

TEST NAME: CMS SCI CHEM Midterm Exam
TEST ID: 619008
GRADE: 09 - Ninth Grade - 12 - Twelfth Grade
SUBJECT: Life and Physical Sciences
TEST CATEGORY: District Benchmark

08/24/15, CMS SCI CHEM Midterm Exam

Student: _____

Class: _____

Date: _____

Instructions

Choose the single best answer for each of the following questions. Use the Chemistry Reference Tables as needed.

1. Which pair of symbols represents nuclei with the same number of neutrons?

- A. ^{56}Co and ^{58}Co
- B. ^{57}Mn and ^{57}Fe
- C. ^{57}Fe and ^{58}Ni
- D. ^{57}Co and ^{58}Ni

2.

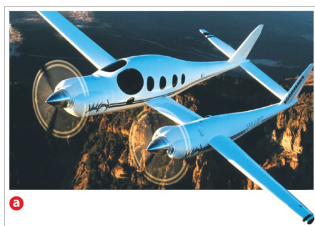
element	protons	neutrons	electrons
1	20	20	20
2	40	40	40
3	20	10	10
4	20	20	40

Which represents an atom of calcium?

- A. 2
 - B. 3
 - C. 1
 - D. 4
3. A scientist has found the following isotope of oxygen: $^{19}_8\text{O}$. How many neutrons are present in this isotope?
- A. 19
 - B. 11
 - C. 27
 - D. 8

4. **Which statement best describes the density of an atom's nucleus?**
- A. The nucleus occupies most of the atom's volume but contains little of its mass.
 - B. The nucleus occupies very little of the atom's volume and contains little of its mass.
 - C. The nucleus occupies most of the atom's volume and contains most of its mass.
 - D. The nucleus occupies very little of the atom's volume but contains most of its mass.
5. **One indicator that electrons in atoms are limited to specific energy levels is that _____.**
- A. the Doppler effect shows a shift in wavelength of H-atom light
 - B. light emitted from excited atoms occurs only at specific wavelengths
 - C. atoms move faster when heated
 - D. the light given off by atoms is all the same wavelength

6.



The electron cloud of an atom can be compared to a spinning airplane propeller. This is because

- A. similarly, electrons can only be found in the nucleus of an atom.
 - B. similarly, electrons can only move in a circle.
 - C. similarly, the electron cloud of an atom represents the locations where an electron is likely to be found.
 - D. similarly, you can know the exact position of an electron at any instant.
7. **Refer to the Bohr model of the hydrogen atom in the chemistry state reference tables. Which electron transition would result in emission of ultraviolet radiation?**
- A. Level 4 to level 1
 - B. Level 4 to level 3
 - C. Level 5 to level 2
 - D. Level 3 to level 2

8. Refer to the Bohr model of the hydrogen atom in the chemistry state reference tables. What color of light is emitted when an electron moves from the third energy level to the second energy level?
- A. red
 - B. yellow
 - C. blue-green
 - D. violet
9. How do the energy gaps between successive electron energy levels in an atom vary from low to high n values?
- A. All energy gaps are the same.
 - B. The energy gap decreases as n increases.
 - C. The energy gap increases as n increases.
 - D. The energy gap changes unpredictably as n increases.
10. Which equation correctly represents the alpha decay of polonium-214?
- A. ${}^{214}_{84}\text{Po} \rightarrow {}^{214}_{85}\text{Po} + {}^0_{-1}\text{e}$
 - B. ${}^{214}_{84}\text{Po} + {}^4_2\text{He} \rightarrow {}^{216}_{90}\text{Th}$
 - C. ${}^{214}_{84}\text{Po} \rightarrow {}^{210}_{82}\text{Pb} + {}^4_2\text{He}$
 - D. ${}^{214}_{84}\text{Po} \rightarrow {}^{214}_{82}\text{Pb} + {}^0_2\text{He}$
11. Iodine-131 is a radioactive isotope with a half-life of 8 days. How many grams of a 64 g sample of iodine-131 will remain at the end of 24 days?
- A. 56 g
 - B. 48 g
 - C. 32 g
 - D. 8 g

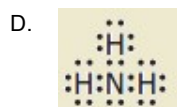
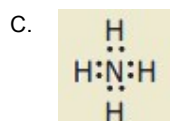
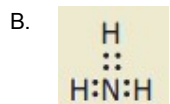
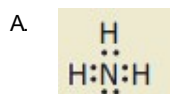
12. A radioactive sample has a half-life of 7.5 min. What fraction of the sample is left after 22.5 min?

- A. 1/2
- B. 1/4
- C. 1/8
- D. 1/16

13. The net charge of an aluminum ion is +3 because there are _____.

- A. 13 protons and 10 electrons in the atom
- B. 13 protons and 10 neutrons in the nucleus
- C. 10 neutrons and 13 electrons in the atom
- D. 10 protons and 13 electrons in the atom

14. Which of the following represents the Lewis dot diagram of ammonia (NH₃)?



15. For which element would XH₃ be a stable species?

- A. C
- B. Cl
- C. P
- D. S

16.

A																	
G																	B
	C												D			E	
													F				

An alien astronaut landed on Earth and created the periodic table shown above. The astronaut was trying to determine what type of bond would be present in several compounds. The type of bond in a compound containing G and E would be _____.

- A. a nonmetallic bond
- B. a metallic bond
- C. a covalent bond
- D. an ionic bond

17. Bonding between two elements of equal electronegativity would be _____.

- A. 50% ionic
- B. primarily ionic
- C. 100% covalent
- D. metallic in character

18. Which compounds contain both ionic and covalent bonds?

I. BaSO_4

II. $\text{Ca}(\text{NO}_3)_2$

III. NH_4Cl

- A. I only
- B. I and III only
- C. II and III only
- D. I, II and III

19. **How do bond length and bond strength change as the number of bonds between two atoms increases?**
- A. Bond length increases and bond strength increases
 - B. Bond length increases and bond strength decreases
 - C. Bond length decreases and bond strength increases
 - D. Bond length decreases and bond strength decreases
20. **What are the strongest intermolecular force between neighboring carbon tetrachloride, CCl_4 , molecules?**
- A. dipole-dipole forces
 - B. dispersion forces
 - C. hydrogen bonds
 - D. covalent bonds
21. **The compounds C_3H_8 , $\text{CH}_3\text{CH}_2\text{OH}$, and CH_3OCH_3 have very similar molar masses. When they are arranged in order of increasing strength of their intermolecular forces, what is the correct order?**
- A. C_3H_8 , CH_3OCH_3 , $\text{CH}_3\text{CH}_2\text{OH}$
 - B. $\text{CH}_3\text{CH}_2\text{OH}$, CH_3OCH_3 , C_3H_8
 - C. CH_3OCH_3 , C_3H_8 , $\text{CH}_3\text{CH}_2\text{OH}$
 - D. $\text{CH}_3\text{CH}_2\text{OH}$, C_3H_8 , CH_3OCH_3
22. **Which is the correct name for the compound MnF_3 ?**
- A. Manganese fluoride (III)
 - B. Manganese (III) fluoride
 - C. Manganese (I) fluoride (III)
 - D. Manganese (III) fluoride (III)

23. What is the name of NH_4OH ?

- A. Ammonium hydroxide
- B. Nitrogen oxygen hydride
- C. Nitrogen hydroxide
- D. Ammonium oxygen hydride

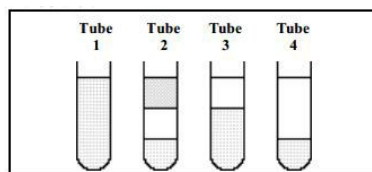
24. What is the correct name for the compound P_4O_6 ?

- A. Phosphoric acid
- B. Phosphorus oxide
- C. Phosphorus (IV) oxide
- D. Tetraphosphorus hexoxide

25. What is the Valence Shell Electron Pair Repulsion (VSEPR) Theory used to predict?

- A. The energy levels in an atom
- B. The shapes of molecules and ions
- C. The electronegativities of elements
- D. The type of bonding in a compound

26. Hexane, C_6H_{14} , is immiscible with water and ethanol. Water and ethanol are miscible. C_6H_{14} has the lowest (smallest) density. Which diagram represents the results when equal volumes of these three liquids are placed in a test tube and shaken?



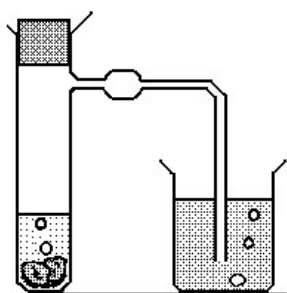
- A. Tube 1
- B. Tube 2
- C. Tube 3
- D. Tube 4

27. Which species is nonpolar?
- A. HCl
 - B. OCl₂
 - C. NCl₃
 - D. CCl₄
28. A hard, crystalline solid with a high melting point does not conduct electricity in any phase. This solid is most likely _____.
- A. an ionic solid
 - B. a metallic solid
 - C. a molecular solid
 - D. a network covalent solid
29. Which element has the highest electrical conductivity?
- A. Ga
 - B. Ge
 - C. As
 - D. Si
30. Iodine would have chemical properties most like _____.
- A. manganese (Mn)
 - B. tellurium (Te)
 - C. chlorine (Cl)
 - D. xenon (Xe)

31. A sodium atom has an electron configuration of $1s^2 2s^2 2p^6 3s^1$. If the sodium atom becomes ionized, its new electron configuration will be the same as which element?
- A. Lithium
 - B. Neon
 - C. Magnesium
 - D. Potassium
32. Which of the following atoms has the largest atomic radius?
- A. barium (Ba)
 - B. chlorine (Cl)
 - C. iodine (I)
 - D. magnesium (Mg)
33. Which element has an outer electron configuration of $s^2 p^4$?
- A. Ca
 - B. Cr
 - C. Ge
 - D. Se
34. Which of these elements has the greatest electronegativity?
- A. Br
 - B. N
 - C. O
 - D. Se

35. Which atom has the smallest first ionization energy?
- A. Na
 - B. K
 - C. Mg
 - D. Ca
36. Which metal reacts most vigorously with water?
- A. Al
 - B. Ca
 - C. Fe
 - D. K
37. What products result when aqueous solutions of CuCl_2 and $(\text{NH}_4)_2\text{S}$ are mixed?
- A. $\text{CuS}(\text{aq})$ and $\text{NH}_4\text{Cl}(\text{s})$
 - B. $\text{CuS}(\text{s})$ and $\text{NH}_4\text{Cl}(\text{aq})$
 - C. $\text{CuS}(\text{aq})$ and $\text{NH}_4\text{Cl}(\text{g})$
 - D. $\text{CuS}(\text{s})$ and $\text{NH}_4\text{Cl}(\text{s})$
38. A chemical change occurs when:
- A. dissolved minerals solidify to form a crystal
 - B. ethanol is purified through distillation
 - C. salt deposits form from evaporated water
 - D. a leaf changes color

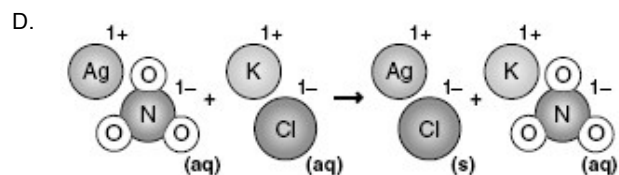
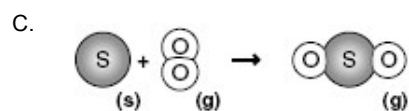
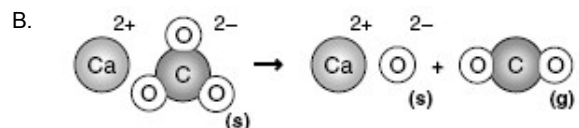
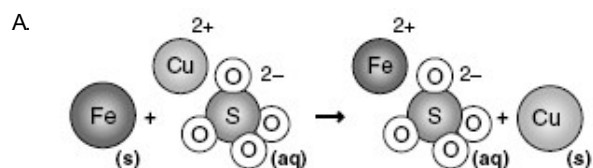
39. Zinc is added to dilute hydrochloric acid in the test tube pictured below.



Is there any evidence that a chemical reaction occurs?

- A. No, there is no evidence.
- B. Yes, gas bubbles are produced.
- C. Yes, zinc dissolves in hydrochloric acid.
- D. Yes, the hydrochloric acid causes a precipitate to form.

40. Which of the following represents a synthesis reaction?



41. What products result when equal volumes of equimolar aqueous solutions of copper (II) sulfate and barium hydroxide are mixed?

- A. $\text{Ba}^{2+}(\text{aq})$, $\text{C}^{2+}(\text{aq})$, $\text{OH}^{-}(\text{aq})$, and $\text{SO}_4^{2-}(\text{aq})$
- B. $\text{Cu}(\text{OH})(\text{s})$, $\text{Ba}^{2+}(\text{aq})$, and $\text{SO}_4^{2-}(\text{aq})$
- C. $\text{BaSO}_4(\text{s})$, $\text{Cu}^{2+}(\text{aq})$, and $\text{OH}^{-}(\text{aq})$
- D. $\text{BaSO}_4(\text{s})$ and $\text{Cu}(\text{OH})_2(\text{s})$

42. $\underline{\hspace{1cm}} \text{C}_3\text{H}_8 + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{CO}_2 + \underline{\hspace{1cm}} \text{H}_2\text{O}$

This chemical equation represents the combustion of propane. When correctly balanced, the coefficient for water is _____.

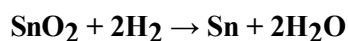
- A. 2
- B. 4
- C. 8
- D. 16

43. $\text{Cu} + 2\text{AgNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{Ag}$

The chemical equation shown is an example of a _____.

- A. single-replacement reaction
- B. synthesis reaction
- C. decomposition reaction
- D. double-replacement reaction

44. According to the balanced equation



What volume of hydrogen, measured at 1 atm and 273 K, is required to react with 2.00 g of SnO_2 ?

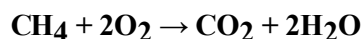
- A. 0.00133 L
- B. 0.00265 L
- C. 0.297 L
- D. 0.595 L



In this reaction, how many grams of Fe_2O_3 are required to completely react with 84 grams of CO?

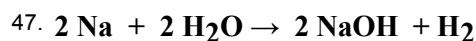
- A. 64 g
- B. 80 g
- C. 160 g
- D. 1400 g

46. When methane (CH_4) gas is burned in the presence of oxygen, the following chemical reaction occurs.



If 1 mole of methane reacts with an excess of oxygen, then

- A. 6.02×10^{23} molecules of CO_2 and 6.02×10^{23} molecules of H_2O are produced.
- B. 1.2×10^{24} molecules of CO_2 and 1.2×10^{24} molecules of H_2O are produced.
- C. 6.02×10^{23} molecules of CO_2 and 1.2×10^{24} molecules of H_2O are produced.
- D. 1.2×10^{24} molecules of CO_2 and 6.02×10^{23} molecules of H_2O are produced.



How many moles of hydrogen gas are produced when 0.066 moles of sodium are completely reacted?

- A. 0.022 mol
- B. 0.033 mol
- C. 0.066 mol
- D. 0.099 mol

48. What is the molecular formula of a substance that has an empirical formula of C_2H_5 and a molecular mass of 58 g/mole?
- A. C_4H_{10}
 - B. C_6H_{15}
 - C. C_2H_5
 - D. C_5H_2
49. A chloride salt of rhenium contains 63.6% Re by mass and 36.4% Cl by mass. What is its empirical formula?
- A. $ReCl$
 - B. $ReCl_2$
 - C. $ReCl_3$
 - D. $ReCl_5$
50. Calculate the mass percentage of nitrogen in hydrazinium sulfate $(N_2H_5)_2SO_4$.
- A. 10.8%
 - B. 17.3%
 - C. 34.5%
 - D. 51.2