Exam Review: Calculations

Date: Friday, June 24 Room: 212 Time: 8:30-10:30 am Marks: 120 (75 multiple choice) % of grade: 30%

You will be given a periodic table (as used for tests), a list of polyatomic ions, the activity series, solubility rules, EN values, and a list of constants: 6.02×10^{23}, 22.4 L, 24.8 L, 273 K, 101.3 kPa, 8.31 (kPa·L)/(mol·K), 4.18 J/(g·ºC). Basically, any information that you did not have to memorize for a test, you do not have to memorize for the exam.

This sheet is not a complete review of SCH 3U1 chemistry. You will still need to review all of your notes (especially focus on unit review sheets). This review is meant to help you sort through the different types of calculations that we have done. Try to solve these questions first without your notes (after all, you won't have your notes during the exam).

1. How many electrons, protons, and neutrons are in ^{19}F? Ar-40?
2. What chemical formula results when the following elements are combined: a) Al + S, b) Mg + O?
3. Calculate ΔEN for: NaF, H_2O, O_2. What kinds of intermolecular forces will result in each case?
4. Calculate the percentage composition (by mass) of H_3PO_4.
5. 4.89 ÷ 6.77 + 1.2782 x 2.78 = __ (give your answer with the correct number of significant digits).
6. Boron has two isotopes: ^{10}B (19.9%) and ^{11}B (80.1%). Calculate Boron's average atomic mass.
7. How many atoms are in 7.3 moles of C_2H_4?
8. How much does 3.8 mol $CuSO_4$ weigh in grams?
9. A compound contains C (63.2% by mass), H (8.8%), and O (28.0%). Calculate its simplest formula.
10. A compound has the simplest formula CH_2O and a molar mass of 180 g/mol. Give its molecular formula.
11. Write nuclear equations showing the a) alpha decay of ^{210}Bi, b) beta decay of ^{75}Se.
12. Butane burns according to the equation: $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$. If a 10 mL test tube is filled 1/10 with butane and 9/10 with O_2, how much O_2 will remain at the end of the reaction?
13. $2KNO_3 \rightarrow 2KNO_2 + O_2$. What mass of O_2 can be produced from 592 grams of KNO_3?
14. $3Fe + 2O_2 \rightarrow Fe_3O_4$. What mass of Fe_3O_4 can be produced if 100 grams of O_2 reacts with 4.91 mol Fe?
15. $CuSO_4(aq) + BaCl_2(aq) \rightarrow CuCl_2(aq) + BaSO_4(s)$. What is the percentage yield of $BaSO_4$, if adding 18.0 g of $BaCl_2$ to excess $CuSO_4$ produces 13.2 grams of $BaSO_4$?
16. An alloy is prepared by adding 15 g of Cu to 27 g of gold. Calculate the % W/W of copper in the alloy.
17. A 50,000 L pool has a chlorine concentration of 4.0 ppm. How many grams of chlorine are in the pool?
18. What is the molar concentration of a solution that holds 16 g of NaOH in 2.00 L of solution?
19. What volume of 12.0 M HCl is needed to make 3.00 L of a 0.175 M solution?
20. 3.5 L of 1.3 M KCl is added to 2.0 L of 0.75 M KCl. What is the concentration of the resulting solution?
21. How much precipitate forms when 70 mL of H_2O saturated with KNO_3 is cooled from 52°C to 20°C? (pg. 316)
22. What mass of precipitate forms when 0.35 L of 0.175 M $CaCl_2$ is added to excess $Na_3PO_4(aq)$?
23. a) pH = 7.5, $[H^+]$ = _____, b) $[H^+] = 1.85 \times 10^{-12}$, pH = _____
24. In a titration, 4.42 mL of 0.600 M H_2SO_4 neutralized 5.00 mL of NaOH. What was the concentration of NaOH?
25. a) 22 K = ____ °C b) 756°C = ____ K
26. A aerosol can at 25°C has an internal gas pressure of 150 kPa. What will the pressure be at 200°C?
27. A weather balloon holding 22 L of gas is released at a pressure of 103 kPa & a temperature of 15°C. What is the temperature at 10 km, where the pressure is 15 kPa and the balloon occupies a volume of 108 L?
28. A gas is collected in a long glass tube over water. After equalizing the water level inside and outside the tube, the volume was measured at 35.7 mL. If the atmospheric pressure is 97 kPa and the water temperature is 20.0°C (vapour pressure = 2.34 kPa), calculate the volume of dry gas at STP.
29. A 2.62 g sample of a gas occupies 1.46 L at 22°C and 110 kPa. What is the molar mass of the gas?
30. $2H_2 + O_2 \rightarrow 2H_2O$. What mass of water is produced when 2.4 L of O_2, at SATP, is reacted with excess H_2?
31. Write a balanced equation for the complete combustion of a 27-carbon alkane.
32. A 1.37 g sample of sucrose ($C_{12}H_{22}O_{11}$) is burned in a calorimeter. The 2.3 L of water increases from 23.21°C to 25.58°C. Calculate the heat released. Calculate the molar heat of combustion for sucrose.
33. Using a table of bond energies, write the thermochemical equation for the reaction $H_2 + Br_2 \rightarrow 2HBr$.