

Multiple-Choice Questions (1 point each)

- In a solution, the solvent
 - is a liquid.
 - can be a liquid or gas.
 - can be a solid, liquid, or gas.
 - is never a solid.
 - is the substance present in the smallest concentration.
- A solution is prepared by dissolving 2 g of KCl in 100 g of H₂O. In this solution, H₂O is the
 - solute.
 - solvent.
 - solution.
 - solid.
 - ionic compound.
- When KCl dissolves in water
 - the Cl⁻ ions are attracted to dissolved K⁺ ions.
 - the Cl⁻ ions are attracted to the partially negative oxygen atoms of the water molecule.
 - the K⁺ ions are attracted to Cl⁻ ions on the KCl crystal.
 - the K⁺ ions are attracted to the partially negative oxygen atoms of the water molecule.
 - the K⁺ ions are attracted to the partially positive hydrogen atoms of the water molecule.
- Oil does not dissolve in water because
 - oil is polar.
 - oil is nonpolar.
 - water is nonpolar.
 - water is saturated.
 - oil is hydrated.
- Water is a polar solvent and hexane (C₆H₁₄) is a nonpolar solvent. Which of the following correctly describes the solubility of a solute?
 - mineral oil, soluble in water
 - CaCl₂, soluble in hexane
 - NaHCO₃, soluble in water
 - CCl₄, soluble in water
 - octane, soluble in water
- The pressure exerted by a gas on its container is directly proportional to
 - the volume of the container.
 - the mass of the individual gas molecules.
 - the centigrade temperature of the gas in the sample.
 - the number of molecules of gas in the sample.
 - the Fahrenheit temperature of the gas in the sample.
- The function of a buffer is to
 - change color at the end point of a titration.
 - maintain the pH of a solution.
 - be a strong base.
 - maintain a neutral pH.
 - act as a strong acid.

Balancing Chemical Reactions (14 points, 2 points each)

Directions: Balance each reaction below by writing the correct coefficient before the formula.

8. Potassium sulfate yields potassium sulfite (K_2SO_3) plus oxygen

9. Bromine plus lead(IV) nitride yields lead(IV) bromide plus nitrogen

10. Zinc sulfide plus oxygen yields zinc oxide plus sulfur trioxide

11. Hexane (C_6H_{14}) plus oxygen yields carbon dioxide plus water

12. Iron(III) chloride plus fluorine yields Iron(III) fluoride plus chlorine

13. Calcium plus water yields calcium hydroxide plus hydrogen

14. Hydrochloric acid plus silver acetate yields silver chloride plus acetic acid

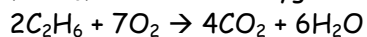
Short Answer Problems (2 points each)

For each problem below, write the equation and show your work. Always use units and box in your final answer.

15. Calculate the total amount of heat (in kcal) required to do the following:
Convert 25 g of ice at $0^\circ C$ to water at $50^\circ C$

16. Calculate the total amount of heat (in kcal) required to do the following:
Convert 900 g of water at $10^\circ C$ to steam at $140^\circ C$

17. Ethane gas, C_2H_6 , reacts with oxygen according to the following balanced chemical reaction:



If 2 moles of ethane gas are allowed to react, how many grams of water will be formed?

18. Calcium metal and oxygen react to form calcium oxide, which is a white solid. If 43.5 grams of Ca and 27.0 grams of O_2 are caused to react:

(a) Which reactant is limiting?

(b) What is the theoretical yield of calcium oxide?

(c) If 32.1 grams of calcium oxide were obtained, what is the percent yield?

19. Is a mixture in which $[I_2]=[H_2]=7.69 \times 10^{-4}$, and $[HI]=5.21 \times 10^{-3}$ at $425.4^\circ C$ at equilibrium or will reaction take place to reach equilibrium? If reaction will take place, in which direction will the reaction take place? The value of K_c for the equilibrium is 54.5 at $425.4^\circ C$.



Directions: Calculate pH, pOH, $[H^+]$, $[OH^-]$ based upon what you are given.

20. pH = 8.53

22. pOH = 5.55

Calculate the pH of each of the solutions listed below: Assume all substances are 100% ionized.

23. 0.0952 M HBr _____

24. 0.071 M HNO_3 _____

25. 0.0006799 M H_2SO_4 _____

26. 2.00 M NaOH _____

27. 0.0150 M NaBr _____

28. 0.01092 M $Ba(OH)_2$ _____

29. 0.0954 M H_2SO_4 _____

30. 0.150 M KOH _____

Indicate whether the solutions listed below will be acidic, basic, or neutral:

31. NaI

32. NaHCO₃

33. NH₄Br

34. Ca₃(PO₄)₂

Write the electron configuration for the elements shown below (1 point each)

35. lithium

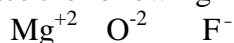
36. zinc

37. tin

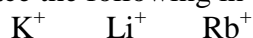
38. Sr

39. S

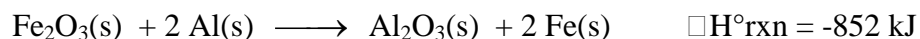
40. Place the following in order of increasing radius.



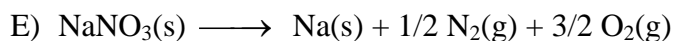
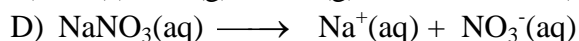
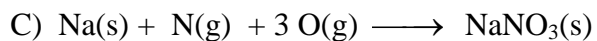
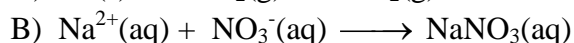
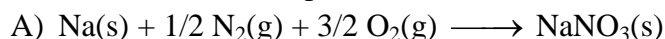
41. Place the following in order of increasing radius.



42. How much energy is evolved during the reaction of 127.7 g of Fe₂O₃, according to the reaction below? Assume that there is excess Al.



43. Choose the reaction that represents ΔH°_f for NaNO₃.



44. Place the following in order of decreasing magnitude of lattice energy.

NaF

CaS

CsI

A) CsI > NaF > CaS

B) CsI > CaS > NaF

C) CaS > CsI > NaF

D) NaF > CsI > CaS

E) CaS > NaF > CsI

45. Which molecule or compound below contains an ionic bond?

- A) CS₂
- B) CCl₄
- C) SiF₄
- D) OBr₂
- E) KNO₃

46. Which of the following elements can form compounds with an expanded octet?

- A) P
- B) C
- C) Li
- D) F
- E) All of the above elements can form compounds with an expanded octet.

Draw a Lewis Structure for each of the following including any non-zero formal charges, sketch the shape, determine the electronic and molecular geometry and indicate whether each molecule or ion is polar or non-polar

47. HCl

51. O₂

48. PCl₃

52. SO₃

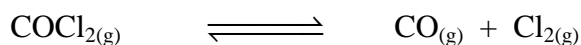
49. Cl₂

53. CBr₄

50. NO

54. BCl₃

55. Is a mixture in which [COCl₂] = 6.55x10⁻⁶, [Cl₂]=7.69x10⁻⁴, and [CO]=5.21x10⁻³ at 100°C at equilibrium or will reaction take place to reach equilibrium? If reaction will take place, in which direction will the reaction take place? The value of K_c for the equilibrium is 2.2x10⁻¹⁰ at 100.0°C.



56. Write equilibrium expressions K_c for each of the following reactions.

