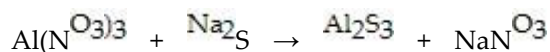


THE FOLLOWING RESOURCE MAY NOT COVER ALL FINAL EXAM MATERIAL

SECTION A

- Which of the following are chemical processes?
  - rusting of a nail
  - freezing of water
  - decomposition of water into hydrogen and oxygen gases
  - compression of oxygen gasA) 1, 2                      B) 2, 3, 4                      C) 1, 3, 4                      D) 1, 4                      E) 1, 3
- What is the volume (in  $\text{cm}^3$ ) of a 63.4 g piece of metal with a density of  $12.86 \text{ g/cm}^3$ ?  
A) 6.65  
B) .425  
C) 4.93  
D) 19.5  
E) none of the above
- $\frac{(0.002843)(12.80184)}{0.00032} = \underline{\hspace{2cm}}$   
A)  $1.1 \times 10^2$                       B) 113.74                      C) 113.736                      D) 113.7                      E) 113.73635
- Which one of the following is not one of the postulates of Dalton's atomic theory?
  - Atoms of an element are not changed into different types of atoms by chemical reactions; atoms are neither created nor destroyed in chemical reactions.
  - Compounds are formed when atoms of more than one element combine; a given compound always has the same relative number and kind of atoms.
  - Each element is composed of extremely small particles called atoms.
  - Atoms are composed of protons, neutrons, and electrons.
  - All atoms of a given element are identical; the atoms of different elements are different and have different properties.
- An atom of the most common isotope of gold,  $^{197}\text{Au}$ , has \_\_\_\_\_ protons, \_\_\_\_\_ neutrons, and \_\_\_\_\_ electrons.  
A) 79, 197, 197                      B) 118, 79, 39                      C) 79, 118, 118                      D) 197, 79, 118                      E) 79, 118, 79
- Which pair of elements would you expect to exhibit the greatest similarity in their physical and chemical properties?  
A) Ca, Sr                      B) Ga, Ge                      C) C, O                      D) Cs, Ba                      E) H, Li
- Which species has 54 electrons?  
A)  $^{132}_{54}\text{Xe}^{2+}$                       B)  $^{118}_{50}\text{Sn}^{2+}$                       C)  $^{132}_{54}\text{Xe}^+$                       D)  $^{128}_{52}\text{Te}^{2-}$                       E)  $^{112}_{48}\text{Cd}$
- When the following equation is balanced, the coefficients are \_\_\_\_\_.



- A) 4, 6, 3, 2      B) 2, 3, 1, 6      C) 1, 1, 1, 1      D) 2, 1, 3, 2      E) 2, 3, 2, 3

9. What is the empirical formula of a compound that contains 27.0% S, 13.4% O, and 59.6% Cl by mass?

- A)  $S_2OCl$       B)  $S^{O_2}Cl$       C)  $SOCl$       D)  $ClS^{O_4}$       E)  $SO^{Cl_2}$

10. The formula weight of potassium phosphate ( $K_3PO_4$ ) is \_\_\_\_\_ amu.

- A) 196.27      B) 86.07      C) 251.37      D) 173.17      E) 212.27

11. A weak electrolyte exists predominantly as \_\_\_\_\_ in solution.

- A) molecules      B) ions      C) an isotope      D) electrons      E) atoms

12. The balanced net ionic equation for precipitation of  $CaCO_3$  when aqueous solutions of  $Na_2CO_3$  and  $CaCl_2$  are mixed is \_\_\_\_\_.

- A)  $Ca^{2+} (aq) + CO_3^{2-} (aq) \rightarrow CaCO_3 (s)$   
 B)  $2Na^+ (aq) + 2Cl^- (aq) \rightarrow 2NaCl (aq)$   
 C)  $Na^+ (aq) + Cl^- (aq) \rightarrow NaCl (aq)$   
 D)  $Na_2CO_3 (aq) + CaCl_2 (aq) \rightarrow 2NaCl (aq) + CaCO_3 (s)$   
 E)  $2Na^+ (aq) + CO_3^{2-} (aq) \rightarrow Na_2CO_3 (aq)$

13.

Which of the following are combination reactions?

- 1)  $CH_4 (g) + O_2 (g) \rightarrow CO_2 (g) + H_2O (l)$   
 2)  $CaO (s) + CO_2 (g) \rightarrow CaCO_3 (s)$   
 3)  $Mg (s) + O_2 (g) \rightarrow MgO (s)$   
 4)  $PbCO_3 (s) \rightarrow PbO (s) + CO_2 (g)$

- a) 2,3 and 4  
 b) 2 and 3  
 c) 1,2,3,and 4  
 d) 4 only  
 e) 1,2, and 3

14. The point in a titration at which the indicator changes is called the \_\_\_\_\_.

- A) standard point  
 B) indicator point  
 C) volumetric point  
 D) setpoint  
 E) endpoint

15. What is the concentration (M) of a NaCl solution prepared by dissolving 9.3 g of NaCl in sufficient water to give 350 mL of solution?

- A) 27      B) 0.45      C)  $2.7 \times 10^{-2}$       D) 18      E) 0.16

16. The value of  $\Delta E$  for a system that performs 111 kJ of work on its surroundings and gains 89 kJ of heat is \_\_\_\_\_ kJ.

- A) 22      B) -200      C) 200      D) -111      E) -22

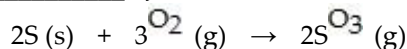
17. Which one of the following is an endothermic process?

- A) ice melting
- B) Both A and C
- C) boiling soup
- D) Hydrochloric acid and barium hydroxide are mixed at 25 °C: the temperature increases.
- E) water freezing

18. A sample of calcium carbonate [CaCO<sub>3</sub> (s)] absorbs 45.5 J of heat, upon which the temperature of the sample increases from 21.1 °C to 28.5 °C. If the specific heat of calcium carbonate is 0.82 J/g-K, what is the mass (in grams) of the sample?

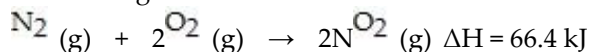
- A) 5.0
- B) 5.0 × 10<sup>3</sup>
- C) 3.7
- D) 410
- E) 7.5

19. The value of ΔH° for the reaction below is -790 kJ. The enthalpy change accompanying the reaction of 0.95 g of S is \_\_\_\_\_ kJ.

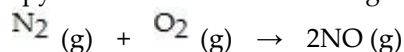


- A) 23
- B) 12
- C) -23
- D) -790
- E) -12

20. Given the following reactions



the enthalpy of the reaction of the nitrogen to produce nitric oxide



is \_\_\_\_\_ kJ.

- A) 90.3
- B) -47.8
- C) 47.8
- D) 180.6
- E) -180.6

21. The wavelength of light emitted from a traffic light having a frequency of  $5.75 \times 10^{14}$  Hz is \_\_\_\_\_.

- A) 641 nm
- B) 583 nm
- C) 522 nm
- D) 702 nm
- E) 674 nm

22. Of the following transitions in the Bohr hydrogen atom, the \_\_\_\_\_ transition results in the emission of the highest-energy photon.

- A)  $n = 3 \rightarrow n = 6$
- B)  $n = 1 \rightarrow n = 4$
- C)  $n = 1 \rightarrow n = 6$
- D)  $n = 6 \rightarrow n = 3$
- E)  $n = 6 \rightarrow n = 1$

23. All of the orbitals in a given electron shell have the same value of the \_\_\_\_\_ quantum number.

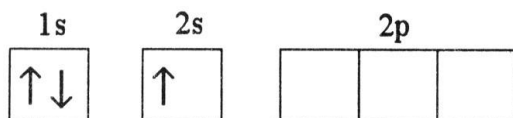
- A) spin
- B) psi
- C) principal
- D) angular momentum

E) magnetic

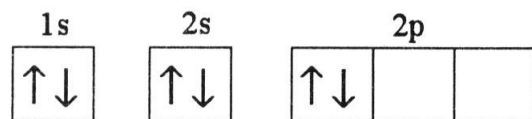
24. An electron cannot have the quantum numbers  $n = \underline{\hspace{2cm}}$ ,  $l = \underline{\hspace{2cm}}$ ,  $m_l = \underline{\hspace{2cm}}$ .  
A) 2, 0, 0                      B) 1, 1, 1                      C) 3, 2, 1                      D) 3, 1, -1                      E) 2, 1, -1

25. Which electron configuration represents a violation of the Pauli exclusion principle?

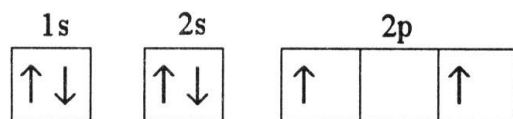
A)



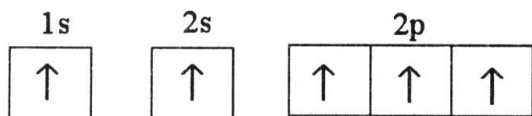
B)



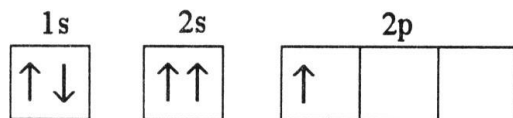
C)



D)



E)



26. The ground-state electron configuration of the element \_\_\_\_\_ is  $[\text{Kr}]5s^14d^5$ .  
A) Cr                      B) Nb                      C) Tc                      D) Mo                      E) Mn

27. In which orbital does an electron in a lead atom experience the greatest effective nuclear charge?  
A) 5s                      B) 5d                      C) 1s                      D) 6s                      E) 4p

28. Which one of the following atoms has the largest radius?  
A) Ca                      B) Rb                      C) Sr                      D) K                      E) Y

29. Of the following atoms, which has the largest first ionization energy?  
A) Sb                      B) Se                      C) Ge                      D) S                      E) As

30. Which isoelectronic series is correctly arranged in order of increasing radius?

- A)  $\text{Ca}^{2+} < \text{K}^+ < \text{Ar} < \text{Cl}^-$
- B)  $\text{K}^+ < \text{Ca}^{2+} < \text{Ar} < \text{Cl}^-$
- C)  $\text{Ca}^{2+} < \text{Ar} < \text{K}^+ < \text{Cl}^-$
- D)  $\text{Ca}^{2+} < \text{K}^+ < \text{Cl}^- < \text{Ar}$
- E)  $\text{Cl}^- < \text{Ar} < \text{K}^+ < \text{Ca}^{2+}$

31. The type of compound that is most likely to contain a covalent bond is \_\_\_\_\_.
- A) a solid metal
  - B) one that is composed of a metal from the far left of the periodic table and a nonmetal from the far right of the periodic table
  - C) held together by the electrostatic forces between oppositely charged ions
  - D) one that is composed of only nonmetals
  - E) There is no general rule to predict covalency in bonds.
32. Of the molecules below, the bond in \_\_\_\_\_ is the most polar.
- A) HBr
  - B)  $\text{H}_2$
  - C) HF
  - D) HCl
  - E) HI
33. There are \_\_\_\_\_ valence electrons in the Lewis structure of  $\text{CH}_3\text{CH}_2\text{Cl}$ .
- A) 12
  - B) 14
  - C) 20
  - D) 10
  - E) 18
34. Of the molecules below, only \_\_\_\_\_ is nonpolar.
- A)  $\text{N}^{\text{H}_3}$
  - B)  $\text{Te}^{\text{Cl}_2}$
  - C)  $\text{H}_2\text{O}$
  - D)  $\text{C}^{\text{O}_2}$
  - E) HCl
35. Which of the following statements about gases is false?
- A) All gases are colorless and odorless at room temperature.
  - B) Gases are highly compressible.
  - C) Distances between molecules of gas are very large compared to bond distances within molecules.
  - D) Non-reacting gas mixtures are homogeneous.
  - E) Gases expand spontaneously to fill the container they are placed in.
36. The kinetic-molecular theory predicts that pressure rises as the temperature of a gas increases because \_\_\_\_\_.
- A) the gas molecules collide more energetically with the wall
  - B) the gas molecules collide more frequently with the wall
  - C) the gas molecules collide less frequently with the wall
  - D) the average kinetic energy of the gas molecules decreases
  - E) both the gas molecules collide more frequently with the wall and the gas molecules collide more energetically with the wall