

Name: _____

- Supply answers to all questions on the answer sheet provided. Use a number 2 pencil.
- Fill in the PID box with the number supplied on the name sticker on this examination paper.
- There are fifty (50) questions all with four (4) point values, for a total of 200 points. Your score will be scaled and used to calculate your final grade in accordance with the syllabus.
- EACH QUESTION HAS ONLY ONE CORRECT ANSWER
- A periodic table and conversion sheet is provided with this paper. You may write on this examination, or separate the pages as necessary.

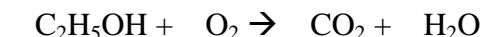
1. There are seven fundamental (base) units in the international (SI) system of units. Which one of the following units is *not* one of them?

- | | | |
|-----------|-----------|-----------|
| a. Second | c. Gram | e. Meter |
| b. Mole | d. Kelvin | f. Ampere |

2. Which one of the following formulas for polyatomic anions is *incorrect*?

- | | |
|---------------------------------|---------------------------------|
| a. CO_3^{2-} carbonate | d. HCO_3^- bicarbonate |
| b. BrO_2^- bromite | e. SO_4^{2-} sulfate |
| c. PO_3^{3-} phosphite | f. ClO^- perchlorate |

3. The products of the combustion of ethanol with oxygen are shown in the following equation:



When properly balanced, the equation indicates that $_$ molecules of O_2 are required to burn 1 molecule of ethanol $\text{C}_2\text{H}_5\text{OH}$.

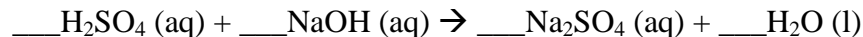
- | | | |
|--------|--------|--------|
| a. 0.5 | d. 2.0 | g. 3.5 |
| b. 1.0 | e. 2.5 | h. 4.0 |
| c. 1.5 | f. 3.0 | i. 4.5 |

4. An isotope of uranium contains 146 neutrons. An atom of this isotope has a charge of $6+$. How many protons are in the nucleus of this atom?

- | | | |
|-------|--------|--------|
| a. 54 | d. 98 | g. 152 |
| b. 86 | e. 140 | h. 238 |
| c. 92 | f. 146 | |

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5. What is the coefficient of water after balancing the following equation?



- | | | |
|------|------|------|
| a. 1 | c. 3 | e. 5 |
| b. 2 | d. 4 | f. 6 |

6. How many moles of oxygen molecules are there in a 128 gram sample?

- | | | |
|------|------|------|
| a. 1 | d. 4 | g. 7 |
| b. 2 | e. 5 | h. 8 |
| c. 3 | f. 6 | |

7. Which element has the highest electron affinity?

- | | | |
|-------------|---------------|-----------|
| a. Boron | d. Silicon | g. Oxygen |
| b. Aluminum | e. Nitrogen | h. Sulfur |
| c. Carbon | f. Phosphorus | |

8. If two elements combine together to form a compound, and one of the two elements has a low electronegativity, and the second of the two elements has a high electronegativity, what kind of bond is formed between them?

- | | |
|-------------|-------------------|
| a. Metallic | d. Polar covalent |
| b. Ionic | e. Intermolecular |
| c. Covalent | |

9. What is the name of the HSO_3^- ion?

- | | |
|------------|--------------|
| a. Sulfite | d. Bisulfite |
| b. Sulfate | e. Bisulfate |
| c. Sulfide | |

10. What is the percentage by mass of phosphorus in ammonium phosphate $(\text{NH}_4)_3\text{PO}_4$?

- | | | |
|---------|---------|---------|
| a. 18.4 | d. 27.4 | g. 44.3 |
| b. 20.8 | e. 33.6 | h. 47.1 |
| c. 26.2 | f. 42.9 | |

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11. Balance the equation for the combustion of benzene, C_6H_6



If 13 grams of benzene are burned in excess oxygen, how many grams of carbon dioxide are produced?

- | | | |
|-------|-------|--------|
| a. 11 | d. 44 | g. 110 |
| b. 22 | e. 66 | h. 220 |
| c. 33 | f. 88 | |

12. What is the oxidation state of phosphorus in $(NH_4)_2HPO_4$?

- | | | | |
|-------|-------|-------|-------|
| a. 1- | d. 1+ | g. 4+ | j. 7+ |
| b. 2- | e. 2+ | h. 5+ | |
| c. 3- | f. 3+ | i. 6+ | |

13. What is the maximum number of electrons that can occupy all the orbitals in the $n=4$ principal quantum energy level of an atom?

- | | | | |
|------|-------|-------|-------|
| a. 2 | d. 8 | g. 14 | j. 32 |
| b. 4 | e. 9 | h. 16 | |
| c. 6 | f. 10 | i. 18 | |

14. What is the noble gas electronic configuration of cadmium (Cd)?

- | | |
|------------------------|------------------------|
| a. $[Ar] 5s^2 4d^{10}$ | d. $[Xe] 6s^2 4d^{10}$ |
| b. $[Kr] 6s^2 5d^{10}$ | e. $[Ar] 4s^2 3d^{10}$ |
| c. $[Kr] 5s^2 5d^{10}$ | f. $[Kr] 5s^2 4d^{10}$ |

15. Examples of a noble gas, an alkali metal, a halogen, and a transition metal, in that order are:

- | Nobel gas | transition metal | alkali metal | nonmetal |
|-------------|------------------|--------------|-----------|
| a. helium | gold | sodium | carbon |
| b. nobelium | manganese | potassium | copper |
| c. argon | beryllium | barium | lead |
| d. neon | nickel | magnesium | sulfur |
| e. xenon | copper | lithium | germanium |
| f. helium | iron | rubidium | silicon |

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22. According to the metric system, 1 _____ = 1,000,000 m.
- a. Gm
 - b. Mm
 - c. μm
 - d. nm
 - e. none of the above
23. According to the metric system, 1 s = 1×10^6 _____.
- a. Ms
 - b. Ms
 - c. Ns
 - d. μs
 - e. none of the above
24. If a motorcycle engine is 115 in.³, what is the volume in liters, given 1 in = 2.54 cm.
- a. 0.292 L
 - b. 0.742 L
 - c. 1.88 L
 - d. 292 L
 - e. 1880 L
25. Platinum is one of the densest elements ($d = 21.5 \text{ g/cm}^3$). What is the volume of a 10.0 g sample of the metal?
- a. 0.465 cm^3
 - b. 2.15 cm^3
 - c. 21.5 cm^3
 - d. 215 cm^3
 - e. 465 cm^3
26. What are the freezing point and boiling point of water on the Kelvin scale?
- a. 0 K and 100 K
 - b. 0 K and 273 K
 - c. 100 K and 273 K
 - d. 100 K and 373 K
 - e. 273 K and 373 K
27. It requires 333 J to melt 1.0 gram of ice at its melting point. The specific heat of water is 4.184 J/K g. How much energy is released when 20 grams of water at 25°C is cooled to 0°C and frozen?
- a. 6.66 kJ
 - b. 2.43 kJ
 - c. 2.09 kJ
 - d. 8.33 kJ
 - e. 8.75 kJ
 - f. 10.4 kJ
28. What is the term for a direct change of state from a gas to a solid?
- a. condensation
 - b. deposition
 - c. sublimation
 - d. vaporization
 - e. none of the above

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29. What is the term for an element that is generally dull, has a low density, and is a poor conductor of heat and electricity?
- a. metal
 - b. nonmetal
 - c. semimetal
 - d. all of the above
 - e. none of the above
30. What is the term for a property that can be observed without changing the chemical formula of a substance?
- a. atomic property
 - b. chemical property
 - c. molecular property
 - d. physical property
 - e. none of the above
31. Which of the following describes a substance in the liquid physical state?
- a. The substance has a variable shape.
 - b. The substance has a fixed volume.
 - c. Particles have restricted movement.
 - d. Particles have a random arrangement.
 - e. All of the above
32. Air contains nitrogen, oxygen, argon and other gases. Which of the following terms describes air?
- a. compound
 - b. element
 - c. heterogeneous mixture
 - d. homogeneous mixture
 - e. none of the above
33. Dynamite is made from TNT and cellulose paper. If the formula is $C_7H_5(NO_2)_3$, what is the number of atoms in the formula of the explosive.
- a. 4
 - b. 15
 - c. 18
 - d. 21
 - e. 45
34. If 2.43 g of magnesium are burned in oxygen to produce 4.03 g of magnesium oxide, what is the mass of reacting oxygen gas?
- a. 1.60 g
 - b. 2.43 g
 - c. 4.03 g
 - d. 6.46 g
 - e. impossible to predict from the given information.

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35. Using atomic notation, indicate the isotope having 26 protons, 32 neutrons, and 26 electrons.

- a. ${}_{26}^{32}\text{Fe}$
- b. ${}_{26}^{58}\text{Fe}$
- c. ${}_{32}^{58}\text{Fe}$
- d. ${}_{26}^{32}\text{S}$
- e. ${}_{32}^{58}\text{S}$

36. Which of the following is not a gaseous non metal?

- a. Ar
- b. Cl
- c. N
- d. S
- e. None of the above

37. What is the predicted formula for a sulfide ion?

- a. S^{6+}
- b. S^{2+}
- c. S^{-}
- d. S^{2-}
- e. S^{6-}

38. What is the systematic name for K^{+} ?

- a. kalium ion
- b. potassium ion
- c. phosphorus ion
- d. potassium (I) ion
- e. sodium (I) ion

39. What is the chemical formula for the perchlorate ion?

- a. Cl^{-}
- b. ClO^{-}
- c. ClO_2^{-}
- d. ClO_3^{-}
- e. ClO_4^{-}

40. What is the chemical formula for the binary compound composed of Co^{3+} and S^{2-} ions?

- a. CoS
- b. Co_2S_3
- c. Co_3S_2
- d. Co_6S_6
- e. None of the above

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41. What is the systematic name for NiS?

- a. nickel sulfide
- b. nickel sulfite
- c. nickel (II) sulfide
- d. nickel (II) sulfite
- e. nickel (II) sulfate

42. What is the term for a type of reaction in which two or more substances are produced from a single compound?

- a. combination
- b. decomposition
- c. double replacement
- d. neutralization
- e. single replacement

43. What term refers to a chemical reaction that releases heat energy?

- a. endothermic
- b. exothermic
- c. isothermal
- d. all of the above
- e. none of the above

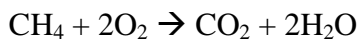
44. What term refers to an insoluble solid substance that is produced from a chemical reaction in aqueous solution?

- a. colloid
- b. precipitate
- c. product
- d. salt
- e. none of the above

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Questions 45-50 refer to the following problem:

16 grams of methane (CH₄) are reacted with 32 grams of oxygen (O₂) to form 11 grams of carbon dioxide (CO₂) and water (H₂O) in the following balanced chemical reaction:



Use the following key for questions 45 to 49:

- | | | | |
|--------|--------|--------|--------|
| a. 0 | c. 1 | e. 2 | g. 3 |
| b. 0.5 | d. 1.5 | f. 2.5 | h. 3.5 |

45. What is the initial (before any reaction occurs) quantity of methane (CH₄) in moles?

46. What is the initial (before any reaction occurs) quantity of oxygen (O₂) in moles?

47. How many moles of the non-limiting reactant are used in the reaction?

48. How much of the limiting reactant is left over at the end of the reaction?

49. How many moles of carbon dioxide are theoretically formed in the reaction?

50. If 11 grams of carbon dioxide are actually formed in the reaction, what is the percent yield?

- a. 0%
- b. 25%
- c. 50%
- d. 75%
- e. 100%

END