramidal (B) tetrahedral (C) T-shaped (D) trigonal planar (E) octahedral

14) 5. Which of the following will require the greatest energy input to separate the ions?  
a. MgI<sub>2</sub> b. MgBr<sub>2</sub> c. MgF<sub>2</sub> d. NaCl e. MgCl<sub>2</sub>

15) Which of the following will have the highest melting point?  
a. NaF b. NaI c. NaCl d. CsCl e. NaBr

16) Which of the following compounds is capable of dipole-dipole interactions?  
a. CH<sub>4</sub> b. SF<sub>6</sub> c. CO<sub>2</sub> d. NH<sub>4</sub><sup>+</sup> e. H<sub>2</sub>CO

17) Which is higher boiling, and why?  
(Both have the same formula, C<sub>3</sub>H<sub>8</sub>O)



18) Rank the boiling points for the following, 1 being highest: Cl<sub>2</sub> Br<sub>2</sub> I<sub>2</sub>

19) Rank the melting points for the following, 1 being highest:



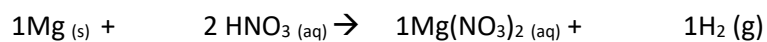


21) Draw the most probable lewis structure for  $\text{CH}_3\text{NO}_2$  indicate all lone pairs and all electrons...  
(HINT: what is a bond made up of)

22) Draw the most probable Lewis structures for N<sub>2</sub>O and NO<sub>2</sub>. Indicate all nonzero formal charges and which structure that would be expected to be most stable.

23) Considering the most probable structure for  $\text{CO}_3^{2-}$ , indicate the type of hybrid orbitals on the Carbon and Oxygen atoms. Predict the expected bond angles. Indicate the relative length and strength of each bond. Show any resonance hybrids and indicate how they are related to the overall observed structure.

24) Considering the following balanced equation



If 15.00 g of magnesium reacts with 25.00 mL of 1.8 M nitric acid;

a) Determine which reactant is limiting and which is excess

b) What is the mass of each product?

c) How much reactant is left over?

25) 60 moles of gas contained in a 150.0 L container at 27°C is squeezed into a 50.0 L container isobarically. What is the new temperature ?

26) Show all of the electrons from a nitrogen atom and show how these are related to the (n, l, ml, ms) notation.



27) What is the maximum number of electrons that are allowed to have the following set of quantum numbers?

$$n = 3 \quad m_l = +1$$

28) A friend tells you that  $N_2$  has three  $\pi$  bonds due to overlap of the three p orbitals on each N atoms, do you agree? If so why? If not why?

29) The element chlorine has two natural isotopes:  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$ , oddly a mass spectrum of chlorine gas has five lines... Explain why this occurred (HINT: its not actually "oddly")