Honour Chemistry Unit 4 Outline: Thermochemistry and Nuclear Chemistry

Chapter 6: Energy Relationships in Chemical Reactions

Classes	Topics	Suggested Reading	✓	Assignments	✓
1	Energy, Radiant Energy, Thermal Energy, Chemical Potential Energy, Potential Energy, Thermochemistry, Open System, Closed System, Isolated System, Law of Conservation of Energy (First Law of Thermodynamics), Heat (q), Work (w), Reaction Pathway, State Function (Property), Systems versus Surroundings, Exothermic versus Endothermic, Internal Energy (E), $\Delta E = q + w$, $w = -P\Delta V$ (only conceptual understanding – no calculations)	6.1: The Nature of Energy and Types of Energy (pg. 172) 6.2: Energy Changes in Chemical Reactions (pg. 173 to 174) 6.3 Introduction to Thermodynamics (pg. 174 to 180)		pg. 198 #1 to 3, 6 to 11	
2	Enthalpy ($H = E + PV$ and $H = n\Delta H_{rxn}$), Change in Enthalpy ($\Delta H = q$) Energy Diagram, Endothermic and Exothermic Change in Enthalpy ($\Delta H < 0$ Exothermic, $\Delta H > 0$ Endothermic), Heating Curve, Potential Energy (Phase Changes, $q = n\Delta H_{fus}$, $q = n\Delta H_{vap}$ and $q = n\Delta H_{sub}$ where $\Delta H_{sub} = \Delta H_{fus} + \Delta H_{vap}$), Kinetic Energy (Temperature Change, Specific Heat, $q = mc\Delta T$, Heat Capacity $q = C\Delta T$), Molar Enthalpy of Solution (ΔH_{sol})	6.4 Enthalpy of Chemical Reactions (pg. 180 to 185) 12.6 Phase Changes (pg. 412 to 415)		pg 199 #21 to 26 pg. 421−423 #61, 69, 71, 72, 78, 112	
3	Molar Enthalpy of Combustion (ΔH_{comb}), Physical and Chemical Calorimetry (Heat Gained = Heat Lost) using Constant-Volume Calorimter (Bomb Calorimeter) or Constant-Pressure Calorimeter (Styrofoam Calorimeter)	6.5: Calorimetry (pg. 185 to 191)		pg. 199−200 #29 to 38	
4 & 5	Molar Heat of Formation (ΔH_f), Theoretical Molar Enthalpy of Reaction ($\Delta H_{rxn} = \Sigma H_{products} - \Sigma H_{reactants}$), Hess's Law (Adding ΔH), Fossil Fuels (Natural Gas, Petroleum, and Coal), Complete and Incomplete Combustions, Fractional Distillation, Cracking and Reforming, Greenhouse Effect (Global Warming), Deforestation, Hydrogen as Fuel, Other Energy Alternatives	6.6: Standard Enthalpy of Formation and Reaction (pg. 191 to 197) 6.7: Present Sources of Energy and New Energy Sources (extra notes)		pg. 200−202 #39 to 42, 45 to 49, 51, 52, 54 to 56, 58, 60 to 64, 67, 68, 74, 76, 80, 81	
6	**Lab #7: Heat of Solution and Molar Heat of Fusion (March 21, Monday)**			**Lab Report #7 Due: (B Block: March 31, Thursday) (D Block: April 1, Friday)**	
7	**Lab #8: Heat of Combustion (B Block: March 22, Tuesday) (D Block: March 23, Wednesday)**			**Lab Report #8 Due: (B Block: March 31, Thursday) (D Block: April 1, Friday)**	
	Chapter 6 Take-Home Quiz (B Block: March 22, Tuesday) (D Block: March 23, Wednesday)	***Chapter 6 Homework Due (March 28, Monday)***		***Ch 6 Take-Home Quiz Due: (B Block: March 24, Thursday) (D Block: March 25, Friday)***	

Chapter 21: Nuclear Chemistry

Classes	Topics	Suggested Reading	✓	Assignments	✓
1	Nucleons (Neutrons and Protons), Nuclear Transmutation, Elementary Particles (proton (${}^{1}_{1}p$ or ${}^{1}_{1}\mathrm{H}$), neutron (${}^{1}_{0}n$), electron or beta particle (${}^{0}_{-1}e$ or ${}^{0}_{-1}\beta$), positron (${}^{0}_{+1}e$ or ${}^{0}_{+1}\beta$), alpha particle (${}^{4}_{2}\mathrm{He}$ or ${}^{4}_{2}\alpha$) and gamma $\left(\gamma \text{ or } {}^{0}_{0}\gamma\right)$ ray), Positron Emission and Electron Capture, Balancing Nuclear Equations	21.1: The Nature of Nuclear Reactions (pg. 709 to 710)		pg. 734 #2, 4, 6; pg. 736 #55	
2	Strong Nuclear Force, Properties of Neutrons, Radioactive Decay, Neutron-to-Proton Ratio (*n/p*), Zone of Stability, Thermodynamic Stability, Mass Defect (Δm), Nuclear Binding Energy ($\Delta E = \Delta mc^2$)	21.2: Nuclear Stability (pg. 711 to 716)		pg. 734−735 #8, 12, 14, 18, 20; pg. 736 #56	
3	Radioactive Decay Series, Kinetics Stability, Rate of Decay, Rate Constant of Decay (k), $\ln\left(\frac{N}{N_0}\right) = -kt$, Half-Life $\left(t_{1/2} = \frac{\ln 2}{k}\right)$, Radioactive Dating (Carbon-14 Urananium-238 and Potassium-40 Dating)	21.3: Natural Radioactivity (pg. 716 to 720)		pg. 735 #24, 25, 29; pg. 737 #66	
4	Transuranium Elements, Particle Accelerator (Cyclotrons and Linear Accelerators), Nuclear Fission, Spontaneous Fission, Nuclear Chain Reaction (Subcritical, Critical, and Supercritical), Critical Mass, Atomic Bomb, Nuclear Fission Reactors (Reactor Core, Moderator, and Control Rods) and their hazards, Light Water vs. Heavy Water Reactors, Breeder Reactors, Nuclear Fusion, Thermonuclear Reactions, Experimental Fusion Reactors, Hydrogen (Thermonuclear) Bomb	21.4: Nuclear Transmutation (pg. 720 to 722) 21.5 & 21.6: Nuclear Fission and Nuclear Fusion (pg. 722 to 729)		pg. 735 #36 pg. 735−736 #38	
5	Radiotracers, Geiger-Müller (Geiger) Counter, Scintillation Counter, Measuring Radioactivity and Intensity (*rad* and *rem*), Natural and Man-made Radiations, Effects of Radiation (Somatic and Genetic Damages), Penetration ability and Ionization ability	21.7 & 21.8: Uses of Isotopes and Biological Effects of Radiation (pg. 729 to 732)			
6	**Unit 4 Test** **(B Block: April 7, Thursday)** **(D Block: April 8, Friday)**	***Chapter 21 Homework Due*** ***(B Block: April 5, Tuesday)*** ***(D Block: April 6, Wednesday)***			