UNIT 7 TEST REVIEW AP CHEMISTRY

1. The relation between ΔH, T, $\cdot \Delta S$ for the reaction X (s) → X (l) at its melting point is

2. How are spark plug of an automobile and activation energy related?\

3. Heat of combustion of ethylene is -1323 kJ/mol, what is the value of heat of combustion of Ethylene if H_2O (l) is produced rather than water vapor. (H_2O (g) → H_2O (l) is -44 kJ·mol⁻¹)

4. Solid Ammonium Chloride dissolves in water and the temperature decreases during the process, then the enthalpy and entropy changes are

5. The change in entropy for the reaction H_2 (g) + C_2H_4 (g) → C_2H_6 (g) is

6. N_2 (g) + 3 H_2 (g) → 2 NH_3 is thermodynamically spontaneous at 298 K, but becomes nonspontaneous at higher temperatures. Then the entropy, enthalpy and free energy changes are

7. I_2 (g) + 3 Cl_2 (g) → 2 ICl_3 (g), Calculate $\Delta H°$ from the bond energy values

8. Calculate standard EMF for the galvanic cell made of Al/Ag.

9. State whether true or false. Oxygen can oxidize Fluoride ion.

10. The number of moles of Ag^+ that can be reduced by 1 mole of Zn is/are

11. Write the cell reaction for the cell made of Cu and Cr. (Charge of Cu is +2 and Cr is +3)

12. Predict if this reaction is possible or not and justify. Cl_2 (g) + 2 I^- (aq) → 2 Cl^- (aq) + I_2 (aq)

13. How long will it take for 1 amp of current to deposit 1 mol of Ni from Ni^{2+} solution.

14. How many grams of Cu is deposited from Cu^{2+} by 0.2 Faradays of electricity.

15. Name the element that can be used as a protective coating for Fe

16. An electrolytic cell made of Zn- Cu was found to have a cell potential of 1 volt instead of 1.1 volt as standard EMF. Explain

17. 3 Br_2 (aq) + 6 OH^- (aq) → 5 Br^- (aq) + BrO_3^- (aq) + 3 H_2O (l), in this reaction does Bromine undergo oxidation or reduction. Justify

18. No. of electrons transferred during the balancing of
2 MnO_4^- (aq) + 10 Br^- (aq) + 16 H^+ (aq) → 2 Mn^{2+} (aq) + 5 Br_2 (aq) + 8 H_2O (l)

19. In a Galvanic cell made of Cu and Sn, which electrode acts anode and where does oxidation take place? The standard solutions are replaced with 0.5 M solutions of each of the ions. Is the cell potential higher than the standard cell or lower or same? Justify. Write the thermodynamically favorable cell reaction between Cu and Sn electrodes(Using +2 ions for each of the ions). Calculate the standard free energy change.

20. Give an example chemical reaction in which the standard entropy change is positive or negative or zero.

21. 10 grams of Aluminum at a temperature T_1 is placed in an insulated cup containing 10 grams of water at a temperature T_2, if T_1 is greater than T_2, it now attains thermal equilibrium(meaning Temperature of both remains constant. Is the change in temperature more for water or Aluminum or equal in both? Justify.

22. Write the conditions for spontaneity for ΔG^0, ΔH^0 and ΔS^0

23. The dissolution of an ionic solid takes place in three steps, 1. Separation of ionic crystal into ions 2. Polar solvent expands to make spaces so that the ions will occupy the empty spaces 3. Ions are inserted into spaces in the polar solvent. Which steps are exothermic and endothermic?

24. For a particular reaction ΔH= Positive and ΔS= Positive, what happens with the increase in temperature in reference to spontatneity?

25. Na(s) + $\frac{1}{2}Cl_2$(g) ↔ $NaCl$(s) Hrxn = -411.2 kJ a) how much heat is released or absorbed when 0.05 moles of Cl_2 is formed from $NaCl$ b) In the 5 hypothetical steps for the formation of Sodium chloride write the equations for the endothermic and exothermic reactions separately(refer to Born- Haber cycle of Chemical bonding)

26. 2HI ↔ H_2 + I_2 Δ H= x, what is the standard enthalpy of formation of HI?

28. $2H_2$ + O_2 → $2H_2O$ For the reaction at 25⁰C the sign for ΔH, ΔS and ΔG are and also calculate the same for the reaction of ammonium thiocynate and barium hydroxide in a closed container. The temperature decreases during the second reaction and a gas is produced.

29. What are the conditions for an endothermic reactions to be spontaneous (ΔG is negative)

30. When Mg metal is placed in Copper (II) sulfate a red deposit forms on Magnesium wire. Explain.

31. What is the quantity that is zero for a perfectly crystalline substance?

32. Calculate the enthalpy for the reaction of trimerization of acetylene to form benzene.

33. An electrochemical cell is made of Sn and Cu. a) Identify the electrode at which oxidation and reduction takes place. b) the mass of Sn decreases, where does it go? c) What is the role of salt bride, explain with a diagram. d) what happens to the cell potential when the concentrations of both electrolytes is decreased to 0.5M.

34. Referring to electrochemical series table write the net ionic equation for the reaction between Sn electrode and $Cu(NO_3)_2$ which is thermodynamically stable. Refer to all possible charges of Sn and Cu. and also calculate the value of ΔG.

35. Calculate the number of moles of electrons transferred in the cell to produce 13 grams of Copper. A current of 4 amperes was used during the process, determine the amount of time in seconds. For this process to occur Copper sulfate should in liquid state not sold, justify.

36. Ethylamine decomposes to form ethene and ammonia. Calculate the ΔS⁰.
Calculate ΔH only from the bond enthalpy values. Based on your value of enthalpy change for the reaction predict whether the temperature decrease or increase or remains same during the reaction. Justify your prediction.

37. $Br_2(l)$ → $Br_2(g)$ ΔH⁰= 30.91 and $I_2(s)$ → $I_2(g)$ ΔH⁰= 62.44, Why is the value larger for Iodine than Bromine. In your explanation identify the type of particle interactions involved and reason for the difference in the magnitude of interactions. Predict which process has the greater change in entropy. Justify. These two elements would react to form IBr(l) predict which would have greater molar enthalpy of vaporization among IBr(l) and $Br_2(l)$. justify.

38. Calcium sulfate dehydrate is heated to form anhydrous Calcium sulfate. Calculate the standard enthalpy, entropy and free energy changes at 298 K.

39.

Half-Reaction	Standard Reduction Potential, $E°$
H_2O_2 + 2 e⁻ → 2 OH⁻	0.88 V
O_2 + 2 H_2O + 2 e⁻ → H_2O_2 + 2 OH⁻	-0.15 V

Calculate standard cell potential. Calculate standard free energy change. The decomposition of Hydrogen peroxide is slow at 298 K but a suitable catalyst increases the rate of decomposition. Explain.

40. A student is given the task of determining the enthalpy of reaction for the reaction between HCl(aq) and NaOH(aq). The following materials are available:

1.00 M HCl (aq)	1.00 M NaOH (aq)	distilled water
2.00 M HCl (aq)	2.00 M NaOH (aq)	goggles
Insulated cups with covers	gloves	lab coat
Thermometer (± 0.1 °C)	stirring rod	

The student may select from the glassware listed in the table below.

Glassware items	Precision
250 mL Erlenmeyer flasks	± 25 mL

100 mL beakers	± 10 mL
100 mL graduated cylinders	± 0.1 mL

a. The student selects two 100 mL beakers, uses them to measure 50 mL each of 1.00 M HCl (aq) solution and 1.00 M NaOH (aq) solution, and measures an initial temperature of 24.5 °C for each solution. Then the student pours the two solutions into an insulated cup, stirs the mixture, covers the cup, and records a maximum temperature of 29.9 °C.

    i. Is the experimental design sufficient to determine the enthalpy of reaction to a precision of two significant figures? Justify your answer.

    ii. List two specific changes to the experiment that will allow the student to determine the enthalpy of reaction to a precision of three significant figures. Explain.

b. A second student is given two solutions, 75.0 mL of 1.00 M HCl and 75.0 mL of 1.00 M NaOH, each at 25.0 °C. The student pours the solutions into an insulated cup, stirs the mixture, covers the cup, and records the maximum temperature of the mixture.

    i. The student calculates the amount of heat evolved in the experiment to be 4.1 kJ. Calculate the student's experimental value for the enthalpy of reaction, in kJ/mol_{rxn}.

    ii. The student assumes that the thermometer and the calorimeter do not absorb energy during the reaction. Does this assumption result in a calculated value of the enthalpy of reaction that is higher than, lower than, or the same as it would have been had the heat capacities of the thermometer and calorimeter been taken into account? Justify your answer.

    iii. One assumption in interpreting the results of the experiment is that the reaction between HCl (aq) and NaOH (aq) goes to completion. Justify the validity of this assumption in terms of the equilibrium constant for the reaction.

c. A third student calculates a value for the enthalpy of reaction that is significantly higher than the accepted value.

    i. Identify a specific error in procedure made by the student that will result in a calculated value for the enthalpy of reaction that is higher than the accepted value. (Vague statements like "human error" or "incorrect calculations" will not earn credit).

    ii. Explain how the error that you identified in part c i) leads to a calculated value for the enthalpy of reaction that is higher than the accepted value.